South Fork Campground Restoration Project – While still in the developmental phase, the objective of this project would be to minimize the fire-induced effects of the 2007 wildfire on the 10 acre South Fork Campground by removing hazard trees, planting conifers, and implementing other restorative activities. The environmental analysis for this project is tentatively scheduled to occur in 2008 with implementation in 2009 or 2010.

Shoreline Fuels Reduction Project – This project consists of mechanical mulching of 32 acres of sub-merchantable trees and hand thinning and piling of 77 acres of sub-merchantable trees, all in the vicinity of the Shoreline Campground. Implementation is scheduled to occur in 2008.

Tyndall Stolle Reforestation Project – This project consists of planting conifers on an estimated 4,127 acres that burned at a high or moderate intensity where competing vegetation is expected and/or where no seed source is present to facilitate natural regeneration. Planting activities are projected to occur in the spring and fall of 2008 and 2009.

Miscellaneous Recreational Activities – Numerous recreation-related uses in the area, such as church camps, hunting, camping, firewood cutting, and sightseeing, are expected to continue in the future.

SFSR Travel Management Project - While still in the developmental phase, the objective of this project would be to minimize undesirable impacts associated with poorly located dispersed campsites and authorized and unauthorized roads and/or trails causing resource damage, as well as to address under-sized culverts, fish passage barriers, and/or structures damaged by the 2007 wildfire in the South Fork Salmon River drainage. The environmental analysis for this project is tentatively scheduled to occur in 2008 with implementation in 2009 or 2010.

Warm Lake Highway Reconstruction Project – The majority of this project was completed in the summer of 2007 and included repair and resurfacing of the Warm Lake Highway (FH22) from Big Creek Summit to its crossing of the South Fork Salmon River.

Road Use and Road Maintenance – In addition to the ongoing use associated with recreational activities, roads within the area would continue to receive routine maintenance and/or repair as priorities dictate and funding allows.

BAER Culvert Replacements – A number of culverts removed in the fall of 2007 as part of the Cascade Complex BAER project would be reinstalled in the summer of 2008.

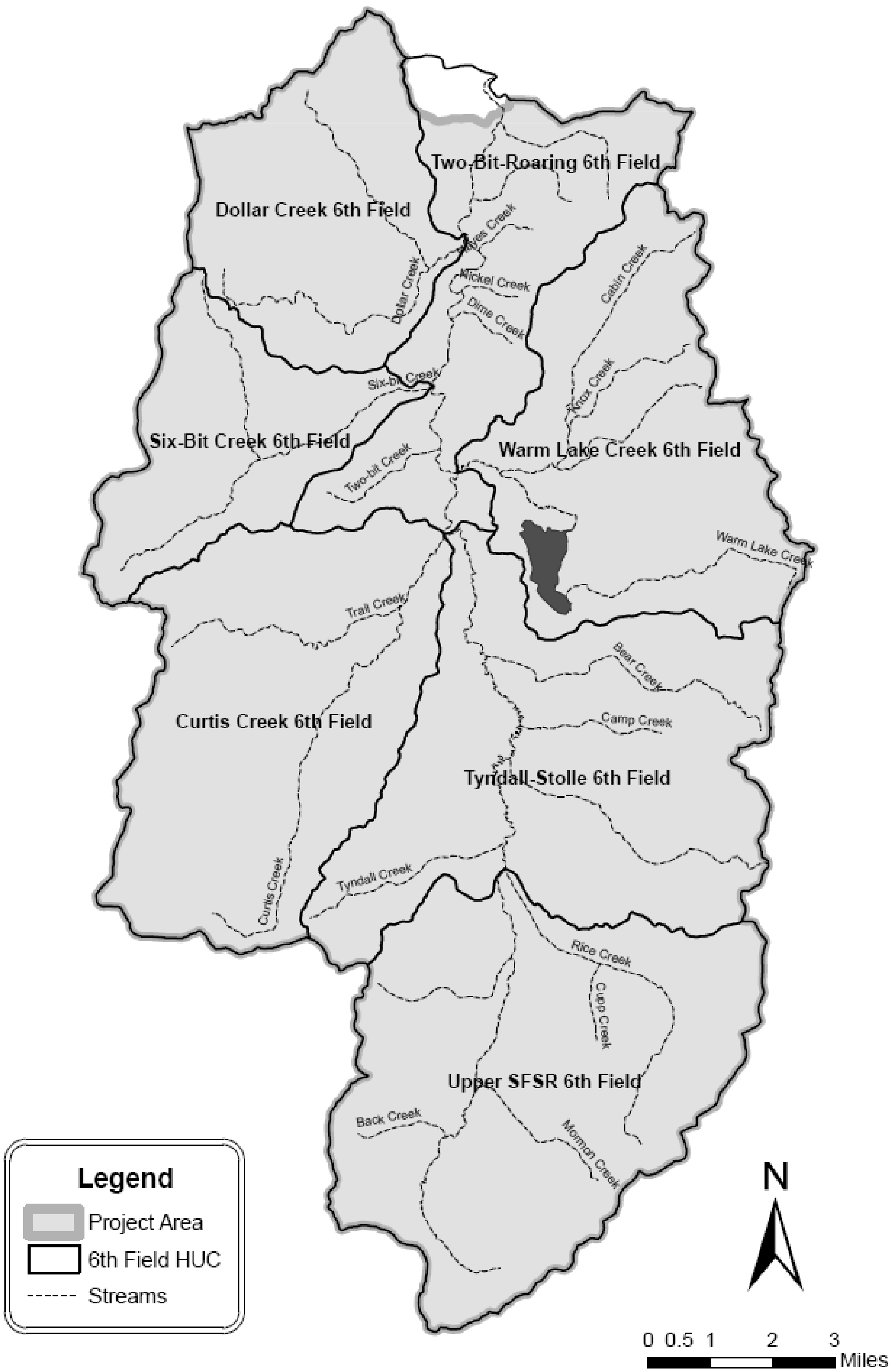
Alternative A would have no direct or indirect effects on wetlands or floodplains within the analysis area, therefore no cumulative effects would occur (P.R., Vol. 11, Wetlands and Floodplains).

Alternatives B and C would have no direct or indirect effects on wetlands or floodplains within the analysis area. Therefore, regardless of the potential effects associated with ongoing or foreseeable future projects, these alternatives would not add incrementally to those effects (P.R., Vol. 11, Wetlands and Floodplains).

3.12 Fisheries

This section of the document discusses the existing characteristics of the fisheries and fish habitat, as well as the effects of the alternatives on those resources. The 103,804 acre project area lies within seven 6^{th} field subwatersheds: Curtis Creek (170602081103), Dollar Creek (1702081004), Six-bit Creek (170602081003), Two-bit Roaring (HUC 170602081001), Tyndall Stolle (170602081101), Upper SFSR (170602081102), and Warm Lake Creek (HUC 170602081002). For the purposes of this analysis the seven 6^{th} field subwatersheds in their entireties, totaling roughly 104,431 acres, were evaluated as separate analysis areas. As displayed in Figure 3-17, a portion of the Two-bit Roaring 6^{th} field occurs outside of the 103,804 acre project area, with the remaining 6^{th} fields located entirely within the project area.

Figure 3-17 Fisheries Analysis Areas



Tributaries within the project area include Cabin Creek, Knox Creek, Dime Creek, Nickel Creek, Hayes Creek, Mirror Creek, Dollar Creek, Six Bit Creek, Two Bit Creek, Curtis Creek, Warm Lake Creek, Bear Creek, Tyndall Creek, Camp Creek, Lodgepole Creek, Rice Creek, Mormon Creek, and several unnamed tributaries. Fish habitat surveys and presence/absence surveys, consisting of snorkeling or electrofishing, were completed in the summers of 1994-1997, 1999, 2000, 2001, 2002, 2004, 2006, and 2007 within the seven 6th field subwatersheds. The SFSR Baseline Substrate Monitoring (‘core samples’) occurs annually at the Dollar and Stolle Meadows sites, and includes four others sites. The information from the SFSR Baseline Substrate Monitoring, including the Dollar and Stolle Meadows sites, is available from the Payette National Forest in an annual monitoring report (Nelson et al 2006).

Chinook salmon, steelhead/rainbow trout, bull trout, westslope cutthroat trout, brook trout, and sculpin are all known to be present in streams within the analysis areas. Table 3-27 displays the occurrence of fish species of concern within the seven 6th field analysis areas. Reference Figure 3-16 for locations of streams (P.R. Vol. 12, Fisheries).

Table 3-27 Occurrence of Fish Species of Concern

Stream	Rainbow/ Steelhead	Brook Trout	Bull Trout	Westslope Cutthroat	Chinook Salmon	Sculpin
Dollar Cr.	X	X	X			
Roaring Cr.	X			X		
Six-bit Cr.	X	X	X		X	
Curtis Cr.	X	X	X	X	X	
Bear Cr.	X	X	X			
Lodgepole Cr.	X	X	X			
Tyndall Cr.			X			X
Rice Cr.	X		X			
Mormon Cr.			X			
SFSR	X				X	

Chinook Salmon and Steelhead Trout - The Snake River spring/summer Chinook salmon (*Oncorhynchus tshawytscha)* and the steelhead trout (*Oncorhynchus mykiss gairdneri)* are listed as threatened fish species. The biology and ecology of these species is described in the 2003 Southwest Idaho Ecogroup Land and Resource Management Plans Final Environmental Impact Statement (pg. 3-123 through 3-130, pg. 3-169 through 3-207) and the Biological Assessment for the Salmon Angling Activities (USDA 2003) The entire SFSR Section 7 Watershed is described more completely in the Biological Assessment of Ongoing Actions Effects to Chinook Salmon and Steelhead Trout in the Upper South Fork Salmon River and Johnson Creek Section 7 Watersheds (Burton 1999) and the Upper South Fork Salmon River/Johnson Creek Ecosystem Analysis at the Watershed Scale (USDA 2002).

The Biological Opinion on the Land and Resource Plans for the Boise, Payette, and Sawtooth National Forests (NOAA 2003) identifies the SFSR as part of the Salmon River Core Area for Chinook salmon and steelhead trout. In 1999 the South Fork Salmon River (SFSR) and its tributaries up to natural barriers were designated as critical habitat for the spring/summer Chinook salmon (64 FR 57399). In 2005 critical habitat for Snake River steelhead was designated as all streams in the SFSR drainage, and includes those providing spawning, rearing, and migration habitat (70 FR 52630).

Chinook and steelhead spawn in the mainstem SFSR upstream and downstream of the Warm Lake Creek confluence. Chinook salmon also spawn in the upper SFSR mainstem from the head of Stolle Meadows to below Dollar Creek. The Dollar Creek spawning area has been used since the mid-1970’s as a substrate fines monitoring reach (P.R. Vol. 12, Fisheries).

Steelhead trout are observed to use similar spawning areas as Chinook salmon which spawn in Cabin Creek above Knox Ranch, and sporadically in Warm Lake Creek near the confluence with the SFSR. Chinook salmon also spawn and rear in Warm Lake Creek between the mouth and Cabin Creek confluence, downstream of the Knox Ranch Administrative Site, and in the mouth of Six-bit Creek and Curtis Creek (P.R. Vol. 12, Fisheries).

Juvenile Chinook salmon rear in the mouths of Cabin Creek, Curtis Creek, Dollar Creek, and several other tributary streams and the margins of the mainstem SFSR. The lower ends of major SFSR tributaries provide important rearing areas for steelhead parr in the SFSR as reflected in occasionally larger densities than in mainstem areas (Thurow 1987).

In the entire SFSR, summer Chinook salmon runs have declined since the 1960's from more than 20,000 fish/year to 2,300 to 4,200 fish/year. However, from 1995 to 2003 Chinook salmon redd counts in the SFSR reach between the IDFG weir and Blackmare Creek near the Poverty Flat CG have increased from a low of 16 in 1995 to a high of 261 in 2003 (P.R. Vol. 12, Fisheries).

Bull Trout - The Columbia River population segment of bull trout (*Salvelinus confluentus)* is currently listed as a threatened species. In addition, bull trout is also identified as a management indicator species (Forest Plan Appendix E, Table E-3, p. E-3).

Bull trout proposed critical habitat and the Draft Recovery Plan were published in the Federal Register in 2002 (67 FR 71236). The Proposed Draft Recovery Plan is available at the FWS website http://pacific.fws.gov/bulltrout. Unit 16, the Salmon River Basin, identifies the SFSR as proposed critical habitat in Subunit iii. The final designation of bull trout critical habitat was published in the Federal Register on September 26, 2005, and became effective October 26, 2005 (50 CFR Vol. 70, No. 185). The Draft Bull Trout Recovery Plan (USDI 2002) and the final rule for critical habitat are available at the USDI FWS website http://pacific.fws.gov/bulltrout. Under the final rule, no designated bull trout critical habitat occurs on the Boise National Forest.

The biology and ecology of bull trout in the Columbia River Distinct Population Segment are described in Chapter 1 of the Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan (USDI 2002). Chapter 17 in the Draft Recovery Plan identifies the SFSR as part of the Salmon River Core Area, which is comprised of 26 local populations of bull trout. The Warm Lake 6^{th} field, Upper SFSR and Tyndall Stolle 6^{th} fields, Curtis Creek 6^{th} field, and the Dollar Creek and Six-bit Creek 6^{th} fields, are each bull trout Local Population Watersheds (LPW) occurring within the project area. A more complete habitat description of the Upper SFSR bull trout subpopulation watershed and the Warm Lake LPW is provided in the Biological Assessment of Ongoing Actions in the Upper South Fork Salmon River Bull Trout Subpopulation (Olson and Burton 2000).

All life history forms of bull trout are known to occur in the upper SFSR. Bull trout distribution and population strength is greatest in the upper SFSR in Mormon Creek. Bull trout are known to inhabit Warm Lake and Rice Lake. These populations may include an adfluvial form. Migratory bull trout in the system provide connectivity to other subpopulations within the SFSR drainage. To some degree, roads in local population watersheds may interfere with migration. Evaluation of known and potential culvert barriers has been conducted in local population watersheds and noted migration barriers in North Fork Dollar Creek, Lodgepole Creek, Bear Creek, Curtis Creek, Two Bit Creek, and Six Bit Creek (P.R. Vol. 12, Fisheries).

Known bull trout spawning and rearing habitats are relatively well distributed over tributaries to the upper SFSR. Large fluvial bull trout have been detected in the upper SFSR and are likely spawning in some of these tributaries. Reproduction in spawning and rearing habitats will include that of fluvial bull trout, but is likely dominated by resident adults. Brook trout are present to some degree in all six local population watersheds on the Boise National Forest and occur in half of the occupied bull trout spawning and rearing habitat (Olson and Burton 2000).

Rearing habitat is available in all of the local population watersheds. Lack of local population strength appears to be related to sediment levels, lack of large pools, potential barriers, and competition with brook trout. No population trend data are available to assess changes in population strength over time (Olson and Burton 2000).

The upper SFSR bull trout subpopulation is not genetically unique. It is well connected to the lower SFSR subpopulation and the Secesh River populations. It is also connected to the Johnson Creek subpopulation through the East Fork SFSR. These populations constitute a meta-population representing a group of semi-isolated subpopulations that are interconnected and likely to share genetic material. Rieman and McIntyre (1993) concluded that isolated populations are more likely to disappear from environmental and demographic effects, rather than from the loss of genetic diversity (Olson and Burton 2000) (P.R. Vol. 12, Fisheries).

Westslope Cutthroat Trout - The westslope cutthroat trout (*Oncorhynchus clarki lewisi*) is listed as a Region 4 Sensitive Species. The life history of the westslope cutthroat trout is described in the Upper South Fork Salmon River and Johnson Creek Watershed Analysis (USDA 1995), pages V-123 through V-125.

Westslope cutthroat are found in ten SFSR tributaries on the Boise and Payette National Forests. All westslope cutthroat subpopulations rate low in abundance except for Buckhorn and Little Buckhorn Creeks on the Payette National Forest, which rated as moderate and high, respectively. Thurow (1987) suggests that the SFSR drainage supports a small population of fluvial westslope cutthroat, and that it is likely resident populations exist in some mainstem tributaries. Westslope cutthroat trout were found in Curtis Creek and Roaring Creek during previous presence/absence surveys (P.R. Vol. 12, Fisheries).

Watershed Condition Indicators - The 2003 Forest Plan management direction (goals, objectives, standards, and guidelines) replaces direction in the 1990 Forest Plan, as amended by Pacfish/Infish, and the 1995 and 1998 Biological Opinions (BOs) for listed fish species. However, Appendix B of the Forest Plan did incorporate components of Pacfish/Infish, the 1995 and 1998 BOs, the Endangered Species Act, and the Clean Water Act important to the Forest's Long-term Aquatic Conservation Strategy (ACS).

Information and process guidance provided in Appendix B of the Forest Plan, also referred to as the "Matrix", comprise a decision support tool that has been developed to assist land managers in assessing how well management actions move toward related resource goals. There are four components/tables in the Matrix with each table divided into 8 overall pathways (major rows). Each of these rows represents a significant pathway by which actions can have potential effects on native and desired non-native fish species, their habitats, and associated beneficial uses. Pathways are further broken down into 24 watershed condition indicators (WCIs). These WCIs improve upon and update the Riparian Management Objectives identified in Pacfish and Infish. In simple terms, direction in Appendix B requires completion of four steps:

1) Identify the desired conditions necessary for any individual WCI to function at an appropriate level. Although the Matrix provides "default" desired conditions for each WCI, it also provides the flexibility to modify these values to reflect desired conditions achievable in a given location and/or to incorporate localized or better information.

2) Identify the environmental baseline (existing condition) of each WCI.

3) Compare the desired condition of each WCI to the environmental baseline to determine if the individual WCI is currently functioning appropriately (FA), functioning at risk (FR), or functioning at an unacceptable risk (FUR).

4) Identify the temporary, short, and long term effects of proposed activities on the relevant WCIs to determine how those activities affect the functionality rating.

The intent is that the processes outlined in the Matrix can be used to track how management actions, over time, are trending FUR and FR indicators toward a FA condition, or are maintaining already FA indicators at multiple scales. How quickly WCIs obtain a FA condition depends on the baseline, the kinds of management actions that are implemented and their effects over time, and the types of natural disturbances that occur.

As noted in Appendix B of the Forest Plan (pg. B-2), not every project, even in a degraded baseline, will be restorative. Some management actions will be proposed in a watershed with a FUR baseline that will result in a temporary or possibly short term "degrade" in the Matrix. These management actions are appropriate as long as they do not retard the attainment of riparian processes and functions, have measurable long term ecological benefits, or do not have substantially measurable short term effects to important subwatersheds or to the overall watershed. If riparian and watershed processes are to be restored over time within watersheds that have a FR or FUR baseline, it is critical that management actions individually and collectively do not further degrade or retard attainment of WCI's. Reference Appendix B of the Forest Plan for detailed information.

The following discussions describe the environmental baselines for the various WCI's. Where applicable, the WCI's were modified from the "default" desired condition to reflect better or more localized information. The updated environmental baselines were developed, in part, to support completion of the *SFSR Hazard Tree Removal Project Biological Assessment* (USDA 2008).

Given that the habitat needs of bull trout are more restrictive than those of Chinook salmon, steelhead trout, or westslope cutthroat trout, this analysis will focus on bull trout.

Subpopulation Size - Subpopulations within the Upper SFSR and Sit-bit 6th fields are functioning appropriately, Tyndall Stolle and Curtis Creek 6th fields are functioning at risk, and subpopulations in the remaining 6th fields are functioning at an unacceptable risk (P.R. Vol. 12, Fisheries).

Growth and Survival **–** The Two-bit Roaring and Dollar Creek 6th fields are considered to be functioning at an unacceptable risk because no bull trout have been documented in those subwatersheds. The remaining 6th fields are functioning at risk because there is less than 10 years of data, because the juvenile to adult ratio is less than one, or because the subwatersheds have unoccupied patches. Although difficult to project to what extent the 2007 wildfire will affect this WCI, an increase in sediment and stream temperatures would reduce the proportion of juvenile fish in relation to adult bull trout (P.R. Vol. 12, Fisheries).

Life History Diversity and Isolation **–**The Two-bit Roaring 6th field is functioning at an unacceptable risk because there are no documented bull trout except for migratory fish. Warm Lake Creek 6th field is functioning at an unacceptable risk because presence is limited to one small resident population. The remaining 6th fields have evidence of both resident and adfluvial life histories with several nearby local population watersheds. However, these remaining 6th fields are considered to be functioning at risk due to several culverts that hinder migration within these 6th fields, as well as between the various 6th fields (P.R. Vol. 12, Fisheries).

Persistence and Genetic Integrity – All seven 6th fields are considered to currently be functioning at an unacceptable risk due to the presence of migration barriers and the effects of the 2007 wildfire (P.R. Vol. 12, Fisheries).

Temperature **–** Although limited, available pre-fire stream temperature data for the various 6th fields revealed 7-day mean maximum temperatures ranging from 15.2 to 18.1^{o}C in Curtis Creek; 14.1 to 17.0^{o}C in Dollar Creek; 18.8 to 20.5^{o}C in Two-bit Roaring; 12.8 to 16.5^{o}C in Tyndall Stolle; 13.0 to 17.5^{o}C in Upper SFSR, and; 14.9 to 26.9^{o}C in Warm Lake Creek. No stream temperature data was available for the Six-bit 6th field (P.R. Vol. 12, Fisheries).

Stream temperatures are expected to increase relative to pre-fire conditions due to large areas of fire-killed trees within riparian conservations areas (Table 3-28). This condition is particularly evident in Lodgepole Creek, Camp Creek, and Bear Creek where large areas of high intensity fire killed most of the trees in the RCAs. Grasses and shrubs are expected to reestablish themselves on burned sites over the next 3 to 5 years and provide some cover. However, it will be many decades before the coniferous overstory provides shade similar to those levels that existed prior to the wildfire. Fire-induced increases in water yield and the associated decrease in stream temperatures may offset the loss of stream shading to some degree. In addition, the presence of numerous springs and groundwater sources in smaller streams such as Bear Creek and Lodgepole Creek will provide some cooling benefit until vegetation is reestablished. This WCI is functioning at risk in the Curtis Creek 6th field and functioning at an unacceptable risk in the remaining 6th field analysis areas (P.R. Vol. 12, Fisheries).

Table 3-28 Burn Severities in RCAs by Subwatershed

Subwatershed	Total RCA Acres	Total Burned	Burn Severity			
			High	Moderate	Low	Unburned
Curtis Creek	3,928	15%	1%	9%	5%	85%
Dollar Creek	2,634	74%	12%	38%	24%	26%
Six-bit Creek	1,932	78%	17%	36%	25%	22%
Two-bit Roaring	1,900	95%	20%	52%	23%	5%
Tyndall Stolle	3,709	89%	45%	36%	8%	11%
Upper SFSR	3,215	89%	11%	44%	34%	11%
Warm Lake Creek	2,221	72%	24%	31%	17%	28%
Totals	**19,539**	**70%**	**19%**	**33%**	**18%**	**30%**

Sediment/Turbidity – In comparison to the pre-fire condition, soil erosion will increase due to the loss of vegetation consumed by the 2007 wildfire and, to a much lesser degree, the fire-induced hydrophobic soil conditions. Sediment delivery to streams will increase as a result of increased surface erosion, decreased surface roughness, and increased water runoff. Sediment will be stored to some degree in the tributary channels and delivered to main channels over time. The total volume of sediment stored behind obstructions will vary between subwatersheds and years in response to changes in bankfull channel width and annual peak flow rates, respectively (Megahan 1982).

As disclosed in Section 3.11.1 of this chapter, the BOISED model projects a post-fire percent over natural sediment yield of 29.5 percent in the Curtis Creek 6th field; 43.1 percent in the Dollar Creek 6th field; 56.6 percent in the Six-bit 6th field; 78.5 percent in the Two-bit Roaring 6th field; 96.5 percent in the Tyndall Stolle 6th field; 52.0 percent in the Upper SFSR 6th field, and; 33.3 percent in the Warm Lake Creek 6th field (P.R., Vol. 11, Sediment).

Though there is no direct relationship between sediment delivery to streams and the sediment/turbidity WCI, an increase in sediment delivery can be expected to increase fine sediment within stream channels, particularly in the response reaches commonly used as spawning habitat (P.R. Vol. 12, Fisheries).

Over time the rate of soil erosion and sedimentation will decrease as vegetation becomes established, dead trees fall to the ground, and water infiltration increases. However, the time needed for these natural processes to occur will vary depending upon the characteristics of the particular site (elevation, aspect, soil type, etc.) and the severity of the burn (P.R. Vol. 12, Fisheries).

The sediment WCI is currently functioning at risk in the Curtis Creek 6th field and functioning at an unacceptable risk in the remaining 6th field analysis areas due to a combination of pre-existing conditions and the impacts of the 2007 wildfire (P.R. Vol. 12, Fisheries).

Chemical Contaminants/Nutrients – The SFSR, including all 1st to 5th order tributaries, was listed as impaired (Water Quality Limited Waterbodies) in the 2002 303(d)/305(b) Integrated Report (IDEQ 2005), with sediment identified as the pollutant of concern. However, none of the streams in the analysis areas are listed for chemicals, metals, or nutrients. All seven 6th fields are currently functioning at risk (P.R. Vol. 12, Fisheries).

Physical Barriers – No barriers are known to exist in the SFSR mainstem. As part of the burned area emergency response (BAER) effort a number of under-sized culverts, some of which also prevented fish migration, were removed in the fall of 2007. Nevertheless, both natural barriers and road culverts continue to prevent fish passage in every 6th field analysis area except Dollar Creek (P.R. Vol. 12, Fisheries).

The Dollar Creek 6th field is functioning appropriately, while the remaining 6th fields are functioning at an unacceptable risk (P.R. Vol. 12, Fisheries).

Substrate Embeddedness **–** Substrate fines by depth (core samples) averaged 29.9 percent between 2001 and 2005 in the mainstem SFSR near its confluence with Dollar Creek. The 28 year average for this site is 28.9 percent. The current trend at this site is coarsening of the geometric mean diameter, with a five-year average diameter of 23.3 mm, or coarse gravel. The other site where long-term core sampling has occurred within the project area is in Stolle Meadows. Substrate fines by depth (core samples) averaged 30.9 percent between 2001 and 2005 in the mainstem SFSR in Stolle Meadows. The 28 year average for this site is 25.2 percent. The current trend at this site is a slight decrease of the geometric mean diameter, with a five-year mean particle diameter of 23.8 mm, or coarse gravel (P.R. Vol. 12, Fisheries). Intergravel quality, based on Tappel and Bjornn (1983), estimates Chinook and steelhead egg survival to be high for the South Fork Salmon River (Nelson et al 2006).

Since a large amount of fine sediment is expected to be delivered to stream channels within the analysis area due to the effects of the 2007 wildfire, and based on changes in fine sediment deposition in the spawning reaches after past landslide events, it is expected that the current post-fire substrate embeddedness will be functioning at an unacceptable risk in the short term time frame for all of the 6^{th} fields except Curtis Creek, which will continue to function at risk (P.R. Vol. 12, Fisheries).

Large Woody Debris - Stream survey data collected prior to the 2007 wildfire determined that, of those streams measured within the various 6^{th} field analysis areas, 75 percent or more met or exceeded the large woody debris values for pristine streams based on locally derived habitat (*The User's Guide to Fish Habitat: Descriptions that Represent Natural Conditions in the Salmon River Basin,* Overton and others 1995) (P.R. Vol. 12, Fisheries).

Post-fire reconnaissance of the area as part of the BAER effort indicated that the 2007 wildfire consumed little of the existing large woody debris in RCAs, even where the fire severity was moderate to high (unpublished Green and Kellett 2007). Green and Kellett (2007) also noted that additional large woody debris was recruited to streams within the burned area as a result of the 2007 wildfire.

Although the wildfire likely had little direct effect on the existing amounts of large woody debris within streams, it has had an indirect effect. Within five years snags within the project area will begin falling to the ground, with the smaller diameter trees the first to fall as they gradually succumb to the forces of nature such as wind and decay. Given the severity of damage within most of the fire-killed trees (Section 3.2.1), an estimated 75 to 85 percent of the snags will have fallen by year 15 (Section 3.2.7) thus greatly increasing the contribution of large woody debris (P.R. Vol. 12, Fisheries).

Burton (2000) monitored two wildfires on the Boise National Forest six years post-wildfire and found instream large woody debris levels increased in both cases, even with rain on snow mass erosion events. Bragg (2000) modeled large woody debris recruitment to stream channels after a wildfire event and found a peak in large woody debris delivery immediately after the fire and another large peak (four fold increase) several decades later. Given that 52 percent of the RCAs within the project area experienced moderate or high burn severities in 2007, large woody debris recruitment would be expected to increase between two to four fold over the next several decades (P.R. Vol. 12, Fisheries).

This WCI is functioning appropriately in all seven 6^{th} fields (P.R. Vol. 12, Fisheries).

Pool Frequency and Quality - Stream survey data collected prior to the 2007 wildfire determined that, of those streams measured within the various 6^{th} field analysis areas: 62.5 percent in the Curtis Creek 6^{th} field; 73 percent in the Two-bit Roaring 6^{th} field; 61 percent in the Warm Lake Creek 6^{th} field; 50 percent in the Upper SFSR 6^{th} field, and; 100 percent of the measured streams in the Dollar Creek , Six-bit Creek, and Tyndall Stolle 6^{th} fields met or exceeded the pool frequency values for pristine streams based on locally derived habitat (*The User's Guide to Fish Habitat: Descriptions that Represent Natural Conditions in the Salmon River Basin*, Overton and others 1995) (P.R. Vol. 12, Fisheries).

Due to temperature modifications and increased sedimentation as a result of the 2007 wildfire, pool frequency is currently functioning at risk in all 6^{th} field analysis areas except Curtis Creek which is functioning appropriately (P.R. Vol. 12, Fisheries).

Large Pools/Pool Quality **–** Given the level of fire intensity and severity in most of the analysis areas, fine sediment would be expected to increase and decrease pool size and depth, as well as reducing the quality of the substrate. This WCI is currently functioning appropriately in the Curtis Creek 6^{th} field, functioning at an unacceptable risk in the Dollar Creek 6^{th} field, and functioning at risk in the remaining 6^{th} field analysis areas (P.R. Vol. 12, Fisheries).

Off-Channel Habitat **–** The Dollar Creek, Six-bit Creek, and Curtis Creek 6^{th} fields are composed almost entirely of moderate to high gradient, moderately to highly confined Rosgen type A and type B channels (Rosgen 1994) that would not be expected to contain much off-channel habitat. The Warm Lake Creek, Tyndall Stolle, Two-bit Roaring, and Upper SFSR 6^{th} fields have off-channel habitat, primarily along the main channel of the SFSR and in the meadow upstream of Warm Lake and in lower Cabin Creek. Based on personal observations, prior to the 2007 wildfire all 6^{th} fields were functioning appropriately. Post-fire, this WCI would continue to function appropriately in the Curtis Creek 6^{th} field, but would be functioning at risk in the remaining 6^{th} fields due to the fire-induced effects on riparian vegetation (P.R. Vol. 12, Fisheries).

Refugia - As part of the burned area emergency response (BAER) effort a number of under-sized culverts, some of which also prevented fish migration, were removed in the fall of 2007. Nevertheless, several culverts hinder migration within several 6^{th} fields, as well as between the various 6^{th} fields. This WCI is currently functioning at risk in all seven 6^{th} field analysis areas (P.R. Vol. 12, Fisheries).

Wetted Width/Maximum Depth Ratio **–** Based on survey data collected prior to the 2007 wildfire, of those stream reaches measured: 86 percent in the Curtis Creek 6^{th} field; 90 percent in the Two-bit Roaring 6^{th} field; 70 percent in the Warm Lake Creek 6^{th} field, and; 100 percent in the Dollar Creek, Six-bit Creek, Tyndall Stolle, and Upper SFSR 6^{th} fields had width/maximum depth ratios of less than 10 (P.R. Vol. 12, Fisheries).

Fire-induced increases in sediment are expected to lead to channel widening in the low gradient response reaches as channels adjust to accommodate higher peak flows due to increased post-fire run-off and shallower channels. However, transport reaches are not expected to change although pools may be temporarily filled by sediment transported through these reaches. Post-fire, this WCI is functioning appropriately in the Curtis Creek 6^{th} field due to the limited effects of the 2007 wildfire, and functioning at risk in the remaining 6^{th} field analysis areas (P.R. Vol. 12, Fisheries).

Streambank Condition **–** Prior to the 2007 wildfire, 86 percent or more of the streams surveyed within the 6^{th} field analysis areas had bank stability values greater than 90 percent. Due to the fire-induced increased sediment delivery and higher peak flows, low gradient stream channels will adjust by channel widening and migration in all 6^{th} fields except Curtis Creek, and lead to decreased bank stability. Within transport reaches, channel widening and migration is not expected and bank stability would remain similar to pre-fire condition (P.R. Vol. 12, Fisheries).

Post-fire bank stability would be characterized as functioning appropriately in the Curtis Creek 6^{th} field and functioning at risk in the remaining 6^{th} fields (P.R. Vol. 12, Fisheries).

Floodplain Connectivity - One surrogate that has been used on the Boise National Forest for this WCI is the ratio between total road miles within riparian conservation areas (RCAs) and total square miles of RCAs. The current (post-fire) RCA road density is: 2.2 mi/mi^2 in the Curtis Creek 6^{th} field; 1.4 mi/mi^2 in the Dollar Creek 6^{th} field; 0.6 mi/mi^2 in the Six-bit 6^{th} field; 2.7 mi/mi^2 in the Two-bit Roaring 6^{th} field; 2.1 mi/mi^2 in the Tyndall Stolle 6^{th} field; 1.4 mi/mi^2 in the Upper SFSR 6^{th} field, and; 1.9 mi/mi^2 in the Warm Lake Creek 6^{th} field (P.R. Vol. 12, Fisheries).

This WCI is currently functioning appropriately in the Six-bit Creek 6th field, functioning at risk in the Dollar Creek and Upper SFSR 6th fields, and functioning at an unacceptable risk in the remaining 6th field analysis areas (P.R. Vol. 12, Fisheries).

Change in Peak/Base Flows - For the purposes of this analysis, Equivalent Clearcut Area (ECA) was used as a means of quantifying the effects of past activities, including the 2007 wildfire, on peak/base flows. Loss of vegetation due to the 2007 wildfire has increased the Equivalent Clearcut Area (ECA) within all seven 6th fields. The post-fire ECA values are currently: 9 percent in the Curtis Creek 6th field; 47 percent in the Dollar Creek 6th field; 38 percent in the Six-bit 6th field; 49 percent in the Two-bit Roaring 6th field; 67 percent in the Tyndall Stolle 6th field; 43 percent in the Upper SFSR 6th field, and; 45 percent in the Warm Lake Creek 6th field (P.R., Vol. 11, Water Yield).

This WCI is currently functioning appropriately in the Curtis Creek 6th field and functioning at an unacceptable risk in all other 6th fields (P.R. Vol. 12, Fisheries).

Change in Drainage Network – One surrogate that has been used on the Boise National Forest for this WCI is the ratio between total road miles within RCAs and the total stream miles. The current (post-fire) ratio of road miles/mile of stream is 0.14 in the Curtis Creek 6th field; 0.09 in the Dollar Creek 6th field; 0.04 in the Six-bit Creek 6th field; 0.17 in the Two-bit roaring 6th field; 0.14 in the Tyndall Stolle 6th field; 0.09 in the Upper SFSR 6th field, and; 0.14 in the Warm Lake Creek 6th field (P.R. Vol. 12, Fisheries).

The Six-bit Creek 6th field is currently functioning appropriately; Dollar Creek and Upper SFSR 6th fields functioning at risk, and the remaining 6th fields functioning at an unacceptable risk (P.R. Vol. 12, Fisheries).

Road Density/Location – The current (post-fire) road density (i.e. total road miles/total square miles in 6th field) is: 1.6 mi/mi^2 in the Curtis Creek 6th field; 1.6 mi/mi^2 in the Dollar Creek 6th field; 0.9 mi/mi^2 in the Six-bit 6th field; 2.1 mi/mi^2 in the Two-bit Roaring 6th field; 2.0 mi/mi^2 in the Tyndall Stolle 6th field; 0.7 mi/mi^2 in the Upper SFSR 6th field, and; 1.2 mi/mi^2 in the Warm Lake Creek 6th field (P.R. Vol. 12, Fisheries).

The current (post-fire) RCA road density (i.e. total road miles in RCAs/total square miles of RCAs) is: 2.2 mi/mi^2 in the Curtis Creek 6th field; 1.4 mi/mi^2 in the Dollar Creek 6th field; 0.6 mi/mi^2 in the Six-bit 6th field; 2.7 mi/mi^2 in the Two-bit Roaring 6th field; 2.1 mi/mi^2 in the Tyndall Stolle 6th field; 1.4 mi/mi^2 in the Upper SFSR 6th field, and; 1.9 mi/mi^2 in the Warm Lake Creek 6th field (P.R. Vol. 12, Fisheries).

This WCI is currently functioning at an unacceptable risk in the Curtis Creek, Two-bit Roaring, and Tyndall Stolle 6th fields and functioning at risk in the other 6th field analysis areas (P.R. Vol. 12, Fisheries).

Disturbance History – Disturbance history is a reflection of a combination of disturbance events that may affect watershed functions including equivalent clearcut area (ECA), geomorphic integrity, RCA road density, and road locations relative to landslide prone areas. Given the loss of riparian vegetation due to the 2007 wildfire and RCA road densities, the Upper SFSR 6th field is currently functioning at risk with the remaining 6th field analysis areas functioning at an unacceptable risk (P.R. Vol. 12, Fisheries).

Riparian Conservation Areas – The effects of the 2007 wildfire on RCAs varied considerably across the analysis areas. As displayed in Table 3-28, moderate or high severity fire affected a range of 10 to 81 percent of the RCAs in the various 6th fields, with over half of the RCAs within the 103,804 acre project area as-a-whole experiencing either high or moderate severity burns. In most cases, the majority of both the overstory and understory riparian vegetation was consumed by these high and moderate severity burns. As a result, with the possible exception of the Curtis Creek 6th field, the vegetation resource would not be described as functioning properly or being within desired conditions (P.R. Vol. 12, Fisheries).

Most of the riparian habitats along the numerous streams in the analysis areas consisted of mature conifer species prior to 2007. These conifer species, in combination with shrubs and brush species, provided valuable shade which assisted in regulating stream temperatures. The conifer species also served as potential sources of large woody debris recruitment to adjacent streams. In most locations the predominant conifer species were Engelmann spruce and lodgepole pine, with lesser amounts of subalpine fir. Based on a comparison of stream locations and wildfire intensities, the stream shading previously provided by these mature conifers is now absent within many of the riparian habitats. While brush species are expected to become reestablished over the next few years, the lack of any seed source in many locations will hinder establishment of conifer species (P.R. Vol. 12, Fisheries).

As previously discussed, stream temperatures in all of the 6th fields except Curtis Creek are expected to reflect an increase in the summer of 2008 due to the extent of moderate and high severity burns. Further, RCA road densities exceed desired conditions in many of the 6th fields and existing culverts prevent fish passage in several locations (P.R. Vol. 12, Fisheries).

The effects of the wildfire on the various riparian functions and processes were also highly variable. Most of the components of riparian conservation areas are discussed in the preceding paragraphs. Three components not previously discussed include nutrients and other dissolved materials, riparian microclimate and productivity, and wildlife habitat.

Spence et al (1996) describes the changes to riparian areas by wildfire: "Fires in upland areas and riparian zones can affect aquatic ecosystems by altering vegetation cover, which in turn influences erosion and sediment transport, water infiltration and routing, the quantity of nutrients reaching streams, the amount of shading, and the input of large woody debris into the system (Wissmar et al 1994). The extent of impacts is generally related to the intensity of the burn. In high intensity fires, soil organic matter that helps hold soils together is consumed, increasing the susceptibility of soils to erosive forces. In addition, volatilization of certain compounds can cause the surface soil layer to become hydrophobic, thereby reducing infiltration of water and increasing surface runoff (Marcus et al 1990). The combined effects of vegetation loss and hydrologic changes can alter the frequency of severe debris torrents (Wissmar et al 1994). Nutrients such as phosphorous, nitrogen, and sulfur may be volatilized into the atmosphere (Everest and Harr 1982) or lost through leaching and soil erosion. The loss of riparian vegetation can increase exposure to solar radiation, causing streams to warm. Inputs of large woody debris may also change following fire in the riparian zone. In speculating about the effects of the Yellowstone fire of 1988, Minshall et al (1989) hypothesize that large woody debris in streams would likely increase immediately following the fire--from augmentation of existing woody debris with falling branches--then decrease through time because new growth contributes little to instream woody debris."

Spence et al (1996) describes how riparian areas function to "… mediate the flow of nutrients to the stream and are, therefore, important regulators of stream production. Subsurface flow from upland areas carries nutrients and dissolved organic matter to the riparian zone, where these materials are taken up by vegetation for plant growth or are chemically altered (Naiman et al 1992). Lowrance et al (1984) found that even narrow riparian zones along streams in agricultural lands significantly affected stream chemistry. Riparian forests modify the chemical composition and availability of carbon and phosphorus, and they promote soil denitrification through changes in the position of oxic-anoxic zones (Pinay et al. 1990 in Naiman et al 1992). During overbank flows, nutrients from floodwaters may be absorbed by riparian vegetation, reducing the total nutrient load in the stream (Cummins et al 1994). Dissolved organic matter inputs can occur from numerous sources besides groundwater. These include leachate from entrained litter and large woody debris in the channel, algal, invertebrate, and fish excretions; and floodplain capture at the time of inundation (Gregory et al 1991)."

"We found no published attempts to define zones of influence for nutrient cycling. Most likely, this reflects the difficulty in tracing the movement of nutrients, particularly with those elements such as nitrogen for which the number of alternative pathways is great. As discussed in Section 3.8, conditions throughout the watershed influence stream chemistry; consequently, the zone of influence extends to the top of the watershed, even though it may be years before nutrients ultimately find their way to the stream. However, the zone of most intense interaction is within the floodplain and hyporheic zones, where subtle changes in oxygen levels can dramatically affect nutrient composition and bioavailability" (Spence et al 1996)."

Spence et al (1996) discusses microclimate function as: "Although not well documented (O'Laughlin and Belt 1994), streamside vegetation can have a significant influence on local microclimates near the stream channel (FEMAT 1993). Chen (1991) reported that soil and air temperatures, relative wind speed, humidity, soil moisture, and solar radiation all changed with increasing distance from clear-cut edges in upslope forests of the western Cascades. Based on Chen's results, FEMAT (1993) concluded that loss of upland forests likely influences conditions within the riparian zone. FEMAT also suggested that riparian buffers necessary for maintaining riparian microclimates need to be wider than those for protecting other riparian functions..."

While riparian areas generally constitute only a small percentage of the total land area, they can be extremely important habitats for wildlife. The attractiveness of riparian zones to wildlife likely reflects three attributes: the presence of water; local microclimatic conditions, and; the more diverse plant assemblages in comparison to surrounding uplands (Spence et al 1996). Given that the 2007 wildfire consumed the majority of the vegetation in many riparian zones, these affected areas currently provide little of the attractive habitat often associated with riparian areas (i.e. diverse plant assemblages and cooler microclimates) (P.R. Vol. 12, Fisheries).

Due to the effects of the 2007 wildfire and pre-existing conditions, this WCI is functioning at an unacceptable risk in all seven 6th field analysis areas (P.R. Vol. 12, Fisheries).

Disturbance Regime - This WCI is functioning at risk within all seven 6th field analysis areas due to a combination of fire-induced effects and pre-existing conditions. The 2007 wildfire is expected to change watershed conditions and response for several decades in most 6th fields. However, existing channel complexity is expected to accommodate increased peak flows and sediment with some adjustment. Existing culverts would continue to prevent fish passage in some locations, and existing roads would continue to contribute sediment to area streams (P.R. Vol. 12, Fisheries).

Integration of Species and Habitat Conditions **–** Although some of the indicators are functioning appropriately, overall this WCI is functioning at an unacceptable risk within all seven 6th field analysis areas largely because of the effects of the 2007 wildfire, but also because of pre-existing conditions including RCA road densities and fish passage barriers. On a larger scale, nearly every local population watershed in the entire SFSR subbasin has been impacted by wildfire within the last decade. Thus, displaced fish have almost no where to go where habitat has not been affected by recent fire. Though local populations of fish are expected to recover in the short to long term time frames, they will probably be impacted by the effects of the 2007 wildfire for at least 10 years (P.R. Vol. 12, Fisheries).

3.12.1 Environmental Consequences Specific to Alternative A

This alternative would have no direct or indirect effects on any watershed condition indicator (WCI), fish habitat, or fish populations (P.R., Vol. 12, Fisheries). This alternative would have no influence on the existing post-fire functionality ratings in the seven 6th field subwatersheds.

In comparison to the pre-fire condition, stream temperatures, soil erosion, and large woody debris recruitment would increase in the project area under this alternative due to the effects of 2007 wildfire (P.R., Vol. 11, Sedimentation).

An increase in substrate embeddedness would most likely occur over the next two to five years or until vegetative recovery reduces the potential of surface and mass erosion. There is a slight potential for increased pool frequency in the future as fire-killed trees fall and contribute large woody debris to streams. Given the potential for fire-induced mass failures, the wetted width/maximum depth ratios in streams may change in the future. The existing road densities in the seven 6th field subwatersheds, both overall and within RCAs, would be maintained. Similarly, existing barriers would continue to prevent fish migration (P.R., Vol. 12, Fisheries).

3.12.2 Environmental Consequences Common to Alternative B and C

Both Alternative B and C would maintain or have no influence on the existing post-fire functionality ratings of the various WCIs in the seven 6th field analysis areas. These alternatives would have no effect on the current population trends of fish species (P.R., Vol. 12, Fisheries).

***Subpopulation Size, Growth and Survival* –** These alternatives would have, at most, a negligible effect on these WCIs. Given modeled sediment delivery distances and incorporated design features, discussed in more detail under the *Sediment/Turbidity* WCI, little if any of the BOISED modeled sediment attributed to harvest activities would be delivered to streams (P.R., Vol. 11, Sediment). Also, as explained in the following discussions, the effects of these alternatives on stream temperatures, water yield/ECA, and large woody debris recruitment would be inconsequential (P.R., Vol. 12, Fisheries).

***Life History Diversity and Isolation, and Persistence and Genetic Integrity* –** These alternatives would have no effect on these WCIs. Similar to Alternative A (No Action), existing barriers would continue to prevent fish passage (P.R., Vol. 12, Fisheries).

***Temperature* –** These alternatives are not expected to have a measurable effect on stream temperature. Design features (Sections 2.4.3.2 and 2.4.3.3) associated with these alternatives prohibit cutting of fire-killed or imminently dead trees within one site potential tree height of streams unless an open authorized road parallels the stream. If a road parallels the stream, cutting of trees within one site potential tree height of a stream may occur upslope of the road, but all activities would be prohibited between the road and stream (P.R., Vol. 12, Fisheries).

FEMAT (1993) found that a buffer of about one site potential tree height is sufficient to maintain shading. Therefore the felling of fire-killed or imminently dead trees beyond one site potential tree height of the stream would not result in a measurable impact on stream shading. In those cases where a road parallels a stream and some trees occur above the road but within one site potential tree height of a stream, estimated to be roughly 10 acres, felling of fire-killed or imminently dead trees would not be expected to have a meaningful effect on stream temperature. These 10 acres occur as 26 different polygons scattered across the seven 6th field analysis areas. Further, since dead trees provide little shade, the cutting of these trees on 10 acres would have little effect on overall stream temperature regardless of their juxtaposition to a stream (P.R., Vol. 12, Fisheries).

Appendix B, pages B-33 to B-36 in the Forest Plan provides direction on delineating RCAs. The analysis completed for this assessment delineated these RCAs based upon site potential tree heights for the appropriate potential vegetation group (PVG). Based upon that analysis, RCAs for perennial streams and intermittent streams providing seasonal rearing and spawning habitat were defined as: 260 feet for PVG 6; 200 feet for PVG 7, and; 160 feet for PVG 10. RCAs widths for ponds, lakes, reservoirs, wetlands, and intermittent streams not providing seasonal rearing and spawning habitat were delineated as 130 feet for PVG 6; 100 feet for PVG 7, and; 80 feet for PVG 10 (P.R., Vol. 11, Sediment).

Chemical Contaminants/Nutrients – The risk of Alternative B or C resulting in a fuel spill and that spilled material reaching the stream system would be discountable (P.R., Vol. 12, Fisheries). Design features (Section 2.4.2.5) associated with these alternatives require preparation of a Spill Prevention Control and Countermeasures Plan, require the Purchaser to have spill containment and clean-up materials on site during project activities, and stipulate that petroleum product storage locations would be designated by Forest Service personnel outside of streamside RCAs. In addition, storage containers with capacities of more than 200 gallons would be maintained in a leakproof condition and located within dikes, berms, or embankments lined with impervious material, and sufficient in size to contain 125 percent of the volume stored at the site. Refueling sites for ground-based equipment would also be designated by Forest Service personnel outside of streamside RCAs and have an approved spill containment plan. In the event of any leakage or spill of petroleum products, the Purchaser would be required to immediately notify the Forest Service and actions taken to control or clean up the spill (Section 2.4.2.5).

The analysis completed for the Thunderbolt Wildfire Recovery Project (USDA 1995) concluded that the probability of a fuel truck having an accident was about 1 in 1,040, or one accident for every 1,040 trips. A review of available records indicates that since that analysis in 1995, no spills from fuel vehicles carrying 500 gallons or more has occurred in the drainage.

Fuel for ground-based equipment would be transported and stored in service trucks with capacities of 100 to 150 gallons. Refueling of this equipment would occur outside of RCAs. Fuel for sawyers would be carried in individual containers of less than two gallons. Since felling activities are prohibited within one site potential tree height of streams unless above a road, it is unlikely that refueling of chainsaws would result in contamination of streams (P.R., Vol. 12, Fisheries).

Physical Barriers – These alternatives would have no effect on existing passage barriers or habitat access (P.R., Vol. 12, Fisheries).

Large Woody Debris – Robinson and Beschta (1990) found that when the distance from a tree to stream was more than one effective tree height, the probability of the tree contributing large woody debris approached zero. Belt and others (1992) found that 85 percent of large woody debris recruitment is contributed from those trees within one site potential tree height of the stream. As disclosed above, design features (Sections 2.4.3.2 and 2.4.3.3) associated with these alternatives prohibit cutting of fire-killed or imminently dead trees within one site potential tree height of streams unless an open authorized road parallels the stream. If a road parallels the stream, cutting of trees within one site potential tree height of the stream may occur upslope of the road, but all activities would be prohibited between the road and stream.

Given incorporated design features, these alternatives would have an immeasurable effect on large woody debris recruitment. These alternatives include cutting of trees on roughly 422 acres of RCAs, 10 acres of which occur within one site potential tree height of a stream but are upslope of an open authorized road. Although a few trees may be felled on these 10 acres where the tops could potentially reach the stream channel, given the locations of streams relative to roads and the existing clearing widths of roads adjacent to proposed units, the probability of this occurring is extremely low. Even if this were to occur on 10 acres, with the abundance of fire-induced snags retained immediately adjacent to streams in the analysis area, future sources of large woody debris recruitment would continue to be more than sufficient to meet desired levels (P.R., Vol. 12, Fisheries).

Relative to the specific stream reaches associated with these 10 acres, inventories of instream material completed in April of 2008 recorded an average of 60 pieces/mile greater than 12 inches in diameter within those stream reaches in PVG 6; an average of 29 pieces/mile greater than 12 inches in diameter within those stream reaches in PVG 7, and; an average of 14 pieces/mile greater than 12inches in diameter within those stream reaches in PVG 10 (P.R., Vol. 12, Fisheries).

Inventories in April of 2008 also recorded the number of standing dead trees greater than 12 inches dbh and within one site potential tree height of these stream reaches. Those inventories revealed that following implementation of Alternative B or C, those stream reaches in PVG 6 would have an average of 24 dead standing trees/acre; those stream reaches in PVG 7 an average of 36 dead standing trees/acre, and; those stream reaches in PVG 10 an average of 30 dead standing trees/acre (P.R., Vol. 12, Fisheries).

The Forest Plan describes greater than 20 pieces/mile instream as functioning appropriately. PVG 10 is dominated by lodgepole pine where climatic, environmental, and/or disturbance regimes typically prevent trees from growing larger than 12 inches dbh, therefore a shortage of large trees in this PVG was not surprising. In conclusion, given the level of large woody debris found instream in April of 2008 and the number of standing dead trees greater than 12 inches dbh that would be retained within one site potential tree height of the stream reaches associated with these 10 acres, post-implementation sources of large woody debris recruitment would be more than sufficient to meet desired levels (P.R., Vol. 12, Fisheries).

Burton (2000) monitored two wildfires on the Boise National Forest six years post-wildfire and found instream large woody debris levels increased in both cases, even with rain on snow mass erosion events. Bragg (2000) modeled large woody debris recruitment to stream channels after a wildfire event and found a peak in large woody debris delivery immediately after the fire and another large peak (four fold increase) several decades later. Given that 52 percent of the RCAs within the project area experienced moderate or high burn severities in 2007, large woody debris recruitment would be expected to increase between two to four fold over the next several decades (P.R. Vol. 12, Fisheries).

Removal of downed trees (i.e. imminently dead) is also not expected to decrease existing or future large woody debris in streams. Since these trees are presently on the ground, only those downed trees immediately adjacent to the streams and/or lying across the streams have any potential of contributing large woody debris to the streams. Design features associated with these alternatives prohibit removal of any downed tree within a minimum of 80 feet of any stream unless above an existing road (P.R., Vol. 12, Fisheries).

Design features associated with these alternatives (reference Section 2.4.2.5) also require field identification of landslide prone areas. These same design features prohibit harvest or ground-based skidding of fire-killed or imminently dead trees on these field-identified landslide prone areas. Incorporation of these design features should effectively mitigate any effects of these alternatives on potential large woody debris recruitment from landslide prone areas (P.R., Vol. 12, Fisheries).

Pool Frequency and Quality – These alternatives would have negligible effects on pool frequency and quality. Given incorporated design features, these alternatives would have an immeasurable effect on large woody debris recruitment and sedimentation. Streamside vegetation would not be affected because project-related activities would be limited to at least one site potential tree height from the stream channel or above open roads (P.R., Vol. 12, Fisheries).

Large Pools/Pool Quality - These alternatives would have no measurable effects on this WCI since the project would have negligible effects on sediment delivery and large woody debris recruitment, and little to no effect on the flow regime and stream channel characteristics (P.R., Vol. 12, Fisheries).

Off Channel Habitat – These alternatives would be expected to have no effect on off-channel habitat. No changes in flow regime are expected, no changes in road/stream crossings would occur, and no treatment within one site potential tree height of streams would occur unless above open roads. Streamside vegetation would not be affected because project-related activities would be limited to at least one site potential tree height from the stream channel or above open roads (P.R., Vol. 12, Fisheries).

Refugia – Alternatives B and C would have no effect on existing passage barriers or habitat access, and therefore no effect on refugia (P.R., Vol. 12, Fisheries).

Wetted Width/Maximum Depth Ratio – These alternatives would have no effect on this WCI. Although some exceptions could occur, there is little chance that implementation of these alternatives would result in the cutting of trees that could potentially survive the fire-induced damage (P.R., Vol. 2, Fire-killed Trees). Therefore water yield/ECA would not be affected and no change in flow regime would be expected. Design features (Sections 2.4.3.2 and 2.4.3.3) prohibiting cutting of fire-killed or imminently dead trees within one site potential tree height of streams, unless above a road, would mitigate any effect on bank stability (P.R., Vol. 12, Fisheries).

Streambank Condition - Exclusion of harvest activities within one site potential tree height of streams, unless above a road, maintenance of sufficient large woody debris recruitment, and design features incorporated to minimize sediment delivery, would result in maintenance of the existing bank stability in area streams under these alternatives (P.R., Vol. 12, Fisheries).

Floodplain Connectivity **–** Since no change in road management is proposed under these alternatives, no effects to floodplain connectivity would be expected (P.R., Vol. 12, Fisheries).

Change in Peak/Base Flows **–** These alternatives would not result in a measurable change in the existing ECA values or water yield. Since only fire-killed and imminently dead trees would be felled, these alternatives would have little impact on the ability of affected acres to intercept precipitation and transpire soil moisture. As disclosed in Section 3.2.1 of this chapter, although some exceptions could occur, given the level of damage seen in those trees identified as fire-killed, there is little chance that implementation of these alternatives would result in the cutting of trees that could potentially survive the fire-induced damage (P.R., Vol. 2, Fire-killed Trees). The cutting of such an insignificant number of trees scattered across the 1,671 acres of proposed units would have a negligible impact on water yield or ECA (P.R., Vol. 11, Water Yield).

A similar scenario would be true for imminently dead trees (e.g. windthrown or successfully attacked by bark beetles). The cutting of windthrown trees would have no effect on evapotranspiration since these trees would no longer have their root systems in the ground. Trees successfully attacked by bark beetles during the summer months could potentially continue to transpire moisture for several months, however any evapotranspiration will have ceased by the following spring. Similarly to fire-killed trees, there is a possibility that a few bark beetle infested trees would be felled that could actually survive the beetle infestation. Although the total number of trees falling under this scenario would be expected to be minor, the exact number is unpredictable. Nevertheless, cutting of these trees would reduce evapotranspiration at site-specific locations. In contrast, retention of these trees on site would facilitate beetle infestations of additional live trees in future years which could also reduce evapotranspiration. Given the few trees expected to fall under this scenario, the cutting of imminently dead trees would have a negligible impact on water yield or ECA (P.R., Vol. 11, Water Yield).

Change in Drainage Network - Since no roads would be constructed, reconstructed, or decommissioned, these alternatives would have no effect on this component of the WCI (P.R., Vol. 12, Fisheries).

Given the narrow (i.e. maximum of 200 feet) linear nature of proposed units, it is unlikely that skid trail construction would be necessary and design features require the District Hydrologist to review on-the-ground all requests to construct skid trails within RCAs (Section 2.4.2.5). Nevertheless, if a surface runoff event occurs, constructed skid trails or furrows created by downhill yarding with off-road jammers could act as channels to collect and deliver water and sediment downslope to a stream. However, given the requirement to cross-ditch and/or place logs on skid trails prior to equipment moving to the next harvest unit (Section 2.4.2.5), this temporary increase in drainage network would not be expected to last more than a week or two in any single unit. Similarly, design features (Section 2.4.2.5) require construction of cross-ditches by hand on created furrows no later than two weeks following completion of harvest within affected units (P.R., Vol. 12, Fisheries).

Road Density and Location - Since no roads would be constructed, reconstructed, or decommissioned, these alternatives would have no effect on this WCI (P.R., Vol. 12, Fisheries).

Disturbance History **–** As explained above, these alternatives would not result in a measurable change in the existing ECA values or water yield (P.R., Vol. 11, Water Yield), nor would they result in more than a temporary (one or two week) increase in the drainage network. Any effects of these alternatives on this WCI would be inconsequential (P.R., Vol. 12, Fisheries).

Disturbance Regime **–** These alternatives are expected to have, at most, a negligible effect on this WCI. These alternatives are not expected to have a measurable effect on stream temperature or large woody debris recruitment. Since only fire-killed and imminently dead trees would be cut, these alternatives are not expected to increase ECA/water yield. These alternatives would have no effect on RCA road densities or existing fish passage barriers. These alternatives would not affect how the subwatersheds and ecological processes respond to scour events, mass wasting, uncharacteristic wildfire, flooding, or drought, nor would these alternatives degrade or retard riparian functions and processes (P.R., Vol. 12, Fisheries).

Integration of Species and Habitat Conditions **–** The effects of Alternative B or C on this WCI would be inconsequential. At most, these alternatives would result in negligible effects on the population pathways due to the lack of measurable effects on sediment, flow conditions, and stream temperatures. These alternatives would have no effect on fish passage barriers. Effects of these alternatives on substrate embeddedness, large woody debris, pool frequency, large pools/pool quality, off-channel habitat, and refugia would be immeasurable. The width/depth ratio, streambank condition, and floodplain connectivity WCIs would not be affected. Since Alternatives B and C would not measurably change forested cover and would not affect the road network, no change in the flow/hydrology pathway would be expected. Alternatives B and C would have at most a negligible effect on the watershed condition pathway WCIs (P.R., Vol. 12, Fisheries).

3.12.3 Environmental Consequences Specific to Alternative B

Sediment/Turbidity **–** Although BOISED reflects slight increases in sedimentation as a result of proposed activities (maximum of 3.0 percent over natural in any given 6^{th} field), the modeled output does not reflect the benefits of many design features incorporated into this alternative. Proper application of these design features would be expected to decrease the likelihood of sediment delivery to streams in quantities sufficient to impact water quality conditions. The Megahan/Ketcheson model was used to estimate sediment delivery distances for several different scenarios based on skidding restrictions disclosed in Chapter 2 (Section 2.4.3.2). It is worth noting that these modeling efforts took into account increased erosion rates expected as a result of the 2007 wildfire. Also, in development of the model, 22 years of rainfall intensity data which included rainfall erosivity values ranging from moderately low to the highest on record was used thus representing an excellent range in rainfall (Megahan and Ketcheson 1996). Also included in the development of the model was 30 years of streamflow data which included the second and third highest flows in the 30 year period (Megahan and Ketcheson 1996).

For tractor skidding on unconstructed skid trails and on slopes less than 40 percent, the Megahan/Ketcheson model predicted, using on-site data, an average sediment delivery distance of 4.6 feet with a maximum delivery distance of 16.4 feet. Relative to the potential for concentration of eroded material and delivery to streams downslope of roads, the Megahan/Ketcheson model predicted, using on-site data, an average sediment delivery distance of 7.7 feet with a maximum delivery distance of 19.0 feet. The minimum distance from the road to the stream on these sites is roughly 20 feet (P.R., Vol. 11, Sediment).

Design features (Section 2.4.3.2) prohibit the use of ground-based equipment on slopes exceeding 40 percent, instead, included material would be removed with an off-road jammer. Off-road jammers in these situations would be confined to the road prism, or slopes within the unit that are less than or equal to 40 percent if above the road, and the logs winched to the off-road jammer prior to be skidded to the landing. One concern associated with this activity is the potential for logs to gouge the ground surface as being winched to the off-road jammer, thus creating furrows for the accumulation of water and transport of eroded material. However, the Megahan/Ketcheson model predicted, using on-site data, an average sediment delivery distance of 4.7 feet with a maximum delivery distance of 6.3 feet. Not reflected in these modeled delivery distances are a design feature (Section 2.4.2.5) that requires construction of cross-ditches by hand on these furrows no later than two weeks after completion of harvest within each affected unit which would further limit the travel distance of eroded material (P.R., Vol. 11, Sediment).

Given the narrow (i.e. maximum of 200 feet) linear nature of proposed units, it is unlikely that skid trail construction would be necessary. Nevertheless, the Megahan/Ketcheson model predicted, using on-site data, an average sediment delivery distance of 5.9 feet with a maximum delivery distance of 14.9 feet for this activity. In order to minimize the potential for sediment delivery from constructed skid trails, design features common to all action alternatives require the District Hydrologist to review on-the-ground all requests to construct skid trails within RCAs prior to their construction. The approval or relocation of these skid trails and/or incorporation of appropriate mitigation measures would be the responsibility of the District Hydrologist (Section 2.4.2.5). Design features (Section 2.4.2.5) also require that, following completion of use, cross-ditches would be constructed at intervals of approximately 20 feet where skid trails exceed 20 percent slope (P.R., Vol. 11, Sediment).

One situation that could affect sediment delivery distances reflected by the Megahan/Ketcheson model would be if fire-induced sediment filled the sediment storage capacity of existing obstructions otherwise available to trap erosion generated by timber harvest activities. As explained above, modeling efforts took into account increased erosion rates expected as a result of the 2007 wildfire. Nevertheless a number of design features, previously discussed, were incorporated to address this concern. In order to minimize sedimentation from harvested units along the #470 and #472 roads, fire-killed trees in the 3 to 7 inch dbh range would be felled and retained on site with the goal of achieving a post-harvest quantity of 500 linear feet of obstructions per acre. These felled trees would be severed as necessary to ensure their entire lengths are in contact with the ground surface and situated perpendicular to the direction of slope (Section 2.4.3.2). Fire-killed and imminently dead trees greater than or equal to 8 inches dbh that are located upslope of an open authorized road and within one site potential tree height of a stream that parallels the road, would be felled and retained on site on roughly 10 acres. In addition, logs would be placed perpendicular to the direction of flow below six drainage structures on the #478 road to capture erosion prior to its delivery to Rice Creek (Section 2.4.3.2). These three activities would not only reduce the potential for delivery of management-induced sedimentation, but would also obstruct delivery of fire-induced sediment (P.R., Vol. 11, Sediment).

While the majority of the harvest-related slash would be removed from the units via whole-tree-yarding and accumulated at landings, incidental amounts of material in the form of limbs and tops of harvested trees would break off during operations and be retained on site. The immediate contribution of this logging slash would increase the number of obstructions beyond those reflected in Megahan/Ketcheson modeling efforts and increase the interception and storage of sediment on the hillslopes (P.R., Vol. 11, Sediment).

Therefore, given incorporated design features and modeled sediment delivery distances, little if any of the BOISED modeled sediment attributed to harvest activities would be delivered to streams (P.R., Vol. 11, Sediment).

Given the narrow (i.e. maximum of 200 feet) linear nature of proposed harvest units and therefore the limited number of logs accumulated at any single location, it is suspected that few landings would be constructed under this alternative and that the Purchaser would instead use unconstructed landings and/or the actual road prism. Under a worse case scenario where landings would be constructed, the Megahan/Ketcheson model predicted, using on-site data, an average sediment delivery distance of 13.4 feet with a maximum delivery distance of 57.8 feet. In order to minimize the potential for sediment delivery from this activity, design features common to all action alternatives (Section 2.4.2.5) prohibit the construction of new landings within one site potential tree height (minimum of 80 feet) of any stream. In addition, prior to construction of landings within the remaining portions of RCAs (i.e. more than one site potential tree height from a stream but within an RCA), the District Hydrologist would review on-the-ground the proposed location. The approval or relocation of such activities and/or incorporation of appropriate mitigation measures would be the responsibility of the District Hydrologist. Therefore this activity is expected to result in negligible amounts of sedimentation to any stream. Assuming under a worse case scenario that some landings are constructed, design features (Section 2.4.2.5) require that, upon completion of harvest activities, all landings constructed in association with this project would be reshaped to provide adequate drainage, scarified to a minimum depth of 18 inches, slash distributed to cover approximately 30 percent of the reshaped surfaces, and planted with a Forest Service approved seed mixture, thereby eliminating the potential for sedimentation in the future (P.R., Vol. 11, Sediment).

A total of approximately 900 truck loads of logs would be removed under this alternative over a period of two years, with the actual haul distributed over numerous different roads. On average, a total of 5 to 10 trucks/day would be expected on any given road. Available traffic count data for the #474.2 road suggests that in excess of 100 vehicles travel along this road on a daily basis during the snow-free season, thus the sediment attributable to dust resulting from increases in logging traffic would be inconsequential (P.R., Vol. 11, Sediment).

Dust generated from unpaved roads would be minor due to slow speeds. Also, contract provisions would require dust abatement when dust is a hazard. With normal dust abatement procedures, noticeable amounts of fine sediment generated by logging traffic would not reach stream channels. Since some potential haul routes may also receive abundant use by recreational traffic during the same time period, dust abatement associated with the timber sale may actually reduce the amount of dust reaching streams that is attributable to recreational uses (P.R., Vol. 11, Sediment).

As part of the Burned Area Emergency Response (BAER) effort, the culvert at the #473 road crossing of Lodgepole Creek was removed in the fall of 2007, thus eliminating authorized motorized access to the #473 road. However, an unauthorized road prism is currently in place that connects the #474.2 road with the #473 road south of the Lodgepole Creek culvert location. This alternative would use this existing unauthorized road (0.7 miles) as a temporary road in order to access the #473 road. This temporary road does not cross any streams, with the closest stream located roughly 150 feet to the north across flat ground. Use of this existing road prism as a haul route would not be expected to increase sediment delivery to any stream channel (P.R., Vol. 11, Sediment).

Substrate Embeddedness **–** As explained above, because of incorporated design features and modeled sediment delivery distances, negligible sediment increases are expected as a result of proposed management activities. Therefore the effects of this alterantive on substrate embeddedness would be immeasurable. In addition, falling of fire-killed trees in the 3 to 7 inch dbh range across roughly 100 acres; falling and retention on site of trees greater than or equal to 8 inches dbh on roughly 10 acres, and; placement of logs below six drainage structures on the #478 road would not only reduce the potential for delivery of management-induced sedimentation, but would also obstruct delivery of fire-induced sediment (P.R., Vol. 11, Sediment).

Riparian Conservation Areas **–** The activities associated with this alternative would not be expected to degrade or retard riparian functions and processes. No changes in RCA road density would occur nor would this alternative have any effect on fish passage barriers. As previously disclosed, this alternative is expected to have no measurable effect on stream temperature or large woody debris recruitment, and would maintain the existing bank stability in area streams (P.R., Vol. 12, Fisheries).

Removal of imminently dead trees (i.e. windthrown or successfully attacked by bark beetles) is not expected to have a measurable effect on natural regeneration of conifers. Although research is limited, trees meeting the definition of "imminently dead" would not be expected to respond to insect infestations by producing abundant crops of cones. Instead, a tree recently infested by insects would expend its available resources to survive the infestation rather than produce cones. Conifer cones in this area typically mature and release their seeds in the fall. Therefore the removal of fire-killed trees in the spring or summer of 2008 would have no effect on the 2007 seed crop. Post-fire stand data collected in October of 2007 revealed that 93 percent of those Douglas-fir, ponderosa pine, and western larch that met the definition of a fire-killed tree had 90 to 100 percent crown scorch. Similarly, 94 percent of the thin-barked species (Engelmann spruce, lodgepole pine, subalpine fir, and grand fir) that were identified as fire-killed had 80 to 100 percent of their basal circumference burned. In general, trees were typically either severely affected by the wildfire or suffered little damage. Although some exceptions could occur, given the level of damage seen in those trees meeting the definition of fire-killed, there is little chance that implementation of this alternative would result in the removal of trees that could potentially survive the fire-induced damage and produce cones in 2008. In conclusion, any effects of this alternative on natural regeneration of conifer species would be discountable and insignificant (P.R., Vol. 2, Fire-killed Trees; P.R. Vol. 2, Regeneration/Aspen).

Proposed activities would occur within 422 acres of "delineated" RCAs under this alternative, 10 acres of which occur within one site potential tree height of streams but upslope of roads. Field reconnaissance indicates that none of these 422 acres, including the 10 acres within one site potential tree height of a stream, exhibit the characteristics of "riparian habitat". Riparian habitats present within the project area are generally narrow in width, with most less than 50 feet wide. Because of the lack of competition with conifers, re-growth of brush, shrub, and grass species should be immediate and abundant within riparian habitats. In fact, re-growth of brush and shrub species was observed in October of 2007 within some riparian habitats, presumably due to the availability of moisture in the soil. Given the lack of activities within riparian habitats, this alternative would not disturb any riparian vegetation nor would this action retard recovery of vegetation within riparian habitats (P.R., Vol. 2, Regeneration/Aspen).

As noted in the *Cascade Complex: South End Burned Area Emergency Stabilization Plan* (USDA 2007), natural regeneration of grasses and shrubs would be expected over the next 2 to 5 years on those sites that burned at a low or moderate severity, with natural regeneration of grasses and shrubs expected to take in excess of five years on sites that burned at a high severity. Given that proposed ground disturbance is projected to occur over the next two years and that re-growth of grasses and/or shrubs would be minimal during this time period, ground disturbance associated with this alternative should have a negligible effect on recovery of grasses and shrubs in non-riparian habitats. While ground disturbance would occur and some individual grass or shrub plants may be disturbed or destroyed, this alternative would not be expected to increase detrimental disturbance (i.e. soil compaction, displacement or puddling) within the various units and should actually result in a slight beneficial effect (P.R., Vol. 11, Detrimental Disturbance).

Although research is limited, ground disturbance associated with logging has been observed to disrupt water-repellent layers (hydrophobic conditions), which may increase water infiltration and thereby decrease overland flow and erosion from burned sites. Ice (1999) states that where water-repellent soils are created by condensation of volatilized organics in the soil, ripping and breaking-up of this layer is essential to rapidly restore infiltration. In addition, Poff (1988) argues that "…salvage logging can improve watershed condition by increasing ground cover, by removing a source of large, high energy water drops, and by breaking up hydrophobic soil layers." The majority of the harvest-created slash would be removed from the units via whole-tree-yarding and accumulated at landings. Nevertheless, incidental amounts of material in the form of limbs and tops of harvested trees would break off during operations, be retained on site, and provide an immediate contribution of organic material. In addition, within harvested units along the NFS road 470 and 472, some fire-killed trees in the 3 to 7 inch dbh range will be felled and retained on site across an estimated 100 acres. Further, fire-killed and imminently dead trees greater than or equal to 8 inches dbh would be felled and retained on site across another 10 acres. While an immediate benefit may not be realized, breaking up the hydrophobic soils via ground-based skidding and contributing slash to the sites would speed the rate of recovery (P.R., Vol. 11, Detrimental Disturbance).

Spence et al (1996) stated that they found no published attempts to define zones of influence for nutrient cycling. Most likely, this reflects the difficulty in tracing the movement of nutrients, particularly with those elements such as nitrogen for which the number of alternative pathways is great. It is known that conditions throughout the watershed influence stream chemistry; consequently, the zone of influence extends to the top of the watershed, even though it may be years before nutrients ultimately find their way to the stream. However, the zone of most intense interaction is within the floodplain and hyporheic zones, where subtle changes in oxygen levels can dramatically affect nutrient composition and bioavailability (Spence et al 1996). Given the lack of published studies on the subject, it is unknown if, or to what extent, removal of fire-killed and imminently dead trees more than one site potential tree height from a stream may impact nutrient cycling. However, it is assumed that meeting the soil productivity needs on these acres would maintain the existing nutrient cycling process. As explained in Section 3.11.4, in comparison to the existing condition, coarse woody debris under this alternative would gradually increase over the next 25 years during which time total tons/acre would remain within or slightly above desired ranges while tons/acre of coarse wood greater than 15 inches in diameter would be within or below desired conditions (P.R., Vol. 11, Coarse Woody Debris).

Previous studies related to the potential effects of this type of action on riparian microclimate and productivity have focused on the removal or retention of live standing riparian vegetation. No known studies exist specifically examining the effects of removing dead standing trees and/or downed logs on riparian microclimate. Although it is assumed that their removal would increase solar radiation and soil temperature, the extent of the potential effect is unknown. While the primary objective would be for soil productivity, maintaining total tons/acre of coarse woody debris within desired ranges over the next 25 years (Section 3.11.4) would help ameliorate any dramatic increases in soil temperature/solar radiation until such time that conifer saplings have become established (P.R., Vol. 12, Fisheries).

Given that the 2007 wildfire consumed over half of the riparian vegetation within most of the 6^{th} field analysis areas, many of the habitat values often associated with riparian areas (i.e. diverse plant assemblages and cooler microclimates) is now limited. With the exception of rodents and other small mammals, these acres currently provide marginal habitat for most wildlife species. Retention of coarse woody material in desired ranges necessary for soil productivity (Section 3.11.4) would maintain some hiding cover and travel corridors for these small mammals (P.R., Vol. 12, Fisheries).

3.12.4 Environmental Consequences Specific to Alternative C

***Sediment/Turbidity* –** Although BOISED reflects slight increases in sedimentation as a result of proposed activities (maximum of 1.7 percent over natural in any given 6^{th} field), the modeled output does not reflect the benefits of many design features incorporated into this alternative. Proper application of these design features would be expected to decrease the likelihood of sediment delivery to streams in quantities sufficient to impact water quality conditions. The Megahan/Ketcheson model was used to estimate sediment delivery distances for several different scenarios based on skidding restrictions disclosed in Chapter 2 (Section 2.4.3.3). It is worth noting that these modeling efforts took into account increased erosion rates expected as a result of the 2007 wildfire. Also, in development of the model, 22 years of rainfall intensity data which included rainfall erosivity values ranging from moderately low to the highest on record was used thus representing an excellent range in rainfall (Megahan and Ketcheson 1996). Also included in the development of the model was 30 years of streamflow data which included the second and third highest flows in the 30 year period (Megahan and Ketcheson 1996).

For tractor skidding on unconstructed skid trails and on slopes less than 40 percent, the Megahan/Ketcheson model predicted, using on-site data, an average sediment delivery distance of 4.6 feet with a maximum delivery distance of 16.4 feet. Relative to the potential for concentration of eroded material and delivery to streams downslope of roads, the Megahan/Ketcheson model predicted, using on-site data, an average sediment delivery distance of 7.7 feet with a maximum delivery distance of 19.0 feet. The minimum distance from the road to the stream on these sites is roughly 20 feet (P.R., Vol. 11, Sediment).

Design features (Section 2.4.3.3) prohibit the use of ground-based equipment on slopes exceeding 40 percent, instead, included material would be removed with an off-road jammer. Off-road jammers in these situations would be confined to the road prism, or slopes within the unit that are less than or equal to 40 percent if above the road, and the logs winched to the off-road jammer prior to be skidded to the landing. One concern associated with this activity is the potential for logs to gouge the ground surface as being winched to the off-road jammer, thus creating furrows for the accumulation of water and transport of eroded material. However, the Megahan/Ketcheson model predicted, using on-site data, an average sediment delivery distance of 4.7 feet with a maximum delivery distance of 6.3 feet. Not reflected in these modeled delivery distances are a design feature (Section 2.4.2.5) that requires construction of cross-ditches by hand on these furrows no later than two weeks after completion of harvest within each affected unit which would further limit the travel distance of eroded material (P.R., Vol. 11, Sediment).

Given the narrow (i.e. maximum of 200 feet) linear nature of proposed units, it is unlikely that skid trail construction would be necessary. Nevertheless, the Megahan/Ketcheson model predicted, using on-site data, an average sediment delivery distance of 5.9 feet with a maximum delivery distance of 14.9 feet for this activity. In order to minimize the potential for sediment delivery from constructed skid trails, design features common to all action alternatives require the District Hydrologist to review on-the-ground all requests to construct skid trails within RCAs. However, the design feature prohibiting ground-based skidding within or through RCAs under this alternative (Section 2.4.3.3) would effectively eliminate the possibility of a skid trail being constructed within an RCA. Design features (Section 2.4.2.5) also require that, following completion of use, cross-ditches would be constructed at intervals of approximately 20 feet where skid trails exceed 20 percent slope (P.R., Vol. 11, Sediment).

One situation that could affect sediment delivery distances reflected by the Megahan/Ketcheson model would be if fire-induced sediment filled the sediment storage capacity of existing obstructions otherwise available to trap erosion generated by timber harvest activities. As explained above, modeling efforts took into account increased erosion rates expected as a result of the 2007 wildfire Nevertheless two design features, previously discussed, were incorporated to address this concern. Specifically, fire-killed and imminently dead trees greater than or equal to 8 inches dbh would be felled and retained on site across 422 acres of RCAs (Section 2.4.3.3). This activity would not only reduce the potential for delivery of management-induced sedimentation, but would also obstruct delivery of fire-induced sediment. In addition, design features associated with this alternative prohibit harvest or ground-based skidding within or through RCAs (Section 2.4.3.3).

While the majority of the harvest-related slash would be removed from the units via whole-tree-yarding and accumulated at landings, incidental amounts of material in the form of limbs and tops of harvested trees would break off during operations and be retained on site. The immediate contribution of this logging slash would increase the number of obstructions beyond those reflected in Megahan/Ketcheson modeling efforts and increase the interception and storage of sediment on the hillslopes (P.R., Vol. 11, Sediment).

Therefore, given incorporated design features and modeled sediment delivery distances, little if any of the BOISED modeled sediment attributed to harvest activities would be delivered to streams (P.R., Vol. 11, Sediment).

Given the narrow (i.e. maximum of 200 feet) linear nature of proposed harvest units and therefore the limited number of logs accumulated at any single location, it is suspected that few landings would be constructed under this alternative and that the Purchaser would instead use unconstructed landings and/or the actual road prism. Under a worse case scenario where landings would be constructed, the Megahan/Ketcheson model predicted, using on-site data, an average sediment delivery distance of 13.4 feet with a maximum delivery distance of 57.8 feet. In order to minimize the potential for sediment delivery, design features common to all action alternatives (Section 2.4.2.5) prohibit the construction of new landings within one site potential tree height (minimum of 80 feet) of any stream. However, the design feature prohibiting ground-based skidding within or through RCAs under this alternative (Section 2.4.3.3) would effectively eliminate the possibility of a landing being constructed within an RCA. Therefore this activity is expected to result in negligible amounts of sedimentation to any stream. Assuming under a worse case scenario that some landings are constructed, design features (Section 2.4.2.5) require that, upon completion of harvest activities, all landings constructed in association with this project would be reshaped to provide adequate drainage, scarified to a minimum depth of 18 inches, slash distributed to cover approximately 30 percent of the reshaped surfaces, and planted with a Forest Service approved seed mixture, thereby eliminating the potential for sedimentation in the future (P.R., Vol. 11, Sediment).

A total of approximately 660 truck loads of logs would be removed under this alternative over a period of two years, with the actual haul distributed over numerous different roads. On average, a total of 5 to 10 trucks/day would be expected on any given road. Available traffic count data for the #474.2 road suggests that in excess of 100 vehicles travel along this road on a daily basis during the snow-free season, thus the sediment attributable to dust resulting from increases in logging traffic would be inconsequential (P.R., Vol. 11, Sediment).

Dust generated from unpaved roads would be minor due to slow speeds. Also, contract provisions would require dust abatement when dust is a hazard. With normal dust abatement procedures, noticeable amounts of fine sediment generated by logging traffic would not reach stream channels. Since some potential haul routes may also receive abundant use by recreational traffic during the same time period, dust abatement associated with the timber sale may actually reduce the amount of dust reaching streams that is attributable to recreational uses (P.R., Vol. 11, Sediment).

As part of the Burned Area Emergency Response (BAER) effort, the culvert at the #473 road crossing of Lodgepole Creek was removed in the fall of 2007, thus eliminating authorized motorized access to the #473 road. However, an unauthorized road prism is currently in place that connects the #474.2 road with the #473 road south of the Lodgepole Creek culvert location. This alternative would use this existing unauthorized road (0.7 miles) as a temporary road in order to access the #473 road. This temporary road does not cross any streams, with the closest stream located roughly 150 feet to the north across flat ground. Use of this existing road prism as a haul route would not be expected to increase sediment delivery to any stream channel (P.R., Vol. 11, Sediment).

***Substrate Embeddedness* –** As explained above, because of incorporated design features and modeled sediment delivery distances, negligible sediment increases are expected as a result of proposed management activities. Therefore the effects of this alterantive on substrate embeddedness would be immeasurable. In addition, falling and retention on site of fire-killed and imminently dead trees greater than or equal to 8 inches dbh across 422 acres would not only reduce the potential for delivery of management-induced sedimentation, but would also obstruct delivery of fire-induced sediment (P.R., Vol. 11, Sediment).

***Riparian Conservation Areas* –** The activities associated with this alternative would not be expected to degrade or retard riparian functions and processes. No changes in RCA road density would occur nor would this alternative have any effect on fish passage barriers. As previously disclosed, this alternative is expected to have no measurable effect on stream temperature or large woody debris recruitment, and would maintain the existing bank stability in area streams (P.R., Vol. 12, Fisheries).

Removal of imminently dead trees (i.e. windthrown or successfully attacked by bark beetles) is not expected to have a measurable effect on natural regeneration of conifers. Although research is limited, trees meeting the definition of “imminently dead” would not be expected to respond to insect infestations by producing abundant crops of cones. Instead, a tree recently infested by insects would expend its available resources to survive the infestation rather than produce cones. Conifer cones in this area typically mature and release their seeds in the fall. Therefore the removal of fire-killed trees in the spring or summer of 2008 would have no effect on the 2007 seed crop. Post-fire stand data collected in October of 2007 revealed that 93 percent of those Douglas-fir, ponderosa pine, and western larch that met the definition of a fire-killed tree had 90 to 100 percent crown scorch. Similarly, 94 percent of the thin-barked species (Engelmann spruce, lodgepole pine, subalpine fir, and grand fir) that were identified as fire-killed had 80 to 100 percent of their basal circumference burned. In general, trees were typically either severely affected by the wildfire or suffered little damage. Although some exceptions could occur, given the level of damage seen in those trees meeting the definition of fire-killed, there is little chance that implementation of this alternative would result in the removal of trees that could potentially survive the fire-induced damage and produce cones in 2008. In conclusion, any effects of this alternative on natural regeneration of conifer species would be discountable and insignificant (P.R., Vol. 2, Fire-killed Trees; P.R. Vol. 2, Regeneration/Aspen).

Proposed activities would occur within 422 acres of “delineated” RCAs under this alternative, 10 acres of which occur within one site potential tree height of streams but upslope of roads. Field reconnaissance indicates that none of these 422 acres, including the 10 acres within one site potential tree height of a stream, exhibit the characteristics of “riparian habitat”. Riparian habitats present within the project area are generally narrow in width, with most less than 50 feet wide. Because of the lack of competition with conifers, re-growth of brush, shrub, and grass species should be immediate and abundant within riparian habitats. In fact, re-growth of brush and shrub species was observed in October of 2007 within some riparian habitats, presumably due to the availability of moisture in the soil. Given the lack of activities within riparian habitats, this alternative would not disturb any riparian vegetation nor would this action retard recovery of vegetation within riparian habitats (P.R., Vol. 2, Regeneration/Aspen).

As noted in the *Cascade Complex: South End Burned Area Emergency Stabilization Plan* (USDA 2007), natural regeneration of grasses and shrubs would be expected over the next 2 to 5 years on those sites that burned at a low or moderate severity, with natural regeneration of grasses and shrubs expected to take in excess of five years on sites that burned at a high severity. Given that proposed ground disturbance is projected to occur over the next two years and that re-growth of grasses and/or shrubs would be minimal during this time period, ground disturbance associated with this alternative should have a negligible effect on recovery of grasses and shrubs in non-riparian habitats. While ground disturbance would occur and some individual grass or shrub plants may be disturbed or destroyed, this alternative would not be expected to increase detrimental disturbance (i.e. soil compaction, displacement or puddling) within the various units and should actually result in a slight beneficial effect (P.R., Vol. 11, Detrimental Disturbance).

Although research is limited, ground disturbance associated with logging has been observed to disrupt water-repellent layers (hydrophobic conditions), which may increase water infiltration and thereby decrease overland flow and erosion from burned sites. Ice (1999) states that where water-repellent soils are created by condensation of volatilized organics in the soil, ripping and breaking-up of this layer is essential to rapidly restore infiltration. In addition, Poff (1988) argues that "…salvage logging can improve watershed condition by increasing ground cover, by removing a source of large, high energy water drops, and by breaking up hydrophobic soil layers." The majority of the harvest-created slash would be removed from the units via whole-tree-yarding and accumulated at landings. Nevertheless, incidental amounts of material in the form of limbs and tops of harvested trees would break off during operations, be retained on site, and provide an immediate contribution of organic material. In addition, fire-killed and imminently dead trees greater than or equal to 8 inches dbh would be felled and retained on site across 422 acres of RCAs (Section 2.4.3.3). While an immediate benefit may not be realized, breaking up the hydrophobic soils via ground-based skidding and contributing slash to the sites would speed the rate of recovery (P.R., Vol. 11, Detrimental Disturbance).

Spence et al (1996) stated that they found no published attempts to define zones of influence for nutrient cycling. Most likely, this reflects the difficulty in tracing the movement of nutrients, particularly with those elements such as nitrogen for which the number of alternative pathways is great. It is known that conditions throughout the watershed influence stream chemistry; consequently, the zone of influence extends to the top of the watershed, even though it may be years before nutrients ultimately find their way to the stream. However, the zone of most intense interaction is within the floodplain and hyporheic zones, where subtle changes in oxygen levels can dramatically affect nutrient composition and bioavailability (Spence et al 1996). Given the lack of published studies on the subject, it is unknown if, or to what extent, removal of fire-killed and imminently dead trees more than one site potential tree height from a stream may impact nutrient cycling. However, it is assumed that meeting the soil productivity needs on these acres would maintain the existing nutrient cycling process. As explained in Section 3.11.4, in comparison to the existing condition, coarse woody debris would gradually increase over the next 25 years during which time total tons/acre would remain within or above desired ranges while tons/acre of coarse wood greater than 15 inches in diameter would be within, above, or below desired conditions (P.R., Vol. 11, Coarse Woody Debris).

Previous studies related to the potential effects of this type of action on riparian microclimate and productivity have focused on the removal or retention of live standing riparian vegetation. No known studies exist specifically examining the effects of removing dead standing trees and/or downed logs on riparian microclimate. Although it is assumed that their removal would increase solar radiation and soil temperature, the extent of the potential effect is unknown. While the primary objective would be for soil productivity, maintaining total tons/acre of coarse woody debris within desired ranges over the next 25 years (Section 3.11.4) would help ameliorate any dramatic increases in soil temperature/solar radiation until such time that conifer saplings have become established (P.R., Vol. 12, Fisheries).

Given that the 2007 wildfire consumed over half of the riparian vegetation within most of the 6th field analysis areas, many of the habitat values often associated with riparian areas (i.e. diverse plant assemblages and cooler microclimates) is now limited. With the exception of rodents and other small mammals, these acres currently provide marginal habitat for most wildlife species. Retention of coarse woody material in desired ranges necessary for soil productivity (Section 3.11.4) would maintain some hiding cover and travel corridors for these small mammals (P.R., Vol. 12, Fisheries).

3.12.5 Cumulative Effects

The effects of any alternative on fish or fish habitat would be limited to the seven 6th field analysis areas. Therefore the area used to assess cumulative effects consists of the 104,431 acre analysis area encompassing the seven 6th field subwatersheds (Figure 3-16).

With the exception of a five acre parcel in the vicinity of Knox Ranch, the entire cumulative effects area is administered by the U.S. Forest Service. Since 1950 an estimated 7,208 acres have been harvested within the cumulative effects area. Historic records indicate that since 1910 roughly 74,147 acres within the cumulative effects area have been affected by wildfire, some of which overlap with harvested acres. Although the specific effects cannot be quantified, the existing conditions disclosed above reflect the impacts of those past activities as well as any recovery that has occurred since those events. Ongoing or foreseeable future activities within this cumulative effects area that could add incrementally to impacts on this resource are listed below. Reference **Appendix B** for additional information and maps related to the cumulative effects analyses completed for this project.

Cabin Salvage, Knox Salvage, and South Fork Houselog Salvage I Sales – These three salvage sales, all under contract to the same Purchaser, were offered following the 2003 South Fork Wildfire. At this time the majority of the included timber has already been removed. However, the Purchaser is expected to continue to remove small amounts of fire-killed and imminently dead timber in 2008.

Power Salvage Sale – This salvage sale permits the removal of downed trees only from 66 acres within sections of the right-of-way of the overhead power line in the Warm Lake Basin. This contract is projected to terminate in July of 2008.

South Fork Campground Restoration Project – While still in the developmental phase, the objective of this project would be to minimize the fire-induced effects of the 2007 wildfire on the 10 acre South Fork Campground by removing hazard trees, planting conifers, and implementing other restorative activities. The environmental analysis for this project is tentatively scheduled to occur in 2008 with implementation in 2009 or 2010.

Shoreline Fuels Reduction Project – This project consists of mechanical mulching of 32 acres of sub-merchantable trees and hand thinning and piling of 77 acres of sub-merchantable trees, all in the vicinity of the Shoreline Campground. Implementation is scheduled to occur in 2008.

Tyndall Stolle Reforestation Project – This project consists of planting conifers on an estimated 4,127 acres that burned at a high or moderate intensity where competing vegetation is expected and/or where no seed source is present to facilitate natural regeneration. Planting activities are projected to occur in the spring and fall of 2008 and 2009.

Miscellaneous Recreational Activities – Numerous recreation-related uses in the area, such as church camps, hunting, camping, firewood cutting, and sightseeing, are expected to continue in the future.

SFSR Travel Management Project - While still in the developmental phase, the objective of this project would be to minimize undesirable impacts associated with poorly located dispersed campsites and authorized and unauthorized roads and/or trails causing resource damage, as well as to address under-sized culverts, fish passage barriers, and/or structures damaged by the 2007 wildfire in the South Fork Salmon River drainage. The environmental analysis for this project is tentatively scheduled to occur in 2008 with implementation in 2009 or 2010.

Sport Fishing for Salmon - The State of Idaho allows sport fishing of Chinook salmon in the South Fork Salmon River on a year to year basis depending on the number of returning fish. This season varies annually in length and the numbers of fish permissible to take, which indirectly influences the amount of use in the cumulative effects area.

Tribal Fishing for Salmon – Tribal members still exercise their treaty rights to fish for salmon in the South Fork Salmon River. In recent years, the salmon runs have increased due to hatchery-raised stock being released to supplement the wild runs. Similarly to sport fishing, the amount of tribal fishing in any given year influences the amount of use in the cumulative effects area.

Warm Lake Highway Reconstruction Project – The majority of this project was completed in the summer of 2007 and included repair and resurfacing of the Warm Lake Highway (FH22) from Big Creek Summit to its crossing of the South Fork Salmon River.

Road Use and Road Maintenance – In addition to the ongoing use associated with recreational activities, roads within the area would continue to receive routine maintenance and/or repair as priorities dictate and funding allows.

BAER Culvert Replacements – A number of culverts removed in the fall of 2007 as part of the Cascade Complex BAER project would be reinstalled in the summer of 2008.

Alternative A would have no direct or indirect effects on any watershed condition indicator, fish habitat, or fish populations, therefore no cumulative effects would occur (P.R., Vol. 12, Fisheries).

Alternatives B and C would have, at most, negligible effects on any WCI. Therefore regardless of potential effects resulting from ongoing or foreseeable future activities, Alternatives B and C would not add incrementally to those effects (P.R., Vol. 12, Fisheries).

Determinations for All Species

Alternative A would have no effect on Chinook salmon, steelhead trout, or bull trout, and; no impact on westslope cutthroat trout (P.R., Vol. 12, Fisheries).

Alternative B or C may affect but is not likely to adversely affect Chinook salmon or their designated critical habitat, steelhead trout or their designated critical habitat, or bull trout, and; may impact individuals but would not likely contribute to a trend towards federal listing or loss of viability to the population or species of westslope cutthroat trout (P.R., Vol. 12, Fisheries).

In addition, Alternatives B and C do not show any measurable effects to mainstem or tributary reaches of the South Fork Salmon River Essential Fish Habitat for Chinook salmon. These alternatives would maintain existing baseline values for water quality and clean substrates (P.R., Vol. 12, Fisheries).

3.13 Irreversible and Irretrievable Effects

For the purposes of this analysis, irreversible effects are defined as those effects resulting from a proposed activity that cannot be reversed within a reasonable period of time as perceived from a human time scale. Irretrievable effects are those effects caused by the activities that change outputs or commodities.

Long Term Soil Productivity - Implementation of Alternative B or C would result in 1.3 percent of the project area being irreversibly committed (total soil resource commitment), an increase of 0.1 percent from the existing 1.2 percent (Section 3.11.4).

Energy - Implementation of Alternative B or C would irretrievably commit an indeterminate amount of fossil fuels in order to remove and transport the products, and to implement activities associated with the alternatives.

3.14 Potential Conflicts with Plans and Policies of Other Jurisdictions

Air Quality **-** Proposed burning activities would comply with state and federal air quality regulations. Alternatives B and C include design features to minimize impacts on air quality (Section 3.7).

American Indian Treaty Rights **-** The proposed alternatives would not conflict with any treaty provisions.

Cultural Resources **–** Alternatives B and C would not be expected to have any direct or indirect effects on historically significant sites. Previously identified sites would be protected under these alternatives (Section 2.4.2.8). The State Historic Preservation Officer has reviewed the resource report and concurred with the no adverse effects determination. Contract provisions that would halt all degrading activities would be included with these alternatives to prevent adverse impacts to any unknown sites discovered during implementation (Section 3.8).

Endangered Species **-** Determinations disclosed in Chapter 3 for threatened, endangered, proposed, and candidate species have concluded that Alternatives B and C <u>may affect</u> but are not likely to adversely affect *Spiranthes diluvialis* (Section 3.2.11). Alternatives B and C <u>may affect</u> but are not likely to adversely affect Canada lynx and northern Idaho ground squirrel (Section 3.10.1). Alternatives B and C <u>may affect</u> but are not likely to adversely affect Chinook salmon or their designated critical habitat, steelhead trout or their designated critical habitat, or bull trout (Section 3.12).

Minerals **-** The proposed alternatives would have no effect on the availability of lands for mining under Federal mining laws and regulations.

Water Quality **-** The State of Idaho Forest Practices Water Quality Management Plan and Forest Service Soil and Water Conservation Practices standards would be implemented to meet State and Federal water quality regulations. Alternatives B and C would not contribute additional sediment, the pollutant of concern, to water quality limited waterbodies in amounts that would prevent the attainment and maintenance of the instream objectives, nor would these alternatives have a measurable effect on the identified beneficial uses of domestic and agricultural water supply, cold water biota, salmonid spawning, primary and secondary contact recreation, and special resource waters. Relative to water quality and fisheries, Alternatives B and C would comply with existing management direction including Forest Plan Standards and Guidelines and the Clean Water Act, as well as Terms and Conditions prescribed in the Biological Opinion prepared for the Forest Plan (Sections 3.11.1 and 3.12).

In addition, felling of fire-killed trees in the 3 to 7 inch dbh range, post-harvest, across an estimated 100 acres; felling and retention on site of fire-killed and imminently dead trees greater than or equal to 8 inches dbh on another 10 acres; adding effective ground cover; placement of log obstructions below six existing drainage structures, and; breaking up the hydrophobic soils via ground-based skidding under Alternative B would be consistent with the intent of the TMDL of reducing sediment, the pollutant of concern (Section 3.11.1).

Falling and retaining on site fire-killed and imminently dead trees greater than or equal to 8 inches dbh across an estimated 422 acres; adding effective ground cover, and; breaking up the hydrophobic soils via ground-based skidding under Alternative C would be consistent with the intent of the TMDL of reducing sediment, the pollutant of concern (Section 3.11.1).

Wildlife **-** Proposed activities would not conflict with current or proposed Idaho Department of Fish and Game management plans.

Migratory Bird Treaty Act **–** All alternatives would comply with the Migratory Bird Treaty Act. This project may however result in an “unintentional take” of individuals during proposed activities. However the project complies with the U.S. Fish and Wildlife Service Director’s Order #131 related to the applicability of the Migratory Bird Treaty Act to federal agencies and requirements for permits for “take”. In addition, this project complies with Executive Order 13186 because the analysis meets agency obligations as defined under the January 16, 2001 Memorandum of Understanding between the Forest Service and U.S. Fish and Wildlife Service designed to complement Executive Order 13186. Migratory bird species are also analyzed and discussed in Sections 3.10.2 and 3.10.4 of this document. If new requirements or direction result from subsequent interagency memorandums of understanding pursuant to Executive Order 13186, this project would be reevaluated to ensure that it is consistent (Section 3.10.4).

3.15 Other Disclosures

NFMA Even-aged Management – No even-aged silvicultural prescriptions would be applied under any alternative. Management activities associated with Alternative B or C would be limited to the cutting of fire-killed and imminently dead trees. Stipulations related to vegetation manipulation at 36 CFR 219.27(b) would not apply.

Effects of Alternatives on Wetlands and Floodplains – Alternatives B and C would not be expected to negatively change the functions or values of wetlands and floodplains as they relate to protection of human health, safety, and welfare; preventing the loss of property values, and; maintaining natural systems. The goals of Executive Orders 11988 and 11990 would be met. All wetlands would be protected through design features which conform to Executive Order 11990 (Section 3.11.5).

Effects of Alternatives on Social Groups - The alternatives do not differ with one another in their effects on minorities, Native American Indians, women, or Civil Liberties of any American Citizen. The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, sexual orientation, or marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

Effects of Alternatives on Threatened, Endangered, and Sensitive Species - The effects on threatened, endangered, proposed, candidate, and sensitive species have been analyzed. Potential effects are disclosed in Chapter 3.

Effects of Alternatives on Prime Range Land, Farm Land, and Forest Land - The alternatives considered are in compliance with the Federal Regulations for prime land. The definition of "prime" forest land does not apply to lands within the National Forest System. The project area does not contain any prime range land or farm land. Under Alternative B or C, Federal lands would be managed with appropriate sensitivity to the effects on adjacent lands.

Energy Requirements and Conservation Potential of Alternatives - With relation to national and global petroleum reserves, the energy consumption associated with the individual alternatives, as well as the differences between alternatives, is insignificant.

Environmental Justice (E.O. 12898) - Executive Order 12898 (59 Fed. Register 7629, 1994) directs federal agencies to identify and address, as appropriate, any disproportionately high and adverse human health or environmental effects on minority populations and low income populations. Based upon the analysis disclosed in this document, the proposed alternatives are in compliance with E.O. 12898.

Clean Air Act - Compliance with design features and smoke management plans would result in no long term impacts. These measures would protect air quality and comply with the rules, regulations, and permit procedures of the EPA and the IDEQ. All alternatives would comply with the provisions of the Clean Air Act (Section 3.7).

Clean Water Act - The objective of the Clean Water Act is to "…restore and maintain the chemical, physical, and biological integrity of the nation's waters." One of the Act's goals is to "…provide for the protection and propagation of fish, shellfish, and wildlife" and provide for "…recreation in and on the water" (33 U.S.C. 466 et seq., Title I, Section 101). Based on the analysis disclosed in this document, all alternatives would satisfy the Clean Water Act. This project includes design features to ensure management activities maintain or improve watershed conditions (Chapter 2). These features, including best management practices, are designed to maintain or improve soil, water, riparian and aquatic resources, including beneficial uses. Cumulatively this direction would ensure continued compliance with the Clean Water Act (Chapter 3).

Invasive Species (E.O. 13112) - Executive Order 13112 on Invasive Species directs that federal agencies should not authorize any activities that would increase the spread of invasive species. This project includes design features to limit the spread of invasive species (Chapter 2).

Other Policies - The existing body of national direction for managing National Forests remains in effect. This action would contribute to the Forest Service Strategic Plan (GPRA 2001).

Consultation with Tribal Governments (E.O. 13175) **–** This order established a requirement for regular and meaningful consultation between federal and tribal government officials on federal policies that have tribal implications.

Three federally recognized Native American tribes have expressed interest in activities proposed in this area; Nez Perce, Shoshone-Paiute and Shoshone-Bannock Tribes. A packet describing the Proposed Action and soliciting comments on that action was mailed to representatives of the Shoshone-Bannock and Nez Perce Tribes in October of 2007. In addition, the Agency presented and discussed the Proposed Action at the November 8, 2007 Wings and Roots meeting. These meetings are an official part of the consultation process between the Shoshone-Paiute Tribe and the Boise National Forest. The Shoshone-Bannock Tribe considers the Wings and Roots meetings as a form of "technical" consultation and uses this process to help assess the need for formal consultation. The tribal notification and subsequent consultation processes described above did not result in the identification of any adverse effects to tribal interests or rights specifically associated with this project.

Facilitation of Hunting Heritage and Wildlife Conservation (E.O. 13443) - On August 16, 2007, President George Bush signed an Executive Order directing appropriate federal agencies to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat. Alternatives B and C would not be expected to impact the quality of elk/mule deer forage or thermal cover, but would slightly reduce the quality of hiding cover. Any impacts would be minimal, however, as these areas constitute less than 100 acres of the proposed units and because the snag component contributes little to the quality of hiding cover. Temporary displacement of big game animals occurring intermittently over a period of two years would be inconsequential and would not result in more than the individual or herd moving to another location away from project activities.

Best Available Science **–** The conclusions summarized in this document are based on a review of the project's record that reflects consideration of relevant scientific information and responsible opposing views where raised by internal or external sources, and the acknowledgement of incomplete or unavailable information, scientific uncertainty, and/or risk where pertinent to the decision being made.