FISHERIES

Introduction

The completion of Hungry Horse Dam in 1952 isolated fish populations in the South Fork of the Flathead River from the rest of the Flathead Basin, in effect creating a separate fisheries ecosystem above the dam (see the following figure). Today, this South Fork watershed is home to what is unquestionably the healthiest native fish assemblage in Montana, with Hungry Horse Reservoir replacing Flathead Lake as habitat for adult fish of species such as bull trout (*Salvelinus confluentus*) and westslope cutthroat trout (*Oncorhynchus clarki lewisi*).

Figure 3-18. Hungry Horse Dam and Reservoir (Photo courtesy of U.S. Bureau of Reclamation)

The South Fork Flathead River watershed consists of approximately 1,072,000 acres that are under the management of the Flathead National Forest. Slightly over 118,000 acres, or 11%, of the entire watershed burned during the summer of 2003. Nearly 90,000 of the burned acres are located within the Bob Marshall Wilderness, where the headwaters of the South Fork arise. The remaining 30,000 burned acres are located in several distinct fire areas scattered along the west side of Hungry Horse Reservoir. These fires along the reservoir are the focus of the post-fire management alternatives proposed by this project. However, the effects of all the fires upon the fish populations of the South Fork will be considered in the cumulative effects analysis for this section.

Analysis Area

The fisheries analysis for this project focuses on several spatial scales, which range from individual reaches within streams, 100 meters or less in length, to the entire length of the South Fork River, its tributaries, and all of Hungry Horse Reservoir.

Information Sources

Information for this analysis has been gathered from a variety of sources. The Flathead National Forest and Montana Department of Fish, Wildlife, and Parks have conducted site-specific fish habitat condition and population status inventories within the South Fork for more than twenty years. The Flathead Basin Commission has sponsored several studies that bear either directly or indirectly upon the South Fork and its aquatic resources. Flathead National Forest fisheries biologists and technicians gathered post-fire data on several key fish habitat quality indicators, while Montana Department of Fish, Wildlife, and Parks biologists monitored fish populations and bull trout spawning levels during and after the fire.

Forest Service biologists prepared a baseline Biological Assessment (BA) of the status of bull trout in 1998 when the species was listed as threatened, as required by Section 7 of the Endangered Species Act (ESA). Finally, peer-reviewed scientific literature has been used as the primary source of information regarding the life histories and habitat requirements of the aquatic organisms found in the South Fork, and the effect of natural and human-caused disturbance upon those organisms.

Affected Environment

Existing Condition of Fish Populations

This section describes the current condition of the habitat and fish populations within the project area. The fires of 2003 burned portions of several major watersheds and many smaller ones along the west side of Hungry Horse Reservoir. The level of fire severity in riparian areas varied both within and between streams, resulting in a patchwork of conditions that range from unburned vegetation to high-severity fire areas where all riparian plants were killed and fire consumed the surface duff layer, leaving bare mineral soil. Most of the available data regarding the project area streams were collected in previous years and reflect pre-fire conditions; however, the fires have probably not yet caused substantial changes in most streams. The impact of wildfire on stream channels may not be fully known until years or even decades after the actual fire (Dunham et al., 2003; Bozek and Young, 1994).

The primary fish-bearing streams affected to some degree by the fires include Doris, Wounded Buck/Wildcat, Clayton, Graves, and Sullivan/Quintonkon Creeks. Numerous smaller streams, some of which contain fish, were also impacted; these include Alpha, Beta, Lid, Goldie, Knieff, Anna, Ball, and Clark Creeks. Fire severity in riparian areas was generally highest in the following streams: Alpha, Beta, Goldie, and Sullivan, where some portions of the riparian areas burned very hot and most or all vegetation was killed. The remaining streams exhibit less extreme fire severity and typically present a mosaic of partially burned and unburned riparian vegetation. Many streams, including Lost Johnny, Wounded Buck, Wildcat, Quintonkon, and Clark, had little or no fire within their respective riparian areas.

The streams that directly enter the west side of Hungry Horse Reservoir can be roughly separated into one of two categories: larger (and longer) streams, which drain predominantly east-west valleys, such as Lost Johnny, Wounded Buck, Graves, and Sullivan; and smaller streams that drain the east-facing ridge along the reservoir, including streams such as Goldie, Knieff, Alpha, and Flossy Creeks. In addition, numerous smaller streams, both perennial and intermittent, are tributary to the larger streams. The larger streams typically include lengthy reaches of lower gradient channel, while the smaller streams often have steep slopes from their headwaters all the way to their mouths. These differences between stream types have a profound effect on the use of the streams by fish and other aquatic species. The following table lists the major streams affected by last year's fires.

Table 3-70. Principal Streams in Project Area

Stream Name	Stream Length (miles)	Bull Trout Present?	Westslope Cutthroat Present?	Tributary to:
Alpha Creek	2.49	No	No	Reservoir
Beta Creek	2.12	No	No	Reservoir
Doris Creek	5.81	Yes[1]	Yes	Reservoir
Lost Johnny Creek	6.55	No[2]	No[2]	Reservoir
Wounded Buck Creek	6.56	Yes	Yes	Reservoir
Wildcat Creek	4.91	Yes[1]	Yes	Wounded Buck Ck.
Flossy Creek	2.48	No	No	Reservoir
Clayton Creek	4.66	No	Yes	Reservoir
Goldie Creek	3.12	No	Yes	Reservoir
Knieff Creek	3.08	No	Yes	Reservoir
Pearl Creek	1.85	No	No	Reservoir
Anna Creek	1.35	No	No	Reservoir
Ben Creek	2.45	No	No	Reservoir
Quintonkon Creek	9.97	Yes	Yes	Sullivan Ck.
Ball Creek	5.36	Yes[1]	Yes	Sullivan Ck.
Branch Creek	5.09	Yes[1]	Yes	Sullivan Ck.
Sullivan Creek	15.59	Yes	Yes	Reservoir
Taylor Creek	1.50	No	Yes	Clark Ck.
Clark Creek	3.94	Yes	Yes	Reservoir

1. Possible incidental use by bull trout; no documented spawning.

2. Possible incidental use in lower reach; natural barrier prevents upstream movement.

In addition to the streams listed in preceding Table, there are numerous smaller streams within the project area, many of which are unnamed and only flow seasonally. Bull trout utilize some of the larger streams for spawning and juvenile rearing, with Wounded Buck, Sullivan, and Quintonkon considered important bull trout streams. Incidental bull trout use has been documented in Doris and Clark Creeks, and the lowermost part of Lost Johnny Creek below a natural barrier. All bull trout in the South Fork are believed to be migratory, that is, fish that spawn in the tributary streams and move to the reservoir or a larger lake to grow to maturity.

Westslope cutthroat trout can be found in most of the perennial streams along the west side of Hungry Horse reservoir. The cutthroat populations may be comprised of both migratory fish, which spend much of their adult life in the reservoir, and resident fish, which live their entire lives in the streams. In some cases resident fish are found above barriers, both natural and man-made, which prevent the adoption of a migratory life history. Some historically fishless high elevation lakes that drain into Hungry Horse Reservoir have populations of westslope cutthroat and other trout species that were established by stocking programs in the past.

Species Ecology

Bull Trout

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 bull trout population in this project area is comprised of adfluvial migratory fish, with juveniles typically moving to Hungry Horse Reservoir from their natal streams at age 2-3, and returning at about 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 stretched 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 listing as a threatened species under the Endangered Species Act in 1998.

Several factors have contributed to the decline of bull trout across most of their historic range. Habitat degradation, interaction with exotic species, over-harvest, and fragmentation of habitat by dams and diversions have all been implicated (Rieman and McIntyre 1995). Bull trout are highly sensitive to environmental change (Rieman and McIntyre 1993) and are particularly intolerant of water temperatures above 15º C (Fraley and Shepard 1989). Substrate size and quality, the availability of cover, and stream channel stability are other habitat requirements linked to bull trout abundance (Rieman and McIntyre 1993). As noted above, bull trout embryo and fry survival decreases with increasing fine sediment levels in spawning gravels. Juvenile bull trout are especially dependant upon stable cobble and boulder substrate for daytime cover and over-winter survival (Thurow 1997). Adult bull trout utilize pool habitats and under-cut streambanks, often in conjunction with large woody debris cover (Rieman and McIntyre 1993). Where bull trout coexist with non-native eastern brook trout (*S. fontinalis*), hybridization between the species has resulted in displacement of bull trout (Leary et al. 1993). No populations of brook trout are known to exist in the South Fork Flathead watershed however.

Interactions with lake trout (*S. namaycush*), another species not native to the Flathead drainage, have been implicated in the decline of bull trout in Flathead Lake. Bull trout in the Flathead Lake population have declined equally in wilderness and managed areas, suggesting that habitat degradation may not be the primary factor in their decline. Lake trout and bull trout competition has been documented elsewhere. Donald and Alger (1993) looked at 34 lakes where the range of the two species overlaps, and found that in 28 cases, only one species was present. In lakes where they coexisted, lake trout were the dominant species, and 3 case histories were documented where lake trout completely displaced bull trout. No lake trout populations are known to exist in the South Fork Flathead above Hungry Horse Dam.

The bull trout population in Hungry Horse Reservoir and the South Fork Flathead River is considered healthy and stable. A limited fishery for the species has recently been approved for the reservoir, a reflection of the confidence biologists have in the status of the population. Anglers with a bull trout "catch card" will be able to target the species in Hungry Horse Reservoir and the South Fork Flathead River beginning in May of 2004. Fishing in the river will be catch and release only, but two fish per season may be kept from the reservoir. The season will close early each year on August 15th to avoid excessive mortality among fish that congregate prior to the annual spawning migration.

Westslope Cutthroat Trout

Westslope cutthroat exhibit the same life history forms as bull trout, and the resident as well as both migratory forms are likely present in the South Fork Flathead watershed. Cutthroat spawn in the spring when water temperatures rise to about 10º C, and fry typically emerge from the spawning beds in late July. Migratory juveniles leave the natal streams at age 2 or 3 and travel downstream as high water levels begin to recede. Westslope cutthroat generally utilize substrate less and pools more than bull trout.

Westslope cutthroat co-existed with bull trout throughout their historic range with the exception of a small area east of the continental divide in the Missouri River drainage. The similar range of the two species suggests that habitat suitable for bull trout is equally suitable for the westslope. The westslope tended to be more widely distributed throughout this range than the bull trout, possibly because more streams have suitable water levels for spring versus fall spawning, or because the cutthroat tolerate warmer temperatures than bull trout (McIntyre and Rieman 1995). This pattern holds true for the project area. Westslope cutthroat are found in virtually all perennial streams in the drainage, including many where bull trout have never been found.

Westslope cutthroat populations have also declined across much of their historic range, but populations in the South Fork are among the most robust anywhere. The decline of westslope cutthroat in other areas can largely be attributed to the same factors that have impacted bull trout. The cutthroat has been especially affected by the introduction of non-native species, most notably brook and rainbow trout (*O. mykiss*). Brook trout appear to competitively exclude the cutthroat, while rainbow trout hybridize with cutthroat, resulting in a loss of genetically pure populations. Some high elevation lakes in the South Fork were stocked in the past with rainbow trout and Yellowstone cutthroat, a practice that has resulted in a loss of genetic purity in a portion of the westslope cutthroat population in the South Fork, and MTFWP is currently developing a plan to replace the non-natives with pure westslope cutthroat.

Mountain Whitefish, Sculpins and Tailed Frogs

Relatively little is known about the populations of other aquatic species native to the project area. Mountain whitefish are common in the larger streams and the main river, as are one or two species of sucker (*Catostomus spp*). Sculpins (*Cottus spp.*) are believed to be abundant and widely distributed throughout the South Fork watershed.

Among amphibians and reptiles, records document the presence of spotted frogs (*Rana luteiventris*), tailed frogs (*Ascaphus* montanus), western toads (*Bufo boreas*), long-toed salamanders (*Ambystoma macrodactylum*), and terrestrial garter snakes (*Thamnophis elegans*) (Maxell et al., 2003). Other species likely exist in the South Fork, including the painted turtle (*Chrysemys picta*).

Existing Habitat and Fish Population Condition

There are substantial data regarding the habitat and fish populations in some of the streams within the burned areas, and a relative lack of data regarding others (Exhibits F-1 and F-2). In general, the bull trout streams have been studied more intensively than the non-bull trout streams as part of efforts to assess and protect the threatened species. Some data gathering has also focused on westslope cutthroat, which were proposed for listing under the ESA, but the US Fish and Wildlife Service (FWS) recently determined that listing is not warranted. Most cutthroat data however concern the genetic purity of the fish populations and not the condition of the habitat. Sullivan Creek has been the target of data collection aimed at determining that stream's status with regard to water quality impairment and beneficial use support as defined in the Clean Water Act (CWA).

Redd counts conducted in recent years have indicated that bull trout which spawn in the Sullivan and Wounded Buck watersheds comprise approximately 15% of the total spawning population of the South Fork Flathead River. Any significant declines suffered by these populations could be expected to have a proportional impact on the entire South Fork population as well. Metapopulation theory suggests that individuals from the greater population of a migratory species such as bull trout would re-colonize the available habitat if a local population were extirpated (Dunham and Rieman 1999). The metapopulation model postulates that this population strategy insulated a species from the effect of local events such as flood or wildfire. To the extent metapopulation processes apply to bull trout in the South Fork, they would reduce the impact of effects to local populations such as the ones in Sullivan, Quintonkon, and Wounded Buck Creeks. The metapopulation theory requires a robust population suitable as a source of individuals to reestablish the local population, a condition that exists in the South Fork. However, one recent study found significant genetic differentiation between bull trout in adjacent drainages within the South Fork River watershed, suggesting that individual bull trout faithfully return to their natal stream to spawn with little mixing between watersheds (Kanda and Allendorf 2001). These findings suggest that each local bull trout population should be protected rather than relying upon metapopulation dynamics to restore them following local extinction.

Most existing stream condition data indicate that streams within the project area contain good quality fish habitat. Common measures of habitat quality include: the composition of the stream bottom substrate, the maximum water temperature, the amount of large woody debris (LWD) in the stream channel, and the abundance and volume of pool habitat. Substrate composition is important primarily as a measure of spawning habitat quality; excessive levels of fine sediment will result in lower survival of trout eggs that are deposited in stream bottom gravel. A device called the McNeil Corer is used to measure the percentage of fine sediment in spawning habitat; when material smaller than 6.4mm comprises 35% or more of the substrate, embryo survival declines rapidly (Weaver and Fraley 1991). Native fish, particularly trout species, evolved in the cold water typical of area streams and any substantial increase in temperature can affect their growth and survival. Large woody debris is an important source of cover for fish, and also plays an important role in creating pool habitat. Pools provide fish with refuge from the temperature extremes of summer and winter, as well as hiding cover from predators. Pool inlets are important feeding stations for stream fish, where they can intercept drifting insects while not expending large amounts of energy fighting the current (Rosenfeld and Boss, 2001).

The quality of stream habitat can be affected by both natural and human caused disturbances to the forest ecosystem. Fire and flood are two of the natural events that shape fish habitat in streams around Hungry Horse Reservoir. Snow avalanche chutes are present in many of the streams within the project area, and periodic avalanches can divert streams and deposit large volumes of woody debris into a channel. All of these events are short-term, well defined perturbations of the environment from which recovery begins immediately and progresses along a pathway determined largely by the geologic and climactic regime of the region. In contrast, long-term natural events such as drought may impact streams and lakes for years or decades.

Human caused disturbances can also have both short and long-term impacts to aquatic ecosystems. Timber harvest may alter the pattern of stream flow, often by increasing peak flows or altering the timing of those flows (MacDonald and Hoffman, 1995; Megahan, 1983). Soil disturbance resulting from timber harvest and road construction can increase sediment delivery to streams. Poorly designed and/or maintained roads can become a chronic source of sediment if they channel runoff into streams. The failure of road crossing culverts can cause many hundreds of tons of soil to enter a stream in a short time. Roads have also been identified as a major contributor to mass failures when slopes are undercut to create a roadbed and subsequently slide when soils become saturated (Megahan and Bohn, 1989). Timber harvest within riparian areas has reduced the recruitment of large woody debris into streams, resulting in a loss of habitat complexity including fewer pools (Hauer et al., 1999; Ralph et al., 1994).

Channel slope, or gradient, is a key factor in determining the habitat characteristics of a stream reach, as well as its response to natural and anthropogenic disturbance, and is often used to classify stream reaches for analysis purposes (Rosgen, 1996). In general, an “A” reach is steep, with large cobble/boulder substrate, and is typically found in the headwaters of a stream and other steep areas. A “B” channel is intermediate in slope, substrate tends to be dominated by cobbles, and riffle habitats are often the dominant channel form. A "C" channel is typically a low gradient, meandering stream with gravels usually the dominant substrate form. Pools are often associated with large woody debris pieces in this channel type, both single pieces and large "debris jams" containing many pieces. Most trout spawning typically occurs in this channel type, although trout redds, or nests, can be found in any channel where a pocket of suitable habitat occurs. These low gradient stream reaches are the most vulnerable to disturbances that alter physical characteristics of the stream such as peak flows, sediment levels, and the abundance of large woody debris.

Modern timber harvest and road building standards known as Best Management Practices (BMPs) began to be applied in the early 1980's and have substantially reduced the impacts of timber management on streams (Waters, 1995). The use of riparian buffer strips where harvest and machinery use are restricted reduces the delivery of sediment while maintaining a supply of LWD for future recruitment by the stream. The decommissioning of unnecessary roads, a process that includes the reconstruction of stream channels at crossing sites, substantially reduces sediment and water runoff and eliminates the risk of culvert failure.

The watersheds within the project area have undergone various levels of timber harvest beginning in the 1940's, with the greatest activity occurring in the 1970's and early 1980's. Past timber harvest was concentrated at the lower elevations above the reservoir, with lesser activity at the upper elevations within the various watersheds. Exceptions to this pattern can be seen in some watersheds, particularly Sullivan/Quintonkon, Doris, Lost Johnny and Wildcat Creeks, where harvest units extended to higher elevations. Road networks were constructed up all major drainages, some reaching virtually to the top of the Swan Divide. There has been relatively little harvest in the project area since 1985, and most harvest since that time has been directed toward the removal of dead and dying trees. The effects of this historic timber harvest are discussed below in the cumulative effects section.

The Forest Plan of the Flathead National Forest contains standards and guidelines for protecting fish habitat and identifying priority bull trout streams (USDA Forest Service, 1985). The present regulations governing fish habitat protection are largely derived from an amendment to the Forest Plan that was adopted regionally in 1995, which is commonly referred to as INFISH (USDA Forest Service, 1995). INFISH defines the requirements for riparian buffer strips, known as Riparian Habitat Conservation Areas (RHCAs), for streams, lakes, and wetlands. In addition, INFISH defines standards for key features of fish habitat in streams, such as pool frequency and the abundance of large woody debris. These standards are collectively referred to as Riparian Management Objectives (RMOs), and were adopted from standards developed in the Cascade Mountains of Washington and Oregon intended to provide quality habitat for anadromous fish such as salmon and steelhead trout. Probably because they were based upon stream habitat in a different geologic and climactic region, the RMOs often do not seem to accurately reflect quality habitat in this area, but they do provide standards for comparisons between individual streams. As an example, few streams on the Flathead National Forest, including wilderness streams, meet the RMO for pool frequency. On the other hand, virtually all streams in this area greatly exceed the RMO for large woody debris. The INFISH standards were only intended to provide interim direction until forests in the region revise their National Forest Management Act (NFMA) Forest Plans, a process currently underway on many forests in Region 1. Tables 2 & 3 below display the INFISH RMOs currently in effect on the Flathead National Forest that are applicable to this project.

Table 3-71. INFISH Riparian Management Objectives

Habitat Feature	Interim Objectives (RMOs)
Pool Frequency	Varies by stream width, see Table 3 below
Water Temperature`	No measurable increase in 7-day maximum water temperature; *and* below 15º C (59º F) in bull trout adult holding habitat and 8.8º C (48º F) in bull trout spawning habitat.
Large Woody Debris	> 20 pieces per mile; > 12 inch diameter; > 35 foot length
Width/depth Ratio	<10, mean wetted width divided by mean depth

Table 3-72. INFISH Pool Frequency Standards by Stream Width

Stream Width (ft/m)	10/3	20/6	25/7.6	50/15.2	75/22.8	100/30.5
Pools per mile	96	56	47	26	23	18

Stream habitat data including INFISH RMOs are typically gathered during inventories that employ a variety of protocols depending on the purpose of the survey, with the "Region 1/Region 4 Fish and Fish Habitat Standard Inventory" (R1/R4)(Overton et al. 1997) survey the most commonly used protocol on the Flathead National Forest. R1/R4 surveys target many indicators of stream habitat quality, including the abundance of LWD, the number of pools per mile of stream, and the percent of fine surface sediments. R1/R4 data are available for segments of several streams within the project area and are summarized below.

Stand-alone channel stability surveys have been conducted in some of the project area streams using a protocol known as the Pfankuch method (Pfankuch, 1975). Pfankuch surveys rate the resistance of a stream to in-channel erosion based upon the condition of 15 different elements such as vegetation quality and substrate size, assigning a numeric score to each element. The total of the individual feature scores determines the stability rating for the reach, which can fall into one of four qualitative categories: excellent, good, fair, and poor. The best fish habitat is generally found in streams that receive a rating of "good", as excellent streams tend to be so well armored that habitat complexity is reduced.

Doris Creek

An R1/R4 survey was conducted on approximately 2.5 miles of Doris Creek in 2001, beginning at the Road 895 crossing and proceeding upstream. The surveyed reach of Doris Creek is riffle dominated, with generally large substrate and fast-moving water. Pool habitat is typically scarce in streams of this type, and fish are generally located in small "pocket pools" formed by large boulders or the root wads of fallen trees that are large enough to resist being carried downstream during high flows.

Road #895A closely parallels Doris Creek for much of its length, but only encroaches on the RHCA, which is 300 feet wide on each side of the stream, at a few points. There are, however, numerous crossings of tributary streams along the length of the road. During a rainstorm that occurred toward the end of the 2003 fire season, many of these stream crossings were contributing sediment to Doris Creek, primarily road surface material that had been churned up by the heavy fire traffic and carried to the road ditch by the rainfall runoff. Due to the size and stream power of the creek most of this sediment is believed to have remained in suspension until deposited in the reservoir. In general, fish habitat in the lower reach of Doris Creek does not appear to be degraded by excess fine sediment.

The R1/R4 survey of Doris Creek identified 10.3 pools per mile, well below the INFISH standard of 56 identified for a stream that is approximately 16 feet wide. However, the pool frequency in Doris Creek is consistent with other similar streams on the Flathead National Forest, including wilderness reference streams, which typically have relatively few pools in comparable channel types. For example Cox Creek, a stream entirely within the Great Bear Wilderness that was surveyed in 1999, had 6.8 pools per mile in a reach of similar width and channel slope.

The surveyed reach of Doris Creek had 187 pieces of LWD all sizes per stream mile, well above the INFISH standard of 20. However, the R1/R4 survey uses a different measurement protocol than INFISH, and many of those pieces of wood would likely be too small to be counted toward the INFISH minimum. Large woody debris is not thought to be limiting fish habitat in Doris Creek however, and there has been relatively little historic harvest within riparian areas along the stream, suggesting that current and future recruitment of LWD should be adequate. The 2003 fire burned very little of the RHCA along Doris Creek.

The width/depth ratio in Doris Creek has not been assessed, however, experience with similar streams on the Flathead National Forest indicates that it would not meet the INFISH standard of 10 or less. However, the R1/R4 survey did find that the stream banks were very stable, an indication that the channel has not been getting wider as a result of bank erosion. If the stream is not getting wider, the only other mechanism that could degrade width/depth ratio is decreasing the depth as a result of excess sediment deposition, and there is likewise no evidence that this is occurring in Doris Creek. The R1/R4 survey in 2001 found only 16% surface fine sediments; by comparison, a 1999 survey in the wilderness stream Cox Creek estimated 40% surface fines. Care must be taken when making comparisons between streams because different observers may produce very different estimates of the same habitat element, and the year and season of the survey can substantially affect the condition of a variable habitat feature such as surface fine sediment. Nonetheless, the data available regarding Doris Creek support the judgment that the width/depth ratio in the stream has not been substantially altered from its natural condition.

The available information on fish populations in Doris Creek is contained in the MFISH database that is maintained by the Montana Department of Fish, Wildlife, & Parks, and can be assessed on their website. According to MTFWP, westslope cutthroat are abundant, year-round residents of Doris Creek, as are mountain whitefish (*Prosopium williamsoni*), another native salmonid. MFISH reports incidental presence of bull trout in Doris Creek, attributed to fish foraging for food. Genetic samples taken from westslope cutthroat in 1984 found no evidence of hybridization with other species or subspecies of trout.

Lost Johnny Creek

Approximately two miles of Lost Johnny Creek were surveyed in 2001 using the R1/R4 survey protocol. Results were very similar to those found in Doris Creek; i.e., bank stability was above 98%, surface fines were low at 14%, and LWD was abundant at 195 pieces per mile. Pools were somewhat more abundant in the surveyed reach at 17.5 per mile, though still well below the INFISH standard.

There is a natural barrier waterfall on Lost Johnny located approximately .5 stream miles above Hungry Horse Reservoir that prevents upstream movement of fish from the reservoir. Although there is suitable habitat above this barrier, the stream is apparently fishless today above the waterfall (Scott Rumsey, MDFWP, personal communication). The MFISH database indicates that mountain whitefish and westslope cutthroat are common in the lower stream reach, and the cutthroat tested as genetically pure in 1985.

Wounded Buck Creek

Wounded Buck Creek is one of two bull trout priority streams within this project area, a designation that requires the Flathead National Forest to place a special emphasis on the species when implementing management actions in the watershed. Riparian buffer widths on intermittent streams within priority watersheds are expanded to 100 feet from the minimum of 50 feet that applies in non-priority streams. Priority bull trout watersheds were identified because of their importance to bull trout for spawning and juvenile rearing.

Three separate reaches of Wounded Buck Creek were surveyed in 1999, using a protocol similar to the R1/R4 method. The three reaches were chosen to assess conditions in areas with different channel slope, roughly corresponding to Rosgen A, B, and C channels (Rosgen, 1996). Pool frequency in the three reaches ranged from 21.9 to 32.2 pools per mile. Surface fines were low, at 10% in the B and C reaches and 4% in the A reach. Large woody debris was very abundant in the B and C reaches, at 249 and 234 pieces per mile, respectively. Wood was scarce in the A channel reach, at only 16 pieces per mile. This reach flows through a large, brush-filled bowl where avalanches and past fire have created an area with very few trees. No harvest or road building has occurred in or above this portion of the watershed, indicating that the low volume of woody debris in the upper stream is a natural condition. Despite the low amount of large woody debris, there were more pools in this stream reach than in the other two, with large boulders and bedrock outcrops acting as the pool forming features. McNeil core samples have been collected in Wounded Buck Creek since 1994 by MTFWP, and have remained near 30% fines during that period, below the 35% threshold identified as impairing embryo survival.

Table 3-73. McNeil Core Data from Wounded Buck Creek, 1994-2002

YEAR	1994	1995	1996	1997	1998	1999	2000	2001	2002
% Fines	31.6	29.9	31.2	33	30.6	31.9	31.1	30.4	32.3

Bull trout are considered common in Wounded Buck Creek by MTFWP, while westslope cutthroat and mountain whitefish are listed as abundant. Bull trout redd counts have ranged from a high of 41 in 1996 to a low of 3 in both 1999 and 2000. There were 10 bull trout redds observed in the autumn of 2003. Some hybridization between westslope and Yellowstone cutthroat trout has been documented in the drainage, probably the result of past stocking of the non-native subspecies in Wildcat Lake.

Wildcat Creek

Wildcat Creek is a large tributary of Wounded Buck Creek that originates from Wildcat Lake, a 40-acre natural lake located in the Jewel Basin Hiking Area. No habitat surveys have been conducted in Wildcat Creek but biologists with the MTFWP have gathered some information in the course of fisheries surveys. The MTFWP information indicates that there are two barrier waterfalls on Wildcat Creek, one a short distance above the confluence with Wounded Buck Creek and the other just below the outlet of Wildcat Lake. Cutthroat trout now found in Wildcat Creek are believed to be downstream migrants from Wildcat Lake, which was historically fishless but has been stocked since the 1930's.

Clayton Creek

Clayton Creek begins in the 62-acre lake of the same name and flows some 4.6 miles, joining Hungry Horse Reservoir just north of Clayton Island. A 2001 R1/R4 survey looked at two miles of the stream and found indicators of good fish habitat quality. The surveyed reach included slightly more than 10% pool habitat, or 33.6 pools per mile. Large woody debris was abundant at 301 pieces per mile, and surface fine sediments were estimated at 19%. Banks were judged to be 98% stable.

Fish, Wildlife, and Parks biologists have identified a natural barrier waterfall on Clayton Creek a short distance above the reservoir that is believed to prevent any movement of fish from the reservoir into the stream. The culvert on Forest Road 895 is also believed to be a fish passage barrier. The stream does contain a population of westslope cutthroat trout that are hybridized with rainbow trout and Yellowstone cutthroat trout that have migrated downstream from Clayton Lake. Originally barren, the lake was stocked with mixed cutthroat species along with rainbows, beginning in 1926.

Goldie Creek

Goldie Creek arises from the eastern slope of Pioneer Ridge and flows three miles to the reservoir, entering at a point opposite Clayton Island. The majority of the stream is a very high gradient A channel type, with several short sections of intermediate gradient B channel interspersed. There is a short reach of low gradient C channel just before the stream enters the reservoir. There are culverts on Forest Roads 895 and 9838 that are believed to be barriers to fish passage.

There have been no fish habitat surveys in Goldie Creek, but channel stability was assessed for several segments of the stream in 1979 and again in 1989 using the Pfankuch methodology described above. All reaches surveyed were rated as having either good or fair channel stability in both years. All reaches but one that received a fair rating had scores close to the good range; the exception is a high gradient A type channel above Road 895 that had a score of 111, close to the threshold of 115 that would indicate poor channel stability. This area suffered some of the highest burn severity observed in the 2003 fires, and it is likely that there will be increased erosion within the stream channel.

Goldie Creek contains a small population of westslope cutthroat that tested as genetically pure in 1984. This population is believed derived from native South Fork stock, as there is no headwaters lake in the drainage and no history of stocking. Fish above Road 9838 are isolated from the remaining population by a barrier culvert; they can move downstream but not return. The culverts beneath the main west side reservoir road, # 895, are also likely barriers to upstream fish passage. A survey conducted by FNF technicians in October of 2003 confirmed that the cutthroat population in Goldie Creek survived the fire.

Knieff Creek

Knieff Creek enters Hungry Horse Reservoir several miles south of Goldie Creek, and is a very similar stream in most respects. Fire severity was high in portions of this watershed, though not to the degree observed in Goldie Creek. Increased sediment delivery to the stream network is likely in the next several years until the vegetation recovers. Like Goldie, Knieff Creek was assessed for channel stability in 1979 and 1989, with all reaches rated as good or fair. A single reach above Road 895 was surveyed in 2001, and channel stability was rated as good.

Knieff Creek is known to contain westslope cutthroat, which are described as abundant by the MFISH database. Genetic analysis conducted on tissue samples in 1984 indicated that the population at that time was genetically pure. Post-fire surveys conducted by the Flathead National Forest confirmed westslope cutthroat are still present in the stream. One culvert identified as a barrier to fish passage was removed following the fire by a Burned Area Emergency Rehabilitation (BAER) team.

Quintonkon Creek

Quintonkon Creek is a large tributary of Sullivan Creek, which it joins a short distance above the reservoir. Quintonkon is considered a bull trout priority stream because of its linkage to Sullivan Creek, and bull trout use the stream for spawning. Redd counts in recent years have ranged from 0 in 1997 to 21 in 2002. Most bull trout spawning occurs above the confluence with Sullivan Creek and below Posey Creek, where a barrier falls prevents further upstream movement.

There is little direct habitat data available on Quintonkon Creek. Road 381 parallels the stream for much of its length, and encroaches into the RHCA in several places. There has been a substantial amount of timber harvest in the watershed, much of it in and adjacent to the RHCA in the upper part of the stream. Virtually all harvest activity in the drainage occurred prior to 1985 and the development of BMP standards, increasing the likelihood that there were negative impacts to the stream. McNeil core samples were taken in 1992 and fine sediment comprised 39.6% of the substrate, a level demonstrated to impair bull trout spawning success (Weaver and Fraley, 1991). Stream stability surveys conducted between 1974 and 1979 ranked conditions as either good or fair.

The Ball Creek fire of 2003 affected only about 3% of the Quintonkon Creek watershed, and did not burn into the riparian area of the main stream. The fire is not expected to have any measurable impact upon the stream or its fish populations. In addition to bull trout, Quintonkon is known to contain abundant westslope cutthroat and mountain whitefish populations (MFISH data). The cutthroat were found to be genetically pure westslopes based upon sampling in 1984 and 2002.

Sullivan Creek

Sullivan Creek is the longest stream (15.59 miles) in the project area, and the most important bull trout stream as well. Sullivan Creek annually produces more bull trout redds than any other stream around the reservoir; there were 45 redds counted in the stream in 2003 after the fire.

Table 3-74. Redd Counts in Sullivan Creek

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Redds	25	8	--	52	50	54	55	45	51	18	45

The bull trout spawning reach in Sullivan Creek begins at approximately Connor Creek, just above the burned area, and extends upstream for several miles. The stream within the fire area and extending to the reservoir is a moderate gradient, B channel type with large substrate. Pools in this lower reach are primarily associated with large boulders and bedrock outcrops, as the stream power is capable of carrying most large woody debris downstream.

In addition to bull trout, Sullivan Creek also hosts abundant populations of westslope cutthroat trout and mountain whitefish. Montana Fish, Wildlife, & Parks biologists have also documented occasional use of the stream by other species including largescale suckers (*Catostomus macrocheilus*) and arctic grayling (*Thymallus arcticus*). The grayling are not native to the South Fork and are likely derived from stocked fish in Handkerchief Lake.

Portions of the riparian zone along lower Sullivan Creek burned hot during the Ball Creek Fire, along with some adjacent upland areas. Post-fire restoration work carried out as part of the BAER efforts were directed toward reducing sediment delivery to the stream from these burned areas. Restoration activities included the installation of some 1,000 straw wattles across the high burn severity areas to prevent rill and gully formation, along with the planting of native shrubs and grasses to further stabilize hill slopes. Sediment entering Sullivan Creek from the burned area would not directly impact bull trout spawning, which occurs upstream, but it could interfere with adult migration runs or impact the foraging success of juvenile bull trout in the lower reaches of the stream. Erosion related to the fire is expected to be greatest in 2004, and should decline substantially in subsequent years as the vegetation recovers.

Sullivan Creek was listed as a water quality impaired stream on the 1996 303(d) list maintained by the Montana Department of Environmental Quality (MDEQ), with the cause listed as siltation resulting from silviculture. The stream was subsequently removed from the list due to a lack of sufficient credible data to determine its status, pending further evaluation. Currently, the stream is listed as fully supporting the “primary contact”, “agriculture”, and “industrial” beneficial uses, with the “drinking water”, “aquatic life”, and “cold water fishery” uses under review by the U.S. Environmental Protection Agency (EPA). The Flathead National Forest is currently cooperating with the MDEQ and the EPA to gather adequate data to make the determination of support for these uses.

Clark Creek

Clark Creek is a small stream that drains the northern slope of Kaw Mountain and flows directly into the reservoir. There was some fire activity in the headwaters of the stream, generally of low severity. There was very little fire within the riparian zones of the stream, and the fire is not likely to have much impact on the stream or its fish population.
There has been extensive timber harvest in the Clark Creek watershed, most of which occurred more than twenty years ago. An R1/R4 survey of the first 2.5 miles of the stream was conducted in 1999, and bank stability averaged approximately 95% throughout the surveyed reach. Large woody debris was abundant in the channel, and surface fines were low. Approximately 10% of the stream was pool habitat.

Clark Creek contains a population of westslope cutthroat trout that were found to be 100% genetically pure in a 1984 test. Bull trout also use Clark Creek in low numbers, and some bull trout redds have been observed in the stream.

Environmental Consequences

The fires of 2003 have the potential to significantly impact the aquatic ecosystems on the west side of Hungry Horse Reservoir in both positive and negative ways. Increased levels of sediment may enter streams until the vegetation recovers. The potential exists for very large pulses of sediment to reach streams if debris torrents occur in tributary channels. The loss of riparian canopy may result in incremental temperature increases, particularly in summer months. Water yield will increase and may contribute to bank erosion and channel instability. On a positive side, the pulse of large woody debris entering the channels should act to stabilize them and accelerate the return to an equilibrium condition. The increased volume of large woody debris should enhance pool formation and increase habitat complexity—the variety of different habitats available to fish at different stages in their life history. Despite high fire mortality of the riparian vegetation in some areas, a sufficient number of trees remain alive to insure a continuous future supply of large woody debris in all but a few stream reaches. The exact response of streams and fishes to these large fires depends a great deal upon the pattern of precipitation and snowmelt, making precise predictions impossible.

The primary concern, from a fisheries perspective, of the proposed timber salvage and associated road management is increased sedimentation that can degrade spawning gravels by filling the interstitial spaces with fine material. Increased sediment can also reduce juvenile rearing success and decrease aquatic insect production by causing increased embeddedness of the substrate (Bjornn et al. 1977, Weaver and Fraley 1991, Deleray et al. 1999). The Section 7 Baseline BA concluded that embeddedness did not appear to be a problem in Wounded Buck, Quintonkon, or Sullivan Creeks. Sediment that enters these systems below the spawning reach is therefore less likely to negatively impact the bull trout population.

Bull trout fulfill very specific requirements in their selection of spawning habitat, requirements that make this habitat both limited and subject to degradation (Rieman and McIntyre 1993). Quality spawning sites are often the most spatially restricted habitat component in streams within the Flathead region (Fraley and Shepard 1989). Because of the importance of this habitat, the fine sediments (< 6.4 mm) entering streams above a bull trout spawning reach pose the highest risk to this fish population, regardless of the source of those sediments. Studies have shown that about 60% of the sediment yield resulting from in-stream activities such as culvert removal is suspended sediment, which ranges up to sand-sized particles (Waters 1995). Virtually all sediment carried in suspension is therefore sufficiently small to impair spawning substrate when it is deposited, as are the finer particles of bedload sediment. Sediments that must travel a greater distance before reaching a stream channel, i.e., sediment entrained by sheet or overland flow, would be comprised of an even higher percentage of fine particles due to the lower waterpower and greater travel distance involved in transporting these particles (Leopold et al. 1964).

Another important consideration relative to sediment is the timing of entry into the stream network. Most naturally entrained sediment enters on the rising limb of the annual hydrograph, when water is rising and first encountering sediment particles (Brooks et al. 1991). This situation typically occurs during the period of snowmelt in this region, producing the turbid streams and rivers we see during spring high flows. The result of this concurrence is a greater likelihood that sediment captured by streams within the burned areas would be flushed into the reservoir prior to deposition. Similar sediment yield curves of smaller magnitude can also be produced during rainstorms. Conversely, sediment that enters a stream during low-flow periods is more likely to be deposited before traveling out of the watershed. Confounding this relationship, however, is the sediment capacity of the stream at any given discharge. If sediment exceeds transport capacity, deposition can occur at any discharge, while transport may continue at very low discharge levels if capacity is not exceeded.

Sediment can also have direct negative effects upon fish, by clogging their gills and interfering with respiration. Excessive levels of turbidity can interfere with capture of prey by sight-feeding fish such as trout. Data are scarce regarding the lethal and sub-lethal effects of sediment on trout, making it difficult to predict the direct effects of high sediment levels. Sediment levels above 400 mg/L have been shown to interfere with the ability of fish to feed, while levels above 20,000 mg/L have caused direct mortality (Bozek and Young 1994). Sediment concentrations in watersheds with large deposits of glacial till have likely been quite high during peak flow events since the end of the last glacial age. This suggests that native fish in this region are adapted to high sediment levels of short duration.

Impacts to the function of riparian zones cause concern when activity occurs along the stream channel. When a forest is left intact near streams, trees are available to shade the channel and be recruited into the stream to become sediment traps, control channel erosion, scour pools, and provide cover for fish (Bryant 1983). Riparian vegetation acts to intercept sediment and maintain channel stability. Processes in riparian areas and streams vary within watersheds. In steep, high gradient, non-fish bearing streams, RHCAs are important for protecting water quality and temperature, preventing surface erosion resulting from rill and gully formation, and providing a source for the recruitment of wood to streams. Farther down in the watershed, vegetation helps store sediment, trees provide stability along the banks, and as trees fall into the stream they would help scour pools and provide cover for rearing fish. Trees that fall into streams also provide a colonization site for some aquatic insects, which are often an important food source for fish.

As required by INFISH, RHCAs have been established along all wetlands and stream courses within the project area. These RHCAs create buffer zones around streams and wetlands within which fish habitat protection and enhancement receive primary emphasis. These INFISH buffer zones are designed to perform the following functions: 1) influence the delivery of sediment, organic matter, and woody debris to streams; 2) provide root strength for channel stability; 3) shade the stream; and 4) protect water quality. Studies have shown that buffer widths of between 50-300' have been very effective in controlling the delivery of non-channelized sediment to streams (Waters 1995). INFISH buffers are believed to adequately maintain riparian functions such as sediment control, temperature moderation, and recruitment of large woody debris and other organic material (INFISH EA). Table 3-75 displays the minimum INFISH buffer widths for priority watersheds and the widths proposed under the action alternatives of this project. Buffer widths may be greater than indicated in the table if site-specific conditions indicate that the riparian area is wider than the minimum width. In isolated cases the buffers may be narrowed when an existing road located within the RHCA adjoins a harvest unit. These adjustments would be approved on a site-specific basis and only when the buffer below the road is adequate to prevent sediment generated in the unit from reaching the stream.

While INFISH does allow harvest to take place within buffers under certain conditions, recent reports have suggested that riparian areas should be off-limits to fire salvage (Beschta et al. 1995; Beschta et al., 2004), and that is the approach taken in this project. Salvage harvest would only be allowed within these riparian buffers under Alternatives B, D, and E of this proposal, in locations where streams cross roads open to the public. In these areas, helicopter harvest would be allowed 200 feet above and below the road, in order to protect public safety and prevent crossing sites and structures from being blocked by downfall or damaged by illegal firewood harvest.

Table 3-75. INFISH RHCA Buffer Widths (Feet)*

Type of RHCA	INFISH Standard	Alt. B	Alt. C	Alt. D	Alt. E
Fish-bearing stream reaches	300	300	300	300	300
Permanently flowing, non-fish bearing	150	150	150	150	150
Seasonally flowing or intermittent streams, priority bull trout watersheds	100	100	100	100	100
Seasonally flowing or intermittent streams, non-priority bull trout streams	50	50	50	50	50
Ponds, lakes, or wetlands > 1 acre	150	150	150	150	150
Ponds, lakes, or wetlands < 1 acre	100	100	100	100	100
Landslide prone areas	100	100	100	100	100

* Montana Streamside Management Zone (SMZ) law requires minimum of 50-foot buffer on all streams.

Another fisheries concern normally associated with timber harvest is the effect upon water yield, or the amount of water reaching stream channels. Substantial increases above normal levels can result in channel destabilization and increased rates of erosion. Live trees reduce water yield through evapotranspiration and canopy interception, but dead trees have little effect upon water yield. Increases in water yield are also common following road building, both because road surfaces intercept sub-surface water and channel it to streams more quickly, and because the road surface creates a net loss of vegetation in the watershed. Soil compaction resulting from use of logging equipment also can contribute to increases in water yield, in much the same way that roads do. This proposal does not call for the removal of trees expected to survive the fire, thereby greatly reducing any potential affect upon water yield. This proposal does not require the construction of any permanent roads, and all salvage logging is designed to minimize soil compaction (see vegetation and soils sections). Water yield will increase in all channels because of the fires, and some channel destabilization is likely to result from increased flows. The areas most likely to be affected by water yield increases are primarily downstream of high burn severity areas, such as Goldie Creek.

Direct and Indirect Effects

Alternative A

This is the “no action” alternative, under which no salvage or road management changes would occur. There would be no direct effects to fish populations if this alternative is selected, but there are potential indirect effects which might occur. The action alternatives require the decommissioning of between 49 and 69 miles of road within the project area. Road decommissioning includes the removal of culverts and other practices that can contribute sediment to streams. The long-term effect of decommissioning is a reduction in sediment levels as roadways and stream channels re-vegetate. If this alternative is chosen, the road decommissioning options would not be carried out, and there would be neither a short-term negative impact nor a long-term positive benefit to the aquatic environment.

In addition to those roads to be decommissioned, if one of the action alternatives is implemented approximately 220 miles of road within the project area would receive BMP treatments to improve drainage, provide fish passage, upsize culverts, and reduce sediment delivery to streams. The effects and benefits of this road maintenance on streams and fish populations have been described in a separate, post-fire BMP project; however, these improvements require funding generated from timber salvage for implementation. Upgrading 220 miles of road would substantially reduce sediment delivery to streams; provide improved fish passage at stream crossings, and significantly reduce the risk of road washout and failure. If the no-action alternative is selected, these roads will continue to contribute sediment and ditch water to streams, isolated fish populations will remain separated by passage barriers, and roads will be at a greater risk of catastrophic failure at crossings.

No additional ground disturbance or sediment production related to management activities would occur under this alternative.

Effects Common to all Action Alternatives

The action alternatives of this proposal (B, C, D, E) all include some level of road decommissioning to improve grizzly bear security and reduce impacts to water quality and fish populations. Roads are usually the attribute of forest management that contributes the greatest volume of sediment to stream channels (Waters 1995). Roads increase the drainage network of a watershed, channeling increased runoff to streams and often contributing to channel instability (Trombulak and Frissell 2000). Road decommissioning typically includes culvert removal, which produces sediment at the removal site that often directly enters the stream. Decommissioning also requires the installation of water bars in the roadway to limit ditch flow, a process that may result in increased sedimentation, particularly if significant precipitation occurs during the excavation of the water bars. Design features such as filter fencing, seeding, and timing removal to occur during low flow periods are only partially successful at controlling sediment generated by decommissioning.

Road decommissioning, particularly culvert removal, is generally viewed as creating short-term harm to fish populations and habitat in exchange for long-term benefits. Culverts have the potential to suffer catastrophic failure if they become plugged with debris or are inadequately sized to accommodate high flows. The sediment generated by culvert failure typically far exceeds that produced by planned removal, particularly on steep slopes where fill depths are greatest (see hydrology section). Improperly installed culverts act as barriers to fish and restrict access to habitat and spawning reaches. Roads that are decommissioned “heal” over time and do not continue to contribute eroded sediment to streams. The decommissioned roads would reduce the drainage density and water yield, effects which would contribute to increased channel stability. The miles of road to be decommissioned vary between alternatives and the effects will be considered individually by alternative.

Timber harvest activity, especially those aspects such as road building and tractor skidding that disturb the soil, have also resulted in increased sediment delivery to streams. The contribution from harvest is generally less than that from the associated road network (Waters 1995). Historic logging practices that included removal of the riparian canopy had other harmful effects upon streams as well, such as increased temperatures and a reduced supply of large woody debris. Modern logging practices that maintain riparian buffer zones have greatly reduced the effects of timber harvest upon aquatic communities (Newbold et al. 1980, Waters 1995). In general, the use of helicopter yarding systems results in less soil disturbance than the use of skyline type systems, which in turn cause less impact than ground-based skidding equipment. Monitoring of the post-fire harvest on the Moose Fire in 2002 did not find substantial sediment delivery to streams resulting from salvage activity. As with road decommissioning, the potential effect of the various timber harvest scenarios will be considered below for each alternative. Fisheries biologists should participate in monitoring of salvage activities to insure the protection of the aquatic resources in the watershed.

As noted above, forest roads are the single greatest source of anthropogenic sediment in forest streams. Most road-related sediment occurs during the initial construction of the road, or as a result of drainage problems on poorly designed or maintained roads. This project requires no new permanent road construction, and only 4.1 miles of temporary road construction. All temporary roads would be constructed on the existing templates of old roads to minimize soil disturbance, and would be fully rehabilitated following use to prevent erosion. There is only one stream channel that must be crossed by a temporary segment, and it is an ephemeral channel that usually only flows water in the springtime. The unit accessed by this road segment must be harvested in the winter, so the channel will likely be dry at the time the crossing is needed.

All roads used to facilitate management activities under the action alternatives would be maintained or improved to meet BMP standards, thus minimizing the risk of sedimentation. Even well designed roads can become sediment sources however when they are subjected to heavy usage. As a result, all action alternatives of this proposal would require that dust abatement measures be utilized to minimize the airborne delivery of sediment to streams. In addition, all roads would be monitored during the usage period to identify areas of deterioration and address them before they can become a source of increased sedimentation.

The greatest risk of sedimentation following wildfire arises from the formation of new channels that deliver sediment into the existing channel network. This occurs when excess overland flow leads to the creation of rills and gullies, often during rainstorms. Downed trees help to prevent the development of rills and gullies by slowing the flowing water and dissipating its energy. The RHCA buffers would help protect against channelized sediment, particularly in areas where fire-killed trees have already fallen across the hill. Design features intended to reduce the occurrence of surface erosion would govern the treatment of unmerchantable material within harvest units. The Features Common and Alternatives descriptions in Chapter 2, as well as the soils section of Chapter 3, provide further information regarding harvest methods and erosion control efforts.

The following discussions of effects pertaining to each action alternative focus primarily on bull trout, currently the only aquatic species located in the project area that is protected under provisions of the Endangered Species Act. Bull trout are widely recognized as a salmonid species that is particularly sensitive to environmental degradation (Rieman and McIntyre 1993, Fraley and Shepard 1989). For this reason, it is generally safe to conclude that processes which favor bull trout populations and habitat also favor other native aquatic species, including westslope cutthroat trout. Cutthroat trout tend to be more widely distributed than bull trout throughout their sympatric range (McIntyre and Rieman 1995), and surveys in the project area support this conclusion. This broad distribution helps to buffer cutthroat populations from disturbance such as wildfire. Cutthroat tend to spawn and rear in headwaters stream reaches, areas that in large part are outside the burned area, and cutthroat use of burned streams following the Yellowstone fires of 1988 did not differ significantly from the use of unburned streams (Reinhart 1991). Redband Trout (*Oncorhynchus* mykiss), a similar species, re-colonized severely burned watersheds in Idaho within one year of the fire (Rieman et al. 1997).

Alternative B

This alternative proposes to salvage harvest fire-killed and dying trees from 130 units covering 4906 acres. Buffer strips would protect all streams within the harvest units as shown in Table 3-75 above. A variety of logging systems would be employed, including ground, cable, and helicopter methods. Each has different effects on ground disturbance, and potentially therefore on fish populations.

Alternative B also requires the decommissioning of 49 miles of road within the watershed. The potential sediment yield of this activity has been modeled and is discussed in the hydrology section of this document. The sediment generated above fish spawning reaches is of greatest concern due to the potential effect of deposition upon egg and fry survival in the spawning gravel. Project activities are planned above bull trout spawning habitat in Wounded Buck Creek, and above presumed cutthroat spawning habitat in several project area streams.

The timber harvest scheduled under this alternative presents a low risk of delivering sediment to the stream system. All harvest units are designed to employ logging methods that minimize soil disturbance. The majority of units would be logged using helicopters or cable systems on existing roads. Units scheduled for ground logging systems would require low-impact techniques such as winter logging or use of slash mats and forwarders (see vegetation section). Sediment modeling using the WEPP model predicted 234 tons of sediment would be delivered to streams as a direct result of timber harvest and the associated landings, temporary roads, and other ground disturbing activity (see hydrology section). Actual sediment delivery depends on many factors, particularly precipitation patterns in the years immediately following the fire. Experience following the Moose Fire of 2001 suggests that the models overestimated the amount of sediment that resulted from harvest activity.

The 404 tons of sediment predicted to result from culvert removals associated with road decommissioning under this alternative are a greater concern for the fisheries. Because this sediment is produced during culvert removals, there is a much greater likelihood that the modeled mass of sediment may be delivered to the streams. The use of BMP mitigation measures would help to reduce the actual amount of sediment produced. The logistics and cost of a decommissioning project of this magnitude would require that the work be carried out over a period of years, with a minimum of four to five years required to complete the work. This extended time frame would limit the amount of sediment entering the streams in any single year and reduce the risk that carrying capacity would be exceeded and result in deposition within the spawning reach. Finally, by timing the work to occur after peak runoff has taken place (a virtual necessity in the high elevations of the watershed) there would be an opportunity to begin to re-vegetate disturbed sites before the next high flow cycle begins. The establishment of new vegetation on these sites would help stabilize the soil and reduce erosion.

This volume of sediment is unlikely to have serious direct effects upon fish, such as impairment of respiratory function or interference with sight feeding. Because there are few barriers to fish movement in the project area, fish would have the opportunity to avoid areas of high disturbance by moving. Less mobile young-of–the-year fish would be most at risk of suffering stress and mortality because of high sediment levels. If stream temperatures rise because of the reduction in stream canopy resulting from the fires, thermal stress may compound the effect of elevated sediment loads upon fish. Fish were asphyxiated by sediment in a heavily burned stream in Yellowstone Park following a summer rainstorm two years after the 1988 fires (Bozek and Young 1994). Sediment resulting from culvert removal typically arrives in two pulses (see hydrology section). 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 revegetated.

The indirect effect of this sediment that causes the most concern from a fisheries perspective is deposition within spawning gravels resulting in decreased survival of eggs and fry. The precise degree of any deposition is impossible to accurately predict because it is dependant on several factors, most important of which is the future precipitation pattern and the resultant volume of stream discharge. Because the decommissioning work would take place over a period of several years, there would be an opportunity to monitor the concentration of fine materials and adjust the work schedule if the levels rise.

Whatever the short-term negative effects of the road decommissioning might be upon fish in Hungry Horse Reservoir and its tributaries, the long-term effects would be beneficial. Sediment delivery would be significantly reduced from the decommissioned roads with the installation of drain dips and, eventually, re-vegetation. The risk of catastrophic culvert failure with its potential huge pulse of sediment would be eliminated. Barriers to fish passage would be removed, allowing access to additional habitat. Water yield would decrease as roads ceased channeling intercepted ground water to streams. The road density within the various watersheds would be reduced, and road density was recently found to negatively correlate with bull trout abundance (Dunham and Rieman 1999).

Implementation of this alternative is not considered likely to threaten the existence of any local bull trout population or the entire South Fork population. This determination is based upon the fact that most bull trout spawning habitat is located upstream of the fire (and project) boundary, and vegetation in the riparian buffers adjacent to the remaining spawning habitat, located along Wounded Buck Creek, was unburned. Similarly, westslope cutthroat trout are widely dispersed throughout the South Fork drainage and their local population is not at risk of extinction from the proposed action.

Alternative C

Alternative C proposes to harvest dead and dying trees from 96 units encompassing 3933 acres, or approximately 1000 fewer acres than the proposed action. The reduction in units and acreage results from eliminating or reducing the size of units considered, for a variety of reasons, to be more sensitive to harvest. These units include several in the vicinity of a bald eagle nest on Clayton Island, and the RHCA units along open roads. The reduction in units and harvested acreage reduces the modeled sediment yield to 182 tons, a reduction of 52 tons from Alternative B, which should reduce project effects on the aquatic ecosystem proportionally.

This alternative would decommission 69 miles of existing road, twenty miles more than Alternative B. The increased miles of decommissioning result in an estimate of sediment yield approximately 20 tons greater than Alternative B, for a total of 424 tons. The primary negative effect of this additional sediment would be a short-term increased risk of impairment to bull trout and westslope cutthroat trout spawning habitat, but the relatively small increase should not substantially add to the impact of the project upon the species. The improved drainage characteristics and reduced risk of a catastrophic road failure resulting from the additional 20 miles of decommissioning would contribute to a gradual and lasting improvement in the quality of fish habitat in the project area.

Alternative D

Alternative D proposes to harvest dead and dying trees from 122 units encompassing 5300 acres. The modeled sediment yield associated with the timber harvest in this alternative is 234 tons. There are eight fewer riparian units along open roads with the access management plan proposed in this alternative. The impact of the harvest proposed in this alternative would be approximately equal to that in Alternative B.

As in Alternative C, approximately 69 miles of road would be decommissioned under this alternative, potentially generating 441 tons of sediment during culvert removals. Again, the greatest risk posed by this sediment is impairment of trout spawning habitat, but the long-term improvement in drainage and habitat connectivity would contribute to better aquatic ecosystem health in the project area while substantially reducing the risk of catastrophic culvert and road failure.

Alternative E

Alternative E proposes to harvest dead and dying trees from 130 units encompassing 5300 acres. The modeled sediment yield associated with the timber harvest in this alternative is 234 tons. This alternative would provide the greatest volume of timber harvest, estimated at 56 million board feet. The increased harvest is associated with a greater volume taken from along open roads than in the other alternatives. The same harvest systems will be employed as in Alternative B, with approximately 60% of all units harvested by helicopter, with the remaining units using either skyline or ground-based harvest equipment. All ground-based units would require appropriate safeguards to minimize soil disturbance.

Alternative E proposes the same 49 miles of road decommissioning as Alternative B, and the short-term impacts and long-term benefits of this action would be the same in both alternatives.

Cumulative Effects

Cumulative effects analysis examines the predicted total impact of the existing condition and any proposed or reasonably foreseeable future activities upon a resource or other value. This part of the analysis will focus upon the probable response of the aquatic ecosystem within Hungry Horse Reservoir and the connected streams and rivers, particularly the fish populations, to the proposed action and any additional actions or events that have the potential to affect those populations. As noted in the introduction to this section, the South Fork Flathead boasts the healthiest native fish community in all of Montana. Regardless of which alternative is implemented by this project, that status would not change.

The choice of suitable geographic boundaries for the cumulative effects analysis for a migratory species such as bull trout can be challenging. The best scientific data available indicates that bull trout that spawn and rear in streams within the project area spend their entire lives between those streams and Hungry Horse Reservoir. Bull trout that spawn and rear in other streams that flow into the reservoir or South Fork of the Flathead River share some portion of that habitat with the fish from Sullivan, Quintonkon, and Wounded Buck Creeks, and must be considered in the cumulative effects analysis for the project.

However, our analysis indicates that this project would have no measurable effect on any aquatic resource beyond the streams within the project area. Potential sediment increases attributable to this project would be difficult to distinguish from the normal background sediment levels entering the reservoir from the burned area. For this reason, the primary focus of the cumulative effects analysis for fisheries will be upon the populations in the streams within the project area. This emphasis on the local population is consistent with a recent recommendation from the local bull trout recovery coordinator for the US Fish and Wildlife Service (Wade Fredenberg, USFWS, personal communication, March 1, 2002).

Drought

The continuing drought in northwestern Montana, which is now in its sixth year, is perhaps the single most significant event affecting fish and aquatic ecosystems within the region. Below normal precipitation has resulted in low water levels in streams, rivers, and lakes. Seasonal wetlands, which can provide important breeding habitat for amphibians, have shrunk in size or dried up as the water table has receded. The drought has largely been responsible for the severe wildfire seasons the region has experienced for the past several years.

Low water levels can affect fish by reducing the amount of available habitat. Pool depths decrease, resulting in water temperatures that are higher during the summer and lower in the winter. Spawning success can decline when redds are dewatered. Fish become more vulnerable to predators, and disease may spread through a population as fish crowd the remaining habitat. Low water levels can also prevent fish from migrating when streams go subsurface or barriers become insurmountable due to low flows.

Fortunately the streams within the project area are not used for irrigating crops, a conflict that exacerbates the effect of the drought in other areas of Montana. There obviously is nothing fisheries biologists can do to end the drought, but fish and amphibians in this region have evolved with periodic droughts and there is as yet no indication that populations have suffered any substantial declines because of the below normal precipitation. The action alternatives proposed for the West Side Reservoir would all provide a small amount of drought mitigation by reducing drainage density when roads are decommissioned. By reducing the miles of road ditch that channel water to streams, more water will percolate into the ground and more slowly travel to the streams, thereby maintaining higher flows for a longer period of time.

If there is a positive side to the drought, the relative lack of precipitation has minimized erosion in the fire areas. To date, fisheries biologists and hydrologists have not witnessed any substantial evidence of erosion in any of the burned areas along the reservoir. Rills and gullies have not been observed on hill slopes, nor have any instances of mass wasting or hill slope failure known to have occurred in the burned areas.

The Fires of 2003

The fires of 2003 were the most extensive to strike the South Fork Flathead watershed for many years. In all, more than 115,000 acres were within the various fire perimeters, the majority (nearly 90,000 acres) in the Little Salmon Complex in the Bob Marshall Wilderness. The fires all display patterns with varying levels of burn severity ranging from areas of high severity where all vegetation was killed and the surface duff layer was consumed, to unburned areas that the fires did not touch.

The magnitude and severity of the fires are discussed more thoroughly in other portions of this document. From a fisheries standpoint however, the fires themselves had a relatively small impact. Although there were likely some direct fish kills, post-fire sampling indicated that all species of fish were present and distributed throughout the stream networks. However, the true impact of the fire upon aquatic resources will not be known for several years.

The effect of fire upon streams and their biota is a topic that has received considerable scrutiny in recent years. Numerous studies have documented effects ranging from increased nutrient levels (Spenser and Hauer 1991) to changes is channel stability and habitat complexity (Rieman et al. 1997) and shifts in the invertebrate community composition (Minshall et al. 1989).

Some fire effects are most pronounced during and immediately after the burn, while others are felt over a period of several months or years. The effect of severe wildfire may still be discernible a century after the fire if large woody debris became unavailable to the stream network. Most fire effects diminish in a decade or less with the recovery of vegetation. Fire severity is often reduced in riparian areas due to their higher moisture and lower topography (McMahon and deCalesta, 1990; Greswell, 1999; Dwire and Kauffman, 2003).

The Blackfoot Complex burned across very little of the identified bull trout spawning habitat along the reservoir. Of the major bull trout streams that flow directly into Hungry Horse Reservoir, only Wounded Buck Creek has spawning habitat downstream of burned areas. The spawning habitat in Sullivan Creek is upstream of the fire perimeter; the limited amount of fire in Quintonkon Creek should have no impact on habitat in that stream. No fire occurred in the Wheeler Creek watershed.

Direct delivery of sediment to streams via sheet, or non-channelized flow, is dependant upon the short-term patterns of precipitation and snowmelt. Most studies have shown that erosion is greatest in the first year following a fire, and declines rapidly as vegetation recovers (see hydrology section). Much of the riparian vegetation in the burned areas suffered only low to moderate fire mortality, or did not burn, and should limit sedimentation resulting from sheet flow. The riparian vegetation in lower Sullivan Creek experienced high mortality, but any sediment reaching the channel in this area should be flushed from the watershed with little impact to the fish populations.

The potential fire effects extend beyond increases in sediment levels. Stream temperatures may rise as a result of a decrease in the riparian canopy that provides direct shade to the stream. The loss of the upland canopy may also contribute to higher water temperatures if precipitation moving over or through the soil is warmed before reaching a stream channel. Any increases in temperature should be minor and well below levels directly harmful to fish. Warmer water temperatures could result in a delay of bull trout spawning, if spawning adults hold in the reservoir until temperatures drop. There is little that fisheries management can do to mitigate any temperature increase beyond protection of the remaining riparian canopy, but certainly native species have survived similar events in their history. The Flathead National Forest will monitor temperatures in the burned area streams in order to further our understanding of the effect of large fires upon stream temperatures.

Instream recruitment of large woody debris should increase in the short term because of the fire. Observations of the fisheries biologist in the months following the fire indicate that a large number of trees have already fallen into the stream channels, and many more are likely to do so over the next several years. In addition, a sufficient number of trees remain alive in most of the riparian corridors to insure a continuing supply of large woody debris in coming decades. The most severely burned riparian areas in lower Sullivan Creek should continue to recruit large woody debris from upstream while the forest re-grows. The effect of this pulse of woody debris should be to accelerate the stabilization of stream channels and increase the habitat complexity, effects that would benefit fish. These benefits should be manifest over a period of five to ten years. There may be instances of channel migration and bank erosion as the streams adjust to the new wood, but these should be short lived and spatially restricted. Flathead National Forest biologists and technicians monitor the streams, and if necessary could take action to restore fish passage. Channel erosion would also be monitored to determine if any actions are needed to reduce undesirable impacts.

Wildfires result in increased levels of nutrients in streams and lakes, particularly reactive phosphorus and compounds of nitrogen. Reactive phosphorus levels increased more than 40-fold in streams of Glacier National Park during the Red Bench Fire of 1988 (Spencer and Hauer, 1991). However, nutrient levels in that study returned to background levels within two weeks, and there is no evidence that the pulse of nutrients contributed to a shift in the flora or fauna of the streams. In cases where the riparian canopy is burned, the increased sunlight reaching the stream may result in increased growth of algae that may persist until the canopy is once again shading the stream. The streams within the project area are all considered to be oligotrophic; i.e.; nutrient-poor, and any short-term increase in nutrient levels resulting from the fires may result in a temporary increase in productivity, but is not likely to contribute to any long-term shifts in the aquatic communities. Nutrients may decline in five to ten years due to the loss of organic material from the uplands, and the return to a pre-fire nutrient regime may require several decades of regeneration (Minshall et al., 1989).

Severely burned watersheds may experience stream channel instability if increased water yields from burned uplands result in peak flow levels substantially above the pre-fire norms (Minshall and Brock, 1991). The degree to which channel erosion occurs in this region is closely tied to patterns of precipitation and snowmelt, particularly in the first few years following the fires. As upland vegetation recovers, water yield increases will decline and stream patterns of discharge will return to historic levels. Thus far in 2004, runoff along

Hungry Horse Reservoir has been below normal and no instances of major in-channel erosion have been observed.

The wilderness fires have the potential to affect fish populations, particularly bull trout, within the South Fork ecosystem. Fire occurred in several important bull trout spawning streams in the wilderness, including Little Salmon, Gordon, Youngs, and Danaher Creeks. However, fire was generally confined to the lower portions of all these watersheds and is not expected to have a major impact upon bull trout spawning within the wilderness.

Fire Suppression

The Blackfoot Fire Complex was a long-duration series of events that occurred during severe drought conditions. Extreme fire behavior often prevented direct attack on the fire fronts, and forced fire crews to concentrate on indirect suppression methods such as the establishment of contingency fire lines, which are constructed ahead of the active fire in anticipation of future fire growth. As safe anchor points were established, mechanized and hand-built fire lines were advanced along the edges of the fires, often with aerial support. Airplanes and helicopters applied both fire retardant and water to the blazes. All these activities have the potential to affect fisheries resources and water quality in different ways.

Phos-Chek brand fire retardant was deployed with large helicopters from portable plants located at the Spotted Bear airfield and the Hungry Horse fire camp. This retardant formulation has demonstrated low toxicity to fish and aquatic invertebrates (Gaikowski et al. 1996). Phos-Chek contains no sodium ferrocyanide, a component of some fire retardants that can release cyanide under the influence of sunlight. Additional retardant was applied by fixed-wing tankers operating out of several regional airports. Protocols for the use of any retardant restrict application within 300' of streams. Retardant is typically used along ridge tops and upper slopes to take advantage of topography or adjacent to natural firebreaks such as scree slopes. Few fish-bearing streams are located in the upper elevations of a watershed, minimizing the danger of retardant directly harming fish. In order to determine the potential effects of fire suppression activities, records relating to the Blackfoot Fire Complex were reviewed, and personnel involved in fire suppression and BAER actions were consulted. To the best of our knowledge, no fish kills were attributed to the use of aerial fire retardant on the fires, nor did any significant amount of retardant reach perennial stream channels.

Water withdrawal for fire fighting purposes also has the potential to impact fish. Helicopter buckets drawing water from lakes and streams could accidentally capture fish directly, although one recent study indicates this is extremely unlikely, probably because fish in this region are adapted to avoiding avian predators (Jimenez and Burton 2001). Fire crews were directed to not dip from streams and lakes outside the South Fork, to prevent the accidental introduction of any non-native species. Most suppression activities ended prior to the onset of bull trout spawning and should not have affected that autumn activity to any appreciable degree. A greater threat to fisheries arises when fire crews operating portable pumps use streams directly as a water source. In the case of small streams, the demand from multiple pumps can significantly deplete stream flow. We are not aware of any cases in the Blackfoot Complex where fish were threatened by water withdrawal for fire fighting purposes. Some temporary log impoundments were built in several streams to create pools, but these were only a few inches high and temporary. These impoundments would not have blocked adult bull trout on their spawning migration. We know of no spills of fuel or other chemicals into streams during fire suppression.

Fire lines were constructed within RHCAs in several locations, including Sullivan Creek, where a historic road was reopened for approximately one mile, which required crossing four ephemeral stream channels. The rains that essentially doused the fires in early September of 2003 resulted in a quantity of sediment eroding from these disturbed channels into Sullivan Creek. The quantity of sediment that entered Sullivan Creek from this one area is unknown, but likely was several tons. These ephemeral streams enter Sullivan below the bull trout spawning reach and this sediment therefore should not have affected spawning. The bull trout redd count in October of 2003 recorded 45 redds, more than double the count of the previous year and approximately the average of the last decade. Large numbers of spawning whitefish were observed in Sullivan Creek by a Forest Service fisheries biologist in early October.

An old road segment that had been converted to a trail along Wounded Buck Creek was excavated as a fire line for approximately one half mile. It is probable that some sediment reached the bull trout spawning reach of the creek as a result of disturbing the vegetation in what is a very wet area. However, it is doubtful that the volume of sediment reaching the creek was great enough to impact spawning of bull trout, particularly since the riparian buffer zone along the creek remains intact and unburned. There were ten bull trout redds counted in the fall after the fires, in Wounded Buck Creek, which is the most since a count of 14 in 1997.

All fire lines were rehabilitated as soon as fire conditions made it safe to do so. Rehabilitation included replacing disturbed soil, covering the soil with slash and debris, and the construction of waterbars on slopes. Inspection of the rehabilitated lines took place in the fall of 2003, and monitoring has continued in 2004 to insure that the fire lines are not channeling sediment to the stream network.

Numerous hazard trees were felled and often decked along roads throughout the fire area during and immediately after the fire. These trees were recovered as part of the hazard tree salvage sale. Hazard trees that were felled in RHCAs have been left in place and will remain unless they pose a risk to crossing structures or they otherwise threaten stream channel stability. Ground disturbance was minimal at these sites and the stream reaches affected are too short to have any measurable impact on overall stream condition.

The existing road network was also utilized as fire line in all the fire areas, requiring the removal of vegetation and some soil disturbance, particularly on roads that had been administratively closed for several years. Ongoing rehabilitation of these roads includes measures such as culvert cleaning and the installation of drain dips to help prevent sediment from reaching streams. See the hydrology section for further discussion of the effects of fire suppression on sedimentation.

BAER

As fire activity began to wane, a Burned Area Emergency Response (BAER) team was assembled to assess the need for urgent action to protect water quality and stream channels as a result of potential impacts from the fires. A variety of measures were implemented, ranging from the cleaning of roadside ditches and culvert inlets to the installation of approximately 1000 straw “wattles”, or erosion barriers, on a severely burned hill slope above Sullivan Creek. Many areas that suffered high burn severity were aerial seeded with a mixture of barley and native grasses to provide some ground cover until natural regeneration occurs.

BAER activities such as the cleaning, removal, and replacement of culverts may result in sediment delivery to streams. Appropriate mitigation measures such as dewatering the crossing site and the installation of sediment barriers are employed to minimize the volume of sediment reaching stream channels during these actions. In all cases, the sediment occurring as a result of BAER implementation actions is a small fraction of the potential sediment that could result from culvert failure or hill slope mass wasting. It is not likely that BAER actions had any serious negative impact upon fish or aquatic ecosystems.

Historic Timber Harvest

All of the project area watersheds have been subject to some level of road construction and timber harvest over the past sixty years. The majority of activity took place prior to 1980 and the adoption of BMP road and timber standards. Within the fire boundaries, timber harvest dating from the 1950s to 1994 had occurred on about 6803 acres, or about 21 percent of the 31,450 acres burned by the West Side Fires (see Vegetation section above). Not all of those acres were treated with regeneration (clear-cut) harvest.

While roads generally extend throughout many of the watersheds, most harvest activity was concentrated in the lower elevations closer to the reservoir. Some early harvest removed trees along the stream banks and left stream reaches with a lack of large woody debris. This practice primarily occurred in steep, ephemeral channel reaches; there appears to be ample large woody debris in all the larger, fish-bearing streams.

Past timber harvest likely caused channel instability in some streams due to increased peak flows, but the primary impacts to fish populations and habitat have occurred as a result of sediment and water delivery associated with the road system. As noted in the hydrology section, the road network continues to deliver an estimated 66 tons of sediment to streams in the project area every year. Poorly designed culverts on some streams within the burned areas prevent fish from moving upstream and have fragmented populations, particularly of west-slope cutthroat trout.

BMP Project

The Flathead National Forest is currently implementing a project aimed at improving the condition of the road network in areas burned by the fires of 2003, using specially appropriated post-fire restoration monies and, potentially, monies generated from the salvage of the burned timber in the fire areas. The extensive forest road network in the project area has suffered for many years from inadequate maintenance due to a lack of funds, resulting in excess sediment and water reaching streams and contributing to degraded fish habitat and destabilized channels. Undersized culverts have scoured stream channels below their outlets and become barriers to fish migration, denying native populations access to important habitat. Depending on the amount of available funding, up to 320 miles of forest road will receive Best Management Practices (BMPs) drainage improvements over the next two or three years. Approximately 164 of these miles are within the project area, with the remainder located in the Crazy Horse, Robert, and Wedge Fire areas.

The installation of BMP-standard improvements will result in some sediment delivery to streams, particularly at sites where undersized culverts are removed and/or replaced with structures designed to accommodate a 100-year flood event, the minimum size allowed under INFISH guidelines. As in BAER efforts, mitigation measures such as dewatering the stream and installing erosion barriers will be employed as needed to minimize sediment delivery. Other BMP improvements, such as the installation of drainage dips and cross-drain pipes in the road prisms should not deliver large quantities of sediment to streams. While there may be short-term negative impacts on fish and habitat during implementation of this project, the ultimate effect will be a substantial improvement in the quality of fish habitat, stream channel stability, and population connectivity in the project area.

South Fork Flathead Westslope Cutthroat Conservation Program

The MTFWP is currently cooperating with the Bonneville Power Administration (BPA) and the FNF to develop a plan to remove non-native and hybridized fish from 21 lakes in the South Fork Flathead, in order to protect the genetic purity of westslope cutthroat trout. The lakes in question were historically stocked with either rainbow trout or “generic” strains of cutthroat trout, often Yellowstone Cutthroats (*Oncorhynchus clarki bouvieri*), both of which can hybridize with westslope cutthroats and result in a loss of genetic purity among the latter subspecies.

The outlet streams of two of the targeted lakes flow through the project area: Wildcat Creek and Clayton Creek. The draft EIS has just been released for this project, and proposes to use fish toxicants to remove all fish from these lakes. Rotenone, a fish toxicant derived from plants, would be used in Clayton Lake, where the proposal calls for the removal of hybridized fish from the lake and approximately 4.5 miles of the stream below. Antimycin, another fish toxicant, is proposed for use in Wildcat Lake, where only the lake and a short reach of stream are targeted for the fish removal. In both cases, streams would be monitored to ensure that the toxicants are rendered non-lethal beyond the target stream reaches.

This project, if implemented, would result in the death of many thousands of targeted fish, and likely there would also be some degree of incidental mortality among pure westslope cutthroat and bull trout as well. Monitoring safeguards designed into the project should limit incidental mortality to very low levels. If this project is not implemented, hybridization among cutthroat populations will likely increase and may ultimately threaten the South Fork westslope population. For more information regarding this project, contact MTFWP in Kalispell, Montana, or visit the website at: http://fwp.state.mt.us/.

Recreation

The South Fork of the Flathead is a popular destination for recreation, attracting both locals and visitors from around the world. Boating, hiking, hunting, and fishing are all popular pastimes. Anglers are attracted to Hungry Horse Reservoir, the South Fork River, and the many high country lakes that dot the landscape of the South Fork. The Jewel Basin hiking area provides an escape from motorized vehicles, while many other trails are open to motorized use and are popular with motorcycle enthusiasts.

The waters of the South Fork are popular with a variety of anglers, ranging from boaters who troll the waters of the reservoir to hikers that use tiny dry flies to coax cutthroat trout from the high mountain lakes of the wilderness. The South Fork River above the reservoir receives angling pressure from fisherman on raft trips that can be as short as a half day or as long as a week. Fishing is generally good to excellent across the spectrum of opportunity within the South Fork.

The streams flowing through the project area generally receive only light fishing pressure, with most anglers preferring the larger water bodies. Fishing regulations are determined by MTFWP and are reviewed each year in order to protect the health of fish populations. Angling is not thought to be currently limiting fish populations within the South Fork. Bull trout populations in the watershed are considered to be so healthy that a limited fishery has been approved in 2004 for the threatened species. Anglers will be allowed to keep two bull trout per season from the reservoir, while fishing in the river will be catch-and-release only. This new fishery requires a special permit and will be closely monitored to ensure that the South Fork bull trout population will continue to thrive.

Recreational use of the trail network, particularly the motorized trails, likely results in some sediment reaching streams within the project area. However, most trails are located on ridge tops away from streams and should have no impact upon water quality. Any sediment produced at trail stream crossings would be in small amounts and should not pose a threat to the aquatic environment.

Cumulative Effects of Alternative A

Fish populations in Hungry Horse Reservoir and the South Fork Flathead River are healthy, as is the majority of the aquatic habitat in the watershed. Alternative A, the "no-action" alternative, would potentially have the greatest negative impact upon fish and their habitat of all the proposed alternatives. Roads are generally accepted as having the greatest detrimental impact upon aquatic ecosystems of any management activity on the Flathead National Forest. If this alternative is chosen, the approximately 220 miles of road that would receive BMP improvements when used as salvage haul routes would instead continue to deteriorate and contribute excess sediment and runoff to streams within the project area. In addition, if the no-action alternative were chosen, no road decommissioning would occur within the project area. An elevated risk of catastrophic culvert failure and massive sediment delivery would exist when compared to the condition that would exist if one of the action alternatives were implemented.

Cumulative Effects of Alternatives B, C, D, & E

If one of the action alternatives is implemented, the effects would be similar regardless of which is chosen. The fish community in the South Fork Flathead would remain healthy and aquatic habitat in the project area would experience some improvement over time, due primarily to reduced impact from the road network. The salvage plan contained in Alternative C would have the least effect upon the aquatic environment, while Alternative E would have the greatest. Alternatives B and D are intermediate and approximately equal in terms of potential impact. However, none of the action alternatives is expected to cause serious harm to fish or their habitat, because all are designed to minimize soil disturbance. The maintenance of RHCA buffers and the absence of new road construction should adequately protect water quality from harvest impacts.

Regulatory Framework and Consistency

The National Forest Management Act requires the Forest Service to manage lands under its jurisdiction in a manner that insures the maintenance of viable populations of native fish. The Flathead National Forest has recently completed a viability analysis for bull trout and westslope cutthroat trout, which concluded that the populations of both species are currently viable within the Flathead National Forest (see Exhibit F-4).

The Forest Plan is the primary document that codifies management standards and guidelines governing activity on national forest system lands. Originally adopted in 1986, the Flathead Forest Plan was amended in 1990 (Amendment No.3) to better define the standards for protection of fish populations. Amendment 3 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 Forest Plan was again amended on August 30, 1995, by the Inland Native Fish Strategy (INFISH) (USDA Forest Service 1995). This interim strategy was designed to provide additional protection for existing populations of native trout, outside the range of anadromous fish, on 22 National Forests in the Pacific Northwest, Northern and Intermountain Regions. 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 metapopulation objectives, or are watersheds that have excellent potential for restoration. Sullivan and Wounded Buck Creeks are priority watersheds. INFISH also established Riparian Management Objectives (RMOs) and Riparian Habitat Conservation Areas (RHCAs). RMOs are habitat parameters that describe good fish habitat. Where site-specific data is available, these RMOs can be adjusted to better describe local stream conditions. These RMOs for stream channel conditions provide the criteria against which attainment or progress toward attainment of riparian goals is measured. RHCAs are portions of watersheds where riparian dependent resources receive primary emphasis. The RHCAs are defined for four categories of stream or water body dependent on flow conditions and presence of fish. The RHCAs are within specific management areas and are subject to standards and guidelines in INFISH in addition to existing standards and guidelines in the Flathead Forest Plan.

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. The recovery plan for bull trout is currently being developed. Critical habitat delineation is also currently being determined. A stand-alone BA for bull trout 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 (Exhibit F-5). The westslope is on the Regional Forester's "sensitive species" list. A Biological Evaluation would be 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) (Exhibit F-6).

Threatened and Sensitive Species Determinations

The Flathead 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 Alternatives 2-5 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 Fish and Wildlife Service when a proposed action is determined likely to affect a listed species. If an action alternative (B through E) is selected for this proposal, a BA would be prepared to make an effects determination of the selected alternative upon bull trout. The initial determination for bull trout for all alternatives is *"may affect, likely to adversely affect"*. The no action alternative merits this determination primarily because the lack of road decommissioning would maintain a higher road density in the watershed, with its associated chronic sediment delivery and risk of catastrophic culvert failure. The adverse affect attached to Alternative A has no corresponding future benefit. Alternatives B though E warrant the adverse affect determination largely because of concerns with sedimentation resulting from road decommissioning and timber harvest. The action alternatives would provide a long-term benefit to bull trout because of the road decommissioning.

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 Exhibit F-7. The determination for westslope cutthroat trout for all alternatives is *"may impact individuals or habitat, but would not likely contribute to a trend towards federal listing or loss of viability to the population or species."*

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