Fish and Water Quality

Introduction

This report covers the analysis of the water and fisheries resources within the Easy Fire Recovery Project area. Proposed actions include fire salvage regeneration, fuels reduction, construction of temporary roads, and maintenance of system roadways. Harvest, fuel reduction, and reforestation efforts would move the vegetation and fuel loading toward historic levels. This would allow fire in the landscape to maintain vegetation while minimizing potential to negatively impact fish and fish habitat in project area streams.

Regulatory Framework

Malheur Forest Plan

The Malheur National Forest Plan (USDA, 1990) as amended, provides direction to protect and manage resources. Only direction pertaining to the water and fish resources portion of the Burned Area Recovery project is included here.

Forest Plan Goals for water and fish resources include:

- Assist in the identification, protection and recovery of threatened, endangered and sensitive species (Goal 15, p. IV-2).
- Provide a favorable flow of water (quantity, quality, and timing) for off-Forest users by improving or maintaining all watersheds in a stable condition (Goal 27, p. IV-2).
- Maintain or enhance water quality to meet State of Oregon standards, considering downstream uses and protection of other riparian and floodplain values (Goal 28, p. IV-2).

The Forest Plan Objectives state how resources will be managed under the Forest Plan. They are discussed by Riparian Area and for Soil and Water (only objectives pertaining to water and fish are listed):

Riparian Area:

- All riparian areas will be managed to protect or enhance their value for water quality, fish habitat and wildlife.

Water:

- Manage soil and water resources to maintain or enhance the long-term productivity of the Forest.
- Integrate mitigation into management activities. Examples of mitigation for soil and water protection include waterbarring skid trails, seeding disturbed soil along riparian areas and size and distribution of harvest units.

Forest-wide Standards provide further guidance:

Threatened, Endangered and Sensitive Species:

- Meet all legal and biological requirements for the conservation of threatened, and endangered plants and animals. Assess all proposed projects that involve habitat changes or disturbance having potential to alter habitat of threatened, endangered or sensitive plant and animal species (Standard 62).
- When threatened or endangered species or habitat are present, follow the required biological assessment process, according to the requirements of the Endangered Species Act (Public Law 93-205). Meet all consultation requirements with the USDI Fish and Wildlife Service, National Oceanic and Atmospheric Administration, and state agencies (Standard 64).
- Specify all protection or mitigation requirements (36 CFR 219.27(a) (8)) before project implementation begins. Manage all habitat for existing federally classified threatened and endangered species to help achieve recovery objectives (Standard 65).
- Perform a biological (field) evaluation for use in planning of proposed projects when sensitive species are present or suspected. Conduct surveys in cooperation with other agencies and groups to document the location of sensitive species populations and provide more specific information on habitat requirements and relative management guidelines (Standard 66).

Protection of Water Quality:

- Comply with State requirements in accordance with the Clean Water Act for protection of waters of the State of Oregon (Oregon Administrative Rules, (Chapter 34041) through planning, application, and monitoring of best management practices (BMPs) in conformance with the Clean Water Act regulations, and federal guidance issued thereto (Standard 117).
- In cooperation with the State of Oregon, the Malheur National Forest will use the following process:

  (a) Select and design BMPs based on site-specific conditions
  (b) Implement and enforce BMPs.
  (c) Monitor to ensure that practices are correctly applied as designed
  (d) Monitor to determine the effectiveness of practices in meeting design expectations and attaining water quality standards.
  (e) Evaluate monitoring results and mitigate where necessary to minimize impacts from activities where BMPs do not perform as expected.
  (f) Adjust BMP design standards and application when beneficial uses are not being protected and water quality standards are not being achieved. Evaluate appropriateness of water quality criteria for reasonably assuring protection of beneficial uses. Consider recommending adjustment of water quality standards (Standard 118).
- Implement the State Water Quality Management Plan, described in Memoranda of Understanding between the Oregon Department of Environmental Quality and US. Department of Agriculture, Forest Service (February 2, 1979 and (December 2,1982), and 'Attachments A and B' referred to in this Memoranda of Understanding (Implementation Plan for Water Quality Planning on National Forest Lands in the

Pacific Northwest, December 1978, and Best Management Practices for Range and Grazing Activities on Federal Lands, respectively).

Site-specific BMPs will be identified and documented during environmental analysis along with evaluations of ability to implement and estimated effectiveness. BMPs are described in General Water Quality Best Management Practices, Pacific Northwest Region, November 1988 (Standard 119).

- Evaluate site-specific water quality effects as part of project planning. Design control measures to ensure projects will meet Oregon water quality standards. Projects that will not meet Oregon water quality standards shall be redesigned, rescheduled, or dropped (Standard 120).
- Conduct a watershed cumulative effects analysis in watersheds where project scoping identifies cumulative effects of activities on water quality or stream channels as an issue. This will include land in all ownerships in the watershed. Disperse activities in time and space to the extent practicable, and at least to the extent necessary to meet management requirements. On intermingled ownerships, coordinate scheduling efforts to the extent practicable (Standard 121).
- Rehabilitate disturbed areas that could contribute sediment to perennial streams (Standard 122).

Updates to Standards 117 and 119

"Complying with State Requirements in accordance with the Clean Water Act…and federal guidance issued thereto." and "Implement the State Water Quality Management Plan….."

Since the Forest Plan was signed, how the Forest Service complies with State Requirement in accordance with the Clean Water Act and how the Forest Service implements the State Water Quality Management Plan has been renegotiated with the State and modified, partly in response to changes in how the US Environmental Protection Agency (EPA) administers the Clean Water Act with the State of Oregon. A new Memorandum of Understanding Between USDA Forest Service and Oregon Department of Environmental Quality to Meet State and Federal Water Quality Rules and Regulations was signed in May 2002. (USDA Forest Service, May 2002) and additional federal guidance and protocols have been issued (Furnish and McDougle, 1999; Hildago-Soltero, 2000; Jensen, undated; USDA Forest Service, Pacific Northwest Region, Regional Office, 1999; USDA Forest Service, undated, "Appendix A"; USDA Forest Service, undated, "Appendix C").

Management Areas and Amendments to the Forest Plan

The Forest Plan, as amended, establishes Management Areas and Standards that pertain to water resources (Forest-wide Goals and Standards apply to all). On the Malheur National Forest, the relationship of these Management Areas and the Standards defined for them is described below.

The original Forest Plan established Management Area MA 3B – Anadromous Riparian Areas. Riparian habitats are areas of land directly affected by water that exhibit either visible vegetation or physical characteristics reflecting an influence from the water. This Management Area, including Description, Goals, and Standards, is described on pages IV-62 to IV-68 of the Forest Plan.

The Forest Plan was amended with Amendment 29 for Management Area 3B in 1994. It established a Desired Future Condition for MA 3B and modified MA3 Standards for the Resource Element of Fish, Water Quality and Wildlife. The description of the Desired Future Condition and the modified Standards are found in Amendment 29 to the Malheur Forest Plan.

The Interim Strategies for Managing Anadromous Fish Producing Watersheds on Federal Lands in Eastern Oregon and Washington, Idaho, and Portions of California (commonly known as PACFISH) amended the Malheur Forest Plan in 1995. PACFISH provides interim direction to protect habitat and populations of anadromous fish. PACFISH establishes Riparian Management Objectives and Standards and Guides to provide protection of fish and fish habitat. The RMOs are listed on pages C-4 to C-6 in the PACFISH Environmental Analysis (EA) (USDA 1995). Forest-wide fisheries standards in the PACFISH EA that apply to this project are listed on pages C-10 to C-17. These include: RF-2(b-f), RF-3(a-c), and RA-2 to RA-5. A copy of the PACFISH EA is available in the project file.

PACFISH and the Continuation of Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales (Regional Forester's Forest Plan Amendment #2, 1995), also identify areas (defined by standard distances from streams and wetlands), to which Standards and Guides would apply. These areas are called Riparian Habitat Conservation Areas (RHCAs) and are applied across all Forest Plan Management Areas. PACFISH establishes standard width buffers, based on slope, on these RHCAs around all streams, wetlands, water bodies and landslide prone areas on the forest (USDA 1995; C-6 to C-9). RHCAs are portions of watersheds where riparian-dependent resources receive primary emphasis, and management activities are subject to specific standards and guidelines.

RHCAs are further differentiated by the following categories:

- Fish-bearing streams, or Category 1.
- Perennial streams, or Category 2.
- Intermittent channels, or Category 4.

Category 4 channels will be recognized as the important link between uplands and the downslope perennial streams. They will be managed to ensure bank and channel stability (Forest Plan, p. IV-55). The direction to recognize the link between uplands and downslope perennial streams is interpreted in the Easy Fire Recovery Project area to include some ephemeral draws, which, if not managed properly, will erode into channels. A severely burned ephemeral draw was assigned a buffer of 15-20 feet (see Mitigation).

Table FW-1: PACFISH RHCA buffer widths.

Type of RHCA	RHCA Width (Feet)
Category 1 - Fish-bearing stream reaches	300
Category 2 - Permanently flowing, non-fish stream reaches	150
Category 3 - Ponds, lakes, reservoirs, or wetlands > 1 acre	150
Category 4 - Seasonally flowing or intermittent stream reaches, wetlands < 1 acre, landslides, and landslide-prone areas	100

Standard Riparian Habitat Conservation Area (RHCA), and the additional PACFISH Riparian Goals, Riparian Management Objectives (RMOs) and Forest-wide aquatic standards apply except when watershed analysis or site specific analysis has occurred or when current Forest Plan direction provides more protection for anadromous fish habitat. For several intermittent channels that underwent high BAER burn severity, the RHCA buffer widths were extended to 150-feet.

Some RMOs and standards contained in Malheur Forest Plan Amendment 29 are considered more protective than those in PACFISH, supercede comparable ones in PACFISH, and apply to the Easy Fire Recovery Project area. The criteria for defining standard RHCAs and the additional Riparian Goals, RMOs and Forest-wide aquatic standards established by PACFISH, which apply to the Easy Fire Recovery Project area, are found in Appendix C of the PACFISH EA (USDA Forest Service, 1995).

Other Regulatory or Legal Requirements that Direct Watershed Management

- Section 208 of the 1972 amendments to the Federal Water Pollution Control Act (Public Law 92-500), specifically mandates identification and control of nonpoint-source pollution resulting from silvicultural activities.
- Clean Water Act, Sections 303, 319, 404. Section 303(d) directs states to list Water Quality Limited Water bodies (303(d) listed streams) and develop Total Daily Maximum Loads to control the non-point source pollutant causing loss of beneficial uses. The Malheur National Forest is consistent with the State of Oregon’s established schedule for completing Total Daily Maximum Loads. Section 319 directs states to develop programs to control non-point source pollution, and includes federal funding of assessment, planning and implementation phases. Section 404 controls the dredge and fill of material in water bodies of the U.S.; culvert replacement and other project watershed improvement activities. Such activities may fall within the jurisdiction of section 404 and are covered with a nationwide general permit.
- Section 403 of Title IV of the Agricultural Credit Act of 1978 (16 U.S.C. 2201-2205) and Title 7, Code of Federal Regulations, Part 624 (7 CFR 624), the Emergency Watershed Protection Program. The objective of these emergency watershed

protection and conservation programs is to assist in relieving imminent hazards to life and property from floods and the products of erosion created by natural disasters that cause a sudden impairment of a watershed.

Analysis Methods

Primary Information sources used to describe the existing condition of the Easy Fire area include the following information sources:

- Burned Area Emergency Rehabilitation (BAER) documents.
- Upper Middle Fork John Day River Watershed Analysis.
- Mossy Analysis Area – Environmental Assessment.
- Clear Creek Environmental Assessment.
- Malheur National Forest Soil Resource Inventory.
- Malheur National Forest (MNF) Geographic Information System (GIS) Database.
- Post-fire aerial photos.
- Post-fire Interim Grazing Guidelines – MNF.
- Post-fire reconnaissance of streams/ephemeral draws.
- Post-fire information from other resource personnel, including the fish biologist, silviculturist, fuels, logging systems and engineering (roads).
- Post fire stream habitat surveys (2002).
- Region 6 Protocol Stream Surveys (1991, 1992).
- Bull Trout Biological Assessment (Clear Creek Analysis).
- Bull Trout Biological Assessment for the John Day River (Mossy Analysis Ongoing Projects).
- Steelhead and Chinook Salmon Biological Evaluation/ Biological Assessment (Clear Creek Analysis).
- Other resource specialist reports prepared for this project, in particular, soils, fuels, and vegetation.

Effects Analysis Methods

The Malheur National Forest GIS was used to evaluate and analyze data available in spatial formats. The BAER report included results of modeling of potential runoff from a selected design storm event. It also included results of the Watershed Erosion Prediction Program (WEPP) modeling of post-fire hillslope erosion and sediment transport to streams.

This information is compared with standards and guidelines from the Malheur National Forest Land and Management Plan (1990), including Amendment 29, to determine the relative condition of the riparian areas, streams, and the effects to fish and fish habitat.

The actions proposed in Alternatives 2-5 and the No Action Alternative 1 were evaluated qualitatively, based on principles of applied watershed science and professional judgment and knowledge of the area. Consideration was given to post-fire condition, desired post-activity condition, and the application of site-specific Best Management Practices (BMPs). The analyses presented build on conclusions from the Soils analyses and incorporate information from other specialist reports such as Fuels and Vegetation to determine direct, indirect, and cumulative effects to water, fish, and fish habitat. Effects were identified and discussed based on site-specific conditions and expected outcomes, including those described in the Existing Condition and those used as measures for the Fish and Water Quality Issue.

The low gradient landscape, both within and downstream, of the project area is expected to limit the potential for observable cumulative effects to the confluence of Easy Creek and Lunch Creek to the west, before the confluence of Clear Creek and Highway 26 to the north, as well as to the confluence of North Reynolds Creek and Mossy Gulch to the south.

Severity of burn was analyzed using two methods: 1) BAER burn severity, and 2) vegetation severity. BAER burn severity describes damage to the soils and ground vegetation. Vegetation severity describes to damage to forest vegetation. This is the reason that acres burned by severity category are not the same for both methods. Also, the total acres burned do not match between the two methods because the fire perimeter used in the mapping was not the same for each method. The fire perimeter for the BAER burn severity map (Figure 5, Map Section) was drawn from remote sensing (satellite imagery) and is not as accurate as the vegetation severity map (Figure 6, Map Section), which was based on observations on the ground. The "official" total acreage for the project area (5, 839 acres) was derived from the vegetation severity map.

WEPP Analysis

After a fire, forest sites recover quickly, as there is often a flush of new vegetation in the year following a fire. Field observations and validation studies suggest that following fire the amount of exposed mineral soil is halved each year until the site is recovered. This usually takes about three or four years (Elliot, et al. 2001).

According to Elliot, Hall and Scheele (2000), forests generally have very low erosion rates unless they are disturbed. Common disturbances include prescribed and wild fire, and harvesting operations. The impact of these operations, however, last only for a short time, perhaps one or two years. After that, the rapid regrowth of vegetation soon covers the surface with plant litter, and potential erosion is quickly reduced. In one study, erosion rates dropped from almost 40 Mg ha-1 (17.8 tons/acre) the first year after a fire to 2.3 Mg ha-1 (1.0 ton/acre) the second, and 1 Mg ha-1 (0.4 ton/acre) the third year (Elliot, Hall and Scheele 2000). The regrowth of vegetation and subsequent increase in canopy and ground cover overshadow any differences due to climate variation among the years.

For any one of the given years, however, the potential erosion depends on the climate. If the year is normal or dry, then it is unlikely for there to be any significant erosion. If the year has above average precipitation, however, then there could be more soil erosion.

The WEPP (Water Erosion Prediction Project) model is a physically-based soil erosion model that can provide estimates of soil erosion and sediment yield considering the specific soil, climate, ground cover, and topographic conditions. It was developed by an interagency group of scientists including the U.S. Department of Agriculture's Agricultural Research Service (ARS), Forest Service, and Natural Resources Conservation Service; and the U.S. Department of Interior's Bureau of Land Management and Geological Survey.

Disturbed WEPP is an interface to the Water Erosion Prediction Project soil erosion model (WEPP) to allow users to describe numerous disturbed forest and rangeland erosion conditions. Disturbed WEPP gives both an average annual erosion, and the probability of a given annual erosion rate following a disturbance. To estimate an average annual erosion, Disturbed WEPP generates a stochastic (random) climate for the climate selected, for the number of years specified. The WEPP model then runs a daily simulation for the specified period of time, and calculates the average annual runoff, erosion, and sediment yield values.

To determine the probability values, Disturbed WEPP is run for the number of years requested, and the annual values of runoff, erosion, and sediment yield are generated by WEPP. Disturbed WEPP then sorts the annual values by magnitude.

Accuracy of Prediction

At best, any predicted runoff or erosion value from this model will be within plus or minus 50 percent of the true value. Erosion rates are highly variable, and most models can predict only a single value. Replicated research has shown that observed values vary widely for identical plots, or the same plot from year to year. Also, spatial variability and variability of soil properties add to the complexity of erosion prediction (Elliot, Hall and Scheele 2000).

Allotment Interactions

The Malheur National Forest has adopted post-fire interim guidelines for grazing after prescribed or wildfire. See Appendix H. These guidelines specify minimum time frames for rest from grazing. The resumption of grazing will be primarily dependent on the time it takes for the vegetation to recover sufficiently to withstand grazing (Sanders 2000). However, other factors that will be taken into consideration include the severity of the fire, affected plant species and aquatic resources, and history of the area. The decision to resume grazing will be made only by designated government officials as specified in Appendix H, although grazing in those areas that experienced moderate to high intensity fire will not resume for at least prior to two growing seasons after the fire to allow for plants to set seed. Grazing, when re-initiated, would be in compliance with applicable standards. Decisions about re-initiating grazing are not part of this EIS and would be made under the authority of the Grazing Permit.

Unknown and Unavailable Information

Stream conditions on private land within and downstream of the burn area are generally unavailable. Assumptions about some conditions which are generally controlled by topography can be derived from publicly available sources such as USGS maps (available to the District as the GIS Primary Base Series cover). Details of past management history on private land, including harvest, especially prior to the fire, are unknown, although general conclusions about past stand management may be made based on observations from public lands and travelways and principles of stand growth.

Wetlands were not mapped in GIS but the District locates and protects them during implementation. Protection is consistent with the Standards and Guidelines of the Forest Plan, as amended. The locations of wetlands were noted generally and included in the description of the Existing Condition.

The research and the state of knowledge for many of the water quality parameters, watershed processes, and watershed functions in most of the United States, including the Malheur

National Forest, have not advanced enough so that definitive quantitative data are commonly available (USDA Forest Service, undated, “Policy and Framework….”).

Recent research demonstrates that some watershed and water quality parameters are highly variable. For instance a recent study (1998, Bunte and MacDonald), “using good scientific methods for making sediment measurements, in a specific watershed, for ten years resulted in measured sediment at *plus or minus 100 percent of the actual value (precision) at the 95 percent confidence interval (reliability).* Modeling would be expected to be more variable. The soil scientist used Disturbed WEPP to model erosion in selected areas within the Easy Fire Recovery Project area. The results of this modeling were extrapolated to the project area based on local knowledge and landscape characteristics.

Because watershed science is not exact and few data are available, the common practice for watershed specialists, like other earth scientists, is to integrate available information with knowledge of basic principles of watershed science and with the physical and biological characteristics of the landscape. Integrating these factors results in a reasoned understanding of watershed conditions, functions, and processes. This understanding can be used to evaluate effects of proposed activities. For the Easy Fire Recovery Project area, this understanding is laid out in the Existing Condition, which forms the basis for the comparison of alternatives. This process of integration of available information with basic principles is consistent with 40 CFR 1502.22 (Unknown and Unavailable Information).

Existing Condition

Watershed Areas

In the Upper Middle Fork John Day watershed, the Middle Fork John Day River (Middle Fork) is an anadromous stream, and is part of the John Day River Basin, which drains into the Columbia River. It is within the Lower Columbia River Subregion in the Pacific Northwest Region.

Clear Creek is the only fish bearing stream within the project area. Clear Creek and all its tributaries drain into the Middle Fork of the John Day River near the town of Bates, Oregon. The Middle Fork is a major tributary to the North Fork John Day River, which empties into the mainstem John Day River at Kimberly, Oregon. The watershed is comprised mostly of public Federal lands administered, primarily, by the U.S. Forest Service. The watershed is made up of 6 subwatersheds.

There are five subwatersheds within the Upper John Day watershed: Dad’s Creek, Reynolds Creek, Deardorff Creek, Rail Creek, and Isham Creek. At the headwaters of the John Day River, water originates from spring-fed tributaries located in the higher elevations of the Strawberry Wilderness, Lookout Mountain, Little Baldy, Baldy Mountain, and Deardorff Mountain. All tributaries drain into the mainstem of the John Day River. The table below shows the distribution of ownership within the two watersheds.

Table FW-2: Ownership Distribution for the Watersheds

Subwatershed (SWS)	Total SWS Acres	Federal Ownership Acres	Percent Federal	Private Acres	Percent Private
Bridge Creek	12,149	11,480	94	669	6
Clear Creek	12,484	12,153	97	331	3
Dry Fork	11,219	11,219	100	-	-
Idaho/Summit Creek	13,289	13,256	100	33	-
Mill Creek	17,841	16,644	93	1,197	7
Squaw Creek	11,296	11,157	99	139	1
Upper Middle Fork John Day Watershed	**78,278**	**75,909**	**97**	**2,369**	**3**
Dad's Creek	27,255	7,076	26	20,179	74
Deardorff Creek	12,870	10,854	84	2,016	16
Isham Creek	21,601	4,976	23	16,625	77
Rail Creek	25,075	15,327	61	9,748	39
Reynolds Creek	19,915	16,358	82	3,557	18
Upper John Day River Watershed	**106,715**	**54,590**	**51**	**52,125**	**49**

Federal land makes up the majority of the Upper Middle Fork John Day watershed. However, private land comprises 49 percent of the Upper John Day River watershed. In two subwatersheds, Dad's Creek and Isham Creek, private ownership makes up three-fourths of the subwatershed.

Topography

The topography of the two watersheds is mountainous with gentle to moderately steep slopes resulting from past volcanic activity (Mount Mazama, 7,000 years ago) and subsequent weathering/erosional processes. The slopes are very stable to stable. The drainage network pattern is dendritic, with moderate to highly diverse aspects and slopes.

For the Upper Middle Fork John Day watershed, elevations range from a high of 6640 feet at the headwaters of Clear Creek, Dry Fork and Clear Creek subwatersheds, to a low of 4020 feet where the Middle Fork John Day River exits the watershed. Elevations in the Upper John Day Watershed range from a high of about 9038 feet at the top of Strawberry Mountain, to a low of 3080 feet where the John Day River exits the Upper John Day Watershed near John Day, Oregon.

Geology

The geology of both watersheds within the Malheur National Forest is predominantly composed of relatively recent volcanic materials. The geologic materials consist of undivided meta-volcanic rocks; volcanic flows and pyroclastic materials of the Clarno and the Strawberry Mountain Volcanic Formations; and fluvial and lacustrine deposits.

The volcanic materials are fine-grained, generally hard, competent and moderately to highly fractured. Platy to blocky fracturing is most common with occasional areas of columnar fracturing. These materials are highly resistant, forming cap ridges and plateaus that are underlain by less resistant pyroclastic rocks.

Periods of tectonic activity, involving uplift, folding, faulting, and periods of erosion have sculpted the landscape to its current form. A few areas have been relatively recently covered with deposits of water deposited materials either concurrent with or after most of the volcanic and tectonic activity ceased. There are a few mapped faults in the area, but they are not very prevalent relative to most other areas of the Forest.

The large-scale geomorphic features for the Upper Middle Fork John Day watershed include the crest of the Vinegar Hill Anticline, which forms the north boundary of the watershed, the crest of the Dixie Anticline, which forms the south boundary, and the Middle Fork Syncline. These features have parallel axis trends, which run northwest to southeast through the area, with the Middle Fork flowing northwest along the trough of the syncline.

Hydrology

Climate

The climate is a combination of maritime and continental influences. The average annual precipitation of the area is fairly low due to the rain shadow effect of the Cascade Range. Annual precipitation ranges from approximately 20 inches at the lower elevations to approximately 40-45 inches at higher elevations.

Approximately 70% of the total precipitation occurs in the form of snow during the winter period from October through March. Rain is not uncommon during late winter and spring and often in the form of rain on snow. Summer months are dominated by convective thunderstorms resulting in short duration, high intensity thunderstorms, as well as dry lightning storms.

Periods of prolonged drought and temperatures in excess of 80+ degree weather are also common during the summer months. Mean temperatures range from 20-30 degrees Fahrenheit during the winter to 40-60 degrees Fahrenheit during the rest of the year with the driest and hottest weather most likely during July and August (USDA Forest Service 1974).

Stream Gradients and Channel Types

The stream channel gradients within the watersheds range from moderately high, at least ten and up to twenty percent in some upper headwater reaches and side tributaries, to lows of one to five percent, in lower elevation and broader valley reaches. Miles of stream by stream categories within the Easy Fire Project Area boundary are shown in Table FW-3 below.

Table FW-3: Stream Miles within Easy Fire Recovery Project Area Boundary by Subwatershed and Stream Category.

Watershed	Subwatershed	Stream Category	Miles of Stream
Upper Middle Fork John Day River	Bridge Creek	1	0
		2	0
		4	1.8
	Clear Creek	1	2.3
		2	1.9
		4	4.2
Upper John Day River	Reynolds Creek	1	0
		2	1.0
		4	0.8

Upper reaches are generally more constrained by steeper slopes and narrow to no flood plains. They generally have very little sinuosity and are best characterized as Rosgen type B channels with small inclusions of type A channels where higher gradients exist and channels are more constrained.

Middle and lower reaches occur in less constrained valley formations having flood-plains ranging from ten to more than one hundred feet wide, allowing stream channels room to "move". Most channels in the middle to lower reaches are best characterized as Rosgen B and C types.

There are also areas with very wide (>100 feet) grassy valley bottoms that were likely historically Rosgen type E channels that were altered by past use, changing them to type F channels and C channels where recovery has begun.

Riparian/ Stream Activities

Minimal activity has been implemented within the Forest Service portions of Clear Creek and the associated riparian area. Clear Creek is the only Category 1 stream that flows within the project area boundary. A few log weirs have been installed in Clear Creek below the project area near its crossing with Highway 26. The disturbance associated with the installation of the weirs has healed with native vegetation reestablished in disturbed areas. There is also an old water box located above the Oregon Department of Transportation compound that was historically used to capture water for domestic use, but has not been used for a number of years and is all but deteriorated. Private portions of Clear Creek and associated riparian areas have been host to a variety of activities including livestock grazing, harvest, and construction of residences along the creek. These residences are still occupied today.

Beneficial Uses

Beneficial uses of water for the watersheds as listed by the State of Oregon include water supply, irrigation and livestock watering, anadromous fish passage, salmonid fish rearing and spawning, resident fish and aquatic life, wildlife and hunting, fishing, and aesthetic quality (Oregon Administrative Rules, Chapter 340, Division 41).

Human Uses

Grazing

In the Upper Middle Fork John Day watershed, grazing had a major influence on the watershed. This grazing is not only by domestic livestock, but also by wild grazing and browsing animals, primarily deer and elk. Thousands of sheep grazed the watershed in the late 1860's until the 1960's. From the 1940's until the present day, most of the domestic livestock grazing in the area was dominated by cattle. Sheep and cattle utilized available forage in a continuous seasons grazing regime.

Overgrazing and unregulated livestock use of riparian areas of the UMFJDR watershed, in particular, has resulted in a loss of streamside vegetation, increased water temperatures, excessive bank erosion, and accelerated sedimentation of gravels in fish spawning areas. The lower reaches of Clear Creek have wider valley bottoms and gentler side slopes and thus have been the primary areas of any past livestock use along this stream.

However, the upper reaches and the higher elevation uplands that are within the project area have been minimally used by livestock due to the difficult nature of the topography and high amount of down wood within the riparian area. Overall, the riparian area along Clear Creek and its tributaries (within the project area and its immediate surroundings) show few impacts from livestock grazing and are considered to be in an improving trend. There are only a few areas associated with small meadows that have seen heavier use by livestock. Side tributaries show little to no livestock use due to steeper side slopes and high levels of down wood.

Approximately 9,000 acres within the Clear Creek subwatershed is part of the 44,145 acre Sullens Grazing Allotment. This allotment was used in 1990, 1993, and 1997. The allotment is currently vacant.

Ditches

There is a number of irrigation ditches located in the Upper Middle Fork John Day watershed. The majority of the ditches are located off the Middle Fork John Day River, however one ditch is diverted from Clear Creek and another on Bridge Creek. Rotary fish bypass screens have been installed and maintained by the Oregon Department of Fish and Wildlife (ODFW). There are screens on all the diversions except on Bridge Creek.

Water withdrawal through these ditches is permitted under individual water rights that have been filed with the State of Oregon. The construction and maintenance of the ditches have also been authorized under Special Use Permits or operated under prior rights.

In the Upper John Day watershed, agricultural irrigation diversions, which are situated well below the Forest boundary, remove portions of flow from Reynolds Creek.

Fire Area and Affected Subwatersheds

The Easy Fire burned approximately 4,500 acres (using BAER burn severity mapping) within two watersheds: the Upper Middle Fork John Day River and the Upper John Day River watersheds (5th field Hydrologic Unit Code - HUC). Both watersheds contain fish-bearing streams (Category 1) and perennial, non-fish bearing streams (Category 2), as well as intermittent stream channels (Category 4). The Subwatersheds and Watersheds map (Figure 3 in the Map Section) shows the boundaries for the watersheds and the subwatersheds containing the Easy Fire burn area.

The Easy Fire occurred within four subwatersheds – Bridge Creek, Clear Creek, Dry Fork and Reynolds Creek. Most of the fire occurred in the Clear Creek subwatershed, where 3,002 acres burned. Clear Creek subwatershed also had the most high burn severity acres, 800 acres. Only a small number of acres (30 acres) were burned within the Dry Fork subwatershed. In the Reynolds Creek subwatershed, most of the acres were of low burn severity, and only 35 acres were high burn severity. The table below lists the acres of the various BAER (Burned Area Emergency Rehabilitation) burn severities in the subwatersheds, HUC 6th field (Bright et. al, 2002).

Table FW-4: Burned Acres by Subwatershed.

Subwatershed (HUC 6th Field)	Total SWS Acres	Unburned Acres in Easy Fire Area	BAER Burn Severity (acres)			Total Acres Burned	% of Subwatershed Burned (*)
			Low	Moderate	High		
Bridge Creek	12,149	256	311	158	172	641	5 (1)
Clear Creek	12,484	605	1,226	976	800	3,002	24 (6)
Dry Fork	11,219	6	24	5	1	30	<1 (<1)
Reynolds Creek	19,915	265	702	127	35	864	4 (<1)
Total	55,767	1,132	2,263	1,266	1,008	4,537	8 (2)

*Percent of subwatershed with high BAER burn severity in ( ).

Figures revised April 2003 to reflect the new subwatershed boundaries.

The watershed and fisheries analysis is focused on the three subwatersheds: Bridge Creek, Clear Creek and Reynolds Creek - where most of the fire burned. Only 30 acres were burned in the Dry Fork subwatershed, and no activities are proposed for those acres.

Streams and BAER Burn Severity

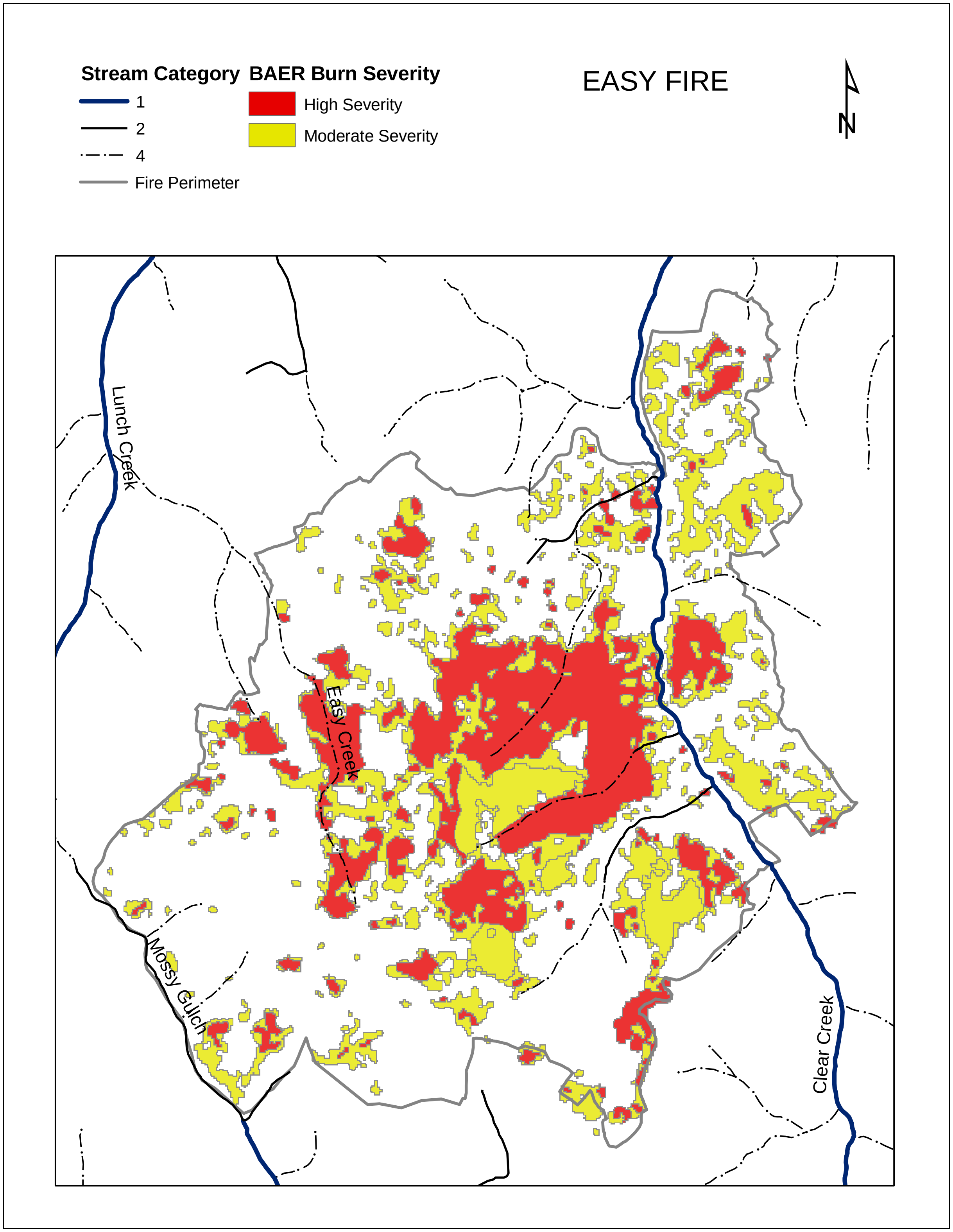
The map "Stream Category and BAER Burn Severity" shows the stream names and their categories within the watershed, with the BAER Burn Severity areas.

The main streams in the fire area are Easy Creek, Clear Creek and its tributaries, and Mossy Gulch and its tributaries. Easy Creek flows through the northwestern portion of the fire area and joins Lunch Creek downstream of the fire area. Clear Creek flows through the eastern portion of the fire area. Mossy Gulch flows along the southwestern border of the fire area. Mossy Gulch joins the North Reynolds Creek and the main Reynolds Creek outside the fire area to the south.

The BAER Burn Severity on the map shows the areas that burned at moderate or high fire severity in the fire area. These burn severities are the Burned Area Emergency Rehabilitation (BAER) ratings, which were based on satellite imagery after the fire along with some ground verification (Burned Area Report 2002, and TenPas & McNeil, 2002). The BAER burn severity indicates fire effects on the ground as related to fuel loading and impacts to soil. Areas that burned at low severity (or were unburned) are not shown on this map. BAER burn severity is different from the fire vegetation severity, which considers the fire-killed and fire-damaged vegetation.

There were very few locations where fire actually burned to the water edge along perennial streams. Intermittent streams (category 4) and ephemeral channels were the channels most affected by the fire. However, changes in the physical and chemical quality of streams due to fire are usually temporary or transitory and dependent on flow regime.

Figure FW-1 Stream Category by BAER Burn Severity



Since there were only minimal effects to riparian areas of perennial streams from the fire, no measurable changes in stream temperature are expected. Within stands completely killed by fire, reestablishment of a canopy density capable of providing shade similar to that of an old-growth stand would occur in increments over approximately 20 years (Beschta and Taylor 1988).

Water temperature is largely a function of the amount of direct sunlight falling on the stream surface (Brown 1970). Changes in stream temperature have been estimated largely as a function of the changes in the amount of riparian vegetation capable of shading streams and by estimated changes in stream flow due to increased evapotranspiration. The only Category I stream in the area, Clear Creek, received only minimal impacts from the fire. It is anticipated that the direct impacts of fire to Clear Creek and its associated riparian area will not have a significant negative impact to its water quality.

The Category II stream riparian areas are within areas of the fire determined to be primarily low or no burn (BAER). While the Category II streams may function in the transport of increased fine sediments from the fire area, it is assumed they will contribute minimal or no increases to the stream temperatures of Clear Creek and Lunch Creek. Those Category IV and Category II streams that flow into Mossy Gulch Creek on the southwest side of the fire also received only low burn severity within their riparian areas. Minimal to no change in the water temperature of Mossy Gulch Creek is anticipated as a result of the Easy Fire.

The Category IV tributaries to Clear Creek and Lunch Creek (Easy Creek) were heavily burned; however, during the predicted flow periods in the winter and early spring it is likely that there would not be a significant rise in temperature to Clear Creek or Lunch Creek as a result of water contributions from the Category IV streams.

Table FW-5 below lists the acres that burned within the riparian habitat (riparian habitat conservation areas – RHCA) and the soil (BAER) burn severity.

Table FW-5: RHCA Acres Burned in Easy Fire Recovery Project Area

Subwatershed	*Stream Category	BAER Burn Severity Acres in RHCAs				% of RHCA in Moderate & High
		High	Moderate	Low to Unburned	Total Acres	
Clear Creek	1	9	18	136	163	17%
	2	6	7	49	62	21%
	4	35	6	53	94	44%
Bridge Creek	4	22	5	15	42	64%
Reynolds Creek	1	-	-	-	-	-
	2	-	<1	38	39	2%
	4	-	<1	18	19	5%
Total		72	37	309	418	

*Stream Category: 1: Fish-bearing stream; 2: Perennial non-fish bearing stream; 4: Intermittent stream

Table FW-6 below lists the intermittent tributaries that burned at moderate or high BAER burn severity. The connecting downstream segments to Clear Creek or to Lunch Creek are also shown with their burn severity and lengths. The Clear Creek tributary system #2 has the shortest runout length for lower severity burns before entering Clear Creek, at 0.2 miles. Clear Creek tributary system #2 has 1.2 miles of stream length that was unburned, or burned in small mosaic patches of low to high severity. Easy Creek has 1.2 mile of unburned length before its confluence with Lunch Creek.

Table FW-6: Burned Stream Channels and Runout Lengths

Stream	Stream Section	Location	BAER Burn Severity	Stream Length
Clear Creek Tributary System #1	Category IV - upper segment	Above Road 2600036	High BAER	0.7 mile
	Category IV - lower segment	Below Road 2600036 to Category II confluence	Low BAER (patches of unburned & moderate)	0.7 mile
	Category II	From Category IV confluence to Clear Creek	Mosaic of unburned to high patches	0.5 mile
Clear Creek Tributary System #2	Category IV	Below Road 2600391 to Cat. II	High BAER	0.9 mile
	Category II	Category IV confluence to Clear Creek	Moderate to low BAER	0.2 mile
Easy Creek – Category IV	Upper segment	Below Road 2600142	High BAER	0.8 mile
	Middle segment	Below Road 2600142	Low BAER	0.4 mile
	Lower segment to Lunch Creek	Outside burn area	-	1.2 miles

Stream Nutrients

Ammonium-N and phosphorous concentrations can increase an order of magnitude after wildfire and organic nitrogen can double (Bitterroot 2001). It is likely these increased nutrient levels across the landscape will enter local streams, and result in increased nutrient levels in those systems as well. The increased nutrient concentration levels are temporary and are usually delivered to the streams by pulses of delivered sediments from midslope erosion. The nutrients are rapidly taken up by stream biota enriching the food base for recovering aquatic life.

Suspended fine sediments and ash detritus can be carried long distances from the fire during high stream flow events and may not settle out until stream flow diminishes or slows. Because Clear Creek is rich in wood and is a lower gradient stream, it is expected that most nutrients and sediment that enter this system will likely remain nearby during lower flows.

Fine and coarse sediments will then remobilize when stream flow energies increase substantially.

Stream Temperatures

The Oregon Department of Environmental Quality (DEQ) is responsible for developing water quality standards that protect beneficial uses of rivers, streams, lakes and estuaries. Section 303(d) of the federal Clean Water Act requires each state to develop a list of water bodies that do not meet standards. This list is submitted to the U.S. Environmental Protection Agency (EPA) every two years.

In the four subwatersheds that contain the fire area, the following streams are listed on the Oregon DEQ's 303(d) list (year 2002) as having limitations in summer stream temperatures: Clear Creek, Dry Fork Clear Creek, Lunch Creek and Reynolds Creek (see Figure 26, Map Section). The 303(d) list indicates that these streams exceed specific temperature criteria in a seven-day average of daily maximum temperatures in the summer season. The beneficial uses affected are bull trout habitat and salmonid rearing habitat.

The table below lists the 303(d) streams and the 7-day average daily temperature maximums. Dry Fork Clear Creek is not shown, since the fire burned only 30 acres in the Dry Fork Clear Creek subwatershed, and no activities are proposed for those acres.

Table FW-7: Stream Temperatures

Stream Site	Criteria	Data Years	7-Day Average Daily Maximum	Days > 50° F Ave.DailyMax	Days > 64° F Ave.DailyMax
Clear Creek 1 [1]	Bull trout: 50° F	1993-2001	62.0 - 64.9	79 - 111	0 - 15
Clear Creek 2 [2]	Bull trout: 50° F	2000-01	57.1 - 57.5	101 -105	0
Clear Creek 3 [3]	Bull trout: 50° F	2000	53.6	15	0
Lunch Creek 1 [4]	Rearing habitat: 64° F	1999 - 2001	64.4 - 68.5	106 - 116	9 - 40
Lunch Creek 2 [5]	Rearing habitat: 64° F	2000-01	65.8 - 66.1	113	20 - 25
Lunch Creek 3 [6]	Rearing habitat: 64° F	2000-01	56.9 - 56.8	88 - 96	0
North Reynolds Crk	Bull trout: 50° F	1994 - 2001	50.0 - 51.8	35 - 60	0
Reynolds Creek 1 [7]	Bull trout: 50° F	1990 - 1992	62 -64	no data	no data
Reynolds Creek 2 [8]	Bull trout: 50° F	1990 - 1992	54 - 57	no data	no data

[1] Downstream of fire area. [5] Midstream segment.
[2] Within the fire area. [6] Upper segment.
[3] Upstream of fire area. [7] Lower segment.
[4] Mouth of stream. [8] Upper segment.

Note: North Reynolds Creek is only identified as a stream of potential concern for temperature, and is not on the 303(d) list.

Streams and rivers with suspected problems are identified by the Oregon DEQ as "water bodies of potential concern." In the Reynolds Creek subwatershed, North Reynolds Creek is identified as a stream of potential concern for temperatures for bull trout, and is not on the 303(d) list.

The warmest temperatures for Clear Creek are in the site (Clear Creek 1) that is 3 ½ miles downstream of the fire area. Within the fire area at Clear Creek 2, the stream temperatures exceeded the bull trout criteria for more than 100 days per year before the fire. However, the riparian areas of Clear Creek within the fire area and upstream of the fire area were fairly intact before and after the fire.

In many cases, the natural stream temperatures may be above established thresholds (per April 2003 discussion with Dave Kretzing, Hydrologist – formerly at Prairie City Ranger District, Malheur National Forest).

Lunch Creek (Category 1) is downstream from the fire area. However, Easy Creek flows into Lunch Creek about 1 mile from the fire area. The upper 0.8 mile portion of Easy Creek (intermittent stream, Category 4) burned at high burn severity.

The Dry Fork Clear Creek was not affected by the fire since the burned area in the subwatershed was small, about 30 acres, and most of those acres were low burn intensity and located away from any streams.

There were very few locations where fire actually burned to the water edge along perennial streams. Intermittent streams (Category 4) and ephemeral channels were the channels most affected by the fire.

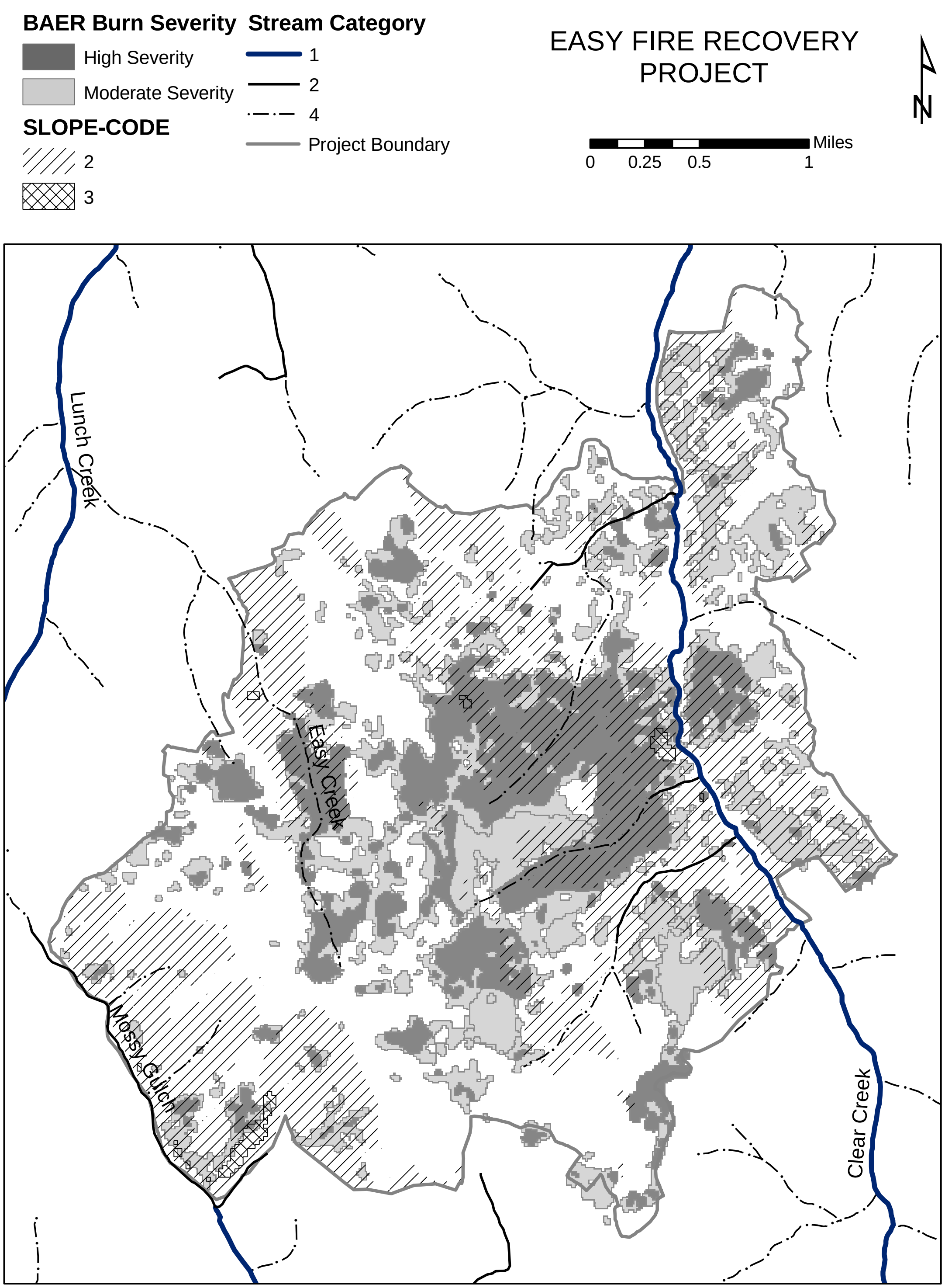
Bull trout are the most sensitive of listed species to increases in water temperature. Water temperature is a major factor determining the distribution of bull trout; bull trout are rarely found in streams with temperatures > 15 degrees C (59 F) (Reiman & McIntyre, 1993). Steelhead/redband trout and chinook salmon are effected to a much lesser degree by high water temperatures compared to bull trout. Water temperature is a key factor affecting growth and survival of all aquatic organisms. Spring spawning temperatures are not an issue but excessive rearing temperatures are a problem in the project area. The State of Oregon sets the upper limit of 64^{o} Fahrenheit for salmonids. Native redband are better adapted to variable eastside temperature fluctuations, but any prolonged exposure to temperatures at or above 77^{o} Fahrenheit is lethal. Increased temperatures also impact fish by reducing the prey base of aquatic insects and reducing the dissolved oxygen. This can lead to disease and mortality.

Turbidity and Sedimentation

For a wide range of burn severities, the impacts on hydrology and sediment transport can be minimal in the absence of precipitation. When precipitation follows moderate to high severity burns the effects can be greater. Consequently varying degrees of erosion and sediment transport may occur across the Easy fire landscape depending on the local severity of burn, steepness of slope and local stream categories.

The map below displays the moderate and high soil burn severity, the steeper slope areas and their proximity to stream channels.

Figure FW-2 Slope Range by BAER Burn Severity



Due to the effects of the fire, sediment yield and stream turbidity are expected to increase above pre-fire levels during winter and spring high flows when most sediment movement occurs. Soils would continue to erode at accelerated levels until adequate ground cover returns, tree downfall is in contact with the soil surface, or new vegetation grows. Recovery of ground cover and erosion rates on different parts of the fire will take from less than a year to a year following the fire on low burn severity sites, from 3 to 4 years on moderate burn severity sites, and from 3 to 5 years on high burn severity sites (BAER burn severity ratings). Recovery refers to the standards and guidelines for effective ground cover in the Malheur National Forest Land and Resource Management Plant (1990). See the Soils Report for more information on plant recovery rates.

The intermittent tributaries to Clear Creek and the upper portion of Easy Creek burned at high burn severities. Sediment transported down these draws would likely be deposited lower down within the intermittent channels, along gentler stream segments and at confluences with other stream courses. The following sections focus on the severely burned tributary areas of Clear Creek and Easy Creek.

Sedimentation – Tributaries to Clear Creek (High BAER burn severity area)

Post-fire hillslope erosion and sediment delivery to streams were modeled by the BAER team using the Water Erosion Prediction (WEPP) model for soil erosion. The erosion estimates are sensitive to cover, slope and actual rainfall, and actual erosion can range up or down by 50% as indicated in the WEPP documentation. The WEPP model gives average erosion estimates for each year based on 30 years of weather records. A severe storm could therefore significantly increase erosion (TenPas and McNeil 2002).

The intermittent tributaries to Clear Creek (and the portion of Easy Creek), which had high burn severity, were identified as focus areas for the erosion modeling. These areas were expected to experience erosion on the order of 2 to 4 tons per acre in the first two years following the fire. For the other areas, which burned at low to moderate, burn severity, the WEPP model showed 0.4 to 0.8 tons per acre of erosion in the next two years following the fire. WEPP predicts sediment transport to the drainage immediately downslope and not through a drainage network. It also does not include wide valley bottom filter strips.

Following the fire in the Clear Creek drainage, surface sheet erosion had occurred along the sideslopes above the intermittent stream channels that underwent moderate and high burn severity. Very fine sands and fine sands, stained by charred organic matter, were deposited with some silt, along parts of the stream courses. Accumulations of material were also behind down woody debris. The sediment deposits were within both the active stream channel and along the bank full width. The stream gradients ranged from 12 to 19%. The estimated amount of sediment along one intermittent stream channel was 1 to 3 cubic yards total along 0.7 mile of stream length. This does not include the material that moved through and out of the intermittent channel segment.

Only one area (about ¼ to ½ acre) had overland surface flow, which occurred over ¼ inch of charred remaining duff. The soil underneath was moist, but not very wet, and the slopes were 48-60 percent, with high amount of gravel and cobbles. Also, only a few areas had small-sized soil pedestals (from rainfall impact). The predominant erosion that had occurred was sheet erosion. There was very little stream bank cutting.

The unburned or low burn severity riparian areas which are downstream of the burned stream courses contained abundant litter cover, down wood, and re-sprouted vegetation to help trap sediment inputs. The amount of sediment within these intact areas decreased compared to those areas immediately adjacent to the burned areas.

Ephemeral Channels Tributary to Clear Creek (High BAER burn severity area)

The table below shows the ephemeral channels that were affected within the subwatershed area of Clear Creek where the predominant fire burn severity was high. Where low burn severity or scattered fire occurred in the ephemeral channels, there was little erosion, with the abundant down wood, litter, and present vegetation.

Table FW-23: Soil Burn Severity in Ephemeral Draws Conditions – Clear Creek Subwatershed (estimated lengths)

Ephemeral Draw	Length within Project Area (miles)	Soil (BAER) Burn Severity
A	0.5	Unburned to low
B	0.7	Low
C	0.4	Moderate to High
D	0.2	High
E	0.2	Unburned to moderate

However, ephemeral channel “C”, which underwent moderate and high burn severity, showed movement of material from the past winter and spring precipitation and runoff. The removal of the ground cover had allowed the water channel to erode the accumulated material (soil and remaining organic material). Material had moved from a rock outcrop/rockwall area and along the channel (15-30% gradient), and had been deposited along the ephemeral channel and below the road culvert. The channel ended on a flattened slope adjacent to a Category IV channel, about 200 feet downslope. The amount of channel material that was deposited within the channel and down through the lower road culvert was about 2 to 3 cubic yards along the 0.4 mile channel length. (See the Soils Appendix C for a map of the ephemeral stream channels.)

Turbidity refers to the amount of light that is scattered or absorbed by a fluid. Turbidity in streams usually results from suspended clay or silt particles in the water column and occurs during storm runoff events. Studies indicate that the ability of salmonids to capture food may be impaired at turbidity values in the range of 25 to 70 Nephelometric Turbidity Units (NTU), growth may be reduced and gill tissues damaged after 5 to 10 days exposure to turbidity of 25 NTU, and some species may be displaced at 50 NTU (MacDonald et.al., 1991).

Oregon Administrative Rules states, “No more than 10 percent cumulative increases in natural streams turbidities shall be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity” (ODEQ, 2002). Ground disturbing activities such as road construction, maintenance and use, and timber harvest can contribute to an increase in stream turbidity. Separating management related turbidity from natural levels would require large amounts of data that is unavailable. There is no turbidity data in the project area or in the subwatersheds.

Sedimentation reduces pool depth, alters substrate composition, reduces interstitial space, and causes channels to braid (Bitterroot, 2001). Abundance of bull trout, steelhead/redband and chinook salmon decline as sedimentation increases. Increases in fine sediment can reduce the availability of spawning habitat, reduce the survival of eggs, alevins, and fry, reduce the abundance of aquatic invertebrates, and reduce summer and winter rearing habitat for juveniles (Furness et. al., 1991). Sediment also absorbs radiation that can increase water temperature. These habitat changes, along with warmer water temperatures, also favor the displacement of native trout by non-native trout (Bitterroot, 2001).

Roads, particularly those that encroach and cross streams increase sediment input into fish habitat. A reduction in the percentage of fine sediments entering streams and embeddedness can be accomplished by repairing, closing (seasonally or permanently) and decommissioning roads that have been identified as sediment sources. See section on "Roads and Sedimentation," and "Effects of Alternatives – Changes Under All Alternatives" for more information.

Water Yield Classes/Stream Discharge & Flow

The hydrologic characteristics of the soils and geologic formations have been classified by water yield class interpretation. Water yield class gives an indication of the rate and amount of water yield expected from a particular soil type based on its infiltration rate, slope, vegetation, and drainage patterns. It provides a relative comparison of differences in detention storage capacity and contributions of runoff, as base or peak flows, between the different soils across the subwatershed. The table below summarizes the water yield classes for the subwatersheds.

Table FW-8: Water Yield Classes

	Water Yield Class (Acres and Percent of Subwatershed)					
	Class I	**Class I-II**	**Class II**	**Class II-III**	**Class III**	**Total**
Bridge Creek						
Acres	8,373	2,608	247	375	546	12,149
Percent of SWS	69	21	2	3	4	
Clear Creek						
Acres	9,594	2,822	68	-	-	12,484
Percent of SWS	77	23	1	-	-	
Reynolds Creek						
Acres	10,625	6,134	-	-	706	17,465
Percent of SWS	61	35	-	-	4	

The water yield Class I rating equates to soils with high water detention storage capacity and low rates of runoff. Precipitation contributes little water for peak flows until detention capacity is exceeded, or unless the soils are initially frozen or saturated. These soils are important in sustaining high base flows due to the large volume of water held in detention storage in the soil mantle.

Soils with moderate water detention storage capacity and moderate rates of runoff are rated Class II. Precipitation contributes to both peak flows and base flows depending on the amount of precipitation and initial conditions of the soil (i.e. already saturated, frozen).

Soils with a low water detention storage capacity and high rate of runoff are rated as Class III. Their storage capacity is low and easily exceeded resulting in most of the water yielded as peak flows. These soils contribute little water for base flows because their storage capacity is low. The coarser textured residual and mixed soils (gravelly to cobbly loams) are the primary soils with a Class III rating.

Drainages dominated by soils with a water yield Class III rating will tend to respond quickly to precipitation events (i.e. be "flashy") and have lower base flows, while drainages dominated by soils with water yield Classes I or II will tend to be buffered to most precipitation events and sustain higher base flows. Most of (or virtually all of) Bridge Creek, Clear Creek and Reynolds Creek subwatersheds are rated in the Water Yield Classes I and II.

Stream flow estimates are limited for the watersheds. The only available long term information on stream flows is peak flow information for the Bridge Creek subwatershed for the period of 1964-1979. Other estimates are from random instantaneous samples of stream flow across the watershed. The tables below summarize available stream flow information for Clear Creek and Bridge Creek.

Table FW-9: Stream Flow for Clear Creek

Year	Flow (CFS) / Date
1993	3.98 / July 14
1994	2.47 / Aug. 9
1995	2.61 / Sept. 6
1996	3.89 / Oct. 23

Source: Upper Middle Fork John Day River Watershed Analysis, December 1998.

Based on the limited flow information available it appears that the lowest flows occur during late summer months (August and September) averaging approximately 2.5 cubic feet per second (cfs). Peak flows have not been measured, but calculations based on drainage area, precipitation and base flows suggest probable peak flows of 35-40 cfs for the Clear Creek subwatershed (from the Clear Creek Biological Evaluation/Biological Assessment – Steelhead and Chinook Salmon 1998).

Table FW-10: Peak Flow for Bridge Creek

Year	Peak Flow (CFS)	Year	Peak Flow (CFS)
1964	22	1972	40
1965	49	1973	19
1966	27	1974	77
1967	35	1975	98
1968	20	1976	35
1969	35	1977	-
1970	53	1978	45
1971	52	1979	52

Source: Upper Middle Fork John Day River Watershed Analysis, December 1998.

For the Upper John Day watershed, major streams within or near the fire area include Mossy Gulch, North Fork of Reynolds Creek, and Reynolds Creek. Perennial flow is restricted to the main stems and the largest tributary reaches of these streams. Sample stream flow data were collected for streams during base flow periods in 1992. Flows in Reynolds Creek were approximately 17 cubic feet per second at the Forest boundary (about 4 1/2 miles downstream from the fire area), and 6 cubic feet per second above the confluence with the North Fork of Reynolds Creek (about 3 1/4 miles downstream of the fire area). Much of the perennial flow in these (stream) systems appears to collect via contribution of ground water along the main stems, rather than from small feeder tributaries.

The overall stream flow regime within both watersheds is dominated by snowmelt runoff, thus the duration and magnitude of flow is determined, to a large extent, by the high elevation snowpack accumulation. Consequently, peak flows can be highly variable, as is indicated by historic data for Bridge Creek. In a typical year, the predominant runoff period occurs from April through June (Upper Middle Fork John Day River Watershed Analysis 1998).

Fire Vegetation Severity, Created Openings and Peak Flows

Following the fire, stand mortality was assessed to determine the overstory and understory vegetation that is likely to die. Trees with complete or near-complete foliage consumption by the fire were clearly dead. However, trees with lesser amounts of damage may or may not survive in the near or long term (Memo 3420, 2002). The mapping of the fire's effect on vegetation survival indicated that larger areas, based on fire-killed vegetation or likely to die, were affected by the fire, compared to the fire burn severities of the soil and fuels on the BAER burn criteria.

The loss of the tree canopy can have an effect on peak flows, with changes in precipitation interception and infiltration, snow accumulation, runoff, and evapotranspiration of the forest vegetation. The table below displays the acres within each category of fire-effected vegetation, and the percent in each subwatershed.

Table FW-11: Vegetation Burn Severity by Subwatershed

Vegetation Burn Severity by Subwatershed			
Subwatershed	**Veg Severity**	**Acres**	**Percent SWS**
Bridge Creek	Light	304	2.5
	Moderate	78	0.6
	Severe	482	4.0
	Unburned	11,284	92.9
	Total	12,149	100.0
Clear Creek	Light	261	2.1
	Partial	61	0.5
	Moderate	1,330	10.7
	Severe	2,084	**16.7**
	Unburned	8,747	70.1
	Total	12,484	100.0
Reynolds Creek	Light	179	0.9
	Moderate	438	2.2
	Severe	435	2.2
	Unburned	18,862	94.7
	Total	19,915	100.0
Dry Fork	Light	4	0.0
	Moderate	24	0.2
	Unburned	11,191	99.8
	Total	11,219	100.0

About sixteen percent (2,084 acres) of the Clear Creek subwatershed contains vegetation that was severely (unlikely to survive) affected by the fire, where there is nearly total mortality. An additional ten percent of the watershed contains moderately affected vegetation (likely to survive), which included stands underburned and portions with relatively high individual tree mortality. The other subwatersheds contain less than five percent of moderate to severely affected vegetation.

In addition to the burn area in the fire area, past harvest, such as clearcut, shelterwood and seed tree harvest has created openings in the forest vegetation. The table below displays the forested area in created openings by subwatershed. In general, units that were partially cut, salvaged, or precommercially or commercially thinned were not considered.

The table below displays the pre-fire and post-fire created openings in each subwatershed. Hydrologic openings are defined as forested areas where most trees are less than 30 years old. Hydrologic openings created by the fire are defined as areas where greater than 60% of the trees were killed or are expected to die.

The figures are for Forest Service lands only. Pre-fire created openings include past clearcuts, shelterwoods and seed tree cuts 30 years or less in age. Partial cuts, such as thinnings, salvage and select tree harvest were not counted in the created openings.

Pre-fire clearcuts and other openings in forested areas that had "severe" or "moderate" fire vegetation severity were not double-counted, since they were already counted in the pre-fire created openings. About half of the "moderate" vegetation severity acres are assumed to have an open canopy equivalent to a created opening.

Table FW-12: Pre- and Post-Fire Created Hydrological Openings by Subwatershed

Subwatershed (SWS)	SWS Acres	Pre-Fire Openings[1] (acres)	Pre-Fire % SWS in Openings	Fire Created Openings – Vegetation Severity (acres)		Post-Fire % SWS in Openings[3]
				Severe[2]	Moderate	
Bridge Creek	12,149	1,505	12	458	64	16
Clear Creek	12,484	1,602	13	2,037	1,264	34
Dry Fork	11,219	782	7	-	24	7
Idaho/Summit Creek	13,289	80	1	-	-	1
Mill Creek	17,841	141	1	-	-	1
Squaw Creek	11,296	1,341	12	-	-	12
UMFJD Watershed	78,278	5,468	7	2,495	1,352	11
Dad's Creek	27,255	748	3	-	-	3
Deardorff Creek	12,870	1,924	15	-	-	15
Isham Creek	21,601	951	4	-	-	4
Rail Creek	25,075	842	3	-	-	3
Reynolds Creek	19,915	1,400	7	425	415	10
UJD Watershed	106,716	5,865	5	425	415	6

[1]Pre-fire created openings include past clearcuts, shelterwoods and seed tree cuts 30 years or less in age. Partial cuts, such as thinnings, salvage and select tree harvest were not counted in the created openings.

[2]Pre-fire clearcuts and other openings in forested areas that had "severe" or "moderate" fire vegetation severity were not double-counted, since they were already counted in the pre-fire created openings.

[3]About half of the "moderate" vegetation severity acres are assumed to have an open canopy equivalent to a created opening.

*Forest Service lands only

Clear Creek subwatershed shows the greatest increase in created openings resulting from the fire. Before the fire, Clear Creek subwatershed had 13 percent of its area in created openings. After the fire, about 34 percent of the subwatershed is expected to act as hydrologic openings. This is assuming that about half of the "moderate" fire vegetation severity acres had enough of a reduction in canopy for the burned areas to act as hydrologic openings.

Bridge Creek subwatershed showed an increase of 4 percent, from 12 to 16 percent, and Reynolds Creek subwatershed showed an increase of 3 percent, from 7 percent to 10 percent.

The other subwatersheds were not affected by the fire, and on a watershed level, the percent of current, post-fire created openings is low (11% for UMFJD, and 6% for UJD).

From the Umatilla Barometer Watershed Program, Helvey & Fowler (1998) found no changes in the magnitude of annual snowmelt peaks in small drainages that were nearly completely harvested by clearcut or shelterwood. However, peaks in one drainage occurred earlier after 60 percent of the drainage was harvested. This indicated earlier snowmelt in that drainage. Daily stream flow peaks did show an increase.

The stream/riparian habitat along Clear Creek was little affected by the fire (see table below), and is characterized by large numbers of large woody debris, highly stable banks, and good channel complexity and vegetative cover. Conifer mortality caused by the fire within the Clear Creek RHCA will provide large woody debris to the riparian area and stream in the future as well as increase vegetative diversity. Any expected small increases in peak water flow are not likely to adversely affect stream channel conditions. The other subwatersheds are not likely to experience increased peak flow from the fire, based on the small percentage of the subwatershed areas affected by the fire.

Table FW-13: Acres of BAER Burn Severity in the Clear Creek RHCA within the Easy Fire Recovery Project Area.

BAER Burn Severity	Acres	Percent of Total Clear Creek RHCA within the Project Area
High	9	6
Moderate	18	12
Low	64	43
Unburned	57	39

Peak flows are probably higher than during historic times. And base flows are likely lower than historic levels. Factors that can increase peak flows and base flows include the following:

- Roads, timber harvest, and livestock grazing have made more land impermeable and have extended drainage networks.
- Even-aged regeneration harvest has accelerated snow melt by increasing snow accumulation, insulation and wind speeds in created openings.
- Fewer beaver dams are available to retard water runoff.

Factors that have decreased peak flows and base flows include the following:

- Denser forest canopies and understory have decreased snow accumulation, insolation, and wind speeds, compared to historic stands that were more open.
- Increased forest density from fire suppression has increased plant transpiration.

See the section on “Roads” for road density information. The net effect probably is an increase in peak flows. This increase is small when compared to the annual variation due to weather.

For Clear Creek subwatershed, which has 16% of the area in severe fire-affected vegetation and 34% in created openings, Class I Water Yield soils make up 77% of the subwatershed. Class I Water Yield soils have high detention storage capacity and low rates of runoff. Class I soils are important in sustaining high base flows due to the large volume of water held in detention storage in the soil mantle. As a result of the high proportion of Class I soils in the watershed, the watershed is able to tolerate extreme peak flow events without serious environmental effects, except under unusual circumstances, such as frozen soils with a rain on snow event.

Twenty four percent of the subwatershed consists of Class II and I-II Water Yield soils, which have moderate water detention storage capacity and moderate rates of runoff. There are no Class III Water Yield soils in Clear Creek.

The duration and magnitude of stream flow is determined, to a large extent, by the high elevation snowpack accumulation. Consequently, peak flows can be highly variable, as is indicated by historic data for Bridge Creek (UMFJD Watershed Analysis 1998). See the previous section on “Water Yield/Stream Discharge & Flow.”

Increased Runoff

As reported earlier, the BAER team concluded that overall, both runoff and sedimentation are expected to increase within those subwatersheds that were influenced by high intensity fire, such as the Clear Creek subwatershed. This is likely to continue until ground cover can be established. Initial recovery of vegetation would result from regrowth of grasses, forbs, shrubs, mosses, liverworts and conifer seedlings. However, less than 5% of the area of these fires had experienced significantly reduced infiltration, which should minimize the amount of increased runoff (also expected to be about 5-10%) (Bright et.al., 2002).

Increases in water runoff could erode less resistant stream banks, scour channels, create new channels (potentially change ephemeral streams to intermittent) while abandoning others, and reactivate floodplains rarely flooded as channel systems lengthen, widen, and move laterally to provide enough area to carry high flows. Portions of channels may be scoured deeper.

New woody debris and sediment may be deposited in the stream channel, altering channel morphology. As the stream works through and redistributes the new material, new aquatic habitat is created and old habitat is rejuvenated.

However, with predicted increases in runoff for the Easy Fire area, these changes in channel morphology and complexity are expected to be minimal overall. Over time, as runoff decreases, the channels will narrow and recover to pre-fire conditions.

Leaving well-dispersed snags with post-fire project activities will eventually help in slowing down surface runoff, and help trap sediments as the snags fall to the ground. However, the more immediate factor in reducing runoff and erosion would be the re-sprouting vegetation, litter fall, and the growth of mosses, lichens, forbs and other herbaceous vegetation, along with the current down wood. Elliot, et al. (2001) noted that field observations and validation studies suggest that following fire the amount of exposed mineral soil is halved each year until the site is recovered. This usually takes about three or four years after a fire. Erosion rates decline significantly the third and fourth year after a fire.

As discussed earlier, recovery of ground cover and erosion rates on different parts of the Easy Fire would take from less than a year to a year following the fire on low burn severity sites, from 3 to 4 years on moderate burn severity sites, and from 3 to 5 years on high burn severity sites (BAER burn severity ratings).

Water retained in woody material is not available for augmenting late-season stream flows, but would provide moist micro-sites for conifers and other vegetation. Large down wood provides moist micro-sites for conifers, shrubs, herbs, fungi, mycorrhizae, mosses, lichens, bacteria and small animals such as earthworms, snails and nematodes.

Water Yield

Annual water yields may increase for several years after the fire, but would decrease to pre-fire levels as the vegetation becomes re-established, and the evapotranspiration rate increases. Helvey & Fowler (1998) found a low response to intensive timber removal. Yield from one small drainage increased during 2 years after 60 percent of the total timber stand was removed, while 2 other drainages showed no changes in water yield after most or all of the timber had been harvested. Any increases in water yield may have been negated by factors such as 1) water use from re-establishing vegetation, 2) below-average precipitation, and 3) increased wind speeds that may have caused snow transport out of the watershed or increased sublimation and evaporation rates.

Increases in water yield from post-fire logging appear to be more closely related to compaction and reduced infiltration than with burned vegetation. This water yield increase is minimal compared to fire related increases caused by loss of transpiration capability, loss by hydrophobic soils, and increases in bare areas.

Grazing and Miscellaneous Water Quality Information

There are no known chemical contamination problems in the watershed. Levels of dissolved oxygen are unknown. (UMF John Day Watershed Analysis 1998). It is likely that dissolved oxygen levels decline during summer low flows in many of the drainages due to the lack of turbulence.

The fire affected two grazing allotments – the Reynolds Creek and the Sullens C&H allotment. The Forest has developed post-fire interim grazing guidelines, which defer grazing in fire areas for at least two grazing seasons, depending on burn severity and existing plant species (Post-Fire Interim Grazing Guidelines, 2003).

The Reynolds Creek Allotment is currently permitted for livestock use from June 1 to September 18. Before the fire, the Sullens C&H Allotment was vacant and remains so currently. For more information on both allotments, consult the range report.

Bridge Creek Meadow is a large wet meadow located downstream of the fire area in the Clear Creek subwatershed. At the time of the Upper Middle Fork John Day watershed analysis, the meadow was in a general upward trend in the vegetative as well as in soil conditions. The meadow contained significant amounts of non-native Kentucky blue grass as well as native sedges and rushes. Lodgepole pine was noted as encroaching upon the meadow, resulting in a reduction of forage production (UMF John Day River WA 1998).

Stream Channel Habitat Condition

Fish Habitat

Fish habitat is a product of natural cycles of disturbance. In western Montana, the two primary natural disturbance mechanisms responsible for initiating stream dynamics that ultimately increase habitat complexity and diversity are fires and floods (Brassfield et.al., 2001). In the short-term, fires trigger other processes, such as erosion and woody debris recruitment, which are critical in the formation of young, biologically rich stream systems. Over longer time periods, fires recycle nutrients, regulate forest development and biomass, and maintain biological pathways. The effect of fire on these processes is ultimately transferred to stream channels. Fires, and the ecological processes associated with them, are thus an integral part of maintaining native fish populations.

The real risk to fisheries is not the direct effects of fire itself, but rather the existing condition of watersheds, fish communities, and stream networks, and the impacts of fighting fires. Therefore, attempting to reduce fire risk as a way to reduce risks to native fish populations may not be prudent (Bitterroot 2001).

In addition to not addressing the true risks to aquatic systems, most proposals to reduce fire risk involve fuel reduction treatments that can, themselves, result in significant risks to fisheries. Salvage of burned trees is often proposed to reduce future fuel loading. While salvage can be accomplished with minimal impacts in some areas, many burned areas are already extremely sensitive to ground disturbance due to the loss of vegetation.

Further disturbance can result in increased erosion, compacted soils, and a loss of nutrients from these areas (USDA 2000, Beschta et al. 1995). Potential values at risk include sediment delivery into fish bearing streams from fire lines, safety zones, fire camps, and bare soils resulting from the fire. Large-scale thinning or construction of fuel breaks in non-burned forests may have fewer direct impacts than salvage, if it occurs from existing roads and outside of riparian areas, but it still won't reduce risks to aquatics, because it's not addressing the source of the problem.

The condition of post-fire fish habitat is strongly influenced by burn severity (Bitterroot 2001): 1) Low severity burns are likely to change habitat little from pre-fire conditions: 2) High severity burns- woody debris, pools, sediment, turbidity, and nutrients will be highly dynamic for the first 1-5 years after fire (Bitterroot 2001); and 3) Moderate severity- habitat changes are likely to be intermediate to the low and high severity and will be influenced to a large degree by site specific factors such as the extent of burning along stream banks, slope of riparian zones, and other factors. Effect to fish habitat in streams of the Easy Fire Recovery project area are expected to follow these trends.

Current habitat conditions in the watersheds reflect almost 140 years of human activities. Where past impacts to riparian and aquatic habitat exist in the two watersheds, four dominant factors have resulted in the degraded conditions: 1) An extensive road system that imposes on most of the riparian areas within the watershed; 2) Past logging practices, which have both directly and indirectly influenced channel morphology; 3) Livestock, which have impacted stream bank stability and changed vegetative species composition; and 4) The significant reduction of beaver populations within the watershed. Water withdrawals and projects that artificially restrict stream channels have also impacted stream channels.

Each of these four factors have led to a simplification of channel structure by reducing the influence of large wood, straightening of the channel, destabilizing stream banks and reducing the amount of bank undercuts, widening channels (increasing width to depth ratios), and by causing streams to downcut their channels, thereby reducing their contact with the floodplains across much of the UMFJDR and UJDR watersheds. However, in contrast to the overall general watershed condition described above, the Clear Creek and Lunch Creek drainages are in generally good condition (see following section on Large Wood).

Large woody debris levels have been reduced along many reaches of streams located in the two watersheds by past harvest activities, stream-side railroad grades, road building, and stream management activities. This reduction in large wood has resulted in reduced numbers of pools, channel diversity and sinuosity, bank stability, as well as increased stream velocities and water temperatures. Also the reduction of wood in channels has resulted in a reduced ability for streams to trap sediments and organic debris and interact with floodplains. The reduced wood levels have also meant a loss of high quality summer and winter rearing habitat for salmonids and other fish species. Bull trout, in particular, prefer complex habitat formed by the accumulation of large wood (Rieman & McIntyre 1993).

However, exceptions to this condition of reduced stream channel large woody debris levels are found in Lunch Creek and Clear Creek, in the Bridge Creek and Clear Creek subwatersheds, respectively, of the UMFJDR watershed (see table below). These subwatersheds contain high levels of woody debris and good channel complexity reflecting the largely unaltered condition of the riparian vegetation along these streams. Past log weir structures have been constructed in the lower portions of Clear Creek in an attempt to increase pool habitat and emulate large woody debris structure.

Table FW-14: Summary of Channel Habitat Conditions in Lunch Creek and Clear Creek

Stream	**Average Gradient % ***	**Average Sinuosity ***	**Bankfull Width to Depth Ratio ****	**Woody Debris per Mile (#large pieces) ****
Clear Creek	3.3	1.2	6-13.7	329 (36)
Lunch Creek	2.7	1.4	15.7	197 (5)

Sources: * Derived from USGS topographic maps.

** Hankin and Reeves stream survey data.

The riparian condition of those streams adjacent the project area in the UJDR watershed, is much different. In Reynolds Creek, to the confluence of North Reynolds Creek, and in North Reynolds Creek, to the confluence with Mossy Gulch Creek, the overstory conifers are rated at fair and the understory does not meet forest plan standards (Mossy Analysis Area EA, 1994). The upper reaches of North Reynolds Creek, from its confluence with Mossy Gulch Creek to its headwaters, also have overstory conifers in fair condition, but at risk of declining due to insect infestation. Most of the understory vegetation is in satisfactory condition.

Mossy Gulch Creek, from its mouth to its headwaters has a conifer overstory condition in decline from insect infestation. However, the understory vegetation meets forest plan standards (Mossy Analysis Area EA, 1994). Mossy Gulch Creek, Reynolds Creek, and the Upper North Reynolds Creek were found to have stable banks. In other parts of the watershed where streams had unstable banks, surveys indicated these conditions had been primarily caused by the impact of recreational use (dispersed camping), trampling and heavy grazing by cattle, not past harvest activities. Riparian shrubs were few and heavily browsed. Mature deciduous trees were present, although heavy browsing of seedlings was restricting or eliminating future populations.

Fish Passage

There are no known fish passage barriers within the project area or along haul routes on Forest Service land.

Stream Inventories

Using Region 6 Level II stream methodology, pre-fire stream inventories were conducted on streams within the project area (Clear Creek, 1992, UMFJDR watershed) and within the potential effected environment immediately adjacent to the project area (Reynolds Creek, North Reynolds Creek, 1991, UJDR watershed). Clear Creek is the only perennial fish bearing stream (Category 1) present in the Easy Fire project area. Post-fire stream inventories were also conducted in 2002 to assess conditions on all Category 1, 2, and 4 streams in the project area. However, the intent of these surveys was to acquire data for only four specific types of habitat not a complete Level II stream inventory. These data were: 1) large woody debris per mile, 2) replacement large wood per mile, 3) pools per mile, and 4) Wolman pebble counts.

Reaches 1 through 4 of the 1992 Clear Creek stream survey and the first 0.30 miles of Reach 5 inventoried channel and riparian conditions below the fire between Highway 26 and the project area boundary, whereas only Reach 1 of the 2002 survey covered the same area. The last mile of Reach 5 and the first 1.85 miles of Reach 6 of the 1992 survey inventoried conditions within the fire boundary, which corresponds to Reach 2 of the 2002 stream survey. The last 0.25 miles of Reach 6 of the 1992 survey and Reach 3 of the 2002 survey were completed above the fire project area boundary.

Large Wood

Twenty pieces of wood per mile (at least 35-feet long and greater than 12-inches in diameter) is considered to be functioning appropriately according to PACFISH (1995). Results of stream surveys are shown in table FW-15 below. Large wood counts include both large and medium woody debris, which is effective in smaller streams. Low LWD component reduces availability of high quality pools, sorting of gravel to create spawning habitat, and increases channel instability and sediment transport, all of which impact fish habitat and populations. Reach one of Reynolds Creek spans the area between the end of private land to the confluence with North Reynolds Creek (about 1 1/2 miles).

Table FW-15: Large wood/mile for surveyed streams in Easy Fire Recovery Project area.

Stream Name	Reach	Total pieces/mile of wood >35-feet long and >12-inches diameter
Upper Middle Fork John Day River Watershed		
Clear Creek 1992	1	94
	2	184
	3	130
	4	144
	5	206
	6	307
Clear Creek 2002	1	42
	2	63
	3	74
Upper John Day River Watershed		
Reynolds Creek	1	No data available
North Reynolds Creek	1	33
	2	103
	3	80
	4	25
	5	177
	6	124

While wood counts in Clear Creek are much lower in 2002 as compared to the 1992 survey, the large wood counts are well above PACFISH (1995) objectives at two to three times PACFISH (1995) levels. Results for the North Reynolds Creek stream survey (1991) also show wood counts to be above PACFISH levels. However, data collected for Clear Creek in 2002 and North Reynolds Creek are below the minimum desired future condition (DFC) values of 80 pieces per mile specified in Amendment 29 of the Malheur Forest Plan (1990).

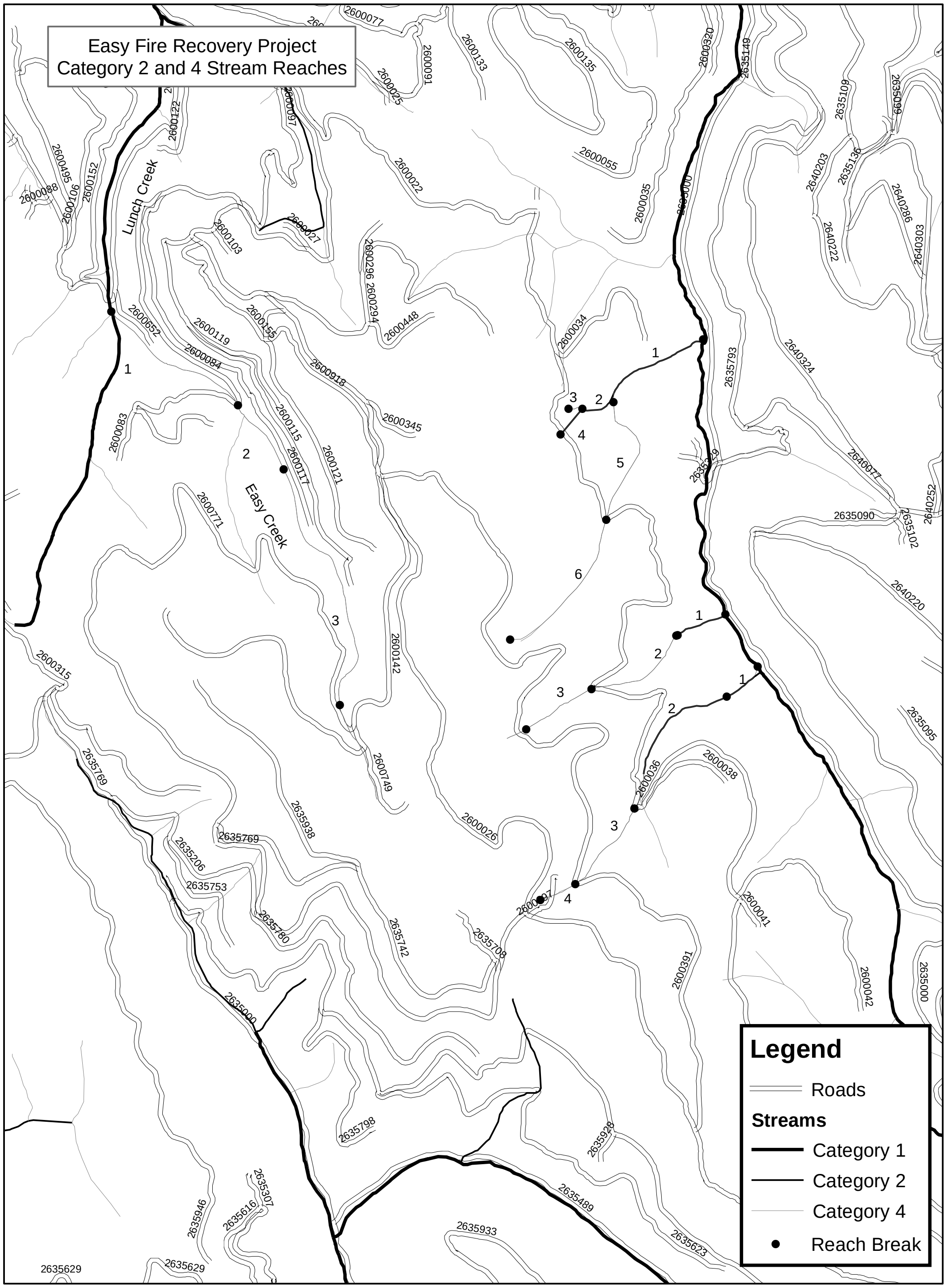
Post–fire wood count data was also collected for Category 2 and 4 streams in 2002 within the Easy Fire Recovery Project area and is shown in the table below. While specific wood count recommendations are not specified in PACFISH or Amendment 29 of the Malheur Forest Plan (1990) for these stream categories, the plan does specify the following as a resource element standard under Fish and Wildlife (Resource Element 12, IV-56): Provide for the input of large, woody debris into all classes of streams and evaluate to determine if objectives are being met. Wood count data was collected in accordance with Region 6 Level II Stream Survey protocol.

Table FW-16: Large wood/mile for Category 2 and 4 streams within the Easy Fire Recovery Project Area.

Stream	Category	Total pieces/mile of wood >35-feet long and >12-inches diameter
Easy Creek	4	40
Tributaries to Clear Creek within Project Area	2	59
Tributaries to Clear Creek within Project Area	4	20

The surveyed reach breaks for these Category 2 and 4 streams are shown in the following figure.

Figure FW-3: Category 2 and 4 Stream Reaches



Large Pools

Large pools function as holding areas for migrating adult salmonids; summer and rearing habitat for juvenile salmonids, adult bull trout, and redband trout; and as refugia during low flows and extreme temperatures.

All surveyed streams were found to be below PACFISH (1995) objectives of 96 pools per mile and Amendment 29 of the Malheur Forest Plan (1990) DFC minimum number of 75 per mile. See table FW-17 below.

Table FW-17: Pools/Mile for surveyed streams in the Easy Fire Recovery Project area.

Stream Name	Reach	Pools/Mile
Upper Middle Fork John Day River Watershed		
Clear Creek 1992	1	15
	2	4
	3	9
	4	5
	5	7
	6	8
Clear Creek 2002	1	12
	2	11
	3	0
Upper John Day River Watershed		
Reynolds Creek	1	50
North Reynolds Creek	1	0
	2	2
	3	8
	4	50
	5	3
	6	2

Stream Substrate

Clear Creek and North Reynolds Creek were found to have a high percentage of embedded units (>35% embedded). No data was available for Reynolds Creek (See Table FW-18 below). Gravel for trout spawning is found in every fish bearing stream reach surveyed in the project analysis area. See following table.

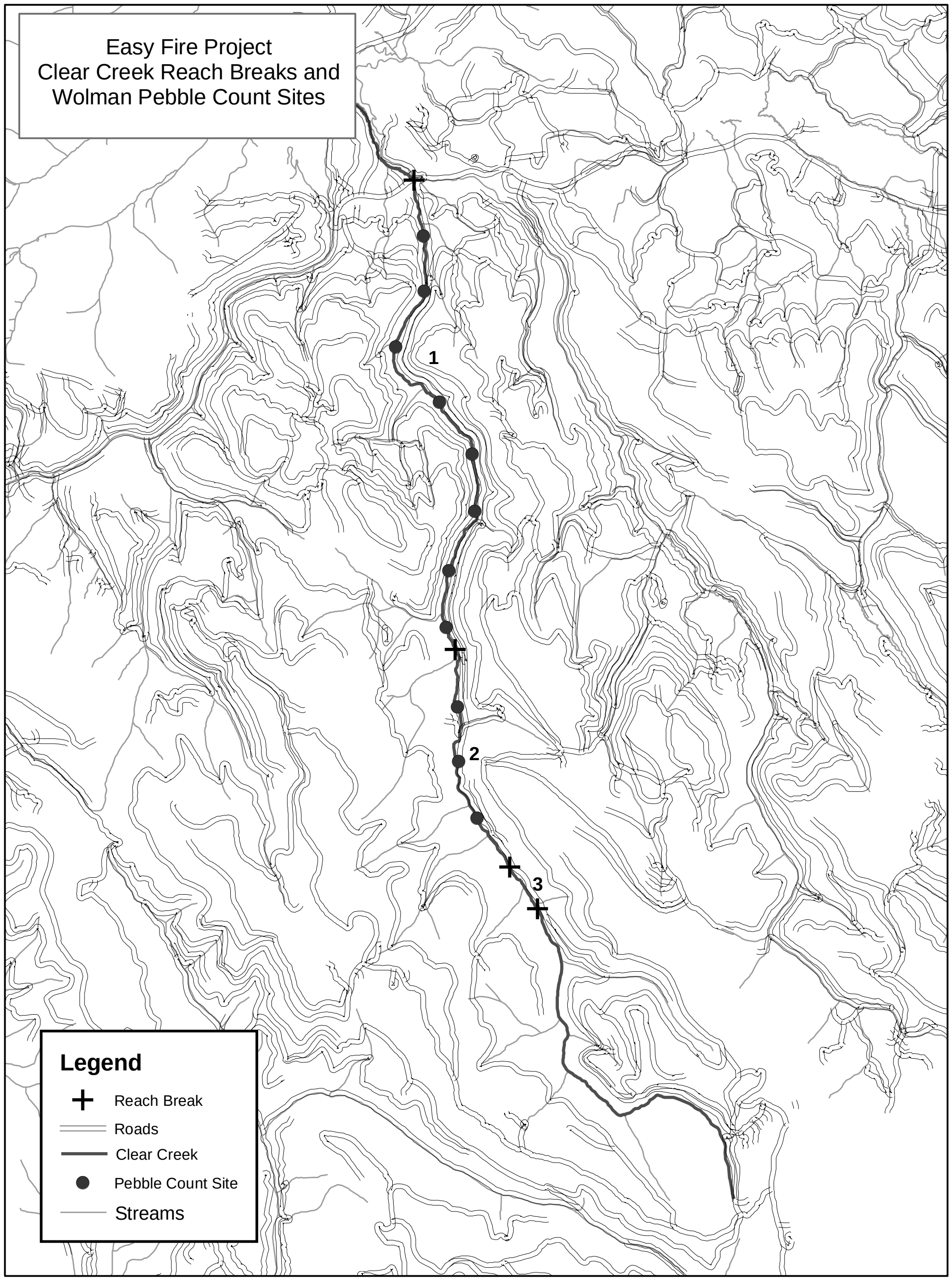
Table FW-18: Substrate of Surveyed Streams in Easy Fire Recovery Project Area

Stream Name	Reach / %units embedded >35%	Dominant Substrate	Subdominant Substrate
Upper Middle Fork John Day River Watershed			
Clear Creek 1992	1/ 75%	Cobble	Gravel
	2/ 0	Gravel	Cobble
	3 /0	Gravel	Cobble
	4/56%	Cobble	Gravel
	5/86%	Gravel	Sand
	6/44%	Cobble	Gravel
Clear Creek 2002	1/No Data	No Data	No Data
	2/No Data	No Data	No Data
	3/No Data	No Data	No Data
Upper John Day River Watershed			
Reynolds Creek	1/ No data available	Cobble	Gravel
North Reynolds Creek	1/ 0	Cobble	Gravel
	2/ 0	Cobble	Gravel
	3/ 25	Cobble	Gravel
	4/ -	Cobble	Gravel
	5/ 100	Cobble	Gravel
	6/ 100	Cobble	Gravel

Wolman Pebble Count Data

While dominant and subdominant substrate and embeddedness data were not collected during the post-fire 2002 Clear Creek survey, Wolman Pebble Count data was collected. The Wolman Pebble Count technique (Wolman, 1954) has recently been recognized as a better alternative to characterize substrate than visual estimation techniques such as embeddedness. Pebble counts are also used as monitoring tools to evaluate entry of fine sediments (i.e., sand, silt, or clay) into streams resulting from management activities such as timber harvest, fire, or road construction. Figure FW-3 depicts reach breaks for this survey as well as the Wolman Pebble Count sites in Reaches 1 and 2.

Figure FW-4: Clear Creek Reach Breaks & Wolman Pebble Count Sites 2002



Wolman pebble count transects were completed downstream (Reach 1) and within (Reach 2) the fire area, according to Region 6 Stream Survey Protocol (Version 2.3). Data was compiled in Table FW-19 below. A pebble count generally consists of a random selection of at least 100 particles from the streambed. Sand, silt, and clay particles are tallied as "less than 2 mm" or what may be regarded generally as potentially harmful to fish. Because the methodology used in collecting data is inherently biased against fines, this data cannot be compared to embeddedness data from the 1992 survey, but will better serve as a monitoring tool to assess post-fire changes in stream channel particle size distributions.

The number of pebbles in size classes are tabulated and converted into percentages. Data is plotted as a cumulative size distribution curve. The resulting frequency distribution represents a representation of the streambed covered by particles of a certain size since each pebble represents a portion of the bed surface. Results are theoretically equivalent to size distributions obtained from bulk samples.

The entire width of the bankfull channel is investigated, and the rocky particles of the streambed are grouped by their size. A frequency distribution by size class is graphed. The resultant curve is used to make inferences about channel dynamics. During bankfull flows, it is expected that all particles smaller than the median value (D50) displayed on the curve will be mobile, and this same value further refines the Rosgen channel type for that reach. In a similar sense, particles larger than the 84^{th} percentile (D84) will comprise the immobile portion of the streambed during bankfull discharge.

Table FW-19: Wolman Pebble Count Data- Clear Creek Survey 2002

Reach	Site	Distance Between Sites (Feet)	Total Distance from Reach Start (Feet)	Percent Finer than 2 mm	D50 (mm)	D84 (mm)
1	1	2752		5	22.7	37.8
1	2	2668	5420	0	27.1	46.5
1	3	3044	8464	0	30.4	65.2
1	4	3951	12415	0	30.3	50.4
1	5	3107	15522	3	10.7	19.6
1	6	2756	18278	0	24.0	63.3
1	7	3248	21526	0	18.1	35.4
1	8	2734	24260	0	15.4	40.0
1	End of Reach	1241	25501			
2	1	2890		11	53.1	105.4
2	2	2837	5727	8	17.3	35.7
2	3	3042	8769	0	25.2	87.2
2	End of Reach	2875	11644			

Percent Bank Stability

Results show Reynolds Creek and Clear Creek to have highly stable banks, exceeding PACFISH (1995) objective levels of >80% and the Malheur National Forest Plan Amendment 29 (1994) DFC value of 90% in the table below. Whereas, only Reach 5 of North Reynolds Creek showed bank stability in excess of 80%.

Table FW-20: Stream bank stability for surveyed streams in Easy Fire Recovery Project area.

Stream Name	Reach	Stream bank Stability (%)
Upper Middle Fork John Day River Watershed		
Clear Creek 1992	1	100
	2	100
	3	100
	4	100
	5	100
	6	100
Clear Creek 2002	1	-
	2	-
	3	-
Upper John Day River Watershed		
Reynolds Creek	1	100
North Reynolds Creek	1	58
	2	55
	3	56
	4	-
	5	86
	6	-

Wetted Width/ Maximum Depth Ratio

High width to depth ratios without shade or undercut banks commonly will allow the sun to elevate stream temperatures above the optimum for salmonid summer rearing. High width to depth ratios can also limit winter rearing by allowing streams to freeze. High width to depth ratios in smaller streams can severely limit habitat available for fish at base flows due to inadequate depth as well as high water temperatures.

Wetted width to maximum depth ratios for all surveyed streams met or exceeded the PACFISH (1995) and the Malheur National Forest Plan Amendment 29 (1994) DFC objective level of <10. All reaches of Clear Creek were less than or equal to 10, Reynolds Creek reaches ranged from 4.6 to 8.7 and North Reynolds Creek reaches ranged from 6.0 to 7.4.

Fish Species

The Upper Middle Fork John Day River (UMFJDR) watershed and the Upper John Day River (UJDR) watershed both contain habitat for two federally listed (threatened) species under the Endangered Species Act (ESA) and three Region 6 sensitive species. Table FW-21 shows the known distribution of these species in the affected environment in and within two miles of the Easy Fire Recover project Boundary.

Summer steelhead (*Oncorhynchus myki*ss), an anadromous salmonid, of the Middle Columbia Evolutionary Significant Unit (ESU) was listed as threatened on 03/25/25/99 and bull trout (*Salvelinus confluentus*) of the Columbia River distinct population segment (DPS) was listed as threatened on 06/10/98. Both resident and fluvial forms of bull trout are present in the watershed, although fluvial forms are rare. Access to historic habitat for bull trout and steelhead into Lunch Creek and upper Bridge Creek only became possible two years ago when a fish ladder was built around the dam at Bates pond. These streams are capable of providing spawning and juvenile rearing habitat in their present condition (UMFJDR WA, 1998).

Region 6 sensitive species include: (1) the mid-Columbia River spring run chinook salmon (*Oncorhynchus tshawytscha*), listed in1997, (2) interior redband trout (*Oncorhynchus mykiss* ssp.), listed in 1986, and (3) westslope cutthroat trout (*Oncorhynchus clarki lewisi*), listed in 2000. Both resident and anadromous forms of redband trout are found in the watersheds. Chinook salmon are anadromous as well. Additionally, the Columbia spotted frog is thought to be present in the two watersheds, however, their presence has not been confirmed.

In addition to federal and regional listing of these fish species, the summer steelhead, bull trout, redband trout, and westslope cutthroat trout are all designated as management indicator species (Malheur National Forest Plan 1990) for assessing changes to fish habitat. Management Indicator Species (MIS) are species of vertebrates and invertebrates whose population changes are believed to best indicate effects of land management activities. Utilizing the MIS concept, the total number of species found within a project area is reduced to a subset of species that collectively represent habitats, species, and associated management concerns. The MIS are used to assess the maintenance of populations (the ability of a population to sustain itself naturally) biological diversity (including genetic diversity, species diversity, and habitat diversity), and effects on species in public demand. The Malheur Forest Plan directs analyses to focus on MIS species.

The bull trout has more specified habitat requirements than other salmonids and is more sensitive to environmental disturbances at all life stages (Rieman & McIntyre, 1993) and consequently is the key indicator species for analyzing effects. While the other management indicator species have similar but less restrictive habitat needs than bull trout, they will benefit by activities that preserve and protect bull trout habitat. In addition to the listed fish, the presence of the mountain whitefish (*Prosopium williamsoni*) in the UMFJDR watershed and brook trout (*Salvelinus fontinalis*), an introduced salmonid, in the UJDR watershed have also been documented in the watersheds.

Table FW-21: Distribution and miles of habitat of Federally Listed and Region 6 Sensitive species in the Upper Middle Fork John Day River Watershed and the Upper John Day River Watershed.

Watershed	Subwatershed	Stream	Bull Trout	Steelhead	Chinook Salmon	Redband Trout	Cutthroat Trout
Upper Middle Fork John Day	Clear Creek	Clear Creek	2.88	3.64	0.57	6.45	
	Bridge Creek	Lunch Creek	3.64 P	3.51		3.64	
Upper John Day River	Reynolds Creek	Mossy Gulch Creek	1.06	1.06		1.06	
		North Reynolds Creek	7.37	3.57		8.00	7.37

P = Potential habitat

The summer steelhead and spring chinook runs in the John Day River Basin are composed entirely of native stocks. The number of anadromous adults returning to the entire John Day Basin range on a yearly basis from 4,000 to 25,000 steelhead and 400 to 3,000 chinook salmon. The Middle Fork John Day River (MFJDR) subbasin produces 24 percent of the wild spring chinook and 30 percent of the wild steelhead of the John Day River Basin (Oregon Water Resources, 1991). In particular, the MFJDR has historically contributed approximately 23% of the total run of steelhead and 12% of the total run of chinook salmon for the John Day River Basin (USFWS and NMFS, 1981). The estimated escapement to the John Day basin is shown in Table FW-22 below and has averaged 13,998 and 2,670 adults since 1987 for steelhead and chinook, respectively.

Table FW-22: Estimated spawning escapement of spring chinook salmon and steelhead to the John Day Basin.

Year	Spring Chinook Salmon	Summer Steelhead Trout
1997	2,700	5,711
1996	3,300	5,658
1995	369	3,900
1994	2,400	9,300
1993	4,000	7,200
1992	3,100	17,100
1991	1,100	7,200
1990	2,200	12,000
1989	2,600	9,600
1988	3,000	36,400
1987	4,600	34,300
Mean	2,670	13,988

Note: Data from Unterwegner pers. Comm., Unterwegner and Gray (1995, 1996, 1997)

Life History Characteristics

General habitat requirements for fish in the project area are very similar in that they require cold, clear water, a complex of diverse habitat (pools, riffles, etc.), hiding cover (logs, cutbanks, debris mats), spawning and rearing areas, and food. The quality of fish habitat is dependent on the quality of the stream channel and surrounding riparian area. Organic material (cones, leaves, stems, logs, insects, etc.) introduced into the stream channel and riparian area influence the type of food or habitat available to fish. If the organic material is decreased or removed, the quality of the habitat decreases.

Although different salmonid species have the same basic habitat requirements, differences in temperature adaptations exist. Generally, salmonids require a water temperature of 65 degrees F or lower to thrive. Most species can survive temperature increases as high as 70 degrees F for short periods of time. However, such temperatures decrease growth rates, spawning, migration, and stamina among other things. There are a couple of exceptions to this general statement for fish in the project area. Redband trout can survive temperatures up to 80 degrees F for short periods of time (Behnke, 1979). Bull trout, on the other hand, cannot survive water temperatures above 55 to 58 degrees F and therefore can only inhabit the colder streams. Also, bull trout are so sensitive to sedimentation and habitat degradation that their range has decreased drastically. Today, healthy populations are found primarily in roadless, headwater areas. Studies done by Ratliffe & Howell (1992) indicate that at least 54% of Oregon’s bull trout populations are at moderate to high risk of extinction.

Summer steelhead

Summer steelhead are the anadromous form of *O. mykiss*. Adult summer steelhead return to freshwater from June through September. Adults overwinter in large rivers while sexually maturing. Adults resume migration to spawning streams in early spring. Spawning takes place in the John Day River Basin from March through mid-June. Eggs incubate during the spring and emergence occurs from April through July depending on water temperatures. Juveniles typically spend two to three years in freshwater. They use mostly moderately sized tributaries to the MFJDR for both spawning and rearing, whereas, chinook salmon generally spawn in the main river. Juvenile steelhead generally utilize habitats with higher water velocities than juvenile chinook salmon. In winter, juveniles utilize deep pools with abundant cover. Juveniles may reside in their natal stream for their entire rearing freshwater phase or may migrate to other streams within a watershed. Smoltification occurs during late winter and emigration to the ocean occurs during the spring. Summer steelhead adults normally rear for 1 or 2 years in the ocean.

Spring chinook salmon

Adult spring chinook salmon return to the John Day River Basin during the spring; generally in May. Adults hold in deep pools during the summer while sexually maturing. Spawning occurs during the fall from late August through September. Embryos incubate over winter and emergence occurs in the spring. Juveniles generally rear for one year in freshwater. Both adult and juvenile chinook salmon seek out the cooler waters of the tributaries when temperatures become high in the MFJDR. Juveniles use habitats with slower water velocities (pools, glides, and side channels). Juveniles overwinter in deep pools with abundant cover. Smoltification and emigration to the ocean occurs in the spring of their second year. The ocean rearing phase lasts for one to three years.

The lower portions of Clear Creek have suitable water quality and habitat for successful spawning and rearing, and it is believed that if more fish were available in the system, more spawning chinook salmon would be observed in Clear Creek.

Redband trout

Native trout found in the internal basins of Oregon are redband trout derived from the Columbia River system. Malheur redband are a genotypic sub-species adapted to unstable, harsh, environments and because they are more adapted to variable water conditions, they probably have resisted hybridization with hatchery fish. Observations have verified this adaptive nature by finding redband in some very marginal waters with high temperatures late in the summer. Redband trout move into smaller tributary streams during the summer to access cooler water during base flow periods. They tend to be small in size and are better suited for the microhabitats being maintained by base flows of less the 0.3 cfs. Hatchery rainbows would not be able to tolerate the such harsh water conditions.

Redband trout are the resident form of *O. mykiss*. Redband trout may or may not be reproductively isolated from steelhead. Redband and steelhead trout from the same geographic area may share a common gene pool. Spawning takes place in the spring from March through May. Eggs incubate during the spring and emergence occurs from April through July depending on water temperatures. Redband trout may reside in their natal stream or may migrate to other streams within a watershed. Habitat requirements are similar for redband trout and juvenile steelhead.

Bull trout

Bull trout are a member of the char family. Bull trout exhibit three life history forms in Oregon: resident, fluvial and adfluvial (Buchanan et. al, 1997). Resident life history forms spawn and rear in their natal streams. Fluvial life history forms migrate and rear to maturity in larger rivers. Adfluvial life history forms migrate and rear to maturity in lakes. Resident and fluvial life history forms are present in the MFJD metapopulation (T. Unterwegner, ODFW, personal communication, 1997). By rearing in larger rivers and lakes migratory forms typically grow to larger sizes compared to resident forms. Increased size results in an increase in fertility (Goetz, 1989).

Bull trout spawn from August through November when water temperatures drop to 5 to 9 C (Fraley & Shepard, 1989). Bull trout require clean gravel with little silt for spawning (Weaver & White, 1985; Rieman & McIntyre, 1993) and are strongly associated with the stream bottom (Rieman & McIntyre, 1993). Increases in fine sediment can reduce embryo survival and fry emergence. Embryos incubate over winter and hatching occurs in January. Successful incubation requires upwelling groundwater. Fry emerge from the gravel in early spring. The extended incubation period suggests that embryos and fry are susceptible to highly variable stream flows, bedload movement and channel instability (Rieman & McIntyre, 1993).

Bull trout fry utilize side channels, stream margins and other low velocity areas (Rieman & McIntyre, 1993). As juveniles increase in size, they utilize pools, undercut banks, areas with large wood and other highly complex habitat. Juveniles require cold water trib rearing habitat with an abundance of rocks and woody debris for cover (Fraley et. al,. 1989). Optimum juvenile growth occurs in water temperatures from 4 to 10 C (Buchanan & Gregory, 1997). Feeding habits of juveniles change as size increases (Shepard et. al, 1984). Juveniles less than 110 millimeters (mm), feed almost exclusively on aquatic insects. Juveniles from 110 to 140 mm begin to feed on fish. Resident fish rear to maturity in natal or nearby streams. Migratory life history forms generally migrate from natal streams to larger rivers or lakes at 2 to 3 years of age. Migration can occur in spring, summer or fall (Shepard et. al, 1984).

Bull trout mature between 5 and 7 years of age (Rieman & McIntyre, 1993). Fluvial adults require large pools with abundant cover in rivers. Adfluvial adults utilize all areas of lakes for rearing habitat (Hanzel, 1986). Adults are found in water temperatures from 4 to 20 C with an optimum temperature of 12 C (Buchanan & Gregory, 1997). Feeding habits of adults vary according to life history form and food availability (Shepard et. al, 1984). Resident adults feed on both insects and fish. Fluvial and adfluvial adults are predominantly piscivorous. Adults begin migrating to spawning areas in late spring through early fall (Martin, 1985). Adults generally return to rearing areas within a month of spawning (Thiesfield et. al, 1996).

Westslope cutthroat trout

Resident WCT are the dominant life-history form present in the John Day River system; however, recent research has indicated larger, possibly fluvial life forms are present in the mainstem John Day River (Gray 1998; M. Gray, ODFW, *pers. comm.* 1999). Resident WCT are the one known life-history form found in the upper John Day River watershed. Resident forms are often isolated in single streams, separated from other stocks by distance and habitat conditions. However, numerous stocks in the Upper John Day River exhibit occupation of multiple, connected tributary streams that are, as a group, isolated from other, single stream stocks by geographic distance and habitat conditions (Gray 1998; Pence 1998). This connectivity is important to avoid isolation and protect the interconnected stocks from cumulative watershed effects (Hemmingsen and Gray 1999 draft).

Westslope cutthroat trout habitat includes small mountain streams, main rivers, and large natural lakes. WCT require cool, clean, well-oxygenated water. In large rivers, adults prefer large pools and areas of slow water velocity; those reaches with many pools and some form of cover generally have the highest fish densities. In lakes, WCT often occur near shore (Spahr et al. 1991). Juveniles of migratory populations may spend 1-4 years in their natal streams, then move (usually in spring or early summer, and/or fall in some systems) to a main river or lake where they remain until they spawn (Spahr et al. 1991), McIntyre and Reiman 1995). Many fry disperse downstream after emergence (McIntyre and Reiman 1995). These fry tend to overwinter in interstitial spaces in the substrate. Larger individuals congregate in pools in the winter.

No information is available regarding WCT spawning locations in the upper mainstem John Day River or its tributaries. However, WCT spawn in small tributary streams on clean gravel substrate at a mean water depth of 17-20 cm and a mean water velocity of 0.3-0.4 m/sec. They tend to spawn in their natal stream (McIntyre and Reiman 1995). Adfluvial populations live in large lakes in the upper Columbia drainage and spawn in lake tributaries. Fluvial populations live and grow in rivers and spawn in tributaries. Resident populations complete their entire life history in tributaries. All three life-history patterns can occur in a single basin (McIntyre and Reiman 1995). Migrants may spawn in the lower reaches of the same streams used by resident fish. Maturing adfluvial fish move into the vicinity of tributaries in fall and winter and remain there until they begin to migrate upstream in spring. Some migratory spawners remain in tributaries during summer months but most return to the main river or lake soon after spawning (Behnke 1992).

Condition and Distribution of Fish Species

Upper Middle Fork John Day River Watershed

Bull trout

Bull trout are reduced in both numbers and distribution within the MFJD River subbasin. Bull trout were found prior to 1990 in Indian Creek, Big Boulder Creek, Butte Cr, Davis Creek, and Vinegar Creek. Bull trout were also found in the mainstem MFJD below Indian Creek and from Clear Creek upstream to Phipps Meadow. It is assumed that interchange between all the John Day River metapopulations occurred in the past. Fluvial life history forms once had access to the Columbia and Snake Rivers and may have used these rivers for rearing habitat (Buchanan et. al, 1997).

Currently, bull trout are found in the Big Creek, Granite Boulder Creek, and Clear Creek drainages. These subpopulations constitute the MFJD metapopulation (Buchanan et. al, 1997). The mainstem MFJD serves as a seasonal migration corridor for the three subpopulations. It is likely that some members of these populations move into the main MFJD River and possibly other tributaries when water temperatures are cooler, but currently it is unknown as to the extent of connectivity between the three populations of the MFJD.

Clear Creek is the only stream in the UMFJDR watershed with documented Bull trout presence. However, it is assumed that use has occurred or will soon in Lunch Creek with access provided two years ago around Bates mill on Bridge Creek.
Status of the upper MFJD subpopulation was classified as ``probably extinct" in 1992 (Ratliff & Howell, 1992). Status for the Granite Boulder and Big Creek subpopulations was classified at ``high risk of extinction" in 1992 (Ratliff & Howell, 1992). These classifications remain unchanged in 1997 (Buchanan et. al, 1997). The Clear Creek subpopulation was classified at ``high risk of extinction" in 1997 (Buchanan et. al, 1997).
Outside influences have affected the viability of bull trout in the UMFJDR watershed. These include: 1) isolation from other Columbia River metapopulations by dams. 2) fragmentation of the John Day bull trout metapopulation into three isolated populations, and 3) isolation of subpopulations in the Middle Fork subbasin due to poor habitat in the Middle Fork John Day River.

Very little data is available to determine the size of the bull trout subpopulation in Clear Creek. In 1992, surveys were conducted by Oregon Department of Fish and Wildlife (ODFW) that included the sampling of bull trout in two locations on Clear Creek. Results of the survey estimated a spawning density of 17 bull trout per mile. Estimating a minimum of three miles of habitat, the estimated population would be 51 spawners. This estimate is rough, as the sampling was not randomized nor conducted without block nets (Claire & Gray, 1993).

Density surveys of bull trout conducted in Big Creek and Granite Boulder Creek estimated 625 spawning age bull trout per 5 miles and 375 spawning age bull trout per 0.75 miles of habitat in Big Creek and Granite Boulder Creek, respectively, in 1992. Given these density estimates and estimated miles of habitat, an additional 1,000 spawning age bull trout are estimated to be a part of the meta-population. These surveys were not conducted with the intention of estimating population size. The estimates presented are merely extrapolations based on available surveys and do not have statistical validity to be expected if the original sampling objectives were to estimate actual population size.

Migratory habitat in the upper Middle Fork of the John Day River is poor due to seasonal thermal barriers and lack of complex pool habitat (Claire & Gray, 1993) and may limit movement between subpopulations in the subbasin.

Summer Steelhead

Summer steelhead runs in the John Day River Basin are composed entirely of native stocks. However, hatchery fish stray into the John Day Basin from the Columbia River (Unterwegner and Gray 1997). Steelhead are present in eight streams of the UMFJDR watershed. The Middle Fork John Day has historically contributed approximately 23% of the total run for the Basin (USFWS and NNFS 1981). Estimated escapement to the John Day Basin has averaged 13,988 adults since 1987 (see Table of estimated spawning escapement of spring chinook salmon and steelhead to the John Day Basin).

Redband Trout

Redband trout are present in all streams in the UMFJDR watershed. No information is available to estimate the population size of redband trout in the watershed.

Spring Chinook Salmon

Spring Chinook in the John Day River Basin are composed entirely of native stocks. Spring chinook salmon are present in three streams in the upper UMFJDR watershed. The MFJDR has historically contributed approximately 12% of the total run for the basin (USFWS and NMFS 1981). Estimated escapement to the John Day Basin has averaged 2,670 adults since 1987 (see Table of estimated spawning escapement of spring chinook salmon and steelhead to the John Day Basin).

Other Fish Species

Distribution and abundance of other fish species in the UMFJDR watershed is unknown.

Upper John Day River Watershed

Bull trout

Historical information prior to 1990 reveals isolated sightings of bull trout were recorded only in Dads Creek, Dixie Creek, and Pine Creek of the UJDR watershed.

The John Day River metapopulation is composed of bull trout in the Prairie City and Upper John Day River watersheds. A determination was made that the bull trout populations in the two watersheds have little chance for connection to other bull trout populations in the John Day River system, thus constituting a separate metapopulation. The Reynolds Creek subwatershed of the UJDR encompasses the southwest edge of the Easy Fire Recovery Project area. Bull trout are found in two streams within this subwatershed that parallel the southwest project area boundary and are potentially affected by project activities; North Reynolds Creek and Mossy Gulch Creek. Mossy Gulch Creek flows along the west side of the project boundary while North Reynolds Creek flows along the south side.

The John Day River metapopulation is rated at low risk of extinction (Buchanan et. al, 1997). Oregon Department of Fish and Wildlife research is currently implementing a life history study on bull trout in this watershed. Spawner density was recorded as 0 by ODFW in 1991. Size ranges of bull trout sampled at that time ranged between 30 and 140 mm indicating resident adults were not present or present at very low numbers. In the same year, spawner density in North Fork Reynolds Creek, where at least one redd has been found, was recorded at 15. During this survey, bull trout sizes ranged from 90 to 230 mm indicating multiple age classes were present. ODFW estimated the total spawner density in the Upper John Day River to be a minimum of 304 in 1990 (ODFW, 1991). Size ranges of bull trout with that survey ranged from 60 to 300 mm indicating all life history stages were present.

Westslope cutthroat trout

The largest concentrations of westslope cutthroat trout (WCT) in Oregon are found on the Malheur National Forest in the upper John Day River and tributaries.

Two branches of the John Day River, the North Fork and mainstem, contain WCT. Historic WCT distribution is sketchy; no tributaries currently absent of WCT are known to have supported these fish in the past (Gray 1998; ICBEMP 1996). However, Kostow (1995) reported "suspected" historical WCT habitat has been reduced 59 %, based on assumptions (no substantive evidence) that WCT had a wider historical distribution in the North Fork. The distribution of WCT in the mainstem of the John Day River system may have been much further downstream than at present; descriptions of the mainstem river valley by explorers and trappers such as Peter Skene Ogden indicate conditions suitable to these fish prior to European settlement of the West. However, distribution of year-round resident fish in the valley and foothill reaches of tributaries may have been reduced from the historic distribution due to habitat alteration (Gray 1998).

Westslope cutthroat trout distribution overlaps with resident redband trout, with WCT generally being found in reaches with higher gradient, cooler temperatures, and more numerous large woody debris *(*Gray 1998*)*. WCT co-evolved with native redband trout throughout the upper John Day River and tributaries. Westslope cutthroat trout distribution in the John Day drainage also overlaps with bull trout, steelhead trout, and chinook salmon but is much wider in distribution. Hybridization and introgression between WCT and redband trout has been noted in areas where overlapping distribution occurs (Kostow 1998; Gray 1998) and has been occurring naturally for as long as both species have been present in the same stream.

Kostow (1995), Gray (1998), and Hemmingsen and Gray (1999 draft) reported WCT distribution upstream from the mainstem John Day River. All occupied subwatersheds in the mainstem John Day are predicted or known to have "depressed" WCT populations. Malheur National Forest (Pence 1998) provided an updated WCT distribution map that contains additional WCT records, including presumed seasonal habitat distribution. In the Upper John Day River, tributaries with WCT include: Graham, Call, Roberts, Reynolds, Deardorff, and Rail Creeks. WCT in these mainstem headwaters area exist within a "checkerboard" of public (Malheur National Forest) and private (mostly commercial timberlands, with some stream-bottom pasture lands) land ownership. Due to this land-ownership pattern, Gray (1998) considered harvest on private timberlands to threaten WCT in this area of the watershed; however, the highly connected streams of this portion of the watershed would allow for rapid WCT recolonization.

Seasonal WCT habitat includes the lower portions of most of these occupied tributaries, an additional tributary without resident WCT (Widows Creek) and the mainstem John Day River downstream to Widows Creek (between the towns of Dayville and Mount Vernon). These "seasonal" zones appear to be habitat for wandering or migratory WCT (Gray, ODFW, *pers. comm.* 1999)

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Other Fish Species

Distribution and abundance of other fish species in the UJDR watershed is unknown or minimal.

Roads and Sedimentation

Forest roads can degrade fish habitat and isolate portions of streams from fish (Furniss et. al, 1991). Most studies of the effects of forest management have found road-building (including skid trails and landings) and road maintenance to be primary sources of sediment. Roaded areas also show increased compaction and reduced levels of vegetative cover. Road associated sediments can be eroded from the road surface, or from slope failures associated with road construction and drainage. Ditches associated with roads have increased the potential for sediment transport. Roads have potential to effect hydrological functions through altering infiltration.

In most cases, there is a sharp increase in sediment yield associated with road-building activities, and a rapid decline as roads stabilize. Increased sediment yields tend to be more persistent if the erosion stems from slope failures or surface runoff associated with continued heavy traffic (MacDonald et. al, 1991). Also, roads that contribute to major erosion have one or more of the following features: steep grades, insufficient drainage structures, native surface materials in areas of erodible soils; dust caused by vehicle traffic on some road surfaces; or rutting caused by vehicle use during wet or saturated conditions (UMF John Day River WA, 1998).

Roads can also degrade fish habitat by increasing stream width to depth ratios through bank damage, decreasing the shade component through hazard tree removal, brushing out for safe sight distance, firewood cutting, and/or by further impacting fish numbers by facilitating angler access. Roads also increase the drainage network, decreasing the time it takes for water to reach stream channels, thereby increasing peak and near peak flows and reducing base flows. Road crossings can impact fish if culverts plug and the road fails which contributes sediment directly to the channel and by creating barriers to passage to some life stage at some flow level.

Road Density

Stronghold populations of salmonids are associated with higher-elevation forested lands and the proportion declines with increasing road densities (Quigley et. al, 1996). The higher the road density, the lower the proportion of subwatersheds that support strong populations of key salmonids. Specifically, the Quigley document shows a strong correlation with road densities of 2 miles/mile^2 or higher and reduction of strong populations of salmonids. Further reductions of strong salmonid populations were identified at densities of 3 and 4 miles/mile^2 or greater. Currently, all subwatersheds have open road densities of 2.9 miles/mile^2 or higher. The following is a synopsis, with accompanying tables, of current and foreseeable road density conditions by watershed:

Table FW – 24: Existing Condition of Subwatershed Road Densities

Existing Condition								
	National Forest		Road Miles			Road Density		
Subwatershed	Acres	Sq. Miles	Closed	Open	Total	Closed	Open	Total
BRIDGE CREEK	11,478	17.9	56.4	65.6	122.0	3.1	3.7	6.8
CLEAR CREEK	12,151	19.0	12.8	79.5	92.3	0.7	4.2	4.9
REYNOLDS CREEK	16,395	25.6	17.5	73.8	91.3	0.7	2.9	3.6

Table FW – 25: Future Condition of Subwatershed Road Densities

Future Condition								
	National Forest		Road Miles			Road Density		
Subwatershed	Acres	Sq. Miles	Closed	Open	Total	Closed	Open	Total
BRIDGE CREEK	11,478	17.9	59.7	62.3	122.0	3.3	3.5	6.8
CLEAR CREEK	12,151	19.0	34.8	57.6	93.5	1.8	3.0	4.9
REYNOLDS CREEK	16,395	25.6	39.6	51.7	91.3	1.5	2.0	3.6

Reynolds Creek Subwatershed

Existing Condition

Currently the Malheur National Forest open road density for the subwatershed at 2.9 mi./sq. mile.

Foreseeable Condition

Prior to the Easy Fire, a portion of the Mossy Access Plan had been implemented. It is foreseeable that the Mossy Access Plan will continue to be implemented in the Reynolds Creek subwatershed, which would reduce the open road density to 2.0 mi./sq. mile

Bridge Creek Subwatershed

Existing Condition

The current open road density for the subwatershed at 3.7 mi./sq. mile. This number is probably close to the actual existing condition but will need to be field verified for the Final EIS.

Foreseeable Condition

It is foreseeable that the Punch Access Plan will continue to be implemented in the Bridge Creek subwatershed, which would reduce the open road density to 3.5 mi./sq. mile

Clear Creek Subwatershed

Existing Condition

The open road density for the subwatershed at 4.2 mi./sq. mile.

Foreseeable Condition

It is foreseeable that we would continue to implement the Clear Creek Access Plan, which will reduce the open road density to 3.0 mi./sq. mile. Also, the entire length of Road 2600391, 5.2 miles, in the Clear Creek subwatershed will be closed year-round to the public with implementation of the Easy Fire Recovery Project Alternatives 2-5, resulting in a further decrease in open road density to 2.8 for this subwatershed.

The cumulative increase in area with compacted/disturbed soils has resulted in increased potential for surface erosional processes across the watersheds.

Generally, all roads within the project area are in good condition. There was one problem road identified in the UMFJD with drainage issues. This was road 2635206, and problems have been corrected (pers. comm. John Johnston, Malheur N.F.). There have been no watershed improvement projects (WIN) identified in the Malheur Forest Plan (1990) or subsequent to the publication of the plan for the project area.

Only one short segment of major maintenance activity is predicted to be needed for haul routes within and outside the project area. This work would be on 0.30 miles of Road 2600026 between junctions with Road 2600022 and Road 2600086 and will involve placement of grid-rolled rock to strengthen the existing road subgrade (located near South Fork of Bridge Creek, about 1/2 mile from Lunch Creek). This work will only be done during dry weather conditions and will not impact nearby fishery resources.

Upper Middle Fork John Day Watershed

For the Upper Middle Fork John Day watershed, few new roads have been built in the last fifteen years. This means most existing cuts and fill slopes are well vegetated with grass growing in many of the native surfaced roads. New roads that have been built are in the upper third of the slope to accommodate skyline logging, avoiding riparian areas. Most erosion takes place within two years of construction. Most of the roads in the watershed are older and therefore more stable. Some reconstruction has taken place, usually involving improving road drainage, adding surfacing, clearing vegetation from road surface, or reinforcing areas that lack sub-grade strength (UMF John Day River Watershed Analysis 1998).

The Upper Middle Fork John Day Watershed Analysis stated that there were no signs of mass failures associated with harvest and/or road building with the exception of the occasional cut bank sloughing on benched roads. The overall lack of recent mass failures and high proportion of the watershed with stable to very stable ratings is indicative of the overall resiliency of the geologic landforms and soils within the watershed (UMF John Day WA 1998).

Management activities can initiate slope movements by undercutting natural slopes during road construction or when roads or other ground disturbing activities alter natural surface and subsurface drainage. During the winter and spring of 1996 the Pacific Northwest experienced flood and storm events that were unusually severe. The Malheur Forest had many roads that sustained damage from these events. However, none of the roads within the Clear Creek subwatershed, which encompasses over 80% of the Easy Fire project area, sustained damage from these events. The roads exhibited very good resiliency to erosional processes and existing drainage structures were able to handle the excessive runoff. This can be attributed to the overall good location and design of roads combined with the high natural resiliency of the soils and geology in the area.

The 1998 watershed analysis for the Upper Middle Fork John Day River did identify several road segments in the Bridge Creek subwatershed and five road segments in the Clear Creek subwatershed as having problems in either drainage, sedimentation, majority of road within the floodplain, or as having undersized culverts. All problem road areas within this watershed have been corrected with timber sale activities associated with the Clear Creek Environmental assessment (pers. communication with John Johnston, Malheur N.F.)

For Bridge Creek, State Highway 26 receives winter sanding of the highway. This sanding can cause increased sediment and turbidity in Bridge Creek as excess material is plowed off the road surface during the winter, and the material can later enter into the stream system during melt-off periods. For Clear Creek, the Clear Creek Environmental Assessment (1996) had addressed these problem road segments and actions have been completed to correct the problems. (Per consultation with Bill Jackson, Logging Systems Specialist and John Johnston, Roads and Engineering, Malheur N.F.; April 2003.)

Overall this watershed is fairly resilient to natural hydrologic disturbances such as flooding, debris flows, or mass movement processes. Even though rain-on-snow events were common during the winter of 1996, the watershed showed little evidence of disturbance associated with flooding or mass soil movement and there was little evidence of increased road related soil disturbances (UMF John Day River WA 1998).

Within the Bridge Creek subwatershed, the State Highway 26 runs along most of the floodplain of Bridge Creek. In the Clear Creek subwatershed, Forest Service Road 2635000 runs along close proximity of Clear Creek's entire length.

After the fire suppression activities on the Easy Fire, the BAER analysis identified Forest Service Roads 2635000 and 2600036 as having numerous locations where there was a high risk of loss of function that would likely degrade adjacent resource values. Emergency rehabilitation funds were collected to repair and restore the functional drainage to these roads in the fall of 2002, and repairs were implemented.

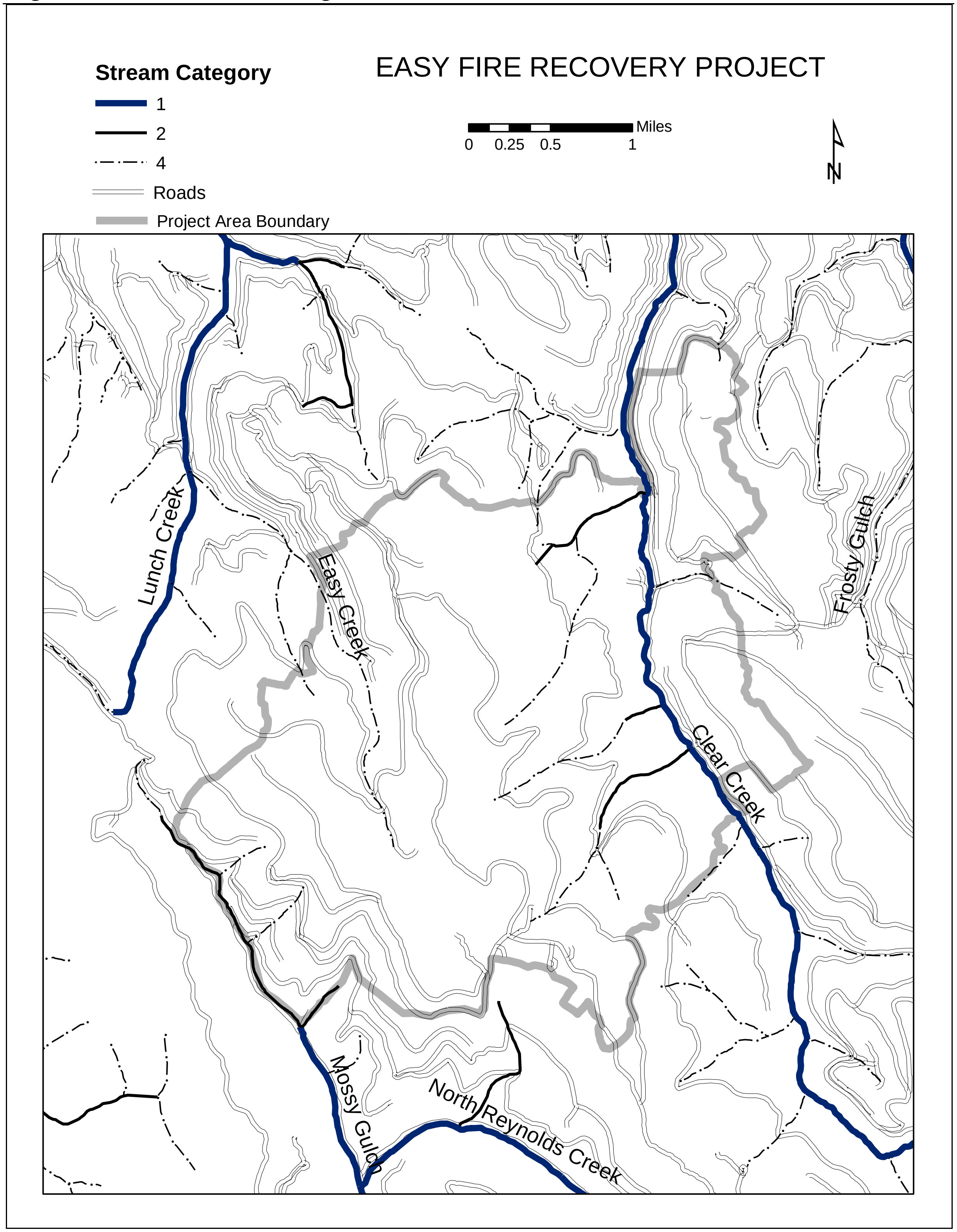
Upper John Day Watershed

Throughout areas in the Mossy and North Reynolds drainages, there were roads built within the riparian areas. A detailed field survey of watershed problems was completed in the summer of 1992. A total of 16 disturbed sites with restoration needs were identified. Of these, four were evaluated as having immediate high risk to water quality. Of the 16 sites identified, 15 resulted from poor road location or maintenance, and one resulted from the unloading of livestock adjacent to a perennial stream. All four of the serious problem areas were associated with roads (Mossy Analysis Area – EA 1994).

The Mossy Environmental Analysis (1994) highlighted problem road areas, and provided for rehabilitation of these areas by subsequent timber sales. In particular the road that parallels North Reynolds Creek, which is about three miles long, is currently closed but proposed for decommissioning/obliteration work. Also, the remaining interconnected roads along the stream are proposed to be closed with gates.

The map below displays the roads within the fire area and the perennial and intermittent streams.

Figure FW-5: Stream Categories and Roads



Fire Effects on the Watersheds and Water Quality

After their ground survey and analysis in August 2002, the BAER Team watershed personnel reached the following conclusions regarding the effects of the fire on the water resources (Bright and others 2002):

Watershed response to fire – flow increase potential (peak and base flows), sediment yield, water repellency:

- Risk is low for increased sediment except in the event of an intense summer thunderstorm.
- Ample amounts of woody material on hill slopes to reduce erosion and trap sediment. Also, substantial subsurface roots to bind soil.
- Burn is a mosaic with vegetative filter among more severely burned sites.
- No substantial flood source areas identified – very little hydrophobicity was found in areas mapped as high intensity.
- Resprouting grass and sedges especially on road shoulders.

Channel response to fire – channel erosion, sediment movement, road drainage problems, alteration of stream morphology related to T&E fish habitat:

- Plenty of vegetation in flood plains to trap sediment.
- Clear Creek tributary – little or no sediment stored in channel that will move into Clear Creek. Also, woody debris remains in the channel.
- Clear Creek - very little burn in the riparian area and where it burned it reduced fuel loading, may prevent more intense fire in the future.

Effects of fire on water temperature in Oregon DEQ 303(d) listed streams:

- Little, if any, effect on shade – nearly all of the Clear Creek riparian area was unburned.

Effects of any flow increase potential on (1) beneficial uses of water (State Highway Maintenance Station water supply [may be groundwater now and not an issue]; Private water source off Clear Creek Road ~ 6 miles north of fire), or (2) property – private bridge on Clear Creek at residence north of Hwy 26:

- No longer a surface water source.
- Can if necessary send an advisory letter that there may be a risk during high flow event.

In summary, the BAER team determined there were no emergency situations related to the fire for or soil/watershed conditions. There were no recommendations such as grass seeding or contour log felling to treat emergency resource conditions in the fire.

Overall, both runoff and sedimentation are expected to increase within those subwatersheds that were influenced by high intensity fire, such as the Clear Creek subwatershed. This is likely to continue until ground cover can be established. However, less than 5% of the area of these fires had experienced significantly reduced infiltration, which should minimize the amount of increased runoff (also expected to be about 5-10%) (from Bright and others 2002).

There is the potential for some short-term negative effects to fishery resources from sediment delivery into streams from storm events. However field survey determinations identified that sufficient down wood on open slopes and along stream banks would minimize this effect and eliminate the “emergency” situation under BAER guidelines. In addition, the fire did not burn intensely within riparian zones leaving live streamside vegetation to buffer and filter potential sediment. A storm event would tend to move sediment through the system and onto flood plains and not deposit in stream channels and impact spawning gravel.

The consequences of the fire on values at risk were outlined as follows:

- Protecting for indicator species (bull trout) will protect other species.
- Fire effects are minimal to the fisheries resource in all streams in and downstream of the fire area. Clear Creek is at properly functioning condition (PFC) for many habitat attributes and can naturally accept impacts of increased sediment and flow from most storms.
- Fire suppression effects – dozer lines may have more effect on fisheries than the fire itself.
- The effect of an intense thunderstorm may cause increased sediment in the stream channel that can ultimately lead to increased productivity and release of nutrients.
- Possible increased productivity and release of nutrients.

Environmental Consequences-Water Quality

Direct and Indirect Effects and Changes Common to All Alternatives

Stream Temperature

For the fire area as a whole, there were very few locations where the fire actually burned to the water’s edge at moderate or high BAER burn severity along perennial streams. The only Category 1 stream in the area, Clear Creek, received only minimal impacts from the fire. Thus, the buffering capacity of the RHCAs along Clear Creek is intact. Also, the Category 2 stream riparian areas were primarily low or no burn (BAER) burn severity. Intermittent streams (Category 4) and ephemeral channels were the channels most affected by the fire. (See Figure FW-1 Stream Category by BAER Burn Severity and Table FW-5). Since there were only minimal effects to riparian areas of perennial streams from the fire, no measurable changes in stream temperature are expected.

For all of the alternatives, no additional disturbance to the remaining shading vegetation on any stream riparian area would occur on Category 1 and 2 streams. No measurable change in water temperature is predicted in any perennial stream as a result of any proposed alternative. 303(d) listed streams will not be at risk from any increased temperature from project activities.

Due to the long runout distances (Table of Mean Flow Distances from Harvest Units to Category 1 Streams) for potential sediment runoff from moderate to severely burned (BAER intensity High) slopes to downstream Category 1 channels of Clear Creek in the Clear Creek subwatershed, Lunch Creek in the Bridge Creek subwatershed, and Mossy Gulch Creek and North Reynolds Creeks in the Reynolds Creek subwatershed, and the assumption that no measurable increases in stream temperature will result from the Easy Fire Recovery project activities, it is anticipated that channel conditions will be maintained in those systems.

Sediment

Under all alternatives, areas that experienced high soil burn severities, on steeper slopes adjacent to stream courses, have the highest potential for sediment delivery to streams. Sediment yield will decrease over time as the area recovers from the effects of fire.

The WEPP model and Disturbed WEPP Interface were used to predict amounts of increased sediment produced from proposed management activities two years (2004) after the Easy Fire. Areas were selected which contained 85-100 percent of high to moderate BAER burn severity in the fall of 2002. Areas were also selected based on their proximity to stream channels. The results for these areas would show the higher amounts of sedimentation that could occur from harvest activities. For the tractor slope areas, the slope analyses continued to the edge of potential units. For helicopter slope areas, the slope analysis included the downslope portions beyond the potential unit, until a road or creek was reached.

The table of site conditions lists the analysis areas with the percent slopes and the BAER burn severities.

Table FW – 26a: Site Conditions for WEPP Analysis Areas

Logging System	Analysis Area	Water Flow Line	Percent Slopes	% BAER Burn Severity	
				High	Moderate
Tractor Harvest	A	1	20 – 40%	100	-
	A	2	5 – 30%	95	5
	B	1	8 – 20%	25	75
	B	2	8 – 20%	40	60
Helicopter Harvest	C	1	30 – 60%	81	6
	C	2	40 – 60%	52	41
	D	1	60 – 70%	40	60
	D	2	40 – 60%	63	32
	D	3	35 – 55%	51	42

Tractor areas A and B were among the potential tractor slope areas that had high amounts of high and moderate BAER burn severity. Helicopter areas C and D were also analyzed with WEPP since these units contain steep slopes that burned at high to moderate BAER burn severity above Clear Creek. These areas would show the higher amounts of sedimentation that could occur from harvest activities.

The figures in the table of Sediment Analysis show the potential sediment increase as annual averages.

Table FW – 26b: Sediment Analysis

Proposed Activity	Analysis Area	Water Flow line	Before Activity Fall 2004 Sedimentation	Potential Sediment Increase From Harvest Activity (annual average)	
			Cubic yd/acre	Cubic yd/acre	Equivalent lbs/acre
Tractor Harvest	A	1	0.101	0.074	100
		2	0.030	0.043	58
	B	1	0.007	0.027	36
		2	0.022	0.027	36
Helicopter Harvest	C	1	0.178	0.016	22
		2	0.144	0.019	26
	D	1	0.185	0.009	12
		2	0.080	0.006	8
		3	0.059	0.001	2

Current average annual sediment rates are estimated at 0.007 to 0.101 cubic yards/acre on the tractor units, and 0.059 to 0.185 cubic yards/acre on the helicopter units. These values equate to 0.001 inch or less of soil depth per acre. Average values for ground that had less burn severity or gentler slopes would be less.

Harvest activities from tractor units could produce an increase of 0.027 to 0.074 cubic yards/acre, while helicopter units could produce 0.001 to 0.019 cubic yards/acre. The steeper slopes on the eastern, downslope end of area A accounts for the higher amounts of potential sediment along the end of flow line 1 (0.074 cubic yards/acre). These values are equivalent to 0.001 inch or less of additional sediment produced per acre. Again, values for ground that had less burn severity or gentler slopes would be less.

The following table lists the units in the alternatives which have both high and moderate BAER burn areas, and that are close to stream courses. These units would have similar erosion and sedimentation rates as those analysis areas discussed above. Areas that had less severe BAER burn severity or gentler slopes would have less erosion and sedimentation.

Table FW – 26c: Units with High & Moderate BAER Severity Close to Stream Courses

Unit	Logging Method	High & Mod. BAER Acres	Adjacent Stream Course	In Alt. 2	In Alt. 3	In Alt. 4
12	Helicopter	29 ac.	Clear Creek, Cat. 1	Yes	No	No
22	Helicopter	65 ac.	Cat. 4 trib. to Clear Creek	Yes	No	Yes
30	Helicopter	70 ac.	Easy Creek (Cat. 4)	Yes	No	Yes
41	Tractor	20 ac.	Easy Creek (Cat. 4)	Yes	Yes	Yes
45	Tractor	56 ac.	Cat. 4 trib. to Easy Creek	Yes	Yes	Yes
65-S	Skyline	41 ac.	Cat. 2 & 4 trib. to Clear Creek	Yes	No	Yes
Total High & Moderate BAER Acres:				261	56	232

Alternative 2 contains all of the units listed in the table, for a total of 281 acres of high to moderate BAER burn severity near stream courses. Alternative 4 has 252 acres, and Alternative 3 has the least at 76 acres.

For the majority of the tractor slopes analyzed, in harvested areas, weather of 6-year return intervals or greater would produce sediment across the unit boundaries, except for the last 30 to 100 feet upslope from unit boundaries. Weather years of 3-year return intervals could produce sediment to the unit edge along the last 30 to 100 feet of unit boundaries. This is based on 30 years of climate.

The analysis based on 50 years of climate indicate that for most of the tractors slopes analyzed, in harvested areas, weather of 5-year return intervals or greater would produce sediment across the unit boundaries. The exception would be for the last 30 to 100 feet upslope from unit boundaries, where weather years of 2 ½-year return intervals could produce sediment to the unit edges. An average climate year (2.5 year return interval) would not produce sediment to unit edges.

For the helicopter units analyzed, in harvested areas, weather years of 5-year return intervals or greater could produce sediment beyond the unit boundaries from management activities, while an average climate year (2.5 year return interval) would not. This is based on 50 years of climate.

The annual sediment values from the tractor units assume that all sediment in the upper slope segments would reach the lower segments, with no diverting of sediment by cross drains. In actual practice, the installation of cross drains would reduce the amount of sediment moving downslope by diverting overland flow and sediment out of the water's flow line down the slope. There would still be erosion from disturbed areas, however.

Also, the spacing of the cross drains is a key factor in controlling the resulting erosion and sedimentation in and from the tractor units. The spacing of the cross drains within the skid trails affects the length of the individual slope segments. This slope length influences the predicted amounts of potential runoff, erosion and sedimentation. Installing cross drains at closer spacing reduces the predicted erosion and sediment values, while wider spacing increases the resulting values. General guidelines for the spacing of cross drains were used in the WEPP analysis for tractor units.

For any one of the given years, however, the potential erosion depends on the climate. If the year is normal or dry, then it is unlikely for there to be any significant erosion. If the year has above average precipitation, however, then there could be more soil erosion.

Roads

Roads closed under CFR and opened for fire suppression activities would be closed.

Cumulative Effects Common to All Alternatives

The list of past, present, and foreseeable actions at the beginning of Chapter 3 was used to analyze cumulative effects. Each action was considered to discern if any may have a measurable effect, when combined with actions proposed for the Easy Fire Recovery Project. Those actions considered are discussed further in each Alternative.

Direct and Indirect Effects of Alternative 1 (No Action)

Harvest

No activities are proposed under this Alternative. There would be no direct or indirect effects on stream channels, RHCAs, MA 3B, or uplands under the No Action Alternative. Current baseline post-fire conditions would remain. Fire recovery would continue based on climate and natural processes. See the section “Effects and Changes Under All Alternatives” for additional effects and changes.

Vegetation

Burned trees would fall on hill slopes and in stream channels and draws in increasing numbers over the next 10 – 30 years. Trees which fall in channels and draws would help retain sediment, and add structure and complexity to the channels.

Along intermittent stream channels (Category 4) that burned with high or moderate soil severity, where hardwood shrubs and trees died, naturally occurring shrubs and trees would become re-established and provide bank stability in about 7-10 years. Existing roots from dead shrubs and trees would continue to provide stability for about 7-9 years, until they decompose.

Vegetation succession would continue without harvest or thinning activities, resulting in the continued buildup of fuels. Untreated post-fire fuel loadings would prohibit the use of fire as a management tool in later management actions to move the landscape and RHCAs toward the desired condition for vegetation and plant communities in the project area. This could again lead to fuel loading which caused the high fire severity as it related to vegetation in upland areas in the Easy Fire Recovery Project area.

Coarse Woody Debris

This alternative proposes no removal of living or dead trees, and therefore, would not reduce the amount of coarse woody material that could be recruited to stream channels in the future.

Roads and Sediment

This alternative would leave the road system as it is. No road mitigation improvement, relocation, closures, or decommissioning projects would occur with this alternative. No additional roads would be constructed. There would be no change in road densities on the subwatershed level. No impacts such as sediment from temporary road and landing construction, reconstruction of decommissioned roads, associated timber sale haul road maintenance, or decommissioning would occur with this alternative. Road maintenance, which can be considered a benefit from re-grading roads, cleaning plugged culverts and cleaning blocked ditch lines, would continue at regularly scheduled intervals. At current and expected future funding levels, this would not allow accomplishment of all maintenance needed.

Due to the minimal amount (0.30 miles) of major road maintenance (Road 2600026, placement of grid-rolled aggregate) need estimated for the project area and the current condition of roads in the area, the associated erosion risk from not doing the road maintenance work with Alternative 1 would be insignificant, at least in the short term. Improvements to soil stability would not occur. Any short term increase in sediment delivery to nearby streams from road treatments would not occur.

Cumulative Effects of Alternative 1 (No Action)

The no action alternative is required and serves as a baseline for comparison of all alternatives. Legacy impacts from roads, harvest, and grazing activities on private and public land have reduced fish habitat quality and complexity, primarily downstream of the fire area. However, this alternative would not cause significant short-term impacts to the watershed and fisheries resources from road maintenance activities, regulated mushroom collection, firewood sales or other foreseen activities. The overall effect of this alternative with ongoing and foreseeable activities would be to maintain or slightly improve cumulative watershed conditions. However, an increased potential for watershed damage from future wildfires may exist.

Direct and Indirect Effects of Alternatives 2, 3, and 4

Harvest

No entry buffers of varying widths would be established along the Riparian Habitat Conservation Areas (RHCAs), according to Amendment #2 and PACFISH direction. These buffer widths range from 300 feet to 100 feet from the streams and channels. No harvest or road activities, other than haul and hazardous tree removal will occur in the RHCAs.

In alternatives 2 and 4, the buffers would be extended to 150 feet distance (instead of the standard 100 feet) along the severely burned intermittent channels, for additional soil and side slope protection (units 22, 30 and 65), because of the condition of the burned RHCAs and the erosion taking place along the severely burned areas in the Clear Creek and Easy Creek drainages.

See the sections "Sedimentation – Tributaries to Clear Creek (High BAER burn severity area)" and "Ephemeral Channels Tributary to Clear Creek (High burn severity area)" in the Watershed and Fisheries Report; and the section on plant recovery in the Soils Report for the rationale for the extended buffers.

Sediment

Although it is predicted that most units, when harvested, will not produce sediments that are transported to streams, harvest on areas that experienced high soil burn severities on steeper slopes adjacent to stream courses will have the highest potential for sediment delivery to streams. However, any sediment delivery to streams from harvest activities is predicted to be only short-term and not affect baseline values.

All alternatives would maintain and protect beneficial uses of water and would comply with all existing state and federal regulations regarding water quality. Since all alternatives would incorporate site-specific best management practices in all activities and the largest portion of the sediment will pass through the system during the winter high flows, no measurable effects on fishery resources is anticipated from project activities. Also, effects upon threatened or sensitive species would be limited by legal constraints. All alternatives will comply with process requirements set forth in the Endangered Species Act of 1973. For a more complete discussion of the existence of, and effects upon threatened and sensitive species, see the Fisheries Biological Evaluation in Appendix F and the Fisheries Biological Assessment in Appendix G.

Coarse Woody Debris

In all harvest alternatives there would be remaining coarse woody debris on site for long-term soil productivity. Some material (slash) would be generated from the harvest activities, from the breakage of limbs and logs. Not all of the slash would be removed, especially on the skyline and helicopter units, where the tree tops would be lopped and scattered on site. This would help reduce the surface erosion. In the Bitterroot Fire on the Boise National Forest, slash left on site helped to reduce fire-induced erosion and was sometimes eliminated. Eroded sediment was stored on the slope behind woody debris instead of moving downslope and being delivered to stream channels (Bitterroot, 2001).

Roads

Temporary spur roads (newly constructed) and reopened decommissioned roads would be used for haul during harvest activities and then closed at the end of harvest activities. There would be no change in the permanent road miles in Alternatives 2, 3 and 4.
Watershed conditions would be improved by reducing erosion sources. Roads that are currently open year long, open seasonally, or closed year round that are needed for access or haul would be maintained as needed to reduce the amount of area that contributes sediment to streams and to reduce erosion from forest roads. This work generally includes blading and shaping of road haul routes and repairing weak areas of subgrade. Shaping roads reduces the risk of water running on the road surface and depositing sediments into streams. The open road density in the Clear Creek subwatershed would be reduced from 3.0 to 2.8 with the 5.2 mile closure of road 2600391. See Road Density.

Cumulative Effects Common to all Alternatives 2,3,4.

Since the direct and indirect effects would be minimal to the stream temperature, channel conditions, and water quality both within the project area and downstream of the project area, there would be no adverse cumulative effects with Alternative 2, 3, and 4. However, there are differences between alternatives 2, 3 and 4 in extent of activities and in the degree of risk in implementing the alternatives. These items are addressed in the individual descriptions of the alternatives. There would not be any change in the total road miles within the project area or within the affected subwatersheds for the alternatives. Consequently, the effects from roads would not change.

Direct and Indirect Effects - Alternative 2

Harvest

A total of 1,777 acres will be harvested with this alternative. The majority of harvest will occur in Clear Creek Subwatershed (953 acres), followed by 481 acres in Reynolds Creek Subwatershed and 343 Acres in Bridge Creek Subwatershed (Table of Proposed Harvest Acres by Subwatershed). In Alternative 2, the principal yarding method will be tractor (979 acres) with a substantial amount of helicopter yarding (545 acres) utilized as well (Table of Harvest Acres by Logging System). Only 253 acres will be cable yarded.

Table FW-27: Proposed Harvest Acres by Subwatersheds

Subwatershed	SWS Acres	Alt. 2 Harvest		Alt. 3 Harvest		Alt. 4 Harvest	
		Acres	% SWS	Acres	% SWS	Acres	% SWS
Clear Creek	12,484	953	8	758	15	526	15
Bridge Creek	12,149	343	4	254	3	343	4
Reynolds Creek	19,915	481	4	285	3	87	1
Total Acres		1,777		1,298		956	

Table FW-28: Harvest Acres by Logging Systems

Alternative	Helicopter Acres	Skyline Acres	Tractor Acres
1	0	0	0
2	545	253	979
3	308	153	837
4	265	58	633

Eight percent (136 acres) of the area to be harvested is considered sensitive due to locations on steeper slopes (31-60%) that were severely burned (BAER burn severity High) (Table of Harvest on Various BAER Burn Severities). The majority of these sensitive areas would be helicopter yarded (82 acres), 38 acres would be skyline and 15 acres would be tractor logged.

The tractor yarding would occur on slopes of 35% or less. The mean flow distance of any eroded materials from units in these areas is predicted to be 0.55 miles to fish bearing streams (Table of Mean Flow Distance from Harvest Units to Category 1 Streams).

Table FW-29: Harvest on Various BAER Burn Severities.

Harvest	Alternative 2 (Acres)	Alternative 3 (Acres)	Alternative 4 (Acres)
High BAER burn severity, Moderate slope (31-60%), All Harvest Methods**** => *Relative sediment risk*	136	22 *	92
High BAER burn severity, Low to Moderate slopes, All Harvest Methods	332	183 *	265
Moderate to High BAER burn severity, Moderate slopes (31-60%), All Harvest Methods**** => *Relative sediment risk*	315	132 *	148
Moderate to High BAER burn severity, Low to Moderate slopes, All Harvest Methods	751	504 *	497
High BAER burn severity, Moderate slopes (31-60%), Tractor yarding****	16	7	14
High BAER burn severity, Low to Moderate slopes, Tractor yarding	162	151	138
Moderate to High BAER burn severity, Moderate slopes, Tractor yarding****	46	32	29
Moderate to High BAER burn severity, Low to Moderate slopes, Tractor yarding => Relative ground impacts to soil	386	369	287
	* Main differences are in helicopter acres.		

****Tractor yarding would be avoided on slopes steeper than 35%

Table FW-30: Mean Flow Distance from Harvest Units to Category 1 Streams.

	Alternative 2	Alternative 3	Alternative 4
Moderate to High BAER, Moderate slopes (31-60%), All Harvest Types*	0.45 mile	0.27 mile**	0.69 mile
High BAER, Moderate slopes (31-60%), All Harvest Types*	0.55 mile	N/A***	0.80 mile

*Tractor yarding would be avoided on slopes steeper than 35%
** Two units only
***There are no harvest units located predominately on moderate slopes that burned at predominately high BAER Intensity

Sediment

There is a higher risk for sediment created by harvest and fuels treatments to be transported outside of specific harvest units (Units 22, 65, 12 in Clear Creek Subwatershed, and Unit 30 in Bridge Creek subwatershed) located on areas of High BAER burn severity on steeper slopes (31-60%), due to their proximity to streams. Mitigation measures listed in Chapter 2 are intended to reduce the on-site erosion and the potential for drainage network increase, which is the primary erosion/sedimentation process in this landscape. The RHCA buffers along these units have been extended to 150 feet, instead of the standard 100 feet. Units 12, 22 and 30 are proposed for helicopter yarding, to help minimize increased soil disturbance and erosion. However, unit 65 includes tractor yarding (10 acres), in addition to skyline yarding (47 acres). Additional protective measures would be applied to these units; however, there is still an increased risk.

For all proposed harvest units, the use of default PACFISH buffers on Category 1-4 stream channels, implementation of BMPs, as well as the creation of buffers and designated skid trail crossings on ephemeral draws is expected to further protect streams and fish.

Therefore, the potential to have an adverse effect on fish or fish habitat with sediment from harvest units is negligible.

Roads

Hazard trees would be cut along all open roads and closed roads that are opened for implementation of Alternative 2. Hazard trees in units would be removed using the same logging system as the unit, while hazard trees outside units would be removed with equipment operated only on the road prism. Hazard trees would be felled but left onsite inside RHCAs to serve as down woody debris. No impacts to fish or fish habitat are expected due to the use of self-loading log trucks or other heavy equipment, which would be restricted to operation on road prisms.

No change in total road densities would occur to included subwatersheds as no new system roads would be constructed (See Road Densities). Alternative 2 would construct about 0.7

miles of temporary road to allow access to harvest. Of these temporary road miles, about 0.2 miles are existing rehabilitated temporary road and about 0.5 miles are decommissioned roads that would be re-opened as temporary roads. Although these roads do not cross stream channels or enter RHCAs, one temporary road is near a Category 2 stream that flows into Clear Creek. These roads would remain for 1-2 years until harvest activities are completed. All miles of temporary road would be stabilized and decommissioned after harvest activities.

Road activities would include haul road maintenance, and the construction and closure of temporary roads. Haul road maintenance (approximately 59.4 miles total) may have short term impacts from sediment during and immediately after implementation from re-grading roads, placement of grid-rolled aggregate, cleaning plugged culverts and cleaning blocked ditch lines, but is a long term benefit thereafter by improving drainage, reducing road failure potential at stream crossings, and reducing chronic sediment input to streams.

The potential to impact individual fish by haul and maintenance activities is minimal since culvert replacements and removals will not occur with this alternative. A higher risk to fish would be from the use of diesel, helicopter fuel, gas, hydraulic fluid, and oil lubricants if these substances were allowed to enter streams in the project area. Only road management activities such as maintenance, and timber and rock haul would occur within RHCAs where chemical contamination of fish habitat is possible. This contamination is possible but not expected due to Malheur National Forest safety measures, which would be followed relative to the use, storage and handling of petroleum products.

Roads that travel along riparian areas or that cross streams tend to impact the aquatic resource more than roads located in uplands. The haul route data presented in Tables FW-31-34 include roads both inside and outside the Easy Fire Recovery project area. A total of 38 stream crossings would occur on haul routes, with the greatest number on Category 4 streams at 19, followed by Category 1 streams at 14 and then Category 2 streams at 5 (Table of Haul Road Crossings of Streams by Stream Category). Of these stream channels, there would be 6 crossings on native, 20 crossings on improved/native (road length partially (spot) rocked with imported materials other than crushed aggregate) roads, and 12 crossings on aggregate surfaced roads (Table of Haul Road Stream Crossings by Stream Categories and Road Surface Material). Although the greatest number of crossings occurs on Category 4 streams, the greatest number of miles of haul occurs along Category 1 streams at 10.0 miles, followed by Category 2 and 4 streams at 2.0 miles each (Table of Haul Road Miles within RHCAs by Road Surface Material and Stream Category). The greatest miles of road along streams has aggregate surfacing at 7.5 miles followed by improved/native roads at 5.9 miles and then native at 0.6 miles (Table of Totals of Haul Road Miles within RHCAs by Road Surface Material). A total of 59.4 miles will be used for haul activities, 14.0 miles of haul road are located within RHCAs, and 45.4 miles are located outside.

Table FW-31: Haul Road Crossings of Streams by Stream Category.

Stream Category	Alternative 2	Alternative 3	Alternative 4
1	14	14	14
2	5	5	4
4	19	19	16
Total	38	38	34

Table FW-32: Haul Road Stream Crossings by Stream Categories and Road Surface Material

Road Surface Material	Alternative 2			Alternative 3			Alternative 4		
	Cat. I	Cat. II	Cat. IV	Cat. I	Cat. II	Cat. IV	Cat. I	Cat. II	Cat. IV
Aggregate/ Gravel	9	2	1	9	2	1	9	2	1
Improved/Native Material	5	2	13	5	2	13	5	2	11
Native Material	0	1	5	0	1	5	0	0	4

Note: No difference between alternatives for aggregate/gravel. However, there are 2 less crossings on improved/native and native material for Alternative 4.

Table FW-33: Haul Road Miles Within RHCAs by Road Surface Material and Stream Category

Road Surface Material	Alternative 2			Alternative 3			Alternative 4		
	Cat. I	Cat. II	Cat. IV	Cat. I	Cat. II	Cat. IV	Cat. I	Cat. II	Cat. IV
Aggregate/ Gravel	7.0	0.5	0.0	7.0	0.5	0.0	7.0	0.5	0.0
Improved/Native Material	3.0	1.4	1.5	3.0	1.4	1.5	3.0	1.3	1.4
Native Material	0.0	0.1	0.5	0.0	0.1	0.6	0.0	0.0	0.5
Total Miles	10.0	2.0	2.0	10.0	2.0	2.1	10.0	1.8	1.9

Table FW-34: Haul Road Miles within RHCAs by Road Surface Material

Road Surface Material	Alternative 2 Miles	Alternative 3 Miles	Alternative 4 Miles
Aggregate/ Gravel	7.5	7.6	7.6
Improved/Native Material	5.9	5.8	5.6
Native Material	0.6	0.7	0.5
Total Road Miles	14.0	14.1	13.7

Summary

In summary, while it is assumed some sediment, although negligible, will reach fish bearing streams as a result of harvest/ activities (especially those units on moderate slopes (31-60%) with high BAER burn severity), it is anticipated there will only be a short term negative impact on fish habitat and these impacts will not result in a change in baseline conditions.

Cumulative Effects - Alternative 2

Legacy impacts from roads, harvest and grazing activities on public land have reduced fish habitat quality and complexity in project area streams, however these impacts are more pronounced in those areas on public and private land downstream of the project area. Riparian vegetation has been reduced and width to depth ratios and stream temperatures are higher than historic levels resulting in reduced fish habitat quality. This has likely reduced fish population size and diversity in the project area and downstream as compared to historic population levels.

Harvest and fuel treatment activities are expected to reduce future fuel loading and the potential for wildfire starting on private land that could impact fish and fish habitat both in and downstream of the Easy Fire Recovery Project area. The extent of road-building activities on private land or the effects are unknown but are not expected to impact the Easy Fire Recovery Project area upstream.

The road management activities associated with Alternatives 2, 3, and 4 (which include routine haul maintenance and road closure activities) are expected to have benefits by reducing sediment that would improve habitat complexity and fish populations more than the No Action alternative (1). However, the reduced sediment volume is predicted to be minimal due to the overall good condition of local roads. The impacts of sediment during implementation of road management activities are expected to have no observable effect to fish habitat or populations.

Habitat conditions for resident and anadromous fish populations are expected to realize a short term degraded condition due to sediment inputs into streams resulting from the overall fire conditions on the landscape and those anticipated from harvest activities. However, no long term change in baseline conditions is expected. By keeping effects within activity areas, proposed activities would not add to legacy conditions such as channel or draw degradation.

Direct and Indirect Effects - Alternative 3

Harvest

In comparison to Alternatives 2 and 4, a moderate number of acres will be harvested with this alternative at 1,298. Similar to Alternative 2, the majority of harvest will occur in Clear Creek Subwatershed (759 acres), followed by 285 acres in Reynolds Creek Subwatershed and 254 Acres in Bridge Creek Subwatershed (Table of Proposed Acres by Subwatersheds).   In Alternative 3, the principal yarding method will be tractor (837 acres) with a substantial amount of helicopter yarding (308 acres) utilized as well (Table of Harvest Acres by Logging System). Only 153 acres will be cable yarded.

Only two percent (22 acres) of the area to be harvested is considered sensitive due to locations on steeper slopes (31-60%) that were severely burned (BAER burn severity High) (Table of Harvest on Various BAER Burn Severities). Eight acres would be helicopter yarded, 7 acres would be skyline and 7 acres would be tractor yarded. The tractor yarding would occur on slopes of 35% or less.   The mean flow distance of any eroded materials from units in these areas is predicted to be the greatest, in comparison to Alternatives 2 and 4 (Table of Mean Flow Distance from Harvest Units to Category 1 Streams).   There are no units to be harvested with Alternative 3 that are located predominately on steeper slopes that burned primarily at high BAER intensity.

For all proposed harvest units, the use of default PACFISH buffers on Category 1-4 stream channels, implementation of BMPs, as well as the designated skid trail crossings on ephemeral draws is expected to further protect streams and fish.

Sediment

Mitigation measures listed in Chapter 2 are intended to reduce the on-site erosion and the potential for drainage network increase, which is the primary erosion/sedimentation process in this landscape.

Roads

Hazard trees would be cut along all open roads and closed roads that are opened for implementation of Alternative 3. Hazard trees in units would be removed using the same logging system as the unit while hazard trees outside units would be removed with equipment operated only on the road prism. Hazard trees would be felled but left onsite inside RHCAs to serve as down woody debris. No impacts to fish or fish habitat are expected due to the use of self-loading log trucks or other heavy equipment, which would be restricted to operation on road prisms.

No change in total road densities would occur to included subwatersheds as no new system roads would be constructed (see Road Densities). Alternative 3 would construct about 0.5 miles of temporary road to allow access to harvest. The total constructed temporary road length is moderate in comparison to Alternatives 2 or 4. One decommissioned road would be re-opened as a temporary road. The reopened decommissioned road would remain for 1-2 years until harvest activities are completed. All miles of temporary road would be stabilized and decommissioned after harvest activities.

Road activities would include haul road maintenance and the construction and closing of temporary roads. Haul road maintenance (approximately 56.0 miles total) may have short term impacts from sediment during and immediately after implementation from re-grading roads, placement of grid-rolled aggregate, cleaning plugged culverts, and cleaning blocked ditch lines, but is a long term benefit thereafter by improving drainage, reducing road failure potential at stream crossings and reducing chronic sediment input to streams.

The potential to impact individual fish by haul and maintenance activities is minimal since culvert replacements and removals will not occur with this alternative. A higher risk to fish would be from the use of diesel, helicopter fuel, gas, hydraulic fluid, and oil lubricants if these substances were allowed to enter streams in the project area. Only road management activities such as maintenance, and timber and rock haul would occur within RHCAs where chemical contamination of fish habitat is possible. This contamination is possible but not expected due to Malheur National Forest safety measures, which would be followed relative to the use, storage and handling of petroleum products.

Roads that travel along riparian areas or that cross streams tend to impact the aquatic resource more than roads located in uplands. Like Alternative 2, a total of 38 stream crossings would occur on haul routes, with the greatest number on Category 4 streams at 19, followed by Category 1 streams at 14 and then Category 2 streams at 5 (Table of Haul Road Crossings of Streams by Stream Category). Of these stream channels, there would be 12 crossings on aggregate and 20 crossings on improved/native surfaced roads (Table of Haul Road Stream Crossings by Stream Categories and Road Surface Material). The least number of roads crossings would occur on native surfaced roads at 6. Like Alternative 2, although the greatest number of crossings occur on Category 4 streams, the greatest number of miles of haul also occurs along Category 1 streams at 10.0 miles, followed by Category 4 streams at 2.1 miles and then Category 2 streams at 2.0 miles (Table of Haul Road Miles within RHCAs by Road Surface Material and Stream Category). The greatest miles of road along streams has aggregate surfacing at 7.6 miles, followed by improved/native roads at 5.8 miles and then native at 0.7 miles (Table of Totals of Haul Road Miles within RHCAs by Road Surface Material). A total of 56.0 miles will be used for haul activities, 14.1 miles of haul road are located within RHCAs, and 41.9 miles are located outside.

Summary

Because units located on moderate slopes (31-60%) with high BAER burn severity and adjacent to Category 1 and 4 streams are eliminated with this alternative, it is anticipated there will be no measurable impacts to fish or fish habitat that result from project activities and that there will be no resultant change in baseline conditions.

Cumulative Effects - Alternative 3

Legacy impacts from roads, harvest and grazing activities on public land have reduced fish habitat quality and complexity in project area streams, however these impacts are more pronounced in those areas on public and private land downstream of the project area. Riparian vegetation has been reduced and width to depth ratios and stream temperatures are higher than historic levels resulting in reduced fish habitat quality. This has likely reduced fish population size and diversity in the project area and downstream as compared to historic population levels.

Harvest and fuel treatment activities are expected to reduce future fuel loading and the potential for wildfire starting on public land and spreading to private land, that could impact fish and fish habitat both in and downstream of the Easy Fire area. The extent of road-building activities on private land or the effects are unknown but are not expected to impact the Easy Fire area upstream.

The road management activities associated with Alternatives 2, 3, 4, and 5 are expected to have benefits by reducing sediment that would improve habitat complexity and fish populations more than the No Action alternative (1), likely improving conditions beyond the pre-fire baseline. The impacts of sediment during implementation of road management activities are expected to have a no observable effect to fish habitat or populations.

Habitat conditions for resident and anadromous fish populations are expected to realize a short term degraded condition due to sediment inputs into streams resulting from the overall fire conditions on the landscape. However, no long term change in baseline conditions is expected. By keeping effects within activity areas, proposed activities would not add to legacy conditions such as channel or draw degradation.

Direct and Indirect Effects - Alternative 4

Harvest

The least number of acres (956) will be harvested with this alternative. Similar to Alternatives 2 and 3, the majority of harvest will occur in Clear Creek Subwatershed (526 acres), followed by 343 acres in Bridge Creek Subwatershed and 87 Acres in Reynolds Creek Subwatershed (Table of Proposed Acres by Subwatersheds). For Alternative 4, the principal yarding method will be tractor (633 acres) with a substantial amount of helicopter yarding (265acres) utilized as well (Table of Harvest Acres by Logging System). Only 58 acres will be cable yarded.

Similar to Alternative 2, a significant portion, 92 acres, or 10% of the area to be harvested is considered sensitive due to unit locations on steeper slopes (31-60%) that were severely burned (BAER burn severity High) (Table of Harvest on Various BAER Burn Severities). The majority of these sensitive areas would be helicopter yarded (47 acres), 31 acres would be skyline and 14 acres would be tractor logged. The tractor yarding would occur on slopes of 35% or less. The mean flow distance of any eroded materials from units in these areas is predicted to be moderate in comparison to Alternatives 2 and 3 at 0.80 miles (Table of Mean Flow Distance from Harvest Units to Category 1 Streams).

For all proposed harvest units, the use of default PACFISH buffers on Category 1-4 stream channels, implementation of BMPs, as well as the creation of buffers and designated skid trail crossings on ephemeral draws is expected to further protect streams and fish.

Sediment

Like Alternative 2, there is a higher risk for sediment created by harvest and fuels treatments to be transported outside of specific harvest units (Units 22, 65 in Clear Creek Subwatershed, and Unit 30 in Bridge Creek subwatershed) located on areas of High BAER burn severity on steeper slopes (31-60%), due to their proximity to streams. These Units are eliminated in Alternative 3. Alternative 2 includes one additional unit, Unit 12, that is a high risk for sediment movement due to the conditions specified above. Mitigation measures listed in

Chapter 2 are intended to reduce the on-site erosion and the potential for drainage network increase, which is the primary erosion/sedimentation process in this landscape. The RHCA buffers along these units have been extended to 150 feet, instead of the standard 100 feet. Units 22 and 30 are proposed for helicopter yarding, to help minimize increased soil disturbance and erosion. However, unit 65 includes tractor yarding (10 acres), in addition to skyline yarding (47 acres). Additional protective measures would be applied to these units; however, there is still an increased risk, although not as great as Alternative 2.

Roads

Hazard trees would be cut along all open roads and closed roads that are opened for implementation of Alternative 4. Hazard trees in units would be removed using the same logging system as the unit while hazard trees outside units would be removed with equipment operated only on the road prism. Hazard trees would be felled but left onsite inside RHCAs to serve as down woody debris. No impacts to fish or fish habitat are expected due to the use of self-loading log trucks or other heavy equipment, which would be restricted to operation on road prisms.

No change in total road densities would occur to included subwatersheds as no new system roads would be constructed (See Road Densities). Alternative 4 constructs 0.2 miles of temporary road (existing rehabilitated temporary road).

Road activities would include haul road maintenance and the construction and closing of temporary roads. The total miles (48.0) of haul roads utilized for this Alternative are substantially less than Alternatives 2 and 3 at 59.4 and 56.0, respectively. Haul road maintenance may have short term impacts from sediment during and immediately after implementation from re-grading roads, placement of grid-rolled aggregate, cleaning plugged culverts and cleaning blocked ditch lines, but is a long term benefit thereafter by improving drainage, reducing road failure potential at stream crossings and reducing chronic sediment input to streams.

The potential to impact individual fish by haul and maintenance activities is minimal since culvert replacements and removals will not occur with this alternative. A higher risk to fish would be from the use of diesel, helicopter fuel, gas, hydraulic fluid, and oil lubricants if these substances were allowed to enter streams in the project area. Only road management activities such as maintenance, and timber and rock haul would occur within RHCAs where chemical contamination of fish habitat is possible. This contamination is possible but not expected due to Malheur National Forest safety measures, which would be followed relative to the use, storage and handling of petroleum products.

Roads that travel along riparian areas or that cross streams tend to impact the aquatic resource more than roads located in uplands. Alternative 4 haul routes cross the fewest streams, in comparison to Alternatives 2 and 3. A total of 34 stream crossings would occur on haul routes, with the greatest number on Category 4 streams at 16, followed by Category 1 streams at 14 and then Category 2 streams at 4 (Table of Haul Road Crossings of Streams by Stream Category). Of these stream channels, there would be 12 crossing on aggregate, 4 on native and 18 on improved/native surfaced roads (Table of Haul Road Stream Crossings by Stream Categories and Road Surface Material). Like Alternatives 2 and 3, although the greatest number of crossings occur on Category 4 streams, the greatest number of miles of haul occur along Category 1 streams at 10.0 miles, followed by Category 4 streams at 1.9 miles and then

Category 2 streams at 1.8 miles (Table of Haul Road Miles within RHCAs by Road Surface Material and Stream Category). Also like Alternatives 2 and 3, the greatest miles of road along streams have aggregate surfacing at 7.6 miles followed by improved/native roads at 5.6 miles and then native at 0.5 miles (Table of Totals of Haul Road Miles within RHCAs by Road Surface Material). A total of 48.0 miles will be used for haul activities, 13.7 miles of haul road are located within RHCAs, and 34.3 miles are located outside.

Summary

Due to less acres harvested on moderate slopes (31-60%) with high BAER burn severity and adjacent to Category 1 and 4 streams than Alternative 2 but much more than Alternative 3, and the least miles of haul roads and miles of haul roads within RHCAs compared to Alternatives 2 and 3, the impacts to fish and fish habitat, although minimal, will be moderate in comparison to Alternatives 2 and 3.

Cumulative Effects - Alternative 4

Legacy impacts from roads, harvest and grazing activities on public land have reduced fish habitat quality and complexity in project area streams, however these impacts are more pronounced in those areas on public and private land downstream of the project area. Riparian vegetation has been reduced and width to depth ratios and stream temperatures are higher than historic levels resulting in reduced fish habitat quality. This has likely reduced fish populations size and diversity in the project area and downstream as compared to historic population levels

Harvest and fuel treatment activities are expected to reduce future fuel loading and the potential for wildfire starting on public land and spreading to private land, that could impact fish and fish habitat both in and downstream of the Easy Fire area. The extent of road-building activities on private land or the effects are unknown but are not expected to impact the Easy Fire area upstream.

The road management activities associated with Alternatives 2, 3, 4, and 5 are expected to have benefits by reducing sediment that would improve habitat complexity and fish populations more than the No Action (1) alternative, likely improving conditions beyond the pre-fire baseline. The impacts of sediment during implementation of road management activities are expected to have a no observable effect to fish habitat or populations.

Habitat conditions for resident and anadromous fish populations are expected to realize a short term degraded condition due to sediment inputs into streams resulting from the overall fire conditions on the landscape and those anticipated from harvest activities. However, no long term change in baseline conditions is expected. By keeping effects within activity areas, proposed activities would not add to legacy conditions such as channel or draw degradation.

Direct and Indirect Effects - Alternative 5

Alternative 5 was an alternative considered but not analyzed in the DEIS.

Harvest

Commercial harvest of fire-killed or dying trees will not occur with implementation of this alternative. However, dead and dying fuels less than 7-inches in diameter will be removed to reduce fuel loadings in all units identified in Alternative 2. These fuels will be grapple piled and burned on slopes less than 35%. On steeper slopes these fuels will be hand-fell and hand-piled prior to burning. The use of default PACFISH buffers on Category 1-4 stream channels and implementation of BMPs is expected to further protect streams and fish, although any effects from fuel treatment activities will be less than Alternatives 2,3, 4.

Sediment

Due to the effects of the fire, sediment yield and stream turbidity are expected to increase above pre-fire levels during winter and spring high flows when most sediment movement occurs. Sediment yield will decrease over time as the area recovers from the effects of fire. For more information, consult the section "Existing Condition." There is a higher risk for sediment created by fuels treatments to be transported outside of specific fuels treatment units (Units 22, 65, 12 in Clear Creek Subwatershed, and Unit 30 in Bridge Creek Subwatershed) located on areas of High BAER burn severity on steeper slopes (31-60%), due to their proximity to streams. However, it is predicted that there will be no transport of sediments outside unit boundaries.

Alternative 5 activities would maintain and protect beneficial uses of water and would comply with all existing state and federal regulations regarding water quality. Since all alternatives would incorporate site-specific best management practices in all activities and the largest portion of the sediment will pass through the system during the winter high flows, no measurable effects on fishery resources is anticipated from project activities. Also, effects upon threatened or sensitive species would be limited by legal constraints. All alternatives will comply with process requirements set forth in the Endangered Species Act of 1973. For a more complete discussion of the existence of, and effects upon threatened and sensitive species, see the Fisheries Biological Evaluation in Appendix F and the fisheries Biological Assessment in Appendix G.

No adverse effects from sediment or turbidity are anticipated as a result of blowdown within riparian areas. Research conducted in the coast range of Oregon has assessed the effects of wind damage within streamside buffers and its effect on accelerated sedimentation (Warner 1993). Amounts of added sediments were generally associated with uprooted trees and were generally small when compared to the overall sediment yield of the streams. The addition of coarse woody debris to the stream channels as a result of blowdown would likely have only temporary, localized effects on water quality. Over time coarse woody material added to stream channels could improve water quality by storing sediment, increasing bank stability, and reducing the erosive force of water by slowing its velocity.

Roads

Effects from road activities will be similar to those discussed for Alternatives 1. Temporary roads would not be constructed and decommissioned roads would not be reopened as in Alternatives 2-4. Although there will be no commercial haul with Alternative 5, those roads proposed for haul activities in Alternative 2 will receive maintenance as needed for properly functioning condition, including the 0.3 miles of grid-rolled rock placement on Road 26000026. There would be no change in permanent road miles and no change in road densities as no new system roads would be constructed. Closure activities will be the same as Alternatives 2-4, including the 5.2 mile closure of Road 2600391 and those roads opened for fire suppression efforts. Watershed conditions would be improved by reducing erosion risks.

Hazard trees cut along roads will be left on site.

Cumulative Effects - Alternative 5

Cumulative effects would be similar to those listed for Alternatives 2, 3, and 4, but would result in less environmental impact due to the size of material being treated for fuels reduction and general absence of commercial hauling and yarding (except units on less than 35% ground slope) equipment.

Foreseeable, Future Actions

The following foreseeable action would likely be completed under a Categorical Exclusion to aid in the vegetative recovery of the burned tributaries of Clear Creek and along Easy Creek.

Riparian Planting: In the tributaries (Category IV) of Clear Creek and in Easy Creek (Category IV) that underwent high burn severities, and in those upland areas posing a high sediment delivery potential to these streams, due to steep slopes with high severity burns, appropriate species would be planted to speed the return of overstory shade, woody debris recruitment, and to minimize sediment input into streams. This planting would decrease the time for hydrologic recovery several years sooner than natural regeneration.

The majority of the Clear Creek RHCA would not be planted because shrubs, native forbs, and grasses are expected to increase rapidly following the fire. Shrub habitat is somewhat scarce but a valuable ecosystem component prior to the fire. With time the return of riparian trees through natural regeneration will shade out the shrubs.

Environmental Consequences - Water Quantity

Direct and Indirect Effects Common to All Alternatives

Peak Flows and Increased Runoff

Created openings, road densities and infiltration rates can have an effect on peak flows and water runoff. As discussed in Existing Condition, Clear Creek subwatershed showed the greatest increase in created openings (21 percent) resulting from the fire. After the fire, about 34 percent of the subwatershed is expected to act as hydrologic openings. This is assuming that about half of the “moderate” fire vegetation severity acres had enough of a reduction in canopy for the burned areas to act as hydrologic openings. Bridge Creek subwatershed showed an increase of 4 percent, from 12 to 16 percent, as a result of the fire. See Table FW-33.

The discussion on water quantity focuses on the Clear Creek and Bridge Creek subwatersheds. The six percent of private land located downstream of the fire area in the Bridge Creek subwatershed would not affect the analysis on water quantity. Reynolds Creek subwatershed contains 18 percent in private lands. However, the private land is located about five miles downstream of the fire project area. Reynolds Creek showed an increase of 3 percent, from 7 percent to 10 percent, which is not significant, in both pre-fire and post-fire conditions. The other subwatersheds had no change from pre-fire to post-fire created openings.

Table FW-35: Pre- and Post-Fire Created Hydrological Openings by Subwatershed*

Subwatershed (SWS)	SWS Acres	Pre-Fire Openings (acres)	Pre-Fire % SWS in Openings	Fire Created Openings – Vegetation Severity (acres)		Post-Fire % SWS in Openings
				Severe	Moderate	
Bridge Creek	12,149	1,505	12	458	64	16
Clear Creek	12,484	1,602	13	2,037	1,264	34

*Applies only to Forest Service lands.

For the fire-affected subwatersheds, the duration and magnitude of stream flow is determined, to a large extent, by the high elevation snowpack accumulation. Consequently, peak flows can be highly variable, as is indicated by historic data for Bridge Creek (See Existing Condition - Water Yield/Stream Discharge & Flow.).

From the Umatilla Barometer Watershed Program, Helvey and Fowler (1998) found no changes in the magnitude of annual snowmelt peaks in small drainages that were nearly completely harvested by clearcut or shelterwood. However, peaks in one drainage occurred earlier after 60 percent of the drainage was harvested. This indicated earlier snowmelt in that drainage. Daily stream flow peaks did show an increase. Other literature has generally noted that any measurable change in flow is more likely when 20-30 percent of a subwatershed is in created openings.

Based upon the amount of created openings and the current total road density (see Total Road Density), Clear Creek subwatershed is the area most likely to experience increased peak flows, with earlier peaks. The increased peak flows would be mainly from the intermittent tributary areas which were high burn severity. However, the stream/riparian habitat along the main stem Clear Creek was little affected by the fire, and is characterized by large numbers of large woody debris, highly stable banks and good channel complexity and vegetative cover. Any expected small increases in peak water flow are not likely to adversely affect the main stem stream channel conditions.

As reported earlier, the BAER team concluded that less than 5% of the area had experienced significantly reduced infiltration. The amount of increased runoff in the high burn severity areas was expected to be 5-10% (from Bright and others 2002).

Within the Bridge Creek subwatershed, the upper 0.8 mile of the Easy Creek drainage burned at high BAER severity. Any increase in peak flow related to the fire or current road densities is expected to be immeasurable, since the fire only increased the openings 4%. Effects downstream would be minimal, since Lunch Creek contains high levels of woody debris, good complexity and unaltered riparian vegetation (see Existing Condition – Stream Channel Habitat Condition).

For Clear Creek and Bridge Creek subwatersheds, Class I Water Yield soils make up 77% and 69% of the subwatersheds. Class I Water Yield soils have high detention storage capacity and low rates of runoff. Class I soils are important in sustaining high base flows due to the large volume of water held in detention storage in the soil mantle. As a result of the high proportion of class I soils, the subwatersheds are able to tolerate extreme peak flow events without serious environmental effects, except under unusual circumstances, such as frozen soils with a rain on snow event.

With predicted increases in runoff for the Easy Fire area, changes in channel morphology and complexity are expected to be minimal overall in the main stream channels. Over time, as runoff decreases from the recovery of vegetation, the burned channels would recover to pre-fire conditions.

Water Yield

Annual water yields may increase for several years after the fire, but would decrease to pre-fire levels as the vegetation becomes re-established, and the evapotranspiration rate increases. There are no conclusive studies that clearly demonstrate that fire causes long-term increased water yield. Temporary (for a few years) increases may occur following large, "clean" fires because although direct evaporation may increase, water detention by litter and debris, and transpiration, both decrease. However, the effect is quickly reduced as vegetation and litter return.

Demonstration of the "increased yield" is difficult because the effect is often temporally shorter than natural variation in climatic events, and because increased evaporation from the soil surface may compensate for reduced transpiration. There is good circumstantial evidence that greater accumulations of snow may occur following fires that remove some tree cover because of decreased interception of snow by the canopy. However, if the burned area exceeds about four times the height of surrounding cover, snow accumulation may decrease due to wind scour (National Wildfire Coordinating Group, 2001).

Helvey and Fowler (1998) found a low water-yield response to intensive timber removal. Yield from one small drainage increased during 2 years after 60 percent of the total timber stand was removed, while 2 other drainages showed no changes in water yield after most or all of the timber had been harvested. Any increases in water yield may have been negated by factors such as 1) water use from re-establishing vegetation, 2) below-average precipitation, and 3) increased wind speeds that may have caused snow transport out of the watershed or increased sublimation and evaporation rates.

The greatest increases in yield would be from areas having very little remaining vegetation. Areas with any residual forest vegetation in other areas would be able to use the increased soil moisture, which would decrease any yield increases.

Direct and Indirect Effects of Alternative 1 (No Action)

No activities are proposed under this alternative. Since there are no activities proposed, there would be no direct or indirect effects to peak flows or water quantity in this alternative. Fire recovery would continue based on climate and natural processes.

As the areas which had reduced infiltration recover over time, and the forest canopy becomes re-established in the created openings, any small increase in peak flows in the intermittent tributaries of Clear Creek would return to pre-fire levels and timing. For Easy Creek in the Bridge Creek subwatershed, any increases in peak flow would be immeasurable. Where there is residual forest canopy in the openings, for the subwatershed as a whole, the reduction in created openings would take 15 to 35 years, depending on the age and amount of remaining forest canopy. In the high burn severity areas, it could take 20-50 years for the areas to naturally regenerate (see the Silviculture report). It would then take an additional 30 or more years for the forest canopy to develop enough such that the areas are no longer created openings.

Over time, ground cover would increase as forest conditions develop, and erosion levels would decrease. Increased ground cover would reduce runoff by allowing more precipitation and runoff to infiltrate into the ground. Root action, animals that burrow in the soil, and freezing water would gradually improve infiltration rates in fire-affected areas and reduce the runoff. Fire-killed trees would contribute large woody debris to the slopes and intermittent stream channels as they fall to the ground (beginning about 10 years). Road effects on peak flows would not change.

Cumulative Effects - Alternative 1 (No Action)

All of the past, ongoing, and reasonable foreseeable future activities identified in the beginning of Chapter 3 have been considered for their cumulative effects on peak flows and water quantity for this alternative. The predicted small increase in peak flow from the tributaries of Clear Creek is not likely to adversely affect the main stem stream channel conditions. The stream/riparian habitat along Clear Creek was little affected by the fire, and is characterized by large numbers of large woody debris, highly stable banks and good channel complexity and vegetative cover. Also, any effect would be well dissipated along the 4 mile section of Clear Creek downstream from the fire area.

Changes in peak flow from Easy Creek (Bridge Creek subwatershed) are not expected to be measurable, since the fire only increased the openings 4%. Any downstream effects from increased peak flow would also be negligible. The upper 0.8 mile of Easy Creek (intermittent stream) burned at high BAER severity. However, the 0.4 mile downstream middle stream segment burned at low severity. And the lower 1.2 miles to Lunch Creek was unburned. Lunch Creek itself contains high levels of woody debris, good complexity and unaltered riparian vegetation.

Direct and Indirect Effects of Alternatives 2, 3 and 4

Forest management activities can affect water yield, sediment and channel structure thereby modifying fish habitat and populations (Chamberlin et al 1991). Increases in sediment yield beyond a stream’s ability to transport the material can decrease the amount and quality of instream habitat available to fish. Increases in water yield can also modify fish habitat by destabilizing banks and modifying channel dimensions. Harvest would only include dead and dying trees and therefore not affect water yield.

Although proposed activities differ in type of harvest and acres treated in Alternatives 2, 3, and 4, none of the alternatives would have measurable changes or effects on peak flows or water yield from current conditions. The road density would not change in any alternative, since there is no new permanent road construction proposed in Alternatives 2, 3, and 4.

Increased runoff can be produced from tractor skid trails and landings. However, the landings and the majority of skid trails in Alternatives 2, 3 and 4 would be subsoiled to reduce soil compaction, and improve water infiltration. Also, cross drains would be installed along skid trails to divert surface runoff from compacted areas or disturbed areas. Grass seeding would also be completed for disturbed soil areas. See Chapter 2 Management Requirements, Constraints and Mitigation Measures.

Leaving well-dispersed snags would also eventually help in slowing down surface runoff, and help trap sediments as the snags fall to the ground. However, the more immediate factor in reducing runoff and erosion would be the resprouting vegetation, litter fall, and the growth of mosses, lichens, forbs and other herbaceous vegetation, along with the current down wood. Elliot, et al. (2001) noted that field observations and validation studies suggest that following fire the amount of exposed mineral soil is halved each year until the site is recovered. This usually takes about three or four years after a fire. Erosion rates decline significantly the third and fourth year after a fire.

As discussed earlier, recovery of ground cover and erosion rates on different parts of the Easy Fire would take from less than a year to a year following the fire on low burn severity sites, from 3 to 4 years on moderate burn severity sites, and from 3 to 5 years on high burn severity sites (BAER burn severity ratings).

Water retained in woody material is not available for augmenting late-season stream flows, but would provide moist micro-sites for conifers and other vegetation. Large down wood provides moist micro-sites for conifers, shrubs, herbs, fungi, mycorrhizae, mosses, lichens, bacteria and small animals such as earthworms, snails and nematodes.

In the long term, leaving higher amounts of snags for future surface wood recruitment could help control runoff from large storm events. Alternative 2 leaves an even distribution in the harvest units for retained snags in small clumps if possible. Alternative 4 would retain higher snag levels in small clumps in harvested areas, which would provide for larger amounts of near-future down wood. Outside harvest units, all snags would be retained, except for those felled along open roads to reduce safety hazards.

Alternative 3 leaves less snags (1-2 snags per acre) than the forest plan standard in harvest areas. However, in Alternative 3, harvest is avoided on the steeper, severely burned slopes in the Clear Creek tributaries and along Easy Creek, where significant snag patches would be retained. The actual acres of harvested high BAER burn areas with reduced snag levels (below the forest plan standard) would be about 373 acres. Outside harvest units, all snags would be retained, except for those felled along open roads to reduce safety hazards.

Activities included in Alternatives 2, 3 and 4, which would neither improve nor detrimentally impact water quality, quantity, or fishery resources, include:

- the removal of dead and dying trees;
- the removal of incidental green trees from less than three acres in proposed landings, skid trails, or temporary roads;
- the site-specific application of BMPs to harvest and fuel treatments (which would retain concentrated flows within the activity units);
- the site-specific application of BMPs to the construction and decommissioning of temporary roads; and.
- placement of grid-rolled rock on 0.30 miles of road 2600026 near South Fork of Bridge Creek, (about 1/2 mile from Lunch Creek).

As in the No Action (1) Alternative, over time, ground cover would increase as forest conditions develop, and erosion levels would decrease. Root action, animals that burrow in the soil, and freezing water would gradually improve infiltration rates in fire-affected areas.

Since no activities are proposed for the riparian habitat areas (RHCAs), fire-killed trees would contribute large woody debris to the intermittent stream channels and the adjacent side slopes beginning in about 10 years until around 30 years, as the trees and limbs fall to the ground, which would slow storm runoff rates by allowing more precipitation and runoff to infiltrate into the ground. However, in Alternatives 2, 3, and 4, there would be less large woody debris falling to the ground in harvest areas (outside of RHCAs), since the larger size fire-killed and dying trees would be harvested. Road effects on peak flows would not change.

Over the longer term (20-50 years), the re-planting of burned areas (harvest areas, existing plantations and RHCAs) would reduce the time that created openings would contribute to peak flows, since replanting would allow the forest canopy to be restored more rapidly, compared to natural regeneration. (See the Silviculture report.)

A minimal, but not measurable increase in annual water yield would result from the removal of dead and dying trees because of the changes in precipitation interception. The increase resulting form harvest activities would not be observable from post-fire levels, since the dead and dying trees would already have a low amount of retaining tree canopy.

The tree canopy can affect the precipitation interception and infiltration, snow accumulation, and the snowmelt and evaporation by affecting wind patterns and solar radiation. In areas where the existing trees have been killed, such as by fire, the loss of the tree foliage (needles and branches) through fire consumption and the later needle drop results in a tree stand that behaves like a hydrological opening, depending on the number of trees that have been killed.

Harvest of dead trees would not create additional hydrologic openings nor affect water yield because dead trees would have little remaining tree canopy to affect the wind patterns and solar radiation. The dead trees are also no longer transpiring or taking up water. The existing condition also includes trees “likely to die” because, based on field sampling, root hairs and cambium of these trees were killed by the fire. The trees are no longer able to take up water and their function in the hydrologic cycle is the same as if they were dead. Thus, the removal of the fire-killed trees would not produce significant changes from the post-fire conditions in terms of water yield, peak flows, or minimum flows. Any increase in annual water yield would diminish as vegetation became re-established on the sites.

Using best available science to determine if trees are dead or alive should result in only a small amount of incorrect calls. The effect of harvesting only a small amount of trees that may be incorrectly classified on hydrologic conditions is expected to be minor. Removing incidental green trees would not substantially alter the percentages of subwatersheds in created hydrologic openings.

Cumulative Effects - Alternatives 2, 3 and 4

All of the past, ongoing, and reasonable foreseeable future activities identified in the beginning of Chapter 3 have been considered for their cumulative effects on peak flow and water quantity for these alternatives. Since Alternatives 2, 3 and 4 would not have any measurable change in peak flows or water quantity from current conditions, there would not be any cumulative effects from the proposed or present, or foreseeable future actions.

The predicted small increase in peak flow from the tributaries of Clear Creek is not likely to adversely affect the main stem stream channel conditions. The stream/riparian habitat along Clear Creek was little affected by the fire, and is characterized by large numbers of large woody debris, highly stable banks and good channel complexity and vegetative cover. Also, any effect would be well dissipated along the 4 mile section of Clear Creek downstream from the fire area.

Changes in peak flow from Easy Creek (Bridge Creek subwatershed) are not expected to be measurable, since the fire only increased the openings 4%. Any downstream effects from increased peak flow would also be negligible. The upper 0.8 mile of Easy Creek (intermittent stream) burned at high BAER severity. However, the 0.4 mile downstream middle stream segment burned at low severity. And the lower 1.2 miles to Lunch Creek was unburned. Lunch Creek itself contains high levels of woody debris, good complexity and unaltered riparian vegetation.

Direct and Indirect Effects of Alternative 5

Under Alternative 5, the natural processes over time would be similar to those effects described for Alternative 1 (No Action). As with all alternatives, there would not be any significant direct nor indirect effects on peak flows or water quantity from Alternative 5.

Alternative 5 provides for 2,524 acres of tree planting in severely burned areas (vegetation burn severity). This tree planting would accelerate the establishment of young forest vegetation, and shorten the time for fire-created openings to transition to a forest canopy.

This alternative also proposes fuels treatment thru the removal of dead and dying fuels less than 7 inches in diameter. The fuels would be grapple piled on the gentle ground, and hand-felled, piled and burned on the steeper slopes. The large diameter down wood would be left on the ground. Grapple piling would treat 1,750 acres, and 1,902 acres would be hand piled and with piles burned.

Grapple piling equipment would be required to have a low ground pressure, and would operate on old skid trails where possible, and operate on dry soil. Grapple piling with burning of the piles would affect about 2 percent (compacted and/or detrimentally burned) of the treated areas. If grapple piling occurs when the soils are moist, the amount of compaction could be higher.

Direct and indirect effects from hand piling and burning of the steeper slopes would be negligible. Burning of piles would produce small areas of detrimentally burned soil.

Cumulative Effects of Alternatives 5

All of the past, ongoing, and reasonable foreseeable future activities identified in the beginning of Chapter 3 have been considered for their cumulative effects on peak flows and water quantity for this alternative. The cumulative effects from Alternative 5 would be similar to those described for the other alternatives. There would be no significant cumulative effects.

The tree planting of severely burned areas (vegetation severity) would accelerate the establishment of young forest vegetation, and shorten the time for fire-created openings to transition to a forest canopy.

Environmental Consequences - Federally Listed and Sensitive Species

Columbia River bull trout (including proposed critical habitat) and mid-Columbia River summer-run steelhead, which are federally listed as threatened, are known to inhabit the area. The Region 6 sensitive species (USDA 2000) include: (1) the mid-Columbia River spring-run chinook salmon (*Oncorhynchus tshawytscha*), listed in 1997, (2) interior redband trout (*Oncorhynchus mykiss* ssp.), listed in 1986, and (3) westslope cutthroat trout (*Oncorhynchus clarki lewisi*), listed in 2000. Additionally, the Columbia spotted frog is thought to be present in the two watersheds, however, its presence has not been confirmed. The determination of effects to this species is documented in the wildlife specialist report and BE. Redband trout and their habitat are found within the Easy Fire Recovery Project Area, while chinook salmon and westslope cutthroat trout are downstream of the project area but within the area of potential effects from project activities. The cutthroat trout and redband trout are also designated as management indicator species for fisheries analyses in the Malheur Forest Plan (USDA 1990). The potential determination for federally listed and sensitive species are as follows:

NLAA	May affect, but is not likely to adversely affect individuals or habitat.
MIIH	May impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.
WIFV	Will impact individuals or habitat with a consequence that the action may contribute to a trend towards federal listing or cause a loss of viability to the population or species.
BI	Beneficial impact.

The following Table of Federally Listed and Sensitive Species Biological Evaluation Summary lists determinations for all alternatives. Effects determinations shown for Alternatives 2, 3, 4, and 5 are based on long term effects (effects greater than two years).

Table FW-36: Sensitive Species Biological Evaluation Summary

Fish Species	Effects Determinations Alternative 1 (No Action)	Effects Determinations Alternative 2	Effects Determinations Alternative 3	Effects Determinations Alternative 4	Effects Determinations Alternative 5 (Restoration)
Columbia River Bull Trout	NLAA	NLAA	NLAA	NLAA	NLAA
Columbia River Bull Trout (CH)	NLAA	NLAA	NLAA	NLAA	NLAA
Mid-Columbia River Summer-run Steelhead	NLAA	NLAA	NLAA	NLAA	NLAA
Interior Redband Trout	MIIH	MIIH(BI)	MIIH(BI)	MIIH(BI)	MIIH(BI)
Westslope Cutthroat Trout	MIIH	MIIH(BI)	MIIH(BI)	MIIH(BI)	MIIH(BI)
Mid-Columbia River Spring-run Chinook Salmon	MIIH	MIIH(BI)	MIIH(BI)	MIIH(BI)	MIIH(BI)
Mid-Columbia River Spring-run Chinook Salmon (EFH)	NLAA	NLAA	NLAA	NLAA	NLAA

CH = Critical Habitat; EFH = Essential Fish Habitat

Columbia River Bull Trout (*Salvelinus confluentus*)

Determination

The Easy Fire Recovery project, including road maintenance, temporary road work, and harvest activities may affect but is not likely to adversely affect (NLAA) Columbia River bull trout or their habitat (proposed critical) with the implementation of Alternatives 1-5.

Mid-Columbia River Spring-run Chinook (*Oncorhynchus tshawytscha*)

Determination

The Easy Fire Recovery project, including road maintenance, temporary road work, and harvest activities may impact Mid-Columbia River spring-run chinook individuals or their habitat (MIIH), but will not likely contribute to a trend towards federal listing or cause a loss of viability to mid-Columbia River spring-run chinook with the implementation of the No Action (1) or Alternatives 2-5. Road closures and haul maintenance will have a beneficial impact (BI) with the implementation of Alternatives 2-5.

Additionally, the Easy Fire Recovery project, including road maintenance, temporary road work, and harvest activities may affect but is not likely to adversely affect (NLAA) Mid-Columbia River spring-run chinook habitat (EFH) with the implementation of Alternatives 1-5.

Mid-Columbia River Summer-run Steelhead (*Oncorhynchus mykiss gairdneri*)

Determination

The Easy Fire Recovery project, including road maintenance, temporary road work, and harvest activities may affect but is not likely to adversely affect (NLAA) Mid-Columbia River summer-run steelhead or their habitat with the implementation of Alternatives 1-5.

Redband Trout (*Oncorhynchus mykiss* ssp.)

Determination

The Easy Fire Recovery project, including road maintenance, temporary road work, and harvest activities may impact inland redband trout individuals or their habitat (MIIH), but will not likely contribute to a trend towards federal listing or cause a loss of viability to inland redband trout with the implementation of the No Action (1) or Alternatives 2-5. Road closures and haul maintenance will have a beneficial impact (BI) with the implementation of Alternatives 2-5.

Westslope Cutthroat Trout (*Oncorhynchus clark lewisi*)

Determination

The Easy Fire Recovery project, including road maintenance, temporary road work, and harvest activities may impact westslope cutthroat trout individuals or their habitat (MIIH), but will not likely contribute to a trend towards federal listing or cause a loss of viability to westslope cutthroat trout with the implementation of the No Action (1) or Alternatives 2-5. Road closures and haul maintenance will have a beneficial impact (BI) with the implementation of Alternatives 2-5.

The following is a summary of effects determinations for alternatives documented in the Biological Evaluation of the Easy Fire Recovery project.

Effects of Alternative 1 (No Action)

Fuel loadings will increase in the project area as snags fall and new vegetation grows. This could lead to a higher severity fire than Easy, resulting in a higher probability for severe soil damage and greater potential impacts to fish and fish habitat.

Road management activities have the highest potential to effect sediment input into streams, thereby impacting fish and their habitat. No additional roads would be constructed or reconstructed, and there would be no reduction in road densities due to road closure activities with this alternative. There would be no road management activities other than routine road maintenance associated with this alternative. Consequently, the effects from roads would not change. Currently, the road system in the project area is in an overall good condition due to recent timber sale road activities so road related impacts are estimated to be minimal in the near future with this alternative.

This alternative "May Impact Individuals or Habitat" for sensitive species listed herein, now and in the future. However the impacts are not expected to be significant or cover a large enough area to reduce population viability, which could result in a "WIFV" determination for sensitive fish species.

Effects Common to Alternatives 2, 3, and 4

Fuel loading in the project area would be reduced with harvest activities associated with these alternatives. These activities could reduce the impacts of future wildfires to fish and fish habitat in the project area and downstream. These harvest activities are not expected to result in measurable increases in sediment or overland flow to nearby streams above that associated with the fire alone.

Road management activities have the highest potential to effect sediment input into streams, thereby impacting fish and their habitat. Alternatives 2, 3, and 4 have temporary road construction and reopening of decommissioned roads but these roads will be closed at the end of their use, and they are not anticipated to effect fish or their habitat due to their distance from fish bearing streams and design considerations. Additionally, Alternatives 2, 3, and 4 will also place grid-rolled rock on 0.30 miles of Road 2600026, as a maintenance activity, and close 5.2 miles of Road 2600391, thereby reducing risks to nearby fish and their habitat. Also, all Alternatives 2, 3, and 4 will involve periodic road maintenance, primarily blading, of haul routes as needed, which will improve long term road condition and routing of sediment and runoff to streams. Short term impacts to fish and fish habitat may be realized in roads passing thru riparian areas but effects are anticipated to be minimal. Impacts "May Impact Individuals or Habitat" but would not likely contribute to a trend towards federal listing or to a loss of viability to the population or species. The long-term reduction in impacts to aquatic indicators would result in a "Beneficial Impact" for listed fish species.

Effects of Alternatives 5

Fuel loading in the project area would be reduced with removal of dead and dying fuels less than 7-inches in diameter. No commercial harvest will occur with this alternative. These activities could reduce the impacts of future wildfires to fish and fish habitat in the project area and downstream. This fuel loading reduction is not expected to result in measurable increases in sediment or overland flow to nearby streams above that associated with the fire alone.

Road management activities have the highest potential to effect sediment input into streams, thereby impacting fish and their habitat. The only road activities to be performed with this alternative are road maintenance, the felling of hazard trees, and road closures. No temporary road construction or reopening of decommissioned roads will occur with this alternative. Road maintenance activities include placement of grid-rolled rock on 0.30 miles of Road 2600026. Road 2600391 (5.2 miles) and those roads opened for fire suppression efforts will be closed. These road activities will reduce risks to nearby fish and their habitat. Road maintenance, primarily blading, as needed, will improve long term road condition and routing of sediment and runoff to streams. Short term impacts to fish and fish habitat may be realized in roads passing thru riparian areas but effects are anticipated to be minimal. Impacts "May Impact Individuals or Habitat" but would not likely contribute to a trend towards federal listing or to a loss of viability to the population or species. The long-term reduction in impacts to aquatic indicators would result in a "Beneficial Impact" for listed fish species.

Mitigation Measures

Refer to table 2-3b in Chapter 2 for the list of mitigation measures related to Fisheries and Water Quality. Because of the condition of the burned RHCAs and the erosion taking place along the severely burned areas in the Clear Creek and Easy Creek drainages, the following mitigation measures are included in the table, to help minimize additional erosion and to provide for future recovery of the ground and channel conditions. See the sections on plant recovery, sedimentation and tributaries and ephemeral channels for the high burn severity area in Clear Creek, for more information.

Units 22, 30 and 65: The RHCA buffer along the burned intermittent channel should be extended to 150 feet slope distance from the water channel, to provide additional protection to help reduce the sideslope erosion and sedimentation, and to provide future down wood for ground cover and for trapping sediment.

Consistency with Direction and Regulations

Malheur Forest Plan

The alternatives are consistent with forest plan direction. None of the potential combined effects are expected to further reduce aquatic habitat elements below forest plan standards or adversely affect the viability of aquatic TES species and would not increase watershed effects over natural, post-fire levels. The application of PACFISH direction is expected to maintain or improve fish habitat conditions in the project area. Stream channel conditions are expected to improve with road management activities, as well as forest plan direction to defer grazing for two or more years following the fire.

Endangered Species Act

All alternatives are consistent with Endangered Species Act direction. Consultation with appropriate federal agencies for those species that may be affected by project activities and listed as threatened or endangered (not applicable) has been completed (see Appendix G, Biological Assessment for Mid-Columbia River Summer Steelhead and Columbia River Bull Trout). It was determined that the preferred Alternative 3 may affect but is not likely to adversely affect (NLAA) summer steelhead and bull trout. Concurrence on the findings in the Biological Assessment was received from the US Fish and Wildlife Service for bull trout on 12/23/2003 and from National Marine Fisheries Service (NOAA Fisheries) for steelhead on 1/16/2004. Additionally NOAA Fisheries in the same letter concurred the Forest Service met the requirements for consultation under the Magnuson-Stevenson Fishery Conservation and Management Act for essential fish habitat (EFH).

Clean Water Act Section 303(d)

There are four streams either in the project area (Clear Creek) or within the potential affected area (Lunch Creek, Dry Fork Clear Creek, and Reynolds Creek) that are currently on the 303(d) list (see Figure 26, Map Section). Clear Creek and Reynolds Creek are listed for water temperature concerns for bull trout while Lunch Creek is listed for water temperature concerns for summer rearing of salmonids.

From a subwatershed perspective, most of the fire occurred in the Clear Creek subwatershed, where 3,002 acres burned. Clear Creek subwatershed also had the most high burn severity acres (BAER rating), 800 acres. Only a small number of acres (30 acres) were burned within the Dry Fork subwatershed. In the Reynolds Creek subwatershed, most of the acres were of low burn severity, and only 35 acres were high burn severity. (See Table FW-4 Burned Acres by Subwatershed.)

For the fire area as a whole, there were very few locations where the fire actually burned to the water's edge at moderate or high BAER burn severity along perennial streams. The only Category 1 stream in the area, Clear Creek, received only minimal impacts from the fire. Thus, the buffering capacity of the RHCAs along Clear Creek is intact. Also, the Category 2 stream riparian areas were primarily low or no burn (BAER) burn severity. Intermittent streams (Category 4) and ephemeral channels were the channels most affected by the fire. (See Figure FW-1 Stream Category by BAER Burn Severity and Table FW-5). Since there were only minimal effects to riparian areas of perennial streams from the fire, no measurable changes in stream temperature are expected.

For all of the alternatives, no additional disturbance to the remaining shading vegetation on any stream riparian area would occur on Category 1 and 2 streams. No measurable change in water temperature is predicted in any perennial stream as a result of any proposed alternative. 303(d) listed streams will not be at risk from any increased temperature from project activities.

The mitigation measures include, among others:

1. No timber harvest in Riparian Habitat Conservation Areas (RHCAs);
2. Extended RHCA buffers of 150 feet slope distance, instead of the standard 100 feet distance, along three of the intermittent stream channels (Category 4) that underwent high BAER burn severity above Clear Creek and along Easy Creek;
3. A no-cut buffer along a burned ephemeral channel;
4. Helicopter logging of units above Clear Creek and along Easy Creek;

5. The PACFISH RHCA buffers for Category 1 and 2 streams; and Category 4 streams not cited above;
6. Limitations for dry or frozen ground road haul; and
7. Dust abatement during summer months. See the chart of soil, fish and watershed mitigation measures in Chapter 2.

The FEIS is consistent with the "Forest Service and BLM Protocol for Addressing Clean Water Act Section 303(d) Listed Waters". In addition to the "Protocol", the May 2002 Clean Water Act Memorandum of Understanding between the Forest Service, PNW Region, and Oregon DEQ states: "WQRP's should be completed where management activities have the potential to affect impaired waters 303(d) listed and a TMDL is not in place" (page 6). For the Easy Fire Recovery EIS, the decision framework was not initiated because the project was not likely to affect the parameter (temperature) for which the potentially affected streams (Clear Creek within the project area, Lunch Creek and Reynolds Creek adjacent to the project area) were listed and therefore a WQRP was not required for the project.

Also, implementation of the above mentioned Protocol requires a collaborative approach with the State and Tribes with the Forest assisting in the development of a TMDL. The John Day basin is scheduled for 2006 (See ODEQ schedule for TMDLs). Along this same timeline the Forest will undertake the development and implementation of a WQRP for the John Day basin in order to provide the specific actions needed in order for the Forest to meet TMDL requirements. Thus the FEIS for this project is consistent with the direction and regulations of the Clean Water Act and 303(d) listed streams.

There will be no measurable effects to currently listed streams and no additions to the Section 303(d) List of Water Quality Impaired water bodies would be made as a result of implementing Alternatives 2, 3, 4, or 5.

Executive Order 12962, Recreational Fisheries

Recreational fisheries are limited in the Easy Fire Recovery project area by legacy water quality and habitat degradation. All alternatives include aquatic conservation actions that would improve the quantity, function, sustainable productivity, and distribution of recreational fisheries as directed under Executive Order 12962, Recreational Fisheries

Executive Orders 11988 and 11990

The proposed alternatives would have no impact on floodplains or wetlands as described.

Irreversible and Irretrievable Commitments of Resources

No irreversible effects are expected. Reduced fish population viability could be an irretrievable commitment of resources, but is not expected due to the application of PACFISH standard and g