VIII. FISHERIES

Introduction

The following analysis documents the existing conditions and potential effects of the proposed action and its alternatives on the aquatic environment and the principal species that are part of that environment. This includes considerations of potential effects to Threatened, Endangered and Sensitive fish species.

Analysis Area Description and Information Sources

Information for this analysis has been gathered from a variety of sources. The Flathead National Forest (Flathead NF) and Montana Department of Fish, Wildlife and Parks (MDFWP) have conducted site-specific fish habitat condition and population status inventories within the watershed for more than twenty years. Forest Service biologists prepared a baseline Biological Assessment (BA) of the status of bull trout in 1998 and updated it for the North Fork Flathead River and Middle Fork Flathead River in 2000 (USDA Forest Service 2000).

The fisheries analysis area for this project encompasses a range of spatial scales which to a large degree reflect the current status of bull trout (Salvelinus confluentus). This analysis area includes the North Fork Flathead River (952 square miles; 609,280 acres) and Flathead Lake (1,144 square miles; 732,680 acres). The Flathead River below the Kerr Dam is not part of this analysis. The construction of Kerr Dam in 1938 isolated fish populations above the dam from populations in the lower river. Similarly, dams on both the South Fork Flathead River and the Swan River have isolated fish populations. Access to these river systems is no longer available to fish residing in and above Flathead Lake (Weaver and Fraley 1991). The broad-scale analysis area for this project includes the upper Flathead basin which encompasses Flathead Lake, the North Fork Flathead River, the Middle Fork Flathead River and the intervening river channel that connects the North Fork Flathead River and the Middle Fork Flathead River.

The cumulative effects area would include the project area from Whale Creek to Moran Creek and extend to Flathead Lake since bull trout and westslope cutthroat trout are adfluvial and spend a portion of their lives in Flathead Lake and Flathead River. The cumulative effects area would not include other North Fork Flathead River tributaries such as Big Creek, Coal Creek, Trail Creek, etc., since each stream has a unique fish populations based upon genetics (Kanda 1999). What these streams have in common is that each fish population uses Flathead Lake to reach sexual maturity and then return to their natal stream to spawn. The food web changes in Flathead Lake, as discussed in this chapter, and the resultant increase in the lake trout population unquestionably contribute greatly to the cumulative effects upon fish populations.

At a finer resolution, this analysis focuses primarily upon Whale Creek, Moose Creek, Hawk Creek, Red Meadow Creek and Hay Creek. All of the creeks flow west to east, and join the North Fork Flathead River above the confluence with the Middle Fork Flathead River.

Affected Environment/Existing Condition

This section describes the current condition of the aquatic environment and the principal species that are part of that environment. This assessment is largely based upon data from Montana Fish, Wildlife and Parks the Biological Assessment for bull trout (USDA Forest Service 2000) as well as the Soils and Hydrology sections of this document. For each stream, the discussion includes a brief description of fish species and habitat and any parameters that have changed from the baseline bull trout matrix written in 2000.

Species Status and Ecology

Bull Trout (Threatened Species)

Bull trout are considered a sensitive species on the Flathead NF. A sensitive species is defined as a species which is susceptible to activity impacts or habitat alterations. The species has also been identified as a "management indicator species" in the Flathead NF Forest Plan. Management indicator species are species identified in a planning process that are used to monitor the effects of planned management activities on viable populations of wildlife and fish, including those that are socially or economically important.

Two basic life history forms of bull trout are known to occur: resident and migratory. Resident bull trout spend their entire lives in their natal streams, while migratory bull trout travel downstream as juveniles to rear in larger rivers (fluvial types) or lakes (adfluvial types). The North Fork Flathead River populations are considered an adfluvial migratory group, with juveniles moving downstream to Flathead Lake at age 2-3, and returning at around age 6 to spawn. Bull trout spawning occurs in the fall and the eggs incubate in the stream gravel until hatching in January (Fraley and Shepard 1989). The alevins remain in the gravel for several more months and emerge as fry in early spring. Unlike many anadromous salmonids, which spawn once and die, bull trout are capable of multi-year spawning (Fraley and Shepard 1989). The historic range of the bull trout extended from California, where the species is now extinct, to the Yukon Territory of Canada (Hass and McPhail 1991). The decline of bull trout across most of their historic range in the United States resulted in their 1998 listing as a threatened species under the Endangered Species Act.

Several factors have contributed to the decline of bull trout. Habitat degradation, interaction with exotic species, over-harvest and the fragmentation of habitat by dams and diversions are all factors contributing to the decline of bull trout (Rieman and McIntyre 1995). But, perhaps the most important factor in the decline of the upper Flathead basin bull trout sub-population is the change in the species composition of Flathead Lake (McIntyre 1998). Opossum shrimp (Mysis relicta) were stocked in 3 lakes with tributaries that feed into Flathead Lake between 1968 and 1975. The shrimp eventually migrated downstream and became established in Flathead Lake. Opossum shrimp were documented in Flathead Lake in 1981, and their number peaked in 1986. The addition of these shrimp to the prey base allowed the populations of two non-native species, lake trout (S. namaycush) and lake whitefish (Coregonus clupeaformis), to expand. It is believed that the expansion of these two species contributed to the decline of bull trout (McIntyre 1998). The mechanisms of the decline are not well understood; however, it is assumed that competition

between these fish species was a major contributor to the decline in bull trout. Bull trout populations remain healthy in both Swan Lake and Hungry Horse Reservoir. Lake trout are absent from Hungry Horse Reservoir but have recently been documented in Swan Lake, raising concern among land and fishery managers.

Bull trout numbers in Flathead Lake have been estimated based upon redd counts. The highest redd count year was 1982, with adult bull trout estimated at 13,000 fish in Flathead Lake (Weaver 1998). The lowest redd count year was 1996, with adult bull trout estimated at 916 fish (Weaver 1998). It is important to note that these are gross estimates based on complex assumptions, but these numbers do provide an indication of the precipitous rate of decline the population suffered in less than two decades.

Westslope Cutthroat Trout (Sensitive Species, Management Indicator Species)

Westslope cutthroat trout are considered a sensitive species on the Flathead NF. A sensitive species is defined as a species which is susceptible to activity impacts or habitat alterations. The species has also been identified as a "management indicator species" in the Flathead NF Forest Plan. Management indicator species are species identified in the planning process that are used to monitor the effects of planned management activities on viable populations of wildlife and fish, including those that are socially or economically important.

Westslope cutthroat trout have two possible life forms, resident and migratory. Migratory forms are further broken down into adfluvial (migrates to lakes) or fluvial (migrates to rivers). All life forms spawn in tributary streams in the springtime when water temperature is about 10 Celsius and flows are high (Liknes and Graham 1988). Cutthroat trout spawn when they are about 4 or 5 years old and only a few survive to spawn again (McIntyre and Rieman 1995). Fry emerge in late June to mid July and may then spend one to four years in their natal streams. While resident fish spend their entire life in tributary streams, migratory life forms can travel several hundred kilometers as they move between Flathead Lake and spawning habitat.

The primary reasons for the decline of this species are similar to those for bull trout. Habitat loss is considered to be a widespread problem. Westslope cutthroat trout have declined due to poor grazing practices, historic logging practices, mining, agriculture, residential development and the lingering impact of forest roads. Fish have been unable to use countless miles of spawning habitat due to barriers created by dams and road culverts. Unlike bull trout, genetic introgression with rainbow trout in the Flathead River Drainage threatens long term persistence of westslope cutthroat trout (Hitt 2003).

The North Fork Flathead River watershed encompasses 952 square miles, of which genetically pure westslope cutthroat trout occupy 67 miles (27 stream reaches) (MDFWP 1998). Of the total linear amount of stream habitat known to be occupied by westslope cutthroat trout in the North Fork Flathead River watershed, 81.9% lie on lands administered by federal agencies (MTFWP 1999). The Flathead River Drainage is considered a "stronghold" for westslope cutthroat trout throughout its range (Shepard et al. 2003).

The U. S. Fish and Wildlife Service (USFWS) was petitioned by environmental groups to include the westslope cutthroat trout under protection of the Endangered Species Act. In 2003, the USFWS determined that listing was not warranted due to wide distribution of the species, available habitat on public lands and conservation efforts underway by state and federal agencies.

Other Species

These watersheds support all native fish and amphibian species believed to have been historically present. In addition to bull trout and westslope cutthroat trout, three other aquatic natives are present; sculpin (Cottus sp.), mountain whitefish (Prosopium williamsoni) and tailed frog (Ascaphus trueii).

Bull Trout: Environmental Baseline – Species and Habitat Indicators

Action agencies authorizing activities in watersheds occupied by bull trout are mandated by the Endangered Species Act of 1973, as amended, to consider effects to bull trout and other Threatened and Endangered species that would likely occur as a result of management actions. Agency biologists use the Matrix of Pathway Indicators (matrix) for bull trout to evaluate and document baseline conditions and to determine the likelihood of "take" of bull trout. Matrix analysis incorporates 4 biological indicators and 19 physical habitat indicators. Analysis of the matrix habitat indicators provides a thorough investigation of the existing baseline condition and potential impacts to bull trout habitat. Determinations of indicator status are listed as "Functioning Appropriately" (FA), "Functioning At Risk" (FAR), and "Functioning At Unacceptable Risk" (FUR). Baseline status determinations for this project are taken from the Section 7 Baseline BA for the North Fork Flathead River and Middle Fork Flathead River, as updated (USDA 2000).

While assessing potential effects to bull trout as a species, agencies have concurrently provided an analysis of effects to the primary constituent elements (PCEs) for bull trout designated critical habitat and related habitat indicators. The Whale Creek and Red Meadow Creek drainages are priority watersheds, and the lower mile on each stream on private land has been designated critical habitat by USFWS. The North Fork Flathead River along private land has also been designated as critical habitat. Table 3-59 includes the PCE for bull trout critical habitat and associated habitat indicators.

Table 3-59. Primary Constituent Elements for Bull Trout Critical Habitat and Associated Habitat Indicators.

PCE#	PCE Description	Associated Habitat Indicators
1	Permanent water having low levels of contaminants such that normal respiration, growth and survival are not inhibited.	Sediment, chemical contamination/nutrients, peak flow
2	Water temperatures ranging from 2 to 15C, with adequate thermal refugia available for temperatures at the upper end of this range.	Temperature, refugia, avg. wetted width/max depth ratio, streambank stability, peak flow, riparian conservation areas (RCA), floodplain connectivity
3	Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and in-stream structures	Large woody Debris (LWD), pool frequency and quality, large pools, off-channel habitat, refugia, avg. wetted width/max depth ratio, streambank stability, RCA, floodplain connectivity
4	Substrates of sufficient amount, size and composition to ensure success of egg and embryo over-winter survival, fry emergence, and young-of-the-year and juvenile survival.	Sediment, substrate embeddedness, LWD, pool frequency and quality.
5	A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, a hydrograph that demonstrates the ability to support bull trout populations.	Peak flow, drainage network, disturbance history and disturbance regime.
6	Springs, seeps, groundwater sources and subsurface water connectivity to contribute to water quality and quantity.	Peak flow, drainage network, disturbance history, riparian conservation areas, floodplain connectivity and chemical contamination/nutrients.
7	Migratory corridors with minimal physical, biological or chemical barriers between spawning, rearing, over-wintering and foraging habitat, including intermittent or seasonal barriers induced by high water temperatures or low flows.	Life history diversity and isolation, persistence and genetic integrity, temperature, chemical contamination/nutrients, physical barriers, wetted width/maximum depth ration, peak flows and refugia
8	An abundant food base including terrestrial organisms of riparian origin, aquatic macro-invertebrates and forage fish.	Growth and survival, life history diversity and isolation, riparian conservation areas and floodplain connectivity.
9	Few or no predatory, interbreeding or competitive non-native species present	Persistence and genetic integrity and physical barriers

Bull Trout Matrix

Whale Creek

Whale Creek is a 4th order stream. Bull trout, westslope cutthroat trout, mountain whitefish and sculpins are present. Bull trout distribution is limited to just above the Shorty Creek confluence

where a waterfall prevents upstream movement. Bull trout have been found several miles up Shorty Creek. However, redd counts in Shorty Creek in the period between 1979 and 1999 showed a substantial decline; particularly from 1982 – 1997, when redds decreased from 52 in 1982 to 2 in 1997 (USDA Forest Service 2000)

Whale Creek is identified as an (Inland Native Fish Strategy) (U.S. Department of Agriculture, 1995) priority watershed on the Flathead NF. Bull trout occupy approximately 18.5 miles of streams within the Whale Creek drainage. Of these, approximately 9 miles are located upstream of the Wedge Canyon Fire of 2003 and were not affected by the fire. The lower 9.5 miles were either within the burn area or in areas downstream of burned areas.

Sub-population Characteristics-Biological

Sub-population Size. Redd counts over the last 19 years have shown a precipitous decline. Juvenile populations have fluctuated with some of the highest numbers in the 1990s.

Table 3-60. Redd Counts and Population Estimates in Whale Creek, 1979 – 2006.

	1979	1980	1981	1982	1983	1984	1985	1986	1987
Redd Counts	35	45	98	211	141	33	94	90	143
Population Estimates	--	--	76	--	38	--	--	32	63

	1988	1989	1990	1991	1992	1993	1994	1995	1996
Redd Counts	136	119	109	61	12	46	32	28	35
Population Estimates	--	33	36	--	100	62	79	72	34

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Redd Counts	17	40	49	68	77	71	14	34	30	56
Population Estimates	9	134	49	46	63	94	55	--	35	--

Table 3-61. Redd Counts Completed in Shorty Creek During Basin Wide Surveys.

	1980	1981	1982	1986	1991	1992	1997	2000	2003
Shorty Creek	4	17	56	35	6	3	2	12	0

According to annual bull trout spawning site inventories from 1980 to 2005 (Weaver et. al. 2006, USDA Forest Service file data), Whale Creek supports up to 67% of the total bull trout spawning redds counted in the North Fork Flathead River system, and up to 42% of redds counted in the

entire Flathead River system. The stream is closed to recreational fishing to protect adfluvial spawning and rearing bull trout.

These declines reflect a trend in all North Fork Flathead River and Middle Fork Flathead River bull trout streams. Declines are due in part from drought in the late 1980s, over-fishing and habitat modification. Perhaps the most responsible mechanism for decline is the change in the Flathead Lake ecosystem and food chain as discussed in the overview. Habitat degradation does not appear to be a leading factor for decline in Whale Creek. This sub-population is functioning at unacceptable risk. (FUR)

Growth and Survival. As note above in the Species Status and Ecology section, this sub-population is in a rapid decline and may not improve until measures are taken to alleviate the changes in Flathead Lake. This sub-population is functioning at unacceptable risk. (FUR)

Life History Diversity and Isolation. The migratory form is still present, albeit in depressed numbers. No resident forms are known to exist. Re-colonization is unlikely if the migratory form is lost. This sub-population is functioning at risk. (FAR)

Persistence and Genetic Integrity. No introgression of bull trout has been documented. The potential for hybridization is non-existent as brook trout are not present in the watershed. Evidence suggests that there is substantial genetic divergence among bull trout populations from different sub-basins in the Flathead basin (Kanda et al. 1994). The amount of genetic divergence among populations within sub-basins is smaller, which suggests that there is some gene flow among sub-populations. Competition/predation is occurring with lake trout in Flathead Lake and all 12 members on a panel of fishery experts responded that there is a greater than 70% probability that this interaction is preventing a recovery goal maintaining 1980s bull trout populations for at least 15 years (McIntyre 1998). Therefore, the probability of this population persisting is low and is functioning at risk. (FAR)

Sub-population Characteristics-Habitat

In addition to the MDFWP survey in 1979, Flathead NF R1/R4 survey data exists from 1995 for Shorty Creek and from1996 for South Shorty Creek.

Temperature. Temperature data is incomplete. Peak summer time temperature in 1979 was 15.6° C for Whale Creek. The highest temperature recorded in South Fork Shorty Creek was 14° C and 15° C in Shorty Creek. There were 23 incidental temperature measurements associated with water quality monitoring procedures between 1977 and 1981 in upper whale Creek. The maximum water temperature recorded was 11.0° C. There were 205 incidental temperature measurements from1977 to 1994 in lower Whale Creek. The maximum water temperature recorded was 17.2° C. There was a mid-April through October continuous recording water temperature monitoring site on lower Whale Creek. This site was monitored from 1988 to 1991. The maximum temperature recorded for those years ranged from 9.5° to 11.7° C. (FA)

Sediment. The Flathead National Forest adopted Flathead Basin Commission (Weaver and Fraley 1991) recommendations for sediment in 1992 (Implementation Note #10). In short,

streams that have greater than 35% fines (<6.4mm) are considered threatened and streams with fines greater than 40% are considered impaired. McNeil core samples have been taken in Whale Creek since 1982. McNeil core sample fines in Whale Creek have fluctuated from a high of 37.2 in 1989 to a low of 22.5 in 1986. Surface fines measured occularly in South Fork Shorty Creek were 24.5 in 1995; surface fines measured in 1999 were 31.4.

McNeil core samples which measure the amount of streambed material less than 6.35 mm in bull trout spawning areas have been taken by MDFWP in Whale Creek since 1981. Samples taken in the fall of 2004 (after the 2003 fire) in Whale Creek increased from 32.1% to 34% indicating that there was a slight increase in sediment following the fire. This finding corresponds well with field observations. Spring rains following the fire have been slight, re-vegetation of ground cover has occurred extensively and erosion from the fire area has been very low. In 2004, a new McNeil core sampling site was established above the fire area to monitor fire effects. At this site fines were 35.6% in 2004 and 33.9% in 2005. Downstream of the fire area fines were 32.1% in 2003, 34% in 2004 and 33.1% in 2005. Percent fines were lower below the fire area than above, therefore the determination is Functioning At Risk. (FAR)

Table 3-62. Median Percentage of Streambed Material Smaller than 6.35 mm in McNeil Core Samples Collected from Whale Creek in Flathead Lake Tributary Streams, 1981 - 2004.

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Whale Creek	25.1	31.8	32.6	29.5	22.5	26.0	28.9	37.2	35.3	--	34.2	32.2

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Whale Creek	33.4	29.5	32.6	31.4	30.9	31.3	31.9	30.8	31.6	30.9	32.1	34.0

Chemical Contamination/Nutrients. There are no concerns with chemical contamination or excess nutrients. Whale Creek was listed on the State's 303(d) list of impaired water bodies due to siltation associated with timber harvest and roads. In 2004, a TMDL was completed that resulted in the removal of Whale Creek from the 303(d) list. (FAR)

Habitat Access. There are no man-made barriers in this watershed. (FA)

Embeddedness. The Flathead National Forest does not measure embeddedness; however substrate scores, which indicate the quality of rearing habitat for juvenile bull trout, have been taken. The scores (12.1 in 1999) indicate that rearing habitat is good. (FA)

Large Woody Debris. The 1979 survey indicates that debris was low and unstable. There are locations along streams where riparian harvest has occurred which has compromised recruitment of LWD. LWD in South Fork Shorty Creek averaged 214 pieces/mile. This should provide a source of LWD to be distributed downstream in Whale Creek. (FAR)

Pool Frequency. The 1979 survey determined that there was a 50% run, 40% riffle and 3% pool in Reach 1, and 50% run, 20% rifle, and 19% pool in Reach 2. Reach 1 started at the mouth and extended to about a mile above the bridge on Road #1671. Reach 2 extended to the Shorty Creek confluence. This most likely correlates with the low amount of wood in the stream. Pools comprised 19% of the habitat units in South Fork Shorty Creek. (FAR)

Large Pools. The 1979 survey used a pool classification system to indicate the value of a pool as fish habitat based upon size, depth and cover. Pool quality was good in Reach 2 with 37% of pools being Class I or II while only 15% were Class I or II in Reach 1. Pool quality was not measured in South Fork Shorty Creek. (FAR)

Off Channel Habitats. Sufficient off channel habitat exist. (FA)

Refugia. Quality habitat exists but is not necessarily protected. INFISH would play a major role in protecting riparian zones; however early timber harvest in the headwaters has resulted in increased peak flows and increased bed load movement and deposition. This is also the case in most North Fork Flathead River tributaries. (FA)

Wetted Width/Maximum Depth Ratio (W/D). No W/D data exists for Whale Creek. It is inferred that this system has had increase peak flows due to timber harvest and road construction, resulting in some bed load movement. In other North Fork Flathead River tributaries this has resulted in increased W/D ratios. The width/maximum depth ratio for South Fork Shorty Creek is around 9, while the wetted width/depth ratio is 26. (FAR)

Streambank Stability. Stability for South Fork Shorty Creek is 76%. The R-1 Stream Channel Stability Ratings for Shorty Creek completed in 1979 range from 55 to 67, all within the good condition range (39-76). The R-1 Stream Channel Stability Ratings for Whale Creek completed in 1976 to 1979 were 50 to 99, which range between a good and a fair condition (77-114). (FA)

Floodplain Connectivity. The stream has access to its floodplain. The average valley width is 115m and is generally unconfined with a sinuous pattern. (FA)

Peak Flow. The water yield increase was modeled for the basin in 1991; see the Hydrology report for the latest water yield estimates. The model estimated a 6.5% annual water yield increase due to the road building and harvest activities. (FAR)

Drainage Network. There are areas of roads and skid trails that intercept near surface groundwater during the spring snow melt period. These areas effectively extend the channel network. (FAR)

Road Density and Location. There are 83 miles of road in the Whale Creek drainage. Densities range from 2.2 mi/mi^2 in Lower Whale Creek to 0.2 mi/mi^2 in upper Whale Creek. Fortunately, many of the roads are below bull trout spawning. For the most part, roads are away from the stream. (FAR)

Disturbance History. High intensity harvest more than 20 years ago has occurred on 7,600 acres; high intensity harvest fewer than 20 years ago has occurred on 1,700 acres. Low intensity harvest more than 20 years ago has occurred on 2,202 acres; and low intensity harvest fewer than 20 years ago has occurred on 740 acres. Much of the older harvest occurred in the headwaters during the 1960s, resulting in bed load deposition in the lower reaches of the stream. (FAR)

Riparian Conservation Areas. There has been some riparian harvest in the past which has reduced the amount of trees available for recruitment. (FAR)

Disturbance Regime. There was a 148 acre fire that burned in upper Shorty Creek in 1973; and in 1985 there was a 167 acre fire that burned in upper Whale Creek. Whale Creek also has several avalanche chutes. During the Wedge Canyon Fire, 4,806 acres (about 11.7%) of the total 40,959 acres in the Whale Creek drainage burned, and 1,827 acres (100%) of the Hornet Creek drainage burned. The ECA for Whale Creek, adjusted for the burn, is 11%; the ECA for the Hornet Creek drainage is 91%. To reflect this watershed change, the Disturbance Regime rating has been lowered from Functioning Appropriately to Functioning At Risk. (FAR)

Integration of Species and Habitat Conditions. Habitat in Whale Creek is in good condition and recovering from impacts due to previous logging activities. The stream is connected and provides good refugia. However, bull trout are depressed as a result of changes in Flathead Lake, as previously discussed in Species Status and Ecology. (FUR)

Moose Creek

Moose Creek is a 3rd order tributary. Bull trout, westslope cutthroat trout, and sculpins are present; although bull trout have only been found in the lower 2.5 miles. Bull trout occur in limited numbers; no redd counts for bull trout have been conducted in Moose Creek. Moose Creek is not a priority bull trout watershed.

Sub-population Characteristics-Biological

Sub-population Size. This population is part of the larger Flathead Lake meta-population and is functioning at unacceptable risk. (FUR)

Growth and Survival. As note above in Species Status and Ecology, this meta-population is in a rapid decline and may not improve until measures are taken to alleviate the changes in Flathead Lake. This sub-population is functioning at unacceptable risk. (FUR)

Life History Diversity and Isolation. The migratory form is still present albeit in depressed numbers; no resident forms are known to exist. Re-colonization is unlikely if the migratory form is lost. This sub-population is functioning at risk. (FAR)

Persistence and Genetic Integrity. No introgression of bull trout has been documented. The potential for hybridization is non-existent as brook trout are not present in the watershed. Evidence suggests that there is substantial genetic divergence among bull trout populations from different sub-basins in the Flathead basin (Kanda et al. 1994). The amount of genetic divergence

among populations within sub-basins is smaller, suggesting that there is some gene flow among sub-populations. Competition and predation is occurring because of lake trout in Flathead Lake. All 12 members on a panel of fishery experts indicated that there is a greater than 70% probability that this interaction is preventing the recovery goal seeking to maintain 1980s bull trout populations for at least 15 years (McIntyre 1998). Therefore, the probability of this population persisting is low and is functioning at risk. (FAR)

Sub-population Characteristics-Habitat

Most North Fork Flathead River tributaries were surveyed between 1979 and 1982 by MDFWP personnel as part of an Environmental Protection Agency study.

Temperature. The average temperature recorded in 1980 was 15° C. (FA)

Sediment. The Flathead NF adopted Flathead Basin Commission (Weaver and Fraley 1991) recommendations for sediment in 1992, (Implementation Note #10). In short, streams that have greater than 35% fines (<6.4mm) are considered threatened and streams with greater than 40% fines are considered impaired. McNeil core samples have never been taken in Moose Creek. In 1980, percent fines were visually estimated to be 27%. If Moose Creek follows the trend of other North Fork Flathead River tributaries, then sediment is Functioning Appropriately. (FA)

Chemical Contamination/Nutrients. There are no concerns with chemical contamination or excess nutrients. This stream is not on the State's 303(d) list of impaired water bodies. (FA)

Habitat Access. There are no man-made barriers in this watershed. A beaver dam near the mouth may be limiting bull trout migration upstream. (FA)

Embeddedness. The Flathead National Forest does not measure embeddedness. Given the small amount of fines and comments from the survey an inference will be made that embeddedness does not appear to be a problem. (FA)

Large Woody Debris. Channel debris was low in the 1980 survey. (FAR)

Pool Frequency. Pools made up less than 5% of the Moose Creek's total area in the 1980 survey. (FAR)

Large Pools. Pool quality was rated as poor. (FAR)

Off Channel Habitats. Sufficient off channel habitat exists. (FA)

Refugia. This stream is too small to serve as refugia for bull trout. Large and more important streams exist within this sub-basin. (FAR)

Wetted Width/Maximum Depth Ratio. There has been less headwater harvesting in this drainage compared to other North Fork Flathead River tributaries. Bed load movement is not as prevalent. (FA)

Streambank Stability. The R-1 Stream Channel Stability Ratings completed from 1976 to 1979 were within the good condition range (39-76). (FA)

Floodplain Connectivity. The stream has access to its floodplain. The stream is generally unconfined with a sinuous pattern. (FA)

Peak Flow. Bed load is not prevalent in this drainage and headwater harvest is minimal. (FA)

Drainage Network. There are some areas of roads and skid trails that intercept near surface groundwater during the spring snow melt period. These areas effectively extend the channel network. (FAR**)**

Road Density and Location. There are 56 miles of road in this Hydrologic Unit Code (HUC). The density is the second highest of any North Fork Flathead River HUC at 1.7 mi/mi². The road parallels the stream and there have been slumps into the creek over the years. (FAR)

Disturbance History. High intensity harvest more than 20 years ago occurred on 2,728 acres; high intensity harvest fewer than 20 years ago took place on 338 acres. Low intensity harvest more than 20 years ago occurred on 720 acres; and low intensity harvest fewer than 20 years ago took place on 980 acres. (FAR)

Riparian Conservation Areas. Recruitment of trees has been reduced in some areas from roads and harvest; resulting in the reduction of LWM in the stream. (FAR)

Disturbance Regime. There was a 1,381 acre wildfire in 1967. There haven't been many other natural disturbances in Moose Creek. (FA)

Integration of Species and Habitat Conditions. Moose Creek is not an important bull trout stream, although juveniles have been known to enter this stream to rear. The migratory form is depressed due to changes in Flathead Lake. (FAR)

Red Meadow Creek

Red Meadow Creek is a 3rd order stream. Bull trout, westslope cutthroat trout, mountain whitefish and sculpins are present. Arctic grayling were stocked in Red Meadow Lake and are also present in the stream.

Sub-population Characteristics-Biological

Sub-population Size. Redd counts are conducted during basin wide survey years, but not during annual index surveys. It is assumed that bull trout spawners have decline in Red Meadow Creek similar to the declines in other North Fork Flathead River tributaries. Juvenile populations have shown a similar trend.

Table 3-63. Redd Counts and Population Estimates in Red Meadow Creek 1979-2005

	1979	1980	1981	1982	1983	1984	1985	1986	1987
Redd Counts		6	19	10				8	
Population Estimates					75			68	48

	1988	1989	1990	1991	1992	1993	1994	1995	1996
Redd Counts				15					
Population Estimates	40	24	50				5	2	5

	1997	1998	1999	2000	2001	2002	2003	2004	2005
Redd Counts	3			1			3		
Population Estimates		14	11	5	6	8	18	5	1

These declines reflect a trend in all North Fork Flathead River and Middle Fork Flathead River bull trout streams. Declines are due in part to drought in the late 1980s, over-fishing and habitat modification. Perhaps the most responsible mechanism for decline is the change in the Flathead Lake ecosystem and food chain as discussed earlier. Habitat degradation does not appear to be a leading factor for decline in Red Meadow Creek. This sub-population is functioning at unacceptable risk. (FUR)

Growth and Survival. As note above in Species Status and Ecology, this sub-population is in a rapid decline and will not improve until measures are taken to alleviate the changes in Flathead Lake. This sub-population is functioning at unacceptable risk. (FUR)

Life History Diversity and Isolation. The migratory form is still present albeit in depressed numbers; no resident forms are known to exist. Re-colonization is unlikely if the migratory form is lost. This sub-population is functioning at risk. (FAR)

Persistence and Genetic Integrity. No introgression of bull trout has been documented. The potential for hybridization is non-existent as brook trout are not present in the watershed. Evidence suggests that there is substantial genetic divergence among bull trout populations from different sub-basins in the Flathead basin (Kanda et al. 1994). The amount of genetic divergence among populations within sub-basins is smaller which suggests that there is some gene flow among sub-populations. Competition and predation is occurring because of lake trout in Flathead Lake. All 12 members on a panel of fishery experts indicated that there is a greater than 70% probability that this interaction is preventing the recovery goal seeking to maintain 1980s bull trout populations for at least 15 years (McIntyre 1998). Therefore, the probability of this population persisting is low and it is functioning at risk. (FAR)

Sub-population Characteristics-Habitat

Temperature. Temperature data is incomplete. Peak summer time temperature in 1979 was 15.6°C. Red Meadow Lake may contribute to warmer temperatures as surface water is drained through the outlet. There were 13 incidental temperature measurements associated with water quality monitoring procedures from 1979 to 1981 in upper Red Meadow Creek. The maximum water temperature recorded was 15.0° C. There were 21 incidental temperature measurements from 1978 to 1981 in lower Red Meadow Creek. The maximum water temperature recorded was 12.0° C. (FA)

Sediment. The Flathead National Forest adopted Flathead Basin Commission (Weaver and Fraley 1991) recommendations for sediment in 1992 (Implementation Note #10). In short, streams that have greater than 35% fines (<6.4mm) are considered threatened while streams with greater than 40% fines are considered impaired. McNeil core samples were taken in Red Meadow Creek in 1990 (40.1% fines). No other sediment data exists for Red Meadow Creek; however, given that the pattern of disturbance is similar to the North Fork Flathead River tributaries an inference will be made that sediment would be considered functioning at risk. (FAR)

Chemical Contamination/Nutrients. There are no concerns with chemical contamination or excess nutrients for Red Meadow Creek. This stream is listed on Montana's 303(d) list of impaired water bodies. The stream is listed as impaired for aquatic life support (cold water fishery) due to siltation and other alteration, primarily caused by natural and silvicultural treatments. (FAR)

Habitat Access. There are no man made barriers in this watershed. (FA)

Embeddedness. The Flathead National Forest does not measure embeddedness. Substrate scores (12.3 in 1999) indicate that rearing habitat is good. (FA)

Large Woody Debris. The 1979 survey indicates that debris was moderate and stable. Extensive harvest along the riparian zone has occurred along Red Meadow Creek. Recruitment of potential LWD to the stream has been reduced. (FAR)

Pool Frequency. The 1979 survey determined that pool habitat was limited; the highest rating of 15% occurring in the headwaters. This is most likely correlated with the low amount of wood in the stream. (FAR)

Large Pools. The 1979 survey used a pool classification system to indicate the value of a pool as fish habitat based upon size, depth and cover. Only 14% of the pools were classified as Class I or II. Therefore, pool quality would be poor. (FAR)

Off Channel Habitats. Sufficient off channel habitat exist. (FA)

Refugia. Red Meadow Creek has limited bull trout habitat which is not as protected as wilderness; but RHCAs do offer riparian area protection. (FAR)

Wetted Width/Maximum Depth Ratio. No W/D data exists, however, it is inferred that this system has had increased peak flow due to timber harvest and road construction, resulting in some bed load movement. In other North Fork Flathead River tributaries this has resulted in increased W/D ratios. (FAR)

Streambank Stability. The R-1 Stream Channel Stability Ratings for Red Meadow Creek, completed from1976 to 1982, were 53 to 108. These range between good condition (39-76) and fair condition (77-114). (FA)

Floodplain Connectivity. The stream has access to its floodplain. The average valley width is 100m and is occasionally confined with a sinuous to an irregular pattern. (FA)

Peak Flow. The water yield increase was modeled for the North Fork of Red Meadow Creek in 1991, see the Hydrology report for the latest water yield estimates. The model estimated a 7.8% annual water yield increase due to the road building and harvest activities. There are visual indicators of bed load movement in tributaries affected by the 1988 wildfire. (FAR)

Drainage Network. There are areas of roads and skid trails that intercept near surface groundwater during the spring snow melt period. These areas effectively extend the channel network. (FAR)

Road Density and Location. There are 37 miles of road in the Red Meadow watershed with a density of 1.3 mi/mi². The road is away from the creek for the most of its length. (FA)

Disturbance History. High intensity harvest more than 20 years ago has occurred on 2,080 acres; high intensity harvest fewer than 20 years ago has occurred on 1,024 acres. Low intensity harvest more than 20 years ago has occurred on 1,753 acres; low intensity harvest took place on 439 acres fewer than 20 years ago. Much of the harvest activity occurred in the headwaters area. (FAR)

Riparian Conservation Areas. There was some riparian harvest in the headwaters which jeopardized recruitment of trees to the stream. (FAR)

Disturbance Regime. In 1970 there was a 1,800 acre wildfire and a 1988 wildfire in the lower drainage. There are numerous avalanche chutes in this drainage. (FA)

Integration of Species and Habitat Conditions. Habitat is in fair condition and connected to the North Fork Flathead River; populations are depressed due to changes in Flathead Lake as discussed in Species Status and Ecology above. (FUR)

Hay Creek and Moran Creek

Hay Creek and Moran Creek are both 3rd order streams. Bull trout, westslope cutthroat trout, mountain whitefish, and sculpins are present. Neither of these streams are priority bull trout watersheds; although bull trout occur throughout Hay Creek and Moran Creek in limited

numbers. Hay Creek has had subsurface flow above its confluence with the North Fork Flathead River, which may be restricting up-stream access for bull trout in the fall. It appears that this dates back at least to 1955 as documented in Dan Block's Master's Thesis (Block 1955). This is most likely from the low gradient in the area and extensive beaver dam complexes. Deposition of bed load in later years has aggravated this problem. MDFWP completed channel work on private land over the last three years to alleviate this problem.

Sub-population Characteristics-Biological

Sub-population Size. Redd counts and juvenile population estimates have not been conducted on these streams. It is assumed that the factors that affect other North Fork Flathead River tributaries are also at work here. This sub-population is functioning at unacceptable risk. (FUR)

Growth and Survival. As note above, this sub-population is assumed to be in decline and will not improve until measures are taken to alleviate the changes in Flathead Lake. This sub-population is functioning at unacceptable risk. (FUR)

Life History Diversity and Isolation. The migratory form is assumed to still be present albeit in depressed numbers. A resident form may exist because of the seasonal and partial access problems, but more work needs to be conducted to determine if this is true. Re-colonization is unlikely if the migratory form is lost. This sub-population is functioning at risk. (FAR)

Persistence and Genetic Integrity. No introgression of bull trout has been documented. The potential for hybridization is non-existent as brook trout are not present in the watershed. Evidence suggests that there is substantial genetic divergence among bull trout populations from different sub-basins in the Flathead (Kanda et al. 1994). The amount of genetic divergence among populations within sub-basins is smaller which suggests that there is some gene flow among sub-populations. Competition and predation is occurring because of lake trout in Flathead Lake and all 12 members on a panel of fishery experts responded that there is a greater than 70% probability that this interaction is preventing a recovery goal maintaining bull trout populations for at least 15 years (McIntyre 1998). Therefore, the probability of this population persisting is low and is functioning at risk. (FAR)

Sub-population Characteristics-Habitat

Temperature. Peak summer time temperature in 1980 for both streams was 10°C. (FA)

Sediment. The Flathead National Forest adopted Flathead Basin Commission recommendations for sediment in 1992 (Implementation Note #10). In short, streams that have greater than 35% fines (<6.4mm) are considered threatened and streams with greater than 40% fines are considered impaired. McNeil core samples have not been taken for these streams. Sediment would be considered functioning at risk given the pattern of disturbance in Hay Creek. (FAR)

Chemical Contamination/Nutrients. There are no concerns with chemical contamination or excess nutrients. This stream is not on Montana's 303(d) list of impaired water bodies. (FA)

Habitat Access. There are no man made barriers in this watershed. (FA)

Embeddedness. The Flathead National Forest does not measure embeddedness. Best professional judgment based upon other streams suggests functioning at risk. (FAR)

Large Woody Debris. The 1980 survey indicates that debris was low to moderate and stable. As a whole, recruitment of LWD has not been compromised from riparian harvests in Moran Creek; however, a moderate amount of harvest has occurred within and along riparian areas in Hay Creek. (FAR)

Pool Frequency. The 1980 survey determined that pool habitat made up, at most, 19% in one reach, but only about 5% in many of the other reaches. This most likely correlates with the low amount of wood in the stream. (FAR)

Large Pools. The 1980 survey used a pool classification system to indicate the value of the pool as fish habitat based upon size, depth and cover. The upper reaches of Hay Creek and the lower reaches of Moran Creek had a high percentage of Class I or II pools. Therefore, pool quality appears good. (FA)

Off Channel Habitats. Sufficient off channel habitat exist. (FA)

Refugia. More important bull trout streams exist in the North Fork Flathead River. These streams would not serve as good refugias for bull trout. (FAR)

Wetted Width/Maximum Depth Ratio. No W/D data exists, however, it is inferred that this system has had increase peak flows due to timber harvest and road construction, resulting in some bed load movement. In other North Fork Flathead River streams this has resulted in increased W/D ratios. (FAR)

Streambank Stability. The R-1 Stream Channel Stability Ratings for Moran Creek, completed between 1976 and 1980, were 53 to 104. These range between a good condition (39-76) and a fair condition (77-114). The R-1 Stream Channel Stability Ratings for Hay Creek completed between 1976 and 1980 were 44 to 100; again ranging between good and fair condition. There is a trend of increased rating values in the later years of measurement. (FAR)

Floodplain Connectivity. The stream has access to its floodplain. The average valley width for Hay Creek is 90m and is generally confined with a sinuous pattern. Moran Creek has an average valley width of 70m and is occasionally confined. (FA)

Peak Flow. There are visual indicators of bed load movement in the main stem of Hay Creek. Considering the amount of road construction and past harvest activities an increase in peak flow would be expected. (FAR)

Drainage Network. There are areas of roads and skid trails that intercept near surface groundwater during the spring snow melt period. These areas effectively extend the channel network. (FAR**)**

Road Density and Location. There are 83 miles of road in this HUC. The density is 1.9 mi/mi². While the road is not in the valley bottom, there are numerous stream crossings. (FAR)

Disturbance History. High intensity harvests more than 20 years ago have occurred on 3,172 acres; high intensity harvests fewer than 20 years ago have occurred on 517 acres. Low intensity harvest more than 20 years ago occurred on 1,589 acres; and low intensity harvests fewer than 20 years ago have occurred on 356 acres. Much of the harvest was in the headwaters area. (FAR)

Riparian Conservation Areas. There has been considerable riparian harvest in the headwaters area. (FAR)

Disturbance Regime. In 1981 there was a 237 acre wildfire and there are avalanche chutes in the headwaters. (FA)

Integration of Species and Habitat Conditions. Hay Creek is marginal bull trout habitat. Beaver dams and subsurface flows near the mouth most likely limit upstream migration of adults in the fall. MDFWP has made attempts to channelize flow and reconnect upstream habitats, although it is too early to tell if this will be effective. (FUR)

Wedge Canyon Fire Sediment Monitoring Results

The results of sediment monitoring following the Wedge Fire in 2003 are reported in the following tables. A McNeil core sampling site already existed downstream of the fire area in Whale Creek and following the fire another site was established upstream of the fire area. The two sites allow a comparison between sediment levels below and above the fire area. Results for both substrate scores, which look at rearing habitat in interstitial areas and percent fines, are shown in Table 3-64 and Table 3-65. Results for Trail Creek are also included to increase the power of the analysis (i.e., sample size). Results are reported for sites upstream and downstream of the fire area.

Table 3-64. 2003 – 2007 Substrate Scoring Results from Whale Creek and Trail Creek (Upstream and Downstream from the Burned Area Emergency Rehabilitation (BAER) Treatment Sites).

Stream	2003	2004	2005	2006	2007
Whale Creek - Upstream	12.6	11.2	11.5	11.8	12.1
Whale Creek - Downstream	N.A.	12.7	11.6	11.7	11.5
Trail Creek – Upstream	N.A.	11.0	10.6	10.1	10.4
Trail Creek - Downstream	N.A.	12.8	13.1	12.8	12.6

Values less than 10.0 indicate threatened status and values less than 9.0 indicate impaired status; higher scores indicate a better habitat.

Table 3-65. Hollow Core Sampling Results (Median % < 6.35 mm; n=12) from Critical Bull Trout Spawning Areas in Whale Creek Above and Below the BAER Treatment Site and in Trail Creek Below the BAER Treatment Site for Spawning Years 2003, 2004, 2005 and 2006.

Stream	2003	2004	2005	2006
Whale Creek - Upstream	N.A.	35.6	33.9	33.9
Whale Creek - Downstream	32.1	34.0	33.1	33.1
Trail Creek - Downstream	30.3	30.6	31.7	31.7

It appears from the monitoring data that the Robert Wedge Fire has had very little effect upon sediment levels in Whale and Trail creeks.

Environmental Consequences

The primary consideration for fish habitat is increased sedimentation that can degrade spawning gravels, reduce winter rearing habitat by filling pools and spaces between gravels, and decrease aquatic insect production (Bjornn et al. 1977, Irving and Bjornn 1984, Weaver and Fraley 1991). These effects directly and indirectly impact fish populations by reducing spawning success, over-winter survival and food availability.

The effects of increased water yield on fish habitat would be a secondary concern. Increased water yields can cause more erosion on hillsides, more stream channel erosion and more bank failures that would increase stream sediment loads (Everest et al. 1985). Furthermore, higher water yields can break open debris jams and release stored sediment loads suddenly. High water yields may produce streamflows capable of moving massive amounts of bed load that fill pools and displaces the eggs and insects that are in the gravel. These effects indirectly affect fish populations by reducing habitat complexity.

Impacts to riparian zones and in-stream woody debris recruitment are other concerns when activity occurs along the stream channel. When a forest is left intact near streams, trees are available for shade and fall into the stream channel. Woody material in the stream channel can serve as sediment traps, control channel erosion, scour pools, provide a food base for insects and provide cover for fish (Bryant 1983).

Alternative 1 (No Action) – Direct, Indirect and Cumulative Effects

Direct effects as described in this report refer to fish mortality or disturbance. Indirect effects refer to modification of habitat, which could result in individual or population effects.

Vegetation in previously harvested and burned areas would mature over time resulting in gradually decreasing water yield for all watersheds and an improved condition. Existing roads would continue to channel surface flow and sediment into streams. Sediment levels may stay elevated and undersized culverts could plug and fail resulting in large increases of sediment into streams.

Cumulative effects in the project area include past, ongoing, and proposed activities from timber harvest, road building and maintenance, private land development, fires and other natural events. These activities have and would continue to incrementally affect fisheries habitat and fish populations by increasing peak flows, decreasing channel stability and increasing sediment inputs. No additional impacts would occur from this alternative and fish populations and habitat would remain as they currently are.

Direct and Indirect Effects Common to Alternatives 2, 3 and 4

INFISH Riparian Habitat Conservation Areas (RHCAs) would be established along all wetlands and stream courses. RHCAs are portions of watersheds where riparian dependent resources receive primary emphasis. The RHCAs are within specific management areas and are subject to standards and guidelines in INFISH and to existing standards and guidelines in the Flathead Forest Plan.

INFISH highlights four roles of RHCAs: 1) influencing the delivery of coarse sediment, organic matter, and woody debris to streams; 2) providing root strength for channel stability; 3) shading the stream; and 4) protecting water quality (Naiman et al. 1992). Processes in riparian areas and streams vary within watersheds. In steep, high gradient, non-fish bearing streams, RHCAs would be important in protecting water quality, shading the stream, influencing and storing sediment, and providing a source of recruitment of wood to streams. Farther down in the watershed, along Whale Creek for example, roots would provide stability along the banks, and as trees fall into the stream they would help scour pools and provide cover for rearing. Lastly, trees provide a colonization site for aquatic insects. Therefore, it is important to understand that processes change along a gradient from the top of the headwater tributaries downstream to main rivers.

Understanding these processes in context with the location of the project is important because objectives may vary. For example, if the project is along a headwater fish bearing stream, retention of large woody debris along the stream would be critical as that wood is important for shading, bank stability, filtering sediment, cover, pool formation and insect production. However, for a project along a river, the trees are important for filtering sediment and bank stability. The wood has a reduced role in pool formation, cover, shading, and production. Other processes have an increased role in providing fish habitat in larger rivers.

RHCAs widths would be 300' for all fish bearing streams in the project area, e.g., Whale Creek, Red Meadow Creek, Moose Creek, Hawk Creek, Spring Creek, Spruce Creek, Hay Creek, and Moran Creek. RHCAs widths would be 150' for perennial non-fish bearing streams and wetlands greater than 1 acre, which would include the headwaters of streams where most of the prescribed burns are proposed. RHCAs widths would be 50' for intermittent streams and tributaries in the headwaters where the prescribed burns are proposed; with the exception of Whale and Red Meadow drainages where a 100’ RHCA is required for intermittent streams as these are “priority” bull trout watersheds.

No LWD would be removed from RHCAs in the project area. Consequently, this project would not interfere with the distribution and function of LWD in the stream network. Riparian

management objectives would be maintained in all units and stream reaches. The retention of LWD within the RHCAs would allow natural recruitment processes to function over time and contribute to the development of the complex habitats essential to bull trout survival (Rieman and McIntyre 1993; Hauer et al. 1999). The INFISH riparian buffer widths are displayed in Table 3-66.

Table 3-66. INFISH Riparian Buffer Widths in Feet, for Each Side of Bank-Full Channel.

Type of Water Body	Minimum INFISH Buffer Width (Feet)
Fish-Bearing Streams	300'
Permanently Flowing, Non-Fish Bearing Streams	150’
Seasonally Flowing or Intermittent Streams	50’
Seasonally Flowing or Intermittent Streams (Priority Watersheds: Whale & Red Meadow)	100’
Ponds, Lakes, or Wetlands > 1 Acre	150’
Ponds, Lakes, or Wetlands < 1 Acre	100’
Landslide Prone Areas	100’

Direct and Indirect Effects by Each Action Alternative

The action alternatives vary with respect to vegetation treatment acres and road treatments. Effects upon fish and fish habitat differ slightly between alternatives with Alternative 3 having the greatest short term effect due to replacement and removal of culverts. Culvert replacements and removals will be discussed in more detail in the roads section of this report.

Mechanized Treatments

Mechanized vegetation treatments by alternative are displayed below in Table 3-67. Although the proposed treatments vary by alternative, particularly with regards to thinning, the effects to fisheries do not markedly differ. Thinning is the predominant silvicultural prescription. Sapling thinning would have no effect on fisheries due to the size of trees removed, hand operation or limited mechanical treatment and no log haul. Peak flows are small (see Hydrology section) as the units are well dispersed across the watersheds and would not affect fish or habitat. Table 3-68 displays acres in bull trout watersheds that would be treated under Alternative 4 which has the most acres treated.

Table 3-67. Summary of Treated Acres by Alternative and Treatment Type.

Treatment Type	Alternative 2 (Acres)	Alternative 3 (Acres)	Alternative 4 (Acres)
Light Understory Thin	92	0	92
Patch Seedtree	124	75	173
Thin Sapling/Small Trees	451	327	585
Thin Sapling	414	94	1299
Thin Sapling 30%	118	0	118
Thin Small/Medium Tree	879	431	1316
Grand Total	**2078**	**927**	**3583**
Prescribed Burn	1364	1192	1431

Table 3-68. Treatment acres by Watershed under Alternative 4 (Greatest Number of Acres).

Watershed	Treatment Acres
Whale	397
Red Meadow*	428
Hay/Moran	691

*All treated acres in Red Meadow are sapling thinning and no log hauling would occur.

The vegetative treatments have been designed for minimal effect upon fisheries and water quality. As previously mentioned, RHCAs would be applied to all treatment units bordering streams. A sizable portion of the units are thinning of sapling sized trees, with no removal of logs, and no effect on fisheries. The unit locations are primarily on flat ground (< 10% slope) lower in the drainages, significantly reducing sediment transport and peak flow effects. Sediment modeling predicted that no sediment would be generated from the harvest or haul routes. One temporary road to Unit BB in Spruce Creek would have a culvert installed that would generate and route sediment to Spruce Creek. The unit locations and proposed haul routes are below bull trout spawning areas, thereby minimizing impacts to embryonic survival.

Riparian values for all watersheds such as water temperature, filtration of sediment and contaminants, large woody debris recruitment and stream bank condition would not be compromised due to the implementation of RHCAs. The implementation of RHCAs on all stream channels would insure that this project would not retard the attainment of Riparian Management Objectives such as temperature, amount of large woody debris and frequency of pools.

Prescribed Burns

There are 9 total prescribed burn units proposed along south facing slopes (Alternative 4, which proposed the greatest amount of burn acres). These burns are primarily intended to create forage

for wildlife. Prescribed burning and culvert removal would generate the most sediment of all the proposed alternatives. The modeling exercise in the Hydrology section displays the amount of sediment expected to be generated for each watershed. The largest modeled increases are for Moose Creek, Red Meadow Creek, Hay Creek and Moran Creek; all of which contain bull trout.

The Water Erosion Prediction Project model (WEPP) was used (see Hydrology section) and predicts sediment generated, but does not estimate the quantity of sediment routed or delivered to a stream network; sediment having the potential to affect fisheries and fish habitat. For example, sediment produced by a prescribed burn may be stored in vegetation or debris outside the unit, never reaching a stream (dependant upon the distance from the stream to the burn). Further confounding any prediction of sediment delivery are rain events. Vegetation quickly recovers following a prescribed burn, particularly since most are spring burns of light intensity. If rain doesn't occur the first spring following the activity, then very little sediment would be routed to a stream. Once vegetation is re-established, a normal rain event in subsequent seasons would fail to route sediment because of the storing and trapping ability of that vegetation. Conversely, a large spring or fall rain event in the first year following the burn would have the highest likelihood to route sediment to streams.

Of the prescribed burn units, there is one perennial stream in Unit 7 of Hay Creek that would have the highest likelihood of routing sediment to Hay Creek. Mitigation measures to reduce this potential impact could include excluding this stream by making two burn units, falling trees parallel to the slope to act as sediment traps or installing wattles parallel to the slope to trap sediment. The remaining burn units have ephemeral channels within them and the likelihood of sediment reaching the main drainages is very low, therefore impacts upon fisheries would be insignificant.

Road Related Work

All action alternatives have a varying degree of road related work such as BMPs, culvert removals or upgrades and log haul. Chapter 2 summarizes much of this information.

Temporary Roads. Each alternative would open up 1.7 miles of an old road template in Teepee Creek to access unit B. This road was last used during the 2003 Wedge Fire and rehabilitated in the fall of that year. Opening this road would require very little work, and there are no culverts or stream crossings on this road. The amount of sediment reaching Tepee Creek, a non-bull trout stream, should be minimal from this action. In Spruce Creek, there is a road that would be used to reach unit BB which would have a culvert replaced in order to bring the road up to haul standards. This would generate some sediment in this non-bull trout watershed. The impacts to westslope cutthroat trout in Spruce Creek would be minor as the culvert would be removed after July 15 when fry have emerged from the gravels. In addition, about 0.3 miles of a new temporary road would be needed to reach unit D, unless private access is obtained. There are no streams associated with this road. The other access roads are behind recently bermed roads or gates and little road preparation would be required to facilitate the log haul.

BMPs. BMPs designed to minimize erosion from haul roads would be implemented along the 14 miles of road in Alternative 3, and the 24 miles of road in Alternative 4. The BMPs would be

implemented prior to the log haul in order to minimize the effects of the log haul. These roads do not closely parallel streams (i.e., they are not within 300') and adequate vegetative buffers exist along the streams; the only entry for sediment into streams would be at stream crossings. Installing BMPs would improve existing conditions; however, short term sediment inputs at stream crossings are likely when BMPs are implemented. No road work is occurring upstream of bull trout spawning. Sediment produced from the BMPs would not be of a magnitude to affect rearing, i.e. sediment would not be filling the large interstitial areas between large gravels and cobbles.

Culvert Removals/Up-sizing. See the Hydrology section of this EA for generated sediment estimates. Unlike the prescribed burns, culvert removals or upgrades would route sediment directly into the stream channel, impacting fish habitat and fish. Mitigation measures consist of dewatering and re-routing the stream at each site, and stream channel work would be performed between July 15 and August 30 to minimize the impact on spawning. The site would be rehabilitated with wattles, filter cloth, shrubs, grass seed, etc., to minimize erosion. Despite these mitigation measures, there would be short term impacts caused primarily by a reduction in the quality of spawning gravels as the interstitial areas become filled. There would also be the potential to impact the growth of juvenile fish as these same interstitial areas are important for invertebrate production and because extreme sediment levels reduce rearing space (Suttle et.al. 2004). The long term benefits associated with culvert removals and upgrades would be that the likelihood of culvert failure would be reduced, thereby reducing the amount of potential sediment delivered if a culvert were to fail.

Tables 3-69 and 3-70 below summarize the culvert removals and up-sizing that would occur under all the action alternatives. In the following tables westslope cutthroat trout are abbreviated as Wct, and bull trout are abbreviated as Bt

Table 3-69. Culvert Removal/Up-sizing on Existing Bermed Roads.

Watershed	Road #	Length (miles)	# Culverts	Action	Species
Spruce	10845	2.6	0	None	Wct
Spruce	10845A	.3	0	None	Wct
Spruce	10845B	.4	0	None	Wct
Teepee	10863	.6	0	None	Wct
Teepee	10864	.7	0	None	Wct
Teepee	10865	.9	0	None	Wct
Teepee	10865B	.4	0	None	Wct
Spring	10867	.7	0	None	Wct
Spring	10868	1.9	0	None	Wct
Spring	10869	.1	0	None	Wct
South Fork Red Meadow	10871	.4	0	None	Wct
Hay	10872	.3	0	None	Wct, Bt
Hay	10894	.5	0	None	Wct, Bt

Watershed	Road #	Length (miles)	# Culverts	Action	Species
Moose	10888	1.7	0	None	Wct, Bt
Moose	10889	.5	0	None	Wct, Bt
Moose	10889A	.3	0	None	Wct, Bt
Moose	5234	1.9	0	None	Wct, Bt
Moran	1643	.5	0	None	Wct, Bt
Red Meadow	1662	1.7	5	Remove culverts	Wct, Bt
Red Meadow	9839	2.9	7	Remove culverts	Wct, Bt
Hawk	1675	2.0	1	Remove culvert	Wct
Whale	5307A	.4	0	None	Wct, Bt

Table 3-70. Culvert Removal/Up-sizing on Roads Proposed to be Bermed.

Watershed	Road #	Length (Miles)	# Culverts[1]	Action	Species
Red Meadow	1681	6.4	12	Remove culverts[2]	Wct, Bt
Spruce	1681	4	17	Up-size 3 culverts, others are low risk	Wct
Moran	5241	4	3	Up-size 1 culvert, others are low risk	Wct, Bt
Teepee	5399	2.2	1	Culvert already up-sized under Robert/Wedge	Wct
Whale	1671	4.7	11	Up-size 2 culverts, others are low risk	Wct, Bt
Moose/Hawk	1677	3.7	5	Up-size 2 culverts, others are low risk	Wct, Bt
Hay	376	4.1	5	Retain culverts, low risk	Wct, Bt

[1]The number of culverts excludes cross drains

[2] Culvert removals would occur only in Alternative 3. Most of these 12 culverts would remain intact in Alternatives 2 and 4.

Roads 1681 (first 4 miles), 1671, 1677, and 5241 are snowmobile routes and the high risk culverts would be up-sized. Roads 5399, 1671, and 1677 have decisions to be bermed from Hornet Wedge or Robert Wedge that have not yet been implemented. The above table displays the number of culverts that would still exist behind berms and would need to be monitored and maintained. The reason the culverts would be retained would be to facilitate snowmobile access.

The culvert removals and up-sizing have the greatest potential to deliver sediment to streams. For example, 25 culverts (at 24 sites) would be removed in Red Meadow Creek. It is expected that 92 tons of sediment would be delivered while removing these culverts; however, 3-4 times that amount of sediment would be delivered were these culverts to fail due to lack of maintenance and because they exceeded their designed life.

These impacts are similar among alternatives, as most of the culvert removals/replacements are the same. The only difference between alternatives is on Road 1681 in Red Meadow Creek watershed, where the 12 culverts along this section of the road would be removed under Alternative 3 and most would remain intact under Alternatives 2 and 4. Therefore, Alternative 3 would have somewhat greater impacts due to sediment delivery to streams than the other alternatives.

Status of INFISH Riparian Management Objectives

INFISH established Riparian Management Objectives (RMOs). RMOs are stream habitat parameters that describe good fish habitat. Where site-specific data is available, RMOs can be adjusted to better describe local stream conditions. RMOs for stream channel conditions provide the criteria against which attainment or progress toward attainment, of riparian goals is measured. For this project, five default RMOs would apply: 1) pool frequency; 2) LWD; 3) mean maximum water temperature; 4) mean wetted width to depth ratio; and 5) bank stability. These default RMOs were intended to be interim standards designed to protect fish habitat until such time as the individual National Forests defined standards suitable to a particular area. In the absence of site-specific standards, the interim standards would apply. No site-specific standards have yet been defined on the Flathead National Forest.

Surveys aimed at INFISH RMO inventories have not been conducted in the two priority bull trout streams within the project areas. However, comparisons with inventoried streams on the Flathead National Forest allow some conclusions to be made with a reasonable degree of confidence. All streams should satisfy the INFISH temperature standard; i.e., stream temperatures do not exceed recommended maximums in spawning and holding habitat. Temperatures in Whale Creek following the Wedge Canyon Fire were consistently below 50 degrees throughout the summer of 2004. Furthermore, there is an abundance of upwelling in these streams that attracts bull trout spawners and provides an influx of 40-42 degree water that keeps these streams quite cool throughout the summer.

The number of pools per mile likely does not meet the INFISH standard; particularly in the (Rosgen) B and C stream channel reaches. This pattern is commonly observed in streams on the Flathead National Forest including wilderness reference reaches. This is most likely a reflection of differing geology between this region and the Cascade Mountains, where the standards were

developed. LWD likely exceeds the INFISH standard by a substantial amount, and should increase as a result of the fires. Pool frequency should increase over time as the streams recruit LWD.

Width/depth ratios on the Flathead National Forest typically exceed the INFISH standard of 10, particularly in the lower gradient reaches where bull trout spawning occurs. Bank stability likely meets or exceeds the INFISH standard of >80% stable (USDA Forest Service 2004). This project would not affect the attainment status of any INFISH RMO because no riparian harvest is occurring and water yield is not being appreciably increased, therefore stream processes remain unaffected.

Status of Environmental Baseline - Species and Habitat Indicators

Similar to the Affected Environment section, the environmental indicators for Whale Creek and Red Meadow Creek have been evaluated to identify changes that would occur to species and habitat indicators and to proposed critical habitat and associated PCEs as a result of the Red Whale project. The following indicators may change with project implementation: 1) Sediment; and 2) Road density and location. The Red Meadow Creek and Whale Creek drainages are particularly susceptible to additional inputs of sediment since both environmental baselines are already functioning at risk (FAR).

The culvert removal and upgrade aspects of this project would have the highest risk of impacting fish habitat in the short-term because of the risk of sediment from culvert removals being deposited in spawning reaches. The vegetation treatment proposed is much less likely to affect bull trout and westslope cutthroat trout habitat, because of the flat ground and low impact harvest systems, the use of BMPs and retention of INFISH riparian buffers -- all of which have proven effective at preventing sediment from being delivered to streams. The amount of sediment expected to result from project activities would not, by itself, lead to extensive pool filling and channel instability.

Sediment

Sediment yield is expected to increase as a result of harvest activity and culvert removal in the short-term. Over the long-term, sediment yield is expected to decrease as a result of lower road densities and riparian plantings at stream crossings.

Temporary roads scheduled to be used with project implementation would not require stream crossings (except for one crossing in Spruce Creek), would be utilized for a short time, and would be reclaimed upon completion of the harvest within the affected units. Identified segments of temporary road are located on stable soils downstream of spawning reaches. Stream buffers, as described in the INFISH plan, would be implemented around any stream channel in the vicinity of a temporary road.

Culvert removal/replacement work would be conducted between July 15 and August 30, after bull trout emergence and prior to spawning. This time frame would allow some re-establishment of new vegetation on these sites that would help stabilize the soil before the next runoff cycle.

Sediment resulting from culvert removal typically arrives in two pulses. The first pulse of sediment is short-term, usually lasting less than four hours, and results from the release of material trapped under and immediately adjacent to the pipe. The second pulse of sediment consists of material entrained during subsequent periods of higher flow, when the stream encroaches upon disturbed banks that have not yet re-vegetated (see Hydrology section of this EA). There are no anticipated major effects associated with this project on any population or habitat parameter, including critical habitat and associated PCEs.

Cumulative Effects

As mentioned previously, there are influences other than habitat degradation that are affecting the Flathead Lake bull trout population. Bull trout populations have declined equally in wilderness streams, Glacier National Park streams, and managed streams. The rivers and Flathead Lake can not be separated; they function as one. If bull trout are to occur in the river system, then measures must first be taken in Flathead Lake to restore bull trout. Monitoring of bull trout habitat by MDFWP indicates that bull trout habitat is as good as it has been since monitoring began in the early 1980s. The habitat is available to support bull trout. The same holds true for westslope cutthroat trout, perhaps even more so because a higher percentage of the population is fluvial or resident.

The Flathead River Drainage Bull Trout Status Report (MDFWP 1998) indicates that the three highest risks to bull trout are legal introductions, fisheries management, and forestry. Rural residential development was listed as a lesser concern. Land ownership in the Middle Fork Flathead River and the North Fork Flathead River are similar; private land (34,000 acres) is concentrated along the main rivers but is predominantly outside of the Wild & Scenic River corridor. Therefore, activities on private land rarely influence spawning habitat and would have a limited influence on any rearing occurring near the mouths of tributaries. The ownership pattern also influences the Flathead National Forest's permitting process. Access to National Forest land is generally provided from county or state roads; there are very few permits granted for easements and access through National Forest land. There would be no effect to bull trout critical habitat designated by the USFWS on the private portions of Red Meadow Creek, Whale Creek and the mainstem North Fork Flathead River as the habitat would be able to function at current levels.

Table 3-71. Checklist for Documenting Minor Effects to the Environmental Baseline and Critical Habitat.

Matrix Parameter	Red Meadow Creek	Whale Creek	Minor Effect
Sub-population Size	FUR	FUR	Maintain
Growth and Survival	FUR	FUR	Maintain
Life History, Diversity and Isolation	FAR	FAR	Maintain
Persistence and Genetic Integrity	FAR	FAR	Maintain
Temperature	FA	FA	Maintain

Matrix Parameter	Red Meadow Creek	Whale Creek	Minor Effect
Sediment	FAR	FAR	Short-term degrade; Long-term improve
Chemical Contamination/Nutrients	FA	FAR	Maintain
Physical Barriers	FA	FA	Maintain
Substrate Embeddedness	FA	FA	Maintain
LWD	FAR	FAR	Maintain
Pool Frequency and Quality	FAR	FAR	Maintain
Large Pools	FAR	FAR	Maintain
Off-Channel Habitat	FA	FA	Maintain
Refugia	FA	FA	Maintain
Width to Depth Ratio	FAR	FAR	Maintain
Bank Stability	FA	FA	Maintain
Floodplain Connectivity	FA	FA	Maintain
Change in Peak/Base Flows	FA	FAR	Improve
Drainage Network Increase	FA	FAR	Maintain
Road Density and Location	FA	FAR	Maintain
Disturbance History	FAR	FAR	Maintain
Riparian Conservation Areas	FA	FAR	Maintain
Disturbance Regime	FAR	FAR	Maintain
Integration of Species and Habitat Concerns	FAR	FUR	Maintain

Glacier National Park manages lands to the east of the North Fork Flathead River and to the north of the Middle Fork Flathead River, and provides excellent habitat for bull trout in occupied streams. Many Glacier National Park streams are of limited importance for bull trout due to elevated water temperatures flowing from lake outlets. The Montana Department of Natural Resources and Conservation manages over 15,000 acres in the Coal Creek State Forest, including the majority of lands in the disjunct Cyclone Lake bull trout population immediately south of the Red Whale project area.

There are several past and ongoing actions which may cumulatively affected fish and fish habitat including:

- The Robert Fire and Wedge Canyon Fire and post salvage projects
- Robert and Wedge Canyon BAER Projects
- Hazard Tree Felling
- Personal Use Firewood Cutting on National Forest Land.

Hazard tree felling occurred in several sections of RHCAs along Whale Creek, but not along other project streams. Trees were generally left on-site for future LWD recruitment and wildlife habitat. Trees may have been removed at some road/stream intersects and above roads where

accumulations could have led to potential culvert failures, or where removal posed no threat to RHCAs. The effect of the fire and suppression efforts had no effect on bull trout in the North Fork Flathead River as evidenced by redd counts. This is because any sediment produced in the drainage would not result in sediment levels above the normal range in the larger river, which has approximately a twenty-fold greater discharge.

Approximately 5.4 miles of Road 9805 in the Whale Creek watershed received BMPs improvements in 2004 and 2005. Short segments of this road were within the RHCA of Hornet Creek, a Whale Creek tributary. There were two culverts on ephemeral channels along this road that were replaced. In addition, Road 318, the main Whale Creek Road, received BMPs treatments for approximately 8.5 miles from its junction with the North Fork Road. The first three miles of this road drain away from Whale Creek and any sediment produced would not pose a risk to bull trout within the stream.

Sediment delivered to streams by project implementation would not, by itself, be likely to result in a major impact to bull trout in the watershed. Fortunately, sediment levels within the watershed did not rise as a result of the Wedge Canyon Fire. The combined sediment increase associated with this project arises primarily from culvert removals and upgrades, and may have a short-term negative effect on the species; primarily on spawning success and young-of-the-year survival. In the long-term, this project would result in less sediment delivery from the watershed and a gradual improvement in the quality of bull trout habitat. This project is not likely to affect other features of bull trout habitat, including temperature, cover and food supply.

The area of the recent fire in Whale Creek would likely be heavily utilized in future years as a source of personal use firewood, because of its proximity to valley communities. Firewood cutting would be regulated by the existing permit system on the Flathead National Forest, which prohibits firewood cutting within 300 feet of any stream or lake. Firewood cutting would not be expected to affect fish or other aquatic resources; largely because there would be limited areas where open roads allow access within RHCAs.

The Hydrology section thoroughly covers cumulative effects from past road construction, timber harvest and wildfires within the project area with regard to sediment yield and water yield. In brief, the McNeil core samples and substrate scores reveal that habitat conditions are as healthy today as they were 20 years ago. Stream environments are very dynamic from year to year depending on snowpack and annual precipitation; however they do maintain a long term equilibrium that is evident here. All action alternatives would contribute a slight cumulative effect, especially in Red Meadow Creek due to the predicted increased sediment levels associated with the culvert removals and upgrades. It is anticipated, based upon past monitoring, that sediment levels would return to near existing conditions within a couple of years.

Regulatory Framework and Consistency

The forest plan is the primary document that codifies management standards and guidelines governing activity on National Forest lands. Management standards for and related to fisheries habitat are contained in the Flathead NF Forest Plan (U.S. Department of Agriculture 1985),

pages II-21 - II-22, and II-26 – II-35. In addition, a separate management area (MA12) was established for riparian areas where specific standards and guides apply (III-52-60).

Originally adopted in 1986, the Flathead NF Forest Plan was amended in 1990 (Amendment No.3) to better define the standards for protection of fish populations. Implementation Note #10, adopted in 1992, established criteria for assessing the quality of spawning habitat relative to fine sediment concentrations in the gravel of the streambed. A stream would be considered "threatened" when the percentage of fine material exceeds 35% in any given year, while levels of 40% or greater would result in the stream being classed as "impaired".

The Inland Native Fish Strategy (INFISH) (U.S. Department of Agriculture 1995) amended the Flathead Forest Plan on August 30, 1995. INFISH is an aquatic conservation strategy developed by the USDA Forest Service to protect habitat and populations of all native fish (U.S. Department of Agriculture 1995). This interim strategy was designed to provide additional protection for existing populations of native fish, outside the range of anadromous fish, on 22 National Forests in the Pacific Northwest Region, Northern Region and Intermountain Region. Implementing this strategy was deemed necessary as these species were at risk due to habitat degradation, introduction of exotic species, loss of migratory forms and over-fishing. As part of this strategy, the Regional Foresters designated a network of priority watersheds. Priority watersheds are drainages that still contain excellent habitat or assemblages of native fish, provide for meta-population objectives or have excellent potential for restoration. There are two priority watersheds within the project areas; Red Meadow Creek and Whale Creek.

All project actions would comply with Flathead NF standards and guides, including INFISH requirements and maintenance of Riparian Management Objectives (RMOs).

The Endangered Species Act (ESA) is responsible for the protection and recovery of listed species such as the bull trout. The bull trout was listed as threatened under ESA in 1998. A stand-alone BA for bull trout, to facilitate consultation with USFWS, would be prepared for the selected alternative in this project as required by section 7 of the ESA. Another native resident of the watershed is the westslope cutthroat trout. The westslope cutthroat trout is on the Regional Forester's "sensitive species" list. A Biological Evaluation has been prepared for westslope cutthroat trout that assesses the cumulative effects of all alternatives upon this sensitive species, as per Regional Directive 2670/1950 (August 17, 1995).

Species Determinations

The Flathead NF Forest Plan provides specific guidance for the protection of fisheries and other aquatic resources, including the riparian zone around still and flowing water. The planned actions proposed under the Action Alternatives comply with all relevant Forest Plan requirements including INFISH. If one of these alternatives is implemented, the fisheries biologist would monitor the activity to insure proper implementation of planned actions.

The Endangered Species Act requires consultation between other federal agencies and the U.S. Fish and Wildlife Service when a proposed action is determined to be likely to affect a listed species. If an action alternative is selected for this proposal, a BA would be prepared to make an

effects determination of that alternative upon bull trout. The initial determination for bull trout for all alternatives is "may affect, likely to adversely affect" due to the culvert removals and upgrades. Although consultation with the USFWS would not be required if the no-action alternative was selected, it is important to note the retention of high risk culverts results in an unfavorable condition on the landscape. This is primarily because the lack of culvert removal/replacement and the existing high risk culverts in the No-Action Alternative would maintain a higher road density in the watershed with the associated chronic sediment delivery and risk of catastrophic culvert failure. The action alternatives warrant the adverse affect determination largely because of concerns with sedimentation resulting from road work. The action alternatives would provide a long-term benefit to bull trout because of the culvert removal/replacements; however the "likely to adversely affect" call is due to short-term sediment increases.

The Flathead National Forest considers the westslope cutthroat trout a sensitive species and requires a similar effects determination when proposed management activity is likely to affect the species. The basis of the determination comes from the Biological Evaluation of the species status, a separate document located in the project file. The determination for westslope cutthroat trout for all alternatives is "may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species."