WATER QUALITY

EFFECTS ON WATER QUALITY FROM THE EXISTING ROAD AND TRAIL SYSTEM UNDER CURRENT LEVELS OF MAINTENANCE.

There are concerns about the effects on water quality from the existing road and trail system under current levels of maintenance. There are also concerns about the effects on water quality if human use levels or road/trail mileages increase**.**

1. EXISTING CONDITION

a. Natural Characteristics and Past Events and Conditions

The Little Belt, Crazies, and Castle Mountains are located in the central part of Montana situated on the east side of the Rocky Mountains generally isolated and extending eastward into the Great Plains. The underlying dominant geology within these small island mountains includes limestone and dolomite atop a basement complex of gneiss and schist. Shale and volcanic rock also occur. These rocks have weathered to form steep limestone cliffs and slopes in the lower elevations and rounded more gently sloping hillsides and ridges in the mid to upper elevations. Topographically, the Little Belt Mountains trend to the northwest-southeast with an average elevation of 7,600 feet. Big Baldy is the highest elevation standing at approximately 9,000 feet.

The mountains within the analysis area are well watered receiving relatively abundant precipitation. The Little Belt Mountains are well watered with an average rainfall of 24 to 40-inches each year. The major drainages within the Little Belt Range include the Smith River on the west side of the analysis area, and Belt Creek, which drains the central part of the mountains. The Judith River and the Musselshell River drain the eastern parts of the Little Belts. Generally, the Castle Mountain drainages flow northwest to the North Fork Smith River and southeast to the Musselshell River. The Crazy Mountains flow is to the northeast to the Musselshell River. Regionally, all waters within the Little Belt, Crazy, and Castle Mountains drain north and east into the Missouri River.

The average level of precipitation is adequate to maintain streamflows throughout the year along most of the mainstem reaches and headwater tributaries. However, the underlying geology plays a significant role in determining whether streamflow is perennial or intermittent. Streamflow losses to limestone geology in the Little Belts have been determined to be significant (Feltis and Shields 1982). These losses result in the low or no flow along some reaches within the project area during late summer/early fall.

All geologic units underlying the Jefferson Division can potentially contain groundwater, with variability in yield and quality depending on the lithology of the formation. Those units with a high degree of porosity and permeability (unconsolidated surface gravel, sandstone and limestone) have the potential to contain large amounts of water. Conversely, those units with low porosity and permeability will contain little free water and have low transmissivity.
The combination of late, deep snow packs, steep slopes and Chinook winds can produce rapid runoff conditions on an approximate ten-year basis. Past flood events typically occurred in late spring when heavy rains on saturated soils added significant flows to channels already full with snowmelt runoff.

The Sheep Creek Range Analysis (USDA 2004) indicates that most of the mainstem reaches have experienced significant flood events in the resent past. Analysis of discharge records for the gauging stations on Sheep Creek indicate that significant floods occurred in 1947, 1953, 1964, 1965, 1967, 1970, 1975, 1978, and 1982. This information suggests that floods of the last 55 years have likely contributed substantially to the current conditions along many stream reaches in the Jefferson Division. These recent flood events have played an important role in forming existing channel conditions. Some of the headwater channels are deeply entrenched with scoured banks (Johnson and Omang 1976). Wide, open floodplains with large cobbly/gravelly deposits are typical of the middle and lower portions of mainstem channels. The channels are still adjusting in these open floodplains with common, active meandering along the unstable alluvial banks. Natural stream sediment is due to dry creep (gravitational movement of surface soils), overland flow and mass failures in the upper reaches and in-channel erosion in the lower reaches. In general, *sediment supply exceeds sediment transport capacity* under average flow regimes.

Stream flow varies throughout the Jefferson Division. Watersheds that lie within the limestone reefs have intermittent flow by mid-summer as stream flow subsides and resurfaces in response to limestone solution channels (cavities that have formed through water movement and dissolution of minerals) and coarse alluvial deposits in the valley bottoms.

Thirty four forest fires ranging in size from 11 to 33,215 acres have occurred within the Jefferson Division over the past 30 years and are summarized in Table III-58 (see discussion on soils). The largest of these fires was the 1990 Turkey fire consuming approximately 33,215 acres, of which, roughly 70 percent was non Forest Service prairie and ranchland. In 1985 the Sand Point fire consumed approximately 10,320 acres of forest and the 1988 Iron Claims fire 1,396 acres. The 3,421-acre Coyote Creek fire occurred in 1996. In 2001 the Monarch fire scorched 1,684 acres near the town of Monarch. Two fires occurred in 2000 and 2003 in the Ant Park area burning 1,403 and 2,107 acres respectively. Many smaller (<10 acres) fires have occurred within the analysis area and are to numerous to include in this analysis. The combination of steep slopes and reduced infiltration resulted in significant increases in peak flows and subsequent channel alterations. Extensive deposits of silt and sand occurred along the lower gradient portions of burned streams. Although surface and instream erosion was high for the years immediately following the fire, current sediment loads have diminished considerably. Flow levels would be expected to be higher than normal until effective vegetation is re-established.

All geologic units underlying the Jefferson Division can potentially contain groundwater, with variability in yields, and quantity, dependent on the lithology of the formation. Those units with a high degree of porosity and permeability (unconsolidated surface gravels, sandstones and limestones) have the potential to contain large amounts of water. Conversely, those units with low porosities and permeability will contain little free water and have low transmissivity.

There are large accumulations of alluvial material throughout the valley bottoms. The permeability of these materials is generally a function of their clay content. Near-surface groundwater is usually present in the valley bottoms, but limited in extent due to adjacent steep slopes.

The type and degree of vegetative cover is also a determinant of stream flow, sediment yield and stream type. Vegetation is largely defined by climate and soils, but other natural agents of fire or insect and disease may alter vegetative composition and ground cover.

b. Human Influences

The most important activities that have affected water resources are livestock grazing, water uses and roads and trails. Grazing allotments occur throughout the drainages, but because of the steep terrain, grazing pressure is concentrated generally in the valleys, meadows and flat plateaus. Headwater channels with flat gradients and banks composed of fine sediments are sensitive to grazing and generally have been impacted to some degree from bank trampling. The mainstem channels have a lower sensitivity to grazing due to depositional bars with high rock content and general lack of forage in these areas.

The Castle Mountain Range Analysis (1997) includes watersheds within the Castle Mountains. Watersheds within in the analysis area include: Checkerboard, Fourmile, Hensley, Warm Springs, and West Fork Cottonwood. Forty-two miles of streams in the Castle Mountains were surveyed. For this analysis, streams were typed based on Rosgen Stream Classification (Rosgen 1985, 1994). Based on the classification, the channels were then grouped into high, moderate, and low sensitivity to grazing. Where high sensitive streams are those that are easily affected by livestock; low sensitive streams are not easily affected. Of the 42 miles of streams surveyed; 21 miles, or 51 percent were highly sensitive; 16 miles, or 38 percent were moderately sensitive; and 5 miles, or 11 percent were classified as having a low sensitivity to grazing. Based on quantitative analysis, observed impacts from past and current activities within the drainage, the existing channel conditions were then categorized as good, fair or poor. Approximately half of the reaches within the Castle Mountains are of high sensitivity and half of these are in poor condition. Streams moderately sensitive or having a low sensitivity to grazing comprise the remaining half of which the majority of the reaches were considered in fair or good condition.

The North Little Belt Mountain Range Analysis (1997) includes watersheds on the northeast part of the Little Belt Mountains. These include Lone Tree, Dry Wolf, Sage, Running Wolf, Yogo, and Warm Springs. Approximately 49 miles of intermittent and perennial streams were evaluated for this analysis and categorized into three condition classes according to the *Process for Assessing Proper Functioning Condition* (USDI-BLM, 1995). The three condition classes are Functioning, Functioning At-Risk, and Non-functioning. Of the 49 miles of streams evaluated in this analysis, 72 percent are functioning, 25 percent are at-risk, and 3 percent are non-functioning.

The Musselshell Range Analysis (2002) included watersheds on the east side of the Little Belt Mountains. These included: Mill, Spring Creek, Daisy Dean, East Fork Haymaker, Hopley, and Saw Mill. The analysis contains 412 miles of streams of which 237 miles of stream are within the allotment boundaries of which 53 miles are perennial. Seventy-one miles of streams were surveyed for this analysis and categorized into three condition classes: Functioning, Functioning At-Risk, and Non-functioning. Sixty-two percent of the streams were classified as functioning; and 29 percent, or 20.7 miles of surveyed streams are classified as less then properly functioning, in part due to grazing. This comprises 39 percent of the total perennial stream miles within the allotments.

The Sheep Creek Range Analysis (2004) project area includes watersheds along the west side of the Little Belt Mountains. These include Ming and Sand Coulee, Deep Creek, Tenderfoot Creek, Eagle Creek, Sheep Creek, and the North Fork Smith River watershed on the south end of the Little Belt Mountains. The Sheep Creek Range Analysis area contains approximately

792 miles of intermittent and perennial streams, of which 408 miles are located within current allotment boundaries. Forty one percent, or 167 miles have been surveyed and categorized into three condition classes: Functioning, Functioning At-Risk and Non-functioning. Fifty-eight percent of the streams were classified as functioning, 89 reaches, or 63.6 miles of surveyed streams, are less than properly functioning in part due to grazing. This comprises 38 percent of the total perennial stream miles within the allotments.

For the most part, roads are limited to the major drainages, while trails are found throughout the Jefferson Division. Roads have resulted in elevated sediment levels where stream channels are confined by fill slopes, when vegetation buffers between roads and streams are not adequate, and at crossing locations (Taylor et al. 1999). Trails have also resulted in elevated levels of sediment when there is an inadequate vegetation buffer between the trail and stream and at crossing locations. A summary of intermittent and perennial stream crossings or GIS indicated intersections of streams with roads and trails and miles of roads and trails within 100 feet of streams by 6th Code Watershed are found in Table III-75. Map 9 shows the location of the 6th Code Watersheds. Crossings of streams vary from bridges, to culverts, to fords. The stability of the crossing, amount of use, and kinds of use vary the impacts to water quality. More discussion of these factors is found under the alternative discussions below. A 100 foot vegetative buffer from streams was chosen based on the Lewis and Clark National Forest Plan and the results from modeling of typical conditions using climate tailored to the analysis area (Water Erosion Prediction Project 2004). In the Lewis and Clark National Forest Plan under Forest-Wide Management Standards for Facilities on page 2-65: "Locate facilities, including roads, drill pads or pipelines, as far from riparian areas as practical. This will generally be no closer than 100 feet." In modeling runs using Water Erosion Prediction Project (WEPP) modeling tailored for the area shows a 100 foot vegetative buffer will stop most sediment from reaching a stream if the road or trail is native surface with less than eight percent grade, has low amounts of traffic and the gradient of the vegetation buffer between the road and stream is less than ten percent.

Road densities can be an indication of runoff and water quality concerns. High road densities can compound the effects of infrequent, high intensity precipitation events. Roads can increase surface and subsurface drainage efficiency, routing upslope waters to natural channels at higher rates and increasing erosion and floodwater levels (Gucinski et al. 2001; Trombulak and Frissell 2000; Eaglin and Hubert 1993). The combination of high road density and human development in floodplains increase the risk of more flood damage to streams during these extreme events. The Interior Columbia Basin Assessment correlated road density in relation to surface fines in streams and found "The effects of roads on surface fines is unclear, though the highest mean values were found in the highest road density class" (Quigley 1997). The road density class referred to is 1.7 to 4.7 miles per square mile. At the 6th Code Watershed level, the road densities of the analysis area ranged from 0.12 to 6.4 miles per square mile (Table III-71, Summary of Roads and Trails within 100 feet of Streams and Stream Crossings). The range in road density is based on roads and watershed area that are enclosed within the Forest boundary. It includes all roads within the Forest Service system inventory deemed open and those that are considered closed. Unless the road is properly obliterated from the landscape it is still affecting watershed functions. However, if the watershed is not contained entirely within the forest boundary the road density may be indicating a false high.

A visual analysis of road density was completed that utilized a "moving window" approach to calculate road density by individual 640 acres blocks and then compiles that information for

spatial display. The analysis included all federal, state and private motorized routes. Copies of these maps are in the project folder. Based on this analysis, several areas are worth mentioning. They include Dry Fork Belt Creek, Dry Wolf, Lone Tree Creek to the forest boundary, headwaters of Belt Creek north to the forest boundary, the mainstem of Sheep Creek to the forest boundary, Newlan Creek, North Fork Smith River to the forest boundary, Deadhorse Creek, Yogo Creek, and South Fork Judith. Other areas of high road density include the areas of Miller Gulch, Lower Tenderfoot, and Belt Park. These areas are interspersed with tracts of private land where many private roads are present.

Erosion and the potential for sedimentation tend to increase with an increase in the use levels of roads and trails. Use damages soils of unsurfaced roads and trails when the type and level of use exceed the soil's capacity to resist impact. The soils of unsurfaced roads and trails are damaged directly by mechanical impact from surface traffic and indirectly by hydraulic modifications, soil transport and deposition (Meyer 2002). A sequence of degradation starts with an increase in the amount of bare soil due to increased injury and loss of vegetation. Next, soil compaction increases with increased use especially when soils are wet and if they have low coarse fragment contents and the road or trail surface subsides. In conjunction with increased compaction soil structure breaks down from the shearing and pumping action of traffic; overall, road and trail shapes tend to widen and deepen (Weaver and Dale 1978). With increased establishment of roads and trails surface water flow is rerouted, infiltration and percolation of water is reduced, ponding of water on the surface increases; water holding capacity of the soils decrease; soil loss by water and wind erosion increases and deposition of transported soil particles increases (Meyer 2002).

Use of graveled surfaced roads and trails, especially by heavy motorized traffic, break down the surfacing material and provide loose material for erosion in the next precipitation event (Burroughs et al., 1984). A greater level of use of gravel-surfaced roads can result in rutting, ponding, and more erosion especially if used when rainfall is occurring.

The impacts from different kinds of trail use are not always consistent. Weaver and Dale (1978) evaluated trails on a grassland site in the Bridger range and timberland site in the Gallatin Range of Montana. On level ground horses were most destructive and hikers least destructive but on grassy slopes motorcycles were the most destructive. On both level and sloping sites, trail widths and depths were greatest for horses and least for hikers. On the grassland site motorcycle damage was greatest when traffic was upslope while horse and foot traffic was most damaging when the traffic was downslope. "Damage generally increased from hiker to motorcycle to horse in our study: if ridden at less conservative speeds, i.e. greater than 20 km/h, motorcycles might be more damaging than horses." Meyer (2002) evaluated OHV trails in Alaska and found that problems arise when these vehicles use trails that were not designed for them. "Because of the unplanned nature of OHV trails, many of them cross soils and sites poorly suited for the level of use occurring on them today." Findings in the three state Off-Highway Vehicle EIS (USDI and USDA 2001) that included Montana were somewhat similar to the studies above. "The degree of disturbance and compaction varies by site and would correspond to the type of driver, vehicle, tire tread, tire width, weight, angle of force to the soil, and vegetative cover. Usually, compaction increases as tire size decreases, or vehicle weight increases and forces such as turning, accelerating or braking are added." Further, sheet or rill erosion "would be most common on poorly designed or maintained roads and trails during periods of high soil moisture, rainfall and/or melting snow." Because of their wider tracking width, greater weight and relatively high power OHVs would be ranked higher than hikers with respect to trail damage, but their placement

with motorcycles and horses is not so clear. In general, the impacts to Forest roads are greatest from full size cars, pickups and trucks compared to hikers, horses, motorcycles or OHVs due to the greater size, weight, power and ease of using full size vehicles under wet or inclement conditions.

Two Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) clean up sites (EPA 2006) are located within the analysis area. Carpenter-Snow Creek Mining district (CSC) and Barker Hughesville (BH) mining district are located in the north central part of the Little Belt Mountains. The sites are historic mining districts, and due to the impacts of the mining activities, groundwater, soil and some streams are contaminated with heavy metals. The CSC district consists of approximately 96 abandoned mines, 21 of which were identified as probable sources of contamination to surface water. There are documented impacts from mining waste to soils, surface water and stream sediments in Carpenter Creek, Snow Creek, and Belt Creek. The BH mining district consists of approximately 46 abandoned mines, 16 have been identified as contaminating surface waters. Ten adits have been identified as discharging high levels of metal and arsenic contaminated water. There are documented impacts from mining waste to soils, surface water and stream sediments to Galena Creek and Dry Fork Belt Creek (EPA 2006).

The Forest has been working with the Doe Run Company (as responsible party) and its contractors to conduct cleanup actions under the CERCLA at the Block P Mill Tailings Site (Site). The Site is part of the Barker-Hughesville Mining District Superfund Site. On-the-ground cleanup actions at the Site were initiated in May 2004. More than 50,000 cubic yards of tailings and contaminated soils were excavated adjacent to the floodplain of Galena Creek and placed in an on-site repository. Studies of groundwater conditions showed the repository location was not expected to result in impacts to groundwater. In 2005, approximately 10,000 cubic yards of additional tailings and contaminated soils were excavated from the banks of the Dry Fork Belt Creek in the vicinity of Bender Creek and placed in the repository. All visible tailings material was removed. Sampling following removal was conducted to ensure residual metal concentrations met cleanup objectives for contaminants of concern (arsenic and lead). The area was re-contoured; agricultural lime, composted material and fertilizer were applied to maintain optimum pH and provide organic matter for subsequent re-vegetation. Coir logs (coconut fiber “logs”) containing shrub and willow starts were placed adjacent to Dry Fork to provide bank stabilization and initiate re-vegetation. Approximately 400 trees and shrubs were planted, and the area was hydroseeded in the spring of 2006. Placement of soil amendments, plantings and seeding of the repository area and other excavated areas took place in the spring 2006 (Strathy 2006).

Monitoring of groundwater conditions at eight monitoring well locations will continue. Surface water quality sampling will continue at ten stations on Galena and Dry Fork Belt Creek. Although monitoring following removal actions has not yet established long term trends, initial groundwater monitoring results following removal and consolidation of tailings have shown a decrease in some contaminants of concern. Removal of tailings material directly from the floodplain of both Galena Creek and Dry Fork Belt Creek should significantly reduce, or eliminate the chance of remobilizing these contaminants during high-water flows. Once vegetation is established adjacent to Dry Fork near Bender Creek, sedimentation risks should also be greatly reduced (Strathy 2006).

Table III-71. Summary of Road and Trails within 100' of streams and Stream Crossings by Watershed*.

Watershed Name	Watershed Managed By FS (sq mi)	Stream Miles by Watershed Managed By FS	% of Stream Miles Managed By FS	% of Watershed Acres Managed By FS	Road Miles within 100' of Stream	Trail Miles within 100' of Stream	Road Stream Crossings	Trail Stream Crossings
Sand Coulee Cr.	3	5.1	5	5		1.6		5
N.F. Smith R.	29	56.1	54	63	1.7		23	
N.F. Eagle Cr.	2	3.0	3	6	0.1		1	
Fourmile Cr.	18	33.1	65	70	2.7	3.8	19	25
Smith R.	10	18.0	11	16	0.0	0.1		2
Cottonwood Cr. (Smith Basin)	5	10.1	46	48	0.1	0.2		
Newlan Cr.	25	65.1	66	71	9.4		52	
Whitetail Cr.(Smith Basin)	7	16.7	13	20	1.3		8	
Sheep Cr.(upper)	42	87.0	96	97	8.7	0.4	75	3
Sheep Cr. (middle)	21	28.9	38	59	2.8		15	
Moose Cr.	35	65.2	96	98	4.8	1.2	29	7
Cooper Cr.	9	18.7	32	40	0.5		3	
Sheep Cr. (lower)	27	51.8	39	47	0.6	5.0	6	22
Tenderfoot Cr. (upper)	40	68.4	100	99	2.5	6.2	21	56
Tenderfoot (middle)	26	52.2	95	96	0.2	3.9	2	30
Tenderfoot (lower)	24	48.4	56	58	0.9	1.4	5	15
N.F. Eagle Cr.	15	20.4	22	35	0.3	2.3	5	15
Bear Cr.	22	49.8	25	35	0.4	0.2	3	3
Deep Cr.	36	76.0	82	81		7.0		60
Ming Coulee	4	6.5	23	15	0.5	0.2	3	4
Jefferson Cr.	32	69.6	100	100	7.2	0.7	42	6
Belt Cr. (upper)	34	53.3	73	83	6.1	2.6	27	29
Belt Cr. (middle)	37	78.9	75	77	7.8	12.0	31	99
Dry F. Belt Cr.	56	129.7	87	90	9.3	8.1	65	85
Tillinghast Cr.	25	40.0	64	73	0.9	1.2	9	5
Pilgrim Cr.	28	52.4	96	97		3.6		17
Logging Cr.	38	71.9	86	90	10.4	2.2	63	16
Belt Creek (lower)	15	33.4	68	63	0.2	0.4	2	2
Lone Tree Cr.	20	40.6	47	49	1.7		20	
Cleveland and Harrison Cr.	50	128.5	97	98	0.4	3.3	5	45
Deadhorse Cr.	49	82.7	97	99	3.4	5.1	36	49
Lost F. Judith River	36	76.3	100	100		2.8		12
South F. Judith R.	36	74.3	86	92	14.1	6.9	87	69

Yogo Cr.	45	96.8	91	97	11.9	2.6	47	21
M.F. Judith R.	37	92.2	94	97	3.0	1.7	26	10
E. Antelope Cr.	19	38.6	54	59		5.0		7
Waite Cr.	5	10.4	18	15				
W. Buffalo Cr.	7	12.0	10	14		1.4		
Sage Cr.	11	26.3	47	47	5.9		52	
Willow Cr.	4	7.2	14	22	0.8		1	
Dry Wolf Cr.	43	96.1	94	96	6.5	2.0	40	13
Dry Wolf Cr.	13	26.8	30	38	0.8		1	
Running Wolf Cr.	19	41.0	48	52	3.8	1.3	28	23
Warm Sp.Cr.	7	13.6	31	36	0.6	0.9	1	2
Bozeman F. Musselshell R.	10	12.5	39	44	0.5	3.2	2	4
Boulder Cr.	15	22.9	32	46	1.7	0.4	13	1
Coub Cr.	7	8.9	26	46	1.2		12	
Muddy Cr.	6	12.2	12	22	0.6		3	
W & M. F. Cottonwood Cr.	36	70.0	70	78	2.5	5.5	22	32
Cottonwood Cr. (Musselshell Basin)	2	3.6	4	6		1.0		
Unknown	3	6.3	4	6	0.7	0.1	5	1
Mill Cr.	20	28.8	40	53	4.3	3.2	26	8
Hall Cr.	16	33.4	53	61	0.9	0.3	8	4
Flagstaff Cr.	15	33.6	62	69	2.6		21	
Spring Cr. (Musselshell basin)	44	102.2	82	89	3.0	5.3	24	16
N. F. Musselshell R. (upper)	14	27.4	22	31	5.1	0.1	26	1
Mud Cr.	9	18.8	22	36	1.3	3.4	9	22
Daisy Dean Cr.	15	30.2	17	28	1.1	4.1	4	17
Miller Cr.	4	7.8	6	7		0.1		1
Haymaker Cr.	34	63.3	43	56	8.3	9.3	63	40
Big Elk/Willow Cr.	19	36.0	27	34	0.3	1.3	2	9
W.F. Hopley Cr.	36	85.4	66	58	6.2	0.1	46	1
Antelope Cr.	7	16.8	23	13	2.9		22	
Roberts Cr.	11	32.8	28	20	4.6		35	
E.F. Roberts Cr.	4	10.1	21	15	1.5		11	
	1395	**2835.6**			**181.1**	**134.4**	**1207**	**913**

*Include Perennial and Intermittent Stream.

Regular road maintenance is important in reducing sediment production from road running surfaces and drainage systems. Removing ruts, reestablishing surface drainage and maintaining surfacing when present are effective measures in controlling sediment (Packer and Christensen 1977; Foltz and Burroughs 1990; Burroughs and King 1989). On average, approximately 5.2 percent of the roads in the project area have received some level of maintenance in the last six years. The table below (Hamann 2006) summarizes road maintenance since 2000.

Table III-72. Summary of Road Maintenance Miles Since 2000

Road Number	2000	2001	2002	2003	2004	2005
47 Jamison Trail Rd					14.2	
67 Lick Ck Rd	3.5	3.4				3.5
119 Sheep Ck Rd	14.3	13.6		1.4	7.9	
120 Dry Fk Belt Ck Rd	5	9.9				5.5
189 Willow Pk Haymaker		10.7				
204 Moose Ck Rd	1			12		
211 Four Mile Rd	8.5		23.5	8.2		4
251 Dry Wolf Rd		20.8		4.9		
262 Lonetree			7		7.1	
266 Yogo Ck Rd		5.5		4		6.9
267 Jefferson Ck			3.7		3.6	
268 Monument Pk			3.3			
270 Lake Ck			3.8			
274 Spring Ck Rd	15.4	15.5		12	15.5	5.5
382 High Mtn Rd		5.6				
487 Memorial Way Rd				5	31.8	7.3
581 Castle Checkerboard Rd			8.3			
584 Roberts Ck Roughlock		3				
585 Bonanza Ck Rd			3.5			
586 Williams Pk Rd	2.7	7.8	6.1			
613 Ruby Henn Ck Rd		5.8		5.8		
694 Pasture Gulch Rd		9				
821 Ettien Ridge Rd		2.1				
822 Judith Sta Rd		0.9		1		
825 Middle Fk Judith Rd		1.4		1.4		
829 Lion Ck Rd		4.4				
830 Studhorse Rd		12.7		12.7		
831 Miller Gulch Rd		7.7			7.3	
834 Harvey Ck Rd			1.3			
836 Lamb Ck Rd			4.5			
837 Deadman Ck Rd			3		4.8	
838 Porphyry Lookout Rd			1.8			
839 Divide Rd	39.9	12.5	13.8	26.6	3.8	25.7
840 Tenderfoot Ck Rd				0.8		
1036 Allen Bulch			3.6	5.5		3.6
1049 Camp Rotary	1.2		1.2			
1077 Jumping Creek			1.1			

Road Number	2000	2001	2002	2003	2004	2005
2000 Butcherknife Rd				4		
2007 Whitetail Ck Rd			1.1			
2019 Mill Ck Rd		6.6		6.6		
2020 Mill Ck Connector		1.1				
2033 Upper Whitetail Rd		1.3		2		
2056 Weatherwax CK Rd			3		3	
3328 Chamberlain Ck Rd		9	4.5		16.1	
3350 Villars Ck Rd			2.5			
3356 South Ridge Rd			2.1			
3466 Lonesome Ck Rd			0.8	0.8		
6339 Newlan Work Center Rd			0.5			
6398 Burnt Ridge Road					1.5	
6407 Island Park Rd			4.9			
6408 Moose Park Rd			1.6			
6412 Moose Mtn Rd			7.3			
6413 Jumping Ck Rd			1.3			
6429 Bear Park Rd		4.2		4.2		
6464 Higgins Park Rd			5.2		1.7	
6492 Black Burre Rd					0.7	
6503 Iron Butte Rd					1	
6511 Belt Park Connector	2.6		2.5	2.5		
8841 Thain Ck Rd			1.8			1.8
9201 Snowmobile Parking Lot			0.6			
Total Miles of Road Maintenance	**94.1**	**174.5**	**129.2**	**121.4**	**120**	**63.8**

Trail maintenance is also important for reducing erosion and sediment production. Maintaining drainage, protecting segments that stay wet longer, and minimizing multiple parallel trails are effective measures (Leung and Marion 1996; Meyer 2002). Trail maintenance in the analysis area has varied according to funding, level of use and trail class. On average approximately 4 to 12 percent of all trails receive some maintenance each year (Metrione 2006; Butts 2006).

c. Applicable Laws, Regulations and Policy

Desired conditions are based on the applicable laws, regulations and policy, which include:

- Federal Clean Water Act
- Montana Water Quality Law
- Forest and Rangeland Renewable Resource Planning Act of 1974 and National Forest Management Act of 1976
- Multiple Use Sustained Yield Act of 1960
- Executive Order 11644, Use of Off-Road Vehicles on the Public Lands (February 8, 1972) Amended by Executive Order 11989 (May 25, 1977), Off Road Vehicles on Public Lands
- Lewis and Clark National Forest Plan
- United States Forest Service Region 1, Policy Direction found in R1/R4 Forest Service Soil and Water Conservation Practices Handbook.

More complete discussion of applicable Laws, Regulations and Policy are found in the project file, and Appendix A, Montana Water Quality law, including *Water Quality Limited Streams* from the 1996 through the 2004 lists.

A critical component of the Desired Condition is meeting Forest Plan direction. An important Management Standard in the Forest Plan for Soil, Water and Air Protection (F3) is: 1) require application of Best Management Practices to project activities to ensure meeting or exceeding State water quality standards. Soil and Water Conservation Practices (SWCPs) (USDA Forest Service 1995) are the equivalent of Best Management Practices (BMPs). Soil and Water Conservation Practices 15.21, Maintenance of Roads, describes the minimum level of maintenance to be: "Provide the basic custodial care required to protect the road investment and to insure that damage to adjacent lands and resources is held to minimum."

As described above, the current level of road and trail maintenance is largely based on funding and Forest priority. Only 3.3 to 9.2 percent of the roads in the analysis area have been maintained yearly since 2000. The roads that have received maintenance are among the most improved and also thought to be most used roads in the analysis area. Approximately 4 to 12 percent of all trails receive some maintenance each year. The trail maintenance focuses on the most developed trails. On Forest Service Lands there are approximately 513 miles of roads and trails within 100 feet of perennial streams and 3100 stream crossings in the analysis area (Tables III-74 and III-75 below). The risk of soil and water impacts from roads and trails that are currently receiving no or little maintenance is moderate or greater. As will be shown in Analysis below, the miles of roads and trails within 100 feet of perennial streams and the number of stream crossings by roads and trails changes little with the Action Alternatives.

The current levels of road and trail maintenance will hold or decrease in the future. This situation applies to the Existing Condition, as well as all the Action Alternatives. Meeting Forest Plan direction with the No Action Alternative or the Action Alternatives based on current levels of maintenance is doubtful.

2. ENVIRONMENTAL CONSEQUENCES

Watersheds, undisturbed by human influences, are not static systems. Deep snowpacks and heavy spring rains can cause flooding. Wildfire, wind or insect and disease mortality can drastically alter the vegetative composition of a watershed. Depending on the extent of mortality and rate of stand decomposition, impacts to stream systems can be significant. However, watersheds left undisturbed after natural events can, and do recover rapidly, and ultimately provide conditions that fully support all beneficial uses within a relatively short time. These natural disturbances occur infrequently, which allows for significant and generally rapid recovery of hydrologic and erosional processes prior to the next major disturbance. This results in pulse effects, which are moderate to high in magnitude, but low in frequency.

a. Alternative 1 – No Action Alternative

Water quality impacts from existing roads and trails are occurring in the analysis area. The risk is greatest at stream crossings and where roads and trails are located close to streams. Of the roughly +1900 miles of roads in the analysis area, current annual maintenance is limited to

3.3 to 9.2 percent of those most heavily used. Some annual maintenance is preformed on approximately 4 to 12 percent of the trail system. The actual use levels of analysis area roads and trails are not well documented but impacts to water quality tend to increase with increased use and with certain kinds of use. The Existing Situation and the Action Alternatives are compared using stream crossings and miles of roads and trails within 100 feet of perennial and intermittent streams.

1. Direct and Indirect Effects

Natural disturbance events will continue to influence hydrologic and erosional processes within the watersheds of the analysis area. Given the current vegetative conditions, drought and associated fuel accumulations, there is potential for wildfires to occur that may be outside the range of conditions (intensity and duration) that have occurred over the last few hundred years. Depending on the intensity and area burned, accelerated soil erosion is possible, particularly where hydrophobic soils may be formed. Channel adjustments could be expected, especially during years of average or higher precipitation/runoff conditions. Stream systems will stabilize however as vegetative recovery progresses.

Only activities such as stream crossing construction or replacement or the use of fords by vehicles and stock are considered a direct effect to the water resource. The sediment delivery and flow disruption that occurs with these actions is immediate.

The erosion and sedimentation from the use and minor maintenance of culverts and bridges and from the use of roads and trails within 100 feet of streams are removed from being direct effects by short distances and time, but are never the less considered indirect effects. Table III-73, Summary of Miles of Roads and Trails Within 100-Foot Buffer of Perennial Streams and Perennial Stream Crossings indicates the relative indirect impacts of roads and trails on the water quality of perennial streams in the analysis area organized by 6th code watersheds. These indirect impacts continue as long as the roads and trails are in place in their current locations. This is because once a trail or road becomes established; the soil of the tread is subject to the continuing erosional forces of rainfall, running water, wind, freeze/thaw cycles, gravity and traffic (Leung and Marion 1996; USDI and USDA 2001). Further, roads and trails at higher elevations show greater soil loss than those at lower elevations. Higher precipitation rates, longer snowmelt periods, more loose soil from more severe freeze/thaw cycles and increased exposure to wind all contribute to higher erosion rates. Some considerations such as road and trail design, surfacing of roads and trails, limiting season of use, limiting kinds of use and maintaining water controlling devices will lower the risk of erosion and sediment reaching streams, but the impacts and the risk exists as long as the roads and trails are in place. The risks and impacts to water resources are lessened or eliminated over time by decommissioning and rehabilitating roads and trails within a 100-foot stream buffer, rehabilitating the stream crossings and reestablishing vegetation effective in controlling erosion on the associated disturbance.

A study of ATV traffic effects to trails and resources (Foltz 2007) concludes that ATV traffic adversely affects natural resources regardless of ATV type, size, or tire type. The study suggests “that to simply limit ATV traffic to trails is not enough to protect the natural resources. Trail planning and design, particularly trail location, are key considerations for limiting disturbance to natural resources.”

The levels of road and trail maintenance are largely based on Forest Service funding and to some extent on volunteers for trails. Forest Service funding for maintenance is not projected

to increase but to likely stay similar to current levels or decrease (Gavrisheff 2004). The Forest priority list of roads for maintenance is also not likely to change. In the last five years 3.3 to 9.2 percent of the roads in the analysis area have been maintained yearly. Rutted running surfaces, lack of functioning water control devices (rolling dips, water bars, ditches and cross drainage culverts) and the breakdown and loss of road and trail surfacing where present increase the risk of sediment reaching perennial streams. Some level of maintenance on approximately 4 to 12 percent of trails in the project area yearly. Trail rutting, erosion, lack of drainage and trail widening have been noted in District files and in comments from the public.

2. Cumulative Effects

The following apply from the list of Cumulative Effects for the project.

Existing cumulative effects models are not adequate to quantify to a single cumulative value, the effects of all the diverse activities in the watersheds including wildfire, livestock grazing, water uses and road and trail use. The only way to address these cumulatively is to address each activity individually and then quantify, in general terms, the cumulative effects between specific activities where appropriate.

Existing roads would compound the effects of stand replacing fire within the analysis area. Roads can increase surface and subsurface drainage efficiency, routing upslope waters to natural channels at higher rates. The effects are expected to be higher with a burn with high intensity over a large area and where road densities are higher.

Prescribed fire as a tool for managing vegetation can cause detrimental soil impacts when severities are too high. Severe burning can consume duff layers and cause physical damage to the surface mineral layers and/or create a water repellant layer that impedes infiltration and can cause massive erosion with sediment reaching streams (Keane et al. 2002). Prescribed fire could be applied throughout the analysis area. Applying prescribed fire within restricted conditions designed to minimize severe burning of soils would minimize risk of water quality impacts.

Livestock grazing impacts to soil and water resources as described in the Existing Condition are expected to continue as well. Full implementation of the Castle Mountain (1997), North Little Belt (1997), Musselshell (2002), and Sheep Creek Range Analysis (2002) improvements and grazing system changes are yet to be realized.
The direct effects to water resources of the occasional replacement of a stream crossing structure for maintenance or improvement needs and the use of fords by vehicles and stock would continue.

The indirect effects of erosion and sedimentation from the use of stream crossings other than fords and from the use of roads and trails within 100 feet of streams would also continue similar in distribution to that shown in Table III-73. Road and trail design would stay similar to the existing condition with upgrading and rerouting implemented as funding allowed. Surfacing of major roads and trails would not likely change in extent in the foreseeable future. The current levels of road and trail maintenance would likely continue or decrease. Maintaining only 3.3 to 9.2 percent of the existing road system each year would likely continue. Some level of maintenance on approximately 4 to 12 percent of the trail system

each year would continue. Existing impacts to soil and water resources from these activities are expected to continue.

Approximately 4,300 acres of timber harvest have occurred in the analysis area since 1970. Between 1970 and 1979, 1,086 acres or 25.3 percent of the harvests occurred; between 1980 and 1989, 23.7 percent or 1016 acres of timber harvests took place within the analysis area; between 1990 and 1999, 1,790 acres or 42 percent of the harvest too place, and; between 2000 and 2006 approximately 399 acres or 9.3 percent of the harvest took place over the last 30 years.

Additional timber harvest is planned for Whitetail Salvage (approximately 65 acres with less than .25-mile of temporary road construction near Whitetail Creek on the Musselshell District) and Newlan Bugs Salvage (approximately 350 acres of harvest, construction of 1.4 miles of temporary road and rehabilitation/decommissioning of approximately 1.9 miles of road along Forest Road 830 as it follows Newlan Creek). **The Monarch Neihart project entails a total of approximately 510 acres of treatment with associated prescribed burning. About 150 acres would be helicopter yarded, 67 acres would be tractor yarded and 293 acres would be manually/mechanically treated with material left on site. No new roads or permanent infrastructure will be constructed to implement this project. Vegetation and fuels reduction of 4,400 acres is also proposed for the Mass Geis Project. Approximately 5.4 miles of temporary roads and 5 miles of new roads are planned for implementation of this project.** Similar to the prescribed burning and timber harvest projects above, project design and application of Soil and Water Conservation Practices (USDA Forest Service 1995) are important for minimizing impacts to soils and water quality.

Stream restoration of Dry Wolf Creek **was** completed in 2006. After the flood of 1964, the Forest Service installed +40 instream structures and rerouted the channel around the campground. Structures included rock gabions and log cross veins. In 2002, 20 gabion structures were removed and grade control structures were installed. The improvements in **2006 included the removal of the remaining gabion structures and installation of additional grade control structures.** These structures **included** rock weirs, cross veins, and rock j-hooks. **A temporary increase in sediment production was anticipated during construction. These increases were expected and were temporary; only last for the period of construction.**

Continued remediation of mine waste from the historic mining activities will likely continue. Completion of the initial clean up at Block P **was** completed in 2006. Continued cleanup within the BH and the CSC mining districts is also expected. These cleanups will further reduce sediment and heavy metal contamination into the affected tributaries to Belt Creek.

b. Action Alternatives 3, 4 and 5

The risk of detrimental impacts to water quality is greater at crossings and when roads and trails are within 100 feet of streams. The risk of detrimental impacts to water quality increases with greater levels of use on roads and trails, with some kinds of uses and with the lack of adequate maintenance of water controlling devises. Even though use levels on many roads and trails in the analysis area are not well documented, the number of crossings and miles of roads and trails within 100 feet of streams can provide comparisons of the risks to water quality between alternatives.

1. Direct and Indirect Effects

Tables III-73 and III-74 display the miles of roads and trails within 100 feet of streams and the number of stream crossings organized by road and trail class by Alternative rather than watersheds. This table arrangement was chosen rather than one organized by watersheds since the Action Alternatives provide little change in total miles or total number of crossings from the existing condition. Further, little difference is found between Action Alternatives in total miles or number of crossings.

Table III-73. Summary of Road and Trail miles within 100' of Streams by Alternative*

Map Code	Existing	Alt3	Alt 4	Alt 5
Roads With No Restrictions	144	105.6	98.5	87.9
Roads with Seasonal Restrictions	13.5	13	13.2	15.5
Roads with Year Long Restrictions	22	23.2	32.1	30.4
Roads to Eliminate	0.8	27.5	28.2	39.2
Trails With No Restrictions on Trail Bikes	90.9	72.6	23.1	15.6
Trails with Seasonal Restrictions on Trail Bikes	26.2	33.5	15.3	48.1
Trails with Yearlong Restrictions on Trail Bikes	17.4	32.3	95.7	54.6
Trails with No Restriction on ATVs	30.4	42.7	16.7	8.3
Trails with Seasonal Restrictions on ATVs	13.3	9.5	7.3	18.6
Trails with Yearlong Restriction on ATVs	90.8	86.4	110.2	91.3
Trails to Eliminate	NA	9.8	10.4	22.3
Administrative Use	1.3	1.3	1.3	1.3
Undetermined Road to System Trail	NA	0.2	0.2	2.1
Undetermined Trail to System Trail	NA	3.4	2.5	2
Undetermined Road to System Road	NA	4.4	3.6	5.6
System Road to System Trail	NA	12.3	9.6	6.6
System Road/Trail to System Jeep Trail	NA	0	0	0
New Trail Construction	NA	3.3	0.8	0.4
New Road Construction	NA	1.3	1.3	1.2
New Created Miles within 100' of Stream	NA	4.6	2.1	1.6
Totals After Full Implementation of Alternatives	315	282	279	253

*Includes perennial and intermittent streams.

The size and complexity of the project area precludes the use of site specific models to estimate sediment loading to water ways. Variables and site specific conditions such as current status of the road/trail way, use levels by travel type, soils, slope, type of crossing, connectivity to waterway, and maintenance history would be needed to reliably quantify sediment impacts to water quality. This information is not consistently available across the Jefferson Division.

The specifics of decommissioning roads (methods, timing) have not been developed for this project. Decommissioning measures for roads could range from a gated closure to a more complete effort including relieving compaction, grading to contour, establishing permanent drain, and seeding. The rate of recovery of soil and hydrologic functioning would vary by site. Full recovery (soil and water functioning) of the sites chosen for decommissioning could be years away.

Table III-74. Summary of Road and Trail Stream Crossings by Alternative*

Map Code	Existing	Alt 3	Alt 4	Alt 5
Roads	1207	901	934	819
Trails	915	931	873	752
Roads With No Restrictions	914	629	607	482
Roads with Seasonal Restrictions	54	84	71	94
Roads with Year Long Restrictions	184	173	241	195
Roads to Eliminate	3	212	217	342
Trails With No Restrictions on Trail Bikes	655	515	199	131
Trails with Seasonal Restrictions on Trail Bikes	160	194	88	249
Trails with Yearlong Restrictions on Trail Bikes	100	222	586	341
Trails with No Restriction on ATVs	187	284	165	55
Trails with Seasonal Restrictions on ATVs	68	46	48	61
Trails with Yearlong Restriction on ATVs	660	601	660	529
Trails to Eliminate	NA	86	105	197
Administrative Use	15	15	15	15
Undetermined Road to System Trail	NA	2	2	19
Undetermined Trail to System Trail	NA	30	23	27
Undetermined Road to System Road	NA	25	20	32
System Road to System Trail	NA	97	60	31
System Road/Trail to System Jeep Trail	NA	0	0	0
New Trail Construction	NA	17	1	5
New Road Construction	NA	3	3	1
New Created Crossings	NA	20	4	6
Totals After Full Implementation of Alternative	**2122**	**1832**	**1807**	**1571**

*Includes perennial and intermittent streams crossings.

Table III-73 shows a shift from authorized motorized trails to non-motorized trails by Alternative. Alternatives 3 would eliminate motorized roads and trail miles by **33** miles compared to existing situation. Alternative 4 would eliminate **36** miles and Alternative 5 would eliminate **62** miles of existing motorized roads and trails within the 100-foot buffer. All the alternatives would reduce the number of trail bike trails with no restrictions within 100 feet of perennial and intermittent streams from the existing **91** miles. Alternative 3 would reduce the trail bike trails with no restrictions to **73** miles, Alternative 4 **to 23** miles and Alternative 5 to **15.6** miles. Even though horse/stock traffic would still be authorized on trails open to non-motorized travel, and even though heavy levels of horse/stock traffic can impact soils, removal of motorized modes of travel would potentially be important for reducing erosion from soils of these trails. Alternative 5 would reduce the total number of road miles within 100 feet of a stream by **39** with Alternative 4 reducing the miles by **28**. Alternative 3 had the lowest reduction of road miles within 100 feet of a stream at **28**. Current levels of ATV and motorcycle traffic on most of the trails under current management are not well documented to know if a reduction in impacts would be real if management were changed as proposed in the Action Alternatives. Even so, if trails with known moderate or greater levels of ATV and motorcycle traffic were to shift to non-motorized travel with light horse/stock use then a reduction of soil impacts and ultimately a reduction of vegetation removal, soil displacement, compaction, erosion and sedimentation would be expected with regular trail maintenance. Alternative 5 followed by Alternatives 4 have the most potential for improvement to water resources. Alternative 3 has the least potential for improvement.

A more detailed look was taken of selected roads and trails in 6th Code watersheds that have the greatest risk of eroding and contributing sediment to streams based on having the most miles of roads and trails within a 100-foot buffer of perennial streams and the most stream crossings. These roads and trails were tracked through the Existing Condition and Action Alternatives, and are shown in Table III-75 below.

Water Quality Limited Streams

The proposed activities are not expected to impact the existing conditions of the Water Quality Limited Streams (WQLS). In fact, the proposed activities may improve the overall water quality condition of WQLS. However, the methods or timing of road closure are not analyzed in this report. Water quality impacts from roads will continue until the roads are properly removed from the landscape. See Appendix A for a list of WQLS.

As described earlier, the levels of road and trail maintenance are largely based on Forest Service funding and to some extent on volunteers. Forest Service funding for maintenance is not projected to increase but it likely to stay at current levels or decrease. The Forest priority of roads for maintenance is also not likely to change. About 3.3 to 9.2 percent of the roads most used in the analysis area have been maintained annually over the last five years. Rutted, running surfaces, lack of functioning water control devices (rolling dips, water bars, ditches and cross drainage culverts), and the breakdown and loss of road and trail surfacing, where present, increase the risk of sediment reaching streams. Some level of maintenance on approximately 4 to 12 percent of trails in the project area occurs yearly. Trail rutting, erosion, lack of drainage, and trail widening have been noted in District files and in comments from the public. *The risk to water quality of perennial streams from roads and trails that are currently receiving no or little maintenance is moderate or greater.*

2. Cumulative Effects

The following apply from the list of Cumulative Effects for the project:

Existing cumulative effects models are not adequate to quantify to a single cumulative value, the effects of all the diverse activities in the watersheds including wildfire, livestock grazing, water uses and road and trail use. The only way to address these cumulatively is to address each activity individually and then quantify, in general terms, the cumulative effects between specific activities where appropriate.

Existing roads would compound the effects of stand replacing fire within the analysis area. Roads can increase surface and subsurface drainage efficiency, routing upslope waters to natural channels at higher rates. The effects are expected to be higher with a burn with high intensity over a large area and where road densities are higher.

Table III-75. Miles of Selected Roads and Trails Within 100 Feet of Streams

6th Code HUC	HUC Main Drainage	Trail or Road	Trail or Road Name	Trail Length	Designated Use, Existing Cond	Road/Trail Class	Existing Condition	Summer Alt. 3	Summer Alt. 4	Summer Alt. 5
100301030104	Four Mile Crk.	TR 716	Grasshopper	6.9	Trail Bike	TC-2 Simple/ Minor Development	1.31	1.31	1.31	0
					Trail Bike/ATV		0	0	0	1.31
		TR 717	Wapiti Park	7.2	Hiker/Trail Bike/Packer	TC-3 Developed/Improved	1.04	1.04	1.04	1.04
		TR 723	Horse Park	3.3	Trail Bike	TC-2 Simple/ Minor Development	0.13	0.13	0.13	0.13
		TR 725	Woodchuck	2.7	ATV/Trail Bike/Packer	TC-3 Developed/Improved	0.04	0.04	0.04	0.04
100301030401	Newlan Creek	FR 831	Miller Gulch	6.7	Passenger	ML-3	2.11	2.11	2.11	2.11
100301030701	Sheep Creek	FR 1036	Allen Park	2.3	Passenger	ML-3	0.32	0.81	0.81	0.81
		FR 3425	Mispah Basin	2.7	High Ground Clearance	ML-2	0.65	0.65	0.65	0.65
100301030702	Sheep Creek	FR 6404	Daniels Cr.	2.0	Closed	ML-1	0.12	0.12	0.12	0.12
		FR 6414	Adams Cr.	1.0	High Ground Clearance	ML-2	0.38	0.38	0.38	0.38
100301030705	Sheep Creek	TR 712	Cabin Cr.	4.2	Trail Bike	TC-3 Developed/Improved	0.70	0.70	0.70	0.70
		TR 722	Calf Cr.	4.7	Trail Bike	TC-3 Developed/Improved	2.06	2.06	2.06	2.06
		TR 724	Calf Cr.	5.2	Trail Bike	TC-3 Developed/Improved	1.94	1.94	1.94	1.94
100301030901	Tenderfoot Cr.	TR 342	Tenderfoot Cr.	24.2	Trail Bike	TC-3 Developed/Improved	2.80	0.09	0	
					Hiker	??		2.71	2.80	2.80
		TR 343	Balsinger	??	Packer	TC-1	2.55	1.37	0	0
								1.18	2.55	2.55
100301030902	Tenderfoot Cr.	TR 342	Tenderfoot Cr.	20.8	Closed	TC-3 Developed/Improved	2.48	1.17	0	0

6th Code HUC	HUC Main Drainage	Trail or Road	Trail or Road Name	Trail Length	Designated Use, Existing Cond	Road/Trail Class	Existing Condition	Summer Alt. 3	Summer Alt. 4	Summer Alt. 5
								1.31	2.48	2.48
		U721	Undetermined	7.2	Undetermined	Undetermined	0.10	0.10	0.10	0.10
		U722	Undetermined	8.8	Undetermined	Undetermined	1.02	1.02	1.02	1.02
		U727	Undetermined	1.7	Undetermined	Undetermined	0.11	0.11	0.11	0.11
100301030903	Tenderfoot Cr.	TR 342	Tenderfoot Cr.	20.8	Trail Bike	TC-3 Developed/Improved	1.25	0.25	1.25	1.25
		TR 345	Bald Hills	4.3	Trail Bike	TC-2 Simple/ Minor Development	0.18	0.18	0.18	0.18
100301050103	Belt Creek									
		TR 329	Crawford Cr.	3.0	Trail Bike	TC-3 Developed/Improved	1.52	1.52	1.52	1.52
		U321	Undetermined	1.4	Undetermined	Undetermined	0.73	0.73	0	0
		U322	Undetermined	0.9	Undetermined	Undetermined	0.06	0.06	0	0
100401030101	Cleveland Cr.	TR 407	Doerr Cr.	3.8	Hiker/Trail Bike/Packer	TC-2				
		TR 442	Stiner Cr.	3.7	Hiker/Trail Bike/Packer	TC-3	1.01	1.01	1.01	1.01

Prescribed fire as a tool for managing vegetation can cause detrimental soil impacts when severities are too high. Severe burning can consume duff layers and cause physical damage to the surface mineral layers and/or create a water repellant layer that impedes infiltration and can cause massive erosion with sediment reaching streams (Keane et al. 2002). Prescribed fire could be applied throughout the analysis area. Applying prescribed fire within restricted conditions designed to minimize severe burning of soils would minimize risk of water quality impacts. Projects that could be implemented over the next five years are found in the Monarch/Neihart area (approximately 650 acres of mechanical fuels treatment with prescribed burning in units along US Highway 89), Ettien Ridge area (approximately 1650 acres of prescribed fire with approximately 680 acres of included timber harvest), Dry Fork of Belt Creek (approximately 2570 acres of burning with approximately 560 acres of timber harvest, 4.9 miles of road reconstruction, 1.7 miles of new road and nearly 20 miles of road decommissioning), Forest Green/Allen Gulch (approximately 160 acres of prescribed burning and 140 acres of timber harvest with less than ¼ mile of temporary road construction), Mass/Geis Creek area (yet to be determined combination of timber harvest and prescribed burning) and smaller prescribed burn units on the Musselshell Ranger District around Forest administrative sites, summer homes, radio repeater sites, campgrounds, helispots, and weather stations (units and areas yet to be determined). Through project design and application of Soil and Water Conservation Practices (USDA Forest Service 1995) the detrimental impacts to soil and water would be minimized.

Livestock grazing impacts to soil and water resources as described in the Existing Condition are expected to continue as well. Full implementation of the Castle Mountain Range Analysis (USDA 1997), North Little Belt Mountain Range Analysis (USDA 1997), Musselshell Range Analysis (USDA 2002), and the Sheep Creek Range Analysis (USDA 2004) improvements and grazing system changes are yet to be realized.

The direct effects to water resources of the occasional replacement of a stream crossing structure for maintenance or improvement needs and the use of fords by vehicles and stock would continue.

The indirect effects of erosion and sedimentation from the use of stream crossings other than fords and from the use of roads and trails within 100 feet of streams would also continue similar in distribution to that shown in Table III-75. Road and trail design would stay similar to the existing condition with upgrading and rerouting implemented as funding allowed. Surfacing of major roads and trails would not likely change in extent in the foreseeable future. The current levels of road and trail maintenance would likely continue or decrease. Maintaining only 3.3 to 9.2 percent of the existing road system each year would likely continue. Some level of maintenance on approximately 4 to 12 percent of the trail system each year would continue. Existing impacts to soil and water resources from these activities are expected to continue.

Approximately 4,300 acres of timber harvest have occurred in the analysis area since 1970. Approximately 1,086 acres or 25.3 percent of the harvests occurred during the 1970s. Between 1980 and 1989, 23.7 percent or 1,016 acres of timber harvests took place within the analysis area. Roughly 1,790 acres or 42 percent of the harvest occurred between 1990 and 1999. And between 2000 and 2006 approximately 399 acres or 9.3 percent of the harvest took

place over the last 30 years. Impacts from the early harvest units have lessened while the impacts will likely continue from the later harvest units until vegetation has recovered.

Stream restoration of Dry Wolf Creek **was** completed in 2006. After the flood of 1964, the Forest Service installed +40 instream structures and rerouted the channel around the campground. Structures included rock gabions and log cross veins. In 2002, 20 gabion structures were removed and grade control structures were installed. The improvements in 2006 **included the removal of the remaining gabion structures and installation of additional grade control structures.** These structures **included** rock weirs, cross veins, and rock j-hooks. **A temporary increase in sediment production was anticipated during construction. These increases were expected and were temporary; only last for the period of construction.**

Continued remediation of mine waste from the historic mining activities will likely continue. Completion of the initial clean up at Block P site will be completed in 2006. Cleanup work in the BH and the CSC mining districts are also expected to continue. These cleanups will further reduce sediment and heavy metal contamination into the affected tributaries to Belt Creek.

c. Effects Common to All Alternatives

The majority of the landforms comprising the Jefferson Division are steep limestone and dolomite reefs and sandstone/shale/mudstone slopes. The hard limestone is relatively resistant to weathering. The sandstone/shale/mudstone parent material weathers to fine-grained sands, silts and clays. The sandstone/shale/mudstone produces both a continual source (low to moderate yield) of upslope sediment and an intermittent source of mass wasting material with high to very high yields.

Recent flood events have played an important role in forming existing channel conditions. Some of the headwater channels are deeply entrenched with scoured banks (Johnson and Omang 1976). Wide, open floodplains with large cobbly/gravelly deposits are typical of the middle and lower portions of mainstem channels. The channels are still adjusting in these open floodplains with common, active meandering along the unstable alluvial banks. Natural stream sediment is due to dry creep (gravitational movement of surface soils), overland flow and mass failures in the upper reaches and in-channel erosion in the lower reaches. In general, *sediment supply exceeds sediment transport capacity* under average flow regimes.

Natural disturbance events will continue to influence hydrologic and erosional processes within the watersheds of the analysis area. Given the current vegetative conditions, drought and associated fuel accumulations, there is potential for wildfires to occur that may be outside the range of conditions (intensity and duration) that have occurred over the last few hundred years. Depending on the intensity and area burned, accelerated soil erosion is possible, particularly where hydrophobic soils may be formed. Channel adjustments could be expected, especially during years of average or higher precipitation/runoff conditions. Stream systems will stabilize however as vegetative recovery progresses.

Road and trail systems have less of an impact to analysis area soils and water than natural disturbances such as wildfire or flooding. Construction and use of roads and trails are chronic sources of erosion and sediment to the analysis area watersheds. Only activities such as stream crossing construction or replacement or the use of fords by vehicles and stock are

considered a direct effect to the water resource. The sediment delivery and flow disruption that occurs with these actions is immediate.

The erosion and sedimentation from the use and minor maintenance of culverts and bridges and from the use of roads and trails within 100 feet of streams are removed from being direct effects by short distances and time, but are never the less considered indirect effects. These indirect impacts continue as long as the roads and trails are in place in their current locations. This is because once a trail or road becomes established; the soil of the tread is subject to the continuing erosional forces of rainfall, running water, wind, freeze/thaw cycles, gravity and traffic (Leung and Marion 1996; USDI and USDA 2001). Further, roads and trails at higher elevations show greater soil loss than those at lower elevations. Higher precipitation rates, longer snowmelt periods, more loose soil from more severe freeze/thaw cycles and increased exposure to wind all contribute to higher erosion rates. Some considerations such as road and trail design, surfacing of roads and trails, limiting season of use, limiting kinds of use and *maintaining water controlling devices* will lower the risk of erosion and sediment reaching streams, but the impacts and the risk exists as long as the roads and trails are in place. The risks and impacts to water resources are lessened or eliminated over time by decommissioning and rehabilitating roads and trails within a 100 foot stream buffer, rehabilitating the stream crossings and reestablishing vegetation effective in controlling erosion on the associated disturbance.

Road densities can be an indication of runoff and water quality concerns. High road densities can compound the effects of infrequent, high intensity precipitation events. Roads can increase surface and subsurface drainage efficiency, routing upslope waters to natural channels at higher rates and increasing erosion and floodwater levels (Gucinski et al. 2001; Trombulak and Frissell 2000; Eaglin and Hubert 1993). The combination of high road density and human development in floodplains increase the risk of more flood damage to streams during these extreme events. Areas of concern within the Jefferson Division include the Dry Fork Belt Creek, Sheep Creek from the headwaters to the mouth, Newlan Creek from the headwaters to the forest boundary, Dead Horse Creek, Yogo Creek and South Fork Judith River.

The levels of road and trail maintenance are largely based on Forest Service funding and to some extent on volunteers for trails. Forest Service funding for maintenance is not projected to increase but to likely stay similar to current levels or decrease (Gavrisheff 2004). The Forest priority list of roads for maintenance is also not likely to change. 3.3 to 9.2 percent of the roads in the analysis area have been maintained yearly in the last 5 years. Rutted running surfaces, lack of functioning water control devices (rolling dips, water bars, ditches and cross drainage culverts) and the breakdown and loss of road and trail surfacing where present increase the risk of sediment reaching perennial streams. Some level of maintenance on approximately 4 to 12 percent of trails in the project area yearly. Trail rutting, erosion, lack of drainage and trail widening have been noted in District files and in comments from the public.

From Tables III-73 and III-74 (Summary of Miles of Roads and Trails within 100 Foot Buffer of Perennial and Intermittent Streams by Alternative and Summary of Road and Trail Stream Crossing by Alternative) approximately **253 to 282** miles of roads and trails are within 100 feet of perennial and intermittent steams depending on alternative. There are approximately **1,561 to 1,832** stream crossings by roads and trails depending on alternative. The risk to water quality of streams from roads and trails that are currently receiving no or little maintenance is moderate or greater depending on individual site factors.

The Cumulative Effects as described above for the No Action and Action Alternatives are very similar. Potential impacts from wildfire, prescribed fire, oil and gas development and campground improvements along with continued impacts from livestock grazing are described above.

d. Effects Common to All Action Alternatives

The effects common to all Action Alternatives include the effects common to all Alternatives above with two exceptions:

1) The Action Alternatives include a limited amount of road and trail decommissioning but the details of decommissioning and timing are yet to be developed. Recovery of soil and hydrologic functioning will vary by site and may be years away.
2) Even though horse/stock traffic would still be authorized on trails open to non-motorized travel, and even though heavy levels of horse/stock traffic can impact soils, removal of motorized modes of travel would potentially be important for reducing erosion from soils of these trails. However, current levels of ATV and motorcycle traffic on most of the trails under current management are not well documented to know if a reduction in impacts would be real if management were changed as proposed in the Action Alternatives. *Even so, if trails with known moderate or greater levels of ATV and motorcycle traffic were to shift to non-motorized travel with light horse/stock use then a reduction of soil impacts and ultimately a reduction of vegetation removal, soil displacement, compaction, erosion and sedimentation would be expected with regular trail maintenance.* Alternative 5 followed by Alternative 4 have the most potential for improvement to soil and water resources with Alternative 3 having the least potential for improvement.
3) **Unauthorized OHV use will likely continue at current levels or increase. Creation of pioneered trails and their effects to water quality will continue to be an ongoing problem.**