WATERSHED RESTORATION PLAN

for

Lake Helena Watershed

Submitted by: Lewis & Clark County
Water Quality Protection District

I. Contents

Lake Helena Watershed Restoration Plan (LHWRP)

February 2015

Executive Summary - needed?

A watershed restoration plan is a work plan that lays out water quality problems and management solutions that will help in restoring and protecting water quality for a geographically defined watershed. The Lake Helena Watershed Restoration Plan (Plan) is a plan to improve water quality on Prickly Pear and Tenmile Creek and its tributaries through best management practices over the next five years.

II. Introductions

A. What is a Watershed Restoration Plan?

A watershed restoration plan is a work plan that lays out water quality problems and management solutions that will help in restoring and protecting water quality for a geographically defined watershed. Watershed plans are a means to resolve and prevent water quality problems that result mainly from nonpoint source pollution. It includes the analysis, actions, participants, and resources related to development and implementation of the plan. The goal is to identify and quantify sources contributing water quality problems; identify and quantify potential solutions; and implement these solutions.

III. Benefits of the Lake Helena Watershed Restoration Plan

A. Economic Vitality and Quality of Life

Water is essential for everyone who lives, does business, or recreates in the Lake Helena watershed. We depend on water for crops and livestock, business and industry, fish and wildlife, boating, swimming, hunting, and fishing. We need a reliable supply of clean, safe, drinking water. The WRP is a locally-developed plan to restore and protect these beneficial uses, which are key to preserving our economic vitality and quality of life.

Without a good plan in place to protect and restore our water quality, this vital resource is likely to suffer additional pollution from our daily activities on the landscape. For example, silt from roads and fields are carried into Tenmile and Prickly Pear Creeks, harming fish and filling in pools. Continued inputs of nitrogen and phosphorus from septic systems, fertilizers and livestock waste will add to algal blooms and low dissolved oxygen in Prickly Pear Creek and Lake Helena. Cattle and pet wastes contribute pathogens to water that children swim in. High nitrate concentrations in groundwater from septic systems can increase drinking water treatment costs and human health concerns.

This document is intended to guide the landowner to improving water quality of those water bodies that are listed on their property in addition to listing priority areas in the watershed that have been identified for restoration work in the next five years.

B. Beneficial Uses of Water Resources

The Montana Water Quality Act (75.5.101 et seq.) provides the framework for implementing state and federal policies to protect the beneficial uses of water. Beneficial uses include agriculture, aquatic life support, drinking water and recreation. Water quality standards to protect these uses are developed by the DEQ and adopted by the Board of Environmental Review. Under the federal Clean Water Act, Montana is required to publish a list of waterbodies in the state not meeting water quality standards (Impaired Waters List). DEQ is required to develop pollution control plans (also known as TMDLs, or total maximum daily loads), that if implemented, will result in meeting water quality standards. DEQ published TMDLs for the Lake Helena watershed in 2006 for 18 waterbodies and 109 waterbody-pollutant combinations. Figure 1 shows Lake Helena watershed's impaired waterbodies. (where?)

IV. Why a Lake Helena Watershed Restoration Plan

A. Opportunities

The Watershed Restoration Plan provides a framework for our community to identify the highest priority and most cost-effective actions to protect our water, now and in the years to come. The planning process offers an opportunity to leverage additional resources to address watershed goals through formation of collaborative partnerships and an action plan to access outside funding sources.

With a DEQ approved WRP, it also allows the WQPD to obtain funding through the Montana Department of Environmental Quality 319 NPS Program for implementation of watershed restoration projects. The WRP is also intended to be a roadmap for the community to identify water quality issues and implement Best Management Practices (there but not sure where to put it yet.outline in Section ?) on their own property.

The Lake Helena Watershed Restoration Plan (WRP) was developed by the Lewis & Clark County Water Quality Protection District, the Lake Helena Watershed Group, and an advisory committee along with the consulting firm Headwaters Policy/Planning Partnership, LLP. Input was also solicited from the public, partner agencies and groups.

B. Overview of Contents of LHWRP

The following watershed plan for the Lake Helena area will cover the nine elements required for a DEQ approved WRP. Out of this process, project priority areas (There but not sure where to put it yet Section ?) have been identified that will be the focus for restoration efforts for the next five years.

It is also important to point out that sediment predominately is a source of impairment watershed wide. It is the intention to add sediment as a priority pollutant for the entire watershed to include potential projects not listed below.

V. Nine elements of a Watershed-based Restoration Plan

The watershed planning process is intended by EPA to be implemented in a dynamic and iterative manner. Although many different components may be included in a watershed plan, EPA has identified nine key elements that are critical for achieving improvements in water quality. In brief, these elements are as follows:

1. Identify and quantify causes and sources of the impairment(s)

2. Estimate expected load reductions

3. Identify BMPs needed to achieve load reductions and critical areas where BMPs will be implemented

4. Estimate needed technical & financial resources

5. Provide an information, education, and public participation component

6. Include schedule for implementing nonpoint source management measures

7. Identify/Describe interim measurable milestones for implementation

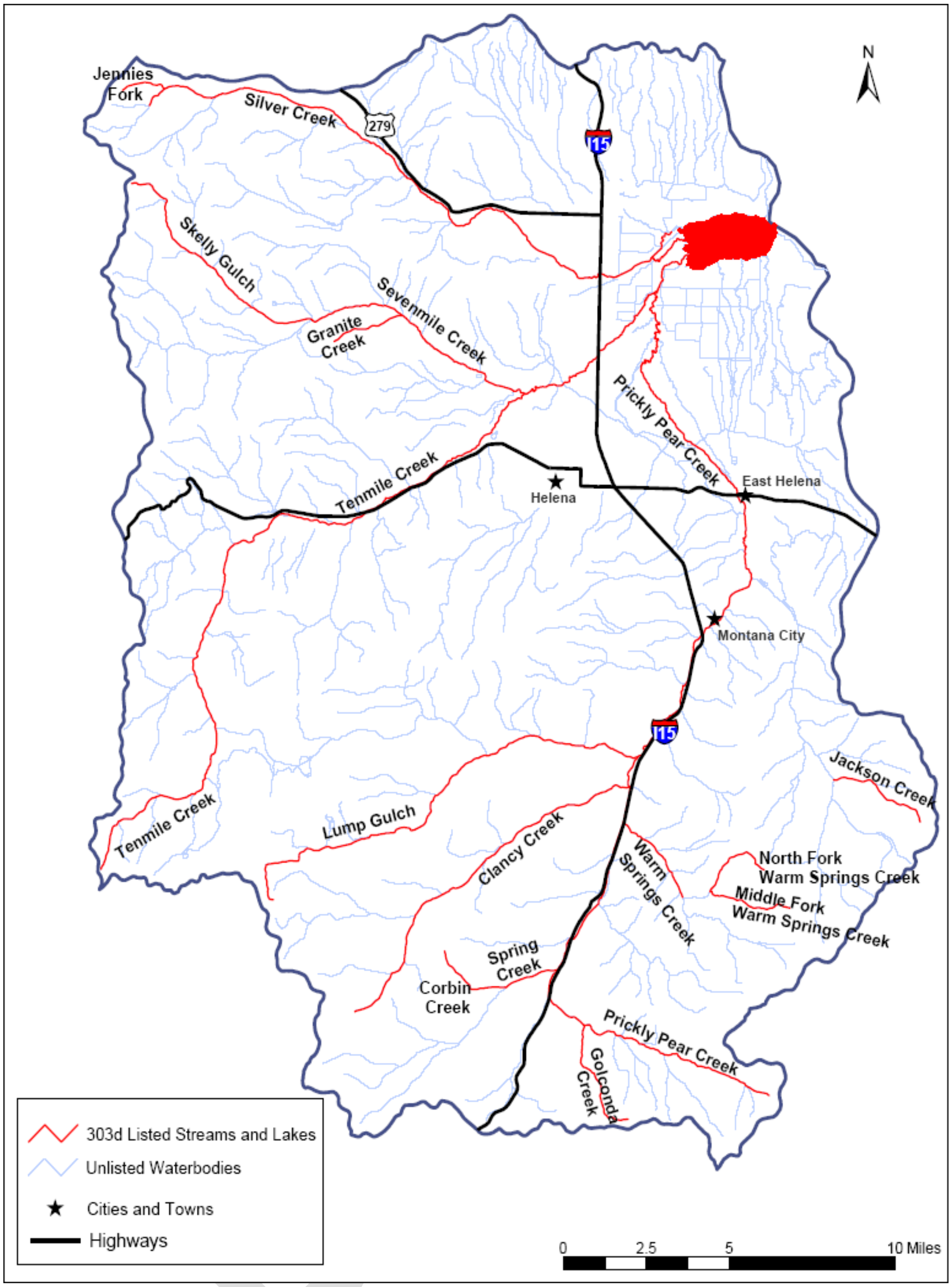
8. Establish criteria to determine if load reductions/ targets are being achieved

9. Provide a monitoring component to evaluate effectiveness of the implementation over time for criteria in number 8.

Change these to elements 1-9.

VI. Lake Helena Watershed

A. Map

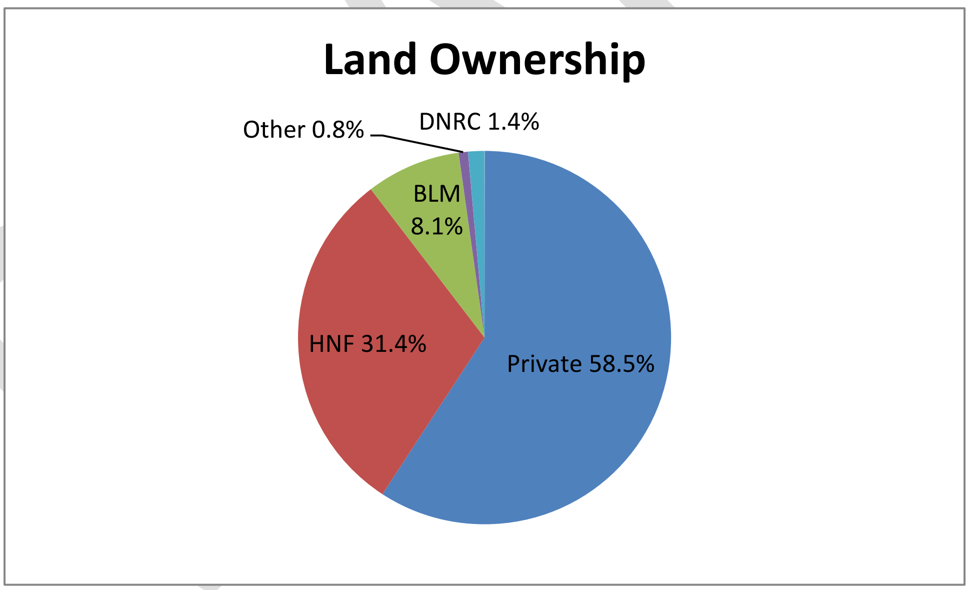


VII. Narrative Description-

A. Lewis & Clark and Jefferson Counties

The Lake Helena Watershed is located in Lewis and Clark (68%) and Jefferson County (32%), within the Upper Missouri River Water Basin. The watershed encompasses 402,000 acres (~620 square miles) and includes the Silver, Tenmile, and Prickly Pear Creek subwatersheds (all perennial streams and USGS 5th field hydrologic units) and Lake Helena (Figure 1). The headwaters of these streams lie within the mountainous and forested lands of the Helena National Forest, along the Continental Divide to the west and the Elkhorn Mountains to the south. The streams flow east and north into and through the Helena Valley to Lake Helena and the Missouri River. Lake Helena was formed through the flooding of an extensive wetlands area formed by the convergence of Silver, Tenmile and Prickly Pear Creeks. When the Upper Missouri River dams were constructed, in particular Hauser Dam, this area was flooded creating the approximately 1600-acre Lake Helena.

Watershed elevations range from 9,381 feet on Elkhorn Peak to 3,550 feet at Lake Helena. Average annual precipitation ranges from 30-inches along the Continental Divide to 10 inches in the lower parts of the valley. Soils range from sand and gravels to loam to silty clay loam and are subject to erosion when vegetation is removed. The stream channels and stream banks are generally composed of sand, gravel and cobbles. But as these streams leave the steeper mountain valleys and enter into the alluvium-filled Helena Valley, finer grain sediments are deposited as stream gradients are reduced and alluvial fans are formed in some locations.



Montana's capital city, Helena, is the center of the watershed. Helena was founded in 1864 upon the discovery of significant placer gold deposits in Last Chance Gulch. This alluvial deposit emanated from a canyon later found to contain hardrock gold and silver veins. Helena became a railroad town in 1883. Its founders established significant banking, financing and supply institutions that supported vast areas of the region. Early on in its development, the area supported industrial operations – smelters, lime production facilities, foundries, lumber yards and many light manufacturing businesses that were linked to mining and agricultural production. Mining occurred in all of the tributaries of the Lake Helena watershed. Roads to access the mine sites were constructed along streams and many of these roads are still in existence today.

The population of the watershed is estimated to be 55,000 people. The area termed the Helena valley and the area along the I-15 corridor have population densities ranging from 100 to over 5,000 persons per square mile.

The Helena valley is the primary population center and economic hub for Lewis and Clark County and northern Jefferson County. The valley continues to encompass the largest percentage of the Lewis and Clark County's population and growth (Lewis and Clark County Growth Policy Plan, 2004). According to a forecast made by the City of Helena, the population of the greater Helena valley will increase to approximately 70,000 by 2020. Northern Jefferson County has grown at rates similar to the Helena valley and this trend is predicted to continue due to the close proximity (6 miles) to the City of Helena and Helena valley businesses.

B. Area

Land use historically changed and continues to change, both geographically and over time, from mining and logging to areas of irrigated agriculture (hay, alfalfa, and other grasses), livestock grazing, industrial use, and residential and commercial development in the cities of Helena and East Helena, the Helena Valley and Northern Jefferson County. Extensive and continuing mining of metals has occurred in the planning area since the 1860's, with many inactive or abandoned mine sites remaining. Dredge and placer mining in the watershed resulted in disruption of natural stream systems. Storm water runoff from Helena and East Helena streets and lawns flows into Tenmile and Prickly Pear Creeks. Wastewater effluent from the Helena and East Helena treatment plants is released under permit into Prickly Pear Creek. Segments of all the main stem creeks have been channelized in the upper and lower reaches, with channelization in the lower reaches causing adverse impacts to riparian vegetation within the Helena Valley.

C. Water Resources –

1. Streams and Lakes

Water rights in the basin are closed to new appropriation due to over-allocation. Municipal and agricultural water diversions have led to dewatered conditions in Tenmile and Prickly Pear creeks. Seventy percent of the City of Helena's water supply is taken from the Upper Tenmile Creek watershed. The remaining thirty percent of Helena's water supply is diverted from Canyon Ferry Reservoir on the Missouri River. The City of East Helena withdraws a portion of its municipal water from an infiltration gallery on McClellan Creek in the Prickly Pear watershed. This source is supplemented by groundwater wells located within the Helena Valley aquifer. Tenmile, Silver, and Prickly Pear Creeks all provide recharge to the Helena Valley aquifer, the only source of drinking water for approximately 25,000 residents in the valley.

2. Wetlands, riparian areas, and floodplains

The Lake Helena portion of the Helena Valley originally consisted of a wetland complex that ranged in size from 3,600 to 7,800 acres. (site)

3. Groundwater

Ground water issues in the Helena Valley reflect the mining history of the area for metals, natural conditions for arsenic, selenium and uranium, nutrients from agriculture and wastewater treatment, and chemicals from anthropogenic sources. Nutrient enrichment of ground water is considered a primary issue. The WQPD has been actively supporting implementation of a septic maintenance program by Lewis & Clark County as a method to control nutrient releases to ground water from non-point sources.

The Helena Valley aquifer comprises surficial alluvial deposits overlying older Tertiary basin fill materials. The contact between recent deposits and older Tertiary deposits is poorly defined, and both units are considered as part of the same aquifer. Ground water in the central part of the valley reflects a vertical, upward gradient with surface flowing wells present in the area. The area near Lake Helena was historically wetlands prior to development of the lake, reflecting a shallow water table in the area. After Lake Helena was established, a series of subsurface drains were installed in the central valley to lower the water table for agricultural use. As a result, the shallow aquifer in the central part of the valley reflects both seasonal recharge from irrigation and water table lowering from drains which generally flow year round. The Helena Valley Aquifer is the source aquifer for numerous Public Water Supplies (PWS) in the valley, as well as individual households using private wells.

Primary recharge to the aquifer system occurs from stream loss along the valley margins, direct infiltration of precipitation, and from flow from the adjacent bedrock aquifer systems. Additional recharge occurs seasonally from the irrigation canal system in the valley, including the main Helena Valley Irrigation Canal which brings water into the valley from outside of the Lake Helena Watershed planning area. Streams in the Helena Valley generally lose from to ground water as they enter the valley, and become gaining streams in down gradient areas near the discharge points into Lake Helena (Swierc, Groundwater report)

VIII. Watershed Stakeholders

A. Overview –

Anyone living in the Lake Helena watershed is a stakeholder. They are also the workers, and recreationists that values clean water and will restore and protect it. Examples of additional stakeholders in the Lake Helena watershed are:

1. Upper Tenmile Steering Committee
2. Lewis & Clark and Jefferson Counties
3. Helena and East Helena city residents
4. Lewis & Clark and Jefferson Valley Conservation Districts

B. Water Users

Water users in the Lake Helena watershed clearly have a stake in maintaining and improving the quality and quantity of the water supply in this area. Primary water uses in the Lake Helena Watershed are listed below.

Water Users	
Agriculture	Livestock watering & irrigation of crops and pasture
Drinking water (Residential)	Upper Tenmile (City of Helena), portion from McClellan Creek (City of East Helena) , groundwater (Valley residents)
Wastewater	City of Helena Groundwater septic users
Recreation	Recreational use by streams & lakes
Fish and Wildlife	Water bodies and associated riparian areas provide important habitat for a variety of mammals, fish, birds, and amphibians.
Forestry	
Mining	

C. Public Participation in the Development of the WRP

The LCCWQPD and the LHWG facilitated public participation in the development of the WRP through the following information, education, and outreach activities and resources. (when did these activities take place?)

1. **Website created to house documents for plan development**
2. **Fact Sheet**
3. **Letter to Stakeholders sent out to the LHWG mailing list of over 800 members**
4. **Stakeholder Interviews- (how many in total)**
5. **Presentations to Community Organizations**
6. **Public Meeting (where? Just one?)**
7. **Survey**
8. **News Media**

IX. Watershed Restoration Priorities and Action Plan

A. Outreach and Education

Information and education has always been an important component for the members of the Lake Helena watershed. Informing and educating the members of past and proposed activities is paramount for successful projects. Their knowledge of the concerns and ways to improve and protect by using best management measures are important to improve water quality in the watershed.

Listed below are ways the WQPD and the LHWG will administer educational outreach to the public to ensure understanding of best management measures applied to listed projects.

Activity	Purpose	Timeline
Social Media	Informs the public of watershed activities	On-going
Newsletter	Sent to roughly 750 members on the mailing list informing of current activities in the watershed	2x year
Presentations	Informing the public on issues of concern in the watershed	3x year
Watershed tours	To highlight previous and proposed restoration work	As-needed
Watershed group meeting	Focuses on one or two current issues in the watershed	Quarterly
Workshops/festival	Informing landowners/public on issues in watershed	On-going
Youth Programs	Increasing youth awareness of water quality and local concerns	On-going

X. Resources to Implement the Plan

A. Technical Assistance

The WQPD and the LHWG does not have a formal technical advisory committee for project review, but the LHWG steering committee and our local partner's coordination and collaboration will be paramount when seeking technical advice on potential projects.

Listed below are set of experts from various agencies that the WQPD and the LHWG collaborate with on potential projects in the watershed . (At what time is current? 2015? Maybe rewrite this more positively. You draw on a set of experts who are actively involved to review projects…)

1. **Allen McNeal, McNeal Resources, Townsend, MT**
2. **DEQ: Mark Ockey, Water Quality Specialist, Helena, MT**
3. **FW&P: Eric Roberts, Fisheries Biologist, Helena, MT**
4. **LC CD: Chris Evans, Administrator, Helena, MT**

5. **LC CD: Jeff Ryan, Supervisor**

6. **MBAC: Brian Obert, Economic Development Specialist**

7. **PPLT: Andrea Silverman, Land Protection Coordinator**

XI. Funding Partners

(table on next page)

Funding partners				
Financial Assistance	**Description**	**Funding**	**Grant cycle**	Contact/Website
EPA Targeted Watershed Grant – May not be available anymore	Capacity building grants to support local watershed efforts	Five to seven awardees will be selected ranging from $30,000-70,000	See EPA website for more information	http://water.epa.gov/grants_funding/twg/initiative_index.cfm
MT FW&P- Future Fisheries Improvement Program	Restore rivers, streams and lakes to improve and restore Montana's wild fish habitats.	Between $350,000 and $650,000 are available.	Applications are considered every year in June and December	http://fwp.mt.gov/fishAndWildlife/habitat/fish/futureFisheries/
Northwestern Energy	Community works fund	Variable	annually	http://www.northwesternenergy.com/community-works/community-works-fund
Five Star Restoration Program	Brings together groups and organizations to provide environmental education and training through projects that restore wetlands and streams.	$5,000-$20.000	Annually	http://water.epa.gov/grants_funding/wetlands/restore/index.cfm
MT DEQ 319	The Montana DEQ provides 319 funding to protect water quality and restore water quality in water bodies whose beneficial uses are impaired by nonpoint source (NPS) pollution and whose water quality does not meet state standards	Recommended range is $20,000 to $300.000 per application	Grant cycle is annual Proposal application due in July Final applications due in October	http://www.deq.mt.gov/wqinfo/nonpoint/319grants.mcpx
DNRC HB 223 funds	Available to Conservation Districts for conservation, education, and natural resource related projects	"On the Ground Projects" $20,000 & Education Projects $10,000	Grant cycle is quarterly	Linda Brander Phone: 406-444- e-mail:lbrander@mt.gov http://dnrc.mt.gov/cardd/LoansGrants/ConservationDistrcitLoanGrants.asp
DNRC Watershed Planning and Assistance Grants	To assist Conservation Districts with expenses associated with watershed planning.	$11,000	Grant cycle is quarterly	Dave Martin Phone: 406-444-4253 e-mail:damartin@mt.gov http://dnrc.mt.gov/cardd/LoansGrants/ConservationDistrcitLoanGrants.asp
DEQ Mini-grants	Administered by the Soil and Water Conservation Districts of Montana, Incorporated (SWCDMI) with assistance from the DEQ NPS Program. To fund local education and outreach efforts that address nonpoint source pollution and water quality issues	Up to $2,000	Grant cycle is biannual	

A. Set of Criteria

There are a wide variety of approaches that can be used to evaluate the management strategies that are listed below. A set of interim criteria has been made for the proposed targeted areas to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards.

Issue	Environmental Indicators to measure progress
Sediment	• Photographs comparing channel width and location. Both historical aerial and ground to obtain an average annual rate. • Modified BEHI conducted on proposed projects
Temperature and Flow	• Length of streambank vegetated. • Maintain streamflow (Proposed Criteria 8-22 cfs for PPC)
Metals	• PH level monitoring • Stream bank stabilization
Nutrients	• Composite soil test at restoration projects tons/year (DEQ Load Reduction Est. Guide)

(Would be nice to tie into monitoring plan more directly)

B. Monitoring Component

Monitoring programs can be designed to track progress in meeting load reduction goals at attaining water quality standards.

Measurable progress is critical to ensuring continued support of water shed projects. By monitoring and gathering data will track that progress is moving forward and to also see if modifications need to be made in the monitoring plan.

The following monitoring component to evaluate the effectiveness of the implementation efforts over time are currently the practices that the LHWG & the WQPD use.

Sediment	DEQ Load reduction calculations
Temperature and flow	Temperature and water discharge measurements
Metals	Stream bank stabilizations projects and water quality sampling
Nutrients	Soil calculations Stream bank stabilizations

XII. History of Watershed Planning and Restoration

Twenty seven stream segments including Lake Helena in the Lake Helena watershed are listed on Montana's 2012 Clean Water Act Section 303(d) List as impaired relative to their ability to support the designated beneficial water uses defined in Montana's water quality standards. In 2006, the Montana Department of Environmental Quality (DEQ) published a "Framework Water Quality Restoration Plan and Total Maximum Daily Loads for the Lake Helena Watershed Planning Area" (DEQ, 2006). This report included assessment of pollution sources, refinement of the water quality improvement goals (or targets), and development of the actual TMDLs, pollutant load allocations, and a conceptual restoration strategy and effectiveness monitoring plan. This document provided a general conceptual plan to attain and maintain the necessary water quality improvements. It did not, however, provide in-depth details about how the plan will be implemented on a site-specific basis.

In 2006 when the Lake Helena Planning area TMDL was completed many of the metals were not completed due to lack of data. July 2013 the metals were completed for the Lake Helena, including Corbin Creek, Granite Creek, Jackson Creek and Silver Creek in an addendum to the Lake Helena TMDL.

XIII. Overview of Pollutants

As previously discussed, the Lake Helena Watershed is a geographically large and complex geographic area with three large streams, dozens of lesser streams, and tributaries, as well as the large central area of the Helena Valley. Natural and man-made environmental impacts vary across the watershed, depending on natural factors such as climate, vegetation, and geology and the intensity and complexity of both historical and current use of the land by humans.

As summarized in the TMDL documents, the important pollutants impacting the water environment in the watershed are sediment, nutrients, metals, and elevated temperatures. Each of these four pollutants is caused by factors that have different effects in different parts of the watershed. Fully documenting these effects and determining their cause is beyond the scope of this document. Environmental science is a complex field requiring contributions from many disciples such as biology, chemistry, geology, meteorology, and engineering. The physical, chemical, and biological factors determining the stream characteristics are complex and interrelated.

However, using the available environmental data in the watershed and background environmental results from research on many similar watersheds, particularly in the Rocky Mountain West, some general spatial trends concerning where some of these factors has an impact in the watershed can be made.

Factors affecting sediment, nutrients, metals, and elevated temperatures:

Sediment is the solid material carried in the streams in the watershed. The amount of sediment in a stream depends on two factors: how particles are eroded from the watershed and how particles are carried downstream. The following discussion is a simplification of a very complex process.

A. Sediment-

Sediment originates from water from rain or snow melt breaking up and moving the soil on the sides of a stream valley. The erodibility of a soil depends on a complex group of factors including the nature and composition of the soil, the size and slope of the land, the amount and types of vegetation, as well as precipitation patterns, climate regime and land use. Typically, older soils with large amounts of clay minerals are less erodible than younger soils composed of minerals freshly derived from weathered igneous or sedimentary rocks. Gravity increases the erodibility of steep land surfaces. Land covered with vegetation with an extensive root system such as trees or grasses is less erodible than land where the vegetation has been disrupted by grazing or fire. Intensive use of land for agriculture, mining, and forestry disrupts the vegetation cover and soil structure increasing the potential for erosion.

The amount of sediment carried past a fixed point in a stream is constantly variable on time scales from seconds to the seasons. At a fixed point in a stream, there is a dynamic balance between how much sediment is deposited in the stream bed, how much sediment is being picked up from the streambed and banks, and how much sediment is being transported by the stream. The amount of sediment transported increases very rapidly as the stream velocity increases. Seasonal variations are very large, with sediment transport often being greatest during snow melt and spring runoff or thunderstorms. Depending on the particle size, particles in the stream can either move on the bottom as bed load, or move in the stream flow bouncing off the bottom (saltation) or completely carried (suspension). Streams are among the most dynamic of land features and can be completely altered by flood events. Outside of short-term transient or episodic weather events, undeveloped stream segments tend to reach a state where sediment erosion and deposition are balanced and the landscape does not rapidly change. Man’s changes to the landscape often upsets this balance. Seemingly small changes in land management such as removing or replacing native streamside vegetation can lead to large stream changes such as rapidly eroding banks and very large increases in sediment load in the stream.

Streams occur as water runs downhill driven by gravity. Higher stream velocities are associated with the steeper slopes of smaller tributary streams in the uplands around a main river valley. At these higher velocities, sediment is more easily transported and relatively less is deposited. Generally these smaller streams are rocky in the stream beds with minimal sediment. As the tributaries enter the larger river, typically the water velocities decrease because the slope of the river is lower and more sediment is deposited. The further from the upland part of the watershed, the more the main river slows and sediment is preferentially deposited rather than transported.

B. Nutrients

Nutrients in water quality discussions usually refer to nitrogen and phosphorus, chemical elements and compounds that promote the growth of plants in streams and lakes such as algae. Large amounts of nutrients in streams promote the growth of algae that uses the available dissolved oxygen in the stream during the night, depleting the oxygen available for other organisms such as fish. The amount of the nutrients in streams and lakes is based on chemical interactions between atmosphere, water, the sediments and the stream biology. The amount of stream nutrients also depends on the amount of nutrients entering the stream from adjacent land uses, which may vary seasonally.

In a general way, nutrients concentrations depend on the watershed land uses, soils, and wastewater discharges. In a fairly developed watershed such as Lake Helena, the amount of nutrients generated from human activities (fertilizer runoff, septic systems, wastewater discharge, agriculture, storm water runoff, etc.) is much greater than from natural sources. In the Lake Helena watershed, nutrients are generated from both point sources such as sewage treatment plants and septic systems as well as non-point sources distributed over the land such as fertilized lawns and agriculture. Groundwater with high nitrogen concentrations from septic systems and fertilizers has been shown to contribute to in-stream water quality impairments in the watershed.

C. Metals

In sufficient concentrations metals such as arsenic, cadmium, copper, lead, and zinc are dangerous to public health if the stream is used as a source of drinking water. Metals are often toxic to fish and other aquatic biota at much lower concentrations than those impacting humans. Metal concentrations can occur naturally as sediment is eroded from metal-containing rocks and transported into streams. Once in the stream, metal ions can be dissolved into stream water or be attached (adsorbed) to sediment particles.

The high concentration of metals in some streams in the Lake Helena Watershed is most likely caused by the large number of historic mining sites in the watershed. Exposed ore, waste rock, and mine tailings with high metal content all weather, releasing metals into watershed streams. Metal contamination in streams is largely determined by the historic mining in the watershed which was in turn controlled by geology. In the watershed, historic mining has been “hard rock” mining for metallic ores in igneous rocks located mostly south and west of Helena.

D. Water Temperature

Water temperature controls the type and amount of biological organisms in a stream from microorganisms to larger organisms such as fish. All organisms have an optimum temperatures range for survival. Temperature also indirectly affects organism survival because rates of both inorganic and organic processes are usually temperature dependent. With increasing temperatures, amounts of microorganisms such as bacteria and algae increase, causing greater consumption of dissolved oxygen, leading to decline of many of the native fish species.

Temperature in a stream depends on how much heat from the atmosphere is absorbed by the water. Water must absorb a significant amount of heat energy in order to cause small increases in temperature; technically water has a large heat capacity. Near a stream, the air, land, and vegetation all have lower heat capacities than the water. Changes in stream temperatures tend to lag behind air temperatures as seasons change; even in late summer, stream water is much cooler than the air temperature.

Stream temperature can reach critically high levels in summer (generally July through September). The lower seasonal water flow and lower water velocities in summer cause less water to pass through a stream reach, increasing the temperature in the remaining water. The lower flows are made worse if there are upstream diversions for agriculture (livestock or crops), upstream direct intake of water from the stream for industrial or drinking water, or upstream pumping from high yield wells, causing water to be drawn out of the stream. The amount of shading of the stream reach also affects the temperature; lower temperatures are associated with fewer hours of direct exposure to sunlight. Land use that results in the removal of trees and tall shrubs from the stream banks increases stream temperatures. Stream temperature impairments are generally found lower in the watershed where the cumulative impact of water diversion and use is most pronounced.

E. Potential Projects Table

I think these are estimates of projects. Would be nice to define what high, medium, and low cost means somewhere. Any idea on time frame for implementation? It could be similar

Projects in Priority area- Lower Tenmile and Prickly Pear Creeks	Measurable Milestone - Targeted Reach	Action Items	Responsible parties	Expected Implementation Time?	Cost
1.Seek willing landowners to put in place and maintain riparian buffers and filter strips	PPC – York to Sierra – 150 feet TMC – DWTP to N.MT – 200 feet	Contact Landowner, develop project, ID partnerships, seek funding	Watershed Group and WQPD and partners and willing landowners in proposed area	When do you expect to implement?	Medium
2.Encourage use of water gaps, off-stream watering, and riparian fencing to control livestock access to the stream	PPC – York to Sierra – 200 feet TMC – DWTP to MT – 200 feet	Contact Landowner, develop project, ID partnerships, seek funding	Watershed Group and WQPD and partners and willing landowners in proposed area		Medium
3.Implement bioengineered stream bank stabilization treatments	PPC – York –500 feet TMC DWTP to PPC – 150 feet	Produce handout – develop and design projects	Watershed Group and WQPD and partners and willing landowners in proposed area		High
4.Eliminate or move or improve diversions to maintain streamflows provide for fish passage	PPC York – Sierra – one diversion TMC DWTP to PPC – one diversion	Consult with biologist, develop and design alternate fish passage	Watershed Group and WQPD and partners and willing landowners in proposed area		High
5.Reduce nutrient loading by supporting efforts, including WWTP optimization studies, to reduce nutrient loading of wastewater discharged to PPC	PPC Wylie to Sierra	Assisting the cities in their efforts to reduce nutrient loading ex. Discuss with government agencies, write letter of support, monitoring, seek funding as needed, evaluate alternatives	Cities of Helena, East Helena		
6.Maintain operation PPC Rewatering project to maintain stream flows	PPC Wylie to Sierra	Purchase 2000 AF to maintain flows in PPC, contract with HVID for delivery to PPWU to replace irrigation stream water. Solicit funding and alter water rights.	WQPD		Medium
7.	Lower Tenmile & Prickly Pear Creeks				
8.					

Sediment

Water Quality Problems

The use of water for fish and aquatic life is not reaching full potential in 12 streams in the Lake Helena watershed due to excessive levels of sediment covering fish spawning and aquatic insect habitat, filling pools, and altering stream channel morphology. (See Figure 1) In some streams, human-caused sediment loading is resulting in unnaturally high levels of turbidity. (EPA 2006)

Stream segments impaired by sediment include:

Clancy Creek – headwaters to the mouth

Corbin Creek – headwaters to the mouth

Jennies Fork – headwaters to the mouth

Lump Gulch – headwaters to the mouth

Middle Fork Warm Springs Creek – headwaters to the mouth

North Fork Warm Springs Creek – headwaters to the mouth

Warm Springs Creek – Middle Fork to the mouth

Prickly Pear Creek – headwaters to Lake Helena

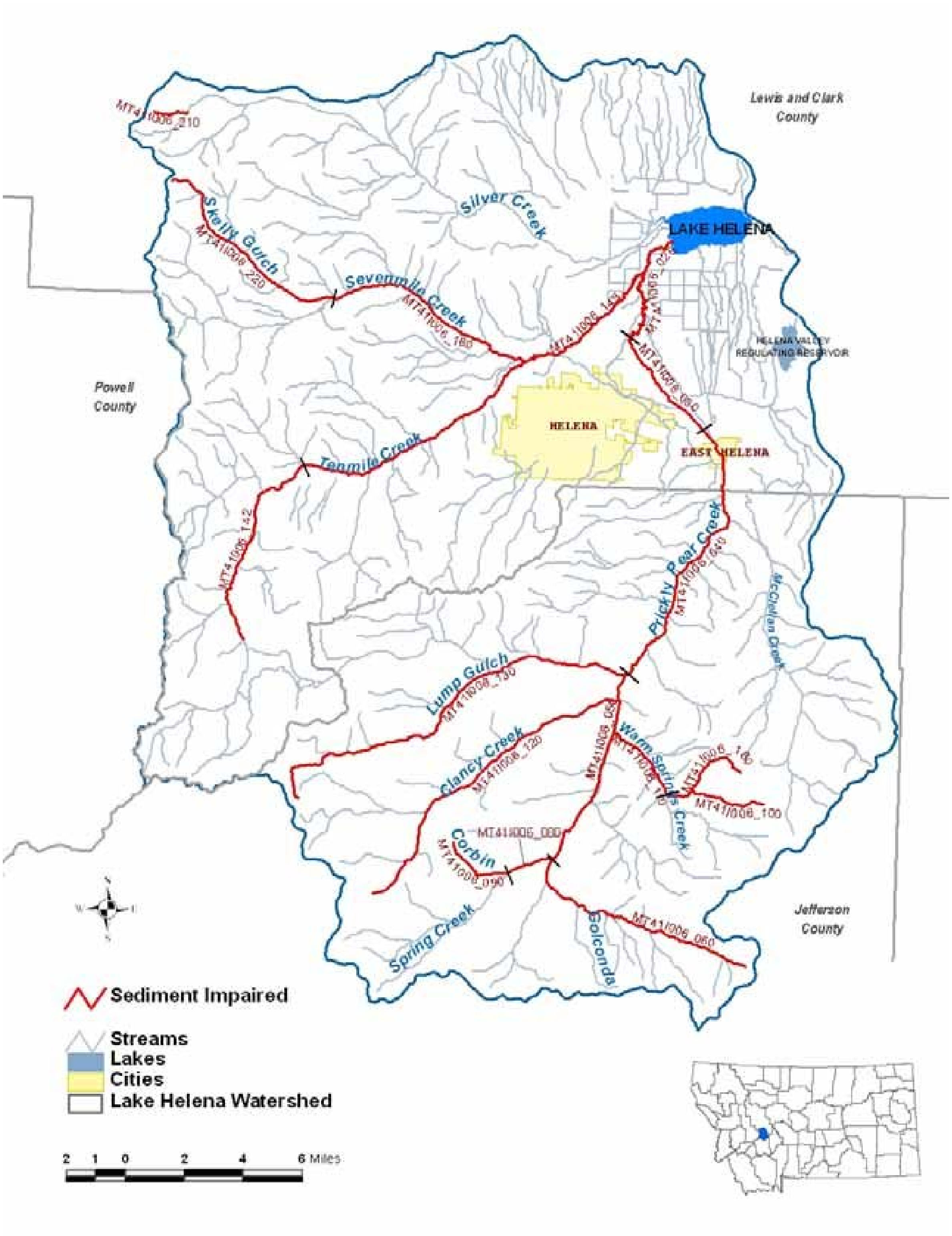
Sevenmile Creek – headwaters to the mouth

Skelly Gulch – headwaters to the mouth

Spring Creek – Corbin Creek to the mouth

Tenmile Creek – headwaters to mouth

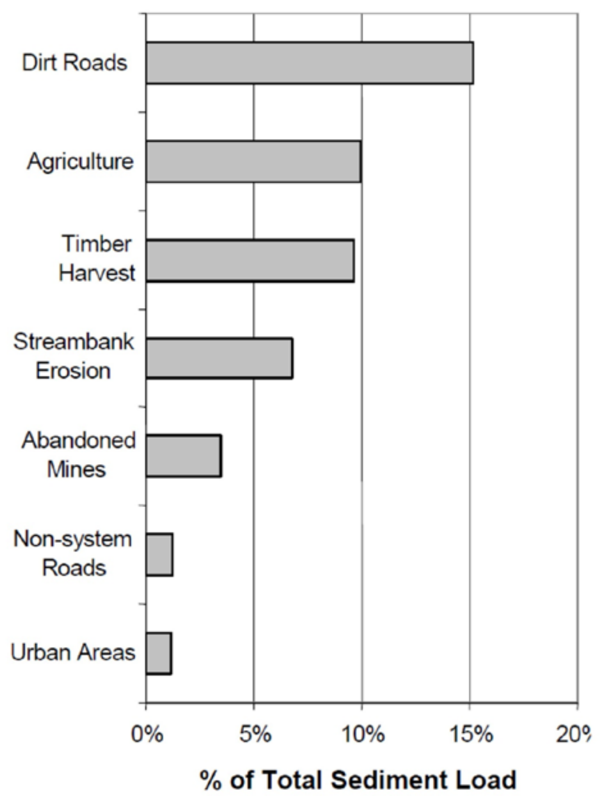
Figure 1-Streams Impaired by Sediment in the Lake Helena Watershed (Source: EPA 2006)



On average, sediment loading in the Lake Helena watershed is estimated to be approximately 47% above the naturally occurring level.

Figure 2 shows the sources of sediment in the Lake Helena Watershed.

Figure 2-Sources of Sediment in the Lake Helena Watershed (Source: EPA 2006)



The relative importance of these individual source categories varies dramatically from stream to stream. Unpaved roads, timber harvest, and abandoned mining are important sources of sediment in the headwaters of the watershed. Agricultural sediment loading increases in importance in the downstream areas of the watershed. Human-caused streambank erosion is an important source of sediment throughout the watershed.

Watershed Restoration Goals

The LCCWQPD and the LHWG have identified projects that reduce sediment as priorities for this WRP. The rationale for targeting sediment as a priority is as follows:

Sediment is a significant cause of impairment in the Lake Helena watershed. Most of the impaired streams in the Lake Helena watershed are polluted by sediment resulting from erosion associated with a variety of land uses.

Metals and some forms of nutrients are often adsorbed to sediment.

Management practices that result in reduced sediment loads have the potential to also reduce pollution from nutrients and metals. Establishment of healthy riparian buffers can also lower water temperature to provide better habitat for fish.

The LCCWQPD and the LHWG have experience with implementing projects that control erosion and sedimentation.

The LCCWQPD and the LHWG have established the following goals from improving watershed health and water quality impaired by sediment in the Lake Helena watershed:

Improve fish and wildlife habitat.

Reduce sediment, nutrients, and associated metals.

Watershed Restoration Strategies

The LHWG and the LCCWQPD have identified the following priority management measures to reduce loads of sediment and associated pollutants in the stream segments specified:

Bioengineered Streambank Stabilization

Filter Strip

Forestry BMPs

Off-Stream Watering Facility

Riparian Buffer

Riparian Fencing

Road BMPs

Storm Water BMPs

Water Gap

These management measures are described in Appendix B.

More detailed information about the amount of sediment load by source and location of sites that contribute sediment loads on specific stream reaches can be found in Volume I (EPA 2004), Volume II, Appendices A and D.

Description of creeks that were listed. How are these water bodies written to guide the landowner to implement BMP's

Clancy Creek

1. Water Quality Problems

Aquatic life and drinking water are important uses of water that are not supported in Clancy Creek. The DEQ has identified pollutants that cause impairment of these beneficial uses of water. (DEQ CWAIC 2014) These include:

- Metals: arsenic, cadmium, copper, lead, and zinc.
- Sedimentation/Siltation**.**

All of the causes of impairment listed above warrant a TMDL.

The uses of Clancy Creek are also affected by alteration of streamside vegetative covers and the substrate (material at the bottom of the stream that provides habitat for aquatic life).

The primary human-caused sources of impairment that were identified in Volume I (2004) and Volume II (EPA 2006) are summarized below.

a) Metals

Abandoned mines, sediment-associated metals and human-caused streambank erosion are the primary sources of metals in Clancy Creek.

b) Sediment

The primary sources of sediment in the Clancy Creek watershed, in order of importance, are streambank erosion, timber harvest, unpaved roads, urban development, and non-system roads and trails.

Streambank erosion was primarily caused by riparian grazing, stream channelization from road encroachment, historic mine tailings piles, and channel encasement. The stream has been widened, straightened and incised as a result of placer mining, which may have altered the stream's hydrology in addition to its morphology.

Clancy Creek Road is directly adjacent to the stream for much of its length. Road sediment is readily transported to Clancy Creek due to the lack of a riparian vegetative buffer, removal of road shoulder vegetation from road grading activities, and the inherent erodibility of the granitic geology.

Sediment is also generated from silvicultural activities and unpaved roads and trails in the upper watershed and residential development downstream.

A 2003 Proper Functioning Condition assessment rated the reach below the Gregory Mine as "Non-functional."

2. Watershed Restoration Opportunities

Landowners can improve water quality and watershed health in Clancy Creek and downstream in Prickly Pear Creek and Lake Helena by cleaning up abandoned mines, closing and reclaiming unauthorized roads and trails, and using appropriate management practices. Management practices can improve fish and wildlife habitat and reduce sediment and associated metals. Brook trout are common in Clancy Creek below the confluence with Kady Gulch. Genetically pure westslope cutthroat trout have been found in the upper two miles of the stream.

1. Watershed Restoration Strategies

Load allocations for Clancy Creek are presented in Appendix C.

Calculations in Volume II show that an overall, watershed scale metals load reduction of 61, 61,42, 54 and 47 percent for arsenic, cadmium, copper, lead, and zinc, respectively would result in achievement of the applicable water quality standards.

An overall, watershed scale sediment load reduction of 40% will result in achievement of the applicable water quality standards.

Priority management measures for Clancy Creek that are described in Appendix B include:

- Filter strips
- Riparian fencing
- Riparian buffers
- Bioengineered stream bank stabilization treatments and stream channel restoration projects
- Off-stream watering facilities
- Water gaps
- Road Best Management Practices (BMPs)

Other important management practices include:

- Stormwater BMPs
- Silvicultural BMPs

Corbin Creek

Water Quality Problems

Aquatic life and drinking water are important uses of water that are not supported in Corbin Creek. The DEQ has identified pollutants that cause impairment of these beneficial uses of water. (DEQ CWAIC 2014) These include:

- Metals: arsenic, cadmium, copper, iron, lead, silver, and zinc
- pH
- Total suspended solids

All of the causes of impairment listed above warrant a TMDL.

The uses of Corbin Creek are also affected by alteration of streamside vegetative covers.

The primary human-caused sources of impairment that were identified in Volume I (EPA 2004) and Volume II (EPA 2006) are summarized below.

Metals

Historic mining activities and sediment-associated metals sources are the primary sources of metals in Corbin Creek. Two mines – Bertha and Alta -- are listed in the State of Montana's inventory of high priority abandoned hard rock mine sites.

Sediment

The primary human-caused sources of sediment, in order of importance, are unpaved roads, human-caused streambank erosion, abandoned mines, timber harvest, and non-system roads and trails.

An aerial photography inventory showed 6 road crossings and road encroachment along 17 percent of the stream. The unpaved Corbin Creek Road is directly adjacent to the stream throughout much of its length. A large quantity of road-based sediment is delivered directly to the stream due to the close proximity to the stream channel and the lack of any significant riparian vegetation in the lower watershed. A large portion of the total road length in the watershed is steep and generates significant sediment loads.

Streambank erosion is primarily caused by riparian grazing, stream channelization, and historic mining activity. Abandoned mines – including the Blackjack and Bertha mines -- contribute 16% of the total Corbin Creek human-caused sediment load. Although the Bertha mine has been partially reclaimed, model results indicate the Bertha mine site continues to produce notable sediment quantities. Severe channel alterations begin after the first road crossing and continue to the mouth. The stream is channelized through the town of Corbin, located in the lowest ¼ mile of Creek.

Unpaved non-system roads and trails in the central and upper watershed contribute sediment due to the lack of runoff mitigation structures.

A 2003 Proper Functioning Condition assessment rated the reach approximately ½ mile above the mouth as "Non-functional", citing excessive sediment deposition, lack of flow and lack of riparian vegetation.

Watershed Restoration Opportunities

Landowners can improve water quality and watershed health in Corbin Creek and downstream in Prickly Pear Creek and Lake Helena by cleaning up abandoned mines, closing and reclaiming unauthorized and unused roads, and using appropriate management practices. Management practices can improve fish and wildlife habitat and reduce sediment and associated metals. Corbin Creek does not currently support fish; however, the Creek is expected to support fish once toxicant levels are reduced.

Watershed Restoration Strategies

Priority management measures for Corbin Creek that are described in Appendix B include:

- Filter strips
- Riparian fencing
- Riparian buffers
- Off-stream watering facilities
- Water gaps
- Bioengineered stream bank stabilization treatments and stream channel restoration projects
- Road BMPs

Silvicultural BMPs are also important.

Load allocations for Corbin Creek are presented in Appendix C.

Calculations in Volume II show that an overall, watershed scale metals load reduction of 25, 97, 89, 66, and 97 percent for arsenic, cadmium, copper, lead, and zinc, respectively would result in achievement of the applicable water quality standards.

An overall, watershed scale sediment load reduction of 23% is estimated to result in achievement of the applicable water quality standards.

B. **Lump Gulch**

1. Water Quality Problems

Aquatic life and drinking water are important uses of water that are not supported in Lump Gulch. The DEQ has identified pollutants that cause impairment of these beneficial uses of water. (DEQ CWAIC 2014) These include:

- Metals: cadmium, copper, lead, and zinc.
- Total suspended solids**.**

All of the causes of impairment listed above warrant a TMDL.

The primary human-caused sources of impairment that were identified in Volume I (EPA 2004) and Volume II (EPA 2006) are summarized below.

a) Metals

Historic mining activities in the upper watershed and sediment-associated metals sources are the primary sources of metals in Lump Gulch. Documented sources of metals include: road sediment delivery points, mine waste rock dumps, a mining dam, and channel incision. There are more than 10 historic hard rock mines in the headwaters area. Four sites are listed in the State of Montana's inventory of high priority abandoned hard rock mine sites: Nellie Grant, two Frohner mines, and General Grant. An aerial photography assessment showed the drainage has been disrupted by historic mining dams at the Frohner Meadows Mine.

Sediment

The primary sources of sediment in the Lump Gulch watershed, in order of importance, are timber harvest, unpaved roads, human-caused streambank erosion, urban development, abandoned mines, and non-system roads and trails.

Significant timber harvest activities have occurred in the Lump Gulch watershed on land owned by the state, BLM, and private landowners.

The Helena National Forest conducted a road sediment survey on the forest portion of the creek and identified five sites that contribute an estimated 3 tons of sediment to the stream each year.

An aerial photography inventory showed 17 road crossings and road encroachment along 22% of the stream. Lump Gulch Road is directly adjacent to the stream throughout much of the central area of the segment length. The erodible parent material, high road usage, close proximity to the stream channel, and a narrow riparian buffer throughout much of the upper watershed results in large quantities of road-based sediment being delivered to the stream.

Streambank erosion is primarily caused by riparian grazing, road encroachment, stream channelization, and historic mining activity.

Below the Helena National Forest's administrative boundary, housing development is prominent and riparian buffer widths decrease.

The Nellie Grant mine has been reclaimed; however, the Frohner and Yama mining sites continue to produce sediment.

Unpaved nonsystem roads and trails in the central and upper watershed contribute sediment due to the lack of runoff mitigation structures and their location in steep topography near watercourses.

A 2003 Proper Functioning Condition assessment rated the reaches above Park Lake and below Little Buffalo Gulch as “Functional – at risk”.

2. Watershed Restoration Opportunities

Landowners can improve water quality and watershed health in Lump Gulch and downstream in Prickly Pear Creek and Lake Helena by cleaning up abandoned mines, closing and reclaiming unauthorized roads and trails, and using appropriate management practices. Management practices can improve fish and wildlife habitat and reduce sediment and associated metals. Brook trout reside in the lower 5 miles of Lump Gulch, while genetically pure westslope cutthroat trout and rainbow/cutthroat hybrids have been found in the upper 6 miles of the stream.

3. Watershed Restoration Strategies

Priority management measures for Lump Gulch that are described in Appendix B include:

- Filter strips
- Riparian fencing
- Riparian buffers
- Bioengineered stream bank stabilization treatments and stream channel restoration projects
- Off-stream watering facilities
- Water gaps
- Road BMPs
- Other important management practices include:
- Stormwater BMPs
- Silvicultural BMPs

Load allocations for Lump Gulch are presented in Appendix C.

Calculations in Volume II show that an overall, watershed scale metals load reduction of 76, 39, 44, and 68 percent for cadmium, copper, lead, and zinc, respectively would result in achievement of the applicable water quality standards.

An overall, watershed scale sediment load reduction of 45% is estimated to result in achievement of the applicable water quality standards.

b) Upper Prickly Pear Watershed, south of Montana City, east of Prickly Pear Creek

(Warm Springs, Golconda Creek)

The east side of the Upper Prickly Pear Watershed shares some characteristics with the west side. The geology is also composed of igneous rocks and is chemically similar (Elkhorn Volcanics). The steep east side was also extensively mined. Unlike the west side, the eastern slopes are extensively forested and are mostly in the Helena National Forest with an extensive network of logging roads. As a result, there is less development, with only scattered subdivisions and housing.

Like the western slopes, eroding logging roads and the eroding volcanic rock result in the transport of large amounts of sediment into the eastern tributaries of Prickly Pear Creek. Metals from the volcanic rock especially in the mining districts accumulate in the tributaries. Reaches of several tributaries have TMDLs for metals and sediment: the headwaters of Prickly Pear Creek; Warm Springs Creek. Golconda Creek has a TMDL for sediment.

North Fork Warm Springs

Water Quality Problems

Aquatic life and drinking water are important uses of water that are not supported in North Fork Warm Springs Creek. Primary contact recreation and agricultural uses are fully supported. The DEQ has identified pollutants that cause impairment of these beneficial uses of water. (DEQ CWAIC 2014) These include:

- Metals: arsenic, cadmium, and zinc.
- Sedimentation/siltation.

All of the causes of impairment listed above warrant a TMDL.

The uses of North Fork Warm Springs Creek are also affected by grazing in the riparian area that has resulted in manure inputs, as well as alteration of streamside vegetative covers and the material at the bottom of the stream that provides habitat for aquatic life.

The primary human-caused sources of impairment that were identified in Volume I (2004) and Volume II (EPA 2006) are summarized below.

Metals

Historic mining activities in the subwatershed are the primary sources of metals in North Fork Warm Springs Creek. The State of Montana’s inventory of mines shows two hard rock mines close to the headwaters and one mine close to the mouth of the stream. None of the mines in the basin are listed in the State of Montana’s inventory of high priority abandoned hard rock mine sites.

Sediment

The primary sources of sediment in the North Fork Warm Springs Creek watershed, in order of importance, are unpaved roads, abandoned mines, timber harvest, streambank erosion, and non-system roads and trails.

Roads cross, and are adjacent to the channel throughout much of the watershed. The Helena National Forest conducted a road sediment survey on the forest portion of the creek and identified 27 sites that are estimated to contribute approximately 15 tons of sediment to the stream each year. The aerial photography inventory showed two road crossings and road encroachment along 26% of the stream.

The aerial photography inventory showed that extensive conifer and deciduous riparian buffers were present on the portion of the stream within the Helena National Forest, but were limited in width on a small section of private property below the headwaters.

A 2003 Proper Functioning Condition assessment rated the reach approximately 0.5 mile upstream of the mouth as "Functional – at risk" as a result of excess sediment deposition.

Watershed Restoration Opportunities

Landowners can improve water quality and watershed health in North Fork Warm Springs Creek and downstream in Prickly Pear Creek and Lake Helena by cleaning up abandoned mines, closing and reclaiming unauthorized roads and trails, and using appropriate management practices. Management practices can improve fish and wildlife habitat and reduce sediment and associated metals. The North Fork Warm Springs Creek is managed as a brook trout fishery.

Watershed Restoration Strategies

Load allocations for North Fork Warm Springs Creek are presented in Appendix C.

Calculations in Volume II show that an overall, watershed scale metals load reduction of 59, 62, 32, and 44 percent for arsenic, cadmium, lead, and zinc, respectively would result in achievement of the applicable water quality standards.

An overall, watershed scale sediment load reduction of 32% is estimated to result in achievement of the applicable water quality standards.

Priority management measures for North Fork Warm Springs Creek that are described in Appendix B include:

- Riparian fencing
- Riparian buffers
- Bioengineered stream bank stabilization treatments and stream channel restoration projects
- Off-stream watering facilities
- Water gaps
- Road BMPs

C. Golconda Creek

1. Water Quality Problems

Aquatic life and drinking water are important uses of water that are not supported in Golconda Creek. The DEQ has identified pollutants that cause impairment of these beneficial uses of water. (DEQ CWAIC 2014) These include the metals cadmium and lead. A TMDL has been established for each of these metals.

The primary human-caused sources of impairment that were identified in Volume I (2004) and Volume II (EPA 2006) are summarized below.

Sediment-associated metals and historic mining activities in the watershed are the primary sources of metals in Golconda Creek.

A 2003 aerial photography inventory showed two road crossings and road encroachment along 20% of the creek. Extensive conifer and deciduous riparian buffers were present in the headwaters and along most of the stream managed by the BLM. Closer to the mouth, the widths of riparian buffers are reduced by development and landscaping in the floodplain. A 2003 Proper Functioning Condition assessment rated the segment about 1.5 miles above the mouth as "Proper Functioning Condition."

Old mining areas were observed in tributary drainages to the west of the main stem. The State of Montana's inventory of mine sites shows three mines in the drainage: Buckeye, Golconda, and Big Chief. None of the mines in the basin is listed in the state's inventory of high priority abandoned hardrock mine sites.

2. Watershed Restoration Opportunities

Landowners can improve water quality and watershed health in Golconda Creek and downstream in Prickly Pear Creek and Lake Helena by cleaning up abandoned mines, closing and reclaiming unauthorized roads and trails, and using appropriate management practices. Management practices can improve fish and wildlife habitat and reduce sediment and associated metals.

3. Watershed Restoration Strategies

Load allocations for Golconda Creek are presented in Appendix C.

Calculations in Volume II show that an overall, watershed scale metals load reduction of 41 and 77 percent for cadmium and lead, respectively would result in achievement of the applicable water quality standards.

Priority management measures for Golconda Creek that are described in Appendix B include:

- Road BMPs

Jackson Creek

- **Water Quality Problems**

- The use of water for aquatic life is not supported in Jackson Creek. (DEQ CWAIC 2014) A TMDL was established for zinc in 2013. Data suggest that the zinc TMDL is met during high flow conditions; however, a reduction in zinc loads is required during some low flow time periods.

- Historic mining activities in the watershed are significant contributors of zinc to Jackson Creek. (EPA 2013) No mines are listed by the State of Montana as high priority and no reclamation work has occurred. According to the Montana Bureau of Mines and Geology's abandoned and inactive mines database, there are two abandoned mines in the basin: the Pilot Mine and the Thomas Cruse Mine.

- A 2003 Proper Functioning Condition assessment rated the segment above the mouth as "Proper Functioning Condition."

- **Watershed Restoration Opportunities**
- Landowners can improve water quality and watershed health in Jackson Creek and downstream in Prickly Pear Creek and Lake Helena by cleaning up abandoned mines. The Helena National Forest estimates that brook trout occupy Jackson Creek to about 1.5 miles upstream from the mouth.

- **Watershed Restoration Strategies**
- The TMDL for zinc in Jackson Creek is variable and depends on streamflow and the hardness of water.

Prickly Pear Creek south of Montana City

a. Main segment of Prickly Pear Creek, south of Montana City

The main segment of Prickly Pear Creek receives water from the two subwatersheds (which ones?) previously described. The main segment receives the sediment and metals transported from the tributaries; this segment has TMDLs for both metals and sediment. The stream has undergone extensive alteration, mostly from extensive placer mining. The stream's native riparian vegetation has largely been removed, causing elevated stream temperatures; this segment of Prickly Pear Creek has a TMDL for temperature.

D. Prickly Pear Creek – Headwaters to Spring Creek

1. Water Quality Problems

Aquatic life and drinking water are important uses of water that are not supported in Prickly Pear Creek from the headwaters to Spring Creek.

The DEQ has identified pollutants that cause impairment of these beneficial uses of water. (DEQ CWAIC 2014) These include:

- Lead.
- Total suspended solids**.**

These causes of impairment warrant a TMDL.

The uses of this segment of Prickly Pear Creek are also affected by alteration of streamside vegetative covers and the material at the bottom of the stream that provides habitat for aquatic life.

The primary human-caused sources of impairment that were identified in Volume I (2004) and Volume II (EPA 2006) are summarized below.

a) Metals

Golconda Creek and historic mining activities in the immediate drainage area are the primary sources of metals. None of the mines in the drainage area of this segment are listed in the State of Montana's inventory of high priority abandoned hard rock mine sites.

b) Sediment

Roads are the primary source of sediment in this segment of Prickly Pear Creek. The Helena National Forest conducted a road sediment survey on the forest portion of the creek and identified 11 sites that are estimated to contribute approximately 5.2 tons of sediment to the stream each year. The aerial photography inventory showed eight road crossings and road encroachment along 30 percent of the stream. Road-related sources of sediment were also identified outside of the Helena National Forest. The last one-third mile of the stream segment was channelized during construction of Interstate 15.

The aerial photography inventory showed that extensive conifer and deciduous riparian buffers were present on the portion of the stream within the Helena National Forest. The widths of deciduous riparian buffers tended to decrease as the valley bottom widths increased downstream. Widths were variable depending on land ownership and proximity to the Tizer Lake Road.

Severe channel alterations begin below the confluence with Golconda Creek; these likely generate sediment. A historical placer gold dredge operation just above I-15 marks where the stream becomes incised, overly widened, and straightened as a result of the operation.

A 2003 Proper Functioning Condition assessment rated the reach approximately one mile upstream of Helena National Forest administrative boundary as "Proper Functioning Condition." (PFC), but noted some sediment deposition.

2. Watershed Restoration Opportunities

Landowners can improve water quality and watershed health in Prickly Pear Creek and downstream in Prickly Pear Creek and Lake Helena by cleaning up abandoned mines, closing and reclaiming unauthorized roads and trails, and using appropriate management practices. Management practices can improve fish and wildlife habitat and reduce sediment and associated metals. Prickly Pear Creek is managed as a trout fishery. Genetically pure westslope cutthroat trout are common year-round residents in this segment of Prickly Pear Creek.

3. Watershed Restoration Strategies

Load allocations for Prickly Pear Creek are presented in Appendix C.

Calculations in Volume II show that an overall, watershed scale metals load reduction of 58, 74, 58, 69, and 60 percent for arsenic, cadmium, copper, lead, and zinc, respectively would result in achievement of the applicable water quality standards.

An overall, watershed scale sediment load reduction of 32% is estimated to result in achievement of the applicable water quality standards.

Priority management measures for Prickly Pear Creek that are described in Appendix B include:

- Riparian buffers
- Bioengineered stream bank stabilization treatments and stream channel restoration projects
- Road BMPs

E. Prickly Pear Creek – Spring Creek to Lump Gulch

1. Water Quality Problems

Aquatic life and drinking water are important uses of water that are not supported in Prickly Pear Creek from Spring Creek to Lump Gulch.

The DEQ has identified pollutants that cause impairment of these beneficial uses of water. (DEQ CWAIC 2014) These include:

- Metals: cadmium, lead, zinc.
- Sedimentation/siltation.

These causes of impairment warrant a TMDL.

The uses of this segment of Prickly Pear Creek are also affected by alteration of streamside vegetative covers and the material at the bottom of the stream that provides habitat for aquatic life.

The primary human-caused sources of impairment that were identified in Volume I (2004) and Volume II (EPA 2006) are summarized below.

a) Metals

Upstream sources, tributary streams, and historic mining activities in the immediate drainage area are the primary sources of metals. Spring seeps were noted entering Prickly Pear Creek from placer tailings piles along the stream. None of the mines in the drainage area of this segment are listed in the State of Montana's inventory of high priority abandoned hard rock mine sites.

b) *Sediment*

Road runoff and road placement are the primary sources of sediment in this segment of Prickly Pear Creek. Tributaries and localized grazing activities also contribute sediment.

The aerial photography inventory showed 16 road crossings. Approximately 91% of the stream segment has been channelized to accommodate the construction of I-15 and the railroad.

The aerial photography inventory showed that the width of deciduous riparian buffers ranged from 30 to 100 feet and were correlated to their distance from roads.

Severe channel alterations from placer mining and the transportation corridor have probably affected the flow regime along this segment.

A 2003 Proper Functioning Condition assessment rated the reach just below the Alhambra RV Park as "Non-functional."

2. Watershed Restoration Opportunities

Landowners can improve water quality and watershed health in Prickly Pear Creek and downstream in Prickly Pear Creek and Lake Helena by using appropriate management practices. Management practices can improve fish and wildlife habitat and reduce sediment and associated metals. Prickly Pear Creek is managed as a trout fishery.

3. Watershed Restoration Strategies

Load allocations for Prickly Pear Creek are presented in Appendix C.

Calculations in Volume II show that an overall, watershed scale metals load reduction of 58, 74, 58, 69, and 60 percent for arsenic, cadmium, copper, lead, and zinc, respectively would result in achievement of the applicable water quality standards.

An overall, watershed scale sediment load reduction of 32% is estimated to result in achievement of the applicable water quality standards.

Priority management measures for Prickly Pear Creek that are described in Appendix B include:

- Riparian fencing
- Riparian buffers
- Bioengineered stream bank stabilization treatments and stream channel restoration projects
- Off-stream watering facilities
- Water gaps
- Road BMPs

F. Spring Creek

1. Water Quality Problems

Aquatic life and drinking water are important uses of water that are not supported in Spring Creek in the listed segment which runs from the confluence with Corbin Creek to the mouth of Spring Creek. The DEQ has identified pollutants that cause impairment of these beneficial uses of water. (DEQ CWAIC 2014) These include:

- Metals: arsenic, cadmium, copper, lead, and zinc.
- Nutrients: total nitrogen and total phosphorous.
- Total suspended solids**.**

All of the causes of impairment listed above warrant a TMDL.

The uses of Spring Creek are also affected by low flows and alteration of streamside vegetative covers and the material at the bottom of the stream that provides habitat for aquatic life.

The primary human-caused sources of impairment that were identified in Volume I (EPA 2004) and Volume II (EPA 2006) for the Spring Creek watershed are summarized below.

a) Metals

Corbin Creek, historic mining activities and sediment-associated metals sources are the primary sources of metals in Spring Creek. The Montana Tunnels Mine in the headwaters of the watershed may also be a source of metals. The Corbin Flats Mine is listed in the State of Montana's inventory of high priority abandoned hard rock mines sites.

b) Nutrients

The primary sources of nitrogen, in order of importance, are dirt roads, septic systems, timber harvest, abandoned mines, and human-caused streambank erosion.

The primary sources of phosphorous, in order of importance, are dirt roads, timber harvest, abandoned mines, and human-caused streambank erosion.

c) Sediment

The primary sources of sediment, in order of importance, are unpaved roads, timber harvest, abandoned mines, human-caused streambank erosion, and non-system roads and trails. Unpaved roads contribute an estimated 43% of the sediment load. Road crossings throughout the watershed and direct road tread drainage in the central watershed are contributing to road related sediment impacts. Timber harvest has occurred in the upper watershed.

Four abandoned mines (Bluebird, Corbin Flats, Washington, and Salvai) were identified as being capable of delivering sediment to the channel. Human-caused streambank erosion is isolated throughout Spring Creek and largely the result of stream channelization and historic mining activity. Non-system roads and trails were observed in the uplands of the Spring Creek watershed.

Nearly the entire segment of the creek above the town of Jefferson City has been channelized by mine reclamation. The 2003 preliminary source assessment showed that riparian buffers were virtually absent.

Most of the creek is surrounded by private lands that are used for grazing and rural housing. The last one-quarter mile of the creek flows through Jefferson City. Tailings piles line the banks throughout the town of Jefferson City.

The 2003 preliminary source assessment noted channel incisement and dewatering resulting from a holding pond and water transfer station used by the Montana Tunnels mine for pumping water to its operation.

Extensive channel alterations from mine reclamation begin near the confluence with Corbin Creek. Volume I described the channel as “basically a ditch” -- the stream is incised and straightened. There is little bank-stabilizing riparian vegetation.

Unpaved non-system roads and trails in the upper watershed contribute sediment due to the lack of drainage structures.

A 2003 Proper Functioning Condition assessment rated the reach approximately 3/4 mile above the mouth as “Non-functional”, citing excessive fines, lack of riparian vegetation, and channel alterations.

2. Watershed Restoration Opportunities

Landowners can improve water quality and watershed health in Spring Creek and downstream in Prickly Pear Creek and Lake Helena by cleaning up abandoned mines, reclaiming and closing unauthorized roads and trails and using appropriate management practices. Management practices can improve fish and wildlife habitat and reduce sediment and associated metals.

3. Watershed Restoration Strategies

Priority management measures for Spring Creek that are described in Appendix D include:

- Filter strips
- Riparian fencing
- Riparian buffers
- Bioengineered stream bank stabilization treatments and stream channel restoration projects
- Off-stream watering facilities
- Water gaps
- Road BMPs

Other important management practices include:

- Stormwater BMPs

- Silvicultural BMPs
- Proper installation and maintenance of septic systems.

Load allocations for Spring Creek are presented in Appendix C.

Calculations in Volume II show that an overall, watershed scale metals load reduction of 56, 87, 64, 82, and 81 percent for arsenic, cadmium, copper, lead, and zinc, respectively, would result in achievement of the applicable water quality standards.

A nitrogen load reduction of 75% would be required to support all beneficial uses. However, the maximum attainable nitrogen load reduction for the Spring Creek watershed is estimated to be only 22%.

A phosphorous load reduction of 83% would be required to support all beneficial uses. However, the estimated maximum attainable phosphorous load reduction for the Spring Creek watershed is only 29 percent.

While it may not be possible to reduce nutrient loads to the levels where all beneficial uses are supported, water quality in Spring Creek and downstream water bodies will continue to degrade if no action is taken to reduce nutrient pollution.

An overall, watershed scale sediment load reduction of 30% is estimated to result in achievement of the applicable water quality standards.

The Helena Valley (Tenmile Creek below water treatment plant, Prickly Pear Creek below Montana City, Silver Creek below Silver City, Spring Creek ?)

(1) Description

(a) Geography - This sub-watershed can be defined as the valley floor, the edges of which are determined where stream slopes (gradients) significantly start to flatten out such as Ten Mile Creek downstream of the water treatment plant and Silver

Creek as it enters the northwestern corner of the Helena Valley. The watershed is largely dominated by the large densely populated urban area of Helena with adjoining less densely populated suburban areas to the west, north, and east. This area is characterized by extensive dense land use by agriculture (grazing, hay), and housing developments with lawns. Because of the extensive development, a significant proportion of the surface area is impermeable, covered with asphalt or concrete.

(b) Hydrology- The surface water and groundwater systems have been extensively changed by human activity. The Helena Irrigation Canal supplies surface water to agriculture in the Valley while the unlined canals leak water, recharging the groundwater. In the central part of the valley, surface drains lower the water table in order that more land is suitable for agricultural use; the drain water is channeled to Lake Helena. Extensive surface water diversions for agriculture reduce stream flow. There are extensive return flows of wastewater to the streams from both point sources (City of Helena Water Treatment Plan, home septic systems) and nonpoint sources (grazing and agriculture on land adjacent to streams). The banks of both Prickly Pear Creek and Ten Mile Creek have been extensively grazed, resulting in increased erosion.

(c) Watershed Functions - Impacts in the major streams result from a complex of factors, including land use in the valley, as well as the accumulation of material from the sub-watersheds. Both Prickly Pear Creek and Ten Mile Creek have TMDLs for nutrients because of the wastewater flows into the streams. The TMDLs for metals for both streams are the result of runoff from rock containing metals in the upper watersheds. The extensive erosion of banks on both streams in the valley has resulted in TMDLs for sediment for both streams. Prickly Pear Creek has been extensively dewatered in the valley. Therefore Prickly Pear Creek has a TMDL for temperature.

(d) Land use

(e) Sources of pollution

Lower Prickly Pear Creek

Water Quality Problems

Agriculture, aquatic life, drinking water, and recreation are all important uses of water that are not supported in some segments of Prickly Pear Creek from Lump Gulch to Lake Helena.

Table 1 shows which uses of water are fully supported and not supported in this reach of Prickly Pear Creek.

Table 1-Beneficial Use Support: Prickly Pear Creek from Lump Gulch to Lake Helena

Use of Water	Fully Supported	Not Supported
Agriculture	Helena Wastewater Treatment Plant (WWTP) Discharge to Lake Helena	Wylie Drive to Helena WWTP Discharge
Aquatic Life		Lump Gulch to Lake Helena
Drinking Water		Lump Gulch to Lake Helena
Primary Contact Recreation		Wylie Drive to Lake Helena

Source: DEQ CWAIC 2014

The DEQ has identified pollutants that cause impairment of these beneficial uses of water. (DEQ CWAIC 2014) These are shown in Table 2.

Table 2-Causes of Impairment with Completed TMDLs , Prickly Pear Creek from Lump Gulch to Lake Helena

Pollutants Causing Impairment	Segment
Metals: arsenic, cadmium, copper, lead, and zinc.	Lump Gulch to Lake Helena
Nutrients: total nitrogen, total phosphorus, nitrate/nitrite.	Wylie Drive to Lake Helena
Sedimentation/Siltation	Lump Gulch to Lake Helena
Water Temperature	Lump Gulch to Wylie Drive

Source: DEQ CWAIC 2014

A TMDL has been established for each of the causes of impairment listed above. The uses of Prickly Pear Creek are also affected by low flows, ammonia, and alteration of streamside vegetative covers and the material at the bottom of the stream that provides habitat for aquatic life. Table 3 shows which reaches are affected by these additional causes of impairment.

Table 3-Additional Causes of Impairment with No TMDLs: Prickly Pear Creek from Lump Gulch to Lake Helena

Pollution	Segment
Alteration in streamside vegetative covers	Lump Gulch to Lake Helena
Ammonia	Wylie Drive to Lake Helena
Low flow alterations	Wylie Drive to Lake Helena
Physical substrate habitat alterations	Lump Gulch to Lake Helena

Source: DEQ CWAIC 2014

Appendix A to Volume II (EPA 2006) identifies the sources of impairment of beneficial uses. Primary sources of impairment in this area are summarized below.

Metals

- Upstream sources and the Lump Gulch tributary.
- Historical mining activities in the immediate drainage area of the Lump Gulch to Wylie Drive segment. None of the mines in the immediate drainage area of this segment are listed in the State of Montana’s inventory of High Priority Abandoned Hardrock Mine Sites.
- The ASARCO East Helena Lead Smelter was permitted to discharge arsenic, cadmium, copper, lead and zinc.

Nutrients

- Wastewater treatment plant discharges are the primary human-caused source of nutrients in the Prickly Pear Creek watershed.
- Septic systems are a significant source of nitrogen.
- Dewatering results in increased nutrient concentrations and increased stream temperature and may exacerbate the impacts of nutrient loading.
- In localized areas, nutrient loading from grazing and single-family residential sources may be far more significant than at the watershed scale.

Sediment

- Agriculture was the single largest source of sediment within the greater Prickly Pear Creek watershed. The reach from Lump Gulch to the WWTP produces the greatest quantities of sediment from agricultural activities.
- Unpaved roads were the second largest source of sediment. The segments between Lump Gulch and Wylie Drive produced the most road-related sediment due to high road densities associated with subdivision development.

- The third largest source of sediment is streambank erosion from activities including riparian grazing, road encroachment, stream channelization, riparian vegetation removal and historic mining activity.
- Clancy Creek and Lump Gulch contribute sediment to Prickly Pear Creek.
- Timber harvest is another significant source of sediment above Wylie Drive.
- Abandoned and active mines and quarries are other sources of sediment.

Temperature

- Three key sources contributed to increased temperatures in Prickly Pear Creek: flow alterations, riparian degradation, and point sources.
- Irrigation withdrawals, industrial withdrawals, and dams reduce the amount of water in the lower 6 miles of Prickly Pear Creek. The Creek has been completely dewatered in the segment between Wylie Drive and the Helena WWTP.
- Proper Functioning Condition assessments were conducted at three sites along lower Prickly Pear Creek in 2003. The upstream site ranked as functional, but at risk. Two downstream segments were ranked non-functional, indicating severe riparian degradation.
- The City of East Helena and City of Helena WWTP outfalls may affect stream temperature. Effluent temperature was not monitored.

Watershed Restoration Goals

The LCCWQPD and the LHWG have the following goals for improving water quality and watershed health in the Lower Prickly Pear Creek watershed:

- Ensure that water continues to flow throughout this reach of Prickly Pear Creek.
- Provide for cooler temperatures in Prickly Pear Creek.
- Improve fish and wildlife habitat.
- Reduce sediment, nutrients, and associated metals.

TMDLs for each pollutant are presented in Appendix C.

Watershed Restoration Strategies

Priority management measures for Prickly Pear Creek for the LHWG and the LCCWQPD for 2014-2019 include:

- Maintain streamflows in Prickly Pear Creek through purchase of water from the Bureau of Reclamation (Prickly Pear Creek Re-Watering Project).
- Identify and pursue additional opportunities to improve instream flows and fish spawning by eliminating or moving diversions when necessary to maintain stream flows or provide for fish passage.
- Seek willing landowners to put in place and maintain riparian buffers and filter strips.
- Encourage use of water gaps, off-stream watering, and riparian fencing to control livestock access to the stream.
- Implement bioengineered stream bank stabilization treatments.

- Reduce nutrient loading by supporting efforts by the cities of Helena or East Helena to reduce nutrients in wastewater discharged to Prickly Pear Creek. These efforts may include plant optimization studies or nutrient trading.

The management measures identified are described in Appendix D. Landowners in this area can use Appendix D as a resource for implementation of management measures on their property.

Load allocations for Prickly Pear Creek are presented in Appendix C. A sediment load reduction of 38% for the entire Prickly Pear Creek watershed is estimated to result in achievement of the applicable water quality standards.

Calculations in Volume II show that watershed scale metals load reductions of 58, 74, 58, 69, and 60 percent, for arsenic, cadmium, copper, lead and zinc, respectively, would result in achievement of the applicable water quality standards.

A nitrogen load reduction of 80% would be required to support all beneficial uses. However, the maximum attainable nitrogen load reduction for the Prickly Pear Creek watershed is estimated to be only 39%. A phosphorus load reduction of 87% would be required to support all beneficial uses. However, the maximum attainable phosphorus load reduction for the Prickly Pear Creek watershed is estimated to be only 62%. While it may not be possible to reduce nutrient loads to the levels where all beneficial uses are supported, water quality in Prickly Pear Creek and Lake Helena will continue to degrade if no action is taken to reduce nutrient pollution. An adaptive management strategy is presented in Volume II (EPA 2006).

The measures identified above will improve water quality and watershed health in this reach in the following ways (See Appendix B):

- Maintaining cooler stream temperatures in Prickly Pear Creek.
- Reducing sediment and nutrient pollution.
- Maintaining continuous flow of water throughout Prickly Pear Creek and thereby improving habitat for fish and other aquatic life.
- Improving fish and wildlife habitat.

Riparian buffers will also trap metals in runoff; however, this management measure will not be sufficient to restore beneficial uses impaired by metals because most metals come from upstream sources.

Error! Reference source not found. presents a summary of initiatives to improve water quality, targeted areas and the party responsible for carrying out the initiative.

Table 4-Initiatives, Targeted Areas, and Responsible Party

Initiative	Targeted Reach	DEQ Segment(s)	Responsible Party
Prickly Pear Creek Restoration Project	Prickly Pear Creek between York and Sierra Roads	Wylie Drive to Helena WWTP Helena WWTP to Lake Helena	LCCWQPD LHWG
Prickly Pear Creek Re-	Immediately downstream	Wylie Drive to	LCCWQPD

Watering Project	of East Helena almost to York Road	Helena WWTP	Prickly Pear Water Users Helena Valley Irrigation District
Aspen Trails Ranch Project	Prickly Pear Creek north of Olsen Road	Wylie Drive to Helena WWTP	PPLT FWP
ASARCO East Helena Facility Site Cleanup	Former ASARCO East Helena Facility site	Lump Gulch to Wylie Drive	METG
Natural Resource Damage Program	Former ASARCO East Helena Facility site	Lump Gulch to Wylie Drive	State of Montana NRDP
City of Helena WWTP	Helena WWTP to Lake Helena	Helena WWTP to Lake Helena	City of Helena

These initiatives are described in more detail below.

Prickly Pear Creek Restoration Project

The LCCWQPD and the LHWG have initiated a restoration project on the lower end of Prickly Pear Creek between York and Sierra roads. (what pollutants addressed? Sediment? Tome)

The goals of this project include: reduce landowner property loss, improve aquatic and riparian habitat, improve livestock management, stabilize the stream channel, increase fish populations, enhance flood storage, and measurably reduce sediment and nutrient loads and temperature impairments.

The LCCWQPD and the LHWG have secured funding for the first phase of this project: the restoration of the segment of Prickly Pear Creek that flows through the Elliot property. This reach has been impacted by significant stream modification. The channel is incised with limited access to its floodplain. Bioengineered streambank stabilization management measures will be implemented following completion of the restoration design.

The LCCWQPD and the LHWG will seek funding as well as opportunities to partner with additional landowners to restore the entire reach of Prickly Pear Creek between York and Sierra roads. Additional opportunities in this reach include the following:

- Restore fish passage and natural hydrology through removal of a diversion and stream channel enhancement. There may be an opportunity to replace the diversion and construct a pipeline or diversion to convey effluent from the City of Helena's wastewater treatment plant to irrigate this property if water rights can be secured. The diversion is currently a barrier to fish passage and also alters the hydrology of the creek, causing sediment deposits and wave erosion.
- Restore natural riparian vegetation in areas where grazing has recently been eliminated.

Prickly Pear Creek Re-Watering Project

The Prickly Pear Creek Re-Watering Project maintains flows in the segment of Prickly Pear Creek from Wylie Drive to the City of Helena WWTP. Prior to 2008, a reach extending approximately 2-3 miles downstream from the Prickly Pear Water Users diversion had been completely dewatered at times during the irrigation season. (This reach begins just downstream from the City of East Helena and extends almost to York Road.)

The Prickly Pear Creek Re-Watering Project was initiated in 2008. Water purchased from the Bureau of Reclamation Canyon Ferry Reservoir Project is substituted for water that has been historically diverted from Prickly Pear Creek to grow crops. Contractual agreements provide for the purchase of 2,000 acre-feet of water from the Canyon Ferry Reservoir Project. When flows in Prickly Pear Creek fall below 20 cfs, the Prickly Pear Water Users stop diverting water from Prickly Pear Creek. The Helena Valley Irrigation District then delivers water purchased from the Canyon Ferry Reservoir Project to the conveyance system used by the Prickly Pear Water Users.

Substitution of Canyon Ferry Reservoir Project water for Prickly Pear Creek water has increased streamflows during the driest time of the year by 2-3 cfs. Since its inception in 2008, the Project has been successful in maintaining a continuous flow of water throughout Prickly Pear Creek. Benefits of maintaining streamflows in Prickly Pear Creek include improved aquatic and riparian habitat for fish and migratory birds as well as fish passage.

Various partners have provided financial support for this project; however, there is no ongoing, stable source of funding. Annual costs for purchase of water are approximately $25,000.

Additional funds are needed to submit an application and obtain approval from the Department of Natural Resources and Conservation to temporarily change the permitted use of these water rights to allow for temporary instream use to benefit the fishery.

Aspen Trails Ranch Project

The Prickly Pear Land Trust (PPLT) acquired a 36-acre parcel on Prickly Pear Creek north of Olsen Road. The parcel includes a small portion of the historic Stansfield Lake lakebed and a spring creek. This parcel has been donated to FWP for the purpose of establishing a day use fishing access site. The PPLT also acquired a 230-acre conservation easement on an adjacent parcel. FWP plans to manage grazing and weeds and restore riparian plant communities and streambanks to more natural conditions. FWP may restore the spring creek. This initiative was funded by the Lewis & Clark County Open Space Bond and the Land and Water Conservation Fund.

ASARCO East Helena Facility Site Cleanup

The Montana Environmental Trust Group (METG) is a private non-profit entity that is responsible for carrying out the cleanup and restoration of the former ASARCO East Helena Facility. Their efforts are focused on soil and groundwater contamination. Improving the quality of Prickly Pear Creek waters is not a specific goal of their effort; however, the activities identified below will affect water quality and quantity. Many impacts have not been analyzed. It is anticipated that environmental impacts of activities will be analyzed in the application and review process for various required permits.

- Measures to stabilize the slag pile and realign Prickly Pear Creek will reduce erosion of slag into Prickly Pear Creek.
- The combined South Plant Hydraulic Control Interim Measures will change hydraulics on the south end of the site.
- Realignment of Prickly Pear Creek with the realigned channel designed for additional meandering, length, and other attributes to lower stream velocities.
- Removal of the smelter dam in 2014. This will remove a barrier to fish passage. Impacts to pollutant loads have not been analyzed.
- The Upper Lake diversion structure will be removed and Upper and Lower Lakes will be drained. Upper Lake, Upper Lake Marsh, and Lower Lake are human-made features that will be returned to pre-smelter conditions.
- Wilson Ditch, which supplies irrigation water to Burnham Ranch, will be abandoned and the point of diversion moved. Sixteen water rights for four different owners are legally tied to the Wilson Ditch Headgate. The current point of diversion at Upper Lake must be relocated for these water rights because Upper Lake will no longer store water.
- Two MPDES permitted discharges will be eliminated: one for discharging treated stormwater from the wastewater treatment plant to Lower Lake that expires July 31, 2015 and an authorization to discharge under a general permit for stormwater discharges associated with

industrial activity. The METG ultimately plans to eliminate these discharges. An Evapotranspiration Cover System has been proposed to cover the majority of the site that will eliminate contact between clean stormwater and contaminated soils so that active stormwater management and treatment is no longer required.

- Restore wetland functions. Removal of Tito Park, Lower Lake, and the open water of Upper Lake will increase the wetlands area by approximately 25 acres.
- A variety of water rights held by METG will be disposed of. Depending on the outcome, instream flows may be affected.

Natural Resource Damage (NRD) Program

The State of Montana's NRD Program has nearly $6 million to restore natural resources in the immediate area of the Former ASARCO East Helena Facility. The NRD has acquired approximately 240 acres of wetlands on the site. Projects may be funded through grants or direct contracts. A restoration plan will likely be developed by 2015. (status?) Prior to that, the NRD is accepting applications for grants of up to $75,000 to restore or substantially improve or replace natural resources damaged by ASARCO.

City of Helena Wastewater Treatment Plant

The City of Helena has significantly reduced its total nitrogen (TN) and total phosphorus (TP) discharges to Prickly Pear Creek from its wastewater treatment plant. Alternative options to reduce nutrient pollution from the plant have been evaluated and some options have been implemented. Total nitrogen discharges have been reduced 24% by weight and total phosphorus discharges have been reduced 27% since 2008. Voluntary measures were implemented and the permit for the City's wastewater treatment facility required the City to conduct an optimization study to improve treatment efficiency for these pollutants by October 1, 2013. The City has established the following goals: monthly average discharge of 8 mg/L or less for TN and 3 mg/L or less for TP.

Biosolids from the plant are land applied to agricultural lands (seasonally) and composted. The plant treats 1.5 million gallons per year of septic waste, reducing pollution from nonpoint sources. The City of Helena's Public Works Department recognizes the potential benefits of nutrient trading. For example, the City could pay for projects that reduce nutrient pollution instead of paying to upgrade the plant. Such projects must be cost-effective, which requires regulatory certainty and the elimination of regulatory barriers.

City of East Helena Wastewater Treatment Plant

The City of East Helena upgraded its wastewater treatment plant in 2014 to reduce copper, zinc and phosphorus discharges.

MDT

The Montana Department of Transportation (MDT) is responsible for maintaining the following routes that are adjacent to Prickly Pear Creek: Interstate 15 and its frontage road and Secondary 518. MDT utilizes traction sand mixed with salt (sand/salt) and salt brine during road winter maintenance activities. Over the past ten years, MDT has decreased the amount of sand applied to roadways within the watershed by: 1) increasing the salt content in the sand/salt mixture, 2) calibrating the sanders on MDT trucks, and 3) training snowplow drivers. The salt content in MDT stockpiles has gradually increased from approximately 5 to 7% ten years ago to the current salt content of 10%. As the salt content of the mix increases, the amount of sand discharged to surface water bodies decreases. MDT has also constructed new stormwater ponds adjacent to Canyon Ferry Road.

Lower Tenmile Creek

Water Quality Problems

Aquatic life and drinking water are important uses of water that are not supported in the segment of Tenmile Creek that begins at the Helena Drinking Water Treatment Plant and goes to the mouth of the creek. (DEQ CWAIC 2014)

The DEQ and the EPA have identified pollutants that cause impairment of these beneficial uses of water. (DEQ CWAIC 2014) These include:

- Metals: arsenic, cadmium, copper, lead, and zinc.
- Nutrients: total nitrogen, total phosphorus, and nutrient/eutrophication biological indicators.
- Sedimentation/Siltation.

All of the above causes of impairment listed above warrant a TMDL. Other types of pollution that do not require a TMDL, but do affect the use of Lower Tenmile Creek include:

- Low flow alterations.
- Alteration in streamside vegetative covers.

The primary human-caused sources of impairment that were identified in Volume II (EPA 2006) are summarized below.

Metals

Upstream sources and abandoned mines in the immediate drainage area are the primary sources of metals in this segment of Tenmile Creek.

Nutrients

The primary human-caused source of nutrients in Tenmile Creek include (in order of importance): septic systems, urban areas, agriculture, dirt roads, streambank erosion, timber harvest, and paved roads.

Sediment

Agriculture is the single largest source of sediment within the greater Tenmile Creek watershed.

Unpaved roads are the second largest source of sediment.

The third largest source of sediment is streambank erosion from activities including riparian grazing, road encroachment, stream channelization, riparian vegetation removal and historic mining activity.

A 2003 Proper Functioning Condition assessment rated the reach above Sevenmile Creek as "Functional – at risk." The stream in this area has healthy and diverse riparian vegetation, but the field crew noted that the stream was riprapped and that pool infilling was occurring. The reach above Green Meadow Drive was classified as "Functional – at risk verging on Non-functional." The field crew noted that the stream had eroding banks, excess sediment deposition, and a limited riparian area. (EPA 2004)

Sediment from urban areas is associated with the development of the Helena Valley.

Dewatering

A TMDL is not required for dewatering; however, the watershed characterization in Volume 1 (EPA 2004) notes that dewatering has affected the natural hydrology of the stream and the quality of aquatic habitat. Dewatering occurs in the reach beginning at McHugh Lane and continuing to a point downstream of I-5 and upstream from where the creek crosses Sierra road. Dewatering is a result of withdrawal for municipal use upstream, diversions for irrigation in this reach, and natural losses to aquifer recharge.

Watershed Restoration Goals

The LCCWQPD and the LHWG have the following goals for improving water quality and watershed health in the Lower Tenmile Creek watershed:

- Seek opportunities to ensure that water continues to flow throughout this reach of Tenmile Creek.
- Improve fish and wildlife habitat.
- Reduce sediment, nutrients, and associated metals.

Watershed Restoration Strategies

The reach between the Helena Drinking Water Treatment Plant and Montana Avenue provides the greatest opportunity to engage landowners in implementing management measures that will reduce sediment, nutrients, and associated metals. Priority management measures for Lower Tenmile Creek for the LHWG and the LCCWQPD for 2014-2019 include:

- Identify and pursue additional opportunities to improve instream flows and fish spawning by eliminating or moving diversions when necessary to maintain stream flows or provide for fish passage.
- Seek willing landowners to put in place and maintain riparian buffers and filter strips.
- Encourage use of water gaps, off-stream watering, and riparian fencing to control livestock access to the stream.
- Implement bioengineered stream bank stabilization treatments and stream channel restoration projects.

The management measures identified are described in Appendix D. Landowners in this area can use Appendix B as a resource for implementation of management measures on their property.

Load allocations for Tenmile Creek are presented in Appendix C. A sediment load reduction of 36% is estimated to result in achievement of the applicable water quality standards.

Calculations in Volume II show that a watershed scale load reduction of 66, 80, 69, 79 and 55 percent for arsenic, cadmium, copper, lead, and zinc, respectively, will result in achievement of the applicable water quality standards.

A nitrogen load reduction of 59% is assumed to be necessary to support all beneficial uses. However, the maximum attainable nitrogen load reduction for the Tenmile Creek watershed is estimated to be only 23%; therefore, it may not be possible to attain the water quality target established for nitrogen. A phosphorus load reduction of 61% is assumed to be necessary to support all beneficial uses. However, the maximum attainable phosphorus load reduction for the Tenmile Creek watershed is estimated to be only 38%. An adaptive management strategy is presented in Volume II (EPA 2006).

The measures identified above will improve water quality and watershed health in this reach in the following ways (See Appendix B):

Reducing sediment and nutrient pollution.

Improving fish and wildlife habitat.

Riparian buffers will also trap metals in runoff; however, this management measure will not be sufficient to restore beneficial uses impaired by metals because most metals come from upstream sources.

Silver Creek

Water Quality Problems

Aquatic life and drinking water are important uses of water that are not supported in Silver Creek from the headwaters to Lake Helena. The DEQ has identified pollutants that cause impairment of these beneficial uses of water. (DEQ CWAIC 2014) These include the metals arsenic and mercury. A TMDL has been established for each of these metals.

The uses of Silver Creek are also affected by the pesticide DDE, low streamflow, and alteration of the substrate -- material at the bottom of the stream that provides habitat for aquatic life.

The primary human-caused sources of impairment that were identified in Volume I (2004), Volume II (EPA 2006), and the Metals TMDL Addendum (EPA 2013) are summarized below.

Sediment-associated metals and historic hard rock mining activities in the upper watershed are the primary sources of metals in Silver Creek. Jennie's Fork is a tributary and contributes to the metals loads. Five mine sites in the watershed are listed in the state's inventory of high priority abandoned hard rock mine sites: Goldsil Mill Site, Drumlummon Mine/Mill Site, Argo Mill Site, Belmont, and Bald Mountain. The historic use of mercury during the amalgamation process at placer mining sites is considered a significant source of mercury impairment.

The Drumlummon Mine and Mill site has been active intermittently since 1876. In 2008, RX Gold and Silver, Inc. began conducting surface and underground exploration work, working under the Small Miner Exclusion Statement. The DEQ issued a MPDES permit to address the discharge of pumped mineshaft water to Silver Creek through a drain field. The permit limits the concentrations of numerous pollutants including mercury. The mine also has a MPDES permit for storm water discharge associated with minor construction activities. In 2013 RX Gold and Silver, Inc. announced plans to halt work and close the Drumlummon Mine indefinitely.

Lewis and Clark County holds a storm water permit for periodic reconstruction of the Marysville Road. Due to the nature of this activity, no metal loading is expected from this source and no waste load is allocated to it in the TMDL.

Silver Creek has been extensively placer mined, resulting in major channel and floodplain disturbance, waste rock dumps, settling ponds and numerous tailings dams spanning the stream channel.

Although DEQ has studied and proposed reclamation activities in the Silver Creek drainage, no action has taken place.

Watershed Restoration Opportunities

Landowners can improve water quality and watershed health in Silver Creek by cleaning up abandoned mines, closing and reclaiming unauthorized roads and trails, and using appropriate management practices. Management practices can improve fish and wildlife habitat and reduce sediment and associated metals. High levels of mercury have been found in fish tissue following a 1976 fish kill; FWP has maintained a fish consumption advisory for Silver Creek since that time. Lower Silver Creek (downstream from Interstate 15 and the D2 drain ditch) has the potential to be a very productive rainbow and brown trout fishery. The D2 drain ditch provides an important spawning area for brown trout.

Watershed Restoration Strategies

Load allocations for Silver Creek are presented in Appendix C.

Calculations in Volume II show that an overall, watershed scale metals load reduction of 65% for arsenic would result in achievement of the applicable water quality standards. Calculations in the Metals TMDL addendum show that a 33% reduction in total mercury loading is required during low flow time periods to meet water quality standards.

Priority management measures for Silver Creek that are described in Appendix D include:

- Filter strips

- Riparian fencing
- Riparian buffers
- Bioengineered stream bank stabilization treatments and stream channel restoration projects
- Off-stream watering facilities
- Water gaps
- Road BMPs

Other important management practices include:

- Stormwater BMPs

XIV. Upper Ten Mile Creek Watershed (To Tenmile Creek water Treatment plant)

The Upper Ten Mile Creek Watershed is a narrow main valley with steep side slopes draining substantial upland areas, particularly to the south. The geology of the area is mostly igneous and volcanic. Associated with the igneous rocks are ore bodies that have been intensively mined; the watershed has one of the highest densities of abandoned mines in Montana. The ridges and sideslopes are largely forestlands in the Helena National Forest, but historically the land near Ten Mile Creek has been greatly disturbed because of extensive mining, and the resultant construction of roads and a railroad. The watershed supplies a substantial portion of the drinking water for the City of Helena.

For this sub-watershed, the geology and steep topography are the natural causes of the pollution of Ten Mile Creek. Weathering and erosion of the volcanic rock yields large amounts of coarse grained sediment that are efficiently transported into Ten Mile Creek because of the steep stream slopes. The very extensive mining activity results in large volumes of sediment containing metals entering Ten Mile Creek. As a result, Ten Mile Creek in this watershed has TMDLs for sediment and metals.

(maybe a map of this subwatershed of interest for this section)

Upper Tenmile Creek

Water Quality Problems

Agriculture, aquatic life, drinking water, and recreation are all important uses of water that are not supported in Upper Tenmile Creek. (Beneficial uses for agriculture and recreation were not assessed for the segment of Tenmile Creek that goes from the headwaters to Spring Creek.) (DEQ CWAIC 2014) The Upper Tenmile watershed is the primary source of drinking water for approximately 31,000 Helena residents.

The DEQ has identified pollutants that cause impairment of these beneficial uses of water. (DEQ CWAIC 2014) These include the following metals for which a TMDL is required: arsenic, cadmium, copper, lead, and zinc.

A TMDL has also been completed for sedimentation/siltation for the reach that extends from Spring Creek to the Helena Drinking Water Treatment Plant. The uses of water in this reach are also affected by low streamflows.

Land uses that affect water quality in the watershed include streamside private residences, recreation, roads, remediation sites, grazing, and timber harvest. a localized area of moderate septic density is located downgradient of drinking water supply intake well #3 but upgradient of drinking water supply intake well #2. (PWS 2012) Should septic system failure occur in this localized area, effluent could leach to area groundwater or enter into Tenmile Creek via interaction of groundwater with surface water.

The primary human-caused sources of impairment that were identified in Volume I (EPA 2004) and Volume II (EPA 2006) are summarized below.

Metals

Historic hard rock mining activities are the primary sources of metals in this segment of Tenmile Creek. Sixteen abandoned mines in the drainage area are listed in the state's inventory of high priority abandoned hardrock mine sites.

Sediment

Roads and localized channel alterations are the primary sediment sources.

Headwaters to Spring Creek. The Helena National Forest conducted a road sediment survey on the forest portion of the segment of Tenmile Creek that extends 6.72 miles from its headwaters to the confluence with Spring Creek. Seven sites contribute approximately 0.76 tons of sediment to the stream each year. Another 14 sites on tributary streams were estimated to contribute 8.7 tons of sediment annually. The aerial photography inventory showed five road crossings and road encroachment along 35 percent of the stream. Upslope logging, exposed stream banks, and stream incisement were notable on this portion of Tenmile Creek. Riparian buffer widths were variable due to moderate road encroachment.

Spring Creek to Water Treatment Plant. Road runoff and channel alterations due to road placement are likely the largest sediment sources in the reach that runs 7.32 miles from Spring Creek to the Helena Drinking Water Treatment Plant. The Helena National Forest conducted a road sediment survey on the forest portion of the creek and identified 11 sites that are estimated to contribute 1.3 tons of sediment each year. The aerial photography inventory showed 20 road crossings and road encroachment along 50 percent of this segment. The stream channel was straightened near the Rimini Road. The aerial photography inventory revealed stream incisement, eroding stream banks, and lack of flow. Intermittent logging has occurred on the slopes above tributary streams. Riparian buffer widths are limited as a result of encroachment from the Rimini Road.

Results of the 2003 Proper Functioning Condition assessment are presented in Table 5.

Table 5 -- Upper Tenmile Creek Proper Functioning Condition Assessment

Reach	Rating	Notes
Headwaters	Proper Functioning Condition	
Above Banner Creek	Functional—at Risk	o Incised o Sediment deposition
Below Bear Gulch confluence	Functional—at Risk	o Under-sized for the available channel o Sediment deposition o Limited riparian zone

Dewatering

The stream is dewatered as a result of water withdrawals by the City of Helena. The streambeds generally are dry during the late summer below the city's intakes on Tenmile Creek and tributaries. During the 2003 source assessment, the stream was observed to be dry or occupying less than half its channel in the reach below the city's intake.

Watershed Restoration Opportunities

Landowners can improve water quality and watershed health in Upper Tenmile Creek and downstream in Lower Tenmile Creek and Lake Helena by cleaning up abandoned mines, closing and reclaiming unauthorized roads and trails, and using appropriate management practices. Management practices can improve fish and wildlife habitat and reduce sediment and associated metals. Brook trout and rainbow trout are found in Upper Tenmile Creek; however, the impairments make the habitat unsuitable for a year-round fishery. The Upper Tenmile Creek watershed is a major wildlife movement corridor.

Priority management measures for Upper Tenmile Creek that are described in Appendix B include:

- Filter strips
- Riparian fencing
- Riparian buffers
- Bioengineered stream bank stabilization treatments and stream channel restoration projects
- Off-stream watering facilities
- Water gaps

- Road BMPs
- Stormwater BMPs
- Silvicultural BMPs
- Proper installation and maintenance of septic systems.

There are several completed, ongoing and planned initiatives that will yield higher quality water in upper Tenmile Creek. These are highlighted below.

Tenmile Creek Water Supply Fuel Reduction Project

A Mountain Pine Beetle infestation in the Upper Tenmile Creek watershed has caused wide-spread tree mortality. Elevated surface fuel loadings create conditions for an intense fire that would be difficult to suppress. Water quality would be adversely affected by an intense fire due to erosion, sedimentation, ash deposition, and debris torrents. Furthermore, falling dead trees and fire have the potential to physically damage the Red Mountain Flume that conveys water to Chessman Reservoir, where it is stored to supply Helena's drinking water.

The City of Helena and the Helena National Forest are working to implement fuels reduction projects to proactively protect the quality and supply of water for Helena residents. The City has already completed fuel reduction projects on city and private lands adjacent to the Red Mountain Flume. In 2014, the Forest issued a Record of Decision and Finding of No Significant Impact for the treatment and removal of fuels and hazard trees along a portion of the Red Mountain flume and Chessman Reservoir.

Watershed Control Program

The City of Helena developed a Watershed Control Program plan in 2011 to minimize contamination by *Cryptosporidium* in Helena's drinking water supply. Goals of the plan include:

1. Identify and manage existing *Cryptosporidium* sources.
2. Address grazing within the watershed.
3. Increase watershed education and public outreach.

Several partners are involved in implementing the plan. Action items include: outreach and education, vault pumping, research and monitoring, and promotion of grazing BMP's.

Superfund Cleanup

The EPA added the Upper Tenmile Creek Mining Area to the Superfund National Priorities List on October 22, 1999 and began cleanup. The U.S. Forest Service is responsible for cleanup within its boundaries.

Helena National Forest

The Helena National Forest rated the Upper Tenmile Creek as a number one priority in its Watershed Condition Framework Assessment. Over the long term, the Forest will implement a Watershed Restoration Action Plan. The Helena National Forest completed a *Tenmile Ecosystem Watershed Analysis* in 2008.

The Forest is in the process of revising the Divide Travel Plan. A Draft Environmental Impact Statement was released in 2014. The Divide Travel Plan Decision will determine which areas will be open or closed for motorized use.

The Helena National Forest is working to include grazing BMP's in management and operational plans.

The lower 8 miles of Rimini road were realigned and paved by Lewis & Clark County in 2014 to reduce erosion and sedimentation.

Upper Ten Mile Watershed Steering Group

Projects have included stream bank stabilization and fish habitat improvement project that entailed planting over 35,000 trees and shrubs; and developing a cooperative plan to maintain instream flows in Upper Tenmile Creek during low flow periods.

Watershed Restoration Strategies

Load allocations for Tenmile Creek are presented in Appendix C. A sediment load reduction of 36% for the entire Tenmile Creek watershed is estimated to result in achievement of the applicable water quality standards.

Calculations in Volume II show that watershed scale metals load reductions of 66, 80, 79 and 55 percent for arsenic, cadmium, copper, lead, and zinc, respectively, would result in achievement of the applicable water quality standard

XV. Western Hills Watershed

The Western Hills Watershed comprises the mountainous area north of Highway 12, west to the Continental Divide, and north to the North Hills. This watershed also includes the Scratch Gravel Hills. Important streams in this area include Seven Mile Creek and Silver Creek. The area geology is mostly sedimentary with a few isolated areas of igneous (granitic) rock near Jenny's Creek, Silver Creek, and Skelly Gulch. Area mining is limited to concentrated locations of intensive mining of smaller ore bodies in igneous rocks, such as the Marysville Mining District. As a result of placer mining, streams near Marysville (Silver Creek, Jenny's Fork) have been extensively reworked and disrupted. Typical vegetation at lower eastern elevations is grasses and shrubs because of lower rainfall. At higher elevations to the west, precipitation is higher, resulting in forests, mostly in the Helena National Forest. Aside from the Marysville area, the area is mostly sparsely developed with scattered houses and ranches at lower elevations with extensive logging and logging roads in the forests.

Both natural factors and land use determine the stream pollution. Sediments eroded at higher elevation are deposited in area streams. Seven Mile Creek, Skelly Gulch, and Jenny's Creek all have TMDLs for sediment. Because of the concentrated mining activity, Seven Mile Creek and Silver Creek have TMDLs for metals. The TMDL for Seven Mile Creek for nutrients is necessary due to runoff from grazing lands. (A map of this sub-watershed would be useful)

Sevenmile Creek

Water Quality Problems

Aquatic life and drinking water are important uses of water that are not supported in Sevenmile Creek. The listed segment runs 7.8 miles from its headwaters to the mouth, where it flows into Tenmile Creek. The DEQ has identified pollutants that cause impairment of these beneficial uses of water. (DEQ CWAIC 2014) These include:

- Metals: arsenic, copper, and lead.
- Nutrients: total nitrogen and total phosphorous.
- Sedimentation/siltation.

All of the causes of impairment listed above warrant a TMDL.

The uses of Sevenmile Creek are also affected by low flows and alteration of streamside vegetative covers.

The primary human-caused sources of impairment that were identified in Volume I (EPA 2004) and Volume II (EPA 2006) for the Sevenmile Creek watershed are summarized below.

Metals

Skelly Gulch and historic mining are the primary sources of metals in Sevenmile Creek. None of the mines in the immediate drainage area are listed in the state's inventory of high priority abandoned hard rock mines sites.

Nutrients

The primary sources of nitrogen, in order of importance, are septic systems, urban areas, human-caused streambank erosion, dirt roads, and timber harvest activities.

The primary sources of phosphorous, in order of importance, are human-caused streambank erosion, dirt roads, urban areas, timber harvest, and agriculture.

An animal confinement area and suspected wastewater seepage from Fort Harrison's defunct sewage treatment facility were documented by GPS in 2003. Additional potential local sources include diffuse sediment, rural housing, and stream dewatering.

Sediment

The primary sources of sediment, in order of importance, are human-caused streambank erosion, unpaved roads, timber harvest, agriculture, non-system roads and trails, and urban areas.

Human-caused streambank erosion is largely a result of riparian grazing impacts, animal feedlot/confinement areas, road and railroad encroachments, stream channelization, beaver dam removal and historic mining activity. The railway and Birdseye Road have caused stream channelization along 13% of the stream. Stream incisement and eroding stream banks were observed approximately 1.25 miles downstream of the Austin Road crossing.

The aerial photography inventory showed five road crossings. Road sediment delivery points were documented by GPS in 2003. Unpaved non-system roads and trails in the uplands of the watershed contribute sediment due to the lack of drainage structures.

Timber harvest has occurred in the uplands of the watershed on state and BLM lands.

Agricultural activities, including straightening for irrigation, irrigation diversions, return flows, and cultivation in the riparian zone, have visibly impacted Sevenmile Creek below Birdseye Road.

A 2003 Proper Functioning Condition assessment rated the reach above the mouth as "Functional-at risk." The field crew observed healthy and diverse riparian vegetation on the left bank, but also noted that the stream was choked with sediment and that cut banks were prevalent on the right bank.

Watershed Restoration Opportunities

Landowners can improve water quality and watershed health in Sevenmile Creek and downstream in Tenmile Creek and Lake Helena by cleaning up abandoned mines, reclaiming and closing unauthorized roads and trails and using appropriate management practices. Management practices can improve fish and wildlife habitat and reduce sediment and associated metals. Sevenmile Creek is managed as a trout fishery; however, trout are considered rare.

Watershed Restoration Strategies

Priority management measures for Sevenmile Creek that are described in Appendix D include:

- Filter strips
- Riparian fencing
- Riparian buffers
- Bioengineered stream bank stabilization treatments and stream channel restoration projects
- Off-stream watering facilities
- Water gaps
- Road BMPs
- Stormwater BMPs
- Proper installation and maintenance of septic systems.

Load allocations for Sevenmile Creek are presented in Appendix C.

Calculations in Volume II show that an overall, watershed scale metals load reduction of 52, 47 and 63 percent for arsenic, copper, and lead, respectively, would result in achievement of the applicable water quality standards.

A nitrogen load reduction of 58% would be required to support all beneficial uses. However, the maximum attainable nitrogen load reduction for the Sevenmile Creek watershed is estimated to be only 20%.

A total phosphorous load reduction of 79% would be required to support all beneficial uses. However, the estimated maximum attainable phosphorous load reduction for the Sevenmile Creek watershed is only 32 percent.

While it may not be possible to reduce nutrient loads to the levels where all beneficial uses are supported, water quality in Sevenmile Creek and downstream water bodies will continue to degrade if no action is taken to reduce nutrient pollution. Sevenmile Creek has been identified as a source of eutrophication in Tenmile Creek.

An overall, watershed scale sediment load reduction of 33% is estimated to result in achievement of the applicable water quality standards.

Skelly Gulch

Water Quality Problems

Aquatic life is an important use of water that is not supported in Skelly Gulch due to sedimentation and siltation. The DEQ has established a TMDL for sedimentation and siltation. (DEQ CWAIC 2014)

The primary human-caused sources of impairment that were identified in Volume I (EPA 2004) and Volume II (EPA 2006) are summarized below.

The primary sources of sediment in the Skelly Gulch watershed, in order of importance, are unpaved roads, timber harvest, human-caused streambank erosion, and non-system roads and trails.

The Helena National Forest conducted a road sediment survey on the forest portion of the creek and identified a single site that contributes an estimated 0.8 ton of sediment to the stream each year. An aerial photography inventory showed 11 road crossings and road encroachment along 17% of the stream. The unpaved Skelly Gulch Road is directly adjacent to the water body throughout much of the lower reach of the stream. There is minimal, if any, riparian buffer in this reach. The road crosses Skelly Gulch in the central reach via a bridge and a stream ford. Five road crossings related to timber harvest units were identified as sediment sources within Helena National Forest ownership.

Timber harvest activities have occurred in the upper watershed within the Helena National Forest as well as in the central area of the watershed.

Streambank erosion is primarily caused by riparian grazing, road encroachment, stream channelization, and historic mining activity. Except for the reach affected by the encroachment of Skelly Gulch Road, riparian buffers were extensive.

Unpaved nonsystem roads and trails in the central watershed contribute sediment due to the lack of runoff mitigation structures.

A 2003 Proper Functioning Condition assessment rated the reach about two miles above the mouth as “Proper Functioning Condition.” Some sediment deposition was noted.

Watershed Restoration Opportunities

Landowners can improve water quality and watershed health in Skelly Gulch and downstream in Sevenmile Creek, Tenmile Creek, and Lake Helena by closing and reclaiming unauthorized roads and trails, and using appropriate management practices. Management practices can improve fish and wildlife habitat and reduce sediment and associated metals. Genetically pure westslope cutthroat have been documented in the upper 3.5 miles of Skelly Gulch. Eastern brook trout have been found in the lower 2.5 miles of the creek.

Watershed Restoration Strategies

Priority management measures for Skelly Gulch that are described in Appendix D include:

- Filter strips
- Riparian fencing
- Riparian buffers
- Bioengineered stream bank stabilization treatments and stream channel restoration projects
- Off-stream watering facilities
- Water gaps
- Road BMPs
- Silvicultural BMPs

Load allocations for Skelly Gulch are presented in Appendix C.

An overall, watershed scale sediment load reduction of 22% is estimated to result in achievement of the applicable water quality standards.

Granite Creek

Water Quality Problems

Drinking water is an important use of water that is not supported in Granite Creek. The listed segment runs 2.5 miles from its headwaters to the mouth, where it flows into Sevenmile Creek. The DEQ has identified pollutants that cause impairment of these beneficial uses of water. (DEQ CWAIC 2014) These include the metals arsenic and cadmium.

The primary human-caused sources of impairment that were identified in Volume I (EPA 2004) and Volume III (EPA 2013) for the Granite Creek watershed are summarized below.

Historic mining activities are the primary sources of metals in Granite Creek. None of the mines in the immediate drainage area are listed in the state's inventory of high priority abandoned hard rock mines sites. Upstream sources also contribute arsenic to Granite Creek.

During a 2004 field reconnaissance, Granite Creek was observed to be dry for its entire length. There was no indication of recent flow. Much of the Granite Creek channel lacked indications of more than brief seasonal flow. Riparian vegetation was absent in the headwaters and lower reaches. In the middle reaches the riparian zone was populated with aspen and a mixture of other vegetation.

Current land uses include grazing and rangeland and limited recreation. The upper half of the watershed is managed by the BLM and the lower half is private ranchland.

Watershed Restoration Opportunities

Landowners can improve water quality and watershed health in Granite Creek and downstream in Sevenmile Creek, Tenmile Creek and Lake Helena by cleaning up abandoned mines and using appropriate management practices.

Watershed Restoration Strategies

Priority management measures for Granite Creek that are described in Appendix D include:

- Riparian fencing
- Off-stream watering facilities
- Water gaps

Load allocations for Granite Creek are presented in Appendix C.

The TMDLs for metals are flow and hardness dependent. A large reduction in arsenic loading is required during low and high flow conditions. No reduction of cadmium is required at the calculated low flow and high flow conditions. However, it is possible that a reduction in cadmium loading is required at times not represented in the sampling data used to calculate the TMDL (EPA 2013)

Jennie's Fork

Water Quality Problems

Aquatic life and drinking water are important uses of water that are not supported in Jennie's Fork from its headwaters to the mouth. Primary contact recreation and agricultural uses are fully supported. The DEQ has identified pollutants that cause impairment of these beneficial uses of water. (DEQ CWAIC 2014) These include lead and sedimentation/siltation. A TMDL has been established for these pollutants.

The uses of Jennie's Fork are also affected by nutrients: Nitrate/Nitrite and Total Phosphorous. (DEQ CWAIC 2014)

The primary human-caused sources of impairment that were identified in Volume I (2004) and Volume II are summarized below.

Metals

Sediment-associated metals and historic hard rock mining activities in the upper watershed are the primary sources of metals in Jennie's Fork. The point of origin of Jennie's Fork is a mine shaft on Mount Belmont. Mining was active at this site until the late 1990s.

The Bald Mountain site is listed in the state's inventory of high priority abandoned hard rock mine sites. The Bald Mountain Mill was located at the head of Jennie's Fork. The BLM capped and revegetated mill tailings located on a slope above the chalet at the Great Divide in 1994. Precipitation and runoff from the Great ski area caused erosion through the cap into the tailings and carried sediments contaminated with metals into Jennie's Fork. Subsequent reclamation activities took place in 2011. Waste sources were removed from areas in or near the floodplain of Jennie's Fork. Affected areas were reclaimed and stream channels were reconstructed to reestablish vegetation and habitat. In 2012 snowmelt runoff at the ski area eroded an abandoned road above the site and deposited sediment in runoff control ditches, causing overflow and moderate erosion to portions of the reclaimed slope. The eroded area was repaired and stabilized in June 2012.

Sediment

The primary sources of sediment in the Jennie's Fork watershed, in order of importance, are unpaved roads, timber harvest, non-system roads, and human-caused streambank erosion.

During the sediment source assessment, significant quantities of sediment were observed entering Jennie's Fork from the Great Divide ski area parking lot during spring snowmelt runoff. The aerial photography inventory showed four road crossings and road encroachment along 56% of the stream. There is an extremely high density of roads in the watershed, particularly in the vicinity of the ski area. Non-system roads are associated with the ski area and historic mining activities.

Timber harvest activities have occurred throughout the upper watershed on mining claims and Great Divide ski runs.

Streambank erosion is primarily caused by riparian grazing, road encroachment, stream channelization, and historic mining activity. The aerial photography assessment showed variable width riparian buffers. The stream flows underground in a series of culverts through most of the ski area. At least three channels were observed carrying spring runoff flow due to an under-sized culvert.

Cattle and horses were observed grazing below the ski area parking lot, impacting the stream banks and riparian vegetation.

A 2003 Proper Functioning Condition assessment rated the reach below the ski area parking lot "Functional—at Risk." The field crew noted that sand deposition was excessive.

Watershed Restoration Opportunities

Landowners can improve water quality and watershed health in Jennie's Fork and downstream in Silver Creek by cleaning up abandoned mines, closing and reclaiming unauthorized roads and trails, and using appropriate management practices.

Watershed Restoration Strategies

Load allocations for Jennie's Fork are presented in Appendix C.

Calculations in Volume II show that a watershed scale metals load reduction of 46% for lead would result in achievement of the applicable water quality standards. A watershed scale sediment load reduction of 27% will result in achievement of the applicable water quality standards.

Priority management measures for Jennie's Fork that are described in Appendix D include:

- Filter strips
- Riparian fencing
- Riparian buffers
- Bioengineered stream bank stabilization treatments and stream channel restoration projects
- Off-stream watering facilities
- Water gaps
- Road BMPs
- Silvicultural BMPs

Lake Helena

Water Quality Problems

Aquatic life and drinking water are important uses of water that are not supported in Lake Helena. Field measurements collected in 2003 showed algal blooms, low visibility, and widely variable dissolved oxygen levels. Agricultural use is fully supported. The DEQ has identified pollutants that cause impairment of these beneficial uses of water. (DEQ CWAIC 2014) These include:

- Metals: arsenic, and lead.
- Nutrients: nitrogen and phosphorous.

All of the causes of impairment listed above warrant a TMDL.

The primary human-caused sources of impairment that were identified in Volume I (EPA 2004) and Volume II (EPA 2006) for the Lake Helena watershed are summarized by pollutant below. The quality of the water in Lake Helena is affected by water from various sources: Prickly Pear Creek, Tenmile Creek, and Silver Creek tributaries; ground water discharge; tile drainage associated with the Helena Valley Irrigation District, treated wastewater discharged to Prickly Pear Creek by the cities of Helena and East Helena; and the Missouri River, water from which is discharged directly or indirectly from the Helena Valley Irrigation Canal and from occasional backflows from Hauser Reservoir to Lake Helena. Most of Silver Creek's small volume of flow never reaches the Helena Valley because of channel losses to ground water and irrigation withdrawals. Although the Lake Helena area was once a substantial wetland, most of the riparian vegetation is now restricted to the portion of the shoreline where Prickly Pear Creek and the Silver Creek Ditch enter Lake Helena. This area is protected by an easement.

Metals

Upstream tributaries are the primary sources of metals in Lake Helena. Local sediment sources also contribute to an increase in arsenic loading to Lake Helena. In addition, contaminated bottom sediment is a potential metals source.

Nutrients

The primary sources of nitrogen, in order of importance, are septic systems, return flows from the Helena Valley Irrigation System, municipal wastewater treatment facilities, and urban areas.

The primary sources of phosphorous, in order of importance, are municipal wastewater treatment facilities, return flows from the Helena Valley Irrigation System, agriculture, dirt roads, and urban areas. Agricultural and single family residential sources may be far more significant in localized areas than at the watershed scale.

Watershed Restoration Opportunities

Landowners can improve water quality and watershed health in Lake Helena by cleaning up tributaries using appropriate management practices. Management practices can improve fish and wildlife habitat. Lake Helena is managed as a trout fishery and hosts several species of fish.

Watershed Restoration Strategies

Priority management measures for Lake Helena that are described in Appendix D include:

- Filter strips
- Riparian fencing
- Riparian buffers
- Bioengineered stream bank stabilization treatments and stream channel restoration projects
- Off-stream watering facilities
- Water gaps

Other important management practices include:

- Stormwater BMPs
- Proper installation and maintenance of septic systems.

Load allocations for Lake Helena are presented in Appendix C.

Calculations in Volume II show that an overall, watershed scale metals load reduction of 61 and 66 percent for arsenic and lead, respectively, would result in achievement of the applicable water quality standards.

An interim total nitrogen load reduction goal of 80% was established. No concentration targets were proposed for Lake Helena. It may not be possible to attain the 80% load reduction goal.

An interim total phosphorous load reduction goal of 87% was established. No concentration targets were proposed for Lake Helena. It may not be possible to attain the 87% load reduction goal.

While it may not be possible to reduce nutrient loads to the levels where all beneficial uses are supported, water quality in Lake Helena will continue to degrade if no action is taken to reduce nutrient pollution in the watershed.

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Abbreviations

BLM	Bureau of Land Management
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
CFS	Cubic Feet per Second
DEQ	Montana Department of Environmental Quality
DNRC	Montana Department of Natural Resources and Conservation
EPA	U.S. Environmental Protection Agency

FWP	Montana Fish, Wildlife and Parks
GPS	Global Positioning System
LCCWQPD	Lewis & Clark County Water Quality Protection District
LHWG	Lake Helena Watershed Group
MCPS	Montana Conservation Practice Standard
MDT	Montana Department of Transportation
METG	Montana Environmental Trust Group, LLC
MFOTG	Montana Field Office Technical Guide
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service
NRD	State of Montana Natural Resource Damage Program
PPLT	Prickly Pear Land Trust
TMDL	Total Maximum Daily Load
WRP	Watershed Restoration Plan

Appendix B

Appendix C

Subwatershed Restoration Needs and Strategy

Understanding in full detail why the various streams and tributaries of the Helena watershed each show specific impairments caused by the four pollutant groups (sediment, nutrients, metals, temperature) is beyond the scope of this discussion. However, by geographically organizing the watershed into sub watersheds, the general spatial trends of the impairments can be understood.

For the purposes of this plan, the watershed is subdivided into six sub watersheds. The boundaries between the sub watersheds are not distinct; the characteristics of neighboring sub watersheds tend to be very similar near the boundary.

The information provided below meets element number one "Identification of causes and sources or groups of similar sources that need to be controlled to achieve load reductions, and any other goals identified in the watershed plan" of the required EPA nine elements.

b. Upper Prickly Pear Creek Tributaries, south of Montana City, west of Prickly Pear Creek (Clancy, Corbin, Lump Gulch)

Map of subwatershed in each

The western slopes of the Upper Prickly Pear Watershed are formed from extensive igneous (granitic) rock that historically was extensively mined. These slopes are drier than the eastern slopes with mostly grasses and brush at lower elevations and limited forests in the Helena National Forest at higher elevations. The land use is mixed with limited development (small towns and housing subdivisions) at lower elevation near the center of the Prickly Pear Valley, ranching dispersed along the tributaries, some extensive mined areas, and limited logging. The area has an extensive network of roads.

The steep slopes accelerate the erosion of the granitic rock, inherently susceptible to weathering, and the rapid transport of coarse sediment into the tributaries of Prickly Pear Creek. Metals accumulate in the tributaries from this erosion. Reaches of several tributaries have TMDLs for both sediment and metals: Clancy Creek; Corbin Creek; Lump Gulch. Grazing near Corbin Creek has raised nutrient concentrations in the stream; Corbin Creek has a TMDL for nutrients.

Appendix D: Best Management Practices

Introduction

This appendix addresses **Element 2** and **Element 3 of a WRP** and includes a description of the nonpoint source management measures that will need to be implemented to achieve load reductions and estimates of the load reductions expected for the management measures. Resources are identified for additional information. Please see Chapter 10: References for the full citation and online links to references, when available.

Bioengineered Streambank Stabilization

Description

Bioengineered treatments used to stabilize and protect banks of streams or constructed channels, and shorelines of lakes or reservoirs. Biological, mechanical, and ecological concepts are synthesized to control erosion and stabilize soil through the use of vegetation. Tree and root wad revetments are used in place of or in combination with rock and concrete. This practice may require deflection of water away from the target reach. Bioengineering treatments are developed systematically, taking into consideration the causes of erosion and the upstream and downstream effects of the treatment and changes that may occur in the watershed hydrology and sedimentation over the design life of the treatments. Vegetation used in bioengineered treatments must be native or compatible with native habitat.

Treatments that include woody debris, woody riparian vegetation, or other treatments that provide shade and cover can improve fish and wildlife habitat in addition to water quality.

Load Reductions and Pollutants

This BMP has the potential to improve the quality of water impaired by the following pollutants:

Nitrogen

Phosphorous

Sediment

Temperature

Biochemical Oxygen Demand

Additional Benefits

Prevent or minimize loss of adjacent land or other properties

Prevent or minimize interference with land use

Prevent or minimize damage to adjacent facilities

Maintain the flow capacity of streams or channels

Improve or enhance the stream corridor for fish and wildlife habitat, aesthetics, recreation

Bioengineering treatments are usually, but not always, much less expensive than traditional methods of streambank erosion control. Allen and Leech (1997) note that costs can vary tremendously due to differences in the availability of materials, hauling distances, labor rates, project objectives, and other factors. Maintenance costs over the life-cycle of the treatment must be considered. Allen and Leech (1997) present comparisons of actual costs of bioengineering treatments with estimated costs of traditional riprapped revetments under similar conditions in the same area. They estimate man-hour costs of bioengineering treatments.

Resources/References

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NRCS, Montana Conservation Practice Standard (MCPS), Streambank and Shoreline Protection, Code 580; Critical Area Planting, Code 342; Open Channel, Code 582

NRCS, EFH, Chapter 16, Streambank and Shoreline Protection

DEQ, MT NPS Management Plan

Conservation Districts

LCWQPD

Filter Strip

Description

A strip of permanent perennial vegetation placed on the downgradient edge of a field, pasture, barnyard, or animal confinement area. The strip can slow surface runoff, filter particulate matter, or absorb and use nutrients. If the purpose of the strip is to take up nutrients, the vegetation must be periodically harvested in order to prevent nutrient buildup. Grazing would not constitute harvesting because nutrients are deposited as well as removed.

Load Reductions and Pollutants

This BMP has the potential to improve the quality of water impaired by the following pollutants:

Nitrogen

Phosphorous

Sediment

Metals

Temperature

Biochemical Oxygen Demand (BOD)

Pathogens

Resources/References

DEQ, MT NPS Management Plan

NRCS, Montana Conservation Practice Standard (MCPS), Field Border, Code 386; Filter Strip, Code 393; Hedgerow Planting, Code 422; Vegetated Treatment Area, Code 635

Conservation Districts

LCWQPD

Forestry

Description

The use of BMPs has proven to be an effective tool in limiting nonpoint source pollution from forest harvesting activities. The DNRC Forestry Practices Program has identified BMPs for the following activities:

Road planning, design and construction

Road maintenance

Road drainage

Timber harvest site preparation and design

Timber harvesting activities

Design, installation, and maintenance of stream crossings

Biennial audits of the application and effectiveness of forestry BMPs on selected high risk sites show that properly applied BMPs can limit nonpoint source pollution, such as sediment from a road or timber harvest.

The most recent field review results showed that BMPs were effective in protecting soil and water resources 98% of the time.

Load Reductions and Pollutants

These BMPs have the potential to improve the quality of water impaired by the following pollutants:

Phosphorous

Metals

Sediment

Temperature

Biochemical Oxygen Demand

Toxic Chemicals

Resources/References

MSU Extension Service (2001)

DNRC Forestry Assistance Program

DNRC (2012)

Off-Stream Watering Facility

Description

A permanent or portable device to provide an adequate amount and quality of drinking water for livestock and wildlife. The device and its location should encourage or enable livestock to obtain water from a source other than a surface water body.

Load Reductions and Pollutants

This BMP has the potential to improve the quality of water impaired by the following pollutants:

Nitrogen

Phosphorous

Sediment

Temperature

Biochemical Oxygen Demand

Pathogens

Additional Benefits

Meet daily water requirements

Improve animal distribution

Resources/References

NRCS, Montana Conservation Practice Standard (MCPS), Watering Facility, Code 614

DEQ, MT NPS Management Plan

Conservation Districts

LCWQPD

Riparian Buffer

Description

A strip of perennial vegetation located adjacent to and upgradient from a water body. The strip must be designed to reduce nonpoint source pollution. Buffer width, slope, species composition, and target pollutants must be considered in the design.

Load Reductions and Pollutants

Riparian vegetative buffers perform the following important functions that help to maintain beneficial uses of water:

Break down, filter, and reduce the amount of pollutants that enter water bodies.

Shade streams to maintain cooler temperatures.

Stabilize stream banks to control erosion.

Provide cover for fish.

Contribute leaves, twigs, and insects to streams, providing food for invertebrates that support fish and wildlife.

Moderate the amount of water in streams by reducing peak flows during floods and storing and slowly releasing water into streams when flows are low.

Vegetated buffers with woody plants provide the most effective water quality protection. Large trees are particularly important for fisheries and maintaining natural stream function by creating pools, riffles, backwaters, small dams, and off-channel habitat. The more complex the vegetation in terms of species and plant height, the greater the variety of wildlife.

This BMP has the potential to improve the quality of water impaired by the following pollutants:

Metals

Nitrogen

Phosphorous

Sediment

Temperature

Biochemical Oxygen Demand

Pathogens

The series of reports prepared by Ellis (2008) summarize the results of more than 80 scientific studies that document the effectiveness of riparian buffers in protecting water quality, and improving fish and wildlife habitat.

Knutson and Naef (1997) reviewed scientific studies and found the following:

In well-forested watersheds, mid-day summer water temperatures rise only 1-2 C (1-1.8° F) above year-round averages. Conversely, unbuffered streams in clear-cut watersheds may experience temperature increases of 7-16C (10-27° F).

The structural diversity created by instream woody debris is essential in providing adequate fish habitat, particularly for spawning and rearing, in all sizes of streams and rivers.

Wenger (1999) reviewed scientific studies and concluded:

Numerous studies have documented the effectiveness of buffers in trapping sediment transported by surface runoff. (Wenger summarized the results of these studies which reported total suspended solid removal rates ranging from 53% to 94%.)

There is a positive correlation between a buffer's width and its ability to trap sediments. Wider buffers provide greater sediment control, especially on steeper slopes.

Other factors that affect the sediment trapping efficiency of buffers are slope, soil infiltration, and the extent of buffers.

It is very important that buffers be continuous along streams.

Additional Benefits

Fish habitat. "Keeping an adequate vegetated buffer along a stream is the most important thing that individual landowners can do to improve or maintain fish habitat . . ." (Ellis, 2008 Part II*).*

Wildlife habitat. More than half of Montana's wildlife use riparian areas for food, protected access to water, cover, resting areas during migration, travel routes; protection from weather, breeding, and nesting. (Ellis, 2008, Part III)

Resources/References

DEQ, MT NPS Management Plan

NRCS, Montana Conservation Practice Standard (MCPS), Access Control, Code 472; Critical Area Planting, Code 342; Fence, Code 382; Field Border, Code 386; Hedgerow Planting, Code 422; Riparian Forest Buffer, Code 391; Riparian Herbaceous Cover, Code 390

Ellis (2008)

Knutson and Naef (2007)

Conservation Districts

LCWQPD

Riparian Fencing

Description

Fencing used to permanently or temporarily control livestock access to riparian areas. Fencing may be used to prevent streambank trampling, reduce nutrient and pathogen pollution, or promote vegetative growth and plant species diversity.

Load Reductions and Pollutants

This BMP has the potential to improve the quality of water impaired by the following pollutants:

Nitrogen

Phosphorous

Sediment

Temperature

Biochemical Oxygen Demand

Pathogens

Resources/References

NRCS, Montana Conservation Practice Standard (MCPS), Access Control, Code 472; Fence, Code 382

DEQ, MT NPS Management Plan

Conservation Districts

LCWQPD

Roads

Description

Dirt roads are the largest source of sediment in the Lake Helena watershed, contributing an estimated 15% of the sediment load (EPA 2006). The contribution of sediment from roads can be minimized with good planning, and proper design, construction, and maintenance of roads, road drainage, and stream crossings. The DNRC Forestry Practices Program has identified BMPs for these activities. BMPs for roads are based on the following concepts:

Minimize the number of roads constructed in a watershed through comprehensive road planning. Use existing roads where practical, unless the use would increase erosion.

Locate roads on stable geology, including well-drained soils and rock formations that slant into the slope. Avoid slumps, slide-prone areas, and wet areas.

Fit roads to the topography, following natural benches and contours. Avoid long, steep road grades and narrow canyons. Minimize disruption of natural drainage patterns.

Vary road grades to reduce concentrated flow in road drainage ditches, culverts, and on fill slopes and road surfaces.

Keep slope stabilization, erosion and sediment control work current with road construction. Do not disturb roadside vegetation more than necessary. Complete construction or stabilize road sections within the same operating season. Minimize earth-moving activities when soils appear excessively wet.

Use sediment fabric fences and/or slash filter windrows to reduce movement of sediment into water bodies.

Consider road surfacing and use of geotextiles to minimize erosion.

Stabilize erodible, exposed soils on slopes adjacent to roads.

Provide adequate drainage from road surfaces using ditch grades, ditch relief culverts, drain dips, open top culverts, rubber water diverters, and water bars. Route road drainage through vegetative filters or sediment-settling structures before the drainage enters streams.

Prevent downslope movement of sediment by using sediment catch basins, drop inlets, changes in road grade, headwalls, or recessed cut slopes.

Grade road surfaces only as often as necessary to maintain a stable running surface and adequate surface drainage. Avoid grading sections of road that don't need grading. Avoid grading when roads are dusty or muddy.

Avoid cutting the toe of cut slopes when grading roads, pulling ditches or plowing snow.

Do not sidecast material over culvert inlets or outlets or into streams. Manage sidecast material to avoid erosion.

Maintain erosion control features of open and closed roads through periodic inspection and maintenance.

Control road dust.

Provide breaks in snow berms to allow road drainage.

Close roads or restrict road use permanently or temporarily to protect water quality.

Leave abandoned roads in a condition that provides adequate drainage without further maintenance.

Minimize the number of stream crossings and choose stable stream crossing sites. Design stream crossings for adequate passage of fish and minimum impact on water quality.

Load Reductions and Pollutants

These BMPs have the potential to improve the quality of water impaired by the following pollutants:

Phosphorous

Metals

Sediment

Temperature

Biochemical Oxygen Demand

Toxic Chemicals

Resources/References

MSU Extension Service (2001)

DNRC Forestry Assistance Program

DNRC (2012)

Septic System Inspection, Operations and Maintenance

Description

Septic systems contribute nutrients, pathogens, and chemicals to ground water and surface water. At the watershed scale (the entire Lake Helena watershed), septic systems are the most significant source of total nitrogen. Septic systems contribute an estimated 29% of the total nitrogen. (EPA 2006)

Management practices to protect water quality include:

Test septic tanks for water tightness before installation is complete.

Maintain septic systems by having them inspected at least annually and pumped every three to five years.

Control and manage water use to avoid hydraulic overload of the septic system.

Redirect surface water flow away from the soil absorption field.

Plant a greenbelt (grassy strip or small, short-rooted vegetation) between the soil absorption field and the shoreline of any nearby stream or lake. Avoid planting water-loving shrubs with deep root systems or trees near the drain field. Mow, but do not fertilize, burn or over water this area.

Keep chemicals, medications, and hazardous wastes out of the septic system.

Keep all vehicles, bikes, snowmobiles, etc. off the tank, pipes and soil treatment area. Follow practices to prevent freezing, including mulching the entire system if needed.

Load Reductions and Pollutants

These BMPs have the potential to improve the quality of water impaired by the following pollutants:

Nitrogen

Phosphorous

Biochemical Oxygen Demand

Pathogens

Toxic Chemicals

While most conventional septic systems are effective in removing phosphorus from effluent, most are not considered effective in removing nitrogen without additional treatment in the soil. Additional nitrogen removal can be achieved with advanced “Level 2” systems, which are required in some areas. Chemicals and drugs disposed of in a septic system will likely migrate to ground water.

Additional Benefits

Minimize unpleasant odors

Reduce growth of algae and weeds in nearby water bodies

Maintain a clean, palatable drinking water supply

Avoid costly repairs or replacement

Resources/References

DEQ 2010

EPA 2006

Jefferson County Environmental Health Department

Lewis and Clark City-County Health Department

Storm Water

Description

Storm water runoff occurs when precipitation from rain or snowmelt flows over the ground. Impervious surfaces like driveways, parking lots, streets, and sidewalks prevent storm water from naturally soaking into the ground. Storm water carries debris, chemicals, dirt and other pollutants into the surface waters of the Lake Helena watershed. Storm water runoff can also pollute the Helena Valley aquifer. Residents and businesses can help to reduce pollution by not dumping pollutants into storm drains and using the following BMPs:

Proper storage, disposal, and recycling of hazardous wastes

Pet waste management

Storm drain inlet protection

Lawn and garden fertilizer management

Litter control and parking lot cleanup

Vehicle and equipment maintenance to prevent leaks

Permeable landscaping

Preservation of existing vegetation

Reuse of storm water by routing runoff to lawns, vegetation, or rain barrels

Settling basins or sediment traps

Composting organic wastes

Vegetated filter strips

Load Reductions and Pollutants

These BMPs have the potential to improve the quality of water impaired by the following pollutants:

Nitrogen

Phosphorous

Sediment

Temperature

Biochemical Oxygen Demand

Pathogens

Toxic Chemicals

Resources/References

Conservation Districts

DEQ, MT NPS Management Plan

LCCWQPD

Water Gap

Description

A controlled access point from which livestock can obtain drinking water directly from a water body. Where possible, the gap should be designed to admit only one animal at a time.

Load Reductions and Pollutants

This BMP has the potential to improve the quality of water impaired by the following pollutants:

Nitrogen

Phosphorous

Sediment

Temperature

Biochemical Oxygen Demand

Pathogens

Resources/References

NRCS, Montana Conservation Practice Standard (MCPS), Access Control, Code 472; Fence, Code 382

DEQ, MT NPS Management Plan

Conservation Districts

LCWQPD

Appendix – WRP development outreach

4. Website

Below is a link to the LHWRP website:

http://www.lccountymt.gov/health/water-quality/restoration-plan.html

The website includes links to the following information related to the WRP: the documents produced during Phase I and II of the watershed restoration planning and TMDL development process, a letter to stakeholders, the fact sheet, a map of the watershed, and links to EPA guidance about developing a watershed restoration plan.

5. Fact Sheet

A 2-page fact sheet was developed that includes an overview of the content and purpose of the WRP, a map and description of affected areas, the importance of the WRP to the Lake Helena watershed, the process for development of the WRP, and resources for additional information and participation. The fact sheet was posted online and distributed through the newsletter of the LHWG. This newsletter has a mailing list of more than 800 recipients.

6. Letter to Stakeholders

A letter was sent from the LHWG Chair to stakeholders. The letter invited participation from stakeholders in the development of the WRP.

7. Stakeholder Interviews

Representatives of the LCCWQPD presented information about the WRP and the planning process and interviewed stakeholders. Interview questions addressed the following topics: values and goals, plans, projects and activities, data, and involvement in the planning process. Representatives of the following entities were interviewed:

- Bureau of Land Management, Butte Field Office
- City of East Helena
- Helena Valley Irrigation District
- Helena National Forest
- Jefferson County
- Jefferson Valley Conservation District
- Lewis & Clark Conservation District
- Lewis & Clark County
- Montana Business Assistance Connection
- Montana Department of Environmental Quality
- Montana Department of Justice Natural Resource Damage Program
- Montana Department of Transportation
- Montana Environmental Trust Group
- Montana Fish, Wildlife, and Parks
- Natural Resources Conservation Service
- PPL Montana
- Prickly Pear Land Trust
- U.S. Environmental Protection Agency

8. Presentations to Community Organizations

A slide presentation was developed to educate community residents about the importance of clean water and the benefits of watershed restoration, water quality impairments, watershed restoration planning, pollutants and sources of pollution found in the Lake Helena watershed, and solutions for improving water quality.

The slide show was presented at meetings of the following groups:

- Kiwanis
- Agri Forum
- Lewis and Clark County Citizen's Advisory Committee on Open Lands (scheduled)
- City of Helena Commission and staff

Participants were provided with an opportunity to ask questions and provide ideas.

9. Public Meeting

The LHWG invited all interested persons to attend a meeting held in the Helena Valley on April 18, 2013 to help identify priority water quality improvement activities. After a short presentation on watershed restoration planning, participants were asked to identify the key issues related to water quality and watershed health in the Lake Helena watershed. Participants were then asked how these issues can best be addressed.

10. Survey

A survey was posted on the website, distributed through meetings and newsletters of stakeholder organizations and the LHWG. The survey asked respondents to answer questions about water quality and watershed health in the Lake Helena watershed, including questions on the following topics:

- Importance of watershed health to respondents.
- Most urgent problems and best opportunities.
- Highest priority impaired water bodies for water quality improvement activities.
- Interest in collaboration on projects.

Thirty-six surveys were returned.

11. News Media

A news release was distributed and two articles appeared in the major area newspaper, the Helena *Independent Record*.

Water users

12. Agriculture

Agricultural uses of water include livestock watering and irrigation of crops and pasture. Hay and small grains are the primary crops grown in this area. A significant portion of the lands in the area are irrigated using water from outside of the Lake Helena watershed. (Water diverted from the Missouri River serves the Helena Valley Irrigation District and provides supplemental water to ditches also served by Tenmile and Prickly Pear Creeks.)

13. Drinking Water

The Upper Tenmile watershed is the primary source of drinking water for approximately 31,000 Helena residents and businesses.

The City of East Helena draws a portion of the drinking water supply for approximately 2, 100 residents from an infiltration gallery adjacent to McClellan Creek.

Drinking water for the remainder of the estimated 55,000 residents in the watershed comes from ground water. Tenmile, Silver, and Prickly Pear Creeks recharge the Helena Valley aquifer, which is the only source of drinking water for approximately 25,000 residents in the Helena Valley.

14. Wastewater

Waters are used by government, businesses, and other organizations to dispose of storm water, process water, cooling water and waste water.

15. Recreation

Recreationists take advantage of the streams and lakes in the Lake Helena watershed to enjoy camping, picnicking, fishing, hunting, wildlife watching, and outdoor learning.

16. Fish and Wildlife

17. The water bodies and associated riparian areas provide important habitat for a variety of mammals, amphibians, fish and birds. Game species include elk, deer, black bear, moose, burbot, mountain whitefish, walleye, yellow perch, and various types of trout and game

II.

Appendix D

TMDLs and Load Allocations by Source

Copy here.