Summary of
Silver Bow Creek and Clark Fork River Metals TMDL
And Bonita-Superior Metals TMDL

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Introduction

The Silver Bow Creek and Clark Fork River Metals TMDL was written by the Montana Department of Environmental Quality (DEQ) in 2014 and is 174 pages long. TMDL (total maximum daily load) documents identify water quality impairments, their causes and sources, and estimate how much loading must be reduced to restore water quality. The Clark Fork mainstem was found to be impaired by metals, from its headwaters to its confluence with the Flathead. This reach is divided into 8 segments; the lower 4 segments are in the central Clark Fork basin (see maps 1 and 2). In addition, a Bonita-Superior Metals TMDL (2013, 124 pages) was developed to address four tributaries of the Central Clark Fork that are metal-impaired -- Cramer Creek, Wallace Creek, Flat Creek and Hall Gulch (see Map 1). This document summarizes information from both of those Metals TMDLS to inform stakeholders about metals-impaired waterbodies in the Central Clark Fork Project Area (from Flint Creek to the Flathead), sources of metals (historic mining and smelting), and remediation and restoration strategies proposed by DEQ.

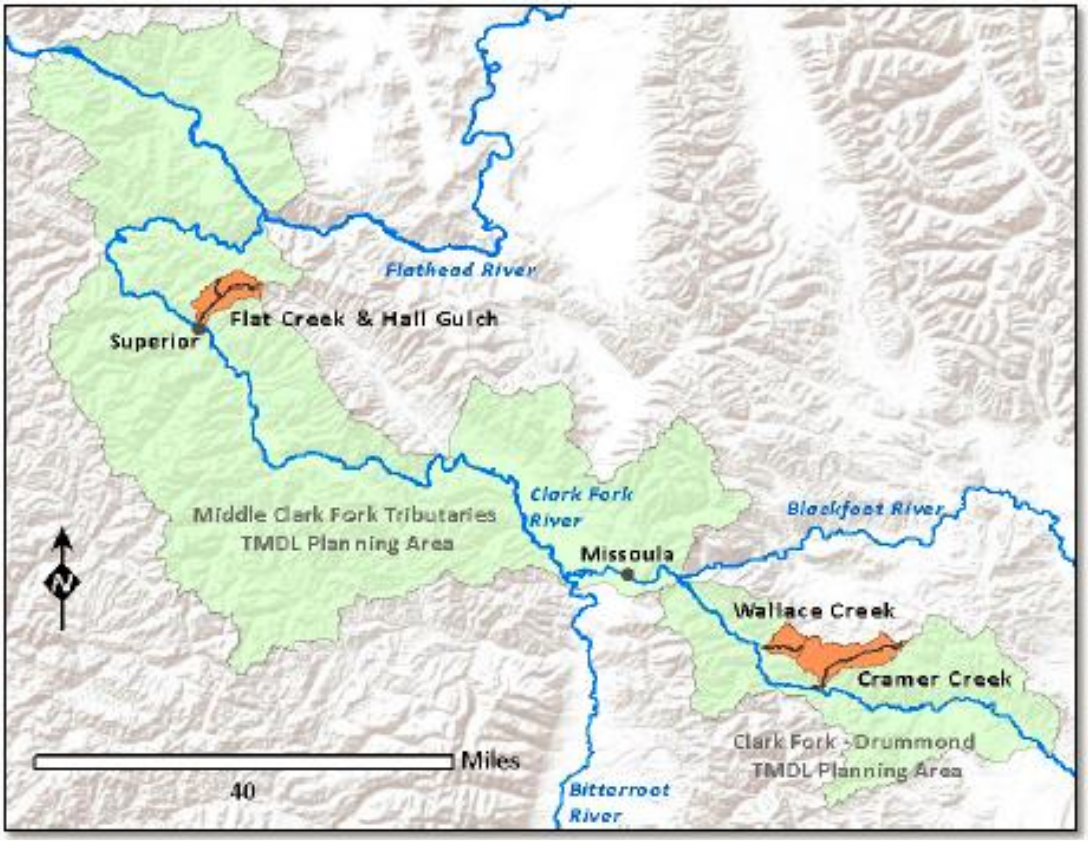
This summary document and others will help inform the creation of a Watershed Restoration Plan (WRP) for the Central Clark Fork Basin Project Area. A WRP can provide a strategic framework for water quality restoration and monitoring in the Central Clark Fork Basin, focusing on how to meet the goals of these Metals TMDLs, and goals presented in other TMDLs for this area as well as other water quality issues of interest to local communities and stakeholders.

Background

Since the 1860's, the Butte/Anaconda area conducted mining, milling and smelting on an industrial scale seldom seen in the United States. Mill tailings were disposed of in and alongside Silver Bow Creek for decades. Major floods in the early part of the 20th century washed large volumes of tailings downstream, and redeposited them in streambank and streambed deposits of Silver Bow Creek and the Clark Fork River. Tailings deposited in the then-newly constructed Milltown Reservoir dramatically reduced the reservoir's storage capacity. In 1980, Congress passed the federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), which generated tax-based funds to designate, study and remediate "Superfund" sites. Multiple Clark Fork Basin sites from Butte to Milltown were added to the National Priorities List of CERCLA sites in 1983. While most of the metal loading in the Clark Fork mainstem comes from the Butte/Anaconda area, numerous small mines in the headwaters of tributaries have contributed to impairments of those tributaries and some have become state or federal superfund sites, or state priorities for cleanup.

Central Clark Fork Project Area

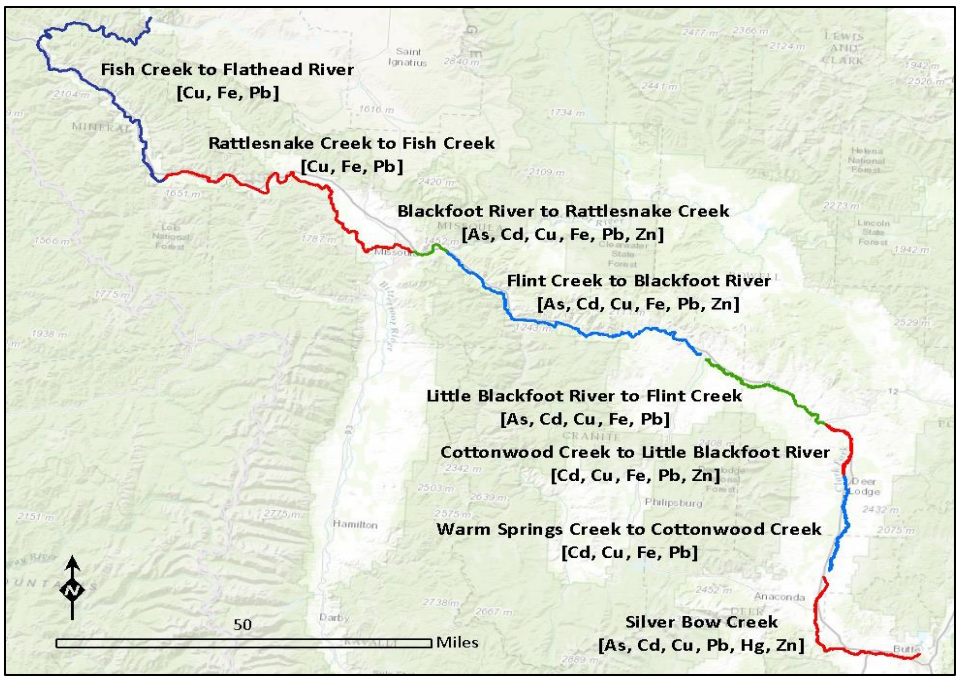
The Central Clark Fork Project area extends from the river's confluence with Flint Creek (near Drummond) to the confluence with the Flathead River (near Paradise) and includes those tributaries that do not have their own TMDLs or WRPs. Most of those tributaries are not known to be impaired by metals. Streams in the Central Clark Fork basin that are considered metal-impaired are: the Clark Fork mainstem, and its tributaries Flint Creek, Cramer Creek, Wallace Creek, Flat Creek, Hall Gulch, and the Bitterroot, Blackfoot and Little Blackfoot Rivers (or their tributaries). However, most of these streams have their own TMDLs and WRPs that address their issues. Some tributaries of Ninemile Creek are also considered to be impaired by metals, but the Ninemile Creek WRP addresses those issues. Hence the Central Clark Fork WRP will focus on impairments by metals of these central Clark Fork tributaries --Cramer, Wallace, and Flat Creeks and Hall Gulch (see map 1) and the central Clark Fork mainstem (see map 2) .



Map 1: Central Clark Fork basin (in green) showing tributaries that are impaired by metals

The Central Clark Fork River is classified as B-1, meaning the waters should be suitable for all of these: drinking, culinary, and food processing purposes, after conventional treatment; bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply. Metals concentrations exceeding the aquatic life and/or human health standards can impair support of these uses including: aquatic life, coldwater fisheries, drinking water, and agriculture. Within aquatic ecosystems, metals can have a toxic or carcinogenic effect on biota (especially those metals that biomagnify). Likewise, humans and wildlife can suffer acute and chronic effects from consuming water or fish with elevated metals concentrations. Because high metals concentrations can be toxic to plants and animals, impaired irrigation or stock water may affect agricultural uses. Although arsenic is a metalloid, it is treated as a metal for TMDL development due to the similarity in sources, environmental effects, and restoration strategies. The DEQ's TMDLs evaluated each pollutant group by the most sensitive uses, to ensure protection of all designated uses and/or aquatic life.

Montana's water quality standard for metals is based on the total recoverable fraction (dissolved metals plus particulate bound metals recovered with a given digestion procedure).
The USGS has recently completed a long-term analysis of water-quality trends in the Upper Clark Fork basin. The study identified trends in sequential 5-year periods (1996–2001; 2001–2005; 2006–2010), and demonstrated that remediation of Silver Bow Creek and Butte is producing measurable water quality gains throughout the project area. It also suggests that the remediation of the Clark Fork River streambanks will result in continued improvement in coming years.



Map 2: Metals TMDLs Prepared for Silver Bow Creek and the Clark Fork River (segments shown in different colors).

Impairment by River Segment in the Central Clark Fork

As required by the Clean Water Act, the Montana DEQ prepares a biennial Integrated Water Quality Report (IR) to present the status of water quality for waterbodies under state jurisdiction. Specifically, the IRs describe the condition and trends of Montana's streams and lakes, contaminants found in groundwater, and the safety of drinking water during the previous 2-year period. All the metals impairments described below are listed in the 2012 Integrated Report.

Clark Fork River from Flint Creek to the Blackfoot River (See Map 2)
This segment is impaired by arsenic and metals: cadmium, copper, iron, lead, and zinc. TMDLs address these and mercury. Targets for cadmium, iron, lead, and zinc are generally met during low flow conditions. Copper exceeds the target by the greatest degree throughout the year, and requires reductions of up to 92% during high flow. Arsenic exceeds targets throughout the year, although concentrations are closer to the target during low flow. Tributary Cramer Creek is impaired by arsenic, barium, cobalt, copper, lead and mercury. Wallace Creek is impaired by copper and zinc.

Clark Fork River from the Blackfoot River to Rattlesnake Creek (See Map 2)
This segment is impaired by copper and lead. TMDLs have been developed for these and for arsenic, cadmium, iron, and zinc. The targets for cadmium, iron, lead, and zinc are generally met during low flow conditions. Copper consistently exceeds the target by the greatest degree throughout the year, and requires reductions of up to 91% during high flow. Arsenic concentrations are largely below the target, with occasional exceedances under all flow conditions.

Clark Fork River from Rattlesnake Creek to Fish Creek (See Map 2)
This segment is impaired by arsenic, cadmium, and copper. More recent data compilation, collection and analysis demonstrate the need for copper, iron, and lead TMDLs for this segment of the Clark Fork River. This segment of the Clark Fork River largely transports metals loads originating upstream in the Deer Lodge Valley, although there are point sources that discharge to this segment, and the Bitterroot River joins the Clark Fork in this reach.

Clark Fork River from Fish Creek to the Flathead River (See Map 2)
This segment is impaired by copper and lead. TMDLs have been developed for these and iron. Exceedances generally occur under high flow conditions, particularly for iron, lead and copper (which also exceed target at low flow). As with all segments, most metal loading comes from the upper river, although there is a point source and an impaired tributary that discharge to this segment. Tributary Flat Creek is impaired by metals including: antimony, arsenic, cadmium, lead, mercury, and zinc, and its tributary Hall Gulch is impaired by antimony, arsenic, iron, lead and zinc.

Metals Source Assessments

The Clark Fork River mainstem upstream of Flint Creek (which enters at Drummond) is the major contributor of metals to the central Clark Fork River (below Flint Creek). Metal levels for each segment was higher during high flow throughout the river, requiring greater load reductions to meet standards than during low flow.

Metals sources in the Upper Clark Fork River basin include a complex assemblage of Superfund sites, point sources permitted under the MPDES, and nonpoint sources. Tributary streams draining mining districts also contribute metals to Silver Bow Creek and the Clark Fork River. The basin was the scene of mining, milling, and smelting on an industrial scale, which led to widespread metals contamination. Waste rock was near-ubiquitous in uptown Butte. Waste rock and tailings disposed of within or adjacent to Silver Bow Creek resulted in metals-rich floodplain and streambank sediments in Silver Bow Creek and the upper Clark Fork River. Smelting in the Anaconda area distributed metals and arsenic across the neighboring landscape and tributary streams.

The Anaconda Company Smelter Site is adjacent to the TMDL project area and includes metals-impaired tributaries such as Warm Springs Creek and Lost Creek, as well as upland areas that drain to the Clark Fork River. However, associated remediation work in these tributaries is separate from work on Silver Bow Creek or the Clark Fork River. Several MPDES-permitted wastewater treatment plants (WWTPs) discharge directly into Silver Bow Creek or the Clark Fork River. Additionally, there are two small municipal separate storm sewer systems (MS4s) draining to Silver Bow Creek and the Clark Fork River: one in Butte and one in Missoula. Several of these domestic WWTPs do not have effluent limits or sampling requirements for metals. In those cases, the effluent could not be characterized. To estimate the copper and lead loads contributed from these sources, DEQ used East Helena's WWTP -- a well-studied domestic wastewater facility of similar age and with similar construction and plumbing. Specific assessments of sources in each stretch of the project area can be found in the Appendix.

Natural background metals loading is usually a minor source. Downstream of the Blackfoot River, where tributary and other flow inputs to the Clark Fork River are influenced less by mineralized geology, natural background is estimated to correspond to one-half the method detection limit for each metal except for iron.

Restoration Strategy

Federal and state government agencies have funded and completed most of the reclamation associated with past mining, and thus statutory mechanisms and corresponding government agency programs will continue to have the leading role for future restoration. Rather than a detailed discussion of specific BMPs, the DEQ provided general restoration programs and funding sources applicable to mining sources of metals loading. These are summarized below:

Adaptive Management

An adaptive management approach that revisits, confirms, or updates loading assumptions is vital to maintaining stakeholder confidence and participation in water quality improvement. Adaptive management uses updated monitoring results to refine loading analysis, to further customize monitoring strategies, and to develop a better understanding of impairment conditions and the processes that affect impairment.

Superfund Authority in Silver Bow Creek, the Clark Fork River, and Flat Creek

CERCLA authorizes two kinds of response actions: short-term removals that require a prompt response, and long-term remediation actions that reduce environmental and health threats from hazardous substance releases. EPA may delegate remediation funding and responsibility for cleanup.

Other Historical Mine Remediation Programs

There are various remediation programs and approaches that can be or currently are being applied within tributary watersheds that drain to the Clark Fork River or Silver Bow Creek. The extent that these programs may be necessary will depend in part on the success of ongoing Superfund work in Silver Bow Creek and the Clark Fork River and the level of stakeholder involvement and initiative throughout the watersheds with impairment by metals.

Remediation Effectiveness Monitoring
Effectiveness monitoring is a major component of the Superfund efforts, and future data collection in the Clark Fork River and Silver Bow Creek is established under the RODs for these Superfund sites. DEQ recommends additional monitoring of mercury concentrations in the Clark Fork River. The impairment determinations were based on single exceedances of the human health target in segments with designated drinking water uses. DEQ will conduct a TMDL Implementation Evaluation (TIE) to determine whether water quality is improving as expected. The TIE process consists of compiling recent data, conducting additional monitoring when needed, completing target comparisons, summarizing the applied BMPs, determining the degree of TMDL achievement, and identifying water quality trends after TMDL development. If the TIE demonstrates the TMDL is being achieved, then the waterbody is recommended for a formal reassessment of its use-support status. If TMDLs are not being met, then DEQ evaluates the recent progress toward restoring water quality and the effectiveness of land, soil, and water conservation practices in place in the watershed. In addition to tracking remediation effectiveness, metals sampling in the Clark Fork River below the mouth of the Blackfoot River would help to track the status of use impairment in these segments.

APPENDIX—Metal Sources for river segments and tributaries of the Central Clark Fork basin

The Metals TMDL states that upstream sources are the greatest source of metals for all the central Clark Fork river segments. And that for the lower 3 segments, natural background levels of metals are assumed to be half the method detection limit, except for iron which is assumed to be 50ug/L. The TMDL does not state what natural background levels are for the Flint to Blackfoot segment.

Metal Sources in the Clark Fork's Flint Creek to Blackfoot River Segment

Superfund Sites Regulated Under CERCLA
This entire segment is part of the Clark Fork River/Milltown Reservoir Superfund Site. The upstream end of this segment (Reach C – Bearmouth Canyon portion of the Superfund site) has relatively minor mine waste deposits. The downstream end of this segment includes the Milltown Reservoir site, which formerly included large volumes of metals-laden sediment that were deposited in the reservoir during the 20th Century. These sediments were excavated and removed following the breaching of Milltown Dam in 2008. During drawdown and subsequent excavation and stream channel reconstruction, some contaminated sediments probably contributed to elevated metals concentrations downstream.

Drummond Wastewater Treatment Plant
The town of Drummond operates a wastewater treatment system that discharges to a facultative lagoon. As the system has an average design flow less than one million gallons per day and does not have any significant industrial contributors, it operates under a general domestic sewage treatment lagoon permit effective until December 31, 2017. No chemistry data are available to characterize the metals load in the discharge.

Missoula MS4
Under EPA's Stormwater Phase II Rule, Missoula is regulated as a small MS4 under a DEQ general permit. The MS4 covers the urban limits, which includes Bonner. DEQ determined that all the stormwater in the Bonner portion of the MS4 drains northward into the Blackfoot River where no metals impairment conditions exist.

In addition to the mainstem's metal impairment, metals impaired tributaries to this segment include: Flint Creek, Cramer Creek, and Wallace Creek. Flint Creek is an appreciable source of metals load, especially mercury.

Metal Sources to Wallace and Cramer Creeks, tributaries to the Clark Fork between Flint & Blackfoot

Metal sources to Cramer Creek are abandoned silver-lead and manganese mines and ore mills. BLM reclaimed the site from 2001-2004, removing 130,000 cubic yards of mine waste. Wallace Creek had multiple small historic mines and a copper mill. No remedial actions have been performed. The old mill site has been used as a gravel pit..

Metal Sources in the Clark Fork's Blackfoot River to Rattlesnake Creek Segment

Missoula MS4

Under EPA's Stormwater Phase II Rule, Missoula is regulated as a small MS4 under a DEQ general permit. The MS4 covers the urban limits, which includes East Missoula and Hellgate. A minor portion (17%) of the Missoula MS4 permit area drains to this segment of the Clark Fork River. The MS4 permit requires sampling for representative commercial/industrial and residential areas for copper, lead and zinc, but not arsenic, cadmium, or iron.

Metal Sources in the Clark Fork's Rattlesnake Creek to Fish Creek Segment

Missoula Wastewater Treatment Plant

The Missoula WWTP is a domestic WWTF permitted to discharge to the Clark Fork River. The permit was under an administrative extension at the time of the TMDL. While it has no effluent limits for metals, the plant samples semi-annually for arsenic and total recoverable metals: antimony, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc (no data for iron). These loads are very small compared to in-river loads, particularly during high flows when impairment conditions are of concern.

Missoula MS4

Under EPA's Stormwater Phase II Rule, Missoula is regulated as a small MS4 under a DEQ general permit. The MS4 permit area corresponds to the Missoula urban area, and includes areas managed by Missoula City and County, the University of Missoula, and Montana Department of Transportation. The City of Missoula has primary responsibility for the permit, but the other entities are all co-permittees. Much of the stormwater generated within Missoula is managed by dry wells or sumps, which capture stormwater and drain it into the vadose zone, the unsaturated area below the ground surface and above the groundwater table. Areas such as the heart of downtown Missoula collect stormwater in storm sewers which discharge to surface water. The MS4 permit requires sampling for copper, lead and zinc, but not iron.

Seaboard Foods, LLC

Seaboard Foods, LLC has a MPDES permit to discharge from Daily's Premium Meats, located in Missoula. The permit does not provide effluent limits for metals, but requires sampling for arsenic, cadmium, copper and lead.

M2Green Redevelopment (formerly Stone Container Corporation)

This permit was originally issued for a discharge of process wastewater from a pulp and paper plant. Stone Container Corporation operated the plant until 2010, and sold the property to M2Green Redevelopment in 2011. The MPDES permit was also transferred to M2Green in 2011. The majority of the former plant has been demolished, and M2Green is currently in the planning phase of a redevelopment project to create an industrial park. M2Green plans a WWTF to treat domestic wastewater from employee restroom and shower facilities, and modified the permit renewal application to allow discharge of domestic wastewater rather than industrial wastewater. The renewed permit was issued on March 14, 2014.

Alberton Wastewater Treatment Plant

The Town of Alberton's WWTP had an administratively extended permit to discharge to the Clark Fork River at the time of this TMDL. The discharge was sampled semi-annually for arsenic, cadmium and copper in 2009 and 2010. The permit does not provide effluent limits for metals. Only one copper result was identified in EPA's ICIS database, and was below water quality targets at the laboratory detection limit. No data are available for lead. However, an estimate may be made by using average concentrations from a community of similar age, with similar treatment technology, with copper and lead concentrations likely derived from residential plumbing, as is the case in Alberton.

Metal Sources in the Clark Fork's Fish Creek to Flathead River Segment

Permitted Source: Superior Wastewater Treatment Plant

The town of Superior's WWTF (MT0020664) is permitted to discharge to the Clark Fork River. The facility is located at Riverside Avenue, Superior. The permit does not provide effluent limits for metals, nor require any metals sampling. Therefore no data are available to characterize the effluent's effect on metals in the Clark Fork River. However, an estimate may be made by using average concentrations from a community of similar age, with similar treatment technology, and copper and lead concentrations likely derived from residential plumbing, as is the case in Superior.

Metal Sources to Flat Creek, tributary of the Clark Fork and Hall Gulch, tributary to Flat Creek

EPA placed the Flat Creek Iron Mountain Mine and Mill on Superfund's National Priority List in 2009. The site is in the Flat Creek watershed, at Superior MT. There are historic mine tailings in the streambanks and streambed. As a result, Flat Creek is impaired by metals including: antimony, arsenic, cadmium, lead, mercury, and zinc. The tributary drainage Hall Gulch had additional mines and a similar list of metal impairments. Of these, only lead impairs this segment of the Clark Fork River. EPA, DEQ and USFS have carried out a series of remedial actions, and Mineral County adopted some institutional controls. High flows in spring 2018 required some repairs of those remedial actions. Leakage from underground workings may require perpetual treatment.

More information in the Bonita-Superior Metals TMDL and in at this EPA web site.
https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.cleanup&id=0801914

The entire Silver Bow Creek & Clark Fork River Metals TMDL document (174pp) can be seen at
http://deq.mt.gov/Portals/112/Water/WQPB/TMDL/PDF/SilverBowCFRMetals/C01-TMDL-05a.pdf