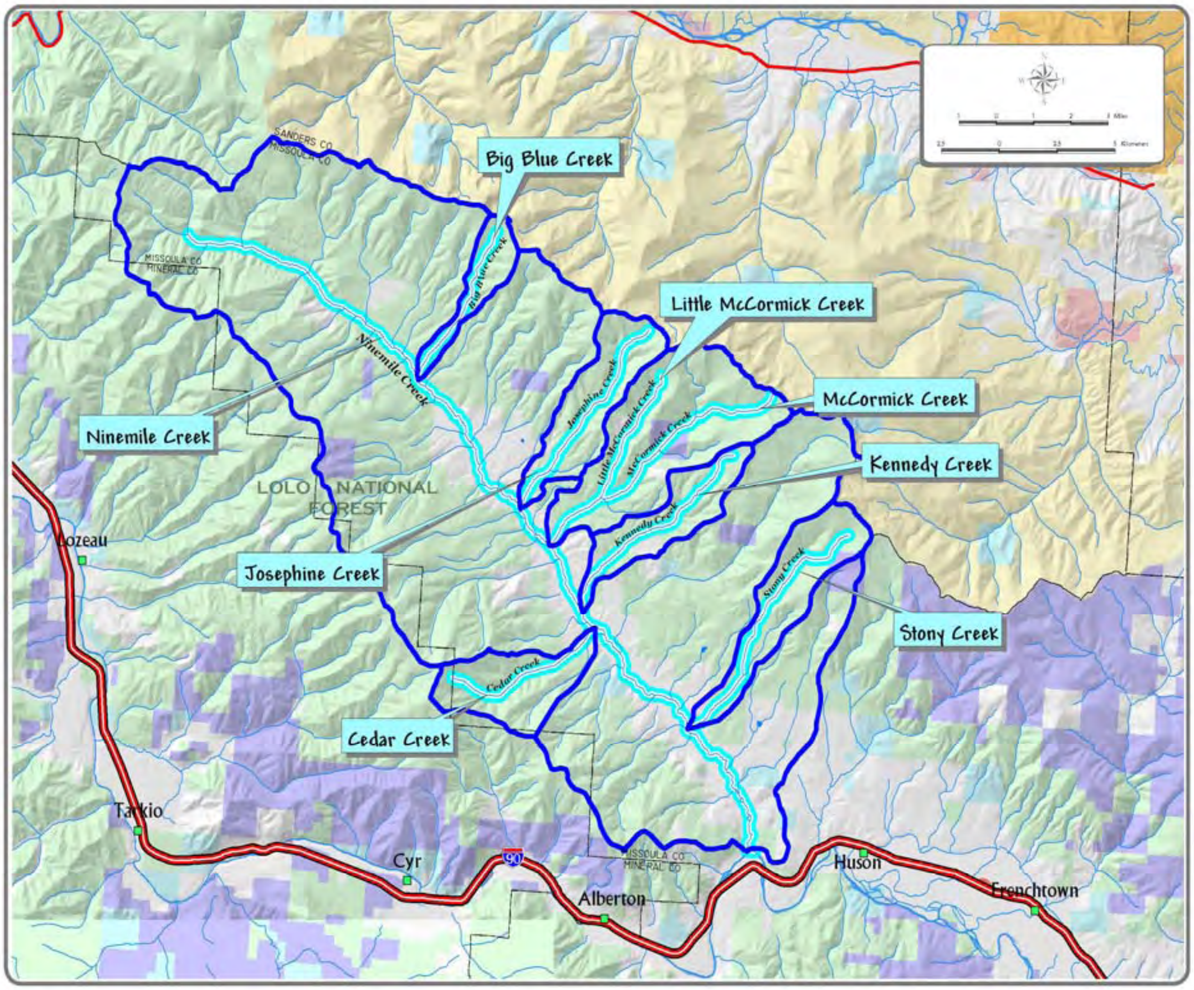
WATER QUALITY RESTORATION PLAN and TOTAL MAXIMUM DAILY LOADS for the NINEMILE PLANNING AREA



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EXECUTIVE SUMMARY

The Ninemile Creek watershed is a forested drainage, encompassing approximately 119,000 acres located primarily in Missoula County. The Ninemile Creek Watershed (also referred to in this document as the Ninemile TMDL Planning Area, or NTPA) is one of more than 90 TMDL planning areas in the State of Montana in which water quality is currently or was previously listed as impaired or threatened. In each of these TMDL planning areas, the State of Montana is required to develop TMDLs to reduce pollutant loading and eliminate other negative impacts to water quality in impaired and threatened water bodies.

Located primarily within Missoula County, Montana, the Ninemile TMDL Planning Area is comprised of lands managed predominately by the United States Forest Service (USFS). The major waterbody in the Ninemile TPA is Ninemile Creek, a tributary of the Clark Fork River. Nine waterbodies within the planning area currently on the Montana 303(d) list and are the subject of ongoing TMDL development efforts in support of which this report has been assembled. The listed causes of impairment include flow alterations, habitat alterations, siltation, and metals (copper, lead, zinc, and mercury). A watershed-scale approach was used to evaluate the beneficial uses in the following waterbodies:

- Big Blue Creek
- Josephine Creek
- Upper McCormick Creek
- Lower McCormick Creek
- Little McCormick Creek
- Kennedy Creek
- Stony Creek
- Cedar Creek
- Ninemile Creek

Table E-1, provides a summary of how each of these waterbodies were addressed in this Water Quality Restoration Plan (WQRP).

Although habitat alterations are the most common listed causes of impairment in the Ninemile TPA, the EPA does not require TMDLs for habitat alterations, which are considered pollution, not pollutants. However, as an added measure of protection for beneficial use support, habitat alterations were evaluated with potential sources of sediment, and a sediment source assessment was conducted for all of the listed streams.

It has been determined that the cold-water fishery and aquatic life beneficial uses in Big Blue, are potentially fully supported. This waterbody is not considered impaired due to habitat or sediment-related causes (siltation) and therefore, no TMDLs are required. TMDLs have been prepared for all of the other listed waterbodies in the Ninemile TPA.

To help address any assumptions or uncertainties that arose, a monitoring strategy is developed as part of this WQRP. Additionally, a phased study is suggested that will help better define potential dewatering and flow alteration issues in the Ninemile TPA.

Table E-1. Summary of Required TMDL Elements for the Ninemile TMDL Planning Area.

Water Bodies & Pollutants of Concern	11 individual water body/pollutant combinations described as follows: - Big Blue Creek (pollutants: habitat alterations) - Josephine Creek (pollutants: habitat alterations) - Little McCormick Creek (pollutants: habitat alterations; flow alterations) - McCormick Creek - upper (pollutants: habitat alterations) - McCormick Creek - lower (pollutants: habitat alterations) - Kennedy Creek (pollutants: metals, siltation, dewatering, flow alterations) - Stony Creek (pollutants: habitat alterations; siltation) - Cedar Creek (pollutant: habitat alterations) - Ninemile Creek (pollutant: habitat alterations; siltation)
Section 303(d)(1) or 303(d)(3) TMDL	- 303(d)1
Impaired Beneficial Uses **Impaired vs threatened??**	- Big Blue Creek (impaired uses: cold water fish) - Josephine Creek (impaired uses: cold water fish) - Little McCormick Creek (impaired use: aquatic life, cold water fish, drinking water, and recreation) - McCormick Creek - upper *(*impaired uses: cold water fish***)*** - McCormick Creek - lower (impaired uses: aquatic life; cold water fish) - Kennedy Creek (impaired use: aquatic life, cold water fish, drinking water, and recreation) - Stony Creek (impaired uses: cold water fish) - Cedar Creek (impaired uses: cold water fish) - Ninemile Creek (impaired use: aquatic life; cold water fish)
Pollutant Sources **All sources or just pollutants?**	- Habitat alterations and siltation from agriculture, range land, silviculture, resource extraction, placer mining, highway/road/bridge construction, irrigated crop production, pasture land, stream bank modification/destabilization, abandoned mining, and channelization. - Metals (copper, lead, zinc, and mercury from – abandoned mining, resource extraction - Dewatering/flow alteration from abandoned mining, placer mining, resource extraction, and agriculture
Target Development Strategies	- In-stream sediment loads comparable to reference conditions - Biological targets that represent full support of biological conditions - Supplemental indicators to help ensure use support of beneficial uses
TMDLs	- Buck Creek: no TMDL; waterbody appears to fully support beneficial uses. Anticipated that stream will be listed as fully supporting all beneficial uses in 2006). - Josephine Creek: 54.8 tons/year, a 92.8% reduction in sediment loading. - McCormick Creek[1]: 164.5 tons/year, a 92.2% reduction in sediment loading. - Kennedy Creek: 49.9 tons/year, a 93.8% reduction in sediment loading. Metals loading reduced to levels allowed by Montana numeric water quality standards (discharge and hardness dependent) - Stony Creek: 55.9 tons/year, a 28.8% reduction in sediment loading - Cedar Creek: 55.6 tons/year, a 60.9% reduction in sediment loading - Ninemile Creek: 2,868, a 74.3% reduction in sediment loading
Allocation	- Big Blue Creek: No allocation; waterbody potentially fully supports beneficial uses - Josephine Creek: A 92.8% reduction in sediment loading from forest roads and mining - McCormick Creek1: A 92.2% reduction in sediment loading from forest roads and mining - Kennedy Creek: A 93.8% reduction in sediment loading from forest roads and mining; metals loading reductions from mining-related sources sufficient to reduce metals concentrations to below state standards - Stony Creek: A 28.8% reduction in sediment loading from forest roads - Cedar Creek: A 60.9% reduction in sediment loading from forest roads, agriculture, and timber harvest - Ninemile Creek: A 74.3% reduction in sediment loading from forest roads, fire, timber harvest, agriculture, and mining.

Table E-1. Summary of Required TMDL Elements for the Ninemile TMDL Planning Area.

Restoration Strategies	- Upgrade forest roads to meet Montana Forestry BMPs; - Reclaim forest roads that are surplus to the needs of forest managers; - Implement Montana's Forestry BMPs on all timber harvest operations; - Continue post fire restoration and sediment mitigation efforts; - Encourage riparian restoration and implementation of agricultural BMPs. - Manage noxious weeds - Promote non-structural erosion control - Upgrade undersized culverts over time to better accommodate large floods and reduce the risk of culvert failure; - Correct priority fish passage barriers that are significantly affecting the connectivity of native fish habitats. - Continue riparian management and monitoring in areas impacted by livestock use; - Encourage flood plain development setback. - Pursue funding for restoration of historic mining impacts - Coordinate with the local watershed group to implement TMDL recommendations on private land and to bring local residents and land owners into the TMDL and watershed restoration process.
Margin of Safety	- Conservative assumptions were used in all source assessment modeling. - Metals targets are based on state numeric water quality standards which contain an inherent MOS. Additional restoration targets based on sediment toxicity, biota measures, and stream deposits are also presented as an additional margin of safety to ensure full support of aquatic life and cold water fishery beneficial uses. - The suite of proposed supplemental indicators is intended to help verify target compliance and full beneficial use support. - The proposed supplemental indicators may also provide an early warning method to identify pollutant loading threats that may not otherwise be identified. - The WQRPs presented in this document go beyond what is required by the EPA for TMDL development by including restoration and monitoring for non-pollutants such as habitat alteration, dewatering, and non-listed pollutants such as temperature. By doing so, the WQRPs provide a holistic approach to water quality restoration and thus an additional MOS for beneficial use support. - A large amount of data and assessment information were considered prior to finalizing any impairment determinations. Impairment determination were based on conservative assumptions that error on the side of keeping streams listed and developing TMDLs unless overwhelming evidence of use support was available.
Seasonal Considerations	- Source assessment modeling of sediment loading inherently incorporates runoff flows when erosion is greatest. Metals assessment included both high and low flow sampling. - Targets where developed with seasonality in mind: metal targets include seasonal fluctuation in water hardness upon which standards are based; the % <6 fine sediment target data is collected in the summer, after the flushing flows have passed; macroinvertebrate and periphyton targets and supplemental indicator data is collected during the summer months when these biological communities most accurately reflect stream conditions. - Throughout this document, the data reviewed cover a wide range of years, seasons, and geographic area within the Ninemile TPA.

[1] The McCormick Creek TMDL includes upper, lower, and Little McCormick Creeks, which are all part of the McCormick Creek watershed.
*SCD = Sufficient and Credible Data as identified in 75-5-702, MCA.

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VOLUME I

Water Quality Problem Description

Preface

The following document has been divided up into four separate volumes, each containing separate "sections" that all carry a common theme. While the sections flow numerically from 1.0-11.0, the volumes provide a transitional placeholder between themes for the reader. Additionally, the volumes guide the reader to required specific elements within each section and the entire document.

Volume I *Water Quality Problem Description*, contains Sections 1.0 through 3.0. These Sections include: Section 1.0: Introduction; Section 2.0: Watershed Characterization; and Section 3.0: Water Quality Concerns and Impairment Status. Together, these sections lay out the general characteristics of streams in the Ninemile TMDL Planning Area (NTPA), the existing conditions of these streams, their impairment status history and their current impairment status.

In addition to serving as a precursor for the rest of the document, the primary function of Volume I is to clearly describe and identify the existing conditions of all the waterbodies in the NTPA that were formally on the 303(d) list and determine their current impairment status. The findings in Volume I determine whether or not a Total Maximum Daily Load (TMDL) and subsequent restoration strategies for each waterbody are required.

A detailed outline of each section within Volume I is provided below.

Section 1.0: This introductory section identifies and displays each waterbody that is currently on the 1996 and 2002 303(d) lists. It also describes the impairments for which these streams are formally listed.

Section 2.0: This section, the Watershed Characterization, provides a detailed discussion and inventory of the physical processes and characteristics specific to the NTPA. These include climate, hydrology, geology and soils, morphology and vegetative characteristics. This section also provides information on land ownership, land use and fire history. It is the first step in the TMDL process to help provide a fundamental understanding of the watershed and how the watershed may react to various changes.

Section 3.0: The Water Quality Concerns and Impairment Status Section is a decision point in this document. In order to carry out the required elements of the TMDL process, the waterbodies in question must first be adequately addressed to determine their current impairment status. This section begins by outlining the purpose of the 303(d) list and then identifying each stream on both the 1996 and 2002 303(d) list. The section then presents the applicable beneficial use classifications and State Water Quality Standards for all 303(d) listed streams in the NTPA. Next, this section compares existing 303(d) listed streams to reference streams using numeric targets developed from reference conditions.

To develop a TMDL, it is necessary to establish quantitative water quality goals or endpoints referred to as targets. These targets must represent all the applicable narrative or numeric water quality standards. Section 3.0 describes the approach taken to develop these targets and compares those targets to the existing conditions of the listed waterbodies in the NTPA. The result of this comparison analysis is the current water quality impairment status for all waterbodies in the NTPA. Through this formal TMDL process, some waterbodies were found to be fully supporting and thus TMDLs and restoration strategies were not developed for these waterbodies. These conclusions are summarized in Table 3-42.

A transitional discussion is provided at the beginning of each succeeding volume in this document. As noted earlier, these discussions will guide the reader through the context of each volume and their sections similar to what was described above.

SECTION 1.0
INTRODUCTION

This document presents a Water Quality Restoration Plan that includes Total Maximum Daily Loads for the Ninemile Creek Watershed in Montana. The Ninemile Creek watershed is a forested drainage, encompassing approximately 119,000 acres located primarily in Missoula County. The Ninemile Creek Watershed (also referred to in this document as the Ninemile TMDL Planning Area, or NTPA) is one of more than 90 TMDL planning areas in the State of Montana in which water quality is currently or was previously listed as impaired or threatened. In each of these TMDL planning areas, the State of Montana is required to develop TMDLs to reduce pollutant loading and eliminate other negative impacts to water quality in impaired and threatened waterbodies.

1.1 Background and Purpose

Section 303(d) of the federal Clean Water Act and Section 75-5 of the Montana Water Quality Act provide authority and procedures for monitoring and assessing water quality in Montana's streams and lakes, and for developing restoration plans for those waters not meeting state standards.

This document presents a water quality restoration plan for the Ninemile Creek watershed, including the main stem Ninemile Creek and several of its tributaries. This plan also defines all necessary Total Maximum Daily Loads (TMDLs) for pollutants of concern in the Ninemile watershed, as specified in the *Montana 303(d) List of Impaired and Threatened Waterbodies in Need of Water Quality Restoration*. A TMDL is the total amount of pollutant that a stream may receive from all sources without exceeding water quality standards. A TMDL may also be defined as a reduction in pollutant loading that results in meeting water quality standards.

The 1996, 2000, and/or 2002 Montana 303(d) Lists have included the main stem of Ninemile Creek and Big Blue, Josephine, McCormick, Little McCormick, Kennedy, Stony, and Cedar creeks. These waters were scheduled by the Montana Department of Environmental Quality (DEQ) for development of restoration plans and the necessary TMDLs.

Water quality impairments affecting Ninemile Creek and the above tributaries include sediment pollution, aquatic habitat alterations, and elevated concentrations of heavy metals that negatively impact trout and other forms of aquatic life. The restoration plan outlined in this document establishes quantitative restoration goals for each impaired stream segment and for each category of offending pollutant. The plan provides recommendations for reducing pollutant loads and improving overall stream health, and establishes a monitoring plan and adaptive management strategy for fine-tuning the restoration plan, thus ensuring its ultimate success in restoring water quality in the Ninemile watershed.

1.2 Water Quality Restoration Planning Process

Development of a TMDL water quality restoration plan follows a series of successive steps, which are described below to provide the reader with a general understanding of the process that was used in developing the Ninemile plan.

The first step in developing a water quality restoration plan is to thoroughly evaluate and describe the water quality problems of concern. This includes understanding the characteristics and function of the watershed, and documenting the location and extent of the water quality impairments and developing water quality targets, or endpoints, that represent the applicable water quality standards. These targets are used to determine whether beneficial uses are fully supported.

The next step is to identify each of the contributing causes and sources of impairment. Pollution source assessments are performed at a watershed scale because all potential sources of water quality problems must be considered when developing the restoration plan.

The total maximum daily load of each pollutant that will meet water quality standards and allow for full support of beneficial uses is then calculated and compared to the total pollutant load derived in the source assessment. If the current load exceeds the total maximum daily load, then a pollutant reduction plan is developed. Pollutant reductions and corresponding restoration measures are allocated across the watershed planning area. This allocation process may be applied on the basis of land use (e.g. forestry, urban, mining, transportation, etc.), land ownership (federal, state, private), sub-watersheds or tributaries, or any combination of these. Specific allocations are also established for future growth and development in the watershed, and for any natural sources of impairment that may be present.

Lastly, the water quality restoration plan must include a monitoring component designed to evaluate progress in meeting the water quality targets established by the plan, and to ensure that the restoration measures are, in fact, implemented. The monitoring strategy also provides useful information to help strengthen any assumptions made during the initial process. Taken together, the steps in the water quality restoration planning process described above constitute a water quality-based approach to water pollution control, which is also known as the Total Maximum Daily Load process. The end result becomes a “Water Quality Restoration Plan”, that if implemented will result in the restoration of water quality and full support of all beneficial uses.

SECTION 2.0
WATERSHED CHARACTERIZATION

This section of the Ninemile watershed TMDL and water quality restoration plan provides general background information about the watershed, and sets the stage for a later discussion of water quality problems, and the underlying historic, current and projected future causes of impairment. It is designed to put the subject waterbodies into context of the watershed in which they occur.

2.1 Location

The Ninemile TMDL Planning Area (NTPA) encompasses a geographic area of approximately 186 square miles (119,040 acres). The watershed originates high in the Ninemile and Reservation Divides of the Lolo National Forest. The lower terminus of the watershed is located at the confluence of Ninemile Creek and the Clark Fork River (Map 2-1).

As shown in Table 2-1, most of the NTPA is located within Missoula County, Montana. Small portions of the NTPA headwaters are located within Mineral and Sanders Counties, Montana.

Table 2-1. Counties in the NTPA. Source: NRIS (2003a).

County	Area, square miles	% of watershed
Missoula	178.4	95.8
Mineral	7.5	4.0
Sanders	0.4	0.2

2.2 Impaired Streams

There are nine 303(d)-listed waterbodies in the NTPA, including Ninemile Creek, Stony Creek, Kennedy Creek, upper McCormick Creek, lower McCormick Creek, Little McCormick Creek, Josephine Creek, Big Blue Creek, and Cedar Creek (Map 2-1). The 303(d)-list status of these streams is summarized in Table 2-2.

Throughout Section 2.0, watershed characteristics are presented for the entire Ninemile watershed, and, where appropriate, for each of the 303(d)-listed watersheds individually. Data for upper McCormick, lower McCormick, and Little McCormick Creek (a tributary to McCormick Creek) Creeks are presented as a single watershed, and as a result there are 7 watersheds discussed in this report: Ninemile Creek, Stony Creek, Kennedy Creek, McCormick Creek, Josephine Creek, Big Blue Creek, and Cedar Creek (Map 2-1).

Table 2-2. Waterbodies on Montana's 303(d) List of Impaired Waters and their Associated Level of Beneficial Use Support.

Waterbody & Stream Description	Waterbody #	Use Class	Year	Aquatic Life	Cold Water Fishery	Drinking Water	Swimmable (Recreation)	Agriculture	Industry
NINEMILE CREEK									
Big Blue Creek, from the headwaters to the mouth (Ninemile Creek)	MT76M004_050	B-1	1996		T				
			2002	X	X	X	X	X	X
Cedar Creek, from the headwaters to the mouth (Ninemile Creek)	MT76M004_060	B-1	1996		T				
			2002	X	X	X	X	X	X
Josephine Creek, from the headwaters to the mouth (Ninemile Creek)	MT76M004_040	B-1	1996		T				
			2002	X	X	X	X	X	X
Kennedy Creek, from the headwaters to the mouth (Ninemile Creek)	MT76M004_070	B-1	1996	P	P				
			2002	N	N	N	P	F	F
Little McCormick Creek, from the headwaters to the mouth (McCormick Creek)	MT76M004_080	B-1	1996	N	N	P	N		
			2002	X	X	X	X	X	X
McCormick Creek, from the headwaters to Little McCormick Creek	MT76M004_032	B-1	1996		T				
			2002	P	P	X	X	X	X
McCormick Creek, from Little McCormick Creek to the mouth (Ninemile Creek)	MT76M004_031	B-1	1996		T				
			2002	F	F	X	X	X	X
Ninemile Creek, from the headwaters to the mouth (Clark Fork River)	MT76M004_010	B-1	1996	P	P				
			2002	P	P	X	F	F	F
Stony Creek, from the headwaters to the mouth (Ninemile Creek)	MT76M004_020	B-1	1996		T				
			2002		X				

F= Full Support; **P**= Partial Support; **N**= Not Supported; **T**= Threatened; **X**= Not Assessed (Insufficient Credible Data)

2.3 Topography and Relief

Map 2-2 displays topography and Map 2-3 shows the distribution of slope in the Ninemile Creek TMDL Planning Area. Relief in the NTPA is shown in Map 2-4. The project area landforms range from lower elevation alluvial stream deposits, to dissected moderately sloping foothills, to mid-elevation mountain slopes, and end in sub-alpine basins and ridges. Elevations are highest along the Reservation Divide on the northeast side of the drainage. Ninemile Creek flows southeast to the Clark Fork River. The elevation of the stream at the mouth is approximately 3000 feet.

As shown in Table 2-3, elevation in the Ninemile TMDL Planning Area ranges from 2000 to 8000 feet, with the largest area (17.9%) in the 3500- to 4000-foot category. Approximately 1.6% of the planning area is above 7000 feet. Table 2-3a summarizes the range of elevation within each of the 303(d)-listed watersheds in the NTPA.

Topography and relief data were obtained from the United States Geological Survey's National Elevation Dataset for Montana (NRIS, 2003c).

Table 2-3. Elevation in the NTPA. (NRIS, 2003c).

Category (ft)	Acres	% of area
2000-3500	13,216.9	11.2
3500-4000	21,171.4	17.9
4000-4500	18,475.8	15.6
4500-5000	17,382.3	14.7
5000-5500	15,074.3	12.7
5500-6000	12,981.3	11.0
6000-6500	11,162.2	9.4
6500-7000	7,007.0	5.9
7000-8000	1,920.6	1.6

Table 2-3a. Elevations & Average Slope for the 303(d) NTPA Tributaries. (NRIS, 2003c).

Watershed	Minimum Elevation (ft)	Maximum Elevation (ft)	Elevation Range (ft)	Mean Elevation (ft)	Average Slope (%)
Josephine Creek	3402	7431	4029	5100	35
Big Blue Creek	3658	7221	3563	5471	34
McCormick Creek	3317	7638	4321	5245	38
Kennedy Creek	3215	7047	3832	4642	29
Stony Creek	3068	7969	4902	5221	28
Cedar Creek	3202	7336	4134	4840	38

2.4 Major Land Resource Areas

Major Land Resource Areas (MLRAs) are geographically associated land resource units, usually encompassing several thousand acres, characterized by particular patterns of soils, geology, climate, water resources, and land use. A unit can be one continuous area or several separate nearby areas. The majority of the Ninemile Creek TMDL Planning Area is classified as Northern Rocky Mountains (98%). The remainder of the planning area (2%) is classified as Northern Rocky Mountain Valleys (Table 2-4 and Map 2-5). Table 2-4a presents the distribution of MLRA types within the 303(d)-listed watersheds in the NTPA. No tributaries flow through Northern Rocky Mountain Valleys.

MLRA data were obtained from the United States Department of Agriculture's State Soil Geographic (STATSGO) database (USGS, 2003c).

Table 2-4. Major Land Resource Areas of the NTPA. (USGS, 2003c).

Classification	Acres	Square Miles	%
Northern Rocky Mountains	116,387	182	98
Northern Rocky Mountain Valleys	2,006	3	2
TOTAL	**118,393**	**185**	**100**

Table 2-4a. MLRA Distribution in the 303(d)-Listed NTPA Tributaries (acres). (USGS, 2003c).

MLRA	Big Blue Creek	Cedar Creek	Josephine Creek	Kennedy Creek	McCormick Creek	Stony Creek
Northern Rocky Mountains	1,871.5	3,883.5	4,456	3,513.3	9,459.0	4,522.5
Northern Rocky Mountain Valleys	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	**1,871.5**	**3,883.5**	**4,456**	**3,513.3**	**9,459.0**	**4,522.5**

2.5 Land Ownership

The valley bottom along the main stem of Ninemile Creek is almost entirely in private ownership downstream from St. Louis Creek; above this point, the land is part of the National Forest System. Tributaries flow mainly through National Forest System lands (Map 2-6).

Approximately 82% (97,505 acres) of the NTPA is National Forest System Lands administered by the Federal Government (USDA Forest Service, Lolo National Forest). An additional 15.2% is in private ownership (18,115 acres) and the remainder is managed by the State of Montana (including public trust land and surface water) (Table 2-5).

Table 2-5a presents the distribution of land ownership within the 303(d)-listed watersheds in the NTPA. No Montana State Trust lands are located within the tributaries listed in Table 2-5a.

Table 2-5. Land Ownership/Management Within the NTPA. (NRIS, 2003a).

Owner or Administrator	Acres	Sq. Miles	% of Total
Lolo National Forest	97,505	152.4	81.80%
Private land (undifferentiated)	18,115	28.3	15.20%
Plum Creek Timber lands	2,634	4.1	2.21%
Montana State Trust Land	909	1.4	0.76%
Water	3	0	0.00%
GRAND TOTAL	**119,200**	**186.3**	**100%**

Table 2-5a. Distribution of Land Ownership/Management in the 303(d)-Listed NTPA Tributaries (Acres). (NRIS, 2003a).

Watershed	Private land (undifferentiated)	Plum Creek Timber Lands	Lolo National Forest	Confederated Salish and Kootenai Tribes
Josephine Creek	498.4	0.0	3,957.3	1.1
Big Blue Creek	31.6	0.0	1,834.7	3.8
McCormick Creek	483.0	610.2	8,353.5	11.1
Kennedy Creek	635.4	0.0	2,878.2	0.0
Stony Creek	158.3	147.2	4,204.1	12.0
Cedar Creek	193.3	0.0	3,692.2	0.0
Total	**2,000.0**	**757.5**	**24,920.1**	**28.0**

2.6 Land Use and Land Cover

General land use and land cover data for the Ninemile Creek TMDL Planning Area were derived from the Montana 90-Meter Land Cover Database, available from the Natural Resource Information System (NRIS, 2003d) (Table 2-6 and Map 2-7). The Land Use and Land Cover (LULC) data files describe the vegetation, water, natural surface, and cultural features on the land surface. Table 2-6a presents the distribution of LULC types within the 303(d)-listed watersheds in the NTPA.

The NTPA is dominated by Evergreen Forest (93.17%). Five other classifications, Crop/pasture (3.52%), Mixed Rangeland (0.75 %), Brush Rangeland (0.69%), Exposed Rock (0.67%), and Deciduous forest (0.28%), account for all but 1% of the remaining area, which is covered by a mix of six other LULC types that occur in incidental amounts.

Table 2-6. Land Use and Land Cover Within the NTPA. (NRIS, 2003d).

Classification	Acres	Sq. Mi	Percent
Brush rangeland	813.75	1.27	0.69
Confined feeding	21.69	0.03	0.02
Crop/pasture	4,163.10	6.50	3.52
Deciduous forest	327.76	0.51	0.28
Evergreen forest	110,301.10	172.35	93.17
Exposed rock	790.94	1.24	0.67
Grass rangeland	86.13	0.13	0.07
Mines/quarries	196.35	0.31	0.17
Mixed forest	776.59	1.21	0.66
Mixed rangeland	893.29	1.40	0.75
Other ag	22.41	0.04	0.02
Total	**118,393**	**185**	**100.00**

Table 2-6a. Distribution of LULC types in the 303(d)-Listed NTPA Tributaries (Acres). (NRIS, 2003d).

Watershed	Crop/ Pasture	Grass Rangeland	Brush Rangeland	Mixed Rangeland	Evergreen Forest	Mixed Forest	Exposed Rock
Josephine Creek	0.0	0.0	0.0	0.0	4,390.9	0.9	0.00
Big Blue Creek	0.0	0.0	106.7	0.0	1,684.9	0.0	0.00
McCormick Creek	58.3	0.0	84.1	0.0	8,713.6	0.0	547.09
Kennedy Creek	52.0	0.0	0.0	0.0	3,372.6	22.9	0.00
Stony Creek	207.5	0.0	0.0	0.0	3,980.2	150.8	69.61
Cedar Creek	19.6	86.3	11.6	151.9	3,520.9	7.3	0.00
Total	**337.4**	**86.3**	**202.4**	**151.9**	**25,663.1**	**181.9**	**616.70**

2.7 Geology

Bedrock underlying the Ninemile Valley and exposed on mountaintops of the NTPA consists primarily of fine-grained meta-sedimentary rocks of the Precambrian-age Belt Supergroup. Approximately 63% of the Ninemile TMDL Planning Area is mapped as part of the Belt Supergroup (Map 2-8 and Table 2-7). Rocks of probable Cambrian age have been found in the foothills of the lower part of the Ninemile Valley. Tertiary-age volcanic and sedimentary rock mantle the Cambrian and Precambrian bedrock in the southern Ninemile Valley. Quaternary-age sediments include unconsolidated Pleistocene-age glacial gravel, sand, silt, till, and lake sediments, which are overlain by alluvium of modern streams. The Ninemile fault defines the north side of the Ninemile Valley and the northwestern Missoula Valley (Harrison et al., 1986).

The surficial geology within the Ninemile Valley was greatly influenced by the repeated filling and draining of Glacial Lake Missoula that occurred 12,000 to 15,000 years ago. An ice dam formed along the Clark Fork River and backed water up throughout many of the valleys in western Montana. When the ice dam failed, Glacial Lake Missoula emptied in just a few days, releasing the greatest flood of known geologic record. This process occurred repeatedly, each time resulting in colossal floods and creating deep canyons and other topographic features.

Table 2-7. Geology of the Ninemile Creek TMDL Planning Area (Acres). (USGS, 2003b).

Rock Unit	Ninemile Watershed	Big Blue Creek	Cedar Creek	Josephine Creek	Kennedy Creek	McCormick Creek	Stony Creek
Quaternary alluvial deposits	9,728.8	157.8	157.0	203.7	471.2	362.4	647.2
Quaternary (Pleistocene) lake sediments	1,534.8	0.0	0.0	0.0	0.0	0.0	0.0
Quaternary (Pleistocene) glacial, fluvioglacial, and flood deposits	24,350.4	200.7	69.4	664.6	695.0	1,014.5	363.8
Tertiary sedimentary rocks	5,139.8	0.0	0.0	0.0	110.2	0.0	407.9
Tertiary volcanic rocks	152.2	0.0	0.0	0.0	0.0	0.0	0.0
Cambrian sedimentary rocks, undivided	964.7	0.0	0.0	0.0	0.0	0.0	0.0
Precambrian mafic sills and dikes	1,262.9	166.5	0.0	0.0	0.0	0.0	0.0
Belt Supergroup (Precambrian):							
Pilcher Quartzite	333.9	0.0	0.0	0.0	0.0	0.0	0.0
Garnet Range Formation	10,722.4	0.0	2,105.1	0.0	0.0	0.0	5.9
McNamara Formation	4,653.7	0.0	1,552.0	0.0	0.0	0.0	0.0
Bonner Quartzite	1,133.9	0.0	0.0	0.0	0.0	0.0	0.0
Mount Shields Formation	7,524.6	0.0	0.0	0.0	0.0	0.0	0.0
Shepard Formation	847.0	0.0	0.0	0.0	0.0	0.0	0.0
Snowslip Formation	2,254.8	0.0	0.0	0.0	0.0	0.0	0.0
Middle member of the Wallace Formation	4,422.7	0.0	0.0	0.0	0.0	0.0	0.0
Lower member of the Wallace Formation	10.0	0.0	0.0	0.0	0.0	0.0	0.0
St. Regis Formation	2,004.5	0.0	0.0	0.0	0.0	0.0	178.3
Revett Formation	2,422.2	0.0	0.0	0.0	0.0	0.0	498.5
Burke Formation	13,275.6	0.0	0.0	24.0	523.1	3,306.4	2,421.1
Upper part of the Prichard Formation	14,676.1	223.7	0.0	2,428.5	1,713.9	4,772.7	0.0
Lower part of the Prichard Formation	10,978.0	1,122.7	0.0	1,135.2	0.0	3.0	0.0
Total	**118,393.1**	**1,871.5**	**3,883.5**	**4,456.0**	**3,513.3**	**9,459.0**	**4,522.5**

2.8 Mineral Extraction and Mining

All economic mineral deposits discovered to date in the Ninemile Creek TMDL Planning Area are relatively small occurrences. No large-scale (million-ton) hard rock open pit or underground mines have been developed in the NTPA. Mining operations have been small, but not without an effect on the streams within the NTPA.

Precious-metal occurrences within the NTPA vary from placer and vein gold to base metals (silver, copper, zinc, bismuth, nickel, cobalt) (Chesson et al., 1984). The total production for the Ninemile Creek (specifically Kennedy Creek) Mining District since 1908 was valued at over $480,000, almost all of that in gold (Sahinen, 1957; Sahinen, 1962).

The following sections describe hard rock (lode mining) and placer mining within the NTPA.

2.8.1 Hard Rock (Lode) Mining

Lode mines containing lead, gold, silver, and other base metals were excavated in Upper Kennedy Creek and along Ninemile Creek, 18 miles from the mouth. The location of mines and prospects within the NTPA, as documented by the U.S. Bureau of Mines Mineral Location Database (NRIS, 2003e), is presented in Map 2-9. Table 2-8 lists the priority mine reclamation sites in the NTPA, all of which are in the Ninemile Mining District. Two additional placer permits in the McCormick Creek watershed (Little McCormick and Favorite Gulch) have been granted by the Forest Service that could result in a similar level of activity to that noted above for active sites.

Table 2-8. Priority Mine Reclamation Sites in NTPA. (NRIS, 2003e).

Name	Area (acres)	PA Number	Inventory Date	Basin Name	AIMSS Envir. Score	Waste Rock Volume (yds^3)	Tailings Volume
Hautilla	2	32-057	7/2/1993	Kennedy Creek	0	3800	0
Joe Wallit Mine	12	32-010	7/2/1993	St. Louis Creek	0.41	68300	0
Lost Cabin Mine	7	32-011	7/2/1993	Kennedy Creek	1.54	3700	0
Nugget Mine	3	32-042	7/2/1993	Kennedy Creek	0.88	1300	0

The AIMSS (Abandoned Inactive Mine Scoring System) guides the reclamation efforts of the MDEQ Mine Waste Cleanup Bureau in a "worst first" approach. The AIMSS program ranks waste sources relative to each other using site-specific data and a scoring algorithm (HRS). In AIMSS, four exposure pathways are evaluated: groundwater, surface water, air, and direct contact. For each exposure pathway, three factors are evaluated: 1) likelihood of release; 2) waste characteristics; and, 3) potential receptors. The scores for the three factors are multiplied to derive a pathway score. Pathway scores are weighted more heavily toward certain situations and types of impacts. Higher weights are ascribed to the following: observed releases to groundwater and surface water, especially where a standard is exceeded; sources that are closer to a population base; and, higher contaminant concentrations, large contaminant quantities, and/or large areas of disturbance. Of the four sites in Table 8, the Lost Cabin Mine had the highest AIMSS score and should thus be reclaimed first according to this assessment methodology.

Known mining activity during recent years in the study area has been limited to small-scale (30 yards/year) placer mining at the mouth of Mattie V Creek and at the mouth of Favorite Gulch (MBMG, 1994; McCulloch, 1996).

2.8.2 Placer Mine Effects on Streams

Disruption of stream channels and fish habitat in the NTPA by past placer mining is described by the USDA Forest Service (2002) in its Post-Burn EIS. Key sections of this discussion are presented below and summarized with data from other sources (MDEQ 2003; Land and Water Consulting, Inc., 2001) in Table 2-8a.

> *Past placer mining in the Ninemile drainage has disrupted physical, chemical and biological conditions in this system. In numerous cases, past placer activity appears to have had an inordinate influence on stream condition and function. Nearly four miles of the upper mainstem Ninemile Creek have been dredged, rerouted and confined by mining spoils.*
>
> *A significant portion of lower Mattie V Creek, a tributary in the Upper Ninemile Drainage, has been re-routed through remnant dredge ponds at its lower end. These isolate the stream from the main Ninemile Creek.*
>
> *St. Louis Creek, an important fish production tributary in the Upper Ninemile Drainage, has been extensively placer mined, re-routed, and confined by exposed mine spoils. Little to no vegetative cover remains in some areas. Some of these very unstable mine spoils abut the stream for about 200 meters downstream from the West Fork confluence and are an active source of fine sediment delivery.*
>
> *Just upstream from the West Fork confluence with St. Louis Creek, a large, abandoned strip mine site with a settling pond is hydraulically connected to the stream, resulting in unknown chemical consequences. Past data on effluent from this mine site indicate elevated conductivity. Even with the impacts of past mining activity, St. Louis Creek is an important fish production stream in the Ninemile Drainage. Mining's observed and presumed impacts on the stream suggest that it is still below its historic capacity.*
>
> *Other streams where there are effects from past mining include Marion, Little Blue, Beecher, Sawpit, Martina, Eustache, and upper Ninemile Creeks. There are currently about 18 active mining claims in the Ninemile project area (BLM Land and Mineral Records). However, a current mining claim does not necessarily mean that a mine site is actively being worked. A study by GT Consulting (1999) indicated that aquatic invertebrate assemblages in mined site watersheds were in good condition. These mine sites appear to be primarily physical stressors to stream channels and likely play a minor role in terms of toxic influence.*

Table 2-8a. Effects of Mining on Streams in the Ninemile Creek TMDL Planning Area.

Stream	Placer Mine Descriptions and Effects on Streams*	Lode Mines and Effects on Streams*	Reclamation Completed	Reference
Ninemile Creek	Upper Mainstem Ninemile Creek: 4 miles dredged, rerouted and confined by spoils; siltation slight but widespread, largely from past mining	NA	Unknown	USDA Forest Service (2002)
	Ninemile Creek from Kennedy Creek to just above Montreal Creek: Zone of placer activity 3 miles wide and 14 miles long, including tributaries. Dragline dredge, dryland dredge, hydraulicking & sluicing	NA	Unknown	MDEQ (2003)
	Reach 2 (Big Blue to Beecher Creek): Severely degraded; pools, logs, undercut banks, etc. nearly absent; flood flows confined within the active channel where slag piles are adjacent to the creek	NA	Unknown	Land & Water Consulting, Inc. (2001)
		Ninemile, San Martina, and Provisional Mines: Au-Ag ore	Unknown	MDEQ (2003)
Kennedy Creek	Large dryland dredge, hydraulicking and sluicing	Kennedy Lode: Pb-Zn ore	Unknown	MDEQ (2003)
		Lost Cabin Mine: Ag-Pb-Zn-Cu ore	Unknown	MDEQ (2003)
		Hauttula Mine: Cu-Ag-Au ore	Unknown	MDEQ (2003)
		Nugget Mine:	Unknown	MDEQ (2003)
Josephine	Dragline dredge, hydraulicking and sluicing	Josephine Mine: Cu-Ag-PB ore	Unknown	MDEQ (2003)
St. Lewis	Hydraulicking and sluicing; stream aggraded, re-routed and confined by mine spoils; little veg cover; confined channel and exposed spoils a source of sediment to streams; stream sediment from tailings seen in 2001	Abandoned strip mine with settling pond hydraulically connected to the steam	Unknown	MDEQ (2003); USDA Forest Service (2002)
		Francis Copper Mine (1950s bulldozing and drilling)	Unknown	MDEQ (2003)
Eustache	Hydraulicking and sluicing; aggraded and susceptible to sediment movement; dredge ponds and tailings decrease function during floods; stream sediment from tailings seen in 2001	NA	Unknown	MDEQ (2003); USDA Forest Service (2003)
Pine	Hydraulicking and sluicing	NA	Unknown	MDEQ (2003)
Marion	Hydraulicking and sluicing	NA	Unknown	MDEQ (2003)
Little Marion	Hydraulicking and sluicing	NA	Unknown	MDEQ (2003)
McCormick	Dragline and dryland dredge, hydraulicking and sluicing	NA	Unknown	MDEQ (2003)
Dry Gulch	Hydraulicking and sluicing	NA	Unknown	MDEQ (2003)
Beecher	Hydraulicking and sluicing	NA	Unknown	MDEQ (2003)
Dutch	Hydraulicking and sluicing	NA	Unknown	MDEQ (2003)
Mattie V	Disconnected from Ninemile Creek by a series of dredge ponds—transformed to a "non-functioning" stream in its lower reach; stream sediment from tailings seen in 2001	NA	Unknown	USDA Forest Service (2002)
Pine	Hydraulicking and sluicing	NA	Unknown	MDEQ (2003)
Petty	Hydraulicking and sluicing	NA	Unknown	MDEQ (2003)
Mattie V	Gail #1 Placer Mining Claim		Reclamation vegetation success monitored during 2001. Being considered for development as a mineral material site to support post-burn activities.	USDA Forest Service (2001c)

* Other effects on streams may be present. This table lists information available in the literature cited.

2.9 Soils

Soils in the Ninemile Watershed are derived from a variety of rock units. Precambrian-age meta-sedimentary bedrock crops out on high ridges and mountain slopes. Fine-grained Tertiary valley fill sediments and glacial sand and gravel mantle some of the lower hillsides. Silt and clay from Glacial Lake Missoula cover some of the high benches of Ninemile Creek. The mid- and higher-elevation soils within the planning area contain volcanic ash within their surface layers. The majority of the ash is an eolian (wind blown) deposition originating in the Cascade Mountain Range to the west (e.g., the explosion of Mt. St. Helens). The texture of this volcanic ash surface layer is typically a silt loam with 5-10% surface pebbles (USDA Forest Service, 2002).

Soils derived from Precambrian-age argillites, siltites, quartziates and limestones are classified at the order level as either Inceptisols or Alfisols, with some Mollisols. At the family level, the dominant soil types are Andic Cryochrepts on the ridges, Typic Eurochrepts in the areas of moderate relief, Cryandepts and Andic Cryumbrepts and Cryochrepts in cirque headwalls and basins, and Entic Cryandepts on glaciated mountain slopes.

The soils are shallow (10 to 20 inches) to moderately deep (20 to 40 inches) on the ridges and mid-slopes. They are deep (40 to 60 inches) in the valley bottoms and on toe slopes. The surface soil textures are gravelly or very gravelly loam or silt loams, with surface coarse fragments ranging from 15-20% pebbles or gravels. The subsoils have 25-60% coarse fragments.

Thirteen Natural Resource Conservation Service (NRCS) soil mapping units occur within the Ninemile Creek TMDL Planning Area (Table 2-9 and Map 2-10). Table 2-9a presents the dominant soil series within the 303(d)-listed tributaries in the NTPA. As shown in Table 2-9 and below, three soil units comprise 69% of the NTPA.

- Holloway-Evaro-Sharrott (MT279) 23%
- Mitten-Tevis-Rubble Land (MT403) 23%
- Yourame-Greenough-Winkler (MT684) 23%

Total 69%

A summary of major soil unit descriptions is provided in Table 2-9b. All soils data (series, permeability, USLE K-factor) were obtained from the United States Department of Agriculture's State Soil Geographic (STATSGO) database (NRIS, 2003k).

Table 2-9. Major Soil Series Within the NTPA. (NRIS, 2003k).

Map Unit Name	Acres	Square Miles	% of watershed
Bigarm-Perma-Bignell (MT043)	639.7	1	1
Courville-Craddock-Greenough (MT137)	10,113.9	16	9
Grantsdale-Moiese-Desmet (MT232)	1,325.0	2	1
Half Moon-Cabinet-Glaciercreek (MT235)	41.4	0	0
Holloway-Evaro-Sharrott (MT279)	27,521.2	43	23
Holloway-Phillcher-Rock Outcrop (MT282)	8,626.1	13	7
Holloway-Waldbillig-Mitten (MT280)	1,612.2	3	1
Mitten-Tevis-Rubble Land (MT403)	27,498.0	43	23
Mitten-Winkler-Tevis (MT402)	5,027.5	8	4
Repp-Whitore-Winkler (MT473)	22.9	0	0
Winkler-Evaro-Rock Outcrop (MT647)	3,922.3	6	3
Winkler-Tevis-Mitten (MT648)	5,073.8	8	4
Yourame-Greenough-Winkler (MT684)	26,969.1	42	23
Total	**118,393.1**	**185**	**100**

Table 2-9a. Acres of Dominant Soil Series in the 303(d)-Listed NTPA Tributaries. (NRIS, 2003k).

Soil Unit	Big Blue Creek	Cedar Creek	Josephine Creek	Kennedy Creek	McCormick Creek	Stony Creek
Courville-Craddock-Greenough (MT137)	149.4	0.0	5.8	0.0	22.8	0.0
Holloway-Evaro-Sharrott (MT279)	775.0	1,584.6	1,025.7	243.0	2,864	1,096.9
Holloway-Phillcher-Rock Outcrop (MT282)	288.4	114.3	403.6	23.2	909.7	509.8
Mitten-Tevis-Rubble Land (MT403)	442.7	1,810.0	2,146.5	0.0	1,377.7	0.0
Mitten-Winkler-Tevis (MT402)	0.0	0.00	0.0	548.7	1,113.2	727.4
Winkler-Tevis-Mitten (MT648)	0.0	0.0	0.0	1,109.0	1,605.6	435.8
Yourame-Greenough-Winkler (MT684)	215.9	374.6	874.4	1,589.6	1,566.1	1,752.7
TOTAL	**1,871.5**	**3,883.5**	**4,456**	**3,513.3**	**9,459.0**	**4,522.5**

Table 2-9b. Major Soil Units - Description Summary. (NRCS, 2003).

Soil Units	Depth	Drainage	Parent Material	Slopes	Mean Annual Precip.	Mean Annual Temp (ºF)
Holloway-Evaro-Sharrott	Very deep (shallow for Sharrott)	Somewhat excessively drained (well drained for Sharrott)	Colluvium derived from argillite and quartzite; volcanic ash	8 to 85%	22-35 in.	39º (44º for Sharrott)
Mitten-Tevis-Rubble Land	Very deep	Somewhat excessively drained	Volcanic ash (Mitten) over colluvium from argillite and quartzite	8 to 80 %	30 in.	40-42º
Yourame-Greenough-Winkler	Very deep	Well drained (somewhat excessively drained for Winkler)	Till and colluvium (Yourname); Tertiary alluvium (Greenough); colluvium from argillited, quartzite and breccia tuff (Winkler)	4 to 85 %	19-20 in.	42-43º

2.9.1 Soil Permeability

Table 2-10 shows the permeability values determined by using a minimum permeability value in inches per hour for the surface layer of the most dominant soil type. Minimum soil permeability over 92% of the planning area was 0.6 inches per hour. The other 8% of the planning area is in the 2.0 inches per hour minimum permeability range (Table 2-10, Map 2-11).

Table 2-10a presents the distribution of soil permeability in the 303(d)-listed tributaries of the NTPA.

Table 2-10. Soil Permeability Within the NTPA. (NRIS, 2003k).

Min. Soil Permeability (inches/hr)	Acres	Square Miles	% of watershed
0.6	109,397.0	170.9	92.4
2.0	8,996.1	14.1	7.6
Totals	**118,393.1**	**185.0**	**100.0**

Table 2-10a. Distribution of Soil Permeability in the 303(d)-listed NTPA tributaries (acres). (NRIS, 2003k).

Minimum Permeability (inches/hr)	Big Blue Creek	Cedar Creek	Josephine Creek	Kennedy Creek	McCormick Creek	Stony Creek
0.6	1,871.5	3,883.5	4,456.0	2,404.4	7,853.4	4,086.7
2.0	0.0	0.0	0.0	1,108.9	1,605.6	435.8
Totals	**1,871.5**	**3,883.5**	**4,456.0**	**3,513.3**	**9,459.0**	**4,522.5**

2.9.2 Soil K-Factor

The Universal Soil Loss Equation (USLE) K-factor is a measure of a soil's inherent susceptibility to erosion by rainfall and runoff. Values of K range from 0 to 1 with higher numbers indicative of greater erodibility.

Soils high in clay have low K values, about 0.05 to 0.15, because they are resistant to detachment. Coarse textured soils such as sandy soils have low K values, about 0.05 to 0.2, because of low potential for runoff, even though these soils are easily detached. Medium textured soils, such as the silt loam soils, have moderate K values, about 0.25 to 0.4, because they are moderately susceptible to detachment and they produce moderate runoff. Soils having high silt content are the most erodible of all soils. They are easily detached and tend to crust and produce high rates of runoff. Values of K for these soils are usually greater than 0.4 (Michigan State University, 2002).

The values shown in Table 2-11 are weighted surface soil K-factors; no other depths were considered. The values are weighted by component percent of each soil mapping unit polygon. The soil erosion K-factor was moderate throughout most of the planning area, with 69% of the area characterized by K-factors in the 0.3 – 0.4 range, and 31% characterized by K-factors in the 0.2 – 0.3 range (Table 2-11, Map 2-12). Table 2-11a presents the distribution of soil K-Factor in the 303(d)-listed tributaries of the NTPA.

Table 2-11. Soil Erosion K-Factor Within the NTPA. (NRIS, 2003k).

Weighted USLE K Factor	Acres	Sq. Mi.	% of watershed
0.2-0.3	36,124.1	56.4	31
0.3-0.35	33,055.8	51.6	28
0.35-0.4	49,213.2	76.9	41
Total	**118,393.1**	**185.0**	**100**

Table 2-11a. Distribution of Soil K-Factor in the 303(d)-Listed NTPA Tributaries (Acres). (NRIS, 2003k).

Weighted USLE K Factor	Big Blue Creek	Cedar Creek	Josephine Creek	Kennedy Creek	McCormick Creek	Stony Creek
0.2-0.3	731.2	1,924.3	2,550.1	23.2	2,287.3	509.8
0.3-0.35	775.0	1,584.6	1,025.7	243.0	2,864.0	1,096.8
0.35-0.4	365.3	374.6	880.2	3,247.1	4,307.7	2,915.8
Total	**1,871.5**	**3,883.5**	**4,456.0**	**3,513.3**	**9,459.0**	**4,522.5**

2.10 Climate

The climate of the Ninemile Creek TMDL Planning Area varies greatly with elevation, as is typical of mountainous regions of Montana. Climate models predict that average annual precipitation can be up to 55 inches in the higher elevations of the Ninemile drainage (NRIS, 2003f) (Map 2-13).

There are no NOAA weather stations within the NTPA, but the USDA Forest Service maintains a Remote Automatic Weather Station (RAWS) at the Ninemile Ranger Station (elevation 3300 feet). The two closest NOAA stations are located in two valleys adjacent to the NTPA. One is located southwest of the Ninemile drainage at the Missoula County Airport (Station 245745) and the other is located northwest of the Ninemile drainage in Superior, Montana (Station 248043).

Average annual precipitation measured at the RAWS and NOAA stations ranges from approximately 13.5 inches in Missoula, Montana, to 15.67 inches at the Ninemile Ranger Station, to 16.7 inches in Superior, Montana (Figures 2-1, 2-2, and 2-3). April, May, and June are typically the wettest months of the year. Precipitation falls partly as snow beginning in late October and lasting into early May. As average annual precipitation increases with elevation; so does the proportion of it that falls as snow.

Average maximum temperatures at the weather stations in Missoula, Ninemile, and Superior are close to 80° F during the summer. Average minimum temperatures are in the 14° to 18° F range in January. The average annual maximum temperatures are slightly warmer in Superior (59.6°F) and Ninemile (58.2°F) than in Missoula (56.4°F). The average annual minimum temperatures are about the same for all three locations (Superior: 32.6ºF, Ninemile: 32.2ºF, and Missoula: 32.3º F).

Figure 2-1. Climate Data for Missoula, Montana. (Western Regional Climate Center, wrcc@dri.edu).

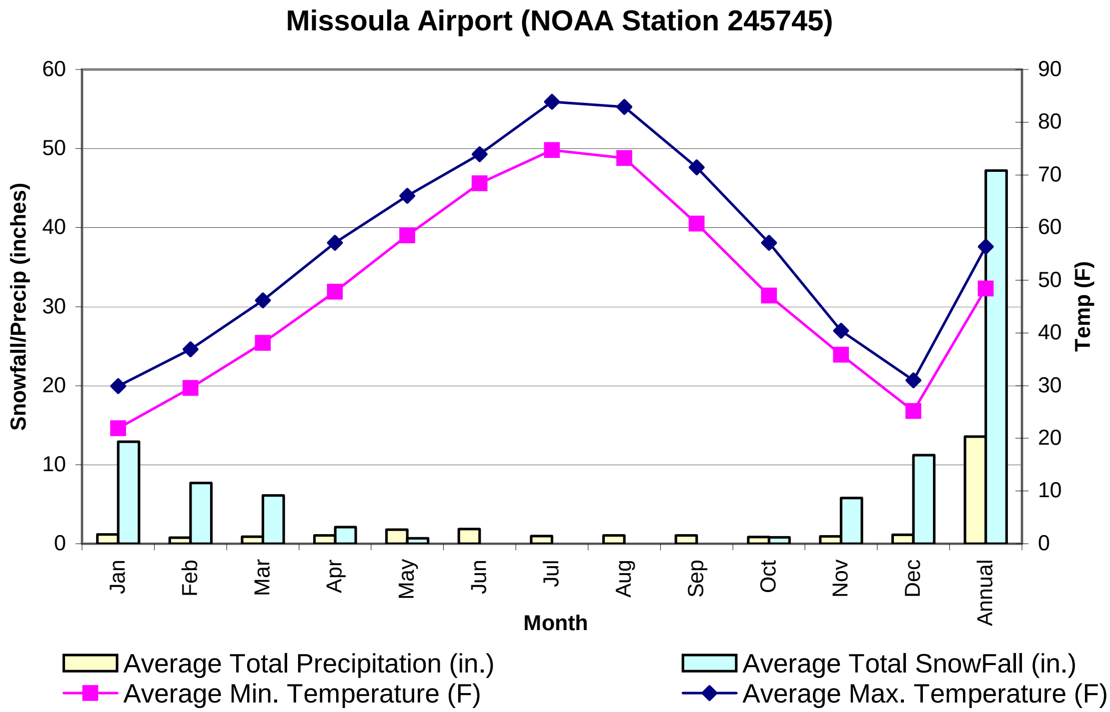


Figure 2-2. Climate Data for Ninemile Ranger Station, Montana. (USDA Forest Service 2001).

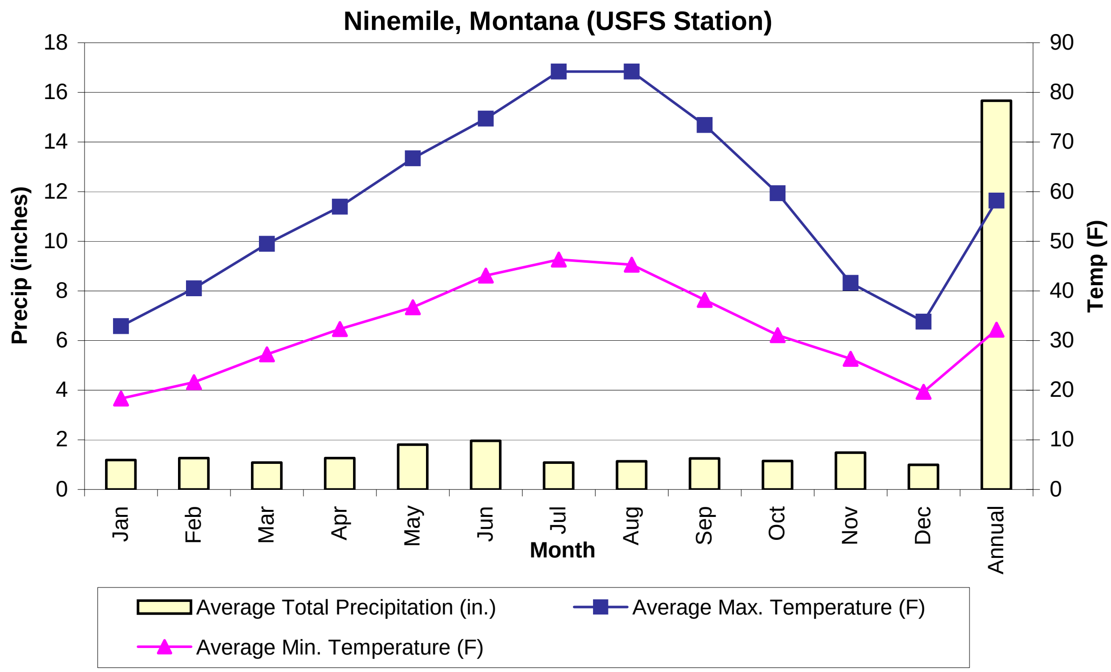
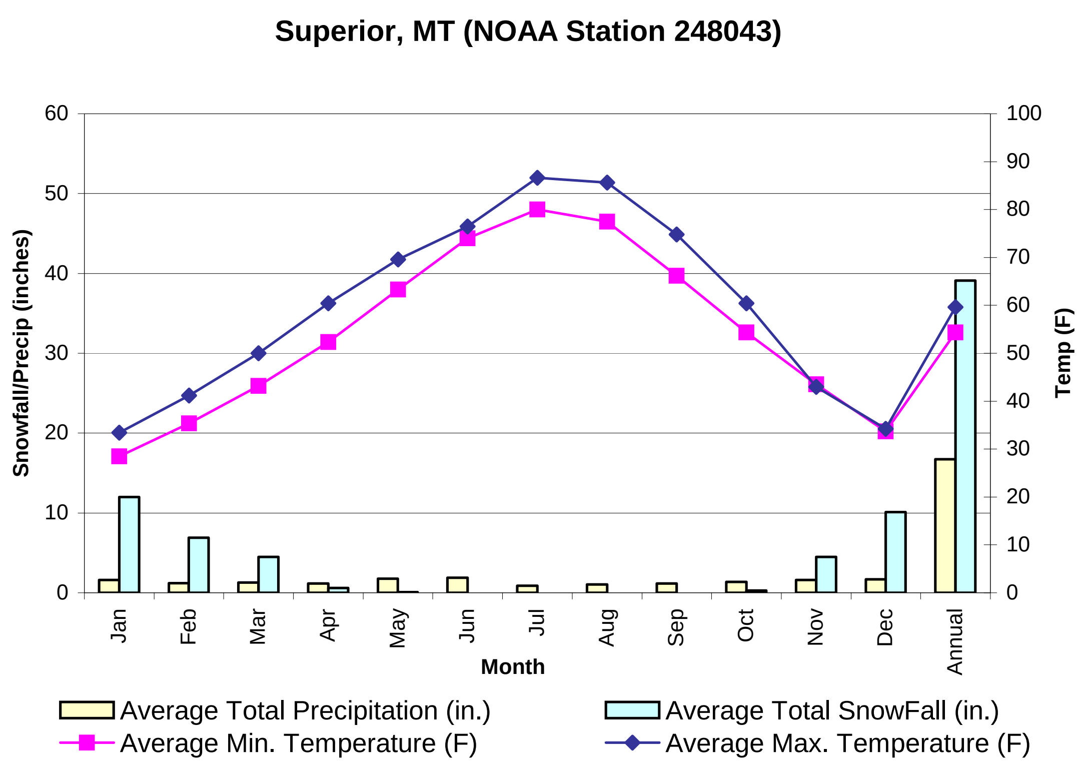


Figure 2-3. Climate Data for Superior, Montana (Source: Western Regional Climate Center, wrcc@dri.edu).



2.11 Hydrology

2.11.1 USGS Stream Gauging

The USGS online database (USGS 2003a) provides data for two USGS stream gauges in the Ninemile Creek TMDL Planning Area (Map 2-14). One station (Alberton) is located on Ninemile Creek 0.5 mile downstream from Big Blue Creek and the other (Huson) is approximately 12 miles downstream on Ninemile Creek near the Ninemile Ranger Station (Table 2-12). The Alberton station measured annual peak information in 1972 and between 1974 and 1982 (Figure 2-4). The Huson station measured daily discharge from 1973 to 1983 and annual peak information from 1974 to 1983.

Table 2-12. USGS Stream Gauges in the NTPA. (USGS, 2003a).

USGS #	Station ID	Start	End	Years Record	Drainage Area (mi^2)
12353250	Ninemile Creek near Alberton	1972, 1974	1982	10	50.2
12353280	Ninemile Creek near Huson	1973	1983	11	170

Ninemile Creek has a mean annual discharge of 136 cfs, based upon the period of 1974 to 1983. The highest flow rate measured during this period was 1700 cfs in January 1974 and the lowest flow rate was 9.4 cfs in December 1974 (USGS, 1984a).

Average monthly flows for Ninemile Creek at the Huson station show seasonal patterns with relatively constant base flows from late summer through fall and winter (Figure 2-5). Flows begin to increase in March, peak in May, and then recede in late May or early June. Peak flows are driven by snowmelt and especially rain-on-snow events.

2.11.2 USGS Discharge Estimates

The USGS (1984b) employed statistical regression equations to estimate long-term flows for Ninemile Creek and other mountain streams because monitoring data in western Montana is limited (USGS, 1984b). For Ninemile Creek Station 12353280 (near Huson), it was determined that the mean annual discharge for the period from 1938 to 1982 was 124 cfs, compared to the 136 cfs recorded from 1974 to 1983. Basin characteristics and mean annual discharge from this report are shown in Table 2-12a.

Table 2-12a. Basin Characteristics and Estimated Mean Annual Discharge for Ninemile Gauging Station (1938-82 Base Period). (USGS, 1984b).

Steam Name and gaging station number	Number of years of Record	Drainage area (mi^2)	Mean Annual Precip (in)	Mean Annual discharge (cfs)	Mean Annual Runoff (inches)
Ninemile Creek (Near Huson)	9	170.0	38	124	9.9

2.11.3 USDA Forest Service Stream Gauging

The USDA Forest Service continued to operate USGS stream gauge 12353280(near Huson) between April and September after 1990 (except for 1992, 1999 and 2000). The station is not operated during the winter due to icing problems. There are no measurements for 1999 and (due to fires) 2000. Stream flows throughout 2001, including peak runoff in spring, were below average, based on mean monthly data from gauging station records. This reflects local climatic conditions of below-average precipitation, especially snow pack, the preceding winter. Snow pack normally reaches maximum in late March/early April. In March/April 2001, snow pack in the area was 44-65% of average (USDA Forest Service, 2002).

Dates and magnitudes of annual peak flows for the period of record at the Ninemile gauge are presented in Figure 2-6. The Forest Service (2002) determined that it is premature to say whether peak flow magnitudes were changed by the Upper Ninemile fires of 2000. Loss of vegetation can cause earlier melt and greater runoff. It is not evident from the 2001 data that peak timing has been advanced.

Figure 2-4. Peak Discharge Recorded in Ninemile Creek Between 1974 and 1984 (USGS, 2003).

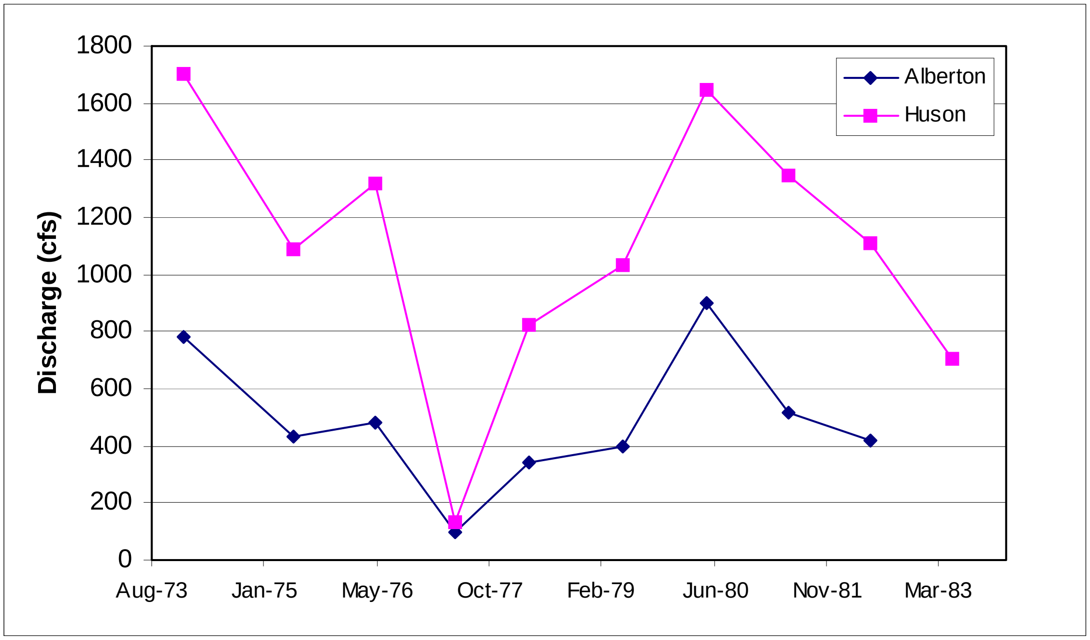


Figure 2-5. Hydrograph of Ninemile Creek Near Huson Using Monthly Averages (1973 – 1983) (USGS, 2003).

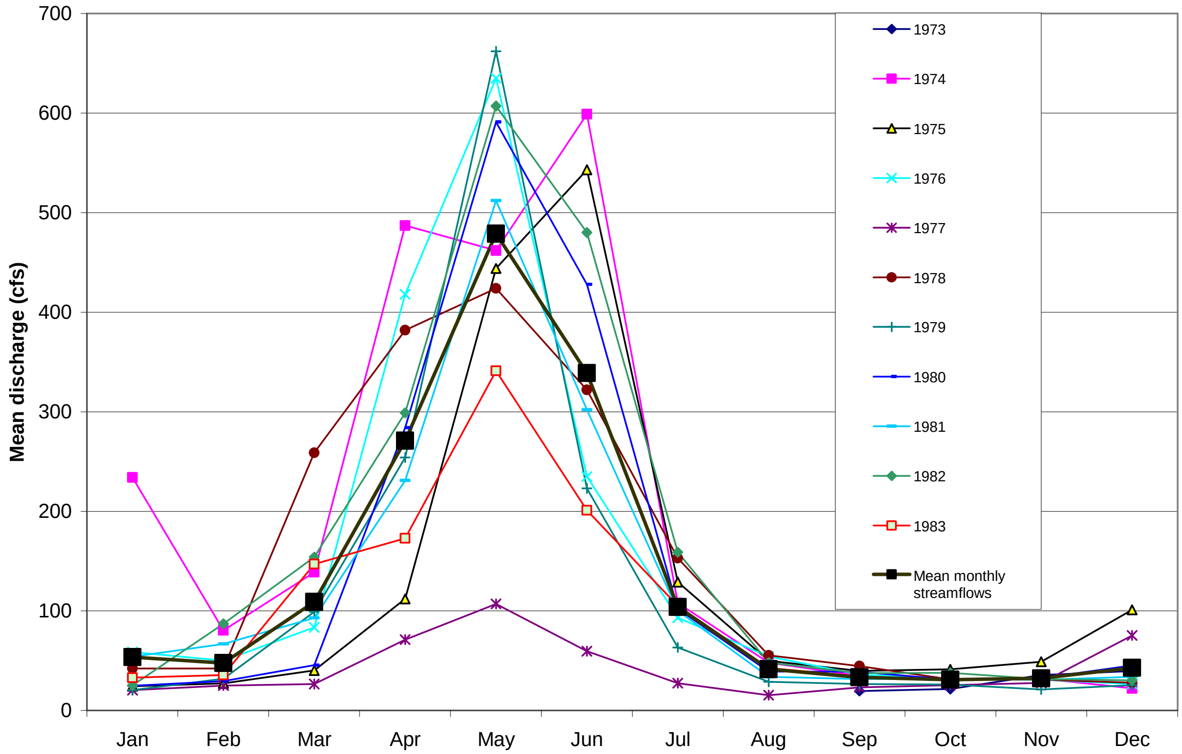
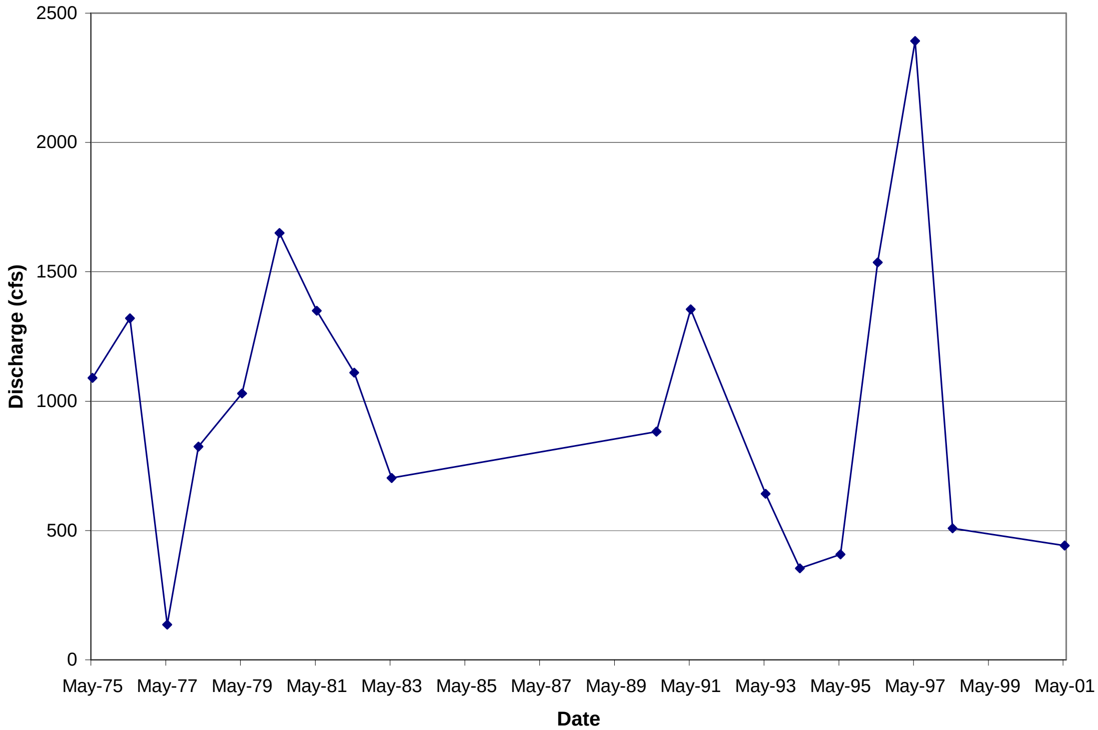


Figure 2-6. Peak Discharge Recorded on Ninemile Creek Near Huson (1975 – 2001) (USGS, 2003; USDA Forest Service, 2002).



2.12 Channel Morphology

Ninemile Creek is a meandering stream approximately 25 miles long, with an average gradient of 39 feet per mile (0.7%) (McMurtrey et al., 1965). The USGS (2003a) lists the mean width and depth of the active channel as 48 feet by 1.5 feet and the mean width and depth of the bank-full channel as 60 feet by 3 feet at the gauge.

2.13 Water Rights and Irrigation

Map 2-15 and Table 2-13 show the available data for points of diversion for the 2,314 different water rights in the Ninemile Creek TMDL Planning Area. There are 171 known wells and 339 known surface water diversions within the NTPA.

Map 2-16 and Table 2-14 present all “points of use” based on water rights and more specifically, Map 2-17 presents the “irrigation points of use” within the NTPA. A total of 343,983 acre-feet per year of water is appropriated for diversion from surface waters and wells in the NTPA. Approximately 7,758 acres (6.5%) of the NTPA watershed is under irrigation. As in shown on Map 2-17, most of this irrigation is concentrated the lower elevations of Ninemile Creek.

Irrigation data were provided by the Montana Department of Natural Resources and Conservation from their Water Resource Survey (NRIS, 2003l).

Table 2-13. Points of Diversion for Water Rights in the NTPA. (NRIS, 2003l).

Type Of Diversion	Count
Bucket	1
Dam	1
Developed Spring	22
Dike	18
Direct From Source	84
Ditch	16
Ditch/Gravity Flow	4
Drain Ditch	1
Flowing	13
Gravity Flow/Direct	3
Headgate	122
Instream	6
Multiple	14
Other Diversion	3
Pipeline	5
Pit	1
Pit/Dam	1
Pump	50
Pump/Gravity Flow	2
Pump/Headgate W/Ditch Or Pipeline	9
Pump/Headgate W/Ditch Or Pipeline/Flood And Dike	3
Sump	6
Unknown	6
Well	171
Total	**562**

Table 2-14. Points of Use for Water Rights in the NTPA. (NRIS, 2003l).

Purpose	Count
Commercial	2
Domestic	198
Fish And Wildlife	7
Fishery	6
Institutional	3
Irrigation	366
Lawn And Garden	50
Mining	73
Multiple Domestic	6
Power Generation	1
Recreation	4
Stock	240
Total	**965**

2.14 Septic System Density and Public Water Supplies

2.14.1 Septic Systems

Table 2-15 and Map 2-18 show septic system information downloaded from NRIS (2003g). Septic system data was generated using the 2000 Census information and assumes there is a statewide average of 2.5 persons per installed septic tank. Three hazard levels were then applied:

High Hazard >300 septic systems (750 persons) per square mile
Medium Hazard 50 (125 persons) to 300 septic systems per sq. mi.
Low Hazard <50 septic systems (125 persons) per square mile

Analysis revealed there are relatively few areas of high hazard (3.46 acres) septic systems in the NTPA. Medium hazard septic systems cover 496 acres and low hazard systems cover 118,701 acres. This information should be used with caution however, because septic hazard in the NRIS database is computed simply as a function of density and does not include consideration of septic location near streams or in floodplains.

Table 2-15. Septic System Density in the NTPA. (NRIS, 2003g).

Acres	2000 Septic Density
118,701	Low
496	Medium
3.46	High

2.14.2 Public Water Supplies

Table 2-16 and Map 2-18 show the two public water supplies located in the NTPA: the Ninemile House and Trailer Court, and the USDA Forest Service Ninemile Ranger Station (NRIS, 2003h). Both of these water supplies are serviced by wells.

Table 2-16. Public Water Supplies in the NTPA. (NRIS, 2003h).

PWSID	Source ID	Primary Name	Source Name	Source Type	City	Resident Pop.	Non-Res Pop.
MT0000492	WL002	Ninemile House and Trailer Court	Ninemile Well	Groundwater	Huson	12	50
MT0062578	WL004	Ninemile Ranger Station	1993 Well # 2	Groundwater	Huson	50	100

2.15 U.S. Army Corps of Engineers 404 Permits

U.S. Army Corps of Engineers 404 permits are required by the Clean Water Act for any activity that involves discharge, or placement of dredged or fill material into the waters of the United States, including wetlands. U.S. Army Corps of Engineers 404 Permits issued for the NTPA are summarized in Tables 2-17 and 2-18. Permit locations in the NTPA are shown in Map 2-19. A listing of all permits is provided in Table 2-19. This information is from the U.S. Army Corps of Engineers RAMS (Regulatory Analysis and Management System) for all sites that have been issued a 404 permit since 1990 (NRIS, 2003i). Individual project numbers (or action identification numbers) can have more than one site, as shown in Table 2-19.

The data in the tables below indicate that most of the 404 Permits issued in the NTPA were individual permits issued in 1992 for bank stabilization along Ninemile Creek.

Table 2-17. Distribution of COE 404 Permit Types in the NTPA. (NRIS, 2003i).

Permit Type	Number of Sites
Individual	26
Nationwide	9

Table 2-18. Distribution by Year – COE 404 Permits in the NTPA. (NRIS, 2003i).

Year	Number of Sites
1992	26
1997	3
1999	1
2000	3
2001	1
2002	1

Table 2-19. COE 404 Permit Project List for the NTPA. (NRIS, 2003i).

Action ID*	Location Number	Year	Project Name	Project Description	Permit Type
199174880	1	1992	Missoula Co. Conservation District	Construct a gravel dike, 544' long, armored with riprap to prevent clays from entering stream and smothering fish redds and young emerging fry. 1351cy of material used for dike and riprap face. 536cy of riprap will be placed at 2 sites for a total of 2.	Individual
199174880	2	1992	Missoula Co. Conservation District	Construct a gravel dike, 544' long, armored with riprap to prevent clays from entering stream and smothering fish redds and young emerging fry. 1351cy of material used for dike and riprap face. 536cy of riprap will be placed at 2 sites for a total of 2.	Individual
199174880	3	1992	Missoula Co. Conservation District	Construct a gravel dike, 544' long, armored with riprap to prevent clays from entering stream and smothering fish redds and young emerging fry. 1351cy of material used for dike and riprap face. 536cy of riprap will be placed at 2 sites for a total of 2.	Individual
199174880	4	1992	Missoula Co. Conservation District	Construct a gravel dike, 544' long, armored with riprap to prevent clays from entering stream and smothering fish redds and young emerging fry. 1351cy of material used for dike and riprap face. 536cy of riprap will be placed at 2 sites for a total of 2.	Individual
199174880	5	1992	Missoula Co. Conservation District	Construct a gravel dike, 544' long, armored with riprap to prevent clays from entering stream and smothering fish redds and young emerging fry. 1351cy of material used for dike and riprap face. 536cy of riprap will be placed at 2 sites for a total of 2.	Individual
199290474	1	1992	Lolo National Forest-Placer Mine	Restoration of failed placer mine settling pond to protect water quality.	Nationwide
199790571	1	1997	Hull, Excavation, Ninemile Creek	Excavate a small island of cobble and gravel that has recently formed and is creating a braided channel pattern in the area. The material to be removed would be 75cy of gravel and cobble bedload from the channel and deposit material on an upland site.	Individual
199790661	1	1997	Jeff Hull, Replace Bridge, Ninemile Crk	Replace bridge on Ninemile Creek.	Nationwide
199790662	1	1997	Jeff Hull, Bank Stab., Ninemile Creek	Install 100' of riprap.	Nationwide
199990503	1	1999	Fire Creek Rnch-Magid,Fish Hab,Ninemile	Enhance and stabilize 570' of Ninemile Creek and 100' of a side channel. Restore a more natural pattern, profile and dimension. Treatment includes channel shaping and bank stabilization. Log veins, root wads conserved topsoil, sod mats and shrub transp.	Nationwide
200090025	1	2000	Demin,Bankstab-Revetment,Ninemile Creek	305 feet of rootwad bank stabilization to protect fence, pumphouse and barn.	Nationwide
200090104	1	2000	Demin,Log Vanes, Ninemile Creek	4 log vanes for bank protection and fish habitat. 17 cubic yards total material in all 4 vanes.	Nationwide
200090169	1	2000	Brugh,Bankstab,Ninemile Creek	Stabilize 300 feet of bank with rootwads and 2 log vanes.	Nationwide
200190165	1	2001	Fire Creek Rnch-Magid,Fish Hab,9 Mile Ck	Stream and riparian restoration for improved fish habitat.	Nationwide
200190315	1	2002	Sousa,Bridge,Ninemile Creek	Application received to remove 38-foot existing bridge on Ninemile Cr and replace with 60-foot clear span bridge, as well as install two 24-inch culverts in an auxiliary side channel.	Nationwide

*Note: Individual project numbers (or action identification numbers) can have more than one site.

2.16 Fish

Table 2-20 provides fisheries distribution data from the Montana Department of Fish, Wildlife and Parks (NRIS, 2003j) for Ninemile Creek. Table 2-20a provides fisheries distribution data on the 303(d)-listed tributaries in the NTPA.

Trout that are native to the NTPA include bull trout (*Salvelinus confluentus)* and westslope cutthroat trout (*Oncorhynchus clarki lewisi* (USDA Forest Service, 2002). Bull trout are listed by the U.S. Fish and Wildlife Service (USFWS) as Threatened, while the U.S. Forest Service has determined westslope cutthroat trout to be a sensitive species. Non-native trout inhabiting streams in the area include brook trout (*S. fontinalis)*, rainbow trout *(O. mykiss)* and brown trout (*Salmo trutta)* (USDA Forest Service, 2002).

Within the project area (Tables 2-20 and 2-20a), rainbow and brown trout tend to occur in the main stem (Ninemile Creek) and in the lower ends of larger tributaries (Map 2-20a). Brook trout are omnipresent but are more dominant in the tributary streams (Map 2-20b), where much of the westslope cutthroat spawning and rearing occur and these species hybridize. Bull trout are thought to be incidental, year-round residents in Ninemile Creek and Cedar Creek. Westslope cutthroat trout are more widely distributed but are abundant only in the upper reach of Butler Creek (Map 2-21a and 2-21b).

While disturbance may favor non-native species, certain tributaries appear to provide poor habitat in general. The native bull trout and westslope cutthroat trout are rare in Cedar Creek, and so are the non-natives (brook and rainbow trout) (Map 2-20b and 2-21b). Although more recent data from the Lolo National Forest indicates that Cedar Creek supports moderately good densities of westslope cutthroat trout. Westslope cutthroat trout are rare in Kennedy Creek and so are brook trout. There are no native trout in Little Blue Creek (downstream from Big Blue Creek) and both brook and brown trout are rare. Finally all five trout species are rare in the main stem Ninemile Creek from the forks down to Little Blue Creek. Since other tributaries harbor healthy trout populations (Bulter Creek, Marion Creek), these tributaries with low trout density may have been severely disturbed.

Table 2-20. Fish Distribution in Ninemile Creek from MDFWP. (NRIS, 2003j).

Species	Abundance	Water Use	Data Quality
Brook Trout			
From (rm 0.0) to (rm 25.5)	Rare	Year-round resident	Extrapolated based on surveys
Brown Trout			
From (rm 0.0) to (rm 11.4)	Abundant	Both resident and Fluvial/Adfluvial populations	Extrapolated based on surveys
From (rm 11.4) to (rm 12.7)	Common	Both resident and Fluvial/Adfluvial populations	Extrapolated based on surveys
From (rm 12.7) to (rm 23.9)	Rare	Both resident and Fluvial/Adfluvial populations	Extrapolated based on surveys
From (rm 23.9) to (rm 25.5)	Rare	Year-round resident	Extrapolated based on surveys
Bull Trout			
From (rm 0.0) to (rm 25.5)	Incidental	Year-round resident	Extrapolated based on extensive samples
Largescale Sucker			
From (rm 0.0) to (rm 25.5)	Common	Year-round resident	Extrapolated based on extensive samples
Longnose Sucker			
From (rm 0.0) to (rm 25.5)	Common	Year-round resident	Extrapolated based on extensive samples
Mountain Whitefish			
From (rm 0.0) to (rm 14.7)	Abundant	Year-round resident	Extrapolated based on surveys
From (rm 14.7) to (rm 15.2)	Common	Year-round resident	Extrapolated based on surveys
From (rm 15.2) to (rm 25.5)	Common	Year-round resident	No Survey, Professional judgment
Rainbow Trout			
From (rm 0.0) to (rm 12.7)	Abundant	Both resident and Fluvial/Adfluvial populations	Extrapolated based on surveys
From (rm 12.7) to (rm 17.4)	Common	Both resident and Fluvial/Adfluvial populations	Extrapolated based on surveys
From (rm 17.4) to (rm 23.9)	Rare	Both resident and Fluvial/Adfluvial populations	No Survey, Professional judgment
From (rm 23.9) to (rm 25.5)	Rare	Year-round resident	No Survey, Professional judgment
Westslope Cutthroat Trout			
From (rm 0.0) to (rm 21.9)	Rare	Year-round resident	Extrapolated based on extensive samples
From (rm 21.9) to (rm 23.9)	Rare	Year-round resident	Extrapolated based on extensive samples
From (rm 23.9) to (rm 25.5)	Common	Year-round resident	Extrapolated based on extensive samples

Table 2-20a. Fish Distribution in 303(d)-Listed Tributaries in the NTPA. (NRIS, 2003j).

Species	Abundance	Water Use	Data Quality
Josephine Creek			
Brook Trout			
From (rm 0.0) to (rm 6.0)	Common	Year-round resident	Extrapolated based on surveys
Rainbow Trout			
From (rm 0.0) to (rm 6.0)	Rare	Year-round resident	Extrapolated based on surveys
Westslope Cutthroat Trout			
From (rm 0.0) to (rm 3.7)	Unknown	Year-round resident	No Survey, Professional judgment
Big Blue Creek			
Brook Trout			
From (rm 0.0) to (rm 4.5)	Abundant	Year-round resident	No Survey, Professional judgment
Westslope Cutthroat Trout			
From (rm 0.0) to (rm 2.9)	Rare	Year-round resident	Extrapolated based on extensive samples
McCormick Creek			
Brook Trout			
From (rm 0.0) to (rm 7.7)	Abundant	Year-round resident	Extrapolated based on surveys
Brown Trout			
From (rm 0.0) to (rm 7.7)	Rare	Year-round resident	Extrapolated based on surveys
Rainbow Trout			
From (rm 0.0) to (rm 7.7)	Rare	Year-round resident	Extrapolated based on surveys
Sculpin			
From (rm 0.0) to (rm 7.7)	Common	Year-round resident	Extrapolated based on surveys
Westslope Cutthroat Trout			
From (rm 0.0) to (rm 4.4)	Common	Year-round resident	Extrapolated based on extensive samples
Kennedy Creek			
Brook Trout			
From (rm 0.0) to (rm 6.2)	Rare	Year-round resident	No Survey, Professional judgment
Westslope Cutthroat Trout			
From (rm 0.0) to (rm 4.6)	Rare	Year-round resident	Extrapolated based on extensive samples
Stony Creek			
Westslope Cutthroat Trout			
From (rm 0.0) to (rm 4.7)	Common	Year-round resident	Extrapolated based on extensive samples
Cedar Creek			
Brook Trout			
From (rm 0.0) to (rm 4.6)	Rare	Year-round resident	Extrapolated based on surveys
Bull Trout			
From (rm 0.0) to (rm 4.6)	Rare	Year-round resident	Extrapolated based on surveys
Rainbow Trout			
From (rm 0.0) to (rm 4.6)	Rare	Year-round resident	Extrapolated based on surveys
Westslope Cutthroat Trout			
From (rm 1.4) to (rm 3.1)	Rare	Year-round resident	Extrapolated based on extensive samples

The USDA Forest Service (2002) Post Burn EIS summarizes their evaluation of fish abundance, distribution and connectivity**. Table 2-21** shows data from their analysis.

Table 2-21. Mean (range) Salmonid Densities in Streams in the Ninemile Drainage (#/m^2) (USDA Forest Service, 2002).

Survey	Bull Trout	Cutthroat Trout	Brook Trout
Riggers, et al. (1988)	1.1 (0-14)[a]	12.6 (0-44)	7.9 (1-50)
Hendrickson and Cikanek (2000)		10.0	
Post Burn Study (2001)	*	6.8 (0-25)	2.8 (0-15.3)

[a]Fish/100 square meters.
*One individual seen.

The USDA Forest Service (2002) analysis of fisheries data is quoted below. This summary was compiled for the post-burn analysis area, and does not address the status of the fishery across the entire Ninemile TPA.

> *Bull trout and cutthroat trout in the Ninemile drainage sub-populations have been classified as "functioning at unacceptable risk" and "functioning at risk", respectively (Hendrickson and Cikanek, 2000). Their classifications were based on habitat and population indicators over a large geographic scale that includes the middle Clark Fork drainages on Lolo National Forest Lands. A few fluvial bull trout are presumed to occupy the drainage (Hendrickson and Cikanek, 2000; USDA Forest Service, 2001a; BAA Appendix G).*
>
> *Ninemile Creek is connected to the Clark Fork without fish passage barriers. Resident cutthroat trout are present in most Ninemile tributaries at moderate densities, with higher densities in less disturbed streams (Hendrickson and Cikanek, 2000). Fluvial cutthroat that are present in the Ninemile Creek have access to some tributary streams, but are blocked from others by water diversion dams, road crossings, stream dewatering, and placer mining activities.*
>
> *The only resident bull trout (possibly a hybrid) observed was in Eustache Creek, the most upstream tributary to Ninemile Creek. Montana Department of Fish, Wildlife and Parks (FWP) sampling also captured one juvenile bull trout in lower Eustache Creek. There has been only one other recent sighting of bull trout in the Ninemile drainage by FWP (Knotek, 2001, pers. comm.).*
>
> *Brook trout are the most abundant and widely distributed non-native fish, followed by rainbow trout, and brown trout.*
>
> *Cutthroat trout were the most abundant native salmonid in the Ninemile Drainage in 2001 (Maps 2-21a and 2-21b). Observed densities fell within the range observed by Riggers et al. (1998). The mean cutthroat density was lower than Riggers et al. (1998), but similar to densities reported by Hendrickson and Cikanek (2000).*
>
> *Riggers et al. (1998) observed bull trout densities in Lolo National Forest streams that were higher than the one bull trout juvenile observed in this project area* (Table 2-21).

Brook trout densities in the Post Burn project area were less than that observed by Riggers et al. (1998). The lower densities of these species in the project area indicate that most streams in the Ninemile drainage are below their fish production capacity. These data are consistent with the "functioning at risk" call made by Hendrickson and Cikanek (2000).

There is the possibility of local fish kills in heavily burned headwater sections of Big Blue, Camp, Soldier and Burnt Fork Creeks (USDA Forest Service, 2001b; BAA Appendix G). In 2001, each of these streams was sampled above the Foothills Road (FS Road #5498), at the lower end of the high severity burn (vegetation) on each of these creeks. There were cutthroat trout in each of these sections (Maps 2-21a and 2-21b), *indicating that if localized kills occurred higher up in these drainages, then there are fish downstream that could re-establish the population. There are no suspected human-caused passage barriers upstream from these areas. Fish passage barriers at the Foothills Road and the main Ninemile Road were remedied in 2001 or are scheduled for rehabilitation in 2002 (USDA Forest Service, 2000; BAER Report). This should provide substantial population and habitat benefits to this section of the Ninemile Drainage.*

Fisheries data collected in 1997 (GT Consulting, 1999) provides additional stream-specific information. GT Consulting (1999) did not estimate fish densities, but they did rate fish populations based on species present, numbers captured, estimated biomass, etc.

In the GT Consulting study (1999), Pine, Big Blue, Camp, Burnt Fork and Upper Ninemile Creeks rated well, based on a number of biological and physical characteristics. This is consistent with the 2001 Post Burn sampling results. Their findings in St. Louis and Mattie V Creeks showed fewer fish, possibly because they sampled one site in each of these streams, where seven and four sites, respectively, were sampled by Post Burn personnel in 2001.

Native salmonid densities in the Ninemile drainage appear to increase from downstream to upstream, with the uppermost tributaries having the highest densities. In particular, Eustache, St. Louis, and upper Ninemile Creeks showed higher cutthroat trout densities when compared to the other streams observed.

Within single streams, there appeared to be a longitudinal gradient in fish distribution. There were higher cutthroat trout (a native species) densities in the middle-most sites within a given stream segment.

The lower ends of individual streams had the greatest numbers of non-native salmonids. This corroborates the literature findings that non-native invasion tends to diminish from downstream to upstream when the invasion point is a downstream location (Adams et al., 2001). This illustrates the importance of maintaining good habitat and strong populations now present in these upstream areas, as well as reconnecting, improving and protecting additional remaining habitats in these upper fish bearing areas.

Non-native salmonids in the Ninemile drainage probably come from the Clark Fork River and Ninemile Creek. Stocked lakes can be a source of non-native fish dispersal further upstream within a watershed. However, the Ninemile drainage has no true lakes at the heads of watersheds.

Observations of non-native salmonid (brook, brown and rainbow trout) distribution in main stem Ninemile sites indicate they are prevalent throughout the main stem, but generally only in the lower portions of the tributaries. Thus, mid- to upper-stream segments within Ninemile watersheds, where non-native species are less likely to occur, are potentially important habitat for native species. In the middle section of Pine Creek above FS Road #5500, there is an impassable barrier at the creek crossing. No fish were seen above this structure, even though there was suitable habitat. By removing this culvert, additional upstream habitat would be available.

Exotic (non-native) fish species may be more tolerant of disturbed habitat (Rieman and McIntyre, 1993). The farthest-downstream site on Burnt Fork Creek showed the highest density of brook trout. This was also the site of extensive fire suppression and post-fire salvage on private land, where all of the riparian area on one side of the stream was cleared. These findings may support the hypothesis that exotic fish species of ten respond better and may out-compete native fish species in disturbed settings. Monitoring long-term fish population trend in this stream could provide valuable information.

2.17 Vegetative Cover

Vegetative data were summarized from GAP information in the Ninemile Creek Planning Area. GAP vegetation classification was developed by the USGS from satellite imagery in the 1990s (Tables 2-22 and 2-22a, and Map 2-22). This vegetation classification attempts to differentiate individual species within general community types (i.e. Ponderosa Pine vs. Conifer Forest). Ground truthing indicates that GAP data does have limitations and the designation of individual species polygons may be of variable quality. Nevertheless, GAP data represents the best available vegetation classification on a landscape scale. GAP data were obtained from the Montana 90-Meter Land Cover Database, available from the Montana State Library Natural Resource Information System (NRIS, 2003d).

Approximately 64% of the Ninemile Creek Planning Area is dominated by four GAP vegetation types: Mixed Mesic Forest (30%), Lodgepole Pine (12%), Douglas-fir (12%), and Mixed Subalpine Forest (10%). An additional 21 forest, shrub, riparian, and herbaceous polygons, each covering from 0.04% to 5% of the area, account for another 34% of vegetation covering the watershed. Polygons representing waterbodies (0.02%); rock (1.1%); mines, quarries, gravel pits (0.2%); and mixed barren sites (0.66%) cover the remaining 2% of the watershed.

The Lolo NF Big Game Winter Range and Burned Area Weed Management Final EIS (2001b – Sec.3) evaluated the effects of the fires of 2000 on vegetation and other resources. The evaluation states that prior to the 2000 fires, vegetation in the Upper Ninemile Drainage was dominated by two habitat types: 1) Douglas fir habitat types which are warm and dry (VRU2), and 2) subalpine fir habitat types (VRU4) characteristic of cold and dry to somewhat mesic forests. Cover types include drought-tolerant Ponderosa pine/Douglas fir on the lower elevations and cold-tolerant whitebark pine stands on the Reservation Divide. The severity of the fire determined the extent to which the habitat was modified.

Even without disturbance, in western Montana, grasslands, dry timber/bunchgrass and timber/shrub communities are considered most at risk from invasion by species such as spotted knapweed and leafy spurge (Losensky, 1987). Fires can increase this risk by opening the vegetation canopy (forest, shrub, or grass) and/or disturbing the soil. The lack of canopy and/or exposed mineral soil permit the establishment of early seral species, which includes both native species and invasive exotics, including most noxious weeds. Furthermore, seedbeds can develop from adjacent infestations or from seed transported by vectors such as wind, water, humans, wildlife, livestock, etc. Following disturbance, weeds will germinate and grow in areas that were seemingly “weed free.” Noxious weeds, particularly spotted knapweed, are well established along roadsides within the Post Burn Project Area. Roads are effective avenues for invasion of noxious weeds. Table 2-23 shows the distribution and density of the weed species that are present in the surveyed burned areas.

Table 2-22. Vegetation Classification (GAP) Within the NTPA. (NRIS, 2003d).

Description	Acres	Sq Miles	% of NTPA
Agricultural Lands - Dry	50.0	0.08	0.04
Agricultural Lands - Irrigated	186.1	0.29	0.16
Altered Herbaceous	1,325.4	2.07	1.12
Very Low Cover Grasslands	1,016.8	1.59	0.86
Low/Moderate Cover Grasslands	3,464.6	5.41	2.93
Moderate/High Cover Grasslands	62.5	0.10	0.05
Montane Parklands and Subalpine Meadows	2,462.3	3.85	2.08
Mixed Mesic Shrub	5,760.1	9.00	4.87
Lodgepole Pine	14,333.9	22.40	12.11
Ponderosa Pine	10,145.2	15.85	8.57
Grand Fir	320.2	0.50	0.27
Western Red Cedar	202.2	0.32	0.17
Douglas-fir	14,164.9	22.13	11.96
Western Larch	3,276.2	5.12	2.77
Douglas-fir/Lodgepole Pine	2,250.8	3.52	1.90
Mixed Whitebark Pine Forest	758.6	1.19	0.64
Mixed Subalpine Forest	11,933.9	18.65	10.08
Mixed Mesic Forest	35,891.3	56.08	30.32
Mixed Xeric Forest	4,992.0	7.80	4.22
Mixed Broadleaf and Conifer Forest	602.0	0.94	0.51
Water	18.0	0.03	0.02
Conifer Riparian	689.0	1.08	0.58
Broadleaf Riparian	718.5	1.12	0.61
Mixed Broadleaf and Conifer Riparian	382.3	0.60	0.32
Graminoid and Forb Riparian	216.2	0.34	0.18
Shrub Riparian	698.5	1.09	0.59
Mixed Riparian	146.1	0.23	0.12
Rock	1,300.5	2.03	1.10
Mines, Quarries, Gravel Pits	240.2	0.38	0.20
Mixed Barren Sites	785.5	1.23	0.66
Total	**118,394.0**	**184.99**	**100**

Table 2-22a. Vegetation Classification (GAP) Within the 303(d)-Listed NTPA Tributaries (Acres). (NRIS, 2003d).

Description	Josephine Creek	Big Blue Creek	McCormick Creek	Kennedy Creek	Stony Creek	Cedar Creek
Agricultural Lands - Dry	0.0	0.0	0.0	4.0	7.3	0.0
Agricultural Lands - Irrigated	0.0	0.0	0.0	0.0	46.3	0.0
Altered Herbaceous	54.0	0.0	64.0	129.4	46.3	18.0
Very Low Cover Grasslands	13.8	0.0	61.4	24.0	44.5	0.0
Low/Moderate Cover Grasslands	51.8	0.0	70.7	36.0	45.8	203.9
Moderate/High Cover Grasslands	0.0	0.0	0.0	0.0	0.0	2.7
Montane Parklands and Subalpine Meadows	47.6	101.0	265.5	6.0	56.7	109.2
Mixed Mesic Shrub	77.6	17.6	595.1	221.5	354.5	102.3
Lodgepole Pine	1,023.9	513.1	1,595.4	366.9	273.8	756.1
Ponderosa Pine	42.7	143.7	42.7	173.2	248.9	359.4
Grand Fir	46.0	6.0	18.0	14.0	0.0	6.0
Western Red Cedar	0.0	0.0	0.0	0.0	0.0	26.0
Douglas-fir	402.1	131.2	855.3	320.7	1,077.0	955.4
Western Larch	303.6	44.0	882.2	395.0	56.5	62.0
Douglas-fir/Lodgepole Pine	33.4	0.0	240.8	22.0	50.9	32.9
Mixed Whitebark Pine Forest	186.1	3.1	181.5	0.0	2.0	8.0
Mixed Subalpine Forest	298.9	436.6	1,415.5	196.1	811.5	132.1
Mixed Mesic Forest	1,520.5	381.4	2,012.6	1,259.4	1,172.2	748.8
Mixed Xeric Forest	162.6	56.0	251.7	79.2	66.9	293.3
Mixed Broadleaf and Conifer Forest	3.6	4.2	200.2	24.0	18.0	0.0
Conifer Riparian	10.2	0.7	54.0	21.3	10.5	16.0
Broadleaf Riparian	18.9	2.4	30.7	28.9	26.0	12.0
Mixed Broadleaf and Conifer Riparian	6.0	8.0	18.0	6.0	16.9	12.2
Graminoid and Forb Riparian	0.0	0.0	6.0	2.0	2.0	0.0
Shrub Riparian	2.0	0.0	20.2	11.1	10.0	2.0
Mixed Riparian	0.0	0.0	4.7	0.0	8.0	1.3
Rock	41.4	22.7	502.6	33.6	59.6	14.0
Mines, Quarries, Gravel Pits	0.0	0.0	0.0	114.1	0.0	0.0
Mixed Barren Sites	108.1	0.0	72.7	21.8	12.0	9.3
Total	**4,454.7**	**1,871.6**	**9,461.8**	**3,488.6**	**4,524.1**	**3,883.2**

Table 2-23. Weed Presence, Distribution, and Density in the Ninemile Post Burn Area. (USDA Forest Service, 2002).

SPECIES	Presence/Distribution
Spotted knapweed *(Centaurea maculosa)*	P/W/H
Meadow (or yellow) hawkweed *(Hieracium pratense)*	P/I/L-H
Canada thistle (*Cirsium vulgare)*	P/W/H old clearcuts
Musk thistle *(Carduus nutans)*	P/I/L clearcuts only
Common tansy *(Tanacetum vulgare)*	P/I/H-R
St. Johnswort *(Hypericum perforatum)*	P/I/M-R
Dalmatian toadflax *(Linaria dalmatica)*	NP/NA
Houndstongue *(Cynoglossum officinale)*	P/W/L
Sulfur cinquefoil *(Potentilla recta)*	P/W/M
Oxeye daisy *(Chrysanthemum leucanthemum)*	P/W/M
Diffuse knapweed *(Centaurea diffusa)*	P/I/L
Yellow toadflax *(Linaria vulgaris)*	P/I/L
Cheatgrass *(Bromus tectorum)*	P/W/M-R

Presence/Distribution/Density
Presence: P = Present; NP = Not present
Distribution: W = Widespread; L = Low; I = Isolated
Density: L = Light; M = Moderate; H = Heavy; R = Found only on roads

2.18 Fires of 2000

The fires of 2000 burned extensively throughout the upper Ninemile Creek TMDL Planning Area. Map 2-23 shows fire locations and severity. Approximately 20,000 acres of private, federal, and state lands were located within the perimeter of the Upper Ninemile Complex Fire. Information regarding the Ninemile burned area was provided by the USDA Forest Service (2001b; 2002).

Elevations in the burned area vary from approximately 4000 feet on the Ninemile Road near Beecher Creek to over 6800 feet at the Reservation Divide. The topography is varied. The Ninemile Fault bisects the northeast corner of the burn. Slopes below the fault are gentle (10-40%) and undulating. Slopes above the fault are steep (40-80%) with highly dissected side drainages. Burned areas are not limited to any particular slope aspect.

The impact fire has on a watershed varies based on the amount of area burned and the severity of the burn. Moderate to high severity burns have the highest potential for impacts to water temperature, runoff, and channel stability. Table 2-24 presents acres and percent of the Ninemile watershed burned at low, moderate, and high severity across the planning area. “Fire Severity” describes the effects of fire on various components of the ecosystem, such as soil, water, or vegetation. Fire severity is classified as high, moderate, or low by the USDA Forest Service (2001b) as follows:

Low severity fires occurred where duff and ground vegetation were lightly burned, many areas of unburned ground vegetation remain throughout the stand, and less than 20% of the dominant and co-dominant overstory trees were killed.

Moderate severity fires resulted in stands of mostly unburned overstory trees and low-to-moderate duff reduction and mortality in the ground vegetation. In theses stands, the fire killed from 20 to 60 percent of the overstory trees. The result is of ten a mosaic of large islands of green trees and large overstory individual trees.

Moderately high severity fires replaced stand, significantly reducing most of the duff, burning the tops of nearly all ground vegetation, and killing from 60 to 90 percent of the overstory trees. These are mostly dead stands with patches of live trees and scattered live individuals.

High severity fires occurred where the duff and tops of the ground vegetation was almost all consumed, leaving few unburned areas, and from 90 to 100 percent of the trees were killed. Usually, these stands are easily identified on aerial photos because all fine twigs and needles were consumed on standing trees or the crowns were completely scorched.

Table 2-24. Burn Severity from Fires of 2000 in the NTPA. (USDA Forest Service, 2002).

Burn Severity	Acres	Percent of burned area
High	605	3
Moderate	3378	17
Low	2073	10
Moderate/Low Mosaic	149	>1
Low/Unburned Mosaic	5906	29
Unburned, but w/i fire perimeter	7922	40
Total	**20,034**	**100**

The percent of watersheds burned, severity, and miles of fire line created in the 2000 Ninemile fires are listed in Table 2-25. Of the six 303(d)-listed tributaries to Ninemile Creek, Big Blue Creek was the only one that burned significantly. Approximately 77% of Big Blue Creek burned in the 2000 fires and 61% of that burned at a high and moderately-high severity.

Table 2-25. Percent Watershed Burned, Severity and Miles of Fire Line in NTPA. (USDA Forest Service, 2002).

Watershed	Area as mi^2 by Project watershed and (% of Watershed that burned)	Percent watershed and (riparian areas) that burned at high and mod-high severity	Total miles of fire line and (miles of fire line within 300 feet of stream)
Eustache	8.9 (6.0)	1.3 (0.1)	6.3 (0.2)
St. Louis	4.4 (42.1)	20.2 (9.0)	6.3 (1.1)
Beecher	5.0 (70.8)	19.3 (10.6)	3.0 (1.5)
Nugget	1.3 (0.0)	0.0 (0.0)	0.2 (0.0)
Sawpit	2.2 (43.7)	15.9 (3.5)	3.5 (0.1)
Martina	2.6 (20.0)	10.9 (0.0)	5.8 (0.4)
Mattie V	1.6 (0.0)	0.0 (0.0)	1.7(0.0)
Burnt Fk	5.6 (87.8)	50.3 (42.9)	3.5 (1.1)
Face 1	.65 (31.8)	3.1 (0.1)	0.7 (0.1)
Face 2	.68 (79.8)	12.7 (1.5)	0.6 (0.0)
Soldier	2.4 (85.4)	70.0 (48.5)	2.2 (1.4)
Camp	2.6 (65.1)	49.5 (33.7)	3.7 (1.3)
Big Blue	2.8 (76.9)	61.1 (35.1)	1.0 (0.5)
Little Blue	2.0 (6.0)	30.9 (16.0)	1.6 (0.8)
Little Bear	6.5 (0.0)	0.0 (0.0)	0.0 (0.0)
Bird	8.9 (0.0)	0.0 (0.0)	0.0 (0.0)
Pine	2.0 (29.5)	8.9 (2.3)	3.9 (0.6)
Face 3	.54 (32.3)	21.0 (0.0)	1.2 (0.0)
Face 4	.13 (0.0)	0.0 (0.0)	0.2 (0.0)
Face 5	.27 (0.0)	0.0 (0.0)	0.0 (0.0)
Face 6	.05 (0.0)	0.0 (0.0)	0.0 (0.0)
Face 7	.96 (0.0)	0.0 (0.0)	0.0 (0.0)
Marion	5.4 (16.7)	2.2 (0.3)	5.7 (2.4)
Face 8	.32 (0.0)	0.0 (0.0)	0.0 (0.0)

2.19 Timber Harvest History

In its Post Burn EIS, the USDA Forest Service (2002) describes the general history of timber harvest in the portion of NTPA affected by the 2000 fires. The EIS states that the gentle ground below the Ninemile Fault and the steep ground immediately above the Ninemile Fault were heavily logged from the 1960’s through the early 1980’s.

Table 2-26 shows the timber acres harvested in the last 30 years in watersheds addressed by the post-burn EIS. The last two columns of Table 2-26 show the ECA for drainages burned by the 2000 fires. The ECA, or Equivalent Clearcut Area, describes a recovering disturbance in terms of what it would currently represent as an equivalent area of new disturbance. For example, a 100-acre stand that was harvested in 1970 might now have juvenile trees that provide 75% of the canopy cover a mature stand would provide. This would equal the effects of a 25 acre clearcut (25%). Watersheds having more than 30% of their watershed in an Equivalent Clearcut condition are generally considered to have a high potential for changes in runoff quantities and timing, based on research results (USDA Forest Service, 2002).

The ECA calculations shown in Table 2-26 include portions of watershed affected by past timber management activities, natural disturbance, and the 2000 fires. This data indicates that for the upper Ninemile as a whole, these disturbances have affected about 25.5 to 26.4% of the watershed.

Using the ECA greater than 30% criterion (see bold italics in Table 2-26), Beecher, Big Blue, Burnt Fork, Camp, Little Blue, Martina, Nugget, Sawpit, Soldier, and St. Louis watersheds are at high likelihood of change in their hydrologic regimes (Sawpit is borderline). In addition to these "true" watersheds, several face areas (Ninemile Face 2 and 3) also have ECAs greater than 30%. In most cases, the 2000 fires are the main contributors to high ECA values. Recent harvest effects are a notable portion of the ECAs in Martina and Nugget Creeks (USDA Forest Service, 2002).

2.19.1 Harvest in Tributary Watersheds with 303(d) Listing

Of the six 303(d)-listed tributaries to Ninemile Creek, Big Blue Creek was the only watershed included in the post-fire analysis. Big Blue Creek had an ECA of 78%, but only 4% of the watershed has been treated with some level of harvest in the last 30 years and thus the ECA resulted primarily from fire effects.

Although other listed tributaries to Ninemile Creek were not included in the post-burn assessment of harvest impacts, sediment loading from timber harvest was calculated for each in the assessment of sediment sources presented in Section 4.0 of this document.

Table 2-26. Harvest and ECA Within Burned Watersheds of the NTPA [Inventory of Drainages Affected by Fires of 2000]. (USDA Forest Service, 2002).

Watershed	FS land treated with some level of harvest[1] in last 30 years (acres)	Percent treated with some level of harvest[1] in last 30 years	Portion of Watershed as ECA(%) – Forest Service Lands Only	Portion of Watershed as ECA(%) - all Land Ownership
Eustache	1,416	25	12	12
St. Louis	452	16	44	44
Beecher	620	16	37	37
Nugget	208	24	30	31
Sawpit	614	43	32	32
Martina	425	25	35	42
Mattie V	351	34	13	13
Burnt Fk	653	18	23	31
Face 1	90	22	3	3
Face 2	169	39	38	38
Soldier	124	8	57	57
Camp	196	12	56	56
Big Blue	73	4	78	78
Little Blue	165	13	42	42
Little Bear	1,588	38	9	10
Bird	1,547	27	4	7
Pine	167	5	17	17
Face 3	154	45	43	43
Face 4	160	100	4	4
Face 5	89	52	0	0
Face 6	0	0	0	0
Face 7	634	100	24	24
Marion	252	7	12	14
Face 8	0	0	0	0
Total Acres	**10,147**	**--**	**--**	**--**
Average Percent	**--**	**28**	**25.5**	**26.5**

[1] Acres include various harvest methods; this is a relative index of entry and potential disturbance, not the total amount of land cleared.

2.20 Roadless Areas

There area two inventoried roadless areas within the Ninemile Creek TMDL Planning Area: Reservation Divide and Stark Mountain (Map 2-24) (USDA Forest Service, 1986). The Reservation Divide Roadless Area covers 16,300 acres and includes the upper portions of all of the drainages north of Ninemile Creek from St. Louis Creek to Stony Creek along the Reservation Divide. The Stark Mountain Roadless Area includes 14,140 acres of the Ninemile Divide, 52% (7304 acres) of which is in the NTPA.

SECTION 3.0 WATER QUALITY IMPAIRMENT STATUS

This section of the document first presents the status of all 303 (d) listed waterbodies in the Ninemile TPA (i.e., which waterbodies are listed as impaired or threatened and for which pollutant). This is followed by a summary of the applicable water quality standards and a translation of those standards into proposed water quality goals or targets. The remainder of this section is devoted to a waterbody by waterbody review of available water quality data and an updated water quality impairment status determination for each listed waterbody.

3.1 303(d) List Status

A summary of the 303(d) list status and history of listings is provided in Tables 3-1 and 3-2. The 2002 303(d) list is the most recently approved by DEQ, but as mentioned in Section 1.1, all necessary TMDLs must be completed for all pollutant waterbody combinations appearing on the 1996 303(d) list. The Montana 1996 303(d) list reported that Big Blue Creek, Cedar Creek, Josephine Creek, upper McCormick Creek, Lower McCormick Creek, and Stony Creek were threatened, and that Kennedy Creek, Little McCormick Creek, and Ninemile Creek were impaired (DEQ, 1996). Listed threats and causes of impairment for these waterbodies included habitat alterations, metals, siltation, and flow alteration (Table 3-2). The most common impaired/threatened beneficial uses were cold-water fishery and aquatic life.

Habitat alteration and flow alteration are considered “pollution” while metals and siltation are considered “pollutants”. It is EPA’s position that TMDLs are only required for “pollutants” that are causing or contributing to waterbody impairments (Dodson, 2001). Therefore, since TMDLs are only required for pollutants, and flow alteration and habitat alteration are not pollutants; the focus of this document is on siltation and metals. Flow alteration and habitat alteration may certainly comprise potential sources or causes of impairments and, while no TMDLs will be established to specifically address these issues, they will be addressed as sources, as appropriate.

Table 3-1. Impaired Streams on the Montana 303(d) List Within the Ninemile TPA.

Sub-Drainage Name Waterbody #	Use Class	Year Listed	Cold-water Fishery	Aquatic Life	Recreation (Swimmable)	Industry	Agriculture	Drinking Water
Big Blue Creek MT76M004-050	B1	1996	T	X	X	X	X	X
		2002	X	X	X	X	X	X
Cedar Creek MT76M004-060	B1	1996	T	X	X	X	X	X
		2002	X	X	X	X	X	X
Josephine Creek MT76M004-040	B1	1996	T	X	X	X	X	X
		2002	X	X	X	X	X	X
Kennedy Creek MT76M004-070	B1	1996	P	P	X	X	X	X
		2002	N	N	P	F	F	N
Little McCormick Creek MT76M004-080	B1	1996	N	N	N	X	X	P
		2002	X	X	X	X	X	X
Upper McCormick Creek MT76M004-032	B1	1996	T	X	X	X	X	X
		2002	F	F	X	X	X	X
Lower McCormick Creek MT76M004-031	B1	1996	T	X	X	X	X	X
		2002	P	P	X	X	X	X
Ninemile Creek MT76N004-010	B1	1996	P	P	X	X	X	X
		2002	P	P	F	F	F	X
Stony Creek MT76M004-020	B1	1996	T	X	X	X	X	X
		2002	X	X	X	X	X	X

Definitions for Table 3-1: Impairment Status
N= Non-support of Beneficial Use.
P = Partial support of Beneficial Use.
F = Full support of Beneficial Use.
T = Threatened support for Beneficial Use.
X = Sufficient Credible Data not available

Table 3-2. Causes of Impairment in the Ninemile TPA.

Sub-Drainage Name Waterbody #	Use Class	Year Listed	Probable Causes
Big Blue Creek MT76M004-050	B1	1996	Habitat Alterations
		2002	No SCD
Cedar Creek MT76M004-060	B1	1996	Habitat Alterations
		2002	No SCD
Josephine Creek MT76M004-040	B1	1996	Habitat Alterations
		2002	No SCD
Kennedy Creek MT76M004-070	B1	1996	Metals/Siltation
		2002	Metals/Habitat Alterations/Dewatering/Flow Alterations
Little McCormick Creek MT76M004-080	B1	1996	Habitat Alterations/Flow Alterations
		2002	No SCD
Upper McCormick Creek MT76M004-032	B1	1996	Habitat Alterations
		2002	Full Support (but no SCD for Ag., Industry, Drinking Water, Recreation)
Lower McCormick Creek MT76M004-031	B1	1996	Habitat Alterations
		2002	Habitat Alterations
Ninemile Creek MT76N004-010	B1	1996	Habitat Alterations/Siltation
		2002	Habitat Alterations/Siltation
Stony Creek MT76M004-020	B1	1996	Habitat Alterations/Siltation
		2002	No SCD

SCD – Sufficient Credible Data

3.2 Applicable Water Quality Standards

Water quality standards include: the uses designated for a waterbody, the legally enforceable standards that ensure that the uses are supported, and a non-degradation policy that protects the high quality of a waterbody. The ultimate goal of this water quality restoration plan, once implemented, is to ensure that all designated beneficial uses are fully supported and all standards are met. Water quality standards form the basis for the targets described in Section 3.3. Pollutants addressed in this Water Quality Restoration Plan include sediment and metals. This section provides a summary of the applicable water quality standards for each of these pollutants.

3.2.1 Classification and Beneficial Uses

Classification is the assignment (designation) of a single or group of uses to a waterbody based on the potential of the waterbody to support those uses. Designated Uses or Beneficial Uses are simple narrative descriptions of water quality expectations or water quality goals. There are a variety of “uses” of state waters including: growth and propagation of fish and associated aquatic life; drinking water; agriculture; industrial supply; and recreation and wildlife. The Montana

Water Quality Act (WQA) directs the Board of Environmental Review (BER, i.e., the state) to establish a classification system for all waters of the state that includes their present (when the Act was originally written) and future most beneficial uses (Administrative Rules of Montana (ARM) 17.30.607-616) and to adopt standards to protect those uses (ARM 17.30.620-670).

Montana, unlike many other states, uses a watershed based classification system with some specific exceptions. As a result, *all* waters of the state are classified and have designated uses and supporting standards. All classifications have multiple uses and in only one case (A-Closed) is a specific use (drinking water) given preference over the other designated uses. Some waters may not actually be used for a specific designated use, for example as a public drinking water supply, however the quality of that waterbody must be maintained suitable for that designated use. When natural conditions limit or preclude a designated use, permitted point source discharges or non-point source discharges may not make the natural conditions worse.

Modification of classifications or standards that would lower a water’s classification or a standard (i.e., B-1 to a B-3), or removal of a designated use because of natural conditions can only occur if the water was originally miss-classified. All such modifications must be approved by the BER, and are undertaken via a Use Attainability Analysis (UAA) that must meet EPA requirements (40 CFR 131.10(g), (h) and (j)). The UAA and findings presented to the BER during rulemaking must prove that the modification is correct and all existing uses are supported. An existing use cannot be removed.

Descriptions of Montana’s surface water classifications and designated beneficial uses are presented in Table 3-3. All waterbodies within the Ninemile TPA are classified as B-1.

Table 3-3. Montana Surface Water Classifications and Designated Beneficial Uses.

Classification	Designated Uses
A-CLOSED CLASSIFICATION:	Waters classified A-Closed are to be maintained suitable for drinking, culinary and food processing purposes after simple disinfection.
A-1 CLASSIFICATION:	Waters classified A-1 are to be maintained suitable for drinking, culinary and food processing purposes after conventional treatment for removal of naturally present impurities.
B-1 CLASSIFICATION:	Waters classified B-1 are to be maintained suitable for drinking, culinary and food processing purposes after conventional treatment; bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.
B-2 CLASSIFICATION:	Waters classified B-2 are to be maintained suitable for drinking, culinary and food processing purposes after conventional treatment; bathing, swimming and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.
B-3 CLASSIFICATION:	Waters classified B-3 are to be maintained suitable for drinking, culinary and food processing purposes after conventional treatment; bathing, swimming and recreation; growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.
C-1 CLASSIFICATION:	Waters classified C-1 are to be maintained suitable for bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.
C-2 CLASSIFICATION:	Waters classified C-2 are to be maintained suitable for bathing, swimming and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.
C-3 CLASSIFICATION:	Waters classified C-3 are to be maintained suitable for bathing, swimming and recreation; growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl and furbearers. The quality of these waters is naturally marginal for drinking, culinary and food processing purposes, agriculture and industrial water supply.
I CLASSIFICATION:	The goal of the State of Montana is to have these waters fully support the following uses: drinking, culinary and food processing purposes after conventional treatment; bathing, swimming and recreation; growth and propagation of fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

3.2.2 Standards

In addition to the Use Classifications described above, Montana's water quality standards include numeric and narrative criteria as well as a nondegradation policy.

Numeric surface water quality standards have been developed for many parameters to protect human health and aquatic life. These standards are in the Department Circular WQB-7 (DEQ, January, 2004). The numeric human health standards have been developed for parameters determined to be toxic, carcinogenic, or harmful and have been established at levels to be protective of long-term (i.e., life long) exposures as well as through direct contact such as swimming.

The numeric aquatic life standards include chronic and acute values that are based on extensive laboratory studies including a wide variety of potentially affected species, a variety of life stages and durations of exposure. Chronic aquatic life standards are protective of long-term exposure to a parameter. The protection afforded by the chronic standards includes detrimental effects to reproduction, early life stage survival and growth rates. In most cases the chronic standard is more stringent than the corresponding acute standard. Acute aquatic life standards are protective of short-term exposures to a parameter and are not to be exceeded.

High quality waters are afforded an additional level of protection by the nondegradation rules (ARM 17.30.701 et. seq.,) and in statute (75-5-303 MCA). Changes in water quality must be "non-significant" or an authorization to degrade must be granted by the Department. However under no circumstance may standards be exceeded. It is important to note that, waters that meet or are of better quality than a standard are high quality for that parameter, and nondegradation policies apply to new or increased discharges to that the waterbody.

Narrative standards have been developed for substances or conditions for which sufficient information does not exist to develop specific numeric standards. The term "Narrative Standards" commonly refers to the General Prohibitions in ARM 17.30.637 and other descriptive portions of the surface water quality standards. The General Prohibitions are also called the "free from" standards; that is, the surface waters of the state must be free from substances attributable to discharges, including thermal pollution, that impair the beneficial uses of a waterbody. Uses may be impaired by toxic or harmful conditions (from one or a combination of parameters) or conditions that produce undesirable aquatic life. Undesirable aquatic life includes bacteria, fungi and algae.

The standards applicable to the list of pollutants addressed in the Ninemile TPA are summarized, one-by-one, below.

3.2.2.1 Sediment

Sediment (i.e., coarse and fine bed sediment) and suspended sediment are addressed via the narrative criteria identified in Table 3-4. The relevant narrative criteria do not allow for harmful or other undesirable conditions related to increases above naturally occurring levels or from discharges to state surface waters. This is interpreted to mean that water quality goals should strive toward a reference condition that reflects a waterbody's greatest potential for water quality given current and historic land use activities where all reasonable land, soil, and water conservation practices have been applied and resulting conditions are not harmful, detrimental or injurious to beneficial uses (see definitions in Table 3-4).

Table 3-4. Applicable Rules for Sediment Related Pollutants.

Rule(s)	Standard
17.30.623(2)	No person may violate the following specific water quality standards for waters classified B-1.
17.30.623(2)(f)	No increases are allowed above naturally occurring concentrations of sediment or suspended sediment (except a permitted in 75-5-318, MCA), settleable solids, oils, or floating solids, which will or are likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish, or other wildlife.
17.30.637(1)	State surface waters must be free from substances attributable to municipal, industrial, agricultural practices or other discharges that will.
17.30.637(1)(a)	Settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines.
17.30.637(1)(d)	Create concentrations or combinations of materials that are toxic or harmful to human, animal, plant, or aquatic life.
	The maximum allowable increase above naturally occurring turbidity is: 0 NTU for A-closed; 5 NTU for A-1, B-1, and C-1; 10 NTU for B-2, C-2, and C-3.
17.30.602(17)	“Naturally occurring,” means conditions or material present from runoff or percolation over which man has no control or from developed land where all reasonable land, soil, and water conservation practices have been applied.
17.30.602(21)	“Reasonable land, soil, and water conservation practices” means methods, measures, or practices that protect present and reasonably anticipated beneficial uses. These practices include but are not limited to structural and nonstructural controls and operation and maintenance procedures. Appropriate practices may be applied before, during, or after pollution-producing activities.

3.2.2.2 Metals

Numeric criteria for metals in Montana include specific standards for the protection of both aquatic life and human health. As described above, acute and chronic criteria have been established for the protection of aquatic life. The criteria for some metals vary according to the hardness of the water. The standards for cadmium, copper, chromium (III), lead, nickel, silver and zinc vary according to the hardness of the water. These standards have an inverse relationship to toxicity (decreasing hardness causes increased toxicity). The applicable numeric criteria for the metals of concern in the Ninemile TPA are presented in Table 3-5.

It should be noted that recent studies have indicated some metals concentrations vary through out the day because of diel pH and alkalinity changes. In some cases the variation can cross the standard threshold (both ways) for a metal. Montana water quality standards are not time of day dependent.

Table 3-5. Montana Numeric Surface Water Quality Standards for Relevant Metals.

Parameter	Aquatic Life (acute) (µL)[a]	Aquatic Life (chronic) (µL)[b]	Human Health (µL)[a]
Copper (TR)	7.3 @ 50 mg/L hardness[c]	5.2 @ 50 mg/L hardness[c]	1,300
Lead (TR)	82 @ 100 mg/L hardness[c]	3.2 @ 100 mg/L hardness[c]	15
Mercury (TR)	1.7	0.91	0.05
Zinc (TR)	67 @ 50 mg/L hardness[c]	67 @ 50 mg/L hardness[c]	2,000

[a]Maximum allowable concentration.
[b]No 4-day (96-hour) or longer period average concentration may exceed these values.
[c]Standard is dependent on the hardness of the water, measured as the concentration of $CaCO_3$ (mg/L) (see Appendix B for the coefficients to calculate the standard).
Note: TR – total recoverable.

3.3 Water Quality Goals and Indicators

To develop a TMDL, it is necessary to establish quantitative water quality targets. TMDL targets must represent the applicable numeric or narrative water quality standards and full support of all associated beneficial uses. For many pollutants with established numeric water quality standards, the water quality standard is used directly as the TMDL target. However, some pollutants have no established numeric water quality standards that can be directly applied as TMDL targets. Where indicators are established for pollutants with only narrative standards, the target must be a waterbody-specific, measurable interpretation of the narrative standard.

Within the Ninemile TPA there are two primary pollutants of concern, metals (copper, lead, mercury, zinc) and siltation. All of the listed metals have numeric water quality standards that can be used as the TMDL target. However there is no numeric water quality standard and no single parameter that can be applied alone to provide a direct measure of beneficial use impairment associated with siltation. As a result, a suite of targets and supplemental indicators has been selected to help determine when impairments are present (Table 3-6). In consideration of the available data for the Ninemile TPA, the targets are the most reliable and robust measures of impairment and beneficial use support available. As described in the one-by-one discussions of individual targets presented in the following paragraphs, there is a documented relationship between the selected target values and beneficial use support, or sufficient reference data is available to establish a threshold value representing “natural” conditions. In addition to having a documented relationship with the suspected impaired beneficial use, the targets have direct relevance to the pollutant of concern. The targets, therefore, are relied upon as threshold values, that if exceeded (based on sufficient data) indicate water quality impairment. The targets will also be applied as water quality goals by which the ultimate success of implementation of this plan will be measured in the future.

The supplemental indicators provide supporting and/or collaborative information when used in combination with the targets. Additionally, some of the supplemental indicators are necessary to determine if exceedances of targets are a result of natural versus anthropogenic causes. However, the proposed supplemental indicators are not sufficiently reliable to be used alone as a measure of impairment because: 1) the cause-effect relationship between the supplemental indicator(s) and beneficial use impairments is weak and/or uncertain; 2) the supplemental indicator(s) cannot be used to isolate impairment associated with individual pollutants (e.g., differentiate between an impairment caused by excessive levels of sediment versus high concentrations of metals); or 3) there is too much uncertainty associated with the supplemental indicator(s) to have a high level of confidence in the result.

Targets and Supplemental Indicators Applied to Beneficial Use Impairment Determinations

The beneficial use impairment determinations presented in Section 3.4 are based a weight of evidence approach in combination with the application of best professional judgment. The weight of evidence approach is outlined in Figure 3-1 and is applied as follows. If none of the target values are exceeded, the water is considered to be fully supporting its uses and no TMDL is necessary. This is true even if one or more of the supplemental indicator values are exceeded. On the other hand, if one or more of the target values are exceeded, the circumstances around the exceedance are investigated and the supplemental indicators are used to provide additional information to support a determination of impairment/non-impairment. In this case, the circumstances around the exceedance of a target value are investigated before it is automatically assumed that the exceedance represents human-caused impairment (e.g., Is the data reliable and representative of the entire reach? Might the exceedance be a result of natural causes such as floods, drought, fire or the physical character of the watershed?). This is also the case where the supplemental indicators assist by providing collaborative and supplemental information, and the weight of evidence of the complete suite of targets and supplemental indicators is used to make the impairment determination.

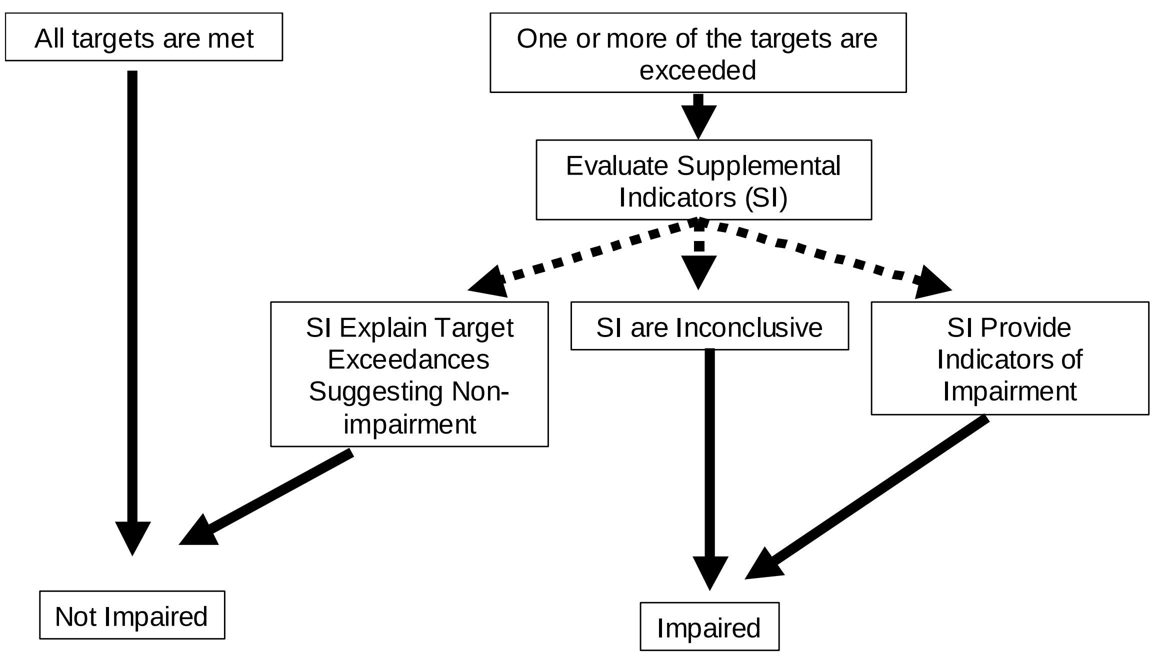


Figure 3-1. Weight-of-evidence Approach for Determining Beneficial Use Impairments.

Targets and Supplemental Indicators as Water Quality Goals

In accordance with the Montana Water Quality Act (MCA 75-5-703(7) and (9)), the DEQ is required to assess the waters for which TMDLs have been completed to determine whether compliance with water quality standards has been attained. This assessment will use the suite of targets specified in Table 3-6 to measure compliance with water quality standards and achievement of full support of all applicable beneficial uses (Figure 3-2). <u>The supplemental indicators will not be used directly as water quality goals to measure the success of this water quality restoration plan</u>. If all of the target values are met, it will be assumed that beneficial uses are fully supported and water quality standards have been achieved. Alternatively, if one or more of the target values are exceeded, it will be assumed that beneficial uses are <u>not</u> fully supported and water quality standards have <u>not</u> been achieved. However, it will not be automatically assumed that implementation of this TMDL was unsuccessful just because one or more of the target values have been exceeded. As above, the circumstances around the exceedance will be investigated. For example, might the exceedance be a result of natural causes such as floods, drought, fire or the physical character of the watershed? Additionally, in accordance with MCA 75-5-703(9), an evaluation will be conducted to determine if:

- The implementation of a new or improved suite of control measures is necessary;
- More time is needed to achieve water quality standards, or;
- Revisions to components of the TMDL are necessary.

Detailed discussions regarding each of the targets and supplemental indicators are presented below.

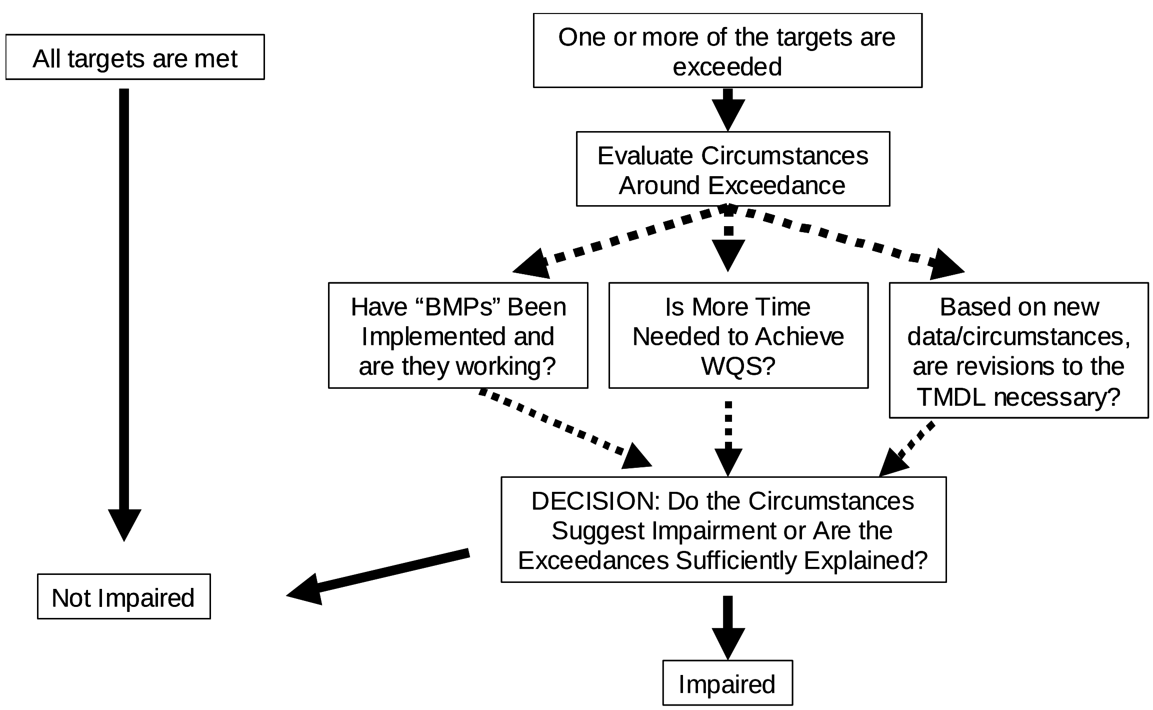


Figure 3-2. Methodology for Determining Compliance with Water Quality Standards.

Table 3-6. Summary of the Proposed Siltation Targets and Supplemental Indicators for the Ninemile TPA.

Targets	Threshold	
Wolman pebble counts % Fines < 6mm	A3 channels	Mean = 14.8%
		Range = 6.5-23.1%
	B3 channels	Mean = 10.0%
		Range = 2-18%
	B4 channels	Mean = 21.0%
		Range = 6-36%
	C3 channels	Mean = 12.0%
		Range = 6-18%
	C4 channels	Mean = 22.0%
		Range = 12-32%
Wolman pebble counts D50	A3 channels	Mean = 107 mm
		Range = 74-140 mm
	B3 channels	Mean = 81 mm
		Range = 50-112 mm
	B4 channels	Mean = 38 mm
		Range = 25-51 mm
	C3 channels	Mean = 81 mm
		Range = 49-113 mm
	C4 channels	Mean = 34 mm
		Range = 22-46 mm
Riffle Stability Index	B channels	45-85
	C channels	45-75
Clinger Richness	≥ 14	
Supplemental Indicators		
Juvenile Bull Trout and Westslope Cutthroat Trout Density	Documented increasing or stable trend	
LWD/mile	>156 pieces/mile	
Pools/mile	Wetted width of stream	Pools/mile
	10	96
	20	56
	25	47
	50	26
	75	23
	100	18
	125	14
	150	12
	200	9
Bankfull Width/Depth Ratio	B channels	< 22
	C channels	< 33

Table 3-6. Summary of the Proposed Siltation Targets and Supplemental Indicators for the Ninemile TPA.

Supplemental Indicators	
Suspended solids concentrations	Comparable to reference condition
Turbidity	High Flow – 50 NTU instantaneous maximum Summer base flow – 10 NTU
Montana Mountain Macroinvertebrate Index of Biological Integrity	> 75%
Percentage of Clinger Taxa	"High"
EPT Richness	≥ 22
Periphyton Siltation Index	< 40
Equivalent Clear Cut Area	<25%
Water Yield	<10%
Other Human-caused sediment sources	No significant sources

3.3.1 Sediment Targets

The proposed sediment targets include percent surface fines, D50s, riffle stability indices, and macroinvertebrate metrics.

3.3.1.1 Surface Sediment

Measurements of the size range of substrate material in the streambed are indicative of salmonid spawning and incubation habitat quality. Fine sediment is often used to describe spawning gravel quality. Increased sediment affects spawning gravels in the following ways: 1) cementing the gravels in place and reducing their viability as spawning substrate, 2) reducing the oxygen available to fish embryos, 3) reducing intragravel water velocities and the delivery of nutrients to and waste material from the interior of the redd, 4) and impairing the ability of fry to emerge as free-swimming fish (Meehan, 1991).

Substrate fine materials less than 6 mm are commonly used to describe potential success of fry emergence, and this size class includes the range typically generated by land management activities (Weaver and Fraley, 1991). Weaver and Fraley (1991) observed a significant inverse relationship between the percentage of material < 6 mm and the emergence success of westslope cutthroat trout and bull trout. Mebane (2001) found that higher increased surface fines < 6 mm negatively affected macroinvertebrate, salmonid, and sculpin species; and Zweig et al. (2001) found that macroinvertebrate taxa richness was inversely related to sediment deposition.

Percent surface fines <6mm are measured with the pebble count method described by Wolman (1954). Threshold pebble count values have not been fully developed by DEQ for Montana, and little Wolman pebble count data was available from least developed reference streams on the Lolo National Forest. To supplement the Lolo NF data, data collected by the Beaverhead/Deerlodge National Forest in Southwest Montana and the greater Yellowstone Ecosystem were utilized. Reference values for B3 channels in the combined database averaged 10 percent, with 68 percent (+/- one standard deviation) of the reference values falling between 2 and 18 percent. In B4, C3, and C4 streams, the mean reference values were 21, 12 and 22 percent respectively, with 68 percent ranges of 2 to 18 percent for B4 streams, 6 to 36 percent for C3 streams, and 12-32 percent for C4 streams.

3.3.1.2 D50

The D50 is the median value of the size distribution in a sample of surface particles, and is typically calculated by use of the Wolman pebble count (Wolman, 1954). It is a measure of the central tendency of the stream substrate, and thus is one of several indicators of how "fine" or "coarse" the substrate is overall. In a study that evaluated the relationship between hillslope disturbance and various in-stream indicators, Knopp (1993) found that a clear trend of decreasing particle sizes in riffles was evident with increasing hillslope disturbance. Moreover, Knopp found a statistically significant difference in average and minimum D50 values when comparing reaches in undisturbed and less disturbed watersheds with reaches in moderately and highly disturbed watersheds.

Very little D50 data was available from least developed reference streams on the Lolo National Forest. To supplement the Lolo NF data, data collected by the Beaverhead/Deerlodge National Forest in Southwest Montana and the greater Yellowstone Ecosystem were utilized. Reference values for B3 channels in the combined database averaged 107 mm, with 68 percent (+/- one standard deviation) of the reference values falling between 74 and 140 mm. In B3, B4, C3, and C4 streams, the mean reference values were 81, 38, 81 and 34 mm respectively, with 68 percent ranges of 50 to 112 mm for B3 streams, 25 to 51 mm for B4 streams, 49 to 113 mm for C3 streams, and 22-46 mm for C4 streams (Table 3-7).

Table 3-7. D50 Targets by Rosgen Stream Type (mm).

Rosgen stream type	**A3**	**B3**	**B4**	**C3**	**C4**
Mean	107	81	38	81	34
+/- one std. deviation	74-140	50-112	25-51	49-113	22-46

3.3.1.3 Riffle Stability Index

The riffle stability index provides an estimate of sediment supply in a watershed. Kappesser (2002) found that riffle stability index values between 40 and 70 in B-channels indicate that a stream's sediment transport capacity is in dynamic equilibrium with its sediment supply. Values between 70 and 85 indicate that sediment supplies are moderately high, while values greater than 85 are suggestive of excessively sediment-loaded streams. Rowe et al. (2003) reviewed the RSI as a potential target variable for sediment TMDLs in Idaho and, based largely on Kappesser's work, recommended an RSI target of < 70. The authors cautioned, however, that this value is most applicable to the belt geology of northern Idaho and would thus likely have to be adjusted in other geologies. In developing sediment TMDLs for the St. Regis River and several of its tributaries, the Montana DEQ conducted an assessment of riffle stability index values, primarily in C-channels. Riffle stability index values of 75 and greater were documented in managed subwatersheds within the St. Regis River drainage. Watersheds were considered to be "managed" in the study if roads existed above a stream survey site. Other managed and unmanaged subwatersheds within St. Regis drainage produced riffle stability index values of between 46 and 75. The results indicated that there was more mobile bedload in managed areas of the St. Regis watershed as compared to less developed stream segments. The DEQ study resulted in recommended RSI targets of 45 – 75. The 45 minimum was included because in some cases, heavily riprapped stream reaches for example, a very low RSI can indicate an unnaturally high sediment transport capacity.

Within the Ninemile Creek watershed, the RSI values for reference streams are slightly higher than expected, ranging from 75 to 84, all in Rosgen B-channels. At the time of this report, no obvious human impacts could be identified to account for the higher expected reference RIS values. As a result, an RSI target of greater than 45 and less than 85 is suggested for sediment impaired Rosgen B streams in the Ninemile TPA. Based on DEQ's study of the St. Regis Watershed, an RSI target between 45 and 75 is suggested for sediment impaired Rosgen C stream channels. It is recognized that this target may need to be adjusted as more reference data is collected.

3.3.1.4 Macroinvertebrates

Macroinvertebrate data helps to provide a better understanding of the cumulative and intermittent impacts that may have occurred over time in a stream, and they are a direct measure of the aquatic life beneficial use. Analytical methods used to interpret macroinvertebrate data are constantly evolving, based on new data and information offered from research. With this in mind, the macroinvertebrate targets and supplemental indicators are intended to integrate multiple stressors/pollutants to provide an assessment of the overall aquatic life use condition. The macroinvertebrate targets are also intended to provide information regarding which pollutant(s) might be causing the impairment.

Several biological indicators were considered for the Ninemile TPA. These indicators include: the Mountain Index of Biological Integrity (IBI) (Bukantis, 1998), several individual biological metrics, and the relative stressor tolerance of dominant benthic and macroinvertebrate taxa. Many of these provide an indication of overall water quality, but do not specifically identify sediment as the cause of the impairment. Of the evaluated metrics, the ***number of clinger taxa*** provides the strongest indication of a sediment impairment. Clinger taxa have morphological and behavioral adaptations that allow individuals to maintain position on an object in the substrate even in the face of potentially shearing flows. These taxa are sensitive to fine sediments that fill interstitial spaces, one of the main niches. This metric is calculated as the number of clinger taxa in a sample, and decreases in the presence of stressors. A minimum of 14 clinger taxa are expected in unimpaired Montana streams, and this is proposed as a target for streams in the Ninemile TPA (Bollman, 1998). Other biological metrics and indexes are discussed as supplemental indicators in Section 3.3.2.

3.3.2 Siltation Supplemental Indicators

As stated previously, the proposed supplemental indicators are not sufficiently reliable to be used alone as a measure of sediment impairment in the streams within the Ninemile TPA. These indicators are used as supplemental information, in combination with the targets, to provide better definition to potential sediment impairments.

3.3.2.1 Fish Populations

Fisheries are an important designated use in freshwater streams. Fish represent the higher trophic levels in streams and lakes. They serve as a surrogate for many physical and biological parameters such as adequate flow, spawning and rearing habitat, appropriate food sources, and proper environmental conditions. Juvenile population densities provide a direct measure of the cold-water fishery beneficial use and therefore provide an important indicator of stream impairment. The proposed supplemental indicator is stable or increasing trends in juvenile population densities.

Bull trout were once common throughout the Lolo National Forest, which includes all of the streams in the Ninemile TPA (Thomas, 1992). However habitat alteration and fragmentation, over fishing, competition with exotic species, and hybridization with brook trout have resulted in a general decline in the size and viability of bull trout populations (Riggers et al., 1998). Only 32 percent of the developed watershed on the LNF still contained bull trout populations in the mid 1990s (Riggers et al., 1998). As with cutthroat trout, the proposed supplemental indicator is a stable or increasing trend in juvenile population densities. However, it is recognized that bull trout populations may be limited by factors other than TMDL-related pollutants and that a severely reduced recruitment population may preclude a rapid recovery of this species despite pollutant reduction efforts. Juvenile population density data for both fish species are used with caution herein due to a number of complicating factors that have little to do with the condition of the spawning tributaries. Fish populations might change due to effects outside of management control such as temperature, peak runoff, primary productivity, and competition from other fish species and invertebrate populations.

For these reasons, the proposed fisheries indicators must be used in combination with the full suite of targets to avoid misinterpretation. Also, a future downward trend, in and of itself, will not arbitrarily indicate that the goals of this plan are not being met. Rather, contingencies in the Monitoring and Adaptive Management Strategy (see Section 6.5) will be implemented if a downward trend is noted in this target.

3.3.2.2 Large Woody Debris

Large woody debris (LWD) is a critical component of quality salmonid habitat, and it is a primary influence on stream function, including sediment and organic material transport, channel form, bar formation and stabilization, and flow dynamics (Bilby and Ward, 1989). Large woody debris plays a significant role in the creation of pools, especially in smaller stream channels (Riggers et al., 1998). Hauer et al. (1999) observed that single pieces of large woody debris situated perpendicular to the stream channel or large woody debris aggregates for the majority of pools in a study conducted in northwestern Montana. Active large woody debris is found in Lolo National Forest reference streams at an average of 156 pieces/mile in 3rd and 4th order streams (Riggers et al., 1998). Thus, it is proposed that target conditions of 156 pieces per mile be adopted for Ninemile Creek and tributaries. However, Riggers et al. found tremendous variability in LWD counts in reference streams, with 68 percent of the reference counts ranging between 10 and 420 pieces per mile. Thus this indicator will have to be applied with caution and in the context of other targets and indicators. For the purposes of this document, LWD was defined according to Overton et al., 1997.

3.3.2.3 Pool Frequency

Pool frequency (pools/mile) is a critical measure of the availability of rearing and refugia habitat for salmonids in the Ninemile TPA. Pools provide the habitat where salmonids spend the majority of their lives. They provide resting habitat for adult fish and rearing habitat for juveniles and sub-adults, and are in some way important to nearly all life stages of salmonids (Bjorn and Reiser, 1991). Pools provide hiding cover, thermal and hydraulic refugia, and feeding areas where energy expenditure is low. An abundance of high quality pools is necessary to sustain healthy salmonid populations. The frequency of high quality pool habitat in a stream can be affected by land management activities such as logging, mining, road construction, and grazing (Bilby, 1984; Clifton, 1989; Sedell and Froggatt, 1984). This in turn can affect fish populations (Riggers et al., 1998).

The Lolo National Forest Plan, as modified by the Inland Native Fish Strategy in August, 1995 includes Riparian Management Objectives (RMO) for pool frequency that apply to streams in the Ninemile TPA. Pool frequency RMOs vary by stream width and are presented in Table 3-8.

Table 3-8. Lolo NF Riparian Management Objectives for Pool Frequency.

Wetted width of stream (ft)	10	20	25	50	75	100	125	150	200
Pools/mile RMO	96	56	47	26	23	18	14	12	9

3.3.2.4 Width/Depth Ratios

Bankfull width/depth ratios describe the cross-sectional shape of stream channels and are an indicator of channel stability. Width/depth ratios are calculated as the bankfull top width divided by average channel depth at the bankfull stage. As the width/depth ratio increases, the stream becomes wider and shallower. Accelerated stream bank erosion and an increased sediment supply accompany increases in the width/depth ratio (Rosgen, 1996). Lower width/depth ratios are associated with the presence of deep pools that provide better thermal protection for coldwater fish (Riggers et al., 1998). Research by Rosgen (1996) and by Riggers et al. (1998) suggests that bankfull width/depth ratios should be between 12 and 22 for healthy B-type stream channels located in metasedimentary geologies on the Lolo National Forest. Width/depth ratios of 10 to 33 are recommended for C-type channels. Based on this research, a maximum channel bankfull width/depth ration of 22:1 is proposed for B-type channels, and a maximum of 33:1 is proposed for C-type channels in the Ninemile TPA.

The proposed width/depth ratio targets would help to address sediment supply issues associated with unstable stream banks, fish habitat issues associated with pool abundance, and thermal problems contributed in part by high surface area to volume ratios. Recovery of width to depth ratios may take decades, and long-term monitoring will be necessary to verify the relationship between this target and full support of designated beneficial uses. Monitoring long-term trends in width/depth ratios should be performed at permanently monumented cross-sections. The cross-sections should be established in riffles of unchannelized reaches.

3.3.2.5 Suspended Sediment Concentration and Turbidity

Suspended sediment monitoring provides a direct measure of sediment transport dynamics while turbidity (a measure of the amount of light scattered or absorbed by a fluid), which is highly correlated with suspended sediment levels, provides an indirect, but more easily conducted measure of sediment. Suspended sediment and turbidity are seasonally variable and strongly correlated to stream discharge. Turbidity and suspended sediment concentrations tend to be hysteretic, with higher values on the rising limb of the hydrograph relative to the falling limb. In supply limited, high-energy stream environments, increased concentrations of suspended sediment during peak flows do not necessarily correspond to impairment of biological function. Monitoring for sediment and turbidity requires long-term, intensive sampling to adequately characterize trends or loads in these parameters and the relationship between them, which varies between watersheds. Studies have suggested that 10 years of monthly sampling would be required to detect a statistically significant trend of 7-12%/year in suspended sediment (i.e. 70-120% change in sediment concentrations over 10 years. The inherent seasonal variability of suspended sediment concentrations and turbidity, and indirect link to biological impacts makes this a challenging variable to use for siltation impairment targets. Nevertheless, turbidity is easily measured and provides an indirect, but more easily obtained measure of suspended sediment concentrations.

Montana’s water quality standard for turbidity varies according to stream classification. The subject waters within the BHPA are all classified as B-1. For B-1 waters, the standard is no more than a 5 NTU (instantaneous) increase above naturally occurring turbidity. In the absence of sufficient data to characterize “naturally occurring turbidity”, it is not possible to directly apply this standard as a TMDL target.

As a result, where turbidity data is available it will be used only as collaborating evidence when combined with other more robust measures of sediment impairment. The State of Idaho’s standard to protect cold-water aquatic life is used as a supplemental indicator value. In accordance with Idaho’s Water Quality Standards and Wastewater Treatment Requirements (58.01.02.250.02.e), turbidity below any applicable mixing zone should not be greater than 50 NTU (instantaneous) (Newcombe et al., 1996). This value will be applied to high flow events or during the time of annual runoff. Some evidence suggests that detrimental effects to biota can occur with turbidity as low as 10 NTU. The State of Idaho therefore has recommended that chronic turbidity not exceed 10 NTU during summer baseflow, and this recommendation has been adopted as a supplemental sediment indicator for listed streams in the NTPA.

Suspended sediment and turbidity conditions in the sediment-listed streams are not known at this time. As part of the monitoring and implementation plan, suspended sediment and turbidity monitoring will be conducted in the listed streams as well as in reference streams. The long-term goal is for discharge-normalized suspended sediment concentrations in the sediment-listed streams to be approximately equal to those in appropriate reference streams and for turbidity values to meet targets metrics summarized in Table 3-6.

3.3.2.6 Macroinvertebrates

Multimetric Index

Macroinvertebrate data are typically organized according to a multimetric index of biological integrity (IBI), or a "multimetric index". Individual metrics (e.g. clinger taxa, percent EPT) are designed to indicate biological response to human-induced stressors. Scores are assigned to individual metrics, summed across several of them, and the total used to compare among samples or sampling sites. Three possible multimetric indices have been developed for Montana: 1) Mountain; 2) Foothill Valley and Plains (MFVP); and 3) Plains. The Mountain IBI was chosen for streams in the Ninemile TPA based on site characteristics, primarily elevation. DEQ uses a scoring procedure with the maximum possible score is 100 percent. Total scores *greater than 75 percent* are considered within the range of anticipated natural variability and represent full support of their beneficial use (aquatic life). Thus a score of greater than 75 percent is proposed as the Mountain IBI supplemental indicator.

Individual Metrics

To date, the strongest candidate metric relating to possible sediment impacts includes the number of clinger taxa (See Section 3.3.1.3). Additional metrics were collectively evaluated and used as supplemental information to assess overall stream condition. The *number of EPT taxa* is a metric describing the richness of mayflies (Ephemeroptera), stoneflies (Plecoptera), or caddisflies (Trichoptera) in a sample. Invertebrates that are members of these groups are generally understood to be sensitive to stressors in streams, whether physical, chemical, or biological. Consequently, they are less common in degraded streams. Metric values decrease in the presence of stressors. Bahls et al. (1992) determined that average EPT taxa richness for mountain streams in Montana was 22 taxa. A minimum of 22 EPT taxa is proposed as a supplemental indicator in the Ninemile TPA.

The *percentage of clinger taxa* in a sample is also proposed as a supplemental indicator. This metric is calculated as the number of individuals categorized as belonging to clinger taxa as a proportion of the total sample, and decreases in the presence of stressors. Literature values or other information on the expected percentage of clingers is not available. A higher percentage of clingers suggests little impact from sediment. This metric, used in conjunction with the number of clinger taxa (Section 3.3.1.3), will provide supplemental information on the overall impacts of sediment.

3.3.2.7 Periphyton

DEQ has collected periphyton samples at sites throughout the State for more than 15 years. Periphyton is recommended as an additional biological assemblage (EPA, 2003; EPA, 1997) and diatoms, in particular, are considered useful water quality indicators because so much is known about the relative pollution tolerances of different taxa and the water quality preferences of common species (Bahls, 2003; Barbour et al., 1999). DEQ uses several different diatom indices to assess stream condition.

Analysis of the periphyton data focused on the siltation index, which provides an indication of periphyton health with regards to sediment impact. The siltation index is the sum of the percent abundances of all species in the silt-tolerant diatom genera Navicula, Nitzschia, and Surirella. A high value (>39.9) for this index indicates potential sediment impacts for mountain streams (Bahls, 2003).

Summary findings from the periphyton data will provide additional information and may suggest the presence of other stressors. Both the siltation index and these summary findings will be used to derive conclusions regarding water quality at each site.

3.3.2.8 Equivalent Clear-Cut

Equivalent Clear-Cut Area (ECA) is an indicator of the potential for cumulative effects from multiple years of vegetation removal, taking into account vegetative recovery. Vegetation removal may affect snow distribution in openings, snow melt rates, and interception by vegetation, which may result in altered snowmelt runoff quantities and timing. In general, an ECA of greater than 25 percent suggests a potential for increased water and sediment yield (Jones and Grant, 1996). Region 1 of the Forest Service also suggests that watersheds with an ECA greater than 30 percent are at risk for having detrimental increased water yields (Bengeyfield personal comm., 6-11-04). ECAs were calculated for the post burn EIS.

3.3.2.9 Water Yield

An increase in water yield can lead to increased flows, higher bank erosion rates, more scouring, and sediment imbalances in a stream. The forest plan for the Lolo National Forest identifies annual water yield increases of 8 to 10 percent as the threshold at which stream channels may begin to adjust and erosion increase. Based on the forest plan, a supplemental indicator of <10% increase in annual water yield has been included for streams in the NTPA.

3.3.2.10 Other Human-Caused Sediment Sources

In order to make accurate impairment decisions, it is important to consider all potential significant sources for any one pollutant. The value in this approach, helps differentiate between natural and human caused conditions. For example, if target values were determined to be exceeding the proposed threshold values, yet no significant human sources exist, this in turn may point to a natural condition. Therefore for purposes of determining impairment status, all significant human-caused sources will be evaluated as supplemental indicators.

3.3.3 Metals Targets and Supplemental Indicators

The targets for metals in the Ninemile TPA are the state water quality standards that were presented in Table 3-5. As an extra margin of safety, two supplemental indicators are proposed:

- Macroinvertebrate and periphyton communities should show no signs of impairment from metals when compared to suitable reference conditions.
- Metals concentrations in fine bed sediments should be below levels that impede aquatic life.

3.3.4 Uncertainty Associated with Targets and Supplemental Indicators

The targets and supplemental indicators were developed to represent desired conditions and achievement of water quality standards. However, a shortage of local reference data and the inherent variability in natural conditions in aquatic ecosystems combine to introduce a degree of uncertainty into the targets and indicators. As a result, reference conditions upon which the target and indicator thresholds were based may not accurately represent local potential, and thus targets and indicators may be difficult to achieve. In response, targets will be evaluated at least every five years (Section 6.3). This evaluation will include consideration of target suitability and could result in modification of the targets and indicators as more suitable reference data become available. Nevertheless, the target and indicator thresholds presented in this document are reasonable approximations of reference conditions based on the available data.

3.4 Current Water Quality Impairment Status

The following section summarizes relevant data in a waterbody specific format for each of the nine listed stream segments in the Ninemile Watershed.

3.4.1 Big Blue Creek

3.4.1.1 Summary of the 303(d) List

The 1996 Montana 303(d) list reported that the cold-water fishery beneficial use was threatened in Big Blue Creek due to habitat alterations. The probable sources of the problems were listed as agriculture, rangeland and silviculture. The primary source of information for the 1996 listing appears to have been a 1985 Montana Interagency Stream Fishery Data Review report that listed stock use, logging, agriculture, and logging slash as human-caused impacts that limited the fishery.

In the 2000 and 2002 303(d) lists, the Montana DEQ concluded that sufficient credible data were not available for Big Blue Creek and that no beneficial use determinations could be made. Big Blue Creek was subsequently scheduled for reassessment (DEQ, 2002). The 303(d) status of Big Blue Creek is summarized in Table 3-9.

Table 3-9. 303(d) Status of Big Blue Creek: MT76M004_050.

Year	Reaches Impaired	Use Support Status	Probable Impaired Uses	Probable Causes of Impairment	Probable Sources of Impairment
1996	From the headwaters to the mouth (Ninemile Creek).	Threatened.	Cold-water fishery.	Other habitat alterations.	Agriculture, Rangeland, Silviculture.
2000/02	From the headwaters to the mouth (Ninemile Creek).	Needs reassessment.	No Sufficient Credible Data (SCD)	No SCD.	No SCD

3.4.1.2 Targets and Supplemental Indicator Data

As described in Section 3.3, a suite of targets representing applicable narrative water quality standards has been developed for listed streams in the Ninemile TPA. A review of available data for Big Blue Creek is provided below. Targets and indicators for which current data are available include: percent surface fines <6 mm, D50, RSI, macroinvertebrates, width/depth ratios, LWD/mile, pools/mile, periphyton, ECA, and other human caused sediment sources. No current data are available for suspended solids concentrations, turbidity, juvenile trout density trends or water yield, and thus these supplemental indicators are not used in the analysis of beneficial use support that follows. As data for these indicators becomes available they may be used for future decisions regarding the impairment status of Big Blue Creek (Section 6.3). Big Blue Creek is a Rosgen B4 channel at the monitoring locations.

Surface Fines (% < 6 mm)

Pebble counts were collected at two reaches in Big Blue Creek. DEQ collected pebble count data in 2003 near the mouth of the stream and found 31 percent fines <6 mm, within the proposed target range of 6 – 36%. Above the foothills road, the Lolo National Forest collected pebble counts at two locations in 2003, and found the % surface fines < 6mm to be 38 and 42 percent, for an average of 40%, slightly above the proposed target range.

Surface Fines (D50)

D50 data were collected at the same time and locations as the percent < 6mm data. Near the mouth of the stream, DEQ measured a D50 of 17.3 mm. Above the foothills road, the LNF found D50s of 21.0 and 19.2 mm, for an average of 20.1 mm. At both locations, the D50 was below the reference range for a Rosgen B4 stream indicating that the median stream substrate particle size was smaller than expected and thus not meeting the target.

Riffle Stability Index

An attempt was made to collect current RSI data but no suitable bars for RSI measurements were located in the monitoring reaches, and thus no RSI data are available.

Macroinvertebrates

Macroinvertebrates were collected at one site near the mouth of Big Blue Creek in 2003. The number of clinger taxa (28) met the target threshold of at least 14 and did not suggest that sediment impacts were present. The Mountain IBI (85.7) and the EPT richness (31) were above the supplemental indicators values of 75 and 22 respectively, indicating support of beneficial uses. The percent clinger taxa was 59.3; no numeric supplemental indicator value has been established for this metric at this time.

Fish Populations

Insufficient data on population trends.

Large Woody Debris (LWD)/Mile

A large woody debris count was conducted by Land and Water Consulting near the mouth of Big Blue Creek in September 2004. A total of 161 pieces of LWD per mile were found in the monitoring reach, meeting the proposed supplemental indicator value of at least 156 pieces per mile. The Lolo National Forest counted woody debris near the foothills road crossing in 2001 and 2003 and found 225 and 246 pieces of LWD per mile respectively, for an average LWD frequency of 236/mile, which meets the proposed supplemental indicator value of at least 156 pieces per mile.

Pools/Mile

Pool counts were conducted simultaneously with the LWD counts described above. Near the mouth the pool frequency was 144/mile. Near the foothills road the frequency in 2001 was 145/mile and in 2003 it was 246/mile. The monitoring reaches near the foothills road were slightly different in 2001 and 2003, which is likely the reason for the apparent change in pool frequency. Regardless, the proposed supplemental indicator of at least 96 pools/mile was met in all the reaches surveyed.

Width/Depth Ratio

Land and Water Consulting measured bankfull width/depth ratios at three locations near the mouth of Big Blue Creek in 2004. The average width/depth ratio in this reach was 7.1, meeting the proposed supplemental indicator of less than 22. Near the foothills road, the LNF measured width/depth ratios at several locations in 2001 and 2003 and found an average value of 11.5, which meets the proposed indicator value for B4 streams.

Turbidity

No data has been collected.

Suspended Solids Concentration

No data has been collected.

Periphyton Siltation Index

DEQ collected periphyton samples in September of 2003 at one location, approximately 400 yards upstream of the mouth of Big Blue Creek. The periphyton community at the site indicated excellent biological integrity, no impairment, and full support of aquatic life uses in Big Blue Creek (Bahls, 2004). The siltation index was 18.6, meeting the proposed supplemental indicator of less than 40.

Equivalent Clear Cut Area

ECA in Big Blue Creek was 78% in 2001 when it was calculated by the LNF for the post-burn EIS. Most of this resulted from the fires of 2000, as only 4 percent of the watershed has been harvested in the previous 30 years.

Water Yield

Existing condition unknown.

Other Human Caused Sediment Sources

As discussed in more detail in Section 3.4.1.3 and in the sediment source assessment in Sections 4.2 and 4.5.1, no significant human caused sediment sources were located in the Big Blue Creek watershed.

3.4.1.3 Sources and Other Relevant Data

The following section presents a summary of potential known sources in the Big Blue Creek watershed as well as additional information that will help to determine the impairment status of Big Blue Creek.

Sources

The Big Blue Creek watershed is 1,871 acres in size and contains approximately 7 miles of stream channels. Ninety eight percent of the lands within the watershed are managed by the Lolo National Forest. The remaining two percent of the watershed is in private ownership, with private lands concentrated near the confluence with Ninemile Creek along the lower half mile of the creek. Elevations in the watershed range from 3,658 at the confluence with Ninemile Creek to 7,221 feet along the reservation divide; the mean elevation is 5,471 feet. The watershed has a road density of 1.0 mi/mi^2; there are two stream crossings in the watershed; and there are 0.8 miles of road and 2.0 miles of jammer road (built for timber harvest, not vehicle traffic) within 300 feet of a perennial or major intermittent stream. The road network is more heavily concentrated in some areas than in others, as approximately 20% of the watershed has a road density of more than 5 mi/mi^2. Moderate to high intensity fires burned 4.73 of the 7 miles of streams in the watershed in 2000. Because of the relative absence of significant human impacts to Big Blue Creek, the Lolo National Forest considers Big Blue Creek a reference watershed and has conducted reference condition stream surveys upstream of the foothills road. Refer to Section 2.0 for additional watershed characteristics. A detailed source assessment is provided in Section 4.5.1.

Physical Data

A. Stream Assessments

GT consulting conducted a stream assessment of Big Blue Creek during the summer of 1997 downstream of the foothills road crossing in section 30. According to the project report:

[At the survey location]… *The average width of Big Blue Creek is 6.1 feet and the average depth is 0.5'. Gradient at the study site was 5.0%. Potential limiting factors noted during the habitat survey were temperature problems because of the cold, short growing season and habitat diversity due to the shallow and small nature of the stream. These are natural features of the stream environment.*

Habitat is primarily high gradient riffle (51%) of stream length, with substantial low gradient riffle (21%). Big Blue Creek contained more LWD than any other stream sampled (596.6 pieces/mile). It contains a low amount of fine sediment (6%), and a high percentage of unstable banks (10%), and a low percentage of undercut banks (9%).

During the summer of 2003, DEQ conducted a stream assessment of Big Blue Creek. DEQ established a monitoring location approximately 400 yards upstream of the mouth and conducted a qualitative stream assessment on the lower 4.3 miles of Big Blue Creek. In general, DEQ found that the physical habitat of lower Big Blue Creek was in excellent condition, with the reach receiving an assessment score that was 93% of the maximum score possible.

B. Discharge

The fires of 2000 were estimated to have a potentially significant effect on flows in the drainage. The post-burn EIS analysis predicted that the 5-year peak flow would increase from 7 to 17 cfs, a 143% increase, and the 10-year peak flow would increase from 18 to 33 cfs, an 83% increase. Given that the ECA in the watershed in 78% and that most of this results from the fires of 2000, the fires are likely to increase water yield as well as peak flows.

C. Temperature

Periodic discreet temperature measurements have been made by the LNF on Big Blue Creek at the 412 Road crossing during discharge measurements, crest stage gage visits, and channel surveys. Most visits have been made during spring and early July, and temperatures have varied between 3.5°C (38.3°F) and 11°C (51.8°F). DEQ measured temperature near the mouth of Big Blue Creek in July of 2003; the temperature was 16.39 C.

To provide a more accurate portrait of the temperature regime in Big Blue Creek and to evaluate the impacts of the fires of 2000 on temperature, a Stowaway temperature logger was installed in Big Blue Creek above the Foothills Road in 2003.

The Montana Department of Environmental Quality has 3 informal standards for the interpretation of temperature data and cold-water fishery use support. Critical temperatures for native salmonids according to the DEQ standards are 9 C for spawning, 12 C for rearing, and 15 C for migration. Because native salmonids (Bull and Westslope Cutthroat trout) spawn in the fall and spring when temperature are not typically elevated, the rearing and migration temperatures are the critical benchmarks against which DEQ evaluates use support. Temperatures in Big Blue Creek were within the range acceptable to native salmonids. Results of the temperature monitoring are summarized in Table 3-10.

Table 3-10. 2003 Water Temperatures on Big Blue Creek.

Site Name	Seasonal Maximum	Seasonal Max Daily ΔT		7-Day averages			Days >	Days >
	Value	Date	Value	Max	Min	ΔT	10.0 C	15.0 C
Big Blue at 5498 (Foothills xing)	14.9	07/31/03	3.1	14.2	11.6	2.5	46	0

D. Fish passage

Two major crossings that were fish passage barriers, one on the Foothills Road, Rd 5498, and the other on the main 412 Ninemile Road have been replaced with bridges and the channels reconstructed to provide fish passage. No other fish barriers are known to exist in the watershed.

Biological Data

A. Fish

A fish survey was conducted by GT consulting during the summer of 1997 on Big Blue Creek below the foothills road crossing. Resulting population estimates for brook trout (<200 mm) were 229 fish per mile and a biomass of 5.8 lbs/acre. The population estimates for cutthroat trout were 251 fish per mile and a biomass of 13.3 lbs/acre. According to the project report, Big Blue Creek supported a relatively robust fishery for a stream of its type, with abundant small brook trout and cutthroat trout (GT Consulting, 1999). Redds surveys were conducted on Big Blue Creek on October 21 and November 10, 1997. No redds were observed.

In July of 2001, the Lolo National Forest conducted fish surveys above and below the foothills road crossing of Big Blue Creek. Above the road LNF found 8.2 cutthroat and 6.5 brook trout per 100m^2; below the road LNF found 13.7 cutthroat and 7.3 brook trout per 100 m^2.

No bull trout were located during either of the fish surveys described above.

At the time of this report, the available data were not adequate for determining trends of juvenile native trout species in Big Blue Creek. Additional fish surveys are included in the monitoring plan described in Section 6.3.

B. Macroinvertebrates

GT Consulting sampled macroinvertebrates at one location, just downstream of the foothills road in section 30 during the summer of 1997. Results of the macroinvertebrate analysis suggested that Big Blue Creek was "in excellent aquatic condition" (GT Consulting, 1999).

C. Chlorophyll a

Montana DEQ collected chlorophyll a sampling just upstream of the mouth of Big Blue Creek on July 25th, 2003. The concentration of chlorophyll a was 49.9 mg/m^2.

Chemical Data

Montana DEQ conducted water chemistry monitoring in Big Blue Creek during the summer of 2003. No violations of state water quality standards were detected.

Fires of 2000

Seventy seven percent of the watershed burned in 2000. Approximately 49% of the watershed burned at moderate to high severity (reflecting soil impacts), and approximately 61.1% of the watershed burned at high and moderately high burn intensity (reflecting impacts to vegetation), including 4.73 miles of stream channel. Impacts related to fire suppression included 0.5 miles of fire line constructed within 300 feet of channels and a dozer crossing, which was rehabilitated.

Big Blue Creek was one of the watersheds that burned severely enough in 2000 to be eliminated from consideration for salvage under the Post Burn EIS. It was one of the watersheds where Burned Area Emergency Rehabilitation (BAER) efforts were focused to reduce the potential for flood-related resource and facility damage due to loss of vegetation and changes in soil properties. BAER work in the watershed focused on road treatments. At the Big Blue Creek crossing on the Foothills Road, road fill was removed and the road at the crossing was lowered and armored in anticipation of high runoff in spring 2001. The culvert that was in place at the time was undersized, and was not anticipated to have the capacity to accommodate increased stream flows resulting from the fires. There were no high flows in spring 2001. The culvert was subsequently replaced with a bridge between August and October 2001. The culvert on the 412 road is scheduled for replacement. Additional BMP installation on the Foothills Road (relief culvert replacement and new installations; improved surface drainage and shoulder berm removal; culvert cleaning; culvert armoring; sediment trap construction; straw mulch and slash filter windrow placement; catch basin reshaping/construction) improved conditions in the Big Blue Creek watershed.

3.4.1.4 Big Blue Creek Water Quality Impairment Summary

The cold-water fishery beneficial use in Big Blue Creek is listed as threatened by habitat alterations resulting from silviculture, agriculture, and rangeland. However these sources do not currently appear to limit beneficial use support in Big Blue Creek. Impacts to aquatic habitat resulting from silviculture appear to be minor, with only two forest road stream crossings and little timber harvest in the past 30 years. The Lolo National Forest sediment modeling predicted no increase above natural in sediment loads as a result of past timber harvest. Additionally, no future timber harvest in planned in the Big Blue Creek watershed at this time to allow for recovery from the 2000 fires. Agricultural and range impact also appear to be limited (see Section 4.5.1.1.2). Most of the watershed is managed by the Lolo National Forest, and forest resource specialist have reported that few if any significant agricultural or range impacts are known to exist on forest lands. Although the lower reach of Big Blue Creek is in private ownership, impacts in this section appear to be limited as well, as the reach scored high on DEQ physical habitat assessment and macroinvertebrate and periphyton communities near the mouth of the creek indicate full support of aquatic life beneficial uses.

Several targets are not currently being met in Big Blue Creek (Table 3-11). In the upper watershed, above the foothills road, % fines < 6 mm is currently estimated at 40%, which exceeds the upper end of the target range by 4 percentage points; and in both the upper and lower watershed, the D50 is below the reference range. Where current data are available, all of the supplemental indicators are with ranges thought to support beneficial uses. Given the relatively minor anthropogenic impacts in the watershed, both currently and the recent past, the potentially elevated levels of fine sediment and the depressed D50 in Big Blue Creek probably result from a combination of the fires of 2000 and natural geologic conditions. Because anthropogenic habitat alterations do not appear to threaten beneficial use support or to result in increased pollutant loading that would threaten beneficial use support, no TMDL will be developed for Big Blue Creek. However, as an added measure of protection in light of the fires of 2000, Big Blue Creek will be included in the monitoring plan presented in Section 6.0.

Table 3-11. Comparison of Available Data for the Proposed Targets and Supplemental Indicators for Lower Big Blue Creek (Rosgen B4 Channel Type).

Targets	**Threshold**	**Available Data**	
		Near mouth	**Above foothills road**
Wolman pebble counts % fines < 6 mm	Mean=21.0; Range = 6-36%	31	40
Wolman pebble counts D50	Mean=38 mm; Range = 25-51mm	17.3	20.1
Riffle Stability Index	45-85	No bars	No bars
Clinger Richness	≥ 14	28	NA
Supplemental Indicators	**Threshold**	**Available Data**	
		Near mouth	**Above foothills road**
Juvenile Bull Trout and Westslope Cutthroat Trout Density	Documented increasing or stable trend	Limited data	Limited data
Suspended solids concentrations	Comparable to reference condition	NA	NA
Turbidity	High Flow – 50 NTU instantaneous maximum Summer base flow – 10 NTU	NA	NA
Width/Depth ratio	<22	7.1	11.5
LWD/mile	>156	161	236
Pools/mile	>96	144	196
Montana Mountain Macroinvertebrate Index of Biological Integrity	> 75%	85.7	NA
Percentage of Clinger Taxa	“High”	59.3	NA
EPT Richness	≥ 22	31	NA
Periphyton Siltation Index	< 40	18.6	NA
		Entire Watershed	
Equivalent Clear Cut Area	<25%	78%	
Water Yield	<10%	NA	
Other Human Caused Sediment Sources	No significant sources	Negligible	

3.4.2 Josephine Creek

3.4.2.1 Summary of the 303(d) List

The 1996 Montana 303(d) list reported that the cold-water beneficial use was threatened in Josephine Creek due to habitat alterations. The probable source of the problem was listed as resource extraction. The 1996 listing appears to have resulted from a 1972 Montana Interagency Stream Fishery Data Review Report that listed mining and a rockslide blockage as human-caused impacts that limited the fishery. The same report listed a fish barrier as a natural limitation on the fishery.

In the 2000 and 2002 202(d) lists, the Montana DEQ concluded that sufficient credible data were not available for Josephine Creek and that no beneficial use determinations could be made.

Josephine Creek was subsequently scheduled for reassessment (DEQ, 2002). The 303(d) status of Josephine Creek is summarized in Table 3-12.

Table 3-12. 303(d) Status of Josephine Creek: MT76M004_040.

Year	Reaches Impaired	Use Support Status	Probable Impaired Uses	Probable Causes of Impairment	Probable Sources of Impairment
1996	From the headwaters to the mouth (Ninemile Creek).	Threatened.	Cold-water fishery.	Other habitat alterations.	Resource extraction.
2000/02	From the headwaters to the mouth (Ninemile Creek).	Needs reassessment.	No Sufficient Credible Data (SCD)	No SCD.	No SCD

3.4.2.2 Targets and Supplemental Indicators

As described in Section 3.3, a suite of targets representing applicable narrative water quality standards has been developed for listed streams in the Ninemile TPA. A review of available data for Josephine Creek is provided below. Targets and indicators for which current data are available include: percent surface fines <6 mm, D50, RSI, macroinvertebrates, width/depth ratios, LWD/mile, pools/mile, periphyton, and other human caused sediment sources. No current data are available for suspended solids concentrations, turbidity, ECA, water yield, or juvenile trout density trends, and thus these supplemental indicators are not used in the analysis of beneficial use support that follows. As data for these indicators becomes available they may be used for future decisions regarding the impairment status of Josephine Creek (Section 6.3). Josephine Creek is a Rosgen B4 channel at the monitoring locations.

Surface Fines (% < 6 mm)

As part TMDL development, pebble counts were collected in three reaches in Josephine Creek. DEQ collected pebble count data in 2003 near the mouth of the stream and found 18 percent fines <6 mm. In the placer mined reach, the Lolo National Forest found 6 percent fines < 6 mm. Further upstream, above forest road 890, Land and Water Consulting collected pebble count data in 2004 and found 36 percent fines < 6 mm. At all 3 locations, current levels of fines < 6 mm are within the proposed target reference ranges; although above road 890 the current percent fines value of 36 is at the upper end of the target range.

Surface Fines (D50)

D50 data were collected at the same time and locations as the percent < 6mm data. Near the mouth of the stream, DEQ measured a D50 of 41.3 mm. In the mined reach, the LNF found a D50 of 71.4. Above road 890, Land and Water Consulting found a D50 of 17.7. The D50 value was within the target ranges near the mouth, but in the mined reach the D50 of 71.4 is well above reference values, and thus the target is not met in this location. The elevated D50 in the mined reach is most likely a direct result of historic placer mining, which has removed much of the fine sediment from this reach. Above road 890, the D50 is below the reference range, indicating that the median stream substrate particle size was smaller than expected and thus not meeting the target.

Riffle Stability Index

Riffle Stability Index data were collected at the same time and locations as the percent <6 mm and D50 data. Near the mouth the RSI was 92, which does not meet the TMDL target. In the mined reach the RSI was 76, and above road 890 it was 68, within the target range at both locations.

Macroinvertebrates

Macroinvertebrates were near the mouth and above road 890 in 2003. The number of clinger taxa (23 and 19 respectively) met the target threshold of at least 14 and did not suggest that sediment impacts were present. The Mountain IBI (81 near the mouth and 95 above road 890) and the EPT richness (29 near the mouth and 32 above road 890) were above the supplemental indicators values of 75 and 22 respectively, indicating support of beneficial uses. The percent clinger taxa was 45 near the mouth and 54 above road 890; no numeric supplemental indicator value has been established for this metric at this time.

Fish Populations

Insufficient data on population trends.

Large Woody Debris (LWD)/Mile

Large woody debris counts were conducted in September 2004 by Land and Water Consulting in the 3 monitoring reaches discussed above. A total of 365 pieces of LWD per mile were found in the monitoring reach near the mouth and 385 pieces of LWD/mile were found above road 890, meeting the supplemental indicator threshold of at least 156 pieces/mile in both locations. However, in the mined reach the LWD count was only 108/mile, which did not meet the supplemental indicator threshold.

Pools/Mile

Pool counts were conducted simultaneously with the LWD counts described above. Near the mouth the pool frequency was 144/mile, and above road 890 it was 127/mile, meeting the supplemental indicator threshold of at least 96/mile in both locations. However, in the mined reach the pool count was 78/mile, below the indicator value.

Width/Depth Ratio

Bankfull width/depth ratios were 4.7 near the mouth, 14.5 in the mined reach, and 6.6 above road 890. Although the width/depth ratio was considerably higher in the mined reach than in adjacent reaches, the supplemental indicator threshold of less than 22 was met in all three monitoring reaches.

Suspended Solids Concentrations

No data has been collected.

Turbidity

No data has been collected.

Periphyton Siltation Index

DEQ collected periphyton samples in September of 2003 near the mouth and above road 890. The siltation index was 46.0 near the mouth, failing to meet the supplemental indicator value of <40. Above road 890 the siltation index was 30.8.

Equivalent Clear-cut Area

Existing condition unknown.

Water yield

Existing condition unknown.

Other Human Caused Sediment Sources

As described in greater detail in Section 4.0, placer mining and forest roads have been identified as significant human caused sources of sediment in the Josephine Creek watershed, and result in a total existing sediment load that is nearly 1,800% of the estimated natural background sediment load.

3.4.2.3 Sources and Other Relevant Data

The following section presents a summary of potential known sources in the Josephine Creek watershed as well as additional information that will help to determine the impairment status of Josephine Creek.

Sources

The Josephine Creek watershed is 4,456 acres in size. Eighty nine percent of the lands within the watershed are managed by the Lolo National Forest. The remaining eleven percent of the watershed is in private ownership, with private lands concentrated near the confluence with Ninemile Creek and in narrow strip along the lower several miles of the creek that has been heavily placer mined in places. Elevations in the watershed range from 3,402 at the confluence with Ninemile Creek to 7,431 feet near the reservation divide; the mean elevation is 5,100 feet. The watershed has a road density of 2.1 mi/mi^2, and GIS mapping layers show 14 stream crossings in the watershed. The road network is concentrated in the lower watershed, below where forest road 890 crosses the creek. Below forest road 890, the creek has been mined extensively. None of the watershed burned in the fires of 2000. Refer to Section 2.0 for additional watershed characteristics. A detailed source assessment is provided in Section 4.5.2.1.

3.4.2.3.1 Physical Data

A. Stream Assessments

During the summer of 2003, DEQ conducted a stream assessment on Josephine Creek that included qualitative evaluations of the lower 3 miles of Josephine Creek near the confluence with Ninemile Creek and of 2.9 miles of upper Josephine Creek above the forest road 890 crossing. The lower reach received an assessment score of 77%, indicating partial impairment; the upper reach received a score of 96%, indicating no impairment and full support of beneficial uses. DEQ's summary notes from the qualitative stream assessments are presented below:

Lower Josephine

This reach has been extensively placer mined. Noticeable effects from this are an increased bed load, decreased size of bed load substrate, & obvious siltation. The channel is moderately unstable, but is being controlled by abundant/dense vegetation. Most of the mining occurred 50 years ago, and the tailings piles have become re-vegetated. Irrigation impacts are moderate to high; the flow in upper Josephine appeared at least 5 times greater than near the mouth. Aquatic life habitat is noticeably reduced…. Fish passage at the Ninemile Creek Rd is extremely improbable due to the dilapidated nature of the culvert. The upstream end was corroded and the stream mostly flows beneath the pipe. The stream flows over some rip-rap at the upstream side & the water drops at least two feet into the culvert mouth; impassable for small fish during low flow and improbable during high flows

Upper Josephine

This reach of Josephine is very healthy. Stream flows through very steep coniferous forests consisting of Larch, Sub-Alpine Firs, Douglass Firs, Spruce, & Cedars. Riparian area very lush with woody vegetation (Alders, Rocky Mountain Maples, Currants, Dogwoods, Thimble Berries, & Raspberries) and grasses. There are a few cut banks where erosion is occurring --most likely during runoff but very little sediment deposition evident.

The Lolo National Forest conducted a stream assessment on Josephine Creek during the summer of 2003. The assessment took place in a reach located in section 9, approximately at the mid point of the patented placer mining claims. Surveyors noted that the stream was dominated by coarse sediment and was lacking potential spawning gravels, pools, cover and LWD. Flow went sub-surface at the end of the monitoring reach in 2003. The crew also noted accumulated bar materials, high (10-15 feet) eroding banks, and obvious mining impacts.

B. Temperature

A temperature logger was deployed in lower Josephine Creek in 2003. Results of the temperature monitoring are summarized in Table 3-13.

The Montana Department of Environmental Quality has 3 informal standards for the interpretation of temperature data and cold-water fishery use support. Critical temperatures for native salmonids according to the DEQ standards are 9 C for spawning, 12 C for rearing, and 15 C for migration. Because native salmonids (Bull and Westslope Cutthroat trout) spawn in the fall and spring when temperature are not typically elevated, the rearing and migration temperatures are the critical benchmarks against which DEQ evaluates use support.

Temperatures in Josephine Creek at the monitoring location appear to be elevated above levels required by native salmonids, probably as a result of stream widening and riparian alterations from placer mining. Diversion of water for agriculture may also impact temperatures in the stream. Josephine Creek has never been listed for temperature (thermal alterations) and the available data are not sufficient for making a beneficial use determination. As a result, additional temperature data will be collected as part of the monitoring plan described in Section 6.7.

Table 3-13. 2003 Water Temperature Data for Josephine Creek.

Site Name	Seasonal Maximum	Seasonal Max Daily ΔT		7-Day averages			Days >	Days >
	Value	Date	Value	Max	Min	ΔT	10.0 C	15.0 C
Josephine	18.2	08/09/03	5.8	17.6	12.4	5.2	63	32

C. Fish Passage

DEQ noted during its assessment of Josephine Creek that the culvert on the Ninemile Road is a probable fish barrier. The Lolo National Forest has reported that a fish passage barrier exists in the SWSW 1/4 of section 35 on Forest Rd 890.

3.4.2.3.2 Biological Data

A. Fish

Very little fisheries data exist for Josephine Creek. More than half of the watershed's mainstream and tributary is contained within private patented mining land making access for survey difficult. A survey by Fish Wildlife and Parks in June 1980 indicated that cutthroat, rainbow, and brook trout were present in the lower mile of stream. Fish Wildlife and Parks revisited Josephine in August 2001 to collect genetic samples from potential cutthroat and found the stream dry in the reach they intended to sample. It is likely that a combined effect from placer mining and diversion contribute to the de-watered condition in this stream.

The current and historic status of bull trout in the watershed is unknown.

At the time of this report, the available data were not adequate for determining trends of juvenile native trout species in Josephine Creek. Additional fish surveys are included in the monitoring plan described in Section 6.3.

B. Chlorophyll a

DEQ conducted chlorophyll a sampling in 2003 at two locations, 100 yards upstream of the mouth and 100 yards upstream of road 890. The concentrations of chlorophyll a were 36.9 and 123 respectively.

3.4.2.3.3 Chemical Data

Montana DEQ conducted water chemistry monitoring in Josephine Creek during the summer of 2003 near the mouth and above road 890. The concentration of total recoverable copper at the lower sampling site below the mined reach of the creek was 0.003 mg/l, which exceeded the states Chronic Aquatic Life Standard of 0.0029 mg/l (at a hardness of 25 mg/l). No other violations of state water quality standards were detected at either sampling location. Copper was sampled again in lower Josephine Creek in the spring of 2004. The concentration of total recoverable copper was 0.0003 mg/l, well below state standards. The stream was sampled again in August 2004, and the concentration of copper was below the detection limit of 0.001 mg/l. Copper will continued to be monitored as part of the monitoring plan for Josephine Creek described in Section 6.3.

3.4.2.4 Josephine Creek Water Quality Impairment Summary

The cold-water fishery beneficial use in the entire length of Josephine Creek is listed as threatened by habitat alteration resulting from resource extraction. However, few anthropogenic impacts to Josephine Creek occur above the forest road 890 crossing. No mining is known to have occurred in the upper watershed, no significant recent timber harvest has occurred, and LNF sediment modeling estimates no increase in sediment loads above natural as a result of timber harvest. The upper watershed is largely unroaded, and macroinvertebrate data indicate full support of aquatic life beneficial uses. All of the targets are currently being met in this reach, with the exception of the D50, which is lower than expected. The % fines < 6 mm indicator is also at the upper end of the reference range. However, in the absence of significant human impacts upstream of the monitoring location, the substrate composition of upper Josephine Creek most likely results from natural processes.

Below the road 890 crossing, there are significant impacts to the stream from historic placer mining. Additional potential impairments to lower Josephine Creek may be occurring due to dewatering for irrigation and flow alterations arising from mining-induced changes to the channel geometry and substrate. Within the mined reach, all of the targets are within reference ranges except for the D50, which is elevated above the reference range. Most likely, placer mining has removed much of the finer material from the stream substrate, resulting in an artificially elevated D50. Aquatic habitat in the mined reach has been heavily affected by the placer mining, as reflected by the severely depressed LWD and pool/mile counts.

Although mining has not occurred in the immediate vicinity of the monitoring location near the mouth of Josephine Creek, excessive sediment loading as a result of mining may still impact the stream in this reach. The riffle stability index is elevated above reference condition, indicating potential streambed instability, and the periphyton siltation index suggests that sediment loading may be impacting aquatic life near the mouth of Josephine Creek. As part of this water quality restoration plan, a sediment TMDL has been developed to address sediment and habitat related mining impacts to Josephine Creek (Section 4.5.2.3). For details on sediment source assessment and load estimation, refer to Section 4.5.2.1. Table 3-14 compares existing conditions to the proposed target/indicator thresholds.

Additional water quality issues

As reported above, Josephine Creek is not listed for metals, but copper concentrations were slightly elevated in lower Josephine Creek when it was sampled in the summer of 2003. Subsequent sampling in the spring and summer of 2004 detected no violations of state water quality standards, and thus no TMDL for copper has been developed at this time. To further investigate copper loading to Josephine Creek, a monitoring plan has been developed and is presented in Section 6.3. Temperatures in the mined reaches of Josephine Creek appear to be elevated, and thus temperature monitoring is proposed in Section 6.3. In addition, an evaluation of dewatering/flow alteration will be addressed in a phased approach, as described in Section 6.6.

Table 3-14. Comparison of Available Data for the Proposed Targets and Supplemental Indicators for Lower Josephine Creek (Rosgen B4 Channel Type).

Targets	Threshold	Available Data		
		Near mouth	**In mined reach**	**Above FR 890**
Wolman pebble counts % fines < 6 mm	Mean=21.0; Range = 6-36%	18	6	36
Wolman pebble counts D50	Mean=38 mm; Range = 25-51mm	41.3	71.4	17.7
Riffle Stability Index	45-85	92	76	68
Clinger Richness	≥ 14	23	NA	19
Supplemental Indicators	**Threshold**	**Available Data**		
		Near mouth	**In mined reach**	**Above FR 890**
Juvenile Bull Trout and Westslope Cutthroat Trout Density	Documented increasing or stable trend	Limited data	Limited data	Limited data
Suspended solids concentrations	Comparable to reference condition	NA	NA	NA
Turbidity	High Flow – 50 NTU instantaneous maximum Summer base flow – 10 NTU	NA	NA	NA
Width/Depth ratio	<22	4.7	14.5	6.6
LWD/mile	>156	365	108	385
Pools/mile	>96	174	78	127
Montana Mountain Macroinvertebrate Index of Biological Integrity	> 75%	81	NA	95
Percentage of Clinger Taxa	"High"	45	NA	54
EPT Richness	≥ 22	29	NA	32
Periphyton Siltation Index	< 40	46.01	NA	30.78
		Entire Watershed		
Equivalent Clear Cut Area	<25%	NA		
Water Yield	<10%	NA		
Other Human Caused Sediment Sources	No significant Sources	Significant sources from placer mining and forest roads		

3.4.3 Little McCormick Creek

3.4.3.1 Summary of the 303(d) List

The 1996 Montana 303(d) list reported that Little McCormick Creek did not support its aquatic life, cold-water fishery, and recreation beneficial uses, and only partially supported its drinking water beneficial use. At the time, impairments to Little McCormick Creek were thought to result from flow alteration and other habitat alterations. Sources of these impairments were listed as placer mining and resource extraction. Supporting data for the 1996 listing could not be located for this report.

In reviewing the 303(d) list in 2000, however, DEQ determined that the existing data on Little McCormick Creek did not meet the requirements for sufficient and credible data, and thus no beneficial use support determination could be made, and Little McCormick Creek was scheduled for reassessment. The 303(d) status of Little McCormick Creek is summarized in Table 3-15.

Table 3-15. 303(d) Status of Little McCormick Creek: MT76M004_080.

Year	Reaches Impaired	Use Support Status	Probable Impaired Uses	Probable Causes of Impairment	Probable Sources of Impairment
1996	From the headwaters to the mouth (McCormick Creek).	Not supported.	Aquatic life, cold-water fishery, recreation.	Flow Alteration, Other habitat alterations.	Placer mining, Resource extraction.
		Partial support.	Drinking water.		
2000	From the headwaters to the mouth (McCormick Creek).	Needs reassessment.	No Sufficient Credible Data (SCD)	No SCD.	No SCD.

3.4.3.2 Targets and Supplemental Indicators

As described in Section 3.3, a suite of targets representing applicable narrative water quality standards has been developed for listed streams in the Ninemile TPA. A review of available data for Little McCormick Creek is provided below. Targets and indicators for which current data are available include: percent surface fines <6 mm, D50, RSI, width/depth ratios, LWD/mile, pools/mile, and other human caused sediment sources. No current data are available for juvenile trout density trends, suspended solids concentrations, turbidity, macroinvertebrates, periphyton, ECA, or water yield, and thus these targets and supplemental indicators are not used in the analysis of beneficial use support that follows. As data for these targets and indicators becomes available they may be used for future decisions regarding the impairment status of Little McCormick Creek (Section 6.3). Little McCormick Creek is a Rosgen B4 channel at the monitoring locations.

Surface Fines (% < 6 mm)

As part TMDL development, pebble counts were collected in September 2004 in the mined reach of Little McCormick Creek and upstream of the mined reach in a relatively undisturbed reference reach. In the placer mined reach, the percent fines < 6 mm was 5.9 and above the mined reach it was 7.3, meeting the target in both locations.

Surface Fines (D50)

D50 data were collected at the same time and locations as the percent < 6mm data. In the mined reach, the D50 was 47 and in the upstream reach it was 41, meeting the target in both locations.

Riffle Stability Index

Riffle Stability Index data were collected at the same time and locations as the percent <6 mm and D50 data. Above the mined reach the RSI was 74, meeting the target. In the mined reach, no suitable bars could be located near the monitoring locations on which to conduct the RSI measurements. Historic mining is the probable cause for the absence of bars in this reach.

Macroinvertebrates

No data has been collected.

Fish Populations

Insufficient data on population trends.

Large Woody Debris (LWD)/Mile

A total of 317 pieces of LWD per mile were found in the reference reach, meeting the supplemental indicator of at least 156 pieces/mile. In the mined reach, the woody debris count was only 108 pieces/mile, below the supplemental indicator threshold.

Pools/Mile

In the reference reach, the pool frequency was 127/mile, meeting the supplemental indicator threshold of at least 96/mile. In the mined reach, the pool frequency as only 77/mile, below the supplemental indicator threshold.

Width/Depth Ratio

The bankfull width/depth ratio in the reference reach was 4.4, meeting the supplemental indicator threshold of less than 22. In the mined reach, the width/depth ratio was 25, indicating an over widened stream channel and failing to meet the supplemental indicator.

Suspended Solids Concentrations

No data has been collected.

Turbidity

No data has been collected.

Periphyton Siltation Index

No data has been collected.

Equivalent Clear-cut Area

Existing condition is unknown.

Water Yield

Existing condition is unknown.

Other Human Caused Sediment Sources

As described in greater detail in Section 4.0, placer mining and forest roads have been identified as significant human caused sources of sediment in the Little McCormick Creek watershed.

3.4.3.3 Sources and Other Relevant Data

Beyond the target and supplemental indicator data presented above, very limited information was available with which to evaluate beneficial use support on Little McCormick Creek.

A note in DEQ's DataRev 7 files states that, "The General Report of all waterbody data states that a report (not found) noted the stream had been extensively placer mined in the past and as a result the stream is no longer perennial and is severely limited in its habitat capability and fish numbers."

According to the draft Frenchtown Face EIS:

In Little McCormick Creek, the base level of the valley bottom has been lowered a minimum of 12 feet with the subsequent displacement of thousands of cubic yards of earth materials: active mining is still taking place there. Placer mining has resulted in reworking of the entire valley bottom upstream from FDR 329 for approximately ½ mile and for some distance downstream of the road too. This has led to dewatering of this reach of stream after spring peak flows have passed, and there is little remaining riparian vegetation in the disturbed materials. Some work was attempted to re-establish a channel through the reach, but the channel is still non-functional.

The Lolo NF conducted a fisheries monitoring survey in lower Little McCormick Creek in July 2002 and found a relatively high number of cutthroat trout (15 fish/100m^2) in watered sections of the stream, which was the highest population density found in the entire McCormick Creek watershed. The LNF reported that the stream bottom of much of this reach has been turned upside down through placer mining activity. The stream is not confined by dredge piles like main McCormick Creek, but there are large amounts of unconsolidated valley fill with little functional floodplain or riparian habitat. According to the LNF, this section of stream is often de-watered because of the valley bottom disturbance, and was completely dry in 2001 in August and early summer of 2003.

In June 2004, water chemistry samples were collected from Little McCormick Creek near its confluence with McCormick Creek. No violations of state water quality standards were detected, and all metals for which the samples were analyzed were below detection limits.

Refer to Section 2.0 for additional watershed characteristics. A detailed source assessment is provided in Section 4.5.3.1.

3.4.3.4 Little McCormick Creek Water Quality Impairment Summary

Sediment and Habitat

Based on the available data, significant habitat impacts appear to exist in the Little McCormick Creek watershed as a result of historic mining. Although most of the targets for which current data is available are within reference ranges, no bars were located in the mined reach on which to collect RSI information. The lack of bars probably results from placer mining induced simplification of the channel structure. Pool and LWD counts are well below expected values, providing further evidence of channel simplification, and the width/depth ratio in the mined reach is more than five times that of the reference reach. Although Little McCormick Creek is listed for habitat alterations, which do not require a TMDL, these alterations appear to have resulted in elevated sediment loading to Little McCormick Creek and to downstream receiving waterbodies, and thus a sediment TMDL has been developed and is presented in Section 4.5.3.3. For details on sediment source assessment and load estimation, refer to Section 4.5.3.1. Table 3-16 compares existing conditions to the proposed target/indicator thresholds.

Flow Alteration/Dewatering

Although lower Little McCormick Creek goes dry in the summer of most years, this appears to result from to disturbances caused by placer mining, not from dewatering. Flow alteration will have to be reduced by restoration of the stream channel. When restoration occurs, flow will be monitored to ensure that dewatering issues are addressed.

Metals

No water chemistry data in support of the 1996 listing for drinking water were located. Water chemistry sampling in 2004 indicated no violations of state drinking water or aquatic life water quality standards, and therefore no TMDL for metals has been developed. Additional water quality sampling will be included in the monitoring plan for Little McCormick Creek to further verify that state standards are not exceeded (Section 4.0).

Table 3-16. Comparison of Available Data for the Proposed Targets and Supplemental Indicators for Little McCormick Creek (Rosgen B4 Channel Type).

Targets	**Threshold**	**Available Data**	
		Mined Reach	**Above Mined Reach reference condition**
Wolman pebble counts % fines < 6 mm	Mean=21.0; Range = 6-36%	5.9	7.3
Wolman pebble counts D50	Mean=38 mm; Range = 25-51mm	47	41
Riffle Stability Index	45-85	No bars	74
Clinger Richness	≥ 14	NA	NA
Supplemental Indicators	**Threshold**	**Available Data**	
		Near mouth	**In mined reach Above FR 890**
Juvenile Bull Trout and Westslope Cutthroat Trout Density	Documented increasing or stable trend	NA	NA
Suspended solids concentrations	Comparable to reference condition	NA	NA
Turbidity	High Flow – 50 NTU instantaneous maximum Summer base flow – 10 NTU	NA	NA
Width/Depth ratio	<22	25	4.4
LWD/mile	>156	108	317
Pools/mile	>96	77	127
Montana Mountain Macroinvertebrate Index of Biological Integrity	> 75%	NA	NA
Percentage of Clinger Taxa	"High"	NA	NA
EPT Richness	≥ 22	NA	NA
Periphyton Siltation Index	< 40	NA	NA
		Entire Watershed	
Equivalent Clear Cut Area	<25%	NA	
Water Yield	<10%	NA	
Other Human Caused Sediment Sources	No significant Sources	Significant sources from placer mining and forest roads	

3.4.4 McCormick Creek

3.4.4.1 Summary of the 303(d) List

McCormick Creek is treated by DEQ as two waterbodies for TMDL-related purposes: McCormick Creek upstream of the confluence with Little McCormick Creek (MT76M004_032) and McCormick Creek downstream of the confluence with Little McCormick Creek (MT76M004_031). For ease of presentation, they are treated as a single stream in this report.

The 1996 Montana 303(d) list reported that all of McCormick Creek was threatened for support of its cold-water fishery beneficial use. At the time, threats to McCormick Creek were thought to result from other habitat alterations, with the probable source of impairment listed as resource extraction.

In reviewing the 303(d) list in 2000 and 2002, however, DEQ determined that upstream of the confluence with Little McCormick Creek, beneficial uses in McCormick Creek were fully supported. DEQ also determined that downstream of the Little McCormick Creek confluence, the cold-water fishery and aquatic life beneficial uses in McCormick Creek were only partially supported due to other habitat alterations. The probable sources of the problems were listed as abandoned mining, channelization, and resource extraction. The 303(d) status of McCormick is summarized in Table 3-17.

Table 3-17. 303(d) Status of McCormick Creek: MT76M004_032 & MT76M004_031.

Year	Reaches Impaired	Use Support Status	Probable Impaired Uses	Probable Causes of Impairment	Probable Sources of Impairment
1996	From the headwaters to the mouth (Ninemile Creek)	Threatened	Cold-water fishery.	Other habitat alterations.	Resource extraction.
2000/02	From the headwaters to Little McCormick Creek	Full support	None[1]	None	None
	From Little McCormick Creek to the mouth (Ninemile Creek)	Partial Support	Aquatic life and cold-water fishery[1]	Other habitat alterations	Abandoned mining, channelization, and Resource extraction

[1]Did not meet SCD for agriculture, industry, drinking water, and recreation.

3.4.4.2 Targets and Supplemental Indicators

As described in Section 3.3, a suite of targets representing applicable narrative water quality standards has been developed for listed streams in the Ninemile TPA. A review of available data for McCormick Creek is provided below. Targets and indicators for which current data are available include: percent surface fines <6 mm, D50, RSI, macroinvertebrates, width/depth ratios, LWD/mile, pools/mile, periphyton, ECA, and other human caused sediment sources. No current data are available for suspended solids concentrations, turbidity, water yield, or juvenile trout density trends, and thus these supplemental indicators are not used in the analysis of beneficial use support that follows. As data for these indicators becomes available they may be used for future decisions regarding the impairment status of McCormick Creek (Section 6.3). McCormick Creek is a Rosgen B4 channel at the monitoring locations.

Surface Fines (% < 6 mm)

As part TMDL development, pebble counts were collected in three reaches in McCormick Creek. DEQ collected pebble count data in 2003 near the mouth of the stream and found 27 percent fines <6 mm. In the placer-mined reach near the forest boundary, Land and Water Consulting found 5 percent fines < 6 mm in 2004. Further upstream, above forest road 390, Land and Water Consulting collected pebble count data in 2004 and found 18 percent fines < 6 mm. At all 3 locations, current levels of fines < 6 mm are within the proposed target reference ranges.

Surface Fines (D50)

D50 data were collected at the same time and locations as the percent < 6mm data. Near the mouth of the stream, DEQ measured a D50 of 41.0 mm. In the mined reach, the Land and Water found a D50 of 65. Above road 390, Land and Water Consulting found a D50 of 50. The D50 value was within the target ranges near the mouth and above road 390, but in the mined reach the D50 of 65 was well above reference values, and thus the target was not met in this location. The elevated D50 in the mined reach is most likely a direct result of historic placer mining, which has removed much of the fine sediment from this reach.

Riffle Stability Index

Riffle Stability Index data were collected at the same time and locations as the percent <6 mm and D50 data. In the mined reach, the RSI was 97, which does not meet the TMDL target. Near the mouth the RSI was 84, and above road 390 it was 75, within the target range at both locations.

Macroinvertebrates

Macroinvertebrates were collected near the mouth and above road 390 in 2003. The number of clinger taxa (26 and 27 respectively) met the target threshold of at least 14 and did not suggest that sediment impacts were present. The Mountain IBI (81 near the mouth and 81 above road 390) and the EPT richness (25 near the mouth and 24 above road 390) were above the supplemental indicators values of 75 and 22 respectively, indicating support of beneficial uses. The percent clinger taxa was 80 near the mouth and 66 above road 390; no numeric supplemental indicator value has been established for this metric at this time.

Fish Populations

Insufficient data on population trends.

Large Woody Debris (LWD)/Mile

Large woody debris counts were conducted in September 2004 by Land and Water Consulting near the mouth and above road 390, and by LNF in the mined reach in 2003. A total of 210 pieces of LWD per mile were found in the monitoring reach near the mouth and 320 pieces of LWD/mile were found above road 390, meeting the supplemental indicator threshold of at least 156 pieces/mile in both locations. However, in the mined reach the LWD count was only 129/mile, which did not meet the supplemental indicator threshold.

Pools/Mile

Pool counts were conducted simultaneously with the LWD counts described above. Near the mouth the pool frequency was 168/mile, and above road 390 it was 218/mile, meeting the supplemental indicator threshold of at least 96/mile in both locations. However, in the mined reach the pool count was 27/mile, below the indicator value.

Width/Depth Ratio

Bankfull width/depth ratios were 8.0 near the mouth, 19.7 in the mined reach, and 7.1 above road 390. Although the width/depth ratio was considerably higher in the mined reach than in adjacent reaches, the supplemental indicator threshold of less than 22 was met in all three monitoring reaches.

Suspended Solids Concentrations

No data has been collected.

Turbidity

No data has been collected.

Periphyton Siltation Index

DEQ collected periphyton samples in September of 2003 near the mouth and above road 390. The siltation index was 35.4 near the mouth and 35.5 above road 390, meeting the proposed supplemental indicator of less than 40 at both locations.

Equivalent Clear Cut Area

The equivalent clear-cut area (ECA) on national forest lands in 2001 was six percent and across the entire watershed it was ten percent, well below the supplemental indicator threshold of <25 percent.

Water Yield

Existing condition is unknown.

Other Human Caused Sediment Sources

As described in greater detail in Section 4.0, placer mining and forest roads have been identified as significant human caused sources of sediment in the McCormick Creek watershed, and result in a total existing sediment load that is nearly 2,100% of the estimated natural background sediment load.

3.4.4.3 Sources and Other Relevant Data

The following section presents a summary of potential known sources in the McCormick Creek watershed as well as additional information that will help to determine the impairment status of McCormick Creek.

Sources

The McCormick Creek watershed is 9,459 acres in size. Eighty eight percent of the lands within the watershed are managed by the Lolo National Forest. The remaining twelve percent of the watershed is in private ownership, with private lands concentrated near the confluence with Ninemile Creek and in a section near the headwaters owned by the Plum Creek Timber Company. Elevations in the watershed range from 3,317 at the confluence with Ninemile Creek to 7,638 near the reservation divide; the mean elevation is 4,321 feet. Average annual precipitation is 41 inches. There are approximately 21 miles of streams in the watershed for a drainage density of approximately 1.4 mi/mi^2. The watershed has a road density of 4.2 mi/mi^2, and GIS mapping layers show 28 stream crossings in the watershed. There are a total of 61 miles of roads in the watershed, 11 of which are within 300 feet of a stream channel. Sixty percent of the forest road network has been closed to vehicle traffic. Evidence of historic placer mining is common in the creek below the Little McCormick Creek confluence. None of the watershed burned in the fires of 2000. Refer to Section 2.0 for additional watershed characteristics. A detailed source assessment is provided in Section 4.5.3.1.

3.4.4.3.1 Physical Data

A. Stream Assessments

GT Consulting conducted a stream assessment on McCormick Creek during the summer of 1997 in a reach in section 15 that had been placer mined. According to the project report:

[At the survey location]…McCormick Creek is a 3rd order stream with a “B” channel type and an elevation of approximately 3590’. The average width of McCormick Creek is 12.5 feet and the average depth is 0.4’. Gradient at the site was 3.0%. This stream was apparently placer mined at some time in the past. Scars from this activity are still apparent in the lack of meanders, and tailings piles on the bank. Potential limiting factors noted during the habitat survey were temperature problems because of the cold, short growing season and the tailings piles which line the stream bank. Several logs have been placed in the stream in an apparent attempt to increase pools and improve fish habitat.

During the summer of 2003, DEQ conducted an assessment of McCormick Creek, which included qualitative stream evaluations on 2 miles of lower McCormick Creek and 5.8 miles of upper McCormick Creek. The reaches received scores of 82% and 92% of maximum respectively, both indicative of full support of beneficial uses.

DEQ’s summary notes from the qualitative stream assessments are presented below:

Upper McCormick

This reach is in great shape. Potential problems could be timber harvest towards the headwaters area. The road following drainage was recently reconstructed and widened creating easy access. The road could also be a source of sediment. The stream is of high gradient flowing through steep coniferous forest. Riparian is very thick with alders. Substrate is dominated by large *cobble and small boulders. There are snags of woody debris and very little areas of lateral cutting and erosion.*

Lower McCormick

Near the mouth the stream has hay fields for a short distance. Above fields is where mining activities (placer) have taken place. Large tailings piles run along one and sometimes both banks ranging anywhere from 4'-35' tall. Adequate soil still remains for most vegetation. Alders, Snow Berries, and other woody debris growing very well in riparian area. Coniferous trees are also growing well outside of riparian area. Old age classes of vegetation missing, canopy cover not quite what it should be. Water temperature was slightly elevated

B. Temperature

Temperatures of 18.99 near the mouth and 16.27 above the Little McCormick Creek confluence were recorded by DEQ during it assessment of McCormick Creek on 7/24/03.

A Stowaway temperature logger was deployed by the Lolo National Forest in McCormick Creek just upstream of the Forest boundary in 2002. When the logger was retrieved in October, it was partially out of the water, so some data near the end of the record may be suspect. A logger was also deployed in 2003, in the same location, and a third logger was deployed by the Forest Service's PIBO Effectiveness Monitoring Team in 2003 in the same general vicinity as the Lolo logger (slightly upstream).

The Table 3-18 summarizes the temperature data collected on McCormick Creek. It should be noted that the PIBO temperature logger was removed approximately one month before the Lolo logger.

Maximum water temperatures in McCormick Creek in 2002 were higher than main stem Ninemile Creek: 2003 data appear to confirm the 2002 data although daily maximum temperature range was higher in 2002. According to LNF, temperature data indicate that McCormick Creek is one of the warmest streams in the Ninemile drainage. In 2002 and 2003, respectively, 43% and 64% of the 7-day average maxima were greater than 15 C.

The Montana Department of Environmental Quality has 3 informal standards for the interpretation of temperature data and cold-water fishery use support. Critical temperatures for native salmonids according to the DEQ standards are 9 C for spawning, 12 C for rearing, and 15 C for migration. Because native salmonids (Bull and Westslope Cutthroat trout) spawn in the fall and spring when temperature are not typically elevated, the rearing and migration temperatures are the critical benchmarks against which DEQ evaluates use support. Temperatures in McCormick Creek appear at times to exceed the tolerances of native salmonids.

McCormick Creek as never been listed for temperature (thermal modifications). To the extent that temperatures are elevated due to human activities in the watershed, the likely causes include channel widening and riparian degradation from placer mining. Continued temperature monitoring is included in the monitoring plan for McCormick Creek described in Section 6.7.

Table 3-18. 2002 and 2003 Water Temperature Data on McCormick Creek.

Year	Seasonal Maximum	Seasonal Max Daily ΔT		7-Day averages			Days >	Days >
	Value	Date	Value	Max	Min	ΔT	10.0 C	15.0 C
2002	21.4	08/17/02	14.2	20.6	7.7	12.8	69	43
2003	21.5	07/30/03	8.8	20.7	12.5	8.1	99	69
2003_PIBO	19.4	07/15/03	7.3	19.1	12.3	6.8	71	63

C. Fish Passage

According to the Lolo National Forest, there is a fish passage barrier on an unnamed tributary to McCormick Creek on forest road 392 in section 1 SWSW ¼, which is owned by the Plum Creek Timber Company. It is not know if this section of stream supports fish at this time. The crossing at the Little McCormick Creek confluence is often de-watered from the mining disturbance upstream, and the pipe is partially blocked by alluvium and may be a passage barrier. Depth and flow connectivity are likely a problem under low flow conditions. There are also several fish barriers in Little McCormick Creek as a result of old mining dams.

D. Mining

The main stem of McCormick Creek has placer been mined in the past. There are large ridges of mine tailings lining the stream below the Little McCormick Creek confluence, which confine the channel and prevent it from moving laterally. In 1993 the Lolo National Forest implemented a habitat improvement project in the placer mined reach to stabilize the stream channel and to provide increased in-stream habitat for fish by using large wood cross structures to create additional pool habitat

3.4.4.3.2 Biological Data

A. Fish

A fish survey was conducted by GT Consulting during the summer of 1997 on McCormick Creek in a mined reach in section 15. Resulting population estimates for brook trout (<200 mm) were 87 fish per mile and a biomass of 3.1 lbs/acre. The population estimates for cutthroat trout were 272 fish per mile and a biomass of 2.3 lbs/acre. A redd survey conducted on 10/21/97 found no redds.

The Lolo National Forest has also monitored fish populations in McCormick Creek. According to the LNF, fish populations in McCormick Creek are indicative of an altered system. A mixed fish assemblage of brook, cutthroat, and rainbow trout exist in most segments of the stream up to section 10, with cutthroat trout becoming more dominant in the upper reaches. The Forest has comparative fish population data from 1992 and 2002 from stream sections in the lower dredge pile confined reach of stream, most of the stream in section 15. The 1992 data indicate a fish assemblage dominated by brook trout, with far fewer cutthroat trout; $32/100m^2$ and $2.1/100m^2$, respectively. Data from 2002 show a considerable difference in fish assemblage with cutthroat trout being the dominant component and brook trout the lesser component of the assemblage, at 6.7/100m^2 vs. 1.5/100m^2. It is unclear what drives this potential difference in fish assemblage between years. After the 1992 fish survey, the Forest undertook a project to diversify the stream channel using log drop structures and large boulders. These features still persist and provide some degree of pool habitat and cover in an otherwise fairly simple stream channel and could explain some of the apparent increase in cutthroat numbers.

Although the population of cutthroat trout appears to be increasing, population trends are not understood well enough to make an accurate determination of supplemental indictor support. The current and historic status of bull trout in the watershed is unknown.

Additional fisheries population monitoring is included in the monitoring plan described in Section 6.3.

B. Periphyton

GT Consulting sampled periphyton in a mined reach of McCormick Creek in section 15 during the summer of 1997. According to the project report, the periphyton community in McCormick Creek indicated “good water quality”.

C. Macroinvertebrates

GT Consulting sampled macroinvertebrates in a mined reach of McCormick Creek in section 15 during the summer of 1997. According to the project report, “McCormick Creek contained a less abundant than average macroinvertebrate population, but with more than average numbers of EPT taxa. The Hilsenhoff biotic index was 3.45, indicating good biotic conditions. Overall, macroinvertebrates indices indicate excellent water quality.”

D. Chlorophyll a

DEQ conducted chlorophyll a sampling at the two locations where it conducted macroinvertebrate and periphyton sampling. The chlorophyll a concentrations at the upper and lower sites were 79.1mg/m2 and 47.2 mg/m2 respectively.

3.4.4.3.3 Chemical Data

DEQ conducted water quality sampling at two locations on McCormick Creek during the summer of 2003, near the mouth and above the Little McCormick Creek confluence. No violations of state water quality standards were detected at either location.

3.4.4.3.4 Fires of 2000

None of the watershed burned in 2000.

3.4.4.4 McCormick Creek Water Quality Impairment Summary

Sediment and Habitat

In 1996 the cold-water fishery beneficial use was listed as threatened along the entire length of McCormick Creek due to habitat alterations resulting from resource extraction. In 2000, DEQ revised the listing to indicate that beneficial uses were supported in McCormick Creek upstream of the Little McCormick Creek confluence and that aquatic life and cold-water fishery beneficial uses were impaired below the confluence due to habitat alterations resulting from resource extraction, abandoned mining, and channelization. Based on the available data, the 2000 revision to the 303(d) status of McCormick Creek were justified. Upstream of the Little McCormick Creek confluence, few significant human impacts are known to occur. In this section of McCormick Creek, all targets and supplemental indicators for which current data are available appear to be within expected ranges of reference conditions.

Downstream of the confluence, significant habitat impacts appear to exist in the McCormick Creek watershed as a result of historic mining. Mining induced alteration is reflected in the targets and supplemental indicators in the mined reach. The D50 is elevated above the expected range, probably because much of the fine material in this section of the stream was removed by placer mining, resulting in an artificially elevated median substrate particle size. The RSI is above the reference range, indicating possible streambed instability. The width/depth ratio, while still meeting the target condition, is elevated when compared to relatively unimpacted reaches upstream and downstream of the mined reach. Pool and LWD frequencies are not meeting target values and are depressed when compared to adjacent unmined reaches; and the width/depth ratio in the mined reach is at least twice that of adjacent unmined reaches. At the monitoring location near the mouth, in a reach that has not been mined, targets and supplemental indictors are within the expected range of reference conditions.

Although McCormick Creek is listed for habitat alterations, which do not require a TMDL, these alterations probably result in elevated sediment loading, and thus a sediment TMDL has been developed and is presented in Section 4.5.3.3. For details on sediment source assessment and load estimation, refer to Section 4.5.3.1. Table 3-19 compares existing conditions to the proposed target/indicator thresholds.

Flow Alteration/Dewatering and Temperature

In addition, the stream appears to be impacted by both flow alterations and elevated temperatures as a result of mining impacts; although it has never been formally listed for these reasons. Temperatures are most likely elevated as a result of the over-widening of the stream caused by mining, and may not be addressed separately from habitat alterations and sediment, but will continued to be monitored (Section 6.3). Although flow alterations are also probably the result of mining induced channel impacts, the magnitude of irrigation withdrawals is unknown, and flow alteration will be address via the phased approach presented in Section 6.6.

Table 3-19. Comparison of Available Data for the Proposed Targets and Supplemental Indicators for McCormick Creek (Rosgen B4 Channel Type).

Targets	**Threshold**	**Available Data**		
		Near mouth (not mined)	**In mined reach**	**Above road 390**
Wolman pebble counts % fines < 6 mm	Mean=21.0; Range = 6-36%	27	5.0	18
Wolman pebble counts D50	Mean=38 mm; Range = 25-51mm	41	65	50
Riffle Stability Index	45-85	84	97	75
Clinger Richness	≥ 14	26	NA	27
Supplemental Indicators	**Threshold**	**Available Data**		
		Near mouth	**In mined reach**	**Above FR 390**
Juvenile Bull Trout and Westslope Cutthroat Trout Density	Documented increasing or stable trend	Limited Data	Limited Data	Limited Data
Suspended solids concentrations	Comparable to reference condition	NA	NA	NA
Turbidity	High Flow – 50 NTU instantaneous maximum Summer base flow – 10 NTU	NA	NA	NA
Width/Depth ratio	<22	8.0	19.7	7.1
LWD/mile	>156	210	129	320
Pools/mile	>56	168	27	218
Montana Mountain Macroinvertebrate Index of Biological Integrity	> 75%	81	NA	81
Percentage of Clinger Taxa	"High"	80	NA	66
EPT Richness	≥ 22	25	NA	24
Periphyton Siltation Index	< 40	35.4	NA	35.5
		Entire Watershed		
Equivalent Clear Cut Area	<25%	10%		
Water Yield	<10%	NA		
Other Human Caused Sediment Sources	No significant Sources	Significant sources from placer mining and forest roads		

3.4.5 Kennedy Creek

3.4.5.1 Summary of the 303(d) List

The 1996 Montana 303(d) list reported that aquatic life and cold-water fishery beneficial uses were partially supported in Kennedy Creek due to metals and siltation. The probable sources of the problems were listed as agriculture and resource extraction. The decision to list the stream in 1996 appears to have resulted from overwhelming qualitative evidence of mining impacts and from a 1999 Bureau of State Lands report that included copper, mercury, lead, and zinc concentrations that violated state water quality standards

In the 2000 and 2002 303(d) lists, Montana DEQ reviewed the existing data and determined that Kennedy Creek did not support its aquatic life, cold-water fishery, or drinking water beneficial uses, and only partially supported its recreation beneficial use due to dewatering, flow alteration, metals, and other habitat alterations. Sources of these impairments were listed as abandoned mining and agriculture. Agricultural and industrial beneficial uses in Kennedy Creek were determined to be fully supported. The 303(d) status of Kennedy Creek is summarized in Table 3-20.

Table 3-20. 303(d) Status of Kennedy Creek: MT76M004_070.

Year	Reaches Impaired	Use Support Status	Probable Impaired Uses	Probable Causes of Impairment	Probable Sources of Impairment
1996	From the headwaters to the mouth (Ninemile Creek).	Partial support	Aquatic life, cold-water fishery.	Metals, Siltation.	Agriculture, Resource extraction.
2000	From the headwaters to the mouth (Ninemile Creek).	Not supported	Aquatic Life, cold-water fishery, drinking water.	Dewatering, Flow alteration, Metals (Cu, Pb, Hg, Zn), Other habitat alterations.	Abandoned mining, Agriculture.
		Partial support	Recreation		
		Full support	Agriculture, industry	N/A	N/A

3.4.5.2 Sediment Targets and Supplemental Indicators

As described in Section 3.3, a suite of targets representing applicable narrative water quality standards has been developed for listed streams in the Ninemile TPA. A review of available data for Kennedy Creek is provided below. Sediment-related targets and indicators for which current data are available include: percent surface fines <6 mm, D50, RSI, width/depth ratios, ECA, LWD/mile, pools/mile, and other human caused sediment sources. No current data are available for suspended solids concentrations, turbidity, juvenile trout density trends, macroinvertebrates, water yield, or periphyton, and thus these targets supplemental indicators are not used in the analysis of beneficial use support that follows. As data for these targets and indicators become available they will be used for future decisions regarding the impairment status of Kennedy Creek (Section 6.3). Upper Kennedy Creek is a Rosgen A3 channel; lower Kennedy Creek is a Rosgen B4 channel.

Surface Fines (% < 6 mm)

As part TMDL development, pebble counts were collected in two reaches in Kennedy Creek by Land and Water Consulting in 2004. In the mined reach, the % fines < 6 mm was 5, and further upstream above road 5507 the percent fines < 6 mm was 6 percent. At both locations the % fines target was met.

Surface Fines (D50)

D50 data were collected at the same time and locations as the percent < 6mm data. In the mined reach the D50 was 36 and above road 5507 it was 80, meeting the target at both locations.

Riffle Stability Index

No suitable bars were located in the monitoring reaches on which to perform the RSI analysis. In the mined reach, the absence of bars may result from mining-induced alterations to channel structure and sediment transport. Above road 5507, Kennedy Creek is a Rosgen A channel, and as such would naturally be characterized by few if any gravel bars.

Macroinvertebrates

No data has been collected.

Large Woody Debris (LWD)/Mile

Large woody debris counts were conducted in September 2004 by Land and Water Consulting in the mined reach and above road 5507. A total of 169 pieces of LWD per mile were found in the mined reach and 168 pieces of LWD/mile were found above road 5507, meeting the supplemental indicator threshold of at least 156 pieces/mile in both locations.

Pools/Mile

Pool counts were conducted simultaneously with the LWD counts described above. In the mined reach there were 295 pools/mine, which met the supplemental indicator threshold of at least 96/mile. Above road 5507 there were 56 pools/mile, which did not meet the indicator threshold.

Width/Depth Ratio

Bankfull width/depth ratios were 4 above road 5507 and 10.9 in the mined reach meeting the supplemental indicator threshold in both cases.

Suspended Solids Concentrations

No data has been collected.

Turbidity

No data has been collected.

Periphyton Siltation Index

No data has been collected.

Equivalent Clear Cut Area

The equivalent clear cut area (ECA) on national forest lands in the watershed is 6 percent, and across the entire watershed it is 12 percent, below the supplemental indicator threshold of <25 percent.

Water Yield

Existing condition is unknown.

Other Human Caused Sediment Sources

As described in greater detail in Section 4.0, placer mining and forest roads have been identified as significant human caused sources of sediment in the Kennedy Creek watershed, and result in a total existing sediment load that is nearly 2,100% of the estimated natural background sediment load.

3.4.5.3 Metals

The Montana Department of State Lands (now DNRC) Abandoned Mine Reclamation Bureau has conducted two hazardous materials inventory site summaries for abandoned mines on Kennedy Creek, one at the Lost Cabin Mine and the other at the Nugget Mine, which is downstream of Lost Cabin. Both assessments were conducted in July 1993. The location of these mines is shown in Map 2-9.

At the Lost Cabin Mine, no discharging adits, seeps, or springs were located. Concentrations of arsenic, mercury, copper, and lead were elevated at least three times background concentrations in the approximately 3,700 cubic yards of waste rock that were present at the site. Elevated concentrations of copper, mercury, and lead were present in fine stream sediments at the site and were attributed to releases from the Lost Cabin Mine. Surface water samples revealed no violations of state drinking water standards, but the concentration of copper exceeded the state's acute and chronic aquatic life criteria. Copper in surface water concentrations are presented in Table 3-21.

Table 3-21. Copper in Surface Water at Lost Cabin Mine, July 1993.

Location	Copper (ug/l)	Hardness (mg/l CaCO3)	Standard (chronic/acute)
20 ft below bridge, down gradient of Lost Cabin Mine.	7.73	23	2.9/3.8
Down gradient of Hautilla mine; up gradient of Lost Cabin	2.63	20.3	2.9/3.8

At the Nugget Mine, one discharging adit was sampled. Discharge from the adit was approximately 1.3 gallons/minute. No violations of state drinking water standards were detected in the adit water, but the concentration of lead exceeded the state's chronic aquatic life criteria, and the concentrations of zinc and copper exceeded that state's chronic and acute aquatic life criteria. Concentrations of arsenic, lead, and copper were elevated at least three times background concentrations in the approximately 1,300 cubic yards of waste rock that were present at the site. Elevated concentrations of copper and lead were present in fine steam sediments at the site and were attributed to releases from the Nugget Mine. Surface water samples from Kennedy Creek revealed concentrations of lead that exceeded the state's chronic aquatic life criteria, and the concentrations of zinc and copper exceeded that state's chronic and acute aquatic life criteria (Table 3-22)

Table 3-22. Water Quality Standards Violations at Nugget Mine, 1993.

Location	Metal	Concentration (ug/l)	Hardness (mg/l CaCO3)	Standard Chronic/Acute (ug/l)
Adit Water	Copper	38.6	33	3.6/4.9
	Lead	6.1	33	0.8/19.9
	Zinc	1370	33	46.8/46.8
Kennedy Creek between Lost Cabin and Nugget Mines	Copper	7.73	23	2.9/3.8
	Lead	2.24	23	0.5/13.9
	Zinc	37.7	23	37.0/37.0
Kennedy Creek below Nugget Mine	Copper	6.7	23	2.9/3.8
	Lead	1.67	23	0.5/13.9
	Zinc	60.1	23	37.0/37.0

The Department of State Lands also sampled for mercury as part of its assessment of the Kennedy Creek mining complex in 1993. The concentration of mercury was below aquatic life standards, but exceeded the state's human health standard at all sampling locations (Table 3-23).

Table 3-23. Mercury Violations in Kennedy Creek Mining Complex, 1993.

Mine	Location	Concentration (ug/l)	Human Health Standard
Lost Cabin	Above Lost Cabin Mine but below Hautilla Mine	0.097	0.05 ug/l
	Below Lost Cabin Mine but above Nugget Mine	0.056	
Nugget	Adit Water	0.096	
	Kennedy Creek between Lost Cabin and Nugget Mines	0.071	
	Kennedy Creek below Nugget Mine	0.056	

Water chemistry sampling was conducted in September of 2003 and in June and August of 2004 as part of ongoing TMDL development efforts (did not include mercury sampling). Samples were collected at three locations: above the mining complex, below the mining complex, and near the mouth. In general, metals concentrations appear to have declined since 1993. In the September 2003, the concentration of lead exceeded the state's chronic aquatic life criteria at the monitoring location near the mouth of the stream, but no other violations of state water quality standards occurred. In the June of 2004, the concentration of copper and zinc exceeded the state's chronic aquatic life standard at the monitoring locations below the mining complex and near the mouth. In most cases, water quality standards were exceeded by extremely small margins, with the exception of the concentration of zinc near the mouth of Kennedy Creek, which was nearly 4 times the standard in June 2004. No violations of human health standards were detected. No violations of human health or aquatic life standards were detected in the

August 2004 sampling. Violations of state water quality standards from the 2003/2004 sampling are summarized in Table 3-24.

Table 3-24. Water Quality Standards Violations in Kennedy Creek, 2003-2004.

Location	Date	Metal	Concentration (ug/l)	Hardness (mg/l CaCO3)	Standard Chronic/Acute (ug/l)
Near Mouth	September 2003	Lead	2.0	61.1	1.7/43.6
Below Mining Complex	June 2004	Copper	3.0	21	2.9/3.8
Below Mining Complex	June 2004	Zinc	40.0	21	37.0/37.0
Near Mouth	June 2004	Copper	3.0	23	2.9/3.8
Near Mouth	June 2004	Zinc	140.0	23	37.0/37.0

Mercury was sampled at 3 locations in Kennedy Creek in August 2004 – above the mining complex, below the mining complex, and near the mouth of the creek. The concentration of mercury was below the 0.0002 mg/l detection limit in all cases.

Water chemistry sampling from Ninemile Creek below the Kennedy Creek confluence in 2003 revealed no violations of state water quality standards.

In September 2003, DEQ collected metals in fine bed sediment samples at the 3 locations described above. Results of the analysis are summarized in Table 3-25. Montana currently has no water quality related standards for metals in fine sediments, but analytical results for copper, lead, and zinc reveal that the lowest concentrations were found above the mining complex at Kennedy 1. Concentrations were highest in the mining complex (Kennedy 2), and declined slightly near the mouth of the stream at Kennedy 3. No analysis is available for mercury.

Table 3-25. Metals in Fine Sediment Concentrations in Kennedy Creek, September 2003 (ug/g).

Metal	Kennedy 1	Kennedy 2	Kennedy 3
Silver	<1	<1	<1
Aluminum	16,500	9,620	10,100
Arsenic	30.3	20.1	11.8
Barium	205	173	143
Beryllium	<1.5	<1.5	<1.5
Cadmium	<0.5	0.8	<0.5
Chromium	11.7	5.8	6.3
Copper	37.3	63.8	41.5
Iron	20,600	16,000	12,800
Lead	39.4	64.1	38.0
Manganese	566	988	405
Nickel	20.1	13.3	9.1
Antimony	0.3	0.3	<0.2
Selenium	1.6	<1	<1
Thallium	<1.00	<1	<1
Zinc	49.1	464	318

3.4.5.4 Sources and Other Relevant Data

The following section presents a summary of potential known sources in the Kennedy Creek watershed as well as additional information that will help to determine the impairment status of Kennedy Creek.

Sources

The Kennedy Creek watershed is 3,513 acres in size. Eighty two percent of the lands within the watershed are managed by the Lolo National Forest. The remaining eighteen percent of the watershed is in private ownership, with private lands concentrated near the confluence with Ninemile Creek and in a narrow band of private mining claims along the lower 2 to 3 miles of the stream. Elevations in the watershed range from 3,215 feet at the confluence with Ninemile Creek to 7,047 feet near the reservation divide; the mean elevation is 4,642 feet. Average annual precipitation is 27 inches. There are approximately 9 miles of streams in the watershed for a drainage density of 1.6 mi/mi^2; five miles of the road network is within 300 feet of a stream channel. The watershed has a road density of 3.6 mi/mi^2, and GIS mapping layers show 9 stream crossings in the watershed. Forty five percent of the forest road network has been closed to vehicle traffic. Evidence of historic mining is common in the creek. None of the watershed burned in the fires of 2000. Refer to Section 2.0 for additional watershed characteristics. A detailed source assessment is provided in Section 4.5.4.1.

3.4.5.4.1 Physical Data

A. Stream Assessments

In 2003 the Lolo National Forest conducted a "walkthrough" survey of the reach upstream from the mine adit in the northeast portion of section 13 (end of road 387, at the barricade), and a low-intensity stream channel survey through the southeast corner of T16N, R23W, sec. 22. In the area surveyed in section 22, road confinement, grazing, and impacts from mine tailings adjacent to the stream were the predominant physical impacts noted on National Forest land. Recent riparian harvest under the power line was also noted. There are piles of tailings along the stream above the barricade, and a fairly large area of unvegetated material upstream of the adit.

A partial walk through and drive survey of Kennedy Creek above the Forest boundary (~1.5 miles up from the main Ninemile Road crossing) in 2002 by Forest personnel found signs of a disturbed channel and floodplain. The channel is confined in areas by an encroached road that plays a role in bank instability, channel confinement, and likely sediment delivery. There appears to be little quality pool habitat and in-channel wood. About 3-miles up road 387 (section 13) the road is a gated because of a major road failure that does not allow for vehicle travel past this point.

According to the LNF, about a quarter, to three-eights mile above the road closure (along this reach the road confines the channel) is the beginning of considerable disturbance from past mining activity. There is a settling pond (~100+feet by ~50feet) that captures water from an old adit. The pond and berm confine the channel extensively and there is very limited riparian vegetation. The water appears high in iron, and filamentous algae was prevalent in the feeder and outlet channel to the pond, even in the winter. Above this area the channel and valley bottom remains very disturbed and multiple areas of material spoils and channel confinement were apparent. Much of this is adjacent to where a tributary in the NE portion of section 13 enters main Kennedy.

According to the LNF, the section of stream from the gate up to the end of this survey (NENE1/4 of section 13 is likely fish habitat, but of poor quality). Channel confinement, road failure, unstable banks and sediment delivery from the road and mine site contribute to what appears to be an aggraded and unstable channel. There is little cover for fish from pools, pool depth, vegetation or banks.

B. Temperature

A temperature logger was deployed in Kennedy Creek in 2003. Results are summarized in Table 3-26. The Montana Department of Environmental Quality has 3 informal standards for the interpretation of temperature data and cold-water fishery use support. Critical temperatures for native salmonids according to the DEQ standards are 9 C for spawning, 12 C for rearing, and 15 C for migration. Because native salmonids (Bull and Westslope Cutthroat trout) spawn in the fall and spring when temperature are not typically elevated, the rearing and migration temperatures are the critical benchmarks against which DEQ evaluates use support. Temperatures were within the range required by native salmonids and elevated temperatures do not appear to impact aquatic life.

Table 3-26. 2003 Water Temperature Data for Kennedy Creek.

Site Name	Seasonal Maximum	Seasonal Max Daily ΔT		7-Day averages			Days >	Days >
	Value	Date	Value	Max	Min	ΔT	10.0 C	15.0 C
Kennedy	14.0	08/01/03	2.2	13.5	11.6	1.9	53	0

C. Flow

According to the LNF, Kennedy Creek often goes dry in the lower sections, which is probably a combined result of diversion and valley bottom disturbance from past mining activity. A 1990 walk-through survey by DEQ also indicated that lower Kennedy Creek was dewatered by irrigation withdrawals.

D. Fish Passage

At least two fish passage barriers exist on Kennedy Creek. At the lower end of the mining complex there is an irrigation diversion pond that is a complete fish passage barrier at most flows, and there is a culvert on a private road crossing on lower Kennedy Creek that is a probable fish passage barrier.

3.4.5.4.2 Biological Data

A. Fish

Little quantitative fisheries data was located for Kennedy Creek. Montana Fish, Wildlife and Parks (FWP) found cutthroat trout in a segment of stream in section 13 in 1980, but did not make a population estimate. The MRIS fisheries database reported 123 brook trout per mile in 1980 near the Lost Cabin mine site. In August 2001 FWP tried to sample cutthroat trout for genetic samples and found the stream de-watered from the mouth in section 27 upstream to where Forest Road 387 ends and thus could not conduct the sampling.

The current and historic status of bull trout in the watershed is unknown.

At the time of this report, the available data were not adequate for determining trends of juvenile native trout species in Kennedy Creek. Additional fish surveys are included in the monitoring plan described in Section 6.3.

3.4.5.4.3 Fires of 2000

None of the watershed burned in the fires of 2000.

3.4.5.5 Kennedy Creek Water Quality Impairment Summary

Siltation (sediment) and Habitat

The cold-water fishery, aquatic life, recreation, and drinking water beneficial uses are listed as impaired along the entire length of Kennedy Creek due to metals, siltation, dewatering, flow alteration, and other habitat alteration arising from abandoned mining, resource extraction, and agriculture. The available data provide overwhelming evidence that mining has impacted Kennedy Creek and that beneficial uses are most likely impaired as a result. Although Kennedy Creek is meeting all of its targets for which current data are available, the magnitude of the mining impacts (discussed in more detail in Section 4.5.4.1), preclude a delisting decision. Furthermore, there is currently an almost total lack of reliable biological data with which to evaluate beneficial use support. Finally, no monitoring location was established below the mined reaches because of on-going restoration work in lower Kennedy Creek (Section 5.2.4.3), and thus the effects of mining on downstream reaches of Kennedy Creek cannot be determined. A sediment TMDL has been developed for Kennedy Creek and is presented in Section 4.5.4.3. Table 3-27 compares existing conditions to the proposed target/indicator thresholds.

Metals

Recent water chemistry monitoring indicates that concentrations of copper, lead, and zinc continue to exceed state water quality standards on some occasions, and thus a TMDL will be developed for these metals. Although mercury concentrations were below detection in August of 2004, this one time sampling event does not provide sufficient evidence for delisting, and thus a

TMDL for mercury has been developed as well. Table 3-28 compares existing conditions to the proposed target/indicator thresholds.

Flow Alteration/Dewatering

During the summer months, lower Kennedy Creek is partially to totally dewatered for irrigation. No TMDL will be developed for flow alteration/dewatering. Instead, these sources of impairment will be addressed in a phased approach, as discussed in Section 6.6.

Table 3-27. Comparison of Available Data for the Proposed Sediment Targets and Supplemental Indicators for Kennedy Creek (Rosgen A3 & B4 Channel Type).

Targets	**Threshold**		**Available Data**	
	Above road 5507 (A3 channel)	**Mined Reach (B4 channel)**	**Above road 5507**	**Mined Reach**
Wolman pebble counts % fines < 6 mm	Mean=14.8.; Range = 6.5-23.1%	Mean=21.0; Range = 6-36%	5	6
Wolman pebble counts D50	Mean=107 mm; Range = 74-140 mm	Mean=38 mm; Range = 25-51mm	80	36
Riffle Stability Index	NA	45-85	No bars	No bars
Clinger Richness	≥ 14	≥ 14	NA	NA
Supplemental Indicators	**Threshold**		**Available Data**	
			Above road 5507	**Mined Reach**
Juvenile Bull Trout and Westslope Cutthroat Trout Density	Documented increasing or stable trend		NA	NA
Suspended solids concentrations	Comparable to reference condition		NA	NA
Turbidity	High Flow – 50 NTU instantaneous maximum Summer base flow – 10 NTU		NA	NA
Width/Depth ratio	A channel = <12	B channel = <22	4	10.9
LWD/mile	>156		168	169
Pools/mile	>96		56	295
Montana Mountain Macroinvertebrate Index of Biological Integrity	> 75%		NA	NA
Percentage of Clinger Taxa	"High"		NA	NA
EPT Richness	≥ 22		NA	NA
Periphyton Siltation Index	< 40		NA	NA
			Entire Watershed	
Equivalent Clear Cut Area	<25%		12%	
Water Yield	<10%		NA	
Other Human Caused Sediment Sources	No significant Sources		Significant sources from placer mining and forest roads	

Table 3-28. Comparison of Available Data for the Proposed Metals Targets and Supplemental Indicators for Kennedy Creek.

Targets	**Threshold (aquatic life chronic water quality standard) ug/L**	**Available Data[1]**
Copper	5.2 @ 50 mg/L hardness	3.0 @ 21 mg/L hardness
Lead	3.2 @ 100 mg/L hardness	2.0 @ 61.1 mg/L hardness
Zinc	67 @ 50 mg/L hardness	140 @ 23 mg/L hardness
Mercury	0.91	Limited Data
Supplemental Indicators	**Threshold**	**Available Data**
Macroinvertebrates	No evidence of impairment from metals	NA
Periphyton	No evidence of impairment from metals	NA
Metals in fines bed sediments	Below levels that would impede aquatic life.	State standards not yet available

[1]Maximum concentration detected, 2003-2004. Water quality standards are for copper, lead, and zinc are hardness dependent and the concentrations of metals reported here violate state chronic aquatic life water quality standards at the hardness concentrations that accompany them.

3.4.6 Stony Creek

3.4.6.1 Summary of the 303(d) List

The 1996 Montana 303(d) list reported that the cold-water fishery beneficial use was threatened in Stony Creek due to siltation and other habitat alterations. The probable sources of the problems were listed as agriculture, irrigated crop production and range land. The 1996 listing appears to have resulted from a 1972 FWP Interagency Stream Fishery report that listed irrigation runoff, domestic stock as human caused factors that were limiting the fishery.

In the 2000 and 2002 202(d) lists, the Montana DEQ concluded that sufficient credible data were not available for Stony Creek and that no beneficial use determinations could be made. Stony Creek was subsequently scheduled for reassessment (DEQ, 2002). The 303(d) status of Stony Creek is summarized in Table 3-29.

Table 3-29. 303(d) Status of Stony Creek: MT76M004_020.

Year	**Reaches Impaired**	**Use Support Status**	**Probable Impaired Uses**	**Probable Causes of Impairment**	**Probable Sources of Impairment**
1996	From the headwaters to the mouth (Ninemile Creek).	Threatened.	Cold-water fishery.	Siltation, Other habitat alterations.	Agriculture, Irrigated crop production, Range land.
2000/02	From the headwaters to the mouth (Ninemile Creek).	Needs reassessment.	No Sufficient Credible Data (SCD)	No SCD.	No SCD.

3.4.6.2 Targets and Supplemental Indicators

As described in Section 3.3, a suite of targets representing applicable narrative water quality standards has been developed for listed streams in the Ninemile TPA. A review of available data for Stony Creek is provided below. Targets and indicators for which current data are available include: percent surface fines <6 mm, D50, RSI, macroinvertebrates, width/depth ratios, LWD/mile, pools/mile, ECA, periphyton, and other human caused sediment sources. No current data are available for suspended solids concentrations, turbidity, water yield, or juvenile trout density trends, and thus these supplemental indicators are not used in the analysis of beneficial use support that follows. As data for these indicators becomes available they may be used for future decisions regarding the impairment status of Stony Creek (Section 6.3). Upper Stony Creek is a Rosgen B3 channel; lower Stony Creek is a Rosgen B4 channel.

Surface Fines (% < 6 mm)

As part TMDL development, pebble counts were collected in two reaches in Stony Creek. DEQ collected pebble count data in 2003 near the mouth of the stream and found 17.1 percent fines <6 mm. Higher in the watershed above forest road 456, the Lolo National Forest found 14 percent fines < 6 mm in 2003. At both locations, current levels of fines < 6 mm are within the proposed target reference ranges.

Surface Fines (D50)

D50 data were collected at the same time and locations as the percent < 6mm data. Near the mouth of the stream, DEQ measured a D50 of 27.6 mm, which meets the target threshold. Above road 456, LNF found a D50 of 142.5, which is above the target range and indicates a median substrate particle size that is larger than expected.

Riffle Stability Index

Near the mouth the RSI was 75, meeting the target threshold. Above road 456 no suitable bars were located in the monitoring reach on which to conduct the RSI analysis. The reason for the absence of suitable bars is unknown.

Macroinvertebrates

Macroinvertebrates were sampled near the mouth and above road 456 in 2003. The number of clinger taxa (17 and 18 respectively) met the target threshold of at least 14 and did not suggest that sediment impacts were present. The Mountain IBI was 85.7 above road 456, meeting the supplemental indicator of at least 75, but near the mouth the Mountain IBI was below the target at only 66.7. Similarly, the EPT richness supplemental indicator threshold of at least 22 was met above road 456 (27) but not near the mouth (18). The percent clinger taxa was 39 near the mouth and 47 above road 456; no numeric supplemental indicator value has been established for this metric at this time.

Fish Populations

Insufficient data on population trends.

Large Woody Debris (LWD)/Mile

Large woody debris counts were conducted in September 2003 and 2004 by Land and Water Consulting and the Lolo National Forest. Near the mouth of the stream there were 158 pieces of LWD/mile and above road 456 the LWD count was 231/mile, exceeding the supplemental indicator threshold of at least 156/mile in both locations.

Pools/Mile

Pool counts were conducted simultaneously with the LWD counts described above. Near the mouth the pool frequency was 158/mile, and above road 456 it was 343/mile, meeting the supplemental indicator threshold of at least 96/mile in both locations.

Width/Depth Ratio

Bankfull width/depth ratios were 5.2 near the mouth, and 15.9 above road 456, meeting the supplemental indicator threshold in both locations.

Suspended Solids Concentrations

No data has been collected.

Turbidity

No data has been collected.

Periphyton Siltation Index

DEQ collected periphyton samples in September of 2003 near the mouth and above road 390. The siltation index was 21.1 near the mouth and 20.4 above road 456, meeting the proposed supplemental indicator of less than 40 at both locations.

Equivalent Clear Cut Area

The equivalent clear cut area (ECA) in national forest lands in the watershed is 5 percent, and across the entire watershed it is 7 percent, well below the supplemental indicator threshold of 25%.

Water Yield

Existing condition unknown.

Other Human Caused Sediment Sources

As described in greater detail in Section 4.0, forest roads have been identified as significant human caused sources of sediment in the Stony Creek watershed, and result in a total existing sediment load that is approximately 160% of the estimated natural background sediment load.

3.4.6.3 Sources and Other Relevant Data

The following section presents a summary of potential known sources in the Stony Creek watershed as well as additional information that will help to determine the impairment status of Stony Creek.

Sources

The Stony Creek watershed is 4,523 acres in size. Approximately 93% of the lands within the watershed are managed by the Lolo National Forest. The remaining seven percent of the watershed is divided in approximately equal parts between the Plum Creek Timber Company and private ownership. Elevations in the watershed range from 3,068 at the confluence with Ninemile Creek to 7,969 feet along the reservation divide; the mean elevation is 5,221 feet. Average annual precipitation is 27 inches. There are approximately 11 miles of streams in the watershed for a drainage density of 1.5 mi/mi^2; 2.9 miles of the road network is within 300 feet of a stream channel. The watershed has a road density of 3.0 mi/mi^2, and GIS mapping layers indicate that there are 7 stream crossings in the watershed. Forty four percent of the forest road network has been closed to vehicle traffic. Stony Creek was not affected by the fires of 2000. Refer to Section 2.0 for additional watershed characteristics. A detailed source assessment is provided in Section 4.5.5.1.

3.4.6.3.1 Physical Data

A. Stream Assessments

During the summer of 2003, DEQ conducted a stream assessment on Stony Creek. DEQ established two monitoring locations: the lower site was approximately ¼ mile upstream of the mouth of Stony Creek, and the upper site was approximately 250 yards upstream of forest road 5490 crossing. DEQ also conducted qualitative stream assessments on 3 miles of lower Stony Creek and 4 miles of upper lower Creek.

DEQ’s summary notes from the qualitative stream assessments are presented below:

Lower Stony Creek

Riparian condition appears natural; mostly forested. There are at least 4 road crossings, which may contribute to siltation. According to the 9-mile ranger station hydrologist, there are several diversion ditches along this reach …Channel appears to transition between an "A" class near the upper boundary to a "B" class for most of the reach. This reach received a score of 84 (out of 100 possible) according to DEQ’s assessment method.

Upper Stony Creek

This reach on Stony creek appears to be very healthy. Grand Fir, Sub-Alpine Fir, Cedar, Douglas Fir, Spruce, Alders all present providing superb canopy cover. Stream dominated by riffles with mostly shallow-fast habitat but abundance of large cobbles/ boulders and woody debris present. Very high gradient in headwaters area flowing through abundance of limestone. No road crossings found in this reach…. This reach very healthy and almost pristine, possibility this reach could be used as a reference for other streams in Ninemile drainage. This reach received a score of 96 (out of a 100 possible) according to DEQ's assessment method.

The Lolo National Forest reports that lower sections of Stony Creek through section 5 have been modified for the maintenance of government stock at the Ninemile Ranger District. Much of the native vegetation in this area has been removed to provide pasture that is used is extensively by mules. The riparian canopy tends to be less dense in the pasture reach than in adjoining reaches. Along the reaches where the Ninemile Ranger District has administrative pastures along lower Stony Creek, the stream is fenced off from livestock use.

B. Temperature

DEQ recorded temperatures of 14.46 C near the mouth of Stony Creek and 12.33 C above road 5490 on 7/24/03.

Two Stowaway temperature loggers were deployed in Stony Creek in 2003. One was deployed in the study reach near the CCC Camp, and the other was near the Forest boundary. The unit near the Forest boundary malfunctioned, but the data from the reference reach near the CCC Camp are presented in (Table 3-30).

The Montana Department of Environmental Quality has 3 informal standards for the interpretation of temperature data and cold-water fishery use support. Critical temperatures for native salmonids according to the DEQ standards are 9 C for spawning, 12 C for rearing, and 15 C for migration. Because native salmonids (Bull and Westslope Cutthroat trout) typically spawn in the fall and spring when temperatures are not elevated, the rearing and migration temperatures are the critical benchmarks against which DEQ evaluates use support. Temperatures in Stony Creek at the monitoring location appear to be within ranges required by native salmonids.

Table 3-30 2003 Water Temperature Data for Stony Creek (Upper Site).

Site Name	Seasonal Maximum	Seasonal Max Daily ΔT		7-Day averages			Days >	Days >
	Value	Date	Value	Max	Min	ΔT	10.0 C	15.0 C
Upper Stony	13.5	07/09/03	1.6	13.2	12.3	0.9	67	0

C. Fish Passage

According to the LNF, Stony Creek has a number of probable fish passage barriers on Forest that fragment fish populations. Three culverts are located on Forest roads 18079, 5489, and 34030 in the NE 1/4 of section 5 and 1 is on Forest road 456 in the NW 1/4 of section 33. The culvert on the main Ninemile Road, County Road 412 may also be a fish passage barrier. Two of the culverts on Forest may be removed (on roads 18079 and 34030) and two may be replaced (on roads 5489 and 456) under the Forest Frenchtown Face forest restoration project. These are relatively high priority pipe fixes and have been identified as such under the Frenchtown Face project and they will likely be remedied in the next couple of years (see Fish Passage Report and associated map).

There are also two substantial irrigation diversions from Stony Creek at two locations (NW 1/4 of section 5 and the NE 1/4 of section 28). Water is diverted and used by both the Forest Service (for its stock program and domestic use), and a private landowner for agriculture. The head gates at both diversions are also impediments to upstream movement of fish and the unscreened intakes are likely a source of some fish entrainment loss, as the point of diversion is not screened. The LNF reports that at times the diversions on Stony Creek nearly dewater the lower reaches of the stream.

3.4.6.3.2 Biological Data

A. Fish

Fish surveys were conducted by GT Consulting in two reaches of Stony Creek in 1997, one in section 7 in lower Stony Creek and one in section 33 in upper Stony Creek. No fish were captured at the lower site; although 2 cutthroat trout were captured outside of the sampling reach. At the upper site, the population of cutthroat trout was estimated at 114 fish/mile and a biomass of 5.2 pounds per acre.

Two mid to upper sites (NENE 1/4 of section 5 up to vicinity of CCC camp NWNW 1/4 of section 33) on Stony Creek were found to support cutthroat trout only, at low to moderate densities. During sampling in 2001, FWP found cutthroat trout densities of $5.8/100m^2$ near the CCC camp and $4.7/100m^2$ upstream from the road 5489 crossing. No non-native fish species were found at these sites. Fish Wildlife and Parks, found only cutthroat trout in 1980 in a middle portion of Stony Creek in section 32. It is unclear why non-native salmonids have not invaded a good portion of this stream, but the fish population data suggest that the middle-upper portions of Stony Creek are important native Westslope cutthroat production areas.

The current and historic status of bull trout in the watershed is unknown.

At the time of this report, the available data were not adequate for determining trends of juvenile native trout species in Stony Creek. Additional fish surveys are included in the monitoring plan described in Section 6.3.

B. Periphyton

GT Consulting sampled periphyton in Stony Creek in 1997 at two locations, one in section 7 in lower Stony Creek and one in section 33 in upper Stony Creek. According to the project report, periphyton populations in Stony Creek indicated, “good water quality” at the lower sampling location; no interpretation was provided for the upper sampling location.

C. Macroinvertebrates

DEQ collected macroinvertebrate samples in Stony Creek during 2003 at two locations: 1) in lower Stony Creek approximately ¼ mile upstream of the mouth; and 2) in upper Stony Creek approximately 250 yards upstream of the forest road 5490 crossing. The macroinvertebrate communities at the upper and lower sites received scores that were 94 and 83 percent of maximum respectively, indicating no impairment to aquatic life and full support of beneficial uses at both locations according to standard DEQ metrics. However the macroinvertebrate community at the lower site provided evidence of potential impacts to the stream: “Evidence for somewhat warmer water temperatures and possible disturbance to reach scale habitat features could be discerned from the benthic assemblage sampled from the lower site…”(Bollman, 2004).

D. Chlorophyll a

DEQ collected chlorophyll a samples in upper and lower Stony Creek at the same locations where macroinvertebrate samples were collected. The concentration of chlorophyll a at the upper and lower sampling locations was 79.0 and 26.9 mg/m2 respectively.

3.4.6.3.3 Chemical Data

Montana DEQ conducted water chemistry monitoring in Stony Creek during the summer of 2003. No violations of state water quality standards were detected. The concentration of arsenic in the fine stream sediments at the upper sampling site (250 yards upstream forest road 5490) were described by DEQ as “slightly elevated” at 8.70 ug/l. DEQ attributed the arsenic levels to natural sources, as no mines are known to exist on Stony Creek.

3.4.6.3.4 Fires of 2000

None of the watershed burned in 2000.

3.4.6.4 Stony Creek Water Quality Impairment Summary

The cold-water fishery beneficial use is listed as threatened in Stony Creek due to siltation and habitat alterations resulting from agriculture, irrigated crop production, and range land.

Siltation (sediment) and Habitat

Based on available information the upper section of Stony Creek, above road 5490, appears to be supporting all beneficial uses. The channel is well-armored and stable; there is excellent riparian vegetation and cold-water temperatures, and moderate numbers of westslope cutthroat trout without a non-native fish component. This reach of Stony Creek is meeting all of its targets for which current data are available except for the D50, which is higher than expected. The elevated D50 does not appear to result from human impacts, and may indicate that siltation is not a significant impact. Potential impairment of beneficial uses may occur downstream of the old road crossing in section 5 SWNE (Forest Road 34030). The channel is less well-armored, fish populations are reduced when compared to upper sites, and human impacts (irrigation withdrawals, grazing, land clearing in adjacent uplands for agriculture) begin to predominate downstream of the road. Macroinvertebrate data indicate that aquatic life has been impacted in lower Stony Creek, and source assessment results (Section 4) indicate that forest roads are contributing a potentially significant anthropogenic sediment load. Therefore, a sediment TMDL has thus been developed for Stony Creek and is presented in Section 4.5.5.3. However it is recognized that all of the targets are currently being met, and that the listing of Stony Creek probably results primarily from legacy impacts. Table 3-31 compares existing conditions to the proposed target/indicator thresholds.

Flow Alteration/Dewatering

Dewatering appears to be an additional problem in Stony Creek. Although no TMDL will be developed for dewatering, it will be addressed in a phased approach, as described in Section 6.6.

Table 3-31. Comparison of Available Data for the Proposed Targets and Supplemental Indicators for Stony Creek (Rosgen B3 and B4 Channel Type).

Targets	Threshold		Available Data	
	Above road 456 (B3 channel)	Near Mouth (B4 channel)	Above road 456	Near Mouth
Wolman pebble counts % fines < 6 mm	Mean=10.0; Range = 2-18%	Mean=21.0; Range = 6-36%	14	17.1
Wolman pebble counts D50	Mean=81 mm; Range = 50-112 mm	Mean=38 mm; Range = 25-51mm	142.5	27.6
Riffle Stability Index	45-85	45-85	No bars	75
Clinger Richness	≥ 14	≥ 14	18	17
Supplemental Indicators	**Threshold**		**Available Data**	
			Near mouth	**In mined reach Above FR 890**
Juvenile Bull Trout and Westslope Cutthroat Trout Density	Documented increasing or stable trend		Limited Data	Limited Data
Suspended solids concentrations	Comparable to reference condition		NA	NA
Turbidity	High Flow – 50 NTU instantaneous maximum Summer base flow – 10 NTU		NA	NA
Width/Depth ratio	<22		15.9	5.2
LWD/mile	>156		231	158
Pools/mile	>96		343	158
Montana Mountain Macroinvertebrate Index of Biological Integrity	> 75%		85.7	66.7
Percentage of Clinger Taxa	"High"		47	39
EPT Richness	≥ 22		27	18
Periphyton Siltation Index	< 40		20.4	21.1
			Entire Watershed	
Equivalent Clear Cut Area	<25%		7%	
Water Yield	<10%		NA	
Other Human Caused Sediment Sources	No significant Sources		Significant sources from forest roads	

3.4.7 Cedar Creek

3.4.7.1 Summary of the 303(d) List

The 1996 Montana 303(d) list reported that the cold-water fishery beneficial use was threatened in Cedar Creek due to habitat alterations. The probable sources of the problems were listed as agriculture, rangeland and silviculture. The 1996 listing appears to have resulted from a 1985 Montana Interagency Stream Fishery Data Review report that domestic stock, logging practices, log jams, and stock tramping as human-caused impacts that limited the fishery. Fish barriers were listed as a natural factor that limited the fishery.

In the 2000 and 2002 202(d) lists, the Montana DEQ concluded that sufficient credible data were not available for Cedar Creek and that no beneficial use determinations could be made. Cedar Creek was subsequently scheduled for reassessment (DEQ, 2002). During the summer of 2003, DEQ conducted a reassessment of Cedar Creek. The 303(d) status of Cedar Creek is summarized in Table 3-32.

Table 3-32. 303(d) Status of Cedar Creek: MT76M004_060.

Year	Reaches Impaired	Use Support Status	Probable Impaired Uses	Probable Causes of Impairment	Probable Sources of Impairment
1996	From the headwaters to the mouth (Ninemile Creek).	Threatened.	Cold-water fishery.	Other habitat alterations.	Agriculture, Rangeland, Silviculture.
2000/02	From the headwaters to the mouth (Ninemile Creek).	Needs reassessment.	No Sufficient Credible Data (SCD)	No SCD.	No SCD

3.4.7.2 Targets and Supplemental Indicators

As described in Section 3.3, a suite of targets representing applicable narrative water quality standards has been developed for listed streams in the Ninemile TPA. A review of available data for Cedar Creek is provided below. For assessment purposes, Cedar Creek was divided into two reaches, one upstream of the forest boundary that is entirely surrounded by pubic land, and one downstream of the forest boundary that is entirely surrounded by private land. No current data are available for the private reach, and the discussions that follow apply only to the reach upstream of the forest boundary. Targets and indicators for which current data are available include: percent surface fines <6 mm, D50, RSI, macroinvertebrates, width/depth ratios, LWD/mile, pools/mile, periphyton, and other human caused sediment sources. No current data are available for suspended solids concentrations, turbidity, ECA, water yield, or juvenile trout density trends, and thus these supplemental indicators are not used in the analysis of beneficial use support that follows. As data for these indicators becomes available they may be used for future decisions regarding the impairment status of Cedar Creek (Section 6.3), Cedar Creek is a Rosgen B4 channel at the monitoring location.

Surface Fines (% < 6 mm)

A pebble count was conducted by the Lolo National Forest upstream of road 5515. The percent fines < 6 mm was 29, which is within the target range.

Surface Fines (D50)

D50 data were collected at the same time and location as the percent < 6mm data. The D50 was 44.4, within the target range.

Riffle Stability Index

The RSI above road 5515 was 84, which is within the target range.

Macroinvertebrates

Macroinvertebrates were sampled above road 5515 in 2003. The number of clinger taxa (20) met the target threshold of at least 14 and did not suggest that sediment impacts were present. The Mountain IBI was 85.7 and the EPT richness was 24, meeting the supplemental indicator of at least 75 and 22 respectively. The percent clinger taxa was 61; no numeric supplemental indicator value has been established for this metric at this time.

Fish Populations

Insufficient data on population trends..

Large Woody Debris (LWD)/Mile

The LNF conducted a LWD count upstream of road 5515 and found 92 pieces/mile, which is below the supplemental indicator threshold of at least 156 pieces per mile.

Pools/Mile

Pool counts were conducted simultaneously with the LWD counts described above, and the pool frequency was 115, which met the supplemental indicator threshold of at least 96 pools/mile.

Width/Depth Ratio

The bank width/depth ratio in Cedar Creek above road 5515 was 9.1, meeting the supplemental indicator at less than 22.

Suspended Solids Concentration

No data has been collected.

Turbidity

No data has been collected.

Periphyton Siltation Index

DEQ collected periphyton samples in September of 2003 above road 5515. The siltation index was 37.7, meeting the proposed supplemental indicator of less than 40.

Equivalent Clear-Cut Area

Existing Condition is unknown.

Water Yield

Existing Condition is Unknown.

Other Human Caused Sediment Sources

As described in greater detail in Section 4.0, placer mining and forest roads, timber harvest, and agriculture have been identified as significant human caused sources of sediment in the Cedar Creek watershed, and result in a total existing sediment load that is nearly 400% of the estimated natural background sediment load.

3.4.7.3 Sources and Other Relevant Data

The following section presents a summary of potential known sources in the Cedar Creek watershed as well as additional information that will help to determine the impairment status of Cedar Creek.

Sources

The Cedar Creek watershed is 3,883 acres in size. Ninety five percent of the lands within the watershed are managed by the Lolo National Forest. The remaining five percent of the watershed is in private ownership, with private lands concentrated near the confluence with Ninemile Creek. Elevations in the watershed range from 3,202 at the confluence with Ninemile Creek to 7,336 feet near the Ninemile divide; the mean elevation is 4,840 feet. The watershed has a road density of 1.0 mi/mi^2, and there are 3 stream crossings in the watershed. None of the watershed burned in the fires of 2000. Refer to Section 2.0 for additional watershed characteristics. A detailed source assessment is provided in Section 4.5.6.1.

3.4.7.3.1 Physical Data

A. Stream Assessments

During the summer of 2003, DEQ conducted a stream assessment of Cedar Creek upstream of the road 5155 crossing. This portion of Cedar Creek received an assessment score that was 95% the maximum possible according to DEQ's standard assessment protocols. The field crew described conditions in this reach of Cedar Creek as follows:

This stream flows out of a roadless area and is only impacted by a hiking trail that follows stream for about 2 miles. Upland area is vegetated by Douglas Firs, Larch, Ponderosa Pines, Snow Berries, Service Berries and some Currants. Riparian area vegetated with thick Alders, Rocky Mountain Maples, Cedars, Douglas Firs, some Larch, lots of woody shrubs especially snow berries and roses. Canopy cover for stream is about 85%. Lots of mosses are growing on larger substrate and algal growth is very light. Areas of bedrock prevent stream from cutting into hillside. Substrate consisted of mainly gravels with sand and some cobbles. There is an abundance of woody debris snags and overhanging banks for adult and juvenile salmonids. The substrate is optimum for spawning. Very little silt or fine sediment present, even in pools. Stream is braided in a few areas. Gravels appear to be moving quite a bit with active degradation, probably at an extent natural to the stream. Flood plain accessible throughout reach.

DEQ also conducted an abbreviated assessment of Cedar Creek near its confluence with Ninemile Creek. The overall score was 72% of maximum, indicating that the stream is "as risk" according to DEQ's interpretation of the assessment results. DEQ noted the clearing of riparian vegetation as a major impact in this reach.

B. Temperature

DEQ measured temperature upstream of road 5155 in July of 2003; the temperature was 14.4 C.

To provide a more accurate portrait of the temperature regime in Cedar Creek, Stowaway temperature loggers were deployed in Cedar Creek upstream from Forest Road 5515 in 2002 and 2003. In 2002, the highest temperature was recorded the second full day of monitoring, meaning that the true temperature peak might have been missed. Temperatures recorded in 2003 were higher than those in 2002. Given the unmanaged condition of the watershed upstream of the monitoring location, the temperature regime in Cedar Creek is probably natural.

Results of the temperature monitoring are summarized in Table 3-33.

Table 3-33 2002 and 2003 Water Temperature Data from Cedar Creek.

Year	Seasonal Maximum	Seasonal Max Daily ΔT		7-Day averages			Days > 10.0 C	Days > 15.0 C
	Value	Date	Value	Max	Min	ΔT		
2002	14.4	08/03/02	3.4	13.8	11.3	2.5	57	0
2003	16.2	07/12/03	3.7	15.9	12.6	3.3	79	27

C. Grazing Impacts

There is a vacant LNF grazing allotment in the Cedar Creek Watershed that was last used 14 years ago, and there are no plans to reopen the allotment. Grazing impacts are thus limited to private lands in the watershed, and these are disused in greater detail in Section 4.5.6.

D. Discharge

Below road 5155, Cedar Creek was dry during the summer of 2003. The extent to which the dewatering is due to natural vs. anthropogenic causes is currently unknown; although just below the road 5515 crossing in NE 1/4 of section 4 is a diversion that services private land downstream. The magnitude and duration of water withdrawal from this point of diversion is unknown at this time.

E. Fish Passage

The culvert at road 5155 is believed to be a barrier to fish passage. According to the Lolo National Forest, the culvert has been retrofitted with baffles and log drop structures to facilitate fish passage. It appears that fish passage may be possible at higher flows but during low flows there is a drop at the last culvert baffle that may not be passable by resident fish.

3.4.7.3.2 Biological Data

A. Fish

In 1991 in the vicinity of the road 5155 crossing, high densities of cutthroat and brook trout (24.7 and 22.6 fish/100m^2, respectively) were found. In 2001, the area was resampled by LNF and the cutthroat density was 12.9 fish/100m^2; no brook trout were observed. This differs from Montana Fish Wildlife and Parks 2001 shocking data where a mixed assemblage of rainbow, brook and brown trout were found, but cutthroat trout were not identified. It is unclear what is responsible for this observed discrepancy in the 2001 data.

The current and historic status of bull trout in the watershed is unknown.

At the time of this report, the available data were not adequate for determining trends of juvenile native trout species in Cedar Creek. Additional fish surveys are included in the monitoring plan described in Section 6.3.

B. Chlorophyll a

Montana DEQ collected a chlorophyll a sample in upper Cedar Creek at the location where macroinvertebrate and periphyton samples were collected. The concentration of chlorophyll a was 34.3 mg/m^2.

3.4.7.3.3 Chemical Data

Montana DEQ collected water chemistry monitoring of Cedar Creek upstream of forest road 5515 during the summer of 2003. No violations of state water quality standards were detected. The stream was dry below forest road 5515; thus no samples could be collected.

3.4.7.3.4 Fires of 2000

None of the watershed burned in 2000.

3.4.7.4 Cedar Creek Water Quality Impairment Summary

The cold-water fishery beneficial use is listed at threatened in Cedar Creek due to siltation and habitat alteration resulting from agriculture, irrigated crop production, and range land.

Siltation (sediment) and Habitat

Above road 5515 the Cedar Creek watershed is largely roadless and few significant anthropogenic impacts are known to occur. All of the targets are within reference ranges. Although the number of pieces of LWD per mile is lower than expected, this condition is most likely the result of natural factors given the lack of human impacts upstream of the survey reach. Below road 5155 little data is currently available with which to evaluate habitat alterations or potential increased in sediment load. This section of Cedar Creek is mostly on private land, and DEQ’s 2003 assessment noted significant near-stream impacts in this reach. A sediment TMDL has been developed for Cedar Creek, and is presented in Section 4.5.6.3. Table 3-34 compares existing conditions to the proposed target/indicator thresholds.

Flow Alteration/Dewatering

The extent to which the dewatering in lower Cedar Creek results from anthropogenic vs. natural causes is currently unknown. Flow alteration will be addressed via a phased approach, as described in Section 6.6.

Table 3-34. Comparison of Available Data for the Proposed Targets and Supplemental Indicators for Cedar Creek (Rosgen B4 Channel Type).

Targets	**Threshold**	**Available Data**	
		Above road 5515	**Near mouth**
Wolman pebble counts % fines < 6 mm	Mean=21.0; Range = 6-36%	29	NA
Wolman pebble counts D50	Mean=38 mm; Range = 25-51mm	28	NA
Riffle Stability Index	45-85	84	NA
Clinger Richness	≥ 14	20	NA
Supplemental Indicators	**Threshold**	**Available Data**	
		Near mouth	**In mined reach Above FR 890**
Juvenile Bull Trout and Westslope Cutthroat Trout Density	Documented increasing or stable trend	Limited Data	Limited Data
Suspended solids concentrations	Comparable to reference condition	NA	NA
Turbidity	High Flow – 50 NTU instantaneous maximum Summer base flow – 10 NTU	NA	NA
Width/Depth ratio	<22	9.1	NA
LWD/mile	>156	92	NA
Pools/mile	>96	115	NA
Montana Mountain Macroinvertebrate Index of Biological Integrity	> 75%	85.7	NA
Percentage of Clinger Taxa	"High"	61	NA
EPT Richness	≥ 22	24	NA
Periphyton Siltation Index	< 40	37.7	NA
		Entire Watershed	
Equivalent Clear Cut Area	<25%	NA	
Water Yield	<10%	NA	
Other Human Caused Sediment Sources	No significant Sources	Significant sources from agriculture, timber harvest, and forest roads	

3.4.8 Ninemile Creek

3.4.8.1 Summary of the 303(d) List

The 1996 Montana 303(d) list reported that Ninemile Creek only partially supported its aquatic life and cold-water fishery beneficial uses. At the time, impairments to Ninemile Creek were thought to result from other habitat alterations and siltation. The sources of these impairments were listed as agriculture, highway/road/bridge construction, irrigated crop production, pasture land, placer mining, resource extraction, silviculture, and stream bank modification/ destabilization.

In reviewing the 303(d) list in 2000, DEQ determined that the existing data on Ninemile Creek only partially supported its aquatic life and cold-water fishery beneficial uses. Impairments to Ninemile Creek were the same as in 1996 – other habitat alterations and siltation. Sources of these impairments were listed as abandoned mining, bank or shoreline modification/destabilization, pasture grazing-riparian and/or upland. Additionally, DEQ determined that Ninemile Creek did fully support the beneficial uses for recreation, agriculture and industry, thus meeting the requirements for sufficient and credible data for these uses. However, the existing data for the beneficial use of drinking water did not meet the requirements for sufficient and credible data, and Ninemile Creek was scheduled for reassessment. The 303(d) status of Ninemile is summarized in Table 3-35.

Table 3-35. 303(d) Status of Ninemile Creek: MT76M004_010.

Year	Reaches Impaired	Use Support Status	Probable Impaired Uses	Probable Causes of Impairment	Probable Sources of Impairment
1996	From the headwaters to the mouth (Clark Fork River)	Partial support	Aquatic life, cold-water fishery.	Other habitat alterations, Siltation.	Agriculture, Highway/ road/bridge construction, Irrigated crop production, Pasture land, Placer mining, resource extraction, silviculture, stream bank modification/destabilization.
2000	From the headwaters to the mouth (Clark Fork River)	Partial Support	Aquatic life, cold-water fishery.	Other habitat alterations, Siltation.	Abandoned mining, bank or shoreline modification/ destabilization, Pasture grazing-riparian and/or upland.
		Full Support	Recreation, Agriculture, Industry.	N/A.	N/A.
		Needs reassessment.	No Sufficient Credible Data (SCD) for drinking water.	No SCD.	No SCD

Refer to Section 2.0 for a characterization of the Ninemile Watershed

3.4.8.2 Targets and Supplemental Indicators

As described in Section 3.3, a suite of targets representing applicable narrative water quality standards has been developed for listed streams in the Ninemile TPA. A review of available data for Ninemile Creek is provided below. Targets and indicators for which current data are available include: percent surface fines <6 mm, D50, RSI, width/depth ratios, LWD/mile, pools/mile, and other human caused sediment sources. No current data are available for suspended solids concentrations, turbidity, juvenile trout density trends, macroinvertebrates, ECA, water yield, or periphyton, and thus these supplemental indicators are not used in the analysis of beneficial use support that follows. As data for these indicators becomes available they may be used for future decisions regarding the impairment status of Ninemile Creek (Section 6.3).

For the target and supplemental indicator assessment, five monitoring locations were established and data were collected in 2003 and 2004 by the Lolo National Forest and Land and Water Consulting. From upstream to downstream the monitoring locations are: 1) near St. Louis Creek; 2) Below FR 4256 bridge; 3) near Bird Creek; 4) downstream of Rennic Creek; and 5) below

Cedar Creek. Reach 3 was a Rosgen C3 channel type; the other reaches were all Rosgen C4 channel types.

Surface Fines (% < 6 mm)

The percent surface fines < 6 mm target was met in all five reaches. The percent surface fines was 4.7 in reach 1, 8.3 in reach 2, 8.0 in reach 3, 4.7 in reach 4, and 9.9 in reach 5.

Surface Fines (D50)

The D50 target was not met in reach 4, where the D50 of 57 exceeded the reference range. In all other reaches, the target D50 targets were met.

Riffle Stability Index

In reach 1 through 5 the RSI was 80, 92, 100, 83, and 90 respectively, failing to meet the target range in all cases and suggesting potential channel instability.

Macroinvertebrates

No data has been collected.

Fish Populations

Insufficient data on population trends.

Large Woody Debris (LWD)/Mile

The LWD target of at least 156/mile was met in reach 1 (215/mile), and reach 2 (160/mile) but not in reaches 3, 4, or 5 (87, 45, and 37 per mile respectively).

Pools/Mile

The pool frequency target threshold is dependent on the wetted width of the stream and thus varies between reaches. The target was met in reach 1 (74/mile) reach 4 (45/mile) and reach 5 (37/mile), but not in reach 2 (25/mile) or reach 3 (44/mile).

Width/Depth Ratio

The bank full width/depth ratios ranged from a maximum of 30 in reach 2 to a minimum of 12.4 in reach 4, meeting the supplemental indicator threshold of less than 33 in all cases.

Suspended Solids Concentrations

No data has been collected.

Turbidity

No data has been collected.

Equivalent Clear-Cut Area

Existing condition unknown.

Water Yield

Existing condition unknown.

Other Human Caused Sediment Sources

As described in greater detail in Section 4.0, placer mining, agriculture, timber harvest, and forest roads have been identified as significant human caused sources of sediment in the Ninemile Creek watershed, and result in a total existing sediment load that is nearly 830% of the estimated natural background sediment load.

3.4.8.3 Sources and Other Relevant Data

The following section presents a summary of potential known sources in the Ninemile Creek watershed as well as additional information that will help to determine the impairment status of Ninemile Creek. Refer to Section 2.0 for additional watershed characteristics. A detailed source assessment is provided in Section 4.5.7.1.

A. Stream Assessments

The Lolo National Forest reported that impacts along main stem Ninemile Creek have resulted from past and ongoing activities including placer mining (active and inactive claims), homes built in the floodplain, agriculture, grazing, roads, and diversions for irrigation. Mining has led to diversion of flow, deposition of waste rock in the stream and riparian area, and channel alteration resulting in decreased channel stability. Channel alteration and removal of riparian vegetation to accommodate all these uses have also impacted the stream. Analysis of historic photographs of the drainage reveals a decrease of 60-80 percent in riparian trees and shrubs along Ninemile Creek since the 1930s (Siegel/St. Louis Salvage EA, 1999). (Post Burn EIS, 2002)

The LNF has also reported that several roads are notable contributors of sediment to Ninemile Creek. The main Ninemile Road (Forest Road #412) is adjacent to Ninemile and lower St. Louis Creek in several locations in the Ninemile drainage, both on the Forest and downstream of the Forest boundary where lands are in private ownership. Road maintenance has resulted in sediment being pushed into these streams, with undercutting of the road fill also contributing sediment directly to the streams. (Post Burn EIS, 2002) The West Ninemile Road also abuts the stream and floodplain in the lower reaches of the stream, and road fill has been undercut in several places.

A Master's thesis by Gould (1998) tried to assess the effectiveness of restoration activities in improving stream condition in lower Ninemile Creek with selected monitoring at two locations. Wolman pebble count analysis showed D50 as 18mm in 1995 and 6.5mm in 1996 at the mouth of Ninemile Creek. At the USGS gage, D50 in 1995 was approximately 30mm and in 1996 it was approximately 45mm. The data show an apparent shift in particle size, with the lower site apparently increasing in fine material and the upper site apparently decreasing in fine materials. Gould also surveyed cross-sections at his two sites between 1994 and 1996 and analyzed total suspended sediment concentrations, and related them to discharge. He determined that suspended sediment in the system at the lower monitoring site was more dependent on discharge than the upper site. Gould concluded that lower Ninemile Creek between his two study sites was in poor condition, and that restoration work had little influence in improving stream channel condition within the study reach, but the time frame (two years) is probably too short to make any meaningful conclusions about long-term trends.

In the Siegel/St. Louis Timber Salvage analysis, the LNF reported that water yields in upper Ninemile Creek were probably excessive due to intense timber harvest in the 1970s and 1980s. At the time of the report (12/99), however, ECA in the upper Ninemile watershed was at 7%, suggesting that water yields were no longer elevated to a degree that was likely to destabilize stream channels. Although water yields had recovered, the analysis indicated that problems still existing as a result of roads and mining impacts.

B. Temperature

2001: A temperature logger was deployed in main stem Ninemile Creek, at the USGS gage site, in August 2001. Summer water temperatures in Ninemile Creek were higher than temperatures in all of the other streams measured in the watershed that year. Daily temperature ranges of up to 9.14°C (16.4°F) were also higher than in the other streams (Table 3-36).

Table 3-36. Temperature in Ninemile Creek at USGS Station, 2001.

Site Name	Seasonal Maximum	Seasonal Max Daily ΔT		7-Day averages			Days >	Days >
	Value	Date	Value	Max	Min	ΔT	10.0 C	15.0 C
9-mile at gage	22.7	09/04/01	9.1	22.0	14.3	7.7	61	54

2002: Temperature loggers were deployed at two sites on Ninemile Creek in 2002: site at the bridge on the Brugh Ranch (T16N, R23W, sec. 27, SW1/4), and an upper site near Soldier Creek on the Forest (T17N, R24W sec. 26). Data for the Brugh site and the upper site near Soldier Creek are summarized in Table 3-37.

Table 3-37. Temperature in Ninemile Creek, 2002.

Site Name	Seasonal Maximum	Seasonal Max Daily ΔT		7-Day averages			Days >	Days >
	Value	Date	Value	Max	Min	ΔT	10.0 C	15.0 C
Ninemile Upper	15.9	08/01/02	6.7	15.2	10.2	5.0	60	9
Ninemile Brugh	18.5	08/01/02	7.2	17.6	12.1	5.5	68	39

In 2002, maximum recorded stream temperatures were 15.9°C (60.6°F) at the upper site, 18.5°C (65.3°F) at the Brugh site, and approximately 20.7°C (69.3°F) at the USGS gage site. The maximum temperature from the USGS site was estimated from a graph of the data; no other data from this site were available in 2002 and thus it is not included in the table above.

2003: Temperature loggers were deployed at the same sites as in 2002 by the Lolo National Forest and an additional logger was deployed near the USGS gauge. In addition, the PIBO Effectiveness Monitoring team deployed a logger in upper Ninemile Creek, approximately 150m upstream from St. Louis Creek. Data from the four sites are summarized in Table 3-38 and are presented from the upstream site (PIBO) sequentially downstream to the USGS site near the mouth.

Table 3-38. Temperature in Ninemile Creek, 2003.

Site Name	Seasonal Maximum	Seasonal Max Daily ΔT		7-Day averages			Days >	Days >
	Value	Date	Value	Max	Min	ΔT	10.0 C	15.0 C
Ninemile_PIBO	11.8	06/29/03	2.8	11.5	9.9	1.6	49	0
Ninemile Upper	18.9	07/10/03	7.2	18.7	12.0	6.7	96	58
Ninemile_Brugh	22.3	06/29/03	8.4	21.9	14.1	7.8	100	75
Ninemile at USGS	23.7	07/15/03	8.6	23.4	15.4	8.0	120	87

The Montana Department of Environmental Quality has 3 informal standards for the interpretation of temperature data and cold-water fishery use support. Critical temperatures for native salmonids according to the DEQ standards are 9 C for spawning, 12 C for rearing, and 15 C for migration. Because native salmonids (Bull and Westslope Cutthroat trout) typically spawn in the fall and spring when temperatures are not elevated, the rearing and migration temperatures are the critical benchmarks against which DEQ evaluates use support.

The data presented above indicate that DEQ's temperature thresholds are exceeded for long periods in Ninemile Creek. The elevated summer temperatures in Ninemile Creek (especially lower Ninemile) may be due to a number of factors. Temperatures were measured in the lower reaches of the stream, where the channel is broad and shallow, allowing the water surface to be more exposed to solar heating than in upstream, confined, reaches. The channel is exposed for most of its 20+ miles above the sampling site; it is a Rosgen type B and C stream, meandering through open meadows with little overhanging vegetation to shade the water. Shrub cover of the stream has been removed since the valley was settled to accommodate land use in the valley. This lack of topographic and vegetative shading, as well as low water conditions in 2002 (likely partially due to irrigation withdrawals) and low flow velocities, would lead to enhanced water heating.

Fish data trends along much of the length of main Ninemile Creek indicate that native fish populations are higher in the upper reaches of the creek where temperatures are lower. Further downstream, salmonid density and native fish populations decrease. Factors driving this are likely temperature increases that have resulted from extensive land conversion and removal of riparian canopy (see discussion above), as well as from increased thermal inputs from tributary streams.

C. Sediment Load

The Lolo National Forest monitored sediment transport in Ninemile Creek in 1990 – 1992 at the mouth of Ninemile Creek and at the USGS gauging station. Results are summarized in Table 3-39. The LNF attributed the relatively high load at the USGS station in 1992 to a bank stabilization riprap project that occurred in the fall of 1991.

Table 3-39. Sediment Transported in Ninemile Creek 1990-1992 (pounds/mi^2).

Year	Monitoring period	USGS station	Mouth
1990	3/14-8/31	13,600	130,947
1991	3/28-9/30	19,843	41,837
1992	3/31-8/18	17,692	7,592

D. Fish Passage

Nearly 50 culverts throughout the Ninemile Watershed, primarily on Forest Service land pose passage problems for fish. The Lolo National Forest has prioritized for replacement or removal 26 of the most important passage problems where the greatest amount of fish benefit from a remedy would be realized. The highest priority projects are typically in watersheds where know native fish production is moderate to strong, and a solution (or solutions where multiple barriers exist in one tributary) could reconnect the entire tributary watershed to main Ninemile. The LNF report on fish barriers in the Ninemile is included as Appendix A.

3.4.8.3.1 Biological Data

A. Fish

A 1997 report by GT Consulting summarized much of the fisheries data that were available at that time. Relevant excerpts from the report are presented below:

Montana Fish, Wildlife and Parks has collected data on fish populations in Ninemile Creek periodically since 1962. Based on the data collected by Montana Fish, Wildlife and Parks, it appear that rainbow and brown trout are found virtually throughout the creek at the present time. However, surveys done in 1962 and 1968 in Ninemile Creek upstream of Pine Creek found only cutthroat, brook, and bull trout. Assuming the historic database is accurate, it indicates that there has been a change in species composition in the upper reaches of Ninemile Creek since the 1960's. There does not appear to be any record of bull trout being collected anywhere in lower or middle Ninemile Creek since 1981 (FWP file data, 1997). However, bull trout were found in upper Ninemile Creek (above Eustache Creek) in the mid-1990's (Riggers, 1998). Cutthroat are presently found primarily in the upper reaches of Ninemile Creek, although there is a record of cutthroat being collected near the confluence with Isaac Creek (approximately 2 miles upstream of the mouth) in 1991. Rainbow and brown trout appear to have expanded their range upstream at least as far as the area between Beecher and Burnt Fork creeks. Brook trout appear to be confined to the headwaters and middle reaches of Ninemile Creek. The downstream-most record for brook trout cam from the reach near Spring Creek in 1991.

In the fall of 1984, data collected by Montana Fish, Wildlife and Parks indicated rainbow trout were generally more abundant than brown trout in all sections. Rainbow trout ranged in size from 1.2 inch to 10.4 inches. Brown trout ranged in size from 2.9 inches to 18 inches. Montana Fish, Wildlife and Parks biologists *concluded that Clark Fork River brown trout were migrating into Ninemile Creek, presumably for spawning purposes (Berg, 1986).*

According to the Montana Bull Trout Scientific Group, resident bull trout populations are found in low densities in the Ninemile Creek drainage, but migratory populations appear to have been entirely eliminated. Extensive sedimentation from mining, logging, and agricultural practices have severely impacted bull trout in the Ninemile Creek drainage (MBTSG, 1996).

Refer to Section 2.16 in the Watershed Characterization for additional fisheries information.

At the time of this report, the available data were not adequate for determining trends of juvenile native trout species in Ninemile Creek. Additional fish surveys are included in the monitoring plan described in Section 6.3.

B. Periphyton

Periphyton was sampled in upper, middle, and lower Ninemile Creek by DEQ in August 1990. The results indicated that Ninemile Creek as “slightly impaired” at the upper site and “slightly to moderately impaired” at the middle and lower sites when compared to two reference streams – the South Fork of the Flathead River and the East Fork of the Bull River (Bukantis, 1990).

Periphyton was sampled again in upper, middle, and lower Ninemile Creek by Stevenson and Schultz in 1993. At the upper site, periphyton indicated that the stream was not impaired and had excellent biological integrity; at the middle site periphyton indicated that the stream was moderately impaired and had fair biological integrity; and at the lower site periphyton indicated that the stream was moderately impaired and had fair biological integrity.

Periphyton was sampled in upper middle and lower Ninemile Creek by Clay in August 1995. At the upper site, periphyton indicated that the stream was not impaired and had excellent biological integrity; at the middle site periphyton indicated that the stream was not impaired and had excellent biological integrity; and at the lower site periphyton indicated that the stream was moderately impaired and had fair biological integrity.

Periphyton samples were collected by Chadwick Ecological Consulting in 1997 at a site in lower Ninemile Creek below the confluence of Isaac Creek and in upper Ninemile Creek between Burnt Fork and Soldier Creeks. According to the project report, periphyton populations at the lower site indicated “excellent water quality”. At the upper site periphyton populations indicated impairment of water quality, but no explanation for the impairment was apparent.

C. Macroinvertebrates

The Lolo National Forest sampled macroinvertebrates in November 1990 at a site near the headwaters, in the middle of the drainage, and near the mouth of Ninemile Creek. In general, macroinvertebrate communities indicted that water quality and/or aquatic habitat declined from upstream to downstream. Based on the biotic condition index, a metric of macroinvertebrate community health, the upper location was at its potential; the middle site as in good condition but could have been better; and the lower site, while in good condition based on the BCI, showed the most sign of stress based on other indicators (USFS, 1991).

Between 1990 and 1995, macroinvertebrate samples were collected by DEQ on a yearly basis, except for 1994, at three locations on Ninemile Creek to evaluate overall biotic condition of the stream, estimate the degree of impairment, and document changes over time. Stream habitat was assessed at each location concurrently with the collection of macroinvertebrate samples. Sampling locations are described in the report as upper, middle, and lower Ninemile Creek (Spawn and Brooks, 1996). According to the project report:

During all five years habitat was classified as optimal in the middle and upper reaches… and suboptimal at the lower reach…. Temporal tends in habitat quality are evident for the lower reach only, showing a reduction in habitat quality over time...Biological conditions were nonimpaired in the upper reach and moderately impaired three of the five years for the middle and lower reaches. No temporal trends are evident for the middle reach, however the lower reach shows a decrease in biointegrity scores each year over time (Spawn and Brooks, 1996). Results are summarized in Table 3-40.

Table 3-40. Macroinvertebrate and Stream Habitat Assessment Results, Ninemile Creek, 1990-1995 (Scores are % of Maximum).

Location	1990	1991	1992	1993	1995	Mean
	Habitat/Macros	Habitat/Macros	Habitat/Macros	Habitat/Macros	Habitat/Macros	Habitat/Macros
Upper	93/94	87/83	86/88	87/96	89/83	88/89
Middle	89/61	85/83	84/75	89/79	83/71	86/74
Lower	70/89	75/79	75/65	67/63	69/29	71/65

Classification: Habitat: >85=Optimal; 58-78=Suboptimal; 30-50=Marginal; 0-23=poor
Macros: >75=Non-impaired; 25-75=Moderately impaired; <25= Severely Impaired.

Macroinvertebrate samples were collected by Chadwick Ecological Consulting in 1997 at a site in lower Ninemile Creek below the confluence of Isaac Creek and in upper Ninemile Creek between Burnt Fork and Soldier Creeks. According to the project report, macroinvertebrate indices at both sites indicated “very good water quality” with an overall macroinvertebrate ranking of 3.75 (out of a possible score of 4.0) at both locations.

3.4.8.3.2 Chemical Data

During the summer of 2003, DEQ collected water chemistry data at seven locations on Ninemile Creek. No violations of state water quality standards were detected.

3.4.8.3.3 Fires of 2000

The fires of 2000 burned extensively throughout the upper Ninemile Creek TMDL Planning Area. Map 2-23 shows fire locations and severity. Approximately 20,000 acres of private, federal, and state lands were located within the perimeter of the Upper Ninemile Complex Fire. Refer to Section 2.18 for additional information.

3.4.8.4 Ninemile Creek Water Quality Impairment Summary

The 303(d) lists indicates that the cold-water fishery and aquatic life beneficial uses in Ninemile Creek are impaired by siltation and habitat alterations resulting from a variety of sources including agriculture, mining, roads, and silviculture.

Siltation (sediment) and Habitat

Although macroinvertebrate and periphyton data from the 1990s appear to indicate an improving trend in the biological integrity of Ninemile Creek, significant sources of sediment and habitat alteration remain. Reduced riparian vegetation, a reduction in flows due to irrigation uses, and possible widening of the stream channel all appear to contribute to elevated temperatures and increased sediment loading in the Ninemile Creek. Historic placer mining has altered the stream channel for several miles.

Five TMDL-related monitoring locations were established on Ninemile Creek and current Target indicator data from these locations is presented in Table 3-41. The locations are numbered 1 to 5, with monitoring location 1 located in upper Ninemile Creek and the remainder of the locations progressing sequentially downstream. Site locations are provided in Table 3-41. Ninemile Creek does not meet its RSI target at any location, suggesting high mobility of stream substrate particles and potential channel instability. All sites are within reference ranges of % fines < 6 mm as measured by the Wolman pebble count. Among the secondary indicators, LWD counts are below expected values in all reaches except reach 1 and pool frequencies are below expected values at monitoring sites 3 and 4.

A sediment TMDL has been prepared for Ninemile Creek and is presented in Section 4.5.7.3.

Flow Alteration/Dewatering and Temperature

Flow alteration will be address via a phased approach, as discussed in Section 6.6. Although Ninemile Creek has never been listed for temperature (thermal modifications), the available data suggest that temperatures may be elevated to levels that could impact aquatic life, and thus temperature will continued to be monitored to track potential improvements in the temperature regime that may occur as sediment reduction and flow augmentation efforts commence in the watershed.

Table 3-41. Comparison of Available Data for the Proposed Targets and Supplemental Indicators for Ninemile Creek (Rosgen C3 and C4 Channel Type).

Targets	Threshold		Available Data at monitoring locations on Ninemile Creek[1]				
	C3: site 3	C4: sites 1, 2, 4, and 5	1	2	3	4	5
Wolman pebble counts % fines < 6 mm	Mean=12.0; Range = 6-18%	Mean=22.0; Range = 12-32%	4.7	8.3	8.0	4.7	9.9
Wolman pebble counts D50	Mean=81 mm; Range = 49-113mm	Mean=34 mm; Range = 22-46mm	42	34	93	57	42
Riffle Stability Index	45-75	45-75	80	92	100	83	90
Clinger Richness	≥ 14	≥ 14	NA	NA	NA	NA	NA
Supplemental Indicators	**Threshold**		**Available Data**				
			1	**2**	**3**	**4**	**5**
Juvenile Bull Trout and Westslope Cutthroat Trout Density	Documented increasing or stable trend		NA	NA	NA	NA	NA
Suspended solids concentrations	Comparable to reference condition		NA	NA	NA	NA	NA
Turbidity	High Flow – 50 NTU instantaneous maximum Summer base flow – 10 NTU		NA	NA	NA	NA	NA
Width/Depth ratio	<33		16.3	30	15	12.4	24
LWD/mile	>156		215	160	87	45	37
Pools/mile	Dependent on wetted width of stream: >56 at sites 1 and 2; >47 at sites 3 and 4; >26 at site 5		74	25	44	45	37
Montana Mountain Macroinvertebrate Index of Biological Integrity	> 75%		NA	NA	NA	NA	NA
Percentage of Clinger Taxa	"High"		NA	NA	NA	NA	NA
EPT Richness	≥ 22		NA	NA	NA	NA	NA
Periphyton Siltation Index	< 40		NA	NA	NA	NA	NA
			Entire Watershed				
Equivalent Clear Cut Area	<25%		NA				
Water Yield	<10%		NA				
Other Human Caused Sediment Sources	No significant Sources		Significant sources from placer mining and forest roads				

[1]Monitoring locations: 1: Near St. Louis Creek; 2:Below FR4256 Bridge; 3:Near Bird Creek; 4: Downstream of Rennic Creek; 5: Below Cedar Creek

3.5 Water Quality Impairment Status Summary

The previous sections presented summaries of all relevant water quality data for waters appearing on the Montana 1996 and 2002 303(d) lists. The weight of evidence approach described in Section 3.3 was then applied to the listed waterbodies to address beneficial use impairments. Using this approach, aquatic life and fishery beneficial use determinations were updated for each waterbody. A summary is presented in Table 3-42.

As shown in Table 3-42, all of the evaluated stream segments except Big Blue Creek are impaired as a result of human-induced changes to sediment (siltation) loading and transport regimes, and sediment TMDLs are presented for these streams in Section 4.0. In Big Blue Creek, core and supplemental indicators are generally within reference ranges, and no significant human-caused sediment sources were located. Thus, no TMDL has been developed for Big Blue Creek, but the stream will be monitored to further verify beneficial use support. Implementation of a Voluntary Water Quality Improvement Strategy is proposed to address all identified anthropogenic sources of sediment in the listed watersheds (Section 5.0). Necessary follow-up monitoring and a conceptual strategy to improve overall watershed health for these waterbodies is presented in Section 6.0.

Table 3-42. Current Water Quality Impairment Status for the Ninemile TPA.

Waterbody Name and Number	Year Listed	Listed Probable Causes	Current Status	Proposed Action
Big Blue Creek MT76M004-050	1996	Habitat Alterations	Not Impaired	▪ Implement Water Quality Improvement Strategy to address identified sources. ▪ Follow-up monitoring.
	2002	No SCD		
Josephine Creek MT76M004-040	1996	Habitat Alterations	Habitat Alteration, Siltation and Flow Alteration	▪ Develop TMDL. ▪ Implement Water Quality Improvement Strategy to address identified sources. ▪ Phased approach to flow alteration. ▪ Follow-up monitoring.
	2002	No SCD		
Little McCormick Creek MT76M004-080	1996	Habitat Alterations/Flow Alterations	Habitat Alteration, Siltation and Flow Alteration	▪ Develop TMDL ▪ Implement Water Quality Improvement Strategy to address identified sources. ▪ Phased approach to flow alteration. ▪ Follow-up monitoring.
	2002	No SCD		
Upper McCormick Creek MT76M004-032	1996	Habitat Alterations	Not Impaired	▪ Include in Water Quality Improvement Strategy with lower McCormick and Little McCormick Creeks.
	2002	Full Support (but no SCD for Ag, Industry, Drinking Water, Recreation)		
Lower McCormick Creek MT76M004-031	1996	Habitat Alterations	Habitat Alteration, Siltation and Flow Alteration. Possibly elevated temperatures.	▪ Develop TMDL. ▪ Implement Water Quality Improvement Strategy to address identified sources. ▪ Phased approach to flow alteration. ▪ Follow-up monitoring. ▪ Follow-up temperature monitoring.
	2002	Habitat Alterations		
Kennedy Creek	1996	Metals and Siltation.	Siltation, Metals and Flow	▪ Develop TMDLs for Metals

Table 3-42. Current Water Quality Impairment Status for the Ninemile TPA.

Waterbody Name and Number	Year Listed	Listed Probable Causes	Current Status	Proposed Action
MT76M004-070	2002	Dewatering, Flow alteration, Metals (Cu, Pb, Hg, Zn), Other habitat alterations.	Alteration	and Sediment ▪ Implement Water Quality Improvement Strategy to address identified sources. ▪ Phased approach to flow alteration. ▪ Follow-up monitoring.
Stony Creek MT76M004-020	1996	Habitat Alterations/Siltation	Habitat Alteration, Siltation and Flow Alteration	▪ Develop TMDL. ▪ Implement Water Quality Improvement Strategy to address identified sources. ▪ Phased approach to flow alteration. ▪ Follow-up monitoring.
	2002	No SCD		
Cedar Creek MT76M004-060	1996	Habitat Alterations	Habitat Alteration and Siltation	▪ Develop TMDL. ▪ Implement Water Quality Improvement Strategy to address identified sources. ▪ Follow-up monitoring
	2002	No SCD		
Ninemile Creek MT76N004-010	1996	Habitat Alterations/Siltation	Habitat Alteration, Siltation and Flow Alteration. Possibly elevated temperatures.	▪ Develop TMDL. ▪ Implement Water Quality Improvement Strategy to address identified sources. ▪ Phased approach to flow alteration. ▪ Follow-up monitoring. ▪ Follow-up temperature monitoring.
	2002	Habitat Alterations/Siltation		

Water Quality Restoration Plan and Total Maximum Daily Loads for the Ninemile Planning Area

VOLUME II

Total Maximum Daily Load Elements

Preface

Volume II, *Total Maximum Daily Load Elements*, contains Section 4.0. This Section is the "Watershed Assessment" section.

The format of this volume is designed to address pollutant sources, water quality goals, water quality targets, TMDLs, and load allocations for each impaired waterbody as defined in Section 3.0 of Volume I.

Sediment (discussed as siltation, TSS and habitat alterations in this document), metals, and flow are the specific listed impairments in the NTPA. Given that these relatively small numbers of impairments are common among the listed streams, each "impairment" section then addresses that specific impairment in a waterbody by waterbody case. This enables the reader to focus on a particular waterbody of their interest while also concentrating an individual impairment at a time.

It is important for the reader to understand terminology used in this section and how each term fits into the overall WQRP/TMDL. Three such terms are briefly described below:

- Source Assessment - A source assessment is a detailed inventory of all verified sources (to include natural sources) applicable to the impairment at question or any additional impairments that are believed to be affecting beneficial uses in the watershed being studied. Basically, a source assessment identifies all sources and estimates the load from each source. The source assessment allows for a linkage to water quality targets, to help determine impairment status; allows for the analysis to quantify loads from sources; and allows for analysis of mitigation measures that are expected to result in reductions of any human-cased sources.
- Allocations - Load allocations are best estimates of the loading of a particular source. For purposes of TMDL development, allocations consist of waste load allocation (point sources), and load allocations (Non point sources and natural).
- Total Maximum Daily Load (TMDL) – The sum of the individual wasteload allocations (WLA), load allocations (LA) and natural background, plus a margin of safety. TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measures that relate to a state's water quality standard.
- Margin of Safety (MOS) – Accounts for the uncertainty about the relationship between pollutant loads and the quality of the receiving waterbody.

A detailed outline of Volume II is provided below.

Section 4.0: The Watershed Assessment Section was developed to completely address all habitat, metals, and sediment related impairments in the NTPA. This section identifies all known sediment sources in the 303(d) listed streams and provides a discussion on the assessment methods used to identify these sediment sources. The section then displays a waterbody by waterbody dialogue whereby source assessment methods, source assessment results, load allocations, TMDLs, and MOS are developed in each waterbody.

While not formal thermal impairments currently exist in the NTPA, temperature data was collected and addressed in this WQRP. It is believed that temperature problems may exist in the NTPA, but data was too inconclusive to make any decisions at this time. Additionally, while flow alteration is not a required TMDL element, flow was addressed as part of this WQRP. Flow addressed because flow is a driving mechanism that influences both sediment and temperature in the NTPA. Since very little is currently understood about flow in the NTPA, no formal targets, load allocations or TMDLs were developed. Instead, a phased approach was presented by which flow issues in the NTPA could be addressed with future efforts. This is outlined in Volume III.

SECTION 4.0
WATERSHED ASSESSMENT

This section of the report describes the methods and summarizes the results of a 2003-2004 assessment of pollution sources in the Ninemile watershed that may be contributing to the documented metals, sediment and habitat related impairments. As discussed in more detail in Section 4.0, sediment and/or habitat alterations appeared as impairments in all of the listed waterbodies in the Ninemile TPA. Metals were a listed impairment only in Kennedy Creek. As reported in Section 4.0, metals sampling was conducted in all of the listed streams, but only in Kennedy Creek did metals concentrations warrant a TMDL. EPA requires that TMDL water quality restoration plans must consider all of the potential contributing sources of the pollutants of concern. The Ninemile technical advisory group began the source assessment process by considering and tabulating all potential sources of metals, sediment and habitat alterations. From this master list, some categories were disregarded if available data and information were available to document their limited importance as possible sources. Other sources were prioritized for additional assessment work. Through this process, a source assessment strategy and work plan was eventually developed. The corresponding assessment methods were selected on the basis of technical feasibility, cost, and time requirements. The Ninemile pollution source assessment approach is described below, by source category.

Several streams in the NTPA are thought to be impacted by flow alteration and/or dewatering. These impairments are being addressed in a phased approach, as discussed in Section 6.6. Additionally, in-stream temperature monitoring revealed potential temperature impairments in some of the streams in the NTPA. These issues will be addressed in Section 5.0.

4.1 Sediment Source Assessment Methods

The Ninemile watershed sediment source assessment focused on evaluating actual and potential sediment inputs from an extensive forest road network, timber harvest, agriculture, mining, potential culvert failure, the fires of 2000 and natural sources. Delivery of sediment from the above described potential source categories was analyzed through a combination of approaches, including field measurements, computer modeling, review of agency records and data, and in-stream indicators. This section provides a summary of methods used to assess sediment-loading sources within the Ninemile watershed.

4.1.1 Natural Erosion Rates, Timber Harvest, the Fires of 2000, and Forest Roads

Natural sediment production and delivery in the Ninemile watershed, as well as the contribution of sediment from timber harvest activity and the fires of 2000 was evaluated using the LOLOSED model. This is a GIS application of the Region 1 Water Yield and Sediment Model (R1-WATSED), which was derived from the Watershed Response Model for Forest Management (WATBAL). Initially models were developed to estimate changes in water yield from forest management activities, and systematic procedures were later added to estimate mass and surface erosion. These surface erosion procedures were adapted from the Guide for

Predicting Sediment Yields from Forested Watersheds (Cline et al., 1981; USDA-Forest Service, 1991).

Although the LOLOSED and WATBAL models generate specific quantitative values for sediment yields, the results are to be used as a tool in interpretation of how real systems may respond, not as an absolute measure against verifiable standards. In examining results, the reviewer must be careful not to focus on the absolute values for sediment yields; these numbers are not meant to represent true, measured, sediment yields. Rather, the reviewer should compare the relative contributions of sediment within a given watershed.

The LoloSED computer model was also used to analyze potential sediment production from forest roads at the watershed scale. Sediment production from roads was determined using coefficients for closure level and natural revegetation, presence or absence of best management practices, time since construction or re-construction, and baseline sediment production rates.

In addition, analysis of potential sediment inputs from roads at stream crossings on National Forest land was conducted using the FroSAM model, a modified version of what is commonly referred to as the "Washington Method" (Washington Forest Practices Manual, 1997). For each stream crossing and/or near stream road segment, the contributing length of road (including cut and fill slopes), the tread width, base erosion rate, gravel factor, percent cover, and percent delivery were determined. A base erosion rate of 30 tons/acre/year was used in this analysis (Washington Forest Practices Manual, 1997). Except for a few stream crossing on private land where no permission for access could be obtained and in places where thick vegetation on the treads of closed roads made travel to crossings impractical, all stream crossings in the forest road network in the Ninemile watershed were assessed with the FroSAM procedure. The FroSAM methodology is included as Appendix B.

Because of differences in methodologies, the LoloSED and FroSAM results are not directly comparable; both, however, provide a useful measure of the potential impact of forest roads on sediment loading in the Ninemile TPA. LoloSED road results are directly comparable to other LoloSED-modeled sediment load estimates (natural, timber harvest, fires of 2000), and thus provide a convenient measure of the relative contribution of each of the modeled sediment sources to the total sediment loads in Ninemile Creek and its listed tributary watersheds. LoloSED does not, however, provide any way of linking the estimated sediment load from forest roads to points of delivery on the ground. The FroSAM method fills this gap by providing an estimate of sediment delivery at stream crossings and near-stream road segments. Although in absolute terms the FroSAM results do not necessarily provide an accurate estimate of the actual sediment load, they do provide a reliable estimate of the relative load at each crossing, and thus provide a useful tool for prioritizing stream crossings and road segments for restoration based on their estimated relative sediment contribution.

4.1.2 Potential Sediment Risk from Culvert Failures

Culvert failure may result in the direct discharge of road fill material into the stream channel. Undersized culverts are susceptible to failure or blowout due to the ponding of water at the culvert inlet. Analysis of sediment risk from culvert failure was completed for 52 culverts and the top 26 were prioritized (Appendix A). Sediment volumes were surveyed at each of these crossing. Fill volumes were converted to tons of sediment based on a materials density conversion to generate an estimate of tons of sediment contained at the surveyed culvert crossing. A detailed analysis of road/stream crossing fill risk failure was not done that involves modeled flow increases and resultant water height to culvert height to identify flow thresholds where partial or complete fill failure could occur. This was not done for the following reasons. Surveys have demonstrated that most pipes in the NTPA are greatly undersized in relation to channel bank full widths, and thus are at some elevated risk of failure. Also, subsequent analysis has shown that most of these surveyed pipes are also fish passage barriers. So it is believed that by prioritizing and fixing the highest priority fish passage problems and the associated risk of failure, this will have a direct benefit to a primary target of this TMDL planning effort, the coldwater fish species, as well as reducing a potential large sediment source."

4.1.3 Sediment from Stream Bank Instability

Bank erosion is a natural process in streams and can contribute a significant natural load of sediment. However, anthropogenic sources, such as grazing, mining, roads, riparian harvests, or flow modifications can lead to increased bank erosion. Due to the size of the Ninemile TPA and the large number of listed stream miles, a coarse filter approach was used to estimate the sediment load from anthropogenic stream bank instability and to attribute this load to human-caused sediment sources. In the main stem of Ninemile Creek and its listed tributaries, Bank Erosion Hazard Index (BEHI) assessments were conducted on a sample of reaches to assess the potential for bank erosion, and results from sampled reaches were extrapolated to the remainder of the listed streams. The BEHI assessments were based on a slightly modified version of the Rosgen (1996) method to characterize stream bank conditions into numerical indices of bank erosion potential.

The modified BEHI methodology evaluated a stream bank’s inherent susceptibility to erosion as a function of six factors, including:

1. The ratio of stream bank height to bankfull stage.
2. The ratio of riparian vegetation rooting depth to stream bank height.
3. The degree of rooting density.
4. The composition of stream bank materials.
5. Stream bank angle (i.e., slope).
6. Bank surface protection afforded by debris and vegetation.

To determine a yearly sediment load from eroding stream banks in each BEHI category within the sampled reaches, bank retreat rates developed by Rosgen 2001 were utilized (Table 4-1). The rate of erosion was then multiplied by the area of eroding bank (in square feet) to obtain a volume of sediment per year, and then multiplied by the sediment density (i.e., average bulk density of 1.3 grams per cubic centimeter from (USDA, 1998) to obtain a mass of sediment per year.

Table 4-1. Bank Retreat Rates Used for Banks of Varying Severity of Erosion.

Bank Erosion Hazard Condition	Retreat Rate from Rosgen 2001 (ft/yr) – used for A and B channels	Retreat Rate from Rosgen 2001 (ft/yr) – used for C channels
Low	0.045	0.09
Moderate	0.17	0.34
High	0.46	0.7
Severe	0.82	1.2

To derive a total sediment load from eroding stream banks for each of the listed streams in the Ninemile TPA, results of the BEHI analysis were extrapolated from the sampled reaches to the remainder of the channel length. For this purpose, the main stem of Ninemile Creek was divided into 5 assessment reaches based on the results of a 2001 study that identified these reaches as containing largely homogenous vegetative and geomorphic character (Land and Water, 2001). Reach descriptions are provided in Table 4-2. Site visits revealed that Reach 1, the headwaters reach, was largely unaffected by human-caused bank instability and thus it was not included in the assessment of sediment from bank erosion. For reaches 3, 4, and 5, air photo analysis was used to determine the total length of eroding bank, and the BEHI results from the sampled banks were extrapolated to the remainder of each reach based on the results of the air photo assessment. For Reach 2 of Ninemile Creek and for the listed tributaries, narrow stream channels and generally dense riparian vegetation made it impossible to identify eroding banks from air photos. Instead, qualitative site visits were conducted in these stream reaches. The purpose of these site visits was to provide estimates of the total length of each waterbody in which stream bank instability was a potentially significant source of sediment. In the reaches where bank instability was determined to be a significant source of sediment, it was assumed that BEHI results were typical of eroding banks throughout the stream, and the BEHI results were extrapolated on a proportional basis. So, for example, if 1 mile of a stream was inventoried during the BEHI analysis and determined to produce 2 tons of sediment/year, and stream bank instability was determined to be a significant sediment source in 5 miles of the stream, then the estimated sediment load from stream bank instability would be 10 tons/year (5 miles x 2 tons/mile/year). Site visits revealed that Stony Creek and Big Blue Creek contained largely stable banks with little evidence of significant human-caused bank erosion, and thus these streams were not included in the analysis. More details on bank condition are provided in the stream-by-stream discussions in Section 4.5.

Table 4-2. Ninemile Creek Assessment Reach Location Descriptions.

Reach Number	Approximate Location	Reach Length (miles)
1	Headwaters to Beecher Creek	3.61
2	Beecher Creek to Moncure Creek	4.45
3	Moncure Creek to Lower Road 5520 Bridge	5.75
4	Lower Road 5520 Bridge to Upper West Side Bridge	8.74
5	Upper West Side Bridge to Mouth	5.79

The intent of this analysis was to provide an estimate of the sediment load from stream bank instability that was produced by human-induced impacts to the streams and was thus in excess of the natural sediment load that could be expected from stream banks even under pristine conditions.

To facilitate the allocation of the sediment load from stream banks to the proper pollutant source categories, the dominant land use in closest proximity to each eroding bank was recorded during the BEHI inventories and, where applicable, during the air photo assessment. Bank instability in the Ninemile TMDL appears to result primarily from two sources: agriculture and mining. Road encroachment has also resulted in bank instability, particularly along Ninemile Creek, but most of these banks have been riprapped, and thus sediment loading from them substantially reduced; although the riprap may have increased erosion on nearby banks resulting in a potential net increase in total sediment loading.

4.1.4 Channel Alterations, Stream Bank Alterations, and Channel Encroachment

Stream channel alterations, stream bank alterations, and channel encroachment reduce the complexity of in-stream habitat, which is detrimental to coldwater fish that require a diversity of habitat features during different life stages (Meehan, 1991). Stream channel alterations are defined as the straightening of meanders, or cutting through of meander curves, with a new channel of less distance than the original. Stream bank alterations are defined as structural practices, such as riprap, jetties, and dikes, used in an attempt to stabilize stream banks. Channel encroachment is defined as an unnatural confinement or constriction of the stream channel, and an accompanying loss of the stream's access to its natural floodplain and the extent of anthropogenic disturbances along the stream channel.

GIS spatial analysis and field measurements were used to quantify the length of stream affected by road encroachment, the length of riprapped banks, and the length of channel altered by mining for Ninemile Creek and its listed tributaries. This analysis is included as a measure of potential habitat alteration and did not result in a sediment load estimate.

4.1.5 Fish Passage Assessment

Culverts were assessed for fish passage capability on Lolo National Forest in the NTPA in 2003. Culvert assessment methods were standard procedures developed by the USDA Forest Service Region 1 (USDA, 2003). Qualitative fish passage surveys were also conducted simultaneously with stream walk for culverts on private land in the 303(d)-listed tributaries to Ninemile Creek. This analysis is included as a measure of potential habitat alteration and did not result in a sediment load estimate.

4.1.6 Future Development

Potential future developments within the Ninemile watershed were reviewed and potential impacts addressed.

4.2 Results

4.2.1 Natural Erosion Rates, Timber Harvest, the Fires of 2000, and Forest Roads from LoloSED Modeling

Table 4-3 presents a summary of LoloSED modeled estimates of sediment generated from four sources: natural background, timber harvest, fires of 2000, and forest roads. The results are also discussed on a stream-by-stream basis in Section 4.5.

Natural sediment production for the entire Ninemile watershed was estimated at 1,347 tons/year based on the LoloSED model runs, or about 7.3 tons of sediment per square mile of watershed area per year. Based on LoloSed model projections for the years 1994-2015, sediment increases due to timber harvest peaked in 2000 at 120 tons/year, or about 9 percent of the expected natural background levels. Sediment production from timber harvest has declined since then, reaching 26.6 tons/year in 2004. Sediment production in future years, through 2015, is expected to show a declining trend. However, currently unplanned future harvest and road construction activities could increase sediment production beyond the projected levels. Within the listed tributary watersheds, only in Cedar Creek are sediment loads estimated to be elevated above background as a result of timber harvest.

The fires of 2000 burned approximately 17 percent of the Ninemile watershed at varying intensity. Post fire sediment loading was estimated to peak in 2001 at 964 tons/year, or 72 percent of the estimated background sediment load. The fire-related sediment load declined to 373 tons in 2004 and is expect to continue to decline, reaching 3 tons/year in 2015, the last year of the modeling analysis. Of the listed tributary watersheds, only Big Blue Creek was affected by the fires of 2000. The fire-related sediment load in Big Blue Creek was projected to peak in 2001 at 21.8 tons/year, decline to 5.8 tons/year in 2004, and reach less than 1 ton/year in 2015, the last year of the analysis.

Sediment production from forest roads was estimated as the amount of forest road erosion that is delivered to the stream channel on an annual basis according to the LoloSED model. Total sediment production from roads in a watershed depends on road density, road location, and landform erodibility, among other variables. Sediment from forest roads reached a peak of 2,310 in 1994 based on LoloSED model projections for the years 1994-2015. The modeled sediment load from forest roads has declined to 1,187 tons/year in 2004, but is still approximately 88 percent of the natural background load. The sediment load from forest roads is projected to decline modestly to 1,102 tons/year in 2015, the last year of the analysis. Within the listed tributary watersheds, forest roads are major sediment source; with road sediment loads exceeding 40% of background sediment loads in all of the watersheds except Big Blue Creek, where forest roads appear to be only a minor source of sediment.

Table 4-3. Modeled Estimates of Sediment Load from Natural Background Sources, Timber Harvest, and the Fires of 2000 (tons/year).

Watershed	Watershed Size (mi^2)	Background Sediment tons/year and (tons/mi^2)	Sediment from Timber Harvest	Area Burned in 2000 (% of watershed)	Sediment from Fires of 2000 tons/year	Sediment from Forest Roads	Road sediment as a % of background sediment
Big Blue Creek	2.9	18.8 (6.5)	0	77	5.78	1.2	6.4
Josephine Creek	7.0	42.4 (6.1)	0	0	0	20.4	48.1
McCormick Creek[1]	14.8	102.5 (6.9)	0	0	0	167.3	163.2
Kennedy Creek	5.5	40.4 (7.3)	0	0	0	39.3	97.3
Stony Creek	7.1	48.8 (6.9)	0	0	0	29.7	60.9
Cedar Creek	6.1	36.6 (6.0)	2.17	0	0	15.3	41.8
Ninemile Creek	185	1,347 (7.3)	26.6	17	373	1,187	88.1

[1] Includes upper, lower and Little McCormick Creeks.

Table 4-4 presents a summary of estimated road sediment at forest road stream crossings based on the FroSAM method described in Section 4.1.1. The results are also discussed on a stream-by-stream basin in Section 4.5. Appendix B, presents the data that was collected at each crossing, as well as maps showing the crossing locations. As was described in Section 4.2, FroSAM results are not expected to agree with LoloSED predictions of sediment loading from forest roads because the two assessment procedures attempt to quantify different aspects of forest road sediment at different scales and according to different methodologies. Instead, the FroSAM loading estimates are used to prioritize forest road stream crossings for restoration based on their relative sediment contributions. Because stream crossings are typically the most significant sediment sources in a forest road network, they are a primary restoration focus of the Ninemile TMDL and WQRP. Results of the FroSAM analysis are summarized in Table 4-4.

More than 400 potential forest road sediment delivery sites were analyzed on-the-ground as part of this TMDL effort, and 191 sediment contributing stream crossings and near-stream road segments were located and quantified. Results and maps depicting source locations can be found in Appendix B.

Table 4-4. FroSAM Estimates of Sediment Load from Forest Road Stream Crossings.

Watershed	Watershed Size (mi^2)	Miles of Roads	Road Density (mi/mi^2)	# of Potential Crossings[1]	Sediment Load (tons/year)
Big Blue Creek	2.9	2.7	1.0	2	4.9
Josephine Creek	7.0	14.7	2.1	14	4.4
McCormick Ck[2]	14.8	61.5	4.2	28	19.8
Kennedy Creek	5.5	19.5	3.6	9	32.0
Stony Creek	7.1	20.9	3.0	7	37.7
Cedar Creek	6.1	6.3	1.0	3	1.5
Ninemile Creek	185	581	3.1	407	676

[1]Based on GIS road and stream layers. Some crossings that appear on GIS layers do not actually exist on the ground.
[2] Includes upper, lower and Little McCormick Creeks.

4.2.2 Potential Sediment Risk from Culvert Failures

The potential sediment load from culvert failure was evaluated at the 26 culverts in the Ninemile watershed that are the highest priority for replacement based on fish passage concerns. The estimated potential sediment load from these culverts is 21,546 tons. One of these culverts is in the Cedar Creek watershed and has an estimated potential sediment load of 315 tons. Another of the culverts is in Josephine Creek, representing a sediment risk of 519 tons. Four of the culverts are in the Stony Creek watershed and represent a potential sediment load of 473 tons. None of the other listed watersheds contain one of the 26 highest priority culverts, so no potential sediment load is available; however culverts exist in all of these watersheds and thus remain an unquantified source of potential sediment.

4.2.3 Stream Bank Erosion

As discussed in Section 4.1.3, stream bank erosion was determined to be a potentially significant source of sediment in 4 of 5 reaches of Ninemile Creek (see Table 4-2 for reach location descriptions) and in portions of several of the listed tributary streams, including Josephine, Kennedy, Little McCormick, McCormick, and Cedar Creeks. Qualitative site visits to Stony and Big Blue Creek and to the headwaters of Ninemile Creek (Reach 1 in Table 4-2) suggested that human-caused bank erosion was not a significant source of sediment and thus bank-related sediment loads were not calculated for these stream reaches. More detail on bank condition is provided in the stream-by-stream discussions beginning in Section 4.5.

Bank erosion was estimated to be a major source of sediment in Ninemile Creek, resulting in a sediment load of 8,240 tons/year. Of this, 2,039 tons/year appeared to result from historic placer mining impacts, located entirely within Reach 2. The remaining 6,201 tons/year appear to result predominately from agricultural sources in Reaches 3, 4, and 5.

In the tributary watersheds, impacts from mining are the primary source of sediment from unstable streams banks, resulting in 699 tons/year in Josephine Creek, 719 tons/year in Kennedy

Creek, 503 tons/year in Little McCormick Creek, and 1,337 tons/year in McCormick Creek. In Cedar Creek, agricultural source were estimated to result in a bank-related sediment load of 88 tons/year. Results of the bank erosion assessment are summarized in Table 4-5.

Table 4-5. Estimates of Bank Erosion Sediment Loads and Sources.

Stream Name	Sediment Load from Bank Erosion	Primary Source
Ninemile Creek Reach 2	2,039	Mining
Ninemile Creek Reach 3	507	Agriculture
Ninemile Creek Reach 4	1,347	Agriculture
Ninemile Creek Reach 5	4,347	Agriculture
Ninemile Creek Total	8,240	See reach descriptions
Josephine Creek	699	Mining
Kennedy Creek	719	Mining
Little McCormick Creek	503	Mining
McCormick Creek	1,337	Mining
Cedar Creek	88	Agriculture

4.2.4 Channel Alterations, Stream Bank Alterations, and Channel Encroachment

The forest road network was one of the major sediment sources for which sediment loads were calculated (Section 4.2.1). The road network can also play a significant roll in habitat alteration. Roads in close proximity to stream channels can impede proper channel function, reduce shade and increase temperatures, and decrease the supply of large woody debris to channels (Meehan, 1991). For the purposes of this analysis, road encroachment was defined as a road within 100 feet of a stream channel. In the Ninemile TPA, encroachment of roads on stream channels is a relatively minor impact in several of the listed watersheds, including Big Blue, Josephine, Stony, and Cedar Creeks. In several other watersheds, including McCormick Creek, Kennedy Creek, and Ninemile Creek, road encroachment is a potentially significant source of habitat degradation. In McCormick and Kennedy Creeks, road encroachment exceeds 20% of the channel length. At some places in the Kennedy Creek watershed, the road is only a few feet from the stream, and in at least one location the stream has eroded the base of the road causing it to fail. Roads encroach to within 100 feet of Ninemile Creek along approximately 8% of its length. Ninemile Creek is a meandering Rosgen C-type channel that if left unimpeded would naturally migrate back and forth across its floodplain; road encroachment can prevent this from happening. Much of the nearly 1 mile of riprapped banks that occur on the Ninemile result from attempts to harden banks in order to save roads from stream meandering.

Placer and/or load mining on Josephine, McCormick (including Little McCormick), Kennedy, and Ninemile Creeks has had a significant effect on channel conditions. Through much of the mined area in these streams, the channels are confined by high tailings piles that restrict the lateral migration of the channel. According to Wohl (2000):

Placer mining that disrupts a course, stable channel bed-surface may increase sediment mobility and preferential transport of fine sediments, leading to downstream aggradation and bank instability associated with braiding…. If the erosional resistance of the channel banks is lowered through the disruption associated with mining, the channel often become latterly unstable, repeatedly shifting back and forth across the valley bottom in a braided pattern…. In contrast, *where mined channels are closely constrained by bedrock valley walls, as in many mountain canyons, the channel may respond to increased sediment primarily through changes in bed configuration and slope.*

More details on mining impact are presented in the stream-by-stream discussions in Section 4.5. Table 4-6 below summarizes channel alterations, stream bank alterations and channel encroachment in the NTPA.

Table 4-6. Channel Alterations, Stream Bank Alterations, and Channel Encroachment.

	Stream Length (miles)	Length of roads within 100 feet of stream(miles)	% of stream length w/ roads within 100 ft	Length of riprap (miles)	% of bank length riprapped	Length of Mining Impacts (miles)	% of stream length impacted by mining
Big Blue Creek	4.59	0.16	3	0	0	0	0
Josephine Creek	4.42	0.21	5	0	0	2.0	45
McCormick Creek[1]	7.76	1.63	21	0	0	2.2	28
Kennedy Creek	5.65	1.80	32	0	0	1.7	30
Stony Creek	7.09	0.25	4	0.1	0.7	0	0
Cedar Creek	4.42	0.16	4	0	0	0	0
Ninemile Creek	31.59	2.40	8	0.98	2	3.9	12

[1] Includes Little McCormick Creek and upper and lower McCormick Creek.

4.2.5 Fish Passage Assessment

Of the 83 culverts assessed throughout the Ninemile Watershed, nearly 50 pose passage problems for fish. Detailed results of the fish passage assessment are presented in Appendix A.

4.2.6 Future Development

Future developments within the Ninemile TPA may have a negative impact on beneficial use support of coldwater fisheries and aquatic life. Potential future development includes timber harvest, agriculture, road construction and maintenance, mining, subdivision development, and increased recreational pressure. Future developments should consider the potential negative impacts on coldwater fisheries and aquatic life. Negative impacts to be avoided include road encroachment and the addition of riprap, placement of culverts that act as fish passage barriers and the removal of large woody debris and riparian vegetation. Other negative impacts with the potential to increase sediment and thermal loads may arise on a site-specific basis. Future developments should proceed only after potential negative impacts to water quality have been addressed and mitigation plans developed.

4.2.7 Sediment Source Assessment Summary

Table 4-7 summarizes the estimated sediment loads for each of the listed streams in the Ninmile TPA. As was reported in Section 3.4, the Lolo National Forest monitored suspended sediment transport at the mouth of Ninemile Creek between March and September of 1990, 91, and 92. Although the monitoring was not year round, it included the runoff period and thus probably captured most of the sediment transport that occurred in these years. The load in 1990 was 12,118 tons, comparing favorably to the total estimated load presented in Table 4-7 of 11,174/tons/year for the Ninemile watershed in 2004. Although conditions in the Ninemile TPA undoubtedly changed in the 14 intervening years, the LNF's 1990 sediment monitoring results suggest that the sediment load estimates calculated for the TMDLs presented in this document are reasonable approximations of potential sediment loads in the watershed. In 1991 and 1992, the LNF estimates of sediment loading at the mouth of Ninemile Creek were much lower -- 3,870 and 702 tons/year respectively, demonstrating the extreme variability in annual sediment loading in the watershed.

Table 4-7. Sediment Source Assessment Summary (tons/year).

	Background	**Timber Harvest**	**Fires of 2000**	**Forest Roads**		**Agriculture[2]**	**Mining[2]**	**Total[3]**
				LoloSed	**FroSAM**			
Big Blue Creek	18.8	0	77	1.2	4.9	0	0	97
Josephine Creek	42.4	0	0	20.4	4.4	0	699	859
McCormick Creek[1]	14.8	0	0	167.3	19.8	0	1,504	1686
Kennedy Creek	5.5	0	0	39.3	32.0	0	719	764
Stony Creek	7.1	0	0	29.7	37.7	0	0	37
Cedar Creek	6.1	2.2	0	15.3	1.5	88	0	112
Ninemile Creek	1,347	26.6	373	1,187	667	6,201	2,039	11,174

[1] Includes upper and lower McCormick Creek and Little McCormick Creek.
[2] Based on stream bank erosion estimates
[3] Using Lolo Sed road estimates

4.3 Metals assessment Methods

The 1996 303(d) list reported that the aquatic life and cold water fishery beneficial uses in Kennedy Creek were only partially supported as a result, in part, of high concentrations of metals, including copper, lead, zinc, and mercury. The 1996 303(d) list also indicated that the drinking water beneficial use in Little McCormick Creek was only partially supported. Although the rationale for this listing could not be determined, it was assumed for this report that measured or suspected high concentrations of metals were at least part of the reason. In 2002, the 303(d) status of both streams was updated. DEQ determined that because of high metals concentrations, the aquatic life, cold-water fishery, and drinking water beneficial uses were not supported in Kennedy Creek. In Little McCormick Creek, DEQ determined that it did not have sufficient credible data with which to make a beneficial use determination.

Metals monitoring was conducted as part of TMDL development in the Ninemile TPA in all of the streams that have ever appeared on the 303(d) list for any reason. This monitoring confirmed that metals concentrations exceed state standards in Kennedy Creek on some occasions and thus a metals TMDL has been developed and is presented below in Section 4.6. No violations of state water quality standards were detected in Little McCormick Creek, and thus no TMDL has been developed for metals in this waterbody. Instead, additional water quality monitoring has been proposed in the monitoring plan described in Section 6.3. The concentration of copper was above state standards on one occasion in Josephine Creek, but subsequent monitoring revealed no additional violations. Additional copper monitoring in Josephine Creek has been included in the monitoring plan presented in Section 6.3. Metals concentrations were below state standards in all of the other listed streams in the Ninemile TPA. Metals sampling results are discussed in more detail in the stream-by-stream data review in Section 3.0.

4.4 Water Quality Goals and Restoration Targets

As noted in Section 3.0, DEQ is required to assess the waters for which TMDLs have been completed to determine whether compliance with water quality standards has been attained. The process by which this will be accomplished is discussed in Section 3.3 (Targets and Supplemental Indicators Applied as Water Quality Goals) and is shown in Figure 3-1. The sediment targets listed in Table 3-6 are proposed as the thresholds against which compliance with water quality standards will be measured in the Ninemile TPA. If all the target threshold values are met, it will be assumed that beneficial uses are fully supported and water quality standards have been achieved. Alternatively, if one or more of the target threshold values are exceeded, it will be assumed that beneficial uses are <u>not</u> fully supported and water quality standards have <u>not</u> been achieved. However, it will not be automatically assumed that implementation of this TMDL was unsuccessful just because one or more of the target threshold values have been exceeded. The circumstances around the exceedance will be investigated. For example, the exceedance might be a result of natural causes such as floods, drought, fire or the physical character of the watershed. In addition, in accordance with MCA 75-5-703(9), an evaluation will be conducted to determine whether:

- The implementation of a new or improved suite of control measures is necessary;
- More time is needed to achieve water quality standards;
- Revisions to components of the TMDL are necessary; or
- Changes in land management practices occur.

Targets for the sediment-listed streams in the Ninemile TPA are presented in Section 3.3 on a stream-by-stream basis. However, the following “water quality goals” are the primary basin-wide objectives of this restoration project. These goals would be achieved through implementation efforts outlined in this restoration plan included in this report.

1. Ensure protection of all streams within the Ninemile TPA, with the intent of avoiding any future impairment conditions and ultimately reducing the overall threat of an impairment to any beneficial use;
2. Ensure full recovery of aquatic life beneficial uses to all impaired and threatened streams within the Ninemile TPA;

3. Avoid conditions where additional water bodies within the Ninemile TPA become impaired;
4. Work with landowners and other stakeholders in a cooperative manner to ensure implementation of water quality protection activities; and
5. Continue to monitor conditions in the watershed to identify any additional impairment conditions, track progress toward protecting water bodies in the watershed, and provide early warning if water quality starts to deteriorate.

These goals are further developed as part of the Restoration Strategy and Monitoring Plan sections of this document (Sections 5.0 and 6.0). To help define measurable objectives toward meeting Goals 1 through 3, numeric targets are developed within previous sections of the document. These targets are meant to reflect those conditions that need to be satisfied to ensure protection and/or recovery of beneficial uses. Goals 4 and 5 are designed to ensure cooperation exists among all parties involved.

A secondary objective of the restoration plan is to improve the connectivity of aquatic habitats throughout the watershed. This would be accomplished by correcting fish passage barriers at stream crossing culverts as outlined in Section 5.0.

4.5 Waterbody Specific Discussions

The following sections provide stream-by-stream results of the sediment source assessment, as well as sediment TMDLs, and allocations.

4.5.1 Big Blue Creek

4.5.1.1 Sediment Source Assessment Results

4.5.1.1.1 Natural Erosion Rates, Timber Harvest, the Fires of 2000, and Forest Roads

As was described in Section 4.1.1, sediment from natural background sources, timber harvest, the fires of 2000, and forest roads was evaluated via LoloSED modeling. Sediment from forest roads was also evaluated at stream crossings via an on-the-ground assessment that was described in Section 4.1.2.

Natural background sediment was estimated to be 18.8 tons/year. Modeled estimates of sediment from timber harvest were zero tons/year, as little recent timber harvest has occurred in the Big Blue Creek watershed. The fires of 2000 burned approximately 77 percent of the watershed and are estimated currently to contribute 5.78 tons/year. The fire related sediment load is expected to drop to almost zero by 2015. Sediment from forest roads was estimated by LoloSED to be 1.2 tons/year, or approximately 6.4% of the natural background sediment load (Table 4-8). The FroSAM analysis predicted an annual sediment delivery of 4.9 tons/year at stream crossings. As described in Section 4.2.1, the FroSAM results are not directly comparable to the LoloSED results, but are included as a way to prioritize restorations efforts (Section 5.2). Increased peak flows and water yields in the watershed as a result of the fires of 2000 may have a potentially significant impact on sediment load in the watershed. The post-burn EIS analysis predicted that the 5-year peak flow would increase from 7 to 17 cfs, a 143% increase, and the 10-year peak flow would increase from 18 to 33 cfs, an 83% increase. Given that the ECA in the watershed is 78% and that most of this results from the fires of 2000, the fires are likely to increase water yield as well as peak flows.

Table 4-8. Big Blue Creek Sediment Source Assessment Results.

Watershed Size (mi^2)	Background Sediment tons/year	Sediment from Timber Harvest	Fires of 2000: Area Burned (% of watershed)	Fires of 2000: Sediment tons/year		Forest Roads: Miles of Roads	Forest Roads: # of Potential Crossings[1]	Forest Roads: Road Density (mi/mi^2)	Forest Roads: Sediment from Forest Roads (tons/year)	
2.9	18.8	0	77	5.78	2004	2.7	2	1.0	4.9	FroSAM
				0.76	2010				1.2	Lolo Sed
				0.69	2015					

[1] Based on GIS road and stream layers. Some crossings that appear on GIS layers do not actually exist on the ground.

4.5.1.1.2 Potential Sediment Risk from Culvert Failures

The Lolo National Forest analyzed the risk of potential sediment delivery from culvert failure at the 26 highest priority fish passage barrier culverts in the Ninemile TPA. None of the culverts in the Big Blue Creek watershed were included in this analysis, and thus culvert failure remains an unquantified source of potential sediment delivery. Additional culvert analysis is proposed in the monitoring plan in Section 6.2.

4.5.1.1.3 Stream Bank Instability

Big Blue Creek was listed, in part, due to habitat alterations resulting from agricultural and range sources. As part of the sediment source assessment for Big Blue Creek, a qualitative evaluation of agricultural impacts was conducted as part of the stream bank erosion sediment load assessment. Stream banks within the watershed are generally stable. Big Blue Creek is a small stream that is typically less then 10 feet wide, and banks are low and well vegetated (Photo 4-1). Although some minor sediment load from agricultural and/or range impacts may exist in the watershed, the sources of this load were not identified during source assessment fieldwork and the load was not quantified.

Photo 4-1. Typical Stream Bank Conditions in Big Blue Creek.

4.5.1.1.4 Channel Alterations, Stream Bank Alterations, and Channel Encroachment

There are approximately 0.16 miles of roads within 100 feet of the Big Blue Creek channel, which represents about 3% of the channel length. No riprap or mining impacts were located during the assessment.

4.5.1.1.5 Fish Passage Assessment

Two major crossings that were fish passage barriers, one on the Foothills Road, Rd 5498, and the other on the main 412 Ninemile Road have been replaced with bridges and the channels reconstructed to provide fish passage. No other fish barriers are known to exist in the watershed.

4.5.1.2 Source Summary

Currently, the major sources of sediment in the Big Blue Creek watershed are natural background sources and the fires of 2000. Relative to these sources, anthropogenic caused sediment loading is small, representing 5 percent of the total sediment load, all of it from forest roads (Table 4-9). Sediment loading is a dynamic process, and changes with harvest activities, fire, forest growth, precipitation/discharge, and other variables in the watershed. Current sources of sediment are not always correlated with current in-stream sediment. In the past, sediment loads may have been higher because of roads, timber harvest, or agriculture. At that time, a high sediment load may have been delivered to the stream, and may still remain in the stream today. In-stream sediment may take years to “flush out” of the system. Therefore there is not necessarily a direct correlation between the current sediment load or current sediment sources of sediment and the measured substrate condition in a stream. However, there does not appear to be a link between current anthropogenic sources of sediment and the in-stream sediment load, as current anthropogenic sources of sediment are low relative to natural sources. Furthermore, as discussed in Section 3.3, the suite of targets and supplemental indicators for Big Blue Creek suggests that beneficial uses are being supported in the watershed. For these reasons, no TMDL will be developed for Big Blue Creek, but a monitoring plan will still be implemented as an additional margin of safety.

Table 4-9. Big Blue Creek Sediment Load Summary.

Sediment Source	Sediment Load (tons/yr)	Sediment Load (%)
Background	18.8	73
Timber Harvest	0	0
Agriculture (bank erosion)	0	0
Fire	5.78	22
Roads	1.2	5
Total	**25.78**	**100**

4.5.1.3 Existing Roads

Although no TMDL will be developed for Big Blue Creek, all reasonable soil and water conservation practices should still be applied to human caused sediment sources in the watershed. As described above, forest roads resulted in an estimated 1.2 tons/year of sediment loading to Big Blue Creek. To address this sediment source, a road sediment reduction target has been set at 57 percent, representing a reduction of 0.68 tons of sediment per year, and resulting in a post-restoration sediment load of 0.52 ton/year from roads. This road sediment reduction was calculated using the FroSAM road assessment methodology described in Section 4.1.1, and represents the estimated sediment load that would remain once all contributing road treads, cut slopes, and fill slopes were reduced to the maximum of 200 feet. Two hundred feet was selected as an example to illustrate the potential for sediment reduction and is not a formal goal of the WQRP. Although the FroSAM analysis was used to estimate the potential for road sediment reduction in the Big Blue Creek watershed, achieving this reduction in sediment loading from road may be occur through a variety of methods.

4.5.2 Josephine Creek

4.5.2.1 Sediment Source Assessment Results

4.5.2.1.1 Natural Erosion Rates, Timber Harvest, the Fires of 2000, and Forest Roads

As was described in Section 4.1.1, sediment from natural background sources, timber harvest, the fires of 2000, and timber harvest (overland flow) and forest roads was evaluated via LoloSED modeling. Sediment from forest roads was also evaluated at stream crossings via an on-the-ground assessment that was described in Section 4.1.1.

Natural background sediment was estimated to be 42.4 tons/year. Modeled estimates of sediment from timber harvest were zero tons/year, as little recent timber harvest has occurred in the

Josephine Creek watershed. The fires of 2000 did not affect the area. Sediment from forest roads was estimated by LoloSED to be 20.4 tons/year, or approximately 48.1% of the natural background sediment load (Table 4-10). The FroSAM analysis predicted an annual sediment delivery of 4.4 tons/year at stream crossings. As described in Section 4.2.1, the FroSAM results are not directly comparable to the LoloSED results, but are included as a way to prioritize restorations efforts (Section 5.0).

Table 4-10. Josephine Creek Sediment Source Assessment Results.

<table>
<tr><th rowspan="2">Watershed Size (mi^2)</th><th rowspan="2">Background Sediment tons/year</th><th rowspan="2">Sediment from Timber Harvest</th><th colspan="2">Fires of 2000</th><th colspan="5">Forest Roads</th></tr>
<tr><th>Area Burned (% of watershed)</th><th>Sediment tons/year</th><th>Miles of Roads</th><th># of Potential Crossings[1]</th><th>Road Density (mi/mi^2)</th><th colspan="2">Sediment from Forest Roads (tons/year)</th></tr>
<tr><td rowspan="2">7.0</td><td rowspan="2">42.4</td><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">14.7</td><td rowspan="2">14</td><td rowspan="2">2.1</td><td>4.4</td><td>FroSAM</td></tr>
<tr><td>20.4</td><td>Lolo Sed</td></tr>
</table>

[1] Based on GIS road and stream layers. Some crossings that appear on GIS layers do not actually exist on the ground.

4.5.2.1.2 Potential Sediment Risk from Culvert Failures

The Lolo National Forest analyzed the risk of potential sediment delivery from culvert failure at the 26 highest priority fish passage barrier culverts in the Ninemile TPA. The culvert at the road 890 crossing of Josephine Creek represents a potential sediment load of 519 tons if the culvert completely failed. Refer to Appendix A for details. Additional potential sediment load may exist at culverts that were not among the 26 high fish passage priorities, and thus sediment risk from culvert failure has been only partially quantified. Culvert analysis is included in the proposed monitoring plan in Section 6.2.

4.5.2.1.3 Stream Bank Instability

A sediment load of 699 ton/year was estimated from human-caused stream bank erosion. All 699 tons/year was attributed to mining, which has impacted approximately 2 miles of Josephine Creek, or approximately 45 percent of the total stream length. Throughout most of the mined reach, large piles of mine tailings line the stream and prevent channel migration. Although the tailings are revegetated in places, widespread bank instability persists, and in-stream habitat has been simplified by a lack of woody debris recruitment. In some reaches, the mining-induced coarsening of the stream substrate results in subterranean flow during the summer. Typical conditions within the mined reaches of Josephine Creek are presented in Photos 4-2 and 4-3.

Photo 4-2. Typical Conditions in Mined Sections of Josephine Creek.

Photo 4-3. Typical Conditions in Mined Sections of Josephine Creek.

4.5.2.1.4 Channel Alterations, Stream Bank Alterations, and Channel Encroachment

As described above, approximately 2 miles of Josephine Creek has been altered by placer mining. Additionally, 0.21 miles of road encroach to within 100 feet of the stream, a distance equal to approximately 5 percent of the stream's length.

4.5.2.1.5 Fish Passage Assessment

DEQ noted during its assessment of Josephine Creek that the culvert on the Ninemile Road is a probably fish barrier. The Lolo National Forest has reported that a fish passage barrier exists in the SWSW 1/4 of section 35 on Forest Rd 890. The road is closed at the point of crossing due to mass instability on the valley sides.

4.5.2.2 Source Summary

Currently, sediment sources in the Josephine Creek watershed are dominated by mining, which account for nearly 92 percent of the sediment load. Natural background sources account for the next largest fraction, 5.6 percent, and forest road account for an additional 2.7 percent. Results are summarized below in table 4-11.

Table 4-11. Josephine Creek Sediment Load Summary.

Sediment Source	Sediment Load (tons/yr)	Sediment Load (%)
Background	42.4	5.6
Timber Harvest	0	0
Mining	699	91.7
Fire	0	0
Roads (LoloSed)	20.4	2.7
Total	**761.8**	**100**

4.5.2.3 TMDL and Allocations

A TMDL is composed of the sum of individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this definition is denoted by the equation:

$$\textbf{TMDL} = \textbf{WLAs} + \textbf{LAs} + \textbf{MOS}$$

There are no point sources of sediment in the Josephine Creek watershed; therefore, that variable can be removed from the equation. The primary human-caused sediment sources in the watershed appear to be placer mining and forest roads. The TMDL for Josephine Creek will be expressed as a 92.8% reduction in total sediment loading. This will be achieved by a 39% reduction in the forest road sediment load and a 100% reduction in loading from mining, resulting in a future total load of 54.8 tons/year. The uncertainties with this are further discussed in Section 4.7.

The TMDL and allocations are summarized in Table 4-12 and are described in more detail in the following paragraphs. The proposed restoration and adaptive management strategy is presented in Section 6.5.

Table 4-12. TMDL and Load Allocations for Sediment in Josephine Creek.

Sources	Current Load (tons/yr)		Reduction	Allocation (tons/yr or approach)
Point Sources (WLA)	0		NA	0
Anthropogenic Nonpoint Sources (LA)	**Background**	42.4	None	42.4: Not controllable
	Existing Roads	20.4	39% 8 tons/yr	12.4
	Historic/Current Harvest	0	NA	0
	Mining	699	100% 699 tons/yr	0
	Future Roads and Harvest	Not Specified	Not Specified	No sediment loading increases other than potential minor predicted short-term increases associated with 100% compliance with applicable BMP standards.
	Total Current Load	**761.8**	**TMDL**	**54.8 tons/year**, a 92.8% reduction.

4.5.2.3.1 Existing Road Allocation

As was presented in Table 4-3, forest roads resulted in an estimated 20.4 tons/year of sediment loading to Josephine Creek. To address this sediment source, a road sediment reduction goal has been set at 39 percent, representing a reduction of 8 tons of sediment per year. This road sediment reduction was calculated using the FroSAM road assessment methodology described in Section 4.1.1, and represents the estimated sediment load that would remain once all contributing road treads, cut slopes, and fill slopes were reduced to the maximum of 200 feet. Two hundred feet was selected as an example to illustrate the potential for sediment reduction and is not a formal goal of the WQRP. Although the FroSAM analysis was used to estimate the potential for road sediment reduction in the Josephine Creek watershed, the proposed reduction in sediment loading from roads may be achieved through a variety of methods.

4.5.2.3.2 Mining Allocation

As described in Section 4.2.3, accelerated stream bank erosion resulting from historic placer mining appears to dominate the sediment load to Josephine Creek. The mined sections of the stream will require complete geomorphic and vegetative restoration if sediment loads are to be reduced in the near future. However, once such restoration is competed, and assuming that no additional mining occurs, sediment loads could be expected to return to normal once riparian plant communities have reached maturity on the restored stream banks, thus the proposed reduction is 100%. Without active restoration, sediment loads will decline naturally over time, but recovery may take decades or more to achieve.

4.5.2.3.3 Future Roads and Harvest Allocation

It is not reasonable to assume that there will be no future silviculture activities in the Josephine Creek watershed. An allocation is therefore required to account for potential future sediment loading. This allocation proposes no future sediment loading increases associated with harvest and/or forest roads other than potential minor, short-term increases that may be predicted and associated with 100 percent compliance with the applicable best management practice (BMP) standards.

4.5.3 McCormick Creek

On the 303(d) list, DEQ treats Little McCormick, upper McCormick, and lower McCormick Creeks as separate waterbodies. Because these streams are within the same watershed, a single TMDL and watershed restoration plan has been developed.

4.5.3.1 Sediment Source Assessment Results

4.5.3.1.1 Natural Erosion Rates, Timber Harvest, the Fires of 2000, and Forest Roads

As was described in Section 4.1.1, sediment from natural background sources, timber harvest, the fires of 2000, and timber harvest (overland flow) and forest roads was evaluated via LoloSED modeling. Sediment from forest roads was also evaluated at stream crossings via an on-the-ground assessment that was described in Section 4.1.2.

Natural background sediment was estimated to be 102.5 tons/year. Modeled estimates of sediment from timber harvest were zero tons/year, as little recent timber harvest has occurred in the McCormick Creek watershed. The fires of 2000 did not affect the area. Sediment from forest roads was estimated by LoloSED to be 167.3 tons/year, or approximately 163% of the natural background sediment load (Table 4-13). The FroSAM analysis predicted an annual sediment delivery of 19.8 tons/year at stream crossings. As described in Section 4.2.1, the FroSAM results are not directly comparable to the LoloSED results, but are included as a way to prioritize restorations efforts (Section 5.0).

Table 4-13. McCormick Creek Sediment Source Assessment Results.

Watershed Size (mi^2)	Background Sediment tons/year	Sediment from Timber Harvest	Fires of 2000		Forest Roads				
			Area Burned (% of watershed)	Sediment tons/year	Miles of Roads	# of Potential Crossings[1]	Road Density (mi/mi^2)	Sediment from Forest Roads (tons/year)	
14.8	102.5	0	0	0	62	28	4.2	19.8	FroSAM
								167.3	Lolo Sed

[1] Based on GIS road and stream layers. Some crossings that appear on GIS layers do not actually exist on the ground.

4.5.3.1.2 Potential Sediment Risk from Culvert Failures

The Lolo National Forest analyzed the risk of potential sediment delivery from culvert failure at the 26 highest priority fish passage barrier culverts in the Ninemile TPA. While none of the culverts in the McCormick Creek watershed fell into the priority list of 26 culverts, there are two (Little McCormick road 4213 and McCormick road 392) that have the potential to contribute sediment loads in the future. However, culvert failure remains an unquantified source of sediment delivery. Additional culvert analysis is proposed in the monitoring plan in Section 6.2.

4.5.3.1.3 Stream Bank Instability

A sediment load of 1,840 tons/year was estimated from human-caused stream bank erosion (503 from Little McCormick Creek and 1,337 from McCormick Creek). All 1,840 tons/year was attributed to mining, which has impacted approximately 2.2 miles of McCormick and Little McCormick Creeks, or approximately 28 percent of the their combined stream length. Throughout most of the mined reach, large piles of mine tailings line the stream and prevent channel migration. Although the tailings are revegetated in places, widespread bank instability persists, and in-stream habitat has been simplified by a lack of woody debris recruitment. In some reaches of Little McCormick Creek, the mining-induced coarsening of the stream substrate results in subterranean flow during the summer. Typical conditions within the mined reaches of McCormick and Little McCormick Creeks are presented in Photos 4-4 and 4-5.

Photo 4-4. Typical Conditions in Mined Sections of Little McCormick Creek.

Photo 4-5. Typical Conditions in Mined Sections of McCormick Creek.

4.5.3.1.4 Channel Alterations, Stream Bank Alterations, and Channel Encroachment

As described above, approximately 2.2 miles of McCormick and Little McCormick Creeks have been altered by placer mining. Additionally, 1.63 miles of road encroach to within 100 feet of the stream, a distance equal to approximately 21 percent of the stream's length.

4.5.3.1.5 Fish Passage Assessment

According to the Lolo National Forest, there is a fish passage barrier on an unnamed tributary to McCormick Creek on forest road 392 in section 1 SWSW ¼, which is owned by the Plum Creek Timber Company. It is not know if this section of stream supports fish at this time. The crossing at the Little McCormick Creek confluence is often de-watered from the mining disturbance upstream, and the pipe is partially blocked by alluvium and may be a passage barrier. Depth and flow connectivity are likely a problem under low flow conditions. The are also several fish barriers in Little McCormick Creek as a result of old mining dams (Photo 4-6).

Photo 4-6. Fish Passage Barrier in Little McCormick Creek.

4.5.3.2 Source Summary

Currently, sediment sources in the McCormick Creek watershed are dominated by mining, which account for nearly 91 percent of the sediment load. Forest roads account for the next largest fraction, 8.3 percent, and natural background sources account for an additional 0.7 percent. Results are summarized below in Table 4-14.

Table 4-14. McCormick Creek Sediment Load Summary.

Sediment Source	Sediment Load (tons/yr)	Sediment Load (%)
Background	14.8	0.7
Timber Harvest	0	0
Mining	1,840	91
Fire	0	0
Roads (LoloSed)	167.3	8.3
Total	**2,022**	**100**

4.5.3.3 TMDL and Allocations

A TMDL is composed of the sum of individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this definition is denoted by the equation:

TMDL = WLAs + LAs + MOS

There are no point sources of sediment in the McCormick Creek watershed; therefore, that variable can be removed from the equation. The primary human-caused sediment sources in the watershed appear to be placer mining and forest roads. The TMDL for McCormick Creek will be expressed as a 92.2% reduction in total sediment loading. This will be achieved by a 63% reduction in the forest road sediment load and a 100% reduction in loading from mining, resulting in a future total load of 164.5 tons/year. The uncertainties with this are further discussed in Section 4.7.

The TMDL and allocations are summarized in Table 4-15 and are described in more detail in the following paragraphs. The proposed restoration and adaptive management strategy is presented in Section 6.5.

Table 4-15. TMDL and Load Allocations for Sediment in McCormick Creek.

Sources	Current Load (tons/yr)		Reduction	Allocation (tons/yr or approach)
Point Sources (WLA)	0		NA	0
Anthropogenic Nonpoint Sources (LA)	**Background**	102.5	None	102.5: Not controllable
	Existing Roads	167	63% 105 tons/yr	62
	Historic/Current Harvest	0	NA	0
	Mining (bank erosion)	1,840	100% 1,840 tons/yr	0
	Future Roads and Harvest	Not Specified	Not Specified	No sediment loading increases other than potential minor predicted short-term increases associated with 100% compliance with applicable BMP standards.
	Total Current Load	2,110	**TMDL**	**164.5 tons/year,** a 92.2% reduction.

4.5.3.3.1 Existing Road Allocation

As was presented in Table 4-3, forest roads were resulted in an estimated 167 tons/year of sediment loading to McCormick Creek. To address this sediment source, a road sediment reduction target has been set at 63 percent, representing a reduction of 105 tons of sediment per year. This road sediment reduction was calculated using the FroSAM road assessment methodology described in Section 4.1.1, and represents the estimated sediment load that would remain once all contributing road treads, cut slopes, and fill slopes were reduced to the maximum of 200 feet. Two hundred feet was selected as an example to illustrate the potential for sediment reduction and is not a formal goal of the WQRP. Although the FroSAM analysis was used to estimate the potential for road sediment reduction in the McCormick Creek watershed, the proposed reduction in sediment loading from roads may be achieved through a variety of methods.

4.5.3.3.2 Mining Allocation (Bank Erosion)

As described in Section 4.2.3, accelerated stream bank erosion resulting from historic placer mining appears to dominate the sediment load to McCormick and Little McCormick Creeks. The mined sections of the stream will require complete geomorphic and vegetative restoration if sediment loads are to be reduced in the near future. However, once such restoration is competed, and assuming that no additional mining occurs, sediment loads could be expected to return to normal once riparian plant communities have reached. Without active restoration, sediment loads will decline naturally over time, but recovery may take decades or more to achieve.

4.5.3.3.3 Future Roads and Harvest Allocation

It is not reasonable to assume that there will be no future silviculture activities in the McCormick Creek watershed. An allocation is therefore required to account for potential future sediment loading. This allocation proposes no future sediment loading increases associated with harvest and/or forest roads other than potential minor, short-term increases that may be predicted and associated with 100 percent compliance with the applicable best management practice (BMP) standards.

4.5.4 Kennedy Creek

4.5.4.1 Sediment Source Assessment Results

4.5.4.1.1 Natural Erosion Rates, Timber Harvest, the Fires of 2000, and Forest Roads

As was described in Section 4.1.1, sediment from natural background sources, timber harvest, the fires of 2000, and timber harvest (overland flow) and forest roads was evaluated via LoloSED modeling. Sediment from forest roads was also evaluated at stream crossings via an on-the-ground assessment that was described in Section 4.1.2.

Natural background sediment was estimated to be 40.0 tons/year. Modeled estimates of sediment from timber harvest were zero tons/year, as little recent timber harvest has occurred in the Kennedy Creek watershed. The fires of 2000 did not affect the area. Sediment from forest roads was estimated by LoloSED to be 39.3 tons/year, or approximately 97% of the natural background sediment load (Table 4-16). The FroSAM analysis predicted an annual sediment delivery of 32.0 tons/year at stream crossings. As described in Section 4.2.1, the FroSAM results are not directly comparable to the LoloSED results, but are included as a way to prioritize restorations efforts (Section 5.0).

Table 4-16. Kennedy Creek Sediment Source Assessment Results.

Watershed Size (mi^2)	Background Sediment tons/year	Sediment from Timber Harvest	Fires of 2000		Forest Roads				
			Area Burned (% of watershed)	Sediment tons/year	Miles of Roads	# of Potential Crossings[1]	Road Density (mi/mi^2)	Sediment from Forest Roads (tons/year)	
5.5	40.4	0	0	0	19.8	9	3.6	32.0	FroSAM
								39.3	Lolo Sed

[1] Based on GIS road and stream layers. Some crossings that appear on GIS layers do not actually exist on the ground.

4.5.4.1.2 Potential Sediment Risk from Culvert Failures

The Lolo National Forest analyzed the risk of potential sediment delivery from culvert failure at the 26 highest priority fish passage barrier culverts in the Ninemile TPA. While none of the culverts in the Kennedy Creek watershed fell into the priority list of 26 culverts, there is one (Kennedy Creek, road 60735, NWSW1/4 Section 23) that have the potential to contribute sediment loads in the future. However, culvert failure remains an unquantified source of sediment delivery. Additional culvert analysis is proposed in the monitoring plan in Section 6.2

4.5.4.1.3 Stream Bank Instability

A sediment load of 719 tons/year was estimated from human-caused stream bank erosion. All 719 tons/year was attributed to mining, which has impacted approximately 1.7 miles of Kennedy Creek, or approximately 30 percent of its total stream length. Throughout much of the mined reach, piles of mine tailings line the stream and prevent channel migration. Although the tailings are revegetated in places, bank instability persists. Typical conditions within the mined reaches of Kennedy Creek are presented in Photos 4-7 to 4-8.

Photo 4-7. Typical Conditions in Mined Sections of Kennedy Creek.

Photo 4-8. Typical Conditions in Mined Sections of Kennedy Creek.

4.5.4.1.4 Channel Alterations, Stream Bank Alterations, and Channel Encroachment

As described above, approximately 1.7 miles of Kennedy Creek have been altered by placer and hard rock mining. Additionally, 1.8 miles of road encroach to within 100 feet of the stream, a distance equal to approximately 32 percent of the stream's length. The road along Kennedy Creek has collapsed in at least one location (Photo 4-9).


Photo 4-9. Road Failure on Kennedy Creek.

4.5.4.1.5 Fish Passage Assessment

At least two fish passage barriers exist on Kennedy Creek. At the lower end of the mining complex there is an irrigation diversion pond that is a complete fish passage barrier at most flows (Photo 4-10), and there is a culvert on a private road crossing on lower Kennedy Creek that is a probable fish passage barrier.


Photo 4-10. Fish Passage Barrier on Kennedy Creek.

4.5.4.2 Source Summary

Currently, sediment sources in the Kennedy Creek watershed are dominated by mining, which accounts for 90 percent of the sediment load. Natural background sources account for the next largest fraction, 5.1 percent, and forest road account for an additional 4.9 percent. Results are summarized below in Table 4-17.

Table 4-17. Kennedy Creek Sediment Load Summary.

Sediment Source	Sediment Load (tons/yr)	Sediment Load (%)
Background	40.4	5.1
Timber Harvest	0	0
Mining	719	90
Fire	0	0
Roads (LoloSed)	39.3	4.9
Total	**798.7**	**100**

4.5.4.3 TMDL and Allocations

A TMDL is composed of the sum of individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this definition is denoted by the equation:

$$\textbf{TMDL = WLAs + LAs + MOS}$$

There are no point sources of sediment in the Kennedy Creek watershed; therefore, that variable can be removed from the equation. The primary human-caused sediment sources in the watershed appear to be mining and forest roads. The TMDL for Kennedy Creek will be expressed as a 93.8% reduction in total sediment loading. This will be achieved by a 81% reduction in the forest road sediment load and a 100% reduction in loading from mining, resulting in a future total load of 49.9 tons/year. The uncertainties with this are further discussed in Section 4.7.

The TMDL and allocations are summarized in Table 4-18 and are described in more detail in the following paragraphs. The proposed restoration and adaptive management strategy is presented in Section 6.5.

Table 4-18. TMDL and Load Allocations for Sediment in Kennedy Creek.

Sources	Current Load (tons/yr)		Reduction	Allocation (tons/yr or approach)
Point Sources (WLA)	0		NA	0
Anthropogenic Nonpoint Sources (LA)	**Background**	42.4	None	42.4: Not controlable
	Existing Roads	39.3	81% 31.8 tons/yr	7.5
	Historic/Current Harvest	0	NA	0
	Mining	719	100% 719 tons/yr	0
	Future Roads and Harvest	Not Specified	Not Specified	No sediment loading increases other than potential minor predicted short-term increases associated with 100% compliance with applicable BMP standards.
	Total Current Load	**800.7**	**TMDL**	**49.9 tons/year**, a 93.8% reduction.

4.5.4.3.1 Existing Road Allocation

As was presented in Table 4-3, forest roads resulted in an estimated 39.3 tons/year of sediment loading to Kennedy Creek. To address this sediment source, a road sediment reduction target has been set at 81 percent, representing a reduction of 31.8 tons of sediment per year. This road sediment reduction was calculated using the FroSAM road assessment methodology described in Section 4.1.1, and represents the estimated sediment load that would remain once all contributing road treads, cut slopes, and fill slopes were reduced to the maximum of 200 feet. Two hundred feet was selected as an example to illustrate the potential for sediment reduction and is not a formal goal of the WQRP. Although the FroSAM analysis was used to estimate the potential for road sediment reduction in the Kennedy Creek watershed, the proposed reduction in sediment loading from roads may be achieved through a variety of methods.

4.5.4.3.2 Mining Allocation

As described in Section 4.2.3, accelerated stream bank erosion resulting from historic mining appears to dominate the sediment load to Kennedy Creek. The mined sections of the stream will require complete geomorphic and vegetative restoration if sediment loads are to be reduced in the near future. However, once such restoration is competed, and assuming that no additional mining occurs, sediment loads could be expected to return to normal once riparian plant communities have reached maturity on the restored stream banks, thus the proposed reduction is 100%. Without active restoration, sediment loads will decline naturally over time, but recovery may take decades or more to achieve.

4.5.4.3.3 Future Roads and Harvest Allocation

It is not reasonable to assume that there will be no future silviculture activities in the Kennedy Creek watershed. An allocation is therefore required to account for potential future sediment loading. This allocation proposes no future sediment loading increases associated with harvest and/or forest roads other than potential minor, short-term increases that may be predicted and associated with 100 percent compliance with the applicable best management practice (BMP) standards.

4.5.5 Stony Creek

4.5.5.1 Sediment Source Assessment Results

4.5.5.1.1 Natural Erosion Rates, Timber Harvest, the Fires of 2000, and Forest Roads

As was described in Section 4.1.1, sediment from natural background sources, timber harvest, the fires of 2000, and forest roads was evaluated via LoloSED modeling. Sediment from forest roads was also evaluated at stream crossings via an on-the-ground assessment that was described in Section 4.1.2.

Natural background sediment was estimated to be 48.8 tons/year. Modeled estimates of sediment from timber harvest were zero tons/year, as little recent timber harvest has occurred in the Stony Creek watershed. The fires of 2000 did not affect the area. Sediment from forest roads was estimated by LoloSED to be 15.3 tons/year, or approximately 31% of the natural background sediment load (Table 4-19). The FroSAM analysis predicted an annual sediment delivery of 37.7 tons/year at stream crossings. As described in Section 4.2.1, the FroSAM results are not directly comparable to the LoloSED results, but are included as a way to prioritize restorations efforts (Section 5.0).

Table 4-19. Stony Creek Sediment Source Assessment Results.

Watershed Size (mi^2)	Background Sediment tons/year	Sediment from Timber Harvest	Fires of 2000		Forest Roads				
			Area Burned (% of watershed)	Sediment tons/year	Miles of Roads	# of Potential Crossings[1]	Road Density (mi/mi^2)	Sediment from Forest Roads (tons/year)	
7.1	48.8	0	0	0	21.3	7	3.0	37.7	**FroSAM**
								15.3	**Lolo Sed**

[1] Based on GIS road and stream layers. Some crossings that appear on GIS layers do not actually exist on the ground.

4.5.5.1.2 Potential Sediment Risk from Culvert Failures

The Lolo National Forest analyzed the risk of potential sediment delivery from culvert failure at the 26 highest priority fish passage barrier culverts in the Ninemile TPA. Four of these culverts are located in the Stony Creek watershed, and represent a total potential sediment load from complete culvert failure of 473 tons. Refer to Appendix A for details. Additional potential sediment load may exist at culverts that were not among the 26 high fish passage priorities, and thus sediment risk from culvert failure has been only partially quantified. Culvert analysis is included in the proposed monitoring plan in Section 6.2.

4.5.5.1.3 Stream Bank Instability

Stony Creek was listed, in part, due to siltation and habitat alterations resulting from agricultural, range, and irrigated sources. As part of the sediment source assessment for Stony Creek, a qualitative evaluation of agricultural impacts was conducted as part of the stream bank erosion sediment load assessment. Results of the assessment indicated that stream banks within the watershed are generally stable. Stony Creek is a small stream that is typically less then 10 feet wide, and banks are low and well vegetated (Photo 4-11 and 4-12). Although some minor sediment load from agricultural and/or range impacts may exist in the watershed, the sources of this load were not identified during source assessment fieldwork and the load was not quantified.

Photo 4-11. Stony Creek Riparian Zone in Lolo National Forest Pasture.

Photo 4-12. Typical Conditions in Grazed Sections of Stony Creek.

4.5.5.1.4 Channel Alterations, Stream Bank Alterations, and Channel Encroachment

There are approximately 0.25 miles of roads within 100 feet of the Stony Creek channel, which represents about 3.5% of the channel length, and approximately 0.1 mile of the stream has been riprapped in the northeast corner of section 5.

4.5.5.1.5 Fish Passage Assessment

According to the LNF, Stony Creek has a number of probable fish passage barriers on Forest that fragment fish populations. Three culverts are located on Forest roads 18079, 5489, and 34030 in the NE 1/4 of section 5 and 1 is on Forest road 456 in the NW 1/4 of section 33. The culvert on the main Ninemile Road, County Road 412 may also be a fish passage barrier. Two of the culverts on Forest may be removed (on roads 18079 and 34030) and two may be replaced (on roads 5489 and 456) under the Forest Frenchtown Face forest restoration project. These are relatively high priority pipe fixes and have been identified as such under the Frenchtown Face project and they will likely be remedied in the next couple of year (see Fish Passage Report and associated map).

There are also two substantial irrigation diversions from Stony Creek at two locations (NW 1/4 of section 5 and the NE 1/4 of section 28). Water is diverted and used by both the Forest Service (for its stock program and domestic use), and a private landowner for agriculture. The head gates at both diversions are also impediments to upstream movement of fish and the unscreened intakes are likely a source of some fish entrainment loss, as the point of diversion is not screened. The LNF reports that at times the diversions on Stony Creek nearly dewater the lower reaches of the stream.

4.5.5.2 Source Summary

Currently, sediment sources in the Stony Creek watershed are dominated by natural sources, which accounts for 62 percent of the sediment load. Forest roads are the major human caused sediment source, accounting for an estimated 38 percent of the total sediment load. Results are summarized below in Table 4-20.

Table 4-20. Stony Creek Sediment Load Summary.

Sediment Source	Sediment Load (tons/yr)	Sediment Load (%)
Background	48.8	62
Timber Harvest	0	0
Fire	0	0
Roads (LoloSed)	29.7	38
Total	**78.5**	**100**

4.5.5.3 TMDL and Allocations

A TMDL is composed of the sum of individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this definition is denoted by the equation:

$$\textbf{TMDL = WLAs + LAs + MOS}$$

There are no point sources of sediment in the Stony Creek watershed; therefore, that variable can be removed from the equation. The primary human-caused sediment source in the watershed appears to be forest roads. The TMDL for Stony Creek will be expressed as a 28.8% reduction in total sediment loading. This will be achieved by a 76% reduction in the forest road sediment load. The uncertainties with this are further discussed in Section 4.7.

The TMDL and allocations are summarized in Table 4-21 and are described in more detail in the following paragraphs. The proposed restoration and adaptive management strategy is presented in Section 6.5.

Table 4-21. TMDL and Load Allocations for Sediment in Stony Creek.

Sources	Current Load (tons/yr)		Reduction	Allocation (tons/yr or approach)
Point Sources (WLA)	0		NA	0
Anthropogenic Nonpoint Sources (LA)	**Background**	48.8	None	48.8: Not controllable
	Existing Roads	29.7	76% 22.6 tons/yr	7.1
	Historic/Current Harvest	0	NA	0
	Fire	0	NA	0
	Future Roads and Harvest	Not Specified	Not Specified	No sediment loading increases other than potential minor predicted short-term increases associated with 100% compliance with applicable BMP standards.
	Total Current Load	**78.5**	**TMDL**	**55.9 tons/year**, a 28.8% reduction.

4.5.5.3.1 Existing Road Allocation

As was presented in Table 4-3, forest roads resulted in an estimated 39.3 tons/year of sediment loading to Stony Creek. To address this sediment source, a road sediment reduction target has been set at 76 percent, representing a reduction of 22.6 tons of sediment per year. This road sediment reduction was calculated using the FroSAM road assessment methodology described in Section 4.1.1, and represents the estimated sediment load that would remain once all contributing road treads, cut slopes, and fill slopes were reduced to the maximum of 200 feet. Two hundred feet was selected as an example to illustrate the potential for sediment reduction and is not a formal goal of the WQRP. Although the FroSAM analysis was used to estimate the potential for road sediment reduction in the Stony Creek watershed, the proposed reduction in sediment loading from roads may be achieved through a variety of methods.

4.5.5.3.2 Future Roads and Harvest Allocation

It is not reasonable to assume that there will be no future silviculture activities in the Stony Creek watershed. An allocation is therefore required to account for potential future sediment loading. This allocation proposes no future sediment loading increases associated with harvest and/or forest roads other than potential minor, short-term increases that may be predicted and associated with 100 percent compliance with the applicable best management practice (BMP) standards.

4.5.6 Cedar Creek

4.5.6.1 Sediment Source Assessment Results

4.5.6.1.1 Natural Erosion Rates, Timber Harvest, the Fires of 2000, and Forest Roads

As was described in Section 4.1.1, sediment from natural background sources, timber harvest, the fires of 2000, and timber harvest (overland flow) and forest roads was evaluated via LoloSED modeling. Sediment from forest roads was also evaluated at stream crossings via an on-the-ground assessment that was described in Section 4.1.2.

Natural background sediment was estimated to be 36.6 tons/year. Modeled estimates of sediment from timber harvest were 2.17 tons/year. The fires of 2000 did not affect the area. Sediment from forest roads was estimated by LoloSED to be 15.3 tons/year, or approximately 97% of the natural background sediment load (Table 4-22). The FroSAM analysis predicted an annual sediment delivery of 1.5 tons/year at stream crossings. As described in Section 4.2.1, the FroSAM results are not directly comparable to the LoloSED results, but are included as a way to prioritize restorations efforts (Section 5.0).

Table 4-22. Cedar Creek Sediment Source Assessment Results.

Watershed Size (mi^2)	Background Sediment tons/year	Sediment from Timber Harvest	Fires of 2000		Forest Roads				
			Area Burned (% of watershed)	Sediment tons/year	Miles of Roads	# of Potential Crossings[1]	Road Density (mi/mi^2)	Sediment from Forest Roads (tons/year)	
6.1	36.6	2.17	0	0	6.1	3	1	1.5	FroSAM
								15.3	Lolo Sed

[1] Based on GIS road and stream layers. Some crossings that appear on GIS layers do not actually exist on the ground.

4.5.6.1.2 Potential Sediment Risk from Culvert Failures

The Lolo National Forest analyzed the risk of potential sediment delivery from culvert failure at the 26 highest priority fish passage barrier culverts in the Ninemile TPA. The culvert at the road 5515 crossing of Cedar Creek was included in the analysis, and it represents a potential sediment load of 315 tons if the culvert failed completely. Refer to Appendix A for details. Additional potential sediment load may exist at culverts that were not among the 26 high fish passage priorities, and thus sediment risk from culvert failure has been only partially quantified. Culvert analysis is included in the proposed monitoring plan in Section 6.2.

4.5.6.1.3 Stream Bank Instability

A sediment load of 88 tons/year was estimated from human-caused stream bank erosion. All 88 tons/year was attributed to agriculture, which impacts the lower 0.75 miles of Cedar Creek, or approximately 17 percent of its total stream length, all on private land.

4.5.6.1.4 Channel Alterations, Stream Bank Alterations, and Channel Encroachment

As described above, approximately 0.75 miles of Cedar Creek have been impacted by agriculture. Additionally, 0.16 miles of road encroach to within 100 feet of the stream, a distance equal to approximately 3.6 percent of the stream's length.

4.5.6.1.5 Fish Passage Assessment

The culvert at road 5155 is believed to be a barrier to fish passage. According to the Lolo National Forest, the culvert has been retrofitted with baffles and log drop structures to facilitate fish passage. It appears that fish passage may be possible at higher flows but during low flows there is a drop at the last culvert baffle that may not be passable by resident fish. No other fish barriers are known to exist in the watershed.

4.5.6.2 Source Summary

Currently, sediment sources in the Cedar Creek watershed are dominated by agriculture, which accounts for 61.9 percent of the sediment load. Natural background sources account for the next largest fraction, 25.8 percent; forest road account for an additional 10.8 percent; and timber harvest accounts for the remaining 1.5 percent. Results are summarized below in Table 4-23.

Table 4-23. Cedar Creek Sediment Load Summary.

Sediment Source	Sediment Load (tons/yr)	Sediment Load (%)
Background	36.6	25.8
Timber Harvest	2.17	1.5
Agriculture	88	61.9
Fire	0	0
Roads (LoloSed)	15.3	10.8
Total	**142.1**	**100**

4.5.6.3 TMDL and Allocations

A TMDL is composed of the sum of individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this definition is denoted by the equation:

$$\textbf{TMDL = WLAs + LAs + MOS}$$

There are no point sources of sediment in the Cedar Creek watershed; therefore, that variable can be removed from the equation. The primary human-caused sediment sources in the watershed appear to be forest roads, timber harvest, and agriculture. The TMDL for Cedar Creek will be expressed as a 60.9% reduction in total sediment loading. This will be achieved by a 34.4% reduction in the forest road sediment load, a 100% reduction in loading from timber harvest, and a 90% reduction in loading from agriculture, resulting in a future total load of 55.6 tons/year. The uncertainties with this are further discussed in Section 4.7.

The TMDL and allocations are summarized in Table 4-24 and are described in more detail in the following paragraphs. The proposed restoration and adaptive management strategy is presented in Section 6.5.

Table 4-24. TMDL and Load Allocations for Sediment in Cedar Creek.

Sources	Current Load (tons/yr)		Reduction	Allocation (tons/yr or approach)
Point Sources (WLA)	0		NA	0
Anthropogenic Nonpoint Sources (LA)	**Background**	36.6	None	36.6: Not controllable
	Existing Roads	15.3	34.4% 5.3 tons/yr	10
	Historic/Current Harvest	2.17	100% 2.17 tons/yr	0
	Agriculture (bank erosion)	88	90% 79 tons/yr	9
	Future Roads and Harvest	Not Specified	Not Specified	No sediment loading increases other than potential minor predicted short-term increases associated with 100% compliance with applicable BMP standards.
	Total Current Load	**142**	**TMDL**	**55.6 tons/year**, a 60.9% reduction.

4.5.6.3.1 Existing Road Allocation

As was presented in Table 4-3, forest roads resulted in an estimated 15.3 tons/year of sediment loading to Cedar Creek. To address this sediment source, a road sediment reduction target has been set at 34.4 percent, representing a reduction of 5.3 tons of sediment per year. This road sediment reduction was calculated using the FroSAM road assessment methodology described in Section 4.1.1, and represents the estimated sediment load that would remain once all contributing road treads, cut slopes, and fill slopes were reduced to the maximum of 200 feet. Two hundred feet was selected as an example to illustrate the potential for sediment reduction and is not a formal goal of the WQRP. Although the FroSAM analysis was used to estimate the potential for road sediment reduction in the Cedar Creek watershed, the proposed reduction in sediment loading from roads may be achieved through a variety of methods.

4.5.6.3.2 Timber Harvest

The Lolo National Forest's LoloSed modeling analysis of sediment from timber harvest predicts that loads will return to zero by 2010 through natural recovery of harvested areas.

4.5.6.3.3 Agriculture (Bank Erosion)

As described in Section 4.2.4, accelerated stream bank erosion resulting from agriculture appears to dominate the sediment load to Cedar Creek. Through a process of channel and riparian restoration and the subsequent application of agricultural BMPs, it is estimated that 90 percent of the load can be eliminated. This load reduction estimate is based on best professional judgment of potential sediment load mitigations that could be applied to grazing pastures and hay fields along Cedar Creek. Inevitably, some sediment load will remain as long as the watershed is actively used for agricultural purposed. The post-restoration load estimate is 9 tons/year

4.5.6.3.4 Future Roads and Harvest Allocation

It is not reasonable to assume that there will be no future silviculture activities in the Cedar Creek watershed. An allocation is therefore required to account for potential future sediment loading. This allocation proposes no future sediment loading increases associated with harvest and/or forest roads other than potential minor, short-term increases that may be predicted and associated with 100 percent compliance with the applicable best management practice (BMP) standards.

4.5.7 Ninemile Creek

4.5.7.1 Sediment Source Assessment Results

4.5.7.1.1 Natural Erosion Rates, Timber Harvest, the Fires of 2000, and Forest Roads

As was described in Section 4.1.1, sediment from natural background sources, timber harvest, the fires of 2000, and timber harvest (overland flow) and forest roads was evaluated via LoloSED modeling. Sediment from forest roads was also evaluated at stream crossings via an on-the-ground assessment that was described in Section 4.1.2.

Natural background sediment was estimated to be 1,347 tons/year. Modeled estimates of sediment from timber harvest were 26.6 tons/year. The fires of 2000 affected 17 percent of the watershed are expected to result in a sediment load of 373 tons in 2004. Sediment from forest roads was estimated by LoloSED to be 1,187 tons/year, or approximately 88% of the natural background sediment load (Table 4-25). The FroSAM analysis predicted an annual sediment delivery of 676 tons/year at stream crossings. As described in Section 4.2.1, the FroSAM results are not directly comparable to the LoloSED results, but are included as a way to prioritize restorations efforts (Section 5.0).

Table 4-25. Ninemile Creek Sediment Source Assessment Results.

<table>
<tr><th rowspan="2">Watershed Size (mi²)</th><th rowspan="2">Background Sediment tons/year</th><th rowspan="2">Sediment from Timber Harvest</th><th colspan="2">Fires of 2000</th><th colspan="5">Forest Roads</th></tr>
<tr><th>Area Burned (% of watershed)</th><th>Sediment tons/year</th><th>Miles of Roads</th><th># of Potential Crossings[1]</th><th>Road Density (mi/mi²)</th><th colspan="2">Sediment from Forest Roads (tons/year)</th></tr>
<tr><td rowspan="2">185</td><td rowspan="2">1,347</td><td rowspan="2">26.6</td><td rowspan="2"></td><td rowspan="2">373</td><td rowspan="2">581</td><td rowspan="2">407</td><td rowspan="2">3.1</td><td>676</td><td>FroSAM</td></tr>
<tr><td>1,187</td><td>Lolo Sed</td></tr>
</table>

[1] Based on GIS road and stream layers. Some crossings that appear on GIS layers do not actually exist on the ground.

4.5.7.1.2 Potential Sediment Risk from Culvert Failures

The Lolo National Forest analyzed the risk of potential sediment delivery from culvert failure at 52 fish passage barrier culverts. These culverts were then prioritized. The top 26 culverts represent a potential sediment load of 21,546 tons. Refer to Appendix A for details. Additional potential sediment load may exist at culverts that were not among the 26 high fish passage priorities, and thus sediment risk from culvert failure has been only partially quantified. Culvert analysis is included in the proposed monitoring plan in Section 6.2.

4.5.7.1.3 Stream Bank Instability

A sediment load of 8,240 tons/year was estimated from human-caused stream bank erosion. Of this, 2,039 tons/year (25%) were attributed to placer mining, and 6,201 tons/year (75%) were attributed to agriculture.

4.5.7.1.4 Channel Alterations, Stream Bank Alterations, and Channel Encroachment

Approximately 3.9 miles of Ninemile Creek, or about 12% of the stream's total length have been impacted by placer mining. Additionally, 2.4 miles of road encroach to within 100 feet of the stream, a distance equal to approximately 7.6 percent of the stream's length. Finally, almost 1 mile of stream banks have been riprapped in Ninemile Creek.

4.5.7.1.5 Fish Passage Assessment

Nearly 50 culverts throughout the Ninemile Watershed, primarily on Forest Service land pose passage problems for fish. Several crossings stream crossing on the county road are also suspected to be fish passage barriers. The Lolo National Forest has prioritized for replacement or removal 26 of the most important passage problems where the greatest amount of fish benefit from a remedy would be realized. The highest priority projects are typically in watersheds where know native fish production is moderate to strong, and a solution (or solutions where multiple barriers exist in one tributary) could reconnect the entire tributary watershed to main Ninemile. The LNF report on fish barriers in the Ninemile is included as Appendix A.

4.5.7.2 Source Summary

Currently, sediment sources in the Ninemile Creek watershed are dominated by agriculture, which accounts for 55 percent of the sediment load. Mining accounts for the next largest fraction, 18 percent; natural background sources account for an additional 12 percent; forest road are estimated to account another 11 percent; and the remaining load comes in relatively small amounts from the fires of 2000 (3 percent) and timber harvest (0.2 percent). Results are summarized below in Table 4-26.

Table 4-26. Ninemile Creek Sediment Load Summary.

Sediment Source	Sediment Load (tons/yr)	Sediment Load (%)
Background	1,347	12
Timber Harvest	26.6	0.2
Mining	2,039	18
Agriculture	6,201	55
Fire	373	3
Roads (LoloSed)	1,187	11
Total	**11,174**	**100**

4.5.7.3 TMDL and Allocations

A TMDL is composed of the sum of individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this definition is denoted by the equation:

$$\textbf{TMDL} = \textbf{WLAs} + \textbf{LAs} + \textbf{MOS}$$

There are no point sources of sediment in the Ninemile Creek watershed; therefore, that variable can be removed from the equation. The primary human-caused sediment sources in the watershed appear to be agriculture, placer mining and forest roads. The TMDL for Ninemile Creek will be expressed as a 92.8% reduction in total sediment loading. This will be achieved by, 75% reduction in sediment from agriculture, a 39% reduction in the forest road sediment load and a 100% reduction in loading from mining, resulting in a future total load of 54.8 tons/year. The uncertainties with this are further discussed in Section 4.7.

The TMDL and allocations are summarized in Table 4-27 and are described in more detail in the following paragraphs. The proposed restoration and adaptive management strategy is presented in Section 6.5.

Table 4-27. TMDL and Load Allocations for Sediment in Ninemile Creek.

Sources	Current Load (tons/yr)		Reduction	Allocation (tons/yr or approach)
Point Sources (WLA)	0		NA	0
Anthropogenic Nonpoint Sources (LA)	**Background**	1,347	None	1,347: Not controllable
	Existing Roads	1,187	69% 819 tons/yr	368
	Fire	373	99% 370 tons/yr	3
	Historic/Current Harvest	26.6	100% 26.6 tons/yr	0
	Agriculture	6,201	75% 4,651 tons/yr	1,150
	Mining	2,039	100% 2,037 tons/yr	0
	Future Roads and Harvest	Not Specified	Not Specified	No sediment loading increases other than potential minor predicted short-term increases associated with 100% compliance with applicable BMP standards.
	Total Current Load	**11,174**	**TMDL**	**2,868 tons/year**, a 74.3% reduction.

4.5.7.3.1 Existing Road Allocation

As was presented in Table 4-3, forest roads resulted in an estimated 1,187 tons/year of sediment loading to Ninemile Creek. To address this sediment source, a road sediment reduction target has been set at 69 percent, representing a reduction of 819 tons of sediment per year. This road sediment reduction was calculated using the FroSAM road assessment methodology described in Section 4.1.1, and represents the estimated sediment load that would remain once all contributing road treads, cut slopes, and fill slopes were reduced to the maximum of 200 feet recommended by Montana's Forestry BMPs. Although the FroSAM analysis was used to estimate the potential for road sediment reduction in the Ninemile Creek watershed, the proposed reduction in sediment loading from roads may be achieved through a variety of methods.

4.5.7.3.2 Fire

The Lolo National Forest's LoloSed modeling analysis of sediment from the fires of 2000 predicts that loads will decline to 3 tons/year by 2015, the last year of the analysis, through natural recovery of burned areas.

4.5.7.3.3 Timber Harvest

The Lolo National Forest's LoloSed modeling analysis of sediment from timber harvest predicts that loads will decline to zero tons/year by 2015 through natural recovery of harvested areas.

4.5.7.3.4 Agriculture (Bank Erosion)

As described in Section 4.2.4, accelerated stream bank erosion resulting from agriculture appears to dominate the sediment load to Ninemile Creek. Through a process of channel and riparian restoration and the subsequent application of agricultural BMPs, it is estimated that 75 percent of the load can be eliminated. This load reduction estimate is based on best professional judgment of potential sediment load mitigations that could be applied to grazing pastures and hay fields along Ninemile Creek. Inevitably, some sediment load will remain as long as the watershed is actively used for agricultural purposes. The post-restoration load estimate is 1,150 tons/year.

4.5.7.3.5 Mining Allocation (bank erosion)

Accelerated stream bank erosion resulting from historic placer mining appears to be a major source of sediment to Ninemile Creek. The mined sections of the stream will require complete geomorphic and vegetative restoration if sediment loads are to be reduced in the near future. However, once such restoration is competed, and assuming that no additional mining occurs, sediment loads could be expected to return to normal once riparian plant communities have reached maturity on the restored stream banks, thus the proposed reduction is 100%. Without active restoration, sediment loads will decline naturally over time, but recovery may take decades or more to achieve.

4.5.7.3.6 Future Roads and Harvest Allocation

It is not reasonable to assume that there will be no future silviculture activities in the Ninemile Creek watershed. An allocation is therefore required to account for potential future sediment loading. This allocation proposes no future sediment loading increases associated with harvest and/or forest roads other than potential minor, short-term increases that may be predicted and associated with 100 percent compliance with the applicable best management practice (BMP) standards.

4.6 Metals TMDL for Kennedy Creek

4.6.1 Available Water Quality Data for Kennedy Creek

All of the available water quality data for Kennedy Creek were reviewed in Section 3.4.5. These data were collected during two sampling periods, one in 1993 by the Montana Abandoned Mine Reclamation Bureau, and more recently in 2003/04 by DEQ as part of TMDL development efforts in the Ninemile TPA. The TMDLs developed in this section will be based on the more recent data collected in 2003/04, which is reviewed again here for convenience.

Current water quality data for copper, lead, and zinc includes analytical results from three sampling locations in Kennedy Creek, each sampled in September 2003, June 2004, and August 2004. The sampling locations were Kennedy 1, located above the mining complex, Kennedy 2, located below the mining complex and above the forest boundary, and Kennedy 3, located in the lower reach of Kennedy Creek near the county road crossing. Mercury data is also available from these three monitoring locations in Kennedy Creek, but was collected only in August 2004.

Table 4-28 provides a summary of the violations of state numeric water quality standards for high flow and low flow conditions. Water quality data collected in June 2004 are used to represent high flow conditions, while data from September 2003 and August 2004 are used to represent low flow (baseflow) conditions. Copper concentrations exceeded Montana chronic aquatic life standard at sites Kennedy 2 and 3 during the high flow sampling in June 2004.

The concentration of copper was 3 ug/l at both locations, exceeding the chronic aquatic life standard of 2.9 ug/l at an average hardness of 22 mg/l by a very small margin. The concentration of copper at Kennedy 1, above the mining complex, 8 ug/l, higher than at the 2 downstream sites, but below state standards due to lower hardness (5 mg/l). The concentration of copper was below state standards at all sampling locations during low flow conditions.

The concentration of lead was generally below state standards, except at station Kennedy 3 near the mouth in September 2003, where the concentration of 2 ug/l violated the chronic aquatic life standard of 1.7 ug/l at a hardness of 61.1 mg/l. No other violations of lead standards were detected.

During the high flow sampling in June 2004, the concentration of zinc at Kennedy 2 was 40 ug/l and at Kennedy 3 it was 140 ug/l, exceeding the chronic aquatic life standard of 37 ug/l at an average hardness of 22 ug/l. No other violations of zinc standards were detected.

Mercury concentrations were below detection in August 2004. No high flow data for mercury are available. It is not clear from the limited available data if mercury concentrations continue to impair beneficial uses in Kennedy Creek. Nevertheless, a mercury TMDL has been developed and is presented later in this section. Additional mercury sampling is included in the monitoring plan in Section 6.3.

No human health (drinking water) violations were detected in any of the sampling in Kennedy Creek.

Table 4-28. Kennedy Creek Seasonal Metals Impairment Summary.

Metal (total recoverable)	Season[1]	N	Concentration Range (ug/l)	Exceedence Summary
Copper	High Flow	3	3 – 8	Exceeded MT chronic aquatic life standard at Kennedy 2 & 3 in June 2004
	Low Flow	6	ND – 4	No violations of state standards.
Lead	High Flow	3	ND	No violations of state standards.
	Low Flow	6	ND – 2	Exceeded MT chronic aquatic life standard at Kennedy 3 in September 2003.
Zinc	High Flow	3	ND – 40	Exceeded MT chronic aquatic life standard at Kennedy 2 & 3 in June 2004
	Low Flow	6	ND – 60	No violations of state standards.
Mercury	High Flow	0	NC	High flow mercury samples were not collected
	Low Flow	3	ND	Mercury was below detection at all 3 sampling locations in August of 2004.

ND = not detected; NC = not collected

4.6.2 Metals Source Inventory.

Historic mining disturbances comprise the main known sources of metals to Kennedy Creek. Mining impacts are evident beginning in the northeast corner of section 13 and continuing downstream almost to the county road near the confluence with Ninemile Creek. At the upper end of the mining complex is the Hauttula mine, a copper prospect that historically had a 150-foot adit. The current condition of the adit is unknown. Approximately ½ mile downstream from the Hauttula mine is the Lost Cabin mine, a group of 6 unpatented claims at which several adits were developed. Further downstream from the Lost Cabin Mine is the Nuggets Mine, where water from the adit discharges to a holding pond and then directly to Kennedy Creek. Much of Kennedy Creek between the upper end of the mining complex and the county road has also been placer mined. (Photo 4-13 and 4-14).

Photo 4-13. Pond of Adit Discharge Water at Nugget Mine on Kennedy Creek.

Photo 4-14. Mine Tailings Loading on Kennedy Creek Near Lost Cabin Mine.

In addition to being possible sources of contaminated water, the mined reaches of Kennedy Creek are also sources of sediment with potentially elevated concentrations of metals. In September 2003, DEQ collected fine sediment samples at the 3 locations described above. Results of the analysis are summarized in Table 4-29. Montana currently has no water quality related standards for metals in fine sediments, but analytical results for copper, lead, and zinc reveal that the lowest concentrations were found above the mining complex at Kennedy 1. Concentrations were highest in the mining complex (Kennedy 2), and declined slightly near the mouth of the stream at Kennedy 3. No analysis is available for mercury.

Table 4-29. Metals in fine sediment concentrations in Kennedy Creek, September 2003 (ug/g).

Metal	Kennedy 1	Kennedy 2	Kennedy 3
Silver	<1	<1	<1
Aluminum	16,500	9,620	10,100
Arsenic	30.3	20.1	11.8
Barium	205	173	143
Beryllium	<1.5	<1.5	<1.5
Cadmium	<0.5	0.8	<0.5
Chromium	11.7	5.8	6.3
Copper	**37.3**	**63.8**	**41.5**
Iron	20,600	16,000	12,800
Lead	**39.4**	**64.1**	**38.0**
Manganese	566	988	405
Nickel	20.1	13.3	9.1
Antimony	0.3	0.3	<0.2
Selenium	1.6	<1	<1
Thallium	<1.00	<1	<1
Zinc	**49.1**	**464**	**318**

4.6.3 Kennedy Creek Metals Restoration Targets, TMDLs and Load Allocations

Water quality restoration targets are established below for high flow and low flow conditions in Kennedy Creek. The restoration targets for specific metals represent the maximum metals concentrations that may occur in Kennedy Creek without exceeding water quality standards. As such, these restoration targets are identical to the B-1 classification numeric water quality standards and represent primary water quality goals of the TMDL process. Additional restoration targets based on sediment toxicity, biota measures, and stream deposits are also presented as an additional margin of safety to ensure full support of aquatic life and cold-water fishery beneficial uses.

Based on the restoration targets, TMDLs are presented below for copper, lead, zinc, and mercury. Following TMDL development, load allocations are discussed for various source areas in the drainage.

4.6.4 Metals Restoration Targets

Table 4-30 provides water quality restoration targets for those metals that exceed B-1 classification water quality standards in Kennedy Creek, including copper, lead, zinc, and mercury. The water quality restoration targets for copper, lead, and zinc are based on the hardness-adjusted chronic aquatic life criteria, which are the most stringent of the state's water quality standard for these metals. Mercury standards are based on the human health standard, which is more stringent than the aquatic life standard; but for mercury the standard is not hardness dependent, and thus neither is the target. Hardness values used in calculating the targets are based on actual measured values as specified in Table 4-29. Because it is unknown what the actual hardness value will be under restoration conditions, the target values (except for mercury) listed in Table 4-30 represent estimated values at the various flow conditions. The actual targets will be based on in-stream hardness values as measured at the time of sampling.

Compliance for the water quality targets will be based on high and low flow water quality data, with no more than one measurement of the concentration for a particular metal exceeding the chronic criteria by more than 10%. This approach is consistent with DEQ guidance for making beneficial use support determinations (DEQ, 2002).

Ideally, the high flow water quality data will need to be collected during the rising limb of the hydrograph, and the low flow water quality data should be collected at or near base flow conditions.

Table 4-30. Water Quality Restoration Targets for Metals in Kennedy Creek.

POLLUTANT	TARGET(S) (ug/l)
Copper	5.2 (low flows) 2.9 (high flows)
Lead	1.3 (low flows) 0.5 (high flows)
Zinc	67 (low flows) 37 (high flows)
Mercury	0.05 (all flows)
All metals	No metals concentrations in sediments that may impede beneficial uses. Macroinvertebrate and periphyton communities must show no impairment from metals.

In addition to the water chemistry-based targets, metals concentrations in sediments cannot impede beneficial uses. This target applies to all metals, either individually or in combination, which may occur at potentially toxic concentrations in stream sediments. As an additional measure of water quality restoration, a target for macroinvertebrate and periphyton communities also applies. These communities must show no impairment from metals as compared to a known reference condition using standard DEQ protocols.

4.6.5 Metals TMDLs for Kennedy Creek

TMDLs are required fro the metals copper, lead, zinc, and mercury since these are the metals contributing to impairment of Kennedy Creek. The TMDLs represent the maximum amount of each metal that the stream can assimilate without exceeding water quality standards. This assimilative capacity is a function of the streamflow rate (dilution capacity), and for some metals, the water hardness (which determines the numeric water quality criteria). Therefore, the TMDL must be designed to be protective of beneficial uses and meet water quality standards under the full range of streamflow and water chemistry conditions anticipated. To achieve this, the metals TMDL is presented as an equation to be used to calculate the maximum allowable load of a specific metal at any time or under any conditions. The TMDL equation is as follows:

Total Maximum Daily Load (TMDL) is lb/day = (X ug/l)(Y cfs)(0.0054), where:

> *X=the applicable water quality numeric standard (target) in ug/l with hardness adjustments where applicable;*
> *Y=streamflow in cubic feet per second;*
> *(0.0054)= conversion factor*

Table 4-31 provides high flow and low flow TMDLs for these metals. These TMDLs were calculated from the equation above using June streamflow measurements for calculating high flow TMDLs (1.7 cfs at Kennedy 2) and August streamflow measurements for the low flow TMDLs (0.32 cfs at Kennedy 2). The restoration targets were taken from Table 4-30. The calculated TMDLs represent the maximum load (lbs/day) of each particular metal that the creek can accommodate without exceeding applicable water quality standards for the specified streamflow conditions and restoration targets.

Table 4-31 also lists the load reductions needed to meet the specific high flow and low flow TMDLs based on available water quality and streamflow data. These calculations were based on the highest concentrations of the listed metals detected during the 2003/04 sampling events, and thus represent worse case scenario according to available data. Under low flow conditions required load reductions include 3.3% for copper, and 74% for zinc. No low flow violations of water quality standards were detected for lead, and no low flow sampling was conducted for mercury. Required load reductions for high flow conditions include 3.3% for copper and 74% for zinc. Lead was below detection during the high flow sampling, and no high flow data was available for mercury.

Table 4-31. Kennedy Creek TMDL and Load Reduction Requirements for Metals at Low and High Flow Conditions.

Pollutant	Target (ug/l)	Calculated Low Flow and High Flow TMDLs[1] (lbs/day)	% Load Reduction Required to Meet TMDLs and Targets
Copper	5.2 (low flows) 2.9 (high flows)	0.0090 (low flows) 0.027 (high flows)	0% (low flows) 3.3% (high flows)
Lead	1.3 (low flows) 0.5 (high flows)	0.0022 (low flows) 0.0046 (high flows)	36% (low flows) 0% (high flows)
Zinc	67 (low flows) 37 (high flows)	0.12 (low flows) 0.34 (high flows)	0% (low flows) 74% (high flows)
Mercury	0.05 (all flows)	0.000086 (low flows) 0.00046 (high flows)	0% (low flows) Unknown (high flows)

[1] Calculated using the formula presented above

The metals TMDLs and required load reductions presented in Table 4-31 apply to specific streamflow conditions and water hardness (except for mercury) used in their calculations. Due to the limited streamflow and water chemistry data available, the degree to which these examples represent typical high and low flow conditions in the drainage is unknown. It is possible that TMDLs calculated from future high and low flow data may vary significantly from the examples presented here. Ultimately, the TMDL is the load of a particular pollutant that Kennedy Creek can assimilate without exceeding B-1 water quality standards at any time.

4.6.6 Kennedy Creek Load Allocations

A TMDL is the sum of all the load allocations (for non point sources) plus all the waste load allocations (for point sources) in a drainage, plus a margin of safety. Because there are no point source discharges subject to the Montana Pollutant Discharge Elimination System permit program in the Kennedy Creek drainage, waste load allocations are not required. The margin of safety is addressed implicitly through the use of human health and chronic aquatic life standards which include an inherent margin of safety. An additional margin of safety results from the use of biological and sediment restoration targets, and from the adoption of a monitoring program designed to further quantify metals loading sources, assist in restoration planning, and assess TMDL compliance. Because no waste load allocations or explicit margin of safety are required, the metals TMDLs for Kennedy Creek consist solely of the nonpoint source load allocations in the drainage.

Based on current information, nonpoint sources of metals impairment potentially requiring load allocations are divided into two categories:

- Category 1: Currently identified sources including 3 historic mining complexes and several miles of placer mining dredge piles, in addition to any natural background metals loading.

- Category 2: Other potential nonpoint sources not yet identified including mining-related disturbances and other human-caused impacts.

Table 4-32 includes preliminary load allocations for the nonpoint source categories. At this time, the entire load allocations for copper, lead, zinc, and mercury are allocated to the Category 1 sources. This assumes that no additional significant metals loading sources are present in the drainage and that the restoration targets can be met by addressing Category 1 sources only.

Section 6.0 describes a water quality monitoring strategy designed to further evaluate potential sources of metal loading in the drainage. The monitoring plan also addresses pot-implementation monitoring requirements intended to assess the effectiveness of restoration activities and compliance with TMDL goals as required in MCA 75-5-703(7). If future monitoring identifies additional sources, the preliminary load allocations in Table 4-32 will need to be adjusted accordingly as part of a phased allocation approach. Ultimately, the load allocation will be driven by attainment of the B-1 classification water quality targets listed in Table 4-32.

Table 4-32. Preliminary Metals Load Allocations for Kennedy Creek.

METAL	TMDL lbs/day	ALLOCATIONS		Margin of Safety
		Identified Non-Point Sources (Category 1)	Possible Other Sources (Category 2)	
Copper	0.0090 (low flows) 0.027 (high flows)	0.0090 (low flows) 0.027 (high flows)	No allocation at this time	Implicit MOS applied through conservatism in TMDL calculation process, numeric water quality standards, and follow-up monitioring.
Lead	0.0022 (low flows) 0.0046 (high flows)	0.0022 (low flows) 0.0046 (high flows)	No allocation at this time	
Zinc	0.12 (low flows) 0.34 (high flows)	0.12 (low flows) 0.34 (high flows)	No allocation at this time	
Mercury	0.000086 (low flows) 0.00046 (high flows)	0.000086 (low flows) 0.00046 (high flows)	No allocation at this time	

4.7 Uncertainty Analysis

4.7.1 Source Assessment Uncertainty

To help address all the assumptions and uncertainties that exist in this WQPR, a monitoring strategy was developed as outlined in Section 5.0. One purpose of this strategy is to both gather additional data and utilize new technologies as they arise. Together, both will help gain better confidence in the decisions that are made today and in the future surrounding beneficial use support in the NTPA.

As described above, a substantial effort was made to identify all significant anthropogenic sources of sediment loading in the listed watersheds of the Ninemile TPA. Where possible, estimates of sediment loads from each of the sources were also made. Although it is felt that this has resulted in sufficient information to reach the conclusions presented in this report, there are still some uncertainties regarding whether or not all of the significant sources have been identified, and regarding the quantification of sediment loads. The primary uncertainties include:

- Bank erosion analysis used to estimate the sediment load from mining and agriculture looked at only a sample of stream banks in the Ninemile TPA and assumed that the banks that were assessed were typical of banks throughout the listed watersheds.

- Sediment loads in non-listed tributaries to Ninemile Creek were not assessed. To the extent that these loads are elevated above natural levels, sediment loading to Ninemile Creek may have been underestimated.
- Bank retreat rates used in the calculation of sediment load from eroding stream banks were developed in the Yellowstone area and have not been verified in the Ninemile TPA.
- It was assumed in the stream bank instability assessment that the land use in closest proximity to each eroding bank was the primary cause of the erosion. It may be possible however that some or all of the erosion results from more complicated systemic problems that were not considered, such as increased water yield or peak flows.
- Modeling estimates have not been verified with recent sediment monitoring.
- Sediment load estimates represent average conditions, but actual sediment loads may vary by an order of magnitude due to natural variability.
- The analysis of potential sediment loading from culvert failure was conducted at only 26 of the culverts in the watershed, and thus sediment risk from culvert failure has been only partially quantified.

4.7.2 TMDL and Load Allocation Uncertainty

The analysis presented in this document assumes that the load reductions proposed for each of the listed streams will enable the streams to meet target condition, and further assumes that meeting target conditions will ensure full support of all beneficial uses. To validate this assumption, implementation monitoring has been proposed in the monitoring plan in Section 6.2. This monitoring is intended to track progress toward meeting targets. If it looks like greater reductions in loading or improved performance is necessary to meet targets, then a new TMDL and/or allocations will be developed based on achievable reductions via application of reasonable land, soil, and water conservations practices. The linkage between meeting targets and supporting beneficial uses will be monitored through several of the supplemental indicators described in Section 6.3, including juvenile trout densities, macroinvertebrates, and periphyton, which are direct measures of aquatic life and cold water fisheries beneficial use support.

4.7.3 Margin of Safety

Applying a margin of safety is a required component of TMDL development. The margin of safety (MOS) accounts for the uncertainty about the pollutant loads and the quality of the receiving water and is intended to protect beneficial uses in the face of this uncertainty. The MOS may be applied implicitly by using conservative assumptions in the TMDL development process or explicitly by setting aside a portion of the allowable loading (EPA, 1999). This plan addresses MOS in several ways:

- Conservative assumptions were used in all source assessment modeling.
- Metals targets are based on state numeric water quality standards which contain an inherent MOS. Additional restoration targets based on sediment toxicity, biota measures, and stream deposits are also presented as an additional margin of safety to ensure full support of aquatic life and cold-water fishery beneficial uses.
- The suite of proposed supplemental indicators is intended to help verify target compliance and full beneficial use support.

- The proposed supplemental indicators may also provide an early warning method to identify pollutant-loading threats that may not otherwise be identified.
- The WQRPs presented in this document go beyond what is required by the EPA for TMDL development by including restoration and monitoring for non-pollutants such as habitat alteration, dewatering, and non-listed pollutants such as temperature. By doing so, the WQRPs provide a holistic approach to water quality restoration and thus an additional MOS for beneficial use support.
- A large amount of data and assessment information were considered prior to finalizing any impairment determinations. Impairment determination were based on conservative assumptions that error on the side of keeping streams listed and developing TMDLs unless overwhelming evidence of use support was available.

4.7.4 Seasonality

Addressing seasonal variations is an important and required component of TMDL development. Throughout this plan, seasonality is an integral factor. Water quality and habitat parameters such as fines sediment, suspended sediment, turbidity, macroinvertebrate and periphyton communities, and metals concentrations are all recognized to have seasonal cycles.

Specific examples of how seasonality has been addressed include:

- Source assessment modeling of sediment loading inherently incorporates runoff flows when erosion is greatest. Metals assessment included both high and low flow sampling.
- Targets where developed with seasonality in mind: metal targets include seasonal fluctuation in water hardness upon which standards are based; the % <6 fine sediment target data is collected in the summer, after the flushing flows have passed; macroinvertebrate and periphyton targets and supplemental indicator data is collected during the summer months when these biological communities most accurately reflect stream conditions.
- Throughout this document, the data reviewed cover a wide range of years, seasons, and geographic area within the Ninemile TPA.

Water Quality Restoration Plan and Total Maximum Daily Loads for the Ninemile Planning Area

VOLUME III

Monitoring & Restoration Plans

Preface

Volume III, Monitoring and Restoration Plans, contains Sections 5.0 and 6.0. These Sections include: Section 5.0: Restoration Strategy; and Section 6.0: Monitoring Strategy.

The primary goal of this WQRP is to develop a plan that, if implemented, will result in full beneficial use support as related to the State Water Quality Standards. The sections in this volume outline approaches that either mitigate known sources of impairment or monitor the uncertainties outlined in Volume II.

A detailed outline of each section within Volume III is provided below.

Section 5.0: The Restoration Strategy Section outlines the mitigation steps needed to meet the required water quality targets and load allocations and ultimately obtaining full beneficial use support for all waterbodies in the NTPA.

The strategies outlined in Section 5.0 are specific to the sources of impairment described in Volume II. However, it is important to note that not all of the strategies outlined in Section 5.0 can be met in short order. Additional steps identified in Section 5.0, would have to be pursued as feasible. The suggestive steps outlined in Section 5.0 are essential to restoring water quality in the NTPA and would be the voluntary responsibility of all stakeholders as additional resources become available.

Section 6.0: The Monitoring Strategy outlines additional data collection needed to answer the uncertainties that were outlined in Volume II. The following objectives were developed as part of the Monitoring Strategy:

1. Document water quality trends associated with future implementation efforts.
2. Monitor progress toward meeting water quality targets.
3. Fill exiting data gaps on both 303(d) listed streams and on streams that, while not formally listed, are thought to impact water quality in the basin.
4. Conduct an adaptive management strategy to fulfill requirements of this WQRP.
5. Conduct a phased hydrologic study to fulfill the requirements of this WQRP.

The primary purpose of the Monitoring Section is two-fold. First, as outlined above, uncertainties exist that limit confident conclusions at this time. Secondly, it is important to monitor trends over time to ensure that the goals and objectives of this WQRP are met and maintained over time.

Similar to the Restoration Strategy outlined in Section 5.0, the monitoring strategy outlined in Section 6.0 are specific to the sources of impairment and uncertainties described in Volume II.

SECTION 5.0
RESTORATION STRATEGY

5.1 Restoration Priorities

This section presents the overall strategy to achieve water quality restoration and meet water TMDL targets and load reductions. The restoration of water quality and habitat conditions in the Ninemile TPA can be achieved through a variety of management or restoration strategies that fall into two categories: watershed-wide management activities to promote overall upland and stream health, and targeted strategies to address observed impairments on 303(d) listed streams.

The following watershed-wide management and restoration activities should be pursued throughout the Ninemile TPA:

- Upgrade forest roads to meet Montana Forestry BMPs.
- Reclaim forest roads that are surplus to the needs of forest managers.
- Implement Montana's Forestry BMPs on all timber harvest operations.
- Continue post fire restoration and sediment mitigation efforts.
- Encourage riparian restoration and implementation of agricultural BMPs.
- Manage noxious weeds.
- Promote non-structural erosion control.
- Upgrade undersized culverts over time to better accommodate large floods and reduce the risk of culvert failure.
- Correct priority fish passage barriers that are significantly affecting the connectivity of native fish habitats.
- Continue riparian management and monitoring in areas impacted by livestock use.
- Encourage flood plain development setback.
- Pursue funding for restoration of historic mining impacts.
- Coordinate with the local watershed group to implement TMDL recommendations on private land and to bring local residents and land owners into the TMDL and watershed restoration process.

Restoration priorities specific to the listed waterbodies are discussed on a stream-by-stream basis in Section 5.2. It is envisioned that the implementation of the restoration strategy outlined here should be a joint effort between Lolo National Forest, FWP, Missoula County, and the Ninemile Watershed Group, with assistance from DEQ and EPA. These organizations should meet to form a TMDL Implementation Team (IT) to begin the restoration process. It is also likely that outside sources of funding (e.g., 319 Grants, EPA Consolidated Funding Grants, etc.) will be sought for implementation. The schedule for implementation will be dictated by available funding and resources.

The strategies outlined in this section are specific to the sources of impairment described in Volume II. However, it is important to note that not all of the strategies outlined in Section 5.0 can be met in short order. However, additional steps identified in this section would have to be pursued as feasible. The suggestive steps outlined are essential to restoring water quality in the

NTPA and would be the voluntary responsibility of all stakeholders as additional resources become available. Moreover, any strategies that are currently scheduled have been structured as the highest priorities that will result in the greatest benefit to the resource in the shortest time frame.

5.2 Waterbody Specific Restoration Requirements

Sections 5.2.1 through 5.2.7 provide specific stream-by-stream restoration recommendations that should be pursued in additional to the general restoration priorities listed above.

5.2.1 Big Blue Creek

As discussed in more detail in Sections 3.4.1 and 4.5.1, Big Blue Creek is currently meeting most of its targets and supplemental indicators, and thus no TMDL was developed. Although few significant human-caused sediment sources were located in the watershed one of the two forest road stream crossings had a road tread, cut slope and/or fill slope that exceeded 200 feet and was thus identified as a restoration priority. This crossing (#115, Appendix B) should be prioritized for restoration.

5.2.2 Josephine Creek

5.2.2.1 Forest Roads

Of the 14 potential forest road sediment sources evaluated in the Josephine Creek sediment source assessment, 3 had contributing road treads, cut slope, and/or fill slopes that exceeded 200 ft and were thus identified as restoration priorities. These contributing areas are identified on the maps in Appendix B as crossings 181, 186, and 219. Sediment mitigation at these sites should result in an estimated 39% reduction in forest road sediment loading to Josephine Creek. This restoration work should occur as funding allows

5.2.2.2 Culverts

Two culverts in the Josephine Creek watershed are suspected barriers to fish passage. The culvert on the main Ninemile had already been scheduled for replacement by Missoula County. The culvert at the road 890 crossing should be prioritized for restoration.

5.2.2.3 Mining

Historic placer mining is the primary human-caused source of sediment in the Josephine Creek watershed. Approximately 2 miles of the stream has been heavily impacted by mining, resulting in an over widened channel characterized by unstable banks, a lack of habitat diversity, and reduced riparian vegetation. The Implementation Team should pursue funding to restore the mined reaches of Josephine Creek.

5.2.3 McCormick Creek

The McCormick Creek watershed includes 3 listed waterbodies that are discussed jointly for restoration purposes: Little McCormick, upper McCormick, and lower McCormick Creeks.

5.2.3.1 Forest Roads

Of the 28 potential forest road sediment sources evaluated in the McCormick Creek watershed sediment source assessment, 3 had contributing road treads, cut slope, and/or fill slopes that exceeded 200 ft and were thus identified as restoration priorities. These contributing areas are identified on the maps in Appendix B as crossings 180, 218, and 250. Sediment mitigation at these sites should result in an estimated 63% reduction in forest road sediment loading to McCormick Creek. This restoration should occur as funding allows

5.2.3.2 Culverts

According to the Lolo National Forest, there is a fish passage barrier on an unnamed tributary to McCormick Creek on forest road 392 in section 1 SWSW ¼, which is owned by the Plum Creek Timber Company. Additionally, the crossing at the Little McCormick Creek confluence is often de-watered from the mining disturbance upstream, and the pipe is partially blocked by alluvium and may be a passage barrier. Depth and flow connectivity are likely a problem under low flow conditions. The are also several fish barriers in Little McCormick Creek as a result of old mining dams The IT should prioritize these barriers for restoration.

5.2.3.3 Mining

Historic placer mining is the primary human-caused source of sediment in the McCormick Creek watershed. Approximately 2.2 miles of the stream has been heavily impacted by mining, resulting in an over widened channel characterized by unstable banks, a lack of habitat diversity, and reduced riparian vegetation. The Implementation Team should pursue funding to restore the mined reaches of McCormick Creek.

5.2.4 Kennedy Creek

5.2.4.1 Forest Roads

Of the 9 potential forest road sediment sources evaluated in the Kennedy Creek watershed sediment source assessment, 2 had contributing road treads, cut slope, and/or fill slopes that exceeded 200 ft and were thus identified as restoration priorities. These contributing areas are identified on the maps in Appendix B as crossings 221, and 238. Sediment mitigation at these sites should result in an estimated 81% reduction in forest road sediment loading to Kennedy Creek. This restoration should occur as funding allows

5.2.4.2 Culverts

At least two fish passage barriers exist on Kennedy Creek. At the lower end of the mining complex there is an irrigation diversion pond that is a complete fish passage barrier at most flows, and there is a culvert on a private road crossing on lower Kennedy Creek that is a probable fish passage barrier. The IT should prioritize these barriers for restoration.

5.2.4.3 Mining

Historic mining is the primary human-caused source of sediment in the Kennedy Creek watershed. Approximately 1.7 miles of the stream has been heavily impacted by mining, resulting in an over widened channel characterized by unstable banks, a lack of habitat diversity, and reduced riparian vegetation. The Implementation Team should pursue funding to restore the mined reaches of Kennedy Creek.

In addition, mining is the probably cause for elevated concentrations of copper, lead, zinc, and possibly mercury in Kennedy Creek. Additional monitoring is probably required to fully understand the metals loading mechanisms in the watershed, but the adits in the mining complex and elevated metals in stream sediment concentrations are probably the primary sources of the metals. Natural sources may also account for a portion of the metals load. The IT should implement metals monitoring in Kennedy Creek and pursue funding to reduce or eliminate human-caused metals sources.

There are a variety of approaches for cleanup of mining operations or other sources of metals contamination in the State of Montana. Several of the primary mine cleanup programs are listed below. It is anticipated that the IT will rely on these programs to reduce metals loading to Kennedy Creek.

- The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- The Montana Comprehensive Environmental Cleanup and Responsibility Act (CECRA)
- The Controlled Allocation of Liability Act (CALA)
- The Voluntary Cleanup and Redevelopment Act (VCRA)
- The Abandoned Mine Lands Reclamation Program (AML)

5.2.5 Stony Creek

5.2.5.1 Forest Roads

Of the7 potential forest road sediment sources evaluated in the Stony Creek watershed sediment source assessment, 5 had contributing road treads, cut slope, and/or fill slopes that exceeded 200 ft and were thus identified as restoration priorities. These contributing areas are identified on the maps in Appendix B as crossings 316, 317, 318, 320, and 333. Sediment mitigation at these crossings should result in an estimated 76% reduction in forest road sediment loading to Stony Creek. This restoration should occur as funding allows.

5.2.5.2 Culverts

According to the LNF, Stony Creek has a number of probable fish passage barriers on Forest that fragment fish populations. Three culverts are located on Forest roads 18079, 5489, and 34030 in the NE 1/4 of section 5 and 1 is on Forest road 456 in the NW 1/4 of section 33. The culvert on the main Ninemile Road, County Road 412 may also be a fish passage barrier. Two of the culverts on Forest may be removed (on roads 18079 and 34030) and two may be replaced (on roads 5489 and 456) under the Forest Frenchtown Face forest restoration project. The IT should work with LNF to prioritize culverts for restoration.

5.2.6 Cedar Creek

5.2.6.1 Forest Roads

Of the 3 potential forest road sediment sources evaluated in the Cedar Creek watershed sediment source assessment, one had a contributing road tread that exceeded 200 ft and was thus identified as a restoration priority. This contributing area is identified on the maps in Appendix B as crossings 328. Sediment mitigation at this crossing should result in an estimated 34% reduction in forest road sediment loading to Cedar Creek. This restoration should occur as funding allows

5.2.6.2 Culverts

The culvert at road 5155 is believed to be a barrier to fish passage. According to the Lolo National Forest, the culvert has been retrofitted with baffles and log drop structures to facilitate fish passage. It appears that fish passage may be possible at higher flows but during low flows there is a drop at the last culvert baffle that may not be passable by resident fish. The IT should prioritize this culvert for restoration.

5.2.6.3 Agriculture

Agriculture is the primary human-caused source of sediment in the Cedar Creek watershed, particularly on private land between the forest boundary the confluence with Ninemile Creek. The Ninemile Watershed Group, in coordination with State and Federal agencies, should work with landowners on watershed stewardship and grazing BMPs to reduce sediment loading and habitat impacts from agriculture and to meet the goals if this WQRP.

5.2.7 Ninemile Creek

5.2.7.1 Forest Roads

Of the 407 potential forest road sediment sources evaluated in the Ninemile Creek watershed sediment source assessment, 141 had contributing road treads, cut slope, and/or fill slopes that exceeded 200 ft and were thus identified as restoration priorities. These contributing areas are identified on the maps in Appendix B. Sediment mitigation at these crossings should result in an estimated 69% reduction in forest road sediment loading to Ninemile Creek. This restoration should occur as funding allows

5.2.7.2 Culverts

Nearly 50 culverts throughout the Ninemile Watershed, primarily on Forest Service land pose passage problems for fish. The Lolo National Forest has prioritized for replacement or removal 26 of the most important passage problems where the greatest amount of fish benefit from a remedy would be realized. The highest priority projects are typically in watersheds where know native fish production is moderate to strong, and a solution (or solutions where multiple barriers exist in one tributary) could reconnect the entire tributary watershed to main Ninemile. The LNF report on fish barriers in the Ninemile is included as Appendix A. The IT should work in conjunction with the LNF to restore fish passage as funding allows.

5.2.7.3 Agriculture

Agriculture is the largest sources of sediment to Ninemile Creek, accounting for 55% of the total sediment load. The Ninemile Watershed Group, in coordination with State and Federal agencies, should work with landowners on watershed stewardship and grazing BMPs to reduce sediment loading and habitat impacts from agriculture and to meet the goals if this WQRP.

5.2.7.4 Mining

Historic placer mining accounts for an estimated 18% of the total sediment load to Ninemile Creek. Approximately 3.9 miles of the stream has been heavily impacted by mining, resulting in an over widened channel characterized by unstable banks, a lack of habitat diversity, and reduced riparian vegetation. The Implementation Team should pursue funding to restore the mined reaches of Ninemile Creek.

SECTION 6.0
MONITORING STRATEGY

As part of the overall implementation strategy for this water quality protection plan, a water quality monitoring plan for the Ninemile TPA is included to help meet the following six objectives:

6. Fill existing data gaps in the current condition of target and supplemental indicator variables.
7. Document progress of future implementation efforts.
8. Monitor progress toward meeting water quality targets and supplemental indicators.
9. Improve our understanding of appropriate reference conditions for the Ninemile TPA.
10. Conduct an adaptive management strategy to fulfill requirements of this WQRP.
11. Conduct a phased hydrologic study to fulfill the requirements of this WQRP.
12. Conduct additional monitoring to better define possible temperature impairments in the NTPA.

This monitoring plan will evaluate the progress toward meeting or protecting water quality standards and associated beneficial uses (Montana State Law (75-5-703(7) and (9)). The monitoring will also address the tracking of specific implementation efforts. It is anticipated that the Stakeholders will help develop monitoring details and help pursue funding for monitoring and data evaluation.

<u>It is important to note that elements of the following monitoring strategy are strictly voluntary in nature. The only requirements are that DEQ formally reevaluate this WQRP/TMDL in 5 years following implementation of this plan. Any data collected by stakeholders will serve to help make impairment decisions in the future.</u>

6.1 Data Gaps in Targets and Supplemental Indicators

The current condition of target and supplemental indicator variables was compared to reference thresholds in the stream-by-stream data review presented in Section 3.0. In some cases current data were not available. Filling these data gaps is the first step of the proposed monitoring plan. Table 6-1 summarizes the data gaps, which will be addressed by the Implementation Team.

Table 6-1. Targets and Supplemental Indicator Monitoring Locations.

Waterbody	Monitoring Location	Missing Target or Supplemental Indicator
All	All	Juvenile Bull Trout and Westslope Cutthroat Trout Population Trends
All	All	Suspended Solids
All	All	Turbidity
All	NA	Water Yield
Big Blue Creek	Above Foothill Road	Macroinvertebrates and Periphyton
Josephine Creek	In mined reach	Macroinvertebrates and Periphyton
Josephine Creek	NA	Equivalent Clear Cut Acres
Little McCormick Creek	In mined reach	Macroinvertebrates and Periphyton
Little McCormick Creek	Above mined reach	Macroinvertebrates and Periphyton
Little McCormick Creek	NA	Equivalent Clear Cut Acres
McCormick Creek	In mined reach	Macroinvertebrates and Periphyton
Kennedy Creek	In mined reach	Macroinvertebrates and Periphyton
Kennedy Creek	Above road 5507	Macroinvertebrates and Periphyton
Kennedy Creek	Above road 5507	Mercury (at high flows)
Kennedy Creek	In mined reach	Mercury (at high flows)
Kennedy Creek	Near Mouth	Mercury (at high flows)
Cedar Creek	Near mouth	Macroinvertebrates, Periphyton, % fine < 6mm, D50, RSI, WD ratio, LWD/mile, Pools/mile,
Cedar Creek	NA	Equivalent Clear Cut Acres
Ninemile Creek	All 5 monitoring locations	Macroinvertebrates and Periphyton
Ninemile Creek	NA	Equivalent Clear Cut Acres

6.2 Implementation and Restoration monitoring

The Lolo National Forest land managers plan implementation and tracking of restoration activities. As feasible, Montana DEQ would periodically assist with the compilation of the implementation efforts of the various landowners described below.

Implementation and restoration monitoring tracking includes annual summaries of such items as the length of road upgraded to BMP standards, length of decommissioned roads, and fish passage barriers corrected.

Should state BMP audits include harvest areas in Ninemile Headwaters TPA that will be compiled by land managers to serve as future reference in evaluating TMDL success.

LNF and other agencies will continue to identify and upgrade or remove fish passage barriers where appropriate. Consultation with local fish biologists is recommended to ensue desired isolated populations wouldn’t be put at risk for introgression. The Implementation Team will document the progress made in removing fish passage barriers and in monitoring the installation of new culverts to prevent new barriers from being created. The sediment risk from culvert failure analysis was conducted on only a fraction of the total culverts in the NTPA. This analysis would be expanded to all culverts as resources become available.

6.3 Monitoring Progress Towards Meeting Targets and Supplemental Indicators

It is important to note that monitoring and data collection of the proposed supplemental indicators used for purposes of this report may not be suitable to use in the future. It is suggestion herein that these data be collected only if feasible, but with the understanding that different indicators may be realized and more appropriately used in the future if needed.

Fine sediment, D50, and RSI Targets

Annual monitoring of trends in surface fines, D50s, and riffle stability indices will occur at locations throughout the listed watersheds. These sites are shown in Table 6-1. Information generated from this monitoring will be used in future evaluation of TMDL target attainment. Particle size distributions and D50s will be assessed using Wolman pebble counts along riffles in permanent benchmarked stream transects (Wolman, 1954) but may be supplanted by other acceptable measures of fines. While the Lolo National Forest will take the lead in this effort within the Forest boundary, other agencies (DEQ FWP, DNRC) and the Ninemile Watershed Group are encouraged to work cooperatively to monitor target variable trends at locations outside of the forest boundary. DEQ would work with all stakeholders on monitoring methods and protocols as necessary. Information generated from this monitoring will be used in future evaluation of TMDL target attainment. Monitoring on private ground is contingent upon landowners granting access to the monitoring locations.

Biological Data

Biological data (to include macroinvertebrate and periphyton sampling) will be collected every five years as a measure of aquatic life beneficial use support. Macroinvertebrate data is especially important to the WQRP, as it is used as a sediment target, several sediment supplemental indicators, and in Kennedy Creek, as a measure of metals impacts on aquatic life.

Suspended Solids and Turbidity

While suspended solids and turbidity typically require long-term data set to help provide any reasonable inferences about the data, both are easily measured and can prove valuable for future target attainment assessments. Therefore, it is recommended that this monitoring occur annually. It is important to note that seasonality is an important factor when measuring suspended solids turbidity. Consequently, multiple data collection about the annual hydrograph would be necessary to adequately characterize trends over time.

Fish Population Monitoring

Data collection efforts will continue in the basin to help maintain the long-term population database currently maintained by FWP and LNF. The goal of this monitoring is to document trends in the populations of juvenile bull trout and westslope cutthroat trout.

Pools/mile, LWD/mile and Width/Depth Ratios

These supplemental indicators will be monitored at least every five years at the sites listed in Table 6-2.

Equivalent Clear Cut Area and Water yield

Few water yield data are currently available for any of the listed streams in the Ninemile TPA, and ECA data are limited. Thus the first priority is to fill these data gaps as described above in Section 6.1. Once current data are available, ECA and Water Yield will be evaluated every 10 years, or following proposed timber harvests or forest fires.

Metals

In support of the TMDLs for copper, lead, zinc, and mercury in Kennedy Creek, these metals should be monitored at least twice a year, once during high flows in the spring and again during base flows in late summer or early autumn.

Although metals targets have not been established for other streams, metals monitoring should also occur in Josephine and Little McCormick Creeks. As reported in Section 3.0, copper concentrations were slightly above the state chronic aquatic life standards in September 2003. Although subsequent re-sampling during the spring and summer of 2004 revealed no further violations, additional copper monitoring should be conducted to better characterize copper concentrations in Josephine Creek. Little McCormick Creek was listed in 1996 as not supporting its drinking water beneficial use. Although no justification for this listing could be located, it is assumed that elevated metals concentrations, or perhaps the suspicion of elevated metals concentrations as a result of mining were the reason for the listing. Metals sampling conducted in 2004 revealed no violations of state water quality standards, but additional monitoring should occur to verify that metals concentrations are below state standards across a range of seasons in Little McCormick Creek.

Table 6-2. Target and Supplemental Indicator Locations in the Ninemile TPA.

Stream	Monitoring Locations
Big Blue Creek	Near mouth Above foothills road
Josephine Creek	Near mouth In mined reach Above road 890
Little McCormick Creek	In mined reach Above mined reach
McCormick Creek	Near mouth In mined reach Above road 390
Kennedy Creek	In mined reach Above road 5502
Stony Creek	Near mouth Above road 456
Cedar Creek	Near mouth Above road 5515
Ninemile Creek	Below Cedar Creek Downstream of Rennic Creek Near Bird Creek Below FR4256 Bridge Near St. Louis Creek

6.4 Reference Monitoring

Continued monitoring of the target/indicator parameters in reference streams is needed to help increase confidence that the targets and supplemental indicator values chosen in this WQRP best represent the narrative water quality standards, and that these values represent reasonable reference conditions for streams in the Ninemile TPA.

DEQ uses the reference condition to determine if narrative water quality standards are being achieved. The term "reference condition" is defined as the condition of a waterbody capable of supporting its present and future beneficial uses when all reasonable land, soil, and water conservation practices have been applied. In other words, reference condition reflects a waterbody's greatest potential for water quality given historic land use activities. DEQ applies the reference condition approach for making beneficial use-support determinations for certain pollutants (such as sediment) that have specific narrative standards.

Waterbodies used to determine reference condition are not necessarily pristine or perfectly suited to giving the best possible support to all possible beneficial uses. Reference condition also does not reflect an effort to turn the clock back to conditions that may have existed before human settlement, but is intended to accommodate natural variations in biological communities, water chemistry, etc. due to climate, bedrock, soils, hydrology and other natural physiochemical differences. The intention is to differentiate between natural conditions and widespread or significant alterations of biology, chemistry or hydrogeomorphology due to human activity. Therefore, reference conditions should reflect minimum impacts from human activities and represent the potential conditions that could be attained (given historical land use) by the application of reasonable land, soil, and water conservation practices. DEQ realizes that pre-settlement water quality conditions usually are not attainable.

Comparison of conditions in a waterbody to reference waterbody conditions must be made during similar season and/or hydrologic conditions for both waters. For example, the TSS of a stream at base flow during the summer should not be compared to the TSS of reference condition that would occur during a runoff event in the spring. In addition, a comparison should not be made to the lowest or highest TSS values of a reference site, which represent the outer boundaries of reference conditions.

The following methods may be used to determine reference conditions:

Primary Approach

- Comparing conditions in a waterbody to baseline data from minimally impaired waterbodies that are in a nearby watershed or in the same region having similar geology, hydrology, morphology, and/or riparian habitat.
- Evaluating historical data relating to condition of the waterbody in the past.
- Comparing conditions in a waterbody to conditions in another portion of the same waterbody, such as an unimpaired segment of the same stream.

Secondary Approach

- Reviewing literature (e.g. a review of studies of fish populations, etc. that were conducted on similar waterbodies that are least impaired).
- Seeking expert opinion (e.g. expert opinion from a regional fisheries biologist who has a good understanding of the waterbody's fisheries health or potential).
- Applying quantitative modeling (e.g. applying sediment transport models to determine how much sediment is entering a stream based on land use information etc.)

DEQ uses the primary approach for determining reference condition if adequate regional reference data are available and uses the secondary approach to estimate reference condition when there are no regional data. DEQ often uses more than one approach to determine reference condition, especially when regional reference condition data are sparse or nonexistent.

6.5 Adaptive Management Strategy

As monitoring data is obtained and evaluated, DEQ in partnership with the stakeholders will adjust load allocations as necessary to meet targets, especially those targets associated with in-stream conditions. Additionally, targets could also be adjusted. These adjustments would take into account new information as it arises

The adaptive management strategy is outlined below:

- **TMDLs and Allocations:** The analysis presented in this document assumes that the load reductions proposed for each of the listed streams will enable the streams to meet target condition, and further assumes that meeting target conditions will ensure full support of all beneficial uses. Much of the monitoring proposed in this section of the document is intended to validate this assumption. If it looks like greater reductions in loading or improved performance is necessary to meet targets, then a new TMDL and/or allocations will be developed based on achievable reductions via application of reasonable land, soil, and water conservations practices.

- **Impairment Status:** As restoration activities are conducted in the Ninemile TMDL and target variables move towards reference conditions, the impairment status of the listed waterbodies would be expected to change. An assessment of the impairment status (see Section 3.3 and Figure 3-2) will occur during the 5-year review period of this WQPR. At the end of 5 years, an evaluation of BMP implementation, target compliance and beneficial use determinations would be made. At this time, recommendations would be made by DEQ to ensure that the goals of this restoration plan are being met. If, at that time, any one goal or target is not being met, an evaluation would be made that would determine one or more of the following:

    - Adjustments to land-use activities;
    - Make changes to original targets;
    - Collect additional data and reevaluate next cycle.

To ensure reasonable and equitable decisions are made regarding future target and/or management adjustments, DEQ would evaluate and compare both reference and TPA stream data collected under this WQRP with the data collected prior to the development of this plan. Future evaluations of beneficial use support will occur according to the guidelines presented in Section 3.3. If at the 5-year evaluation period it is found that any or all of the streams within the Ninemile TPA are fully supporting beneficial uses, steps would be taken to ensure that management practices and mitigation measures outlined in this WQRP would continue. While favorable management practices would be expected to continue, the level of monitoring outlined in this WQRP could be revised. At this time, the monitoring strategy could be scaled back in both the frequency and intensity. While a downsizing of the monitoring program may or may not take place under these circumstances, enough monitoring would occur to ensure that trends could still be observed.

6.6 Flow Phased Approach

In order to adequately describe the flow and dewatering issues in the Ninemile TPA, a comprehensive basin-scale hydrologic investigation must occur. This investigation would be conducted as a phased approach to this WQRP.

Kennedy and Little McCormick Creeks have been formally listed for dewatering and/or flow alterations. Watershed assessment and data review efforts conducted for this document suggest that Josephine, Stony, Cedar, and Ninemile Creeks may also be impacted by flow-related problems. Data reviewed in Section 3.0 suggest the primary water quantity issues in the Ninemile TPA are dewatering for agricultural uses and mining-induced intermittency in formally perennial streams, both resulting in reduced flows. Decreased in-stream flows can adversely affect aquatic life and cold-water fisheries through decreased sediment transport, increased nutrient concentrations and increased temperatures (Meehan, 1991). In the extreme, streams can be completely dewatered, rendering them incapable of supporting aquatic life.

Although dewatering and flow alteration are considered pollution, not pollutants, and as such do not require TMDLs, both can have negative consequences for beneficial use support and are thus including in this WQRP. The large size of this watershed and the long history of water-use practices in the basin necessitate a phased-approach that will consist of a comprehensive basin-scale hydrologic investigation to answer the following questions:

1. What is the natural hydrologic regime of the waterbodies in the Ninemile TPA and what are their expected mean annual natural flows?
2. What is the extent of surface water-use in the basin and how is it used?
3. What is the extent of groundwater-use in the basin?
4. How efficient are the water use mechanisms in the basin?
5. What is the fate of all diverted water in the basin?
6. Given all the water-use in the basin and the need for full support of all beneficial uses, what are the minimum and maximum flows that can be expected in the basin?
7. What is the effect of the timing, magnitude, duration, and location of irrigation return flows?
8. Where and to what extent do mining impacts result in intermittent flows?

In order to sufficiently answer the above questions, the study would include, but not be limited to the following:

- Map and categorize all irrigated lands and major water supply ditches using Geographic Information System (GIS). Orthophoto quadrangles would be scanned and irrigation lands would be delineated from these base photos. The irrigated lands will be categorized and the water supply for each irrigated parcel identified. Potential stream flow sites and monitoring locations would be selected and prioritized.
- Estimate seasonal surface water inflows and outflows from the basin by measuring and monitoring the flows of the principal streams both upstream and downstream of the major irrigation diversions.
- Establishing multiple stations that are yet to be determined would monitor losses from stream channels and evaporation by riparian vegetation.
- Where possible, monitoring of existing groundwater levels using existing wells. As resources permit, additional wells may need to be identified and drilled to provide adequate coverage.
- Estimations of net irrigation water requirements (the amount of applied irrigation water that is actually consumed by a crop) can be done using two methods. One method would be to calculate the theoretical crop evapotranspiration using standard equations and climatic data. The second method would estimate crop water requirements based on hay yields. The effective rainfall will be subtracted from the measured effective crop-water requirement to determine net irrigation water requirements.
- Gross irrigation water requirements (the total amount of water diverted) will be estimated by measuring diversion rates at representative flood, center pivot and side-roll sprinkler irrigated fields. Delivery system efficiency would be determined by dividing the net irrigation requirement by the gross irrigation requirement.

- In the event that inefficiencies are found, mitigation measures would be developed and prioritized.
- Document the location and magnitude of mining-induced intermittency and prioritize mined reaches for restoration.

Once the water budget/irrigation study is complete, a determination of the impairment status could be made and a corrective action plan put in place. In the event irrigation is noted as potentially dewatering a stream in the Ninemile TPA, spatial analysis combined with calculated irrigation water requirements would be applied to generate “what if” scenarios. For example, stream flows and water availability estimates could be provided for different water management scenarios using modeling techniques to be defined. Additionally, allocations could be developed to help meet the needs of both the resource and the water users.

6.7 Temperature Monitoring Phased Approach

None of the NTPA streams have ever been formally listed for thermal impairments. Therefore no steps were taken in this WQRP to completely address temperature. However, given the known land-use and the current habitat alteration impairments, temperature was addressed at a very coarse level.

In-stream temperature thermistors were employed in all of the NTPA impaired streams as part of this WQRP in 2002, 2003 and 2004. This data was evaluated based on bull trout requirements. Additional historic temperature data was also evaluated. Both these data indicated that Lower McCormick Creek and the main stem Ninemile Creek have elevated temperatures. However, no analysis was conducted that properly identified any sources to these elevated values. It is therefore recommended that a phased study be conducted in conjunction with the phased flow alteration study to clearly define the possible temperature issues in the NTPA.

Conceptually, this study would address the following questions:

1. What is the expected natural thermal regime of the NTPA streams?
2. What are appropriate reference streams for comparison to the NTPA streams?
3. What are the current sources that may be attributing to a thermal problem in the NTPA?

In order to help answer question 3 above, it is important to have a general understanding of the “potential” sources that may be attributing to a temperature problem. Known land-use activities in the Ninemile that may be influencing temperature are agriculture, mining, timber harvest, development, and road construction. These activities may result in flow alterations and decreases in riparian shade.

Riparian vegetation, stream morphology, hydrology, climate and geographic location all influence in-stream temperature. Stream morphology is discussed in Section 3.3 of this WQRP Hydrology, is made up of both surface water and ground water flow. Surface water flow and potential return flows from irrigation would need to be addressed under the proposed flow alteration study in Section 6.6. Ground water flows would have to be addressed under another study scenario.

Forested headwater streams rely heavily on streamside shade to maintain cool water temperatures and maintenance of riparian shade can be achieved through proper management techniques. Effective shade screens the water's surface from direct rays of the sun. Highly shaded streams often experience cooler stream temperatures due to reduced input of solar energy (Beschta, 1987; Li et al., 1994). Given the forested environment, timber management and agricultural practices, and headwater stream setting of the NTPA, riparian vegetation could be judged to be one variable that would result in the most achievable and measurable targets.

It is therefore suggested that a study be developed that would identify shade loss in the NTPA. This study would include, but not be limited to:

- Aerial photo analysis and subsequent field site verification that would determine the existing shade condition of the NTPA streams. Additionally, modeling could be used to predict the shade potential in the NTPA.

This study in combination with the proposed flow study would help identify potential sources to thermal impairments and help with the development of an implementation plan to remedy any problems.

Water Quality Restoration Plan and Total Maximum Daily Loads for the Ninemile Planning Area

VOLUME IV

Public Involvement and References

Preface

The final volume of this WQRP contains Sections 7.0 and 8..0. These sections contain a public involvement discussion that fulfills a requirement of this plan and a bibliography of references cited in the text of this document.

Following Volume IV, are the appendices as cited throughout the text of this document.

SECTION 7.0
PUBLIC INVOLVEMENT

Missoula County Conservation District, the Ninemile Watershed Council, the Montana Department of Environmental Quality, Lolo National Forest, and other agencies and stakeholders contributed to the development of this plan through their participation in the Ninemile Creek watershed TMDL technical work group. Early in this project, the Missoula County Conservation District and the Ninemile Creek Watershed Council assumed a leadership role in water quality restoration planning in the Ninemile watershed. Both groups include a broad mix of local interests including landowners, businesses, and agency representatives.

In 2002, Missoula County Conservation District worked in conjunction with the Ninemile Creek Watershed Council to apply for Section 319 funding to begin development of a Ninemile watershed water quality restoration plan. The grant was approved later that year and the project commenced in early 2003. The Lolo National Forest, Montana Department of Environmental Quality, Montana Department of Fish, Wildlife and Parks, and Land & Water Consulting, Inc provided additional project funding and in-kind assistance.

In spring 2003, the Ninemile watershed TMDL technical work group was established to oversee the various assessment activities and planning needed to complete this project. The group also coordinated public involvement aspects of the project, distributed informational newsletters, and hosted a number of public informational meetings and hearings on the project. The workgroup served as the primary clearinghouse for all aspects of plan development, and will have a significant continuing role in its implementation. In April of 2004, a public meeting, sponsored by the Ninemile Watershed Group, was held at the Ninemile Community Center to explain the TMDL process to local residents and to solicit comments and concerns about water quality in the basin.

As for this Water Quality Restoration Plan, a public comment period was started on November 19, 2003 – December 17, 2004. A formal public meeting was held on December 3, 2004 at the Ninemile Ranger Station. DEQ reviewed and responded to comments and attempted to incorporate them where possible. Any future significant revisions to this plan or identification of water quality impairment conditions on future 303(d) lists will also undergo public review.

This final document reflects modifications made in response to the written and verbal comments received throughout the public comment period. The written comments and respective responses to those comments are provided in Attachment C.

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