First Five-Year Review Report

for

Upper Tenmile Creek NPL Site

Lewis and Clark County
Montana

July 2008

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Five-Year Review Report

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List of Acronyms

AMD	Acid Mine Drainage
amsl	above mean sea level
ARARs	Applicable or Relevant and Appropriate Requirements
ATSDR	Agency for Toxic Substances and Disease Registry
BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	Contaminant of Concern
EA	Endangerment Assessment
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
ICs	Institutional Controls
MCL	Maximum Contaminant Levels
MDL	Method Detection Limit
MTDEQ	Montana Department of Environmental Quality
NCP	National Contingency Plan
NPL	National Priority List
O&M	Operation and Maintenance
OU	Operable Unit
PRP	Potentially Responsible Party
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
ug/L	Microgram per Liter
USBR	United States Bureau of Reclamation
USFS	United States Forest Service
USGS	United States Geological Survey

Executive Summary

The U.S. Environmental Protection Agency (EPA) Region 8 conducted the first Five-Year Review of the remedial actions implemented at the Upper Tenmile Creek Mining Area National Priority List (NPL) Site (the Site) near Helena, Montana. The purpose of the Five-Year Review is to determine whether the Site remedy is protective of human health and the environment. The triggering action for this review is the start of remedial action on August 12, 2002. Because hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unrestricted use and unlimited exposure, a Five-Year Review is required by statute.

The ROD anticipated an early completion date for remedial construction in 2012. Therefore, the remedy remains under construction. EPA's Comprehensive Five-Year Review Guidance (June 2001, OSWER No. 9355.7-03B-P) states that:

> *In reviewing a remedy at which construction has not been completed, the review should focus on determining whether the remedy is being constructed in accordance with the requirements of the decision documents and design specifications, and if the remedy is expected to be protective when it is completed.*

Therefore, this Five-Year review evaluates protectiveness in this context.

The Site is located primarily within Lewis and Clark County, southwest of Helena, Montana, and consists of approximately 53 square miles and includes the Upper Tenmile Creek watershed. The headwaters of Upper Tenmile Creek are about six miles upstream of the community of Rimini. The Site has nine OUs designated primarily to account for Removal Program expenditures. However, the only ROD issued for the Site is the OU4 ROD. This ROD states:

> *Watershed OU4 encompasses all of the other Site OUs and includes all historic inactive or abandoned mine sites located in the Upper Tenmile Creek Mining Area Site. In addition to the mine sites, OU4 also includes all other media known to be impacted by mine-related contamination, including AMD (acid mine drainage), groundwater, surface water, stream sediments, residential yards, and contaminated roadways. Since it addresses all mine sites and all media at the site, this (OU4) ROD is expected to be the only ROD for the site.*

With the exception of the community of Rimini, a small residential subdivision at the mouth of the watershed and a few recreation cabins, the Site is largely undeveloped land used for recreation. The City of Helena has relied upon upper Tenmile Creek watershed as a source of potable water for over 100 years. Approximately five residences in Rimini received untreated water directly from Tenmile Creek at the time of the ROD.

The EPA, US Forest Service and Montana Department of Environmental Quality have evaluated and conducted abandoned mine reclamation and cleanups at the Site since the late 1980's. In 1999 the Site was added to the NPL and in 2002 the ROD was released calling for continued mine land reclamation, establishment of a Sitewide waste repository, remediation of residential yards and Rimini Road, and measures to ensure safe drinking water for area residents.

As discussed in the ROD, completion of all response actions is expected to occur not earlier than 2012. Therefore, this Five-Year Review examined the protectiveness of response actions completed to date, including remediation of residential yards and provision of safe drinking water. In addition, water quality trends were examined in Site surface water to determine if any beneficial effects were apparent.

Some residential properties were only partially remediated due to access denial and protection of valuable vegetation and septic systems. These properties were assessed for remedy protectiveness in their current condition. The methodology calculated an area–weighted mean arsenic and lead concentration for each property and compared those concentrations against the corresponding cleanup levels of 120 milligram per Kilogram (mg/Kg) and 1,000 mg/Kg, respectively. The results of these calculations indicate that many of the properties have area-weighed mean arsenic and lead concentrations below the cleanup levels and therefore, are protective of human health in their current condition.

A review of surface water quality data collected in the watershed by the U.S. Geologic Survey suggests that contaminant concentrations at most stations remain largely unchanged with the exception of one tributary to Upper Tenmile Creek (Poison Creek Station) where the concentrations of cadmium, copper, lead, and zinc appear to have declined since implementation of response actions in the drainage. Given that this remedy element is under construction and the expectation in the ROD for extended monitoring prior to drawing conclusions regarding remedy effectiveness, the discussion of water quality trends should be considered very preliminary.

No major concerns were identified with the remedy during this review given when fully implemented, the remedy is expected to result in protection of human health and the environment. The duration of remedial action anticipated by the ROD is at least ten years.

Based on the information provided by CDM (EPAs remediation contractor), conditions on several residential properties in Rimini and the Landmark subdivision continue to pose a human health risk above a level of concern due to access denial by the property owner. Other pending elements of the remedial design include remediation of Rimini Road, reclamation of the majority of the 70 high-priority mine sites within the watershed, improvements to Chessman Reservoir and Red Mountain Flume and construction of a permanent water supply for the community of Rimini.

Other issues of potential concern identified during the Five-Year Review include:

- There is potential that Landmark or Rimini residential water supply(s) may contain contaminants above MCLs at homes where landowners have declined offers of either bottled water or point of use water treatment systems.
- Rimini Road (through Rimini) remains unremediated. Removal of mine wastes from the roadway is required under the ROD. However, as a temporary measure to suppress fugitive dust, at least four-inches of road-base were applied during 2007.
- Institutional controls on future ground water wells have not been implemented as required under the ROD.

- Institutional control(s) to prevent disturbance of capped mine wastes at the Red Water Mine is not required by the ROD and has not been implemented. Such controls would minimize the potential for disturbance of engineered remedies in the event of future land development.

According to the data reviewed and the Site inspection, the remedy is under construction. However, this is expected as the ROD anticipated a completion date of 2012, at the earliest. Remedy elements intended to mitigate risks to human health have been identified as a priority and have largely been completed.

Adverse ecological impacts remain throughout most of the Site. However, the ROD anticipated that such impacts might persist for some time after completion of remedial action before it would be possible to determine if ecological protection is achieved. Overall, the remedy is being constructed in accordance with the decision documents, and the remedy is expected to be protective when it is completed.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name: Upper Tenmile Creek Mining Area Superfund Site, Operable Unit 4.		
EPA ID: MTSFN7578012		
Region: 8	**State:** MT	**City/County:** Helena/Lewis and Clark
SITE STATUS		
NPL status: Listed 10/99		
Remediation status: Under Construction		
Multiple OUs: Yes – However, the remedy for OU4 is considered to address the entire Site.	**Construction completion date:** OU4 – Construction on-going	
Has site been put into reuse? Yes.		
REVIEW STATUS		
Lead agency: EPA		
Author name: Mike Bishop		
Author title: Project Manager	**Author affiliation:** U.S.EPA, Region 8	
Review period: 7/13/07 to 7/31/08		
Date(s) of site inspection: 06/14/07		
Type of review: Statutory		
Review number: 1 (first)		
Triggering action: Start of Remedial Action		
Triggering action date: 8/12/02		
Due date: 8/12/07		

* [“OU” refers to operable unit.]

Five-Year Review Summary Form, cont'd.

Issues:

Item No.	Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
1	There is potential that Landmark or Rimini residential water supply(s) may contain contaminants above MCLs at homes where landowners have declined offers of either bottled water or point-of-use water treatment systems.	Yes	Yes
2	Remediation of some residential properties is under construction. However, for many of these properties, sufficient work has been done to create a condition that is protective of human health. The remaining partially remediated properties and properties that have not undergone any remediation (but were targeted for remedial action) are not protective of human health.	Yes	Yes
3	Rimini Road remains unremediated. However, as a temporary measure to suppress fugitive dust, at least four-inches of road-base were applied during 2007.	No	Yes
4	Institutional controls on future ground water wells have not been implemented.	No	Yes
5	Institutional control to prevent disturbance of capped mine wastes at the Red Water Mine is not required by the ROD and has not been implemented.	No	Yes
6	Many of the remedy components intended to address surface and ground water quality have not been fully implemented (remedy element Nos. 1, 2 and 4; pg 14). However, the ROD anticipated a minimum ten-year implementation period of which five-years has elapsed.	Yes	Yes
7	Performance standards and points of compliance have not been formalized under a Compliance Monitoring Plan for the Luttrell ground water monitoring network or treatment facility effluent discharge.	No	Yes

Five-Year Review Summary Form, cont'd.

Recommendations and Follow-up Actions:

Item No.	Issues	Recommendations and Follow-up Actions	Party Responsible	Due Date
1	There is potential that Landmark or Rimini residential water supply(s) may contain contaminants above MCLs at homes where landowners have declined offers of either bottled water or point of use water treatment systems.	Continue to work with landowners to allow provision of alternative water supply. Continue outreach and education of residents about their exposure risks.	EPA	On-going
2	Remediation of some residential properties is under construction. However, for many of these properties, sufficient work has been done to create a condition that is protective of human health. The remaining partially remediated properties and properties that have not undergone any remediation (but were targeted for remedial action) are not protective of human health.	Continue to work with landowners and local government to secure property access for the purpose of completing remedial action, as necessary to protect human health. However, access limitations may preclude completion of all yards. Continue outreach and education of residents about their exposure risks.	EPA	On-going
3	Rimini Road remains unremediated. However, as a temporary measure to suppress fugitive dust, at least four-inches of road-base were applied during 2007.	Perform Response Action	EPA	As soon as practicable
4	Institutional controls on future ground water wells have not been implemented	Implement institutional controls.	EPA	12/31/10
5	Institutional control to prevent disturbance of capped mine wastes at the Red Water Mine is not required by the ROD and have not been implemented.	Prepare ESD and implement institutional control.	EPA	9/30/10
6	Many of the remedy components intended to address surface and ground water quality have not been fully implemented (remedy element Nos. 1, 2 and 4; pg 14). However, the ROD anticipated a minimum ten-year implementation period of which five-years has elapsed.	Continue Response Actions.	EPA	9/30/12
7	Performance standards and points of compliance have not been formalized under a Compliance Monitoring Plan (CMP) for the Luttrell ground water monitoring network or treatment facility effluent discharge.	Develop and implement CMP	EPA	12/31/09

Five-Year Review Summary Form, cont'd.

Protectiveness Statement(s):

According to the data reviewed and the Site inspection, the remedy is under construction. However, this is expected as the ROD anticipated an early completion date of 2012. Remedy elements intended to mitigate risks to human health have been identified as a priority and have largely been completed. Remedy elements that have yet to be constructed/implemented and are relevant to long-term protection of human health include:

- A permanent water supply for Rimini.
- Institutional control(s) to prevent the use of contaminated ground water for drinking.
- Remediation of residential yards where remaining contaminated soils present a human health risk above a level of concern (access limitations may preclude completion of all yards)
- Remediation of Rimini Road.

Adverse ecological impacts remain throughout most of the Site. However, the ROD anticipated that such impacts might persist for some time after completion of remedial action as remedies stabilize. So, the implementation process called for in the June 2002 ROD makes it impossible to determine at this time whether the remedy is protective. However, in as much as the goals of the ROD are currently met, EPA believes the remedy will ultimately be protective when construction is complete.

Other Comments:

None

Five-Year Review Report

I. Introduction

Purpose of the Review

The purpose of Five-Year Reviews is to determine whether the remedy at the Upper Tenmile Creek Operable Unit National Priority List (NPL) Site (the Site) is protective of human health and the environment. The methods, findings and conclusions of reviews are documented in Five-Year Review Reports such as this. In addition, Five-Year Review reports identify issues found during the review, if any, and makes recommendations to address them.

Authority for Conducting the Five-Year Review

The U.S. Environmental Protection Agency (EPA) is preparing this Five-Year Review pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The EPA interpreted this requirement further in the National Contingency Plan (NCP); 40 CFR §300.430(f) (4) (ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

Who Conducted the Five-Year Review

The EPA Region 8 conducted the Five-Year Review of remedial actions implemented at the Site near Helena, Montana. This review was conducted from July 2007 through July 2008. This report documents the results of the review. HDR Engineering, Inc. (HDR) of Denver, Colorado was retained to prepare this Five-Year Review Report for EPA through a contract with the US Army Corps of Engineers, Kansas City District.

Other Review Characteristics

This is the first Five-Year Review for the Site. The triggering action for this review is the start of remedial action following release of the Record of Decision (ROD) on June 28, 2002. The Site has been divided into nine operable units (OUs) including:

- OU0 – Sitewide
- OU1 – Red Mountain Mine
- OU2 – Bunker Hill Mine
- OU3 – Luttrell Pit
- OU4 – Watershed
- OU5 – Susie Mine
- OU6 – National Extension Mine
- OU7 – Peerless and Queensbury Mines
- OU8 – Upper Valley Forge Mine

The only ROD issued for the Site is the OU4 ROD. However, this ROD states:

> *Watershed OU4 encompasses all of the other Site OUs and includes all historic inactive or abandoned mine sites located in the Upper Tenmile Creek Mining Area Site. In addition to the mine sites, OU4 also includes all other media known to be impacted by mine-related contamination, including AMD (acid mine drainage), groundwater, surface water, stream sediments, residential yards, and contaminated roadways. Since it addresses all mine sites and all media at the site, this (OU4) ROD is expected to be the only ROD for the site.*

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Therefore, this Five-Year review evaluates protectiveness in this context.

II. Site Chronology

Table 1 - Chronology of Site Events

Major hard rock mining in Rimini Mining District.	1870's - 1930's
Limited and intermittent mining in Rimini Mining District.	1930's - 1953
Basin Creek open pit gold mine closes (includes Luttrell Pit).	Mid - 1990's
Removal and Reclamation activities by MTDEQ at 11 mine sites.	1987 - 1990
Montana Department of State Lands (now called DEQ) conducted investigations of 17 mine complexes.	1993 - 1994
EPA Removal Action involving excavation and replacement of waste materials in residential area in lower portion of watershed.	1995
EPA conducted Removal Action at Red Water Mine involving consolidation and capping of mine wastes.	October/November 1997
Lewis and Clark County requests assistance from MTDEQ and USEPA in connection with blow outs at Bunker Hill Mine.	April 1998
Action memorandum for Time Critical Removal Action at Red Mountain and Bunker Hill mines.	June 1999
EA prepared for conversion of Luttrell Pit to Luttrell Waste Repository.	June 1999
Site proposed for the NPL.	July 1999
Removal Actions to relocate 50,000 cubic yards of mine waste from Red Mountain and Bunker Hill mines to the Luttrell Repository.	Summer 1999
NPL Listing.	October 1999
Removal Action to relocate mine wastes from Peerless Jenny/King complex, Susie, and Red Mountain mines to Luttrell Repository.	Summer 2000
RI/FS conducted.	2000 - 2001
Removal Action involving tap water sampling and provision of bottled water to Rimini residents.	January 2001
Final Ecological Risk Assessment.	April 2001
Human Health Risk Assessment	October 2001
Proposed Plan issued.	October 2001
ROD issued.	June 2002
Residential yard clean-up at Landmark Subdivision with disposal to Luttrell Repository. Additional mine waste removal from Lee Mountain mine.	2003 - 2004
Rimini waste water treatment system construction commences.	2005
Residential yard clean-up at Rimini with disposal to Luttrell Repository.	2006
Susie Mine Adit discharge treatment treatability study under EPA Mine Waste Technology Program.	Nov. - Dec. 2006

III. Background

Location and Setting

The Site is located primarily within Lewis and Clark County, southwest of Helena, Montana (Figure 1, Appendix A). The Site consists of approximately 53 square miles and includes the Upper Tenmile Creek watershed and the community of Rimini. From its headwaters, Tenmile Creek flows 28 miles before entering Lake Helena. Only the upper 13 miles are located in the Site.

The Site lies within the Northern Rocky Mountain physiographic province, which is characterized by a succession of distinct mountains and valleys. Tenmile Creek originates at the continental divide at an elevation of 7,200 above mean sea level (amsl) and drops to 4,380 feet amsl at the northern boundary of the Site near the confluence with Sweeney Creek.

With the exception of the community of Rimini and a small residential subdivision (Landmark) at the mouth of the watershed and a few recreation cabins, the Site is largely undeveloped land used for recreation. The City of Helena has relied upon upper Tenmile Creek watershed as a source of potable water for over 100 years. Raw water is supplied to the Tenmile Water Treatment Plant via a gravity pipeline that collects water from intake structures located on Tenmile Creek and its tributaries. The upper Tenmile Creek watershed supplies about 50 percent of the City of Helena's drinking water. Approximately five residences in Rimini received untreated water directly from Tenmile Creek at the time of the ROD. The remainder of residences in Rimini receives water from private wells.

Seasonal surface water flow in the watershed is highly variable. Flow predictions, based on hydrologic modeling and 30-year flow trends yield estimated seasonal flows of 3.9 cubic feet per second (cfs) to 122 cfs. Actual flows at the downstream end of the Site are considerably less due to withdraw by the Helena water supply system. During mid- to late summer, measured flows are often below 5 cfs, with certain reaches dewatered completely. Minimum flows to sustain the aquatic ecosystem have been estimated at 4 cfs.

Ground water flow in upland areas is through fractures, fissures and voids in competent bedrock towards the valley bottom where it discharges to unconsolidated valley-bottom materials along the stream channels. Ground water in unconsolidated valley-bottom materials may subsequently resurface as a contaminant source to surface water. Region ground water flow is generally to the north.

Site History and Extent of Contamination

The Site includes 150 abandoned or inactive mine sites within or near the historic Rimini Mining District. Most historic mining activity took place within the Rimini Mining District and included hard rock mining for gold, lead, zinc, and copper. Active hard rock mining began in the 1870's and continued through the 1930's. Limited intermittent mining continued in the District until 1953. The Site also includes the properties of the now defunct Basin Creek Mine (BCM), an open pit gold mine that operated until the mid-1990s. The Luttrell Pit (part of the BCM) and various haul roads at the BCM are being used to facilitate Site remedies.

Waste rock and tailings contamination is generally limited in lateral and vertical extent to discrete waste areas in the general vicinity of waste rock piles at individual mine sites. The density of these mine sites is greatest in the vicinity of Rimini.

Extensive grading and filling of residential yards in Rimini appears to have distributed readily available mining wastes throughout the community. In addition, evidence of waste transport and deposition in the community has been observed. As a result, surface soil contamination occurred at a majority of the residences in Rimini and at Landmark Subdivision residences near two historic mill sites. The Contaminants of Concern (COCs) for residential exposure to mine wastes and contaminated soils include arsenic and lead.

Rimini Road is an unpaved roadway that was reconstructed with mine waste after a 1981 flood. Portions of the roadbed contain materials with elevated levels of metals. Although this material is largely buried beneath the surface of the road, it remains of concern due to the potential for redistribution during future flood events or exposure of the wastes during routine road grading.

Mobilization of Site contaminants depends on several factors, including physical and chemical processes. Contaminants may be transported from waste rock and tailings through surface water or wind erosion, mass wasting, or to ground water through leaching. Contaminated surface water (including adit discharges) may flow directly into tributaries under a range of flow conditions and be conveyed downstream. Eroded mine wastes are also conveyed downstream where they may be deposited as sediment and continue to release contaminants by leaching. Additional contaminated sediments originate through chemical precipitation. Contaminants in these precipitated sediments may remobilize through dissolution or resuspension. In general, iron-arsenic complexes that remove arsenic from solution are not subject to chemical dissolution unless low pH or reducing environmental conditions are encountered.

Contaminated surface waters also seep into the subsurface impacting subsurface soils and ground water. As discussed in the previous Section, contaminated ground water migrates down gradient within fractured bedrock and unconsolidated valley-bottom deposits.

Mining within the Site has resulted in uncontrolled releases of metal contaminants to local streams from waste rock, tailings, and contaminated mine discharge water. The major threat posed by the abandoned mines is the release of potentially harmful concentrations of arsenic, copper, lead, zinc, and other metals from mine waste. These mine wastes contribute to the contamination of surface water, ground water, and stream sediments throughout the drainage basin of upper Tenmile Creek and its tributaries. There have been documented catastrophic releases of mining wastes during periods of intense thunderstorms or other mass failures of waste material piles.

Surface water quality is highly variable, but generally good in the uppermost tributaries and degrades downstream. In the lower watershed near the water treatment plant, concentrations of contaminants often exceed chronic aquatic life standards for aluminum, cadmium, copper, lead, and zinc. In addition, human health standards have been exceeded for arsenic, cadmium, iron, lead, and manganese. At the time of the ROD, the largest contributors of arsenic load to the watershed include the Susie mine site adit, Lee Mountain site and Red Water Mine in the vicinity of Rimini. The largest contributors of zinc load to the watershed include the Little Sampson, Armstrong and Susie mine sites (near to and upstream of Rimini).

Sediment quality is grouped into three categories; poor, moderate, and good. Stream reaches with sediment of good quality are located in Tenmile Creek headwaters with deteriorating quality immediately upstream of Poison Creek (Figure 2, Appendix A). Sediment quality is either poor or moderate from this confluence to the downstream limit of the Site.

Ground water contamination is extensive near in Rimini and down-gradient of the Red Mountain Mine complex, with concentrations exceeding human health criteria. High arsenic concentrations in Rimini are indicative, in some cases, of AMD from historic mine sites.

Baseline Risk Assessment

Human Health

EPA focuses the human health risk assessment on development of risk-based Preliminary Remediation Goals (PRGs) for the entire Site. These are chemical-specific concentrations that represent the threshold for adverse health effects above a level of concern. Potential exposures to COCs in soil, ground water, surface water, sediment, interior dust, airborne particulates, and fish were evaluated. Based on land uses at the time of the risk assessment and potential future land uses, EPA considered the primary populations of concern to be residents, recreational visitors, and workers.

The following conclusions reached in the Human Health Risk Assessment were summarized in the June, 2002 ROD:

- Excess cancer risk estimates are generally an order of magnitude higher in the Rimini area than elsewhere in the Site. This area is of particular concern because of the high potential for contact with human receptors and the possibility of human redistribution of the contamination. Also, the accuracy of the estimates is greater due to a higher sample density in this area.
- Incidental ingestion of waste rock is the pathway that most frequently creates cancer risks and non-cancer adverse effects in excess of those considered protective.
- Cancer risks and non-cancer effects are elevated based on potential future use of surface water and ground water as a drinking source for both residents and workers.
- Risks associated with incidental ingestion of sediment and adit discharge water are predicted to be above a level of concern. However, elevated risks are localized to the area around Rimini.
- An unacceptable frequency of high blood lead levels (greater than 10 micrograms per deciliter (ug/dL)) is predicted in children where lead concentrations exceed 950 milligrams per Kilogram (mg/Kg). An unacceptable frequency of high blood lead levels in children may also result from consumption of contaminated surface water. Adult exposure to lead in surface soils and waste rock could be significant if exposure is chronic.

In addition to the above-listed human health concerns, the Agency for Toxic Substances and Disease Registry (ATSDR) concluded that fugitive dust associated with Rimini Road may result in an excess cancer risk above a level of concern (ATSDR, 2001). This is due to post-flood road reconstruction in the 1980s using mine tailing.

Chemical-specific performance standards (action levels) are either Applicable, Relevant or Appropriate Requirements (ARARs)-based standards or risk-based remedial goals. Where ARAR-based standards exist, they are considered performance standards. The performance standards for the Site in connection with human health are summarized in Tables 2 and 3 (below) with the basis for the standards noted.

Table 2 - Soil Action Levels for Protection of Human Health

Contaminant	Clean-up Level (mg/kg)	Excavation Criteria[1] (mg/kg)	Basis
Residential			
Arsenic	120	96	Risk-Based
Lead	1,000	800	Risk-Based
Recreational			
Arsenic	1,440	1,150	Risk-Based

[1] Excavation criteria are set 20% lower than the clean-up level as a conservative measure to account for potential measurement error.

Table 3 - Surface and Ground Water Action Levels for Protection of Human Health

Media/Contaminant	Surface Water (ug/L)		Ground Water (ug/L)	
	Concentration	***Basis***	***Concentration***	***Basis***
Arsenic	10	MCL[1]	10	MCL
Cadmium	5	Montana WQS[2]	5	Montana WQS
Copper	1,300	Montana WQS	1,300	Montana WQS
Lead	15	MCL/Montana WQS	15	MCL/Montana WQS
Mercury	0.05	MCL/Montana WQS	2	MCL/Montana WQS
Zinc	2,100	Montana WQS	2,100	Montana WQS

[1] Maximum Contaminant Level
[2] Water Quality Standard (Circular WQB-7)

Ecological Risk

The following conclusions reached in the Ecological Risk Assessment were summarized in the ROD:

- Sensitive ecological receptors are being adversely affected by contaminants in surface water and all solid media. Tenmile Creek near Rimini exhibits the highest risks from all media.
- Dissolved cadmium, copper, lead and zinc are the most important stressors for aquatic biota. Arsenic, cadmium, lead, manganese and zinc are the primary stressors for benthic invertebrates.

- Very low or no flows exist below Rimini during significant portions of the year causing stress on biota.
- Throughout much of the Site, concentrations of metals in surface water, sediment, and soils should be greatly reduced to protect sensitive organisms inhabiting or using these media.

Ecological protection performance standards for the Site are summarized in Table 4 below with the basis for the standard.

Table 4 - Surface Water Action Levels for Ecological Protection

Contaminant	Concentration[1] ug/L	Basis
Aluminum	87	Montana WQS[2]
Arsenic	150	Montana WQS
Cadmium	0.1	Montana WQS
Copper	2.8	Montana WQS
Lead	0.54	Montana WQS
Mercury	0.91	Montana WQS
Zinc	37	Montana WQS

[1] – based on a hardness of 25 mg/L

[2] – Water Quality Standard (Circular WQB-7)

IV. Response Actions

The EPA, US Forest Service (USFS) and Montana Department of Environmental Quality (MTDEQ) have evaluated and conducted abandoned mine reclamation and cleanups at the Site since the late 1980's. In 1999 the Site was added to the NPL, and in 2002 a ROD was released calling for continued mine land reclamation (including treatment of adit discharge), establishment of a Sitewide waste repository, remediation of residential yards and Rimini Road and measures to ensure safe drinking water to area residents.

The following is a summary of the major response actions taken to date:

<u>Actions to Reduce Metal Loading to Surface and Ground Water:</u>

- 1987-1990: Montana Department of State Lands (now MTDEQ) removed waste rock and tailings material from eleven abandoned mine sites and disposed of the materials at an active mine in Jefferson County. At each of the mine sites, the land was recontoured, stabilized in-place, covered and revegetated. Adit discharges associated with the mine sites were not addressed by this action.
- June 1999: The Luttrell Repository, located at the bankrupt Basin Creek Mine, was established as the repository for mine wastes excavated from the Upper Tenmile Creek and Basin Superfund Sites. Engineering designs for the repository include multiple waste disposal cells with permanent top and bottom liners and a leachate collection system. The leachate flows to a lined pond where it is treated prior to discharge.
- Summer 1999: EPA relocated 50,000 cubic yards (cy) of mine waste from the Red Mountain Mine to the Luttrell Repository.

- Summer 2000: EPA and USFS relocated mine wastes from the Peerless Jenny/King complexes, Susie, Red Mountain, Armstrong, Beatrice and Justice mine sites and the Minnehaha drainage to the Luttrell Repository.
- Summer 2001: EPA and USFS relocated mine wastes from Bunker Hill, Queensbury, and Upper Valley Forge mine sites to the Luttrell Repository. EPA conducted surface reclamation work at Red Mountain, Bunker Hill, Susie, Jenny/King and Queensbury sites.
- 2006: EPA conducted a treatability study of a chemical/physical process for metals removal from the Susie Mine adit discharge.

Actions to Reduce Direct Human Contact with Mine Wastes and Contaminated Water:

- 1995: EPA conducted a removal of waste materials in a residential area near the Lower Tenmile Mill Site.
- 1997: EPA relocated 9,500 cy of mine waste away from a residence at the Red Water Mine.
- Spring 2001: EPA installed point-of-use treatment systems for selected residential drinking water supplies in Rimini.
- 2003: EPA removed 10,000 cy of mine waste and contaminated soils from residential properties and roads in the Landmark Subdivision and 22,000 cy of mine waste from the Lee Mountain mine site. Wastes were disposed of at the Luttrell Repository.
- 2004: EPA removed 12,000 cy of mine waste and contaminated soils from residential properties in the Landmark Subdivision. Wastes were disposed of at the Luttrell Repository. Final cover was placed over Cells 1 and 2 at the Luttrell Repository.
- 2005: EPA began installation of a community wastewater treatment facility for Rimini.
- 2006: EPA removed 30,000 cy of mine wastes and contaminated soils from residential properties in Rimini. Wastes were disposed of at the Luttrell Repository.
- 2007: EPA applied at least four-inches of road-base to Rimini Road in Rimini.

As discussed in the ROD, EPA does not expect to complete all response actions until 2012, at the earliest. Response actions taken to date target the primary sources of risk to human health as well as many of the major contributors of metal loads to surface and ground water. These source control actions have minimized the potential for acute releases of metals to the watershed.

V. Progress since the Last Review

This is the first Five-Year Review.

VI. Five-Year Review Process

Administrative Component

This is the first Five-Year Review for the Site. The Five-Year Review was led by Mike Bishop, EPA Project Manager. The following Team Members participated in the review:

- Mike Bishop, EPA Project Manager
- Diana Hammer, Community Involvement Coordinator
- Steven Moores, EPA Attorney
- Larry Scusa, MTDEQ Representative

EPA Contractors:

- Kenneth Napp, HDR Engineering, Inc.

This Five-Year Review included: a review of relevant documents; a meeting with representatives of EPA during a Site visit; interviews with regulatory agency and other personnel; and data review. The review ended in July 2008.

Community Involvement

A display advertisement to announce the Five-Year Review and invite public comment was published in the local newspaper, the Helena Independent Record, on August 1st and 8th, 2007. EPA received and considered several public comments as EPA finalized this Five-Year Review.

Diana Hammer, the EPA Community Involvement Coordinator assigned to the Upper Tenmile Site, conducted interviews with 20 Rimini residents and other interested parties in Helena between February and April 2007.

Karen Ekstrom, contractor with CDM in Helena, provided support for these interviews and the Community Involvement Plan Update (2008). Each person interviewed was asked the same series of eleven open-ended questions. Questions included:

- What do you know about the Upper Tenmile Superfund Site Cleanup?
- How do you get your information about the Project?
- Do you have any concerns about the Site?
- Do you feel your concerns are addressed?
- What aspects of the cleanup are going well?
- What can we do better?
- What additional information would you like?
- How can we best communicate with you about the cleanup?
- If a “working group” were set up to discuss cleanup designs and project activities, would you be interested in participating?
- (if applicable) How did your yard cleanup go?
- Is there anything else you would like to add?

The interviews lasted between 30 and 60 minutes. Individual responses are confidential; however, highlights of these interviews were compiled and the key community issues and concerns were identified. These are included below as part of this Five-Year Review. In general, the following findings were drawn from the interviews:

- The most common concern was over the water and wastewater systems.
- Concern over yard cleanups was the next most common issue raised.
- Communication tools were generally good and well-used.
- More involvement is needed in decisions, including more upfront discussions between EPA and the other stakeholders.
- The perception is that the cleanup is too slow.
- Another perception is that future plans and the cleanup schedule are unclear.
- Watershed issues (river health, abandoned mine cleanup) must be addressed.
- EPA needs to rebuild trust and its credibility.

In response to these concerns, EPA has updated its Community Involvement Plan (2008) and taken steps to work more closely with stakeholders on pending EPA decisions. Specifically, EPA and the MTDEQ have been meeting regularly (approximately every 4-6 weeks) with Rimini residents, City and County officials, and other stakeholders to discuss the water and wastewater systems in the Rimini Community.

EPA continues to participate in the monthly Upper Tenmile Watershed meetings and communicates with Rimini residents, City, County and other stakeholders regularly.

Document Review

In preparing this Five-Year Review Report, the following documents were reviewed:

- Construction Completion Report, Landmark Subdivision Residential Yards Remediation (CDM, 2007).
- 2006 Construction Completion Report, Community of Rimini Residential Yards Remediation (CDM, 2007).
- 2003 Construction Completion Report, Landmark Subdivision Residential Yards Remediation, Upper Tenmile Creek Mining Area Site (CDM, 2004).
- Record of Decision, June 28, 2002.
- Streamflow, Water Quality, and Quantification of Metal Loading in the Upper Tenmile Creek Watershed, Lewis and Clark County, West-Central Montana, September 1998.
- Final Human Health Risk Assessment Report for Upper Tenmile Creek Mining Area Superfund Site (CDM, 2001).
- Ecological Risk Assessment Report for Upper Tenmile Creek Mining Area Superfund Site (CDM, 2001).
- Public Health Assessment, Upper Tenmile Creek Mining Area, Rimini/Helena, Lewis and Clark County, Montana (ATSDR, 2001).

Interviews were conducted with the following individuals to provide supplemental technical information:

- Neil Marsh, CDM (Consultant to EPA)
- Tom Cleasby, US Geological Survey (USGS)
- Larry Scusa, MTDEQ

Data Review

The remedy addresses Sitewide water quality conditions as well as the condition of residential yard soils. Sitewide surface water monitoring data is collected on a regular basis by the USGS at selected stations (Figure 2, Appendix A). The surface water monitoring strategy was detailed in a Statement of Work (SOW) provided to the USGS by EPA and follows the USGS National Field Manual for the Collection of Water Quality Data (Updated 2/27/08). All samples are analyzed by a USGS laboratory. The appropriateness of the SOW is reviewed at an annual meeting between the USGS, MTDEQ and EPA with adjustments made, as appropriate (most recent revision in April 2008). Data generated under the monitoring plan were used by the USGS to prepare time vs. metal concentration graphs that reflect surface water quality trends at the Site.

Routine ground water quality monitoring is also performed by the USGS at the Luttrell Repository to assess potential releases from this facility. This monitoring commenced within the past several years and no obvious water quality trends have been observed (personal communication with Tom Cleasby, 2007). In addition, effluent quality from a repository leachate treatment system is periodically monitored (personal communication with Neil Marsh of CDM, 2007).

Based on conversations with Neil Marsh of CDM and Mike Bishop, EPA Project Manager, the treatment system effluent complies with water quality standards summarized in Tables 3 and 4.

Neither ground water nor treatment system effluent monitoring is performed under a Compliance Monitoring Plan (CMP) identifying points of compliance and performance standards. Given the lack of formal performance measures, USGS data were not reviewed. The preparation of a CMP may be appropriate, as discussed under Issue No. 7 (Section VI.)

Residential yard remediation conducted in the Landmark Subdivision and the community of Rimini was restricted, in some cases, in areas around septic systems, valuable trees and other features. Access denial by property owners also resulted in partial remediation of residential years. As-built drawings were used by EPAs remediation contractor (CDM) to generate data describing the post-remedial condition of the properties in these communities. These data were then used to calculate an area weighted mean arsenic and lead concentration for each property (see Appendix C). The resulting means were compared with the cleanup goals for these chemicals (120 mg/Kg, 1,000 mg/Kg, respectively) to determine whether the remediation performed to date is protective of human health.

Data from the following sources were reviewed to evaluate surface water quality trends and to support calculation of area-weighted mean arsenic and lead concentrations in residential yards:

- Surface Water Quality Data, 1997-2006, provided by USGS, July 2007 (Appendix B).
- Estimated total area of individual residential yards, remediated portion of residential yards, pre-remedial arsenic and lead concentrations in residential yards and arsenic and lead concentrations of backfill used in residential yards in the Landmark Subdivision and Rimini. These data were provided by CDM via email in August 2007 and July 2008 (Appendix C).

A summary of these data and their interpretation for demonstrating remedy performance is provided below.

Sitewide Surface Water Quality

Data in Appendix B suggest that no discernable trend in COC concentrations could be documented at most stations with the exception of the Poison Creek Station where the concentrations of cadmium, copper, lead, and zinc appear to have declined since implementation of response actions in the drainage.

Residential Yard Remediation

Residential properties previously identified as requiring contaminated soil removal were assessed for remedy protectiveness in their condition at the time of this Five-Year Review. The data and methodology used to assess protectiveness are detailed in Appendix C. The results of this analysis indicate that many of the properties have area-weighed mean arsenic and lead concentrations below the cleanup levels, and therefore, are protective of human health in their current condition. Conclusions on a property-by-property basis are provided in Appendix C.

Site Inspection

The Five-Year Review Site Inspection was performed on June 14, 2007 by the EPA Remedial Project Manager, Mike Bishop; Roger Hoogerheide (EPA Project Officer); and Kenneth Napp (HDR Project Manager). The purpose of the Site Inspection was to observe the current Site condition and remedy elements. However, given the large size of the Site (53 square miles), the remote location and difficult access of many mine sites, the Site inspection largely focused on the condition of residential yard remediation in the Landmark Subdivision and the community of Rimini. Information regarding the condition of other remedy elements away from Rimini such as water treatment at individual mine sites and the Luttrell Repository was provided by the EPA and the State Remedial Project Manager.

In the Landmark Subdivision, residential yards appeared vegetated and in good condition, indicating that post-soil removal restoration efforts were successful. In the community of Rimini, those properties subject to remedial action also appeared to be in good condition. Photographs of selected remediated properties in Rimini are provided in Appendix D (Photo Nos. 1, 2 and 3). The unremediated Rimini Road is shown in Photo No. 4 (Appendix D).

The community wastewater treatment facility proposed to replace individual residential septic systems is shown under construction in Photo No. 5 (Appendix D). However, this system will not be completed. Instead, individual residential septic systems will remain in operation (or be replaced as necessary to complete residential yard soil excavation).

It was determined that this option would provide the same protectiveness to the residents, property owners, and workers, be easier to implement, and require substantially less capital cost to implement than construction and operation of a community wastewater facility.

In a telephone interview on July 31, 2007, Mr. Larry Scusa (MT DEQ) reported that response actions involving relocation and/or capping of mine wastes currently have vegetation in good condition on the former mine waste footprint or cap. Vegetative cover is necessary to minimize erosion at remediated waste features.

VII. Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

The remedy remains under construction and therefore, is not functioning as intended by the decision documents. The status and performance of each remedy element is summarized below.

The remedy consists of the following elements:

1. Excavate and dispose of contaminated materials from 70 high-priority mine sites in the Luttrell repository.
2. Develop and implement AMD control measures for adit discharges.
3. Implement institutional controls (ICs) to prevent the use of contaminated ground water for drinking.
4. Augment stream flows in Tenmile Creek through improvements to Chessman Reservoir and Red Mountain Flume.
5. Consider contaminated stream sediment removal if other response actions do not result in achievement of surface water quality performance standards.
6. Excavate contaminated yard soils from residences and recreational use cabins and dispose to the Luttrell repository.
7. Excavate contaminated roadway materials in Rimini Road and transport to Luttrell repository.
8. Construct a permanent water supply system for Rimini (and take temporary measures to provide safe drinking water in the interim).

The ROD anticipated a minimum ten-year remedy implementation period, of which five-years have elapsed. Further, the ROD anticipated that a considerable period of time would elapse after full remedy implementation before it would be known whether the remedy will result in achievement of performance standards for surface and ground (as well as whether overall protectiveness has been achieved). Therefore, EPA has prioritized the implementation of remedy elements to first address risks to human health. These include remedy element nos. 3, 6, and 8, above.

The performance of each remedy element is discussed below:

1. This remedy element is in progress with ten, high-priority mine sites remediated to date (personal communication, Larry Scusa, July 31, 2007). The anticipated benefit is an overall reduction in COC concentrations in surface water. Graphs illustrating water quality trends for selected surface water monitoring stations are provided in Appendix B. A review of these data suggest that COC concentrations at most stations remain unchanged with the exception of the Poison Creek Station where the concentrations of cadmium, copper, lead, and zinc appear to have declined. Given that this portion of the remedy remains under construction and that the ROD anticipated an extended monitoring period prior to drawing conclusions regarding remedy effectiveness, this discussion of water quality trends is preliminary.
2. This remedy element is in progress. The performance of adit discharge controls implemented to date is reflected in surface water quality trends discussed under Item No.1, above.
3. This remedy element had not been implemented at the time of the Five-Year Review.
4. The City of Helena has arranged with the US Bureau of Reclamation (USBR) to secure additional water from the Missouri River to substitute for withdrawals from Upper TenMile Creek.
5. This is a contingency remedy element if implementation of the primary remedy does not achieve performance standards in a reasonable time frame. Therefore, this remedy element has not been implemented.
6. Residential yard clean-ups have been completed as originally intended with the following general exceptions:
    - Properties originally targeted for remedial action were not remediated because the property owner did not give EPA access or EPA could not contact the owner to obtain voluntary access.
    - Properties were only partially remediated at the owner's request or due to easement constraints.
    - Properties with relatively small areas that remain unremediated due to concerns over damage to septic systems and/or the desire to protect valuable trees and other property improvements.

    Properties that remain entirely unremediated are not functioning as intended in the ROD. Partially remediated properties were assessed for remedy protectiveness in their condition at the time of the Five-Year Review. The data and methodology used to assess protectiveness are detailed in Appendix C. The results of this analysis indicate that many properties have area-weighed mean arsenic and lead concentrations below the cleanup levels and therefore, are protective of human health

    Conclusions on a property-by-property basis are provided in Appendix C.
7. This remedy element had not been implemented at the time of the Five-Year Review. However, as a temporary measure to suppress fugitive dust, at least four-inches of road-base were applied during 2007.

8. The permanent water supply system was not implemented at the time of the Five-Year Review. However, the project manager for EPA's contractor (CDM) reported that point-of-use (POU) treatment systems were installed in six residences where drinking water exceeded MCL(s). At the time of this Five-Year Review, there is potential that Landmark or Rimini residential water supply(s) may contain contaminants above MCLs at homes where landowners have declined offers of either bottled water or point-of-use water treatment systems.

Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the time of the remedy selection still valid?

The exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the time of remedy selection remain valid. Additional detail is provided below.

The ROD identified water quality standards as the basis for cleanup levels for surface and ground water. An ARARs review conducted as part of this Five-Year Review identified no new ARARs.

Because water quality standards form the basis for cleanup levels for Site water, an evaluation of exposure assumptions and toxicity data is not applicable. The overall remedial action objective (RAO) for surface and ground water includes achieving surface water quality standards in a reasonable time frame while ensuring a safe drinking water source for Site residents. This RAO remains valid. The overall RAO for soils/mine wastes is to achieve acceptable human and ecological exposure risks. This RAO also remains valid.

The ROD identified risk-based cleanup goals for soils and mine wastes present in residential yards. A review of exposure assumptions and toxicity values used to develop these goals indicates that the values used are within currently accepted standards and in conformance with EPA guidance.

Therefore, the cleanup goals identified for the site remain valid.

Question C: Has other information come to light that could call into question the protectiveness of the remedy?

Access to certain residential properties to allow removal of contaminates soils has been denied by the property owner. In addition, certain property owners have refused to accept bottled water or point-of-use treatment systems. These access limitations call into question the protectiveness of the remedy at this time. However, the remedy is under construction and when completed is expected to be protective of human health and the environment. Additional detail is provided in the Technical Assessment Summary.

One of the mine waste deposits that was consolidated and capped under the Site remedy (Red Water Mine) is located near Rimini along Rimini Road and therefore, may be attractive as a location for future residential development. An IC to prohibit disturbance of this engineered remedy (or any mine wastes capped in the future) was not required under the ROD. Therefore, such an IC should be developed to minimize the likelihood of disturbance of capped mine wastes.

Technical Assessment Summary

According to the data reviewed and the Site inspection, the remedy is under construction. However, this is expected as the ROD anticipated an early completion date of 2012. Remedy elements intended to mitigate risks to human health have been identified as a priority and have largely been completed. Remedy elements relevant to long-term protection of human health that have not yet been constructed/implemented include:

- A permanent water supply for Rimini.
- Institutional control(s) to prevent the use of contaminated ground water for drinking.
- Remediation of residential yards where remaining contaminated soils present a human health risk above a level of concern.
- Remediation of Rimini Road.

Adverse ecological impacts also remain throughout most of the Site. However, the ROD anticipated that such impacts might persist for some time after completion of remedial action as remedies stabilize.

VIII. Issues

Based on the information collected during the first Five-Year Review, the following issues were identified:

Table 5 - Issues

Item No.	Issues	Affects Current Protectiveness	Affects Future Protectiveness
1	There is potential that Landmark or Rimini residential water supply(s) may contain contaminants above MCLs at homes where landowners have declined offers of either bottled water or point of use water treatment systems.	Yes	Yes
2	Remediation of some residential properties is under construction. However, for many of these properties, sufficient work has been done to create a condition that is protective of human health. The remaining partially remediated properties and properties that have not undergone any remediation (but were targeted for remedial action) are not protective of human health.	Yes	Yes
3	Rimini Road remains unremediated. However, as a temporary measure to suppress fugitive dust, at least four-inches of road-base was applied during 2007.	No	Yes
4	Institutional controls on future ground water wells have not been implemented.	No	Yes
5	Institutional control to prevent disturbance of capped mine wastes at the Red Water Mine is not required by the ROD and have not been implemented.	No	Yes
6	Many of the remedy components intended to address surface and ground water quality have not been fully implemented (remedy element Nos. 1, 2 and 4; pg 14). However, the ROD anticipated a minimum ten-year implementation period of which five-years has elapsed.	Yes	Yes
7	Performance standards and points of compliance have not been formalized under a Compliance Monitoring Plan (CMP) for the Luttrell ground water monitoring network or treatment facility effluent discharge.	No	Yes

IX. Recommendations and Follow-up Actions

Table 6 - Recommendations and Follow-up Actions

1	There is potential that Landmark or Rimini residential water supply(s) may contain contaminants above MCLs at homes where landowners have declined offers of either bottled water or point of use water treatment systems.	Continue to work with landowners to allow provision of alternative water supply. Continue outreach and education of residents about their exposure risks.	EPA	On-going
2	Remediation of some residential properties is under construction. However, for many of these properties, sufficient work has been done to create a condition that is protective of human health. The remaining partially remediated properties and properties that have not undergone any remediation (but were targeted for remedial action) are not protective of human health.	Continue to work with landowners and local government to secure property access for the purpose of completing remedial action, as necessary to protect human health. However, access limitations may preclude completion of all yards. Continue outreach and education of residents about their exposure risks.	EPA	On-going
3	Rimini Road remains unremediated. However, as a temporary measure to suppress fugitive dust, at least four-inches of road-base was applied during 2007.	Perform Response Action.	EPA	As soon as practicable
4	Institutional controls on future ground water wells have not been implemented.	Implement institutional controls.	EPA	12/31/10
5	Institutional control to prevent disturbance of capped mine wastes at the Red Water Mine is not required by the ROD and have not been implemented.	Prepare ESD and implement institutional control.	EPA	9/30/10
6	Many of the remedy components intended to address surface and ground water quality have not been fully implemented (remedy element Nos. 1, 2 and 4; pg 14). However, the ROD anticipated a minimum ten-year implementation period of which five-years has elapsed.	Continue Response Actions.	EPA	9/30/12
7	Performance standards and points of compliance have not been formalized under a Compliance Monitoring Plan (CMP) for the Luttrell ground water monitoring network or treatment facility effluent discharge.	Develop and implement CMP	EPA	12/31/09

X. Protectiveness Statement(s)

According to the data reviewed and the Site inspection, the remedy is under construction. However, this is expected as the ROD anticipated an early completion date of 2012. Remedy elements intended to mitigate risks to human health have been identified as a priority and have largely been completed. Remedy elements that have yet to be constructed/implemented and are relevant to long-term protection of human health include:

- A permanent water supply for Rimini.
- Institutional control(s) to prevent the use of contaminated ground water for drinking.
- Remediation of residential yards where remaining contaminated soils present a human health risk above a level of concern (access limitations may preclude completion of all yards)
- Remediation of Rimini Road.

Adverse ecological impacts remain throughout most of the Site. However, the ROD anticipated that such impacts might persist for some time after completion of remedial action as remedies stabilize.

So, the implementation process called for in the June 2002 ROD makes it impossible to determine at this time whether the remedy is protective. However, in as much as the goals of the ROD are currently met, EPA believes the remedy will ultimately be protective when construction is complete.

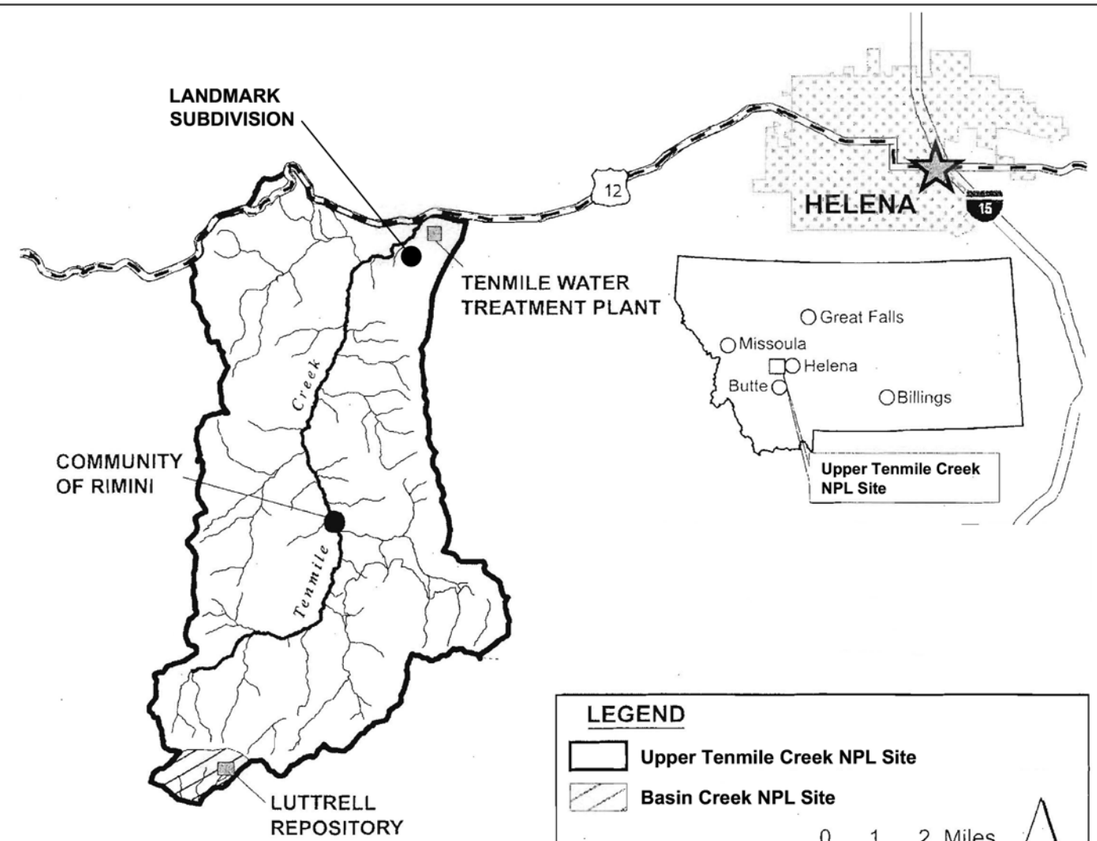
XI. Next Review

The Site requires ongoing Five-Year Reviews in accordance with CERCLA § 121 (c). The next five year review for the Site will be performed by July 2013, five years from the date of this review.

APPENDICIES

APPENDIX A

Figures



From Construction Completion Report (CDM, 2003)

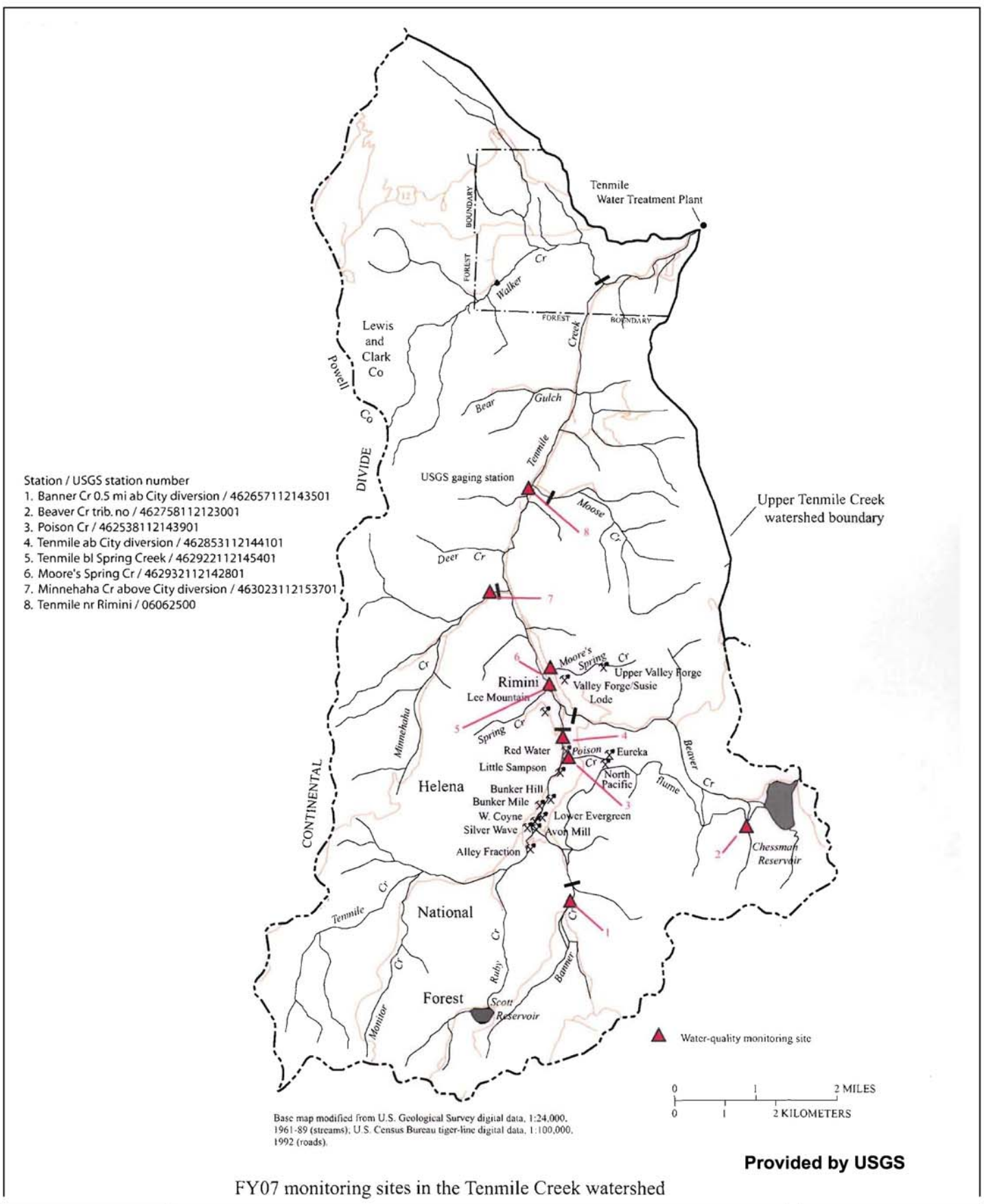
HDR

Upper Ten Mile Creek NPL Site

SITE LOCATION MAP

DATE
AUGUST 2007

FIGURE
1



FY07 monitoring sites in the Tenmile Creek watershed

HDR

Upper Ten Mile Creek
NPL Site

SURFACE WATER MONITORING LOCATIONS

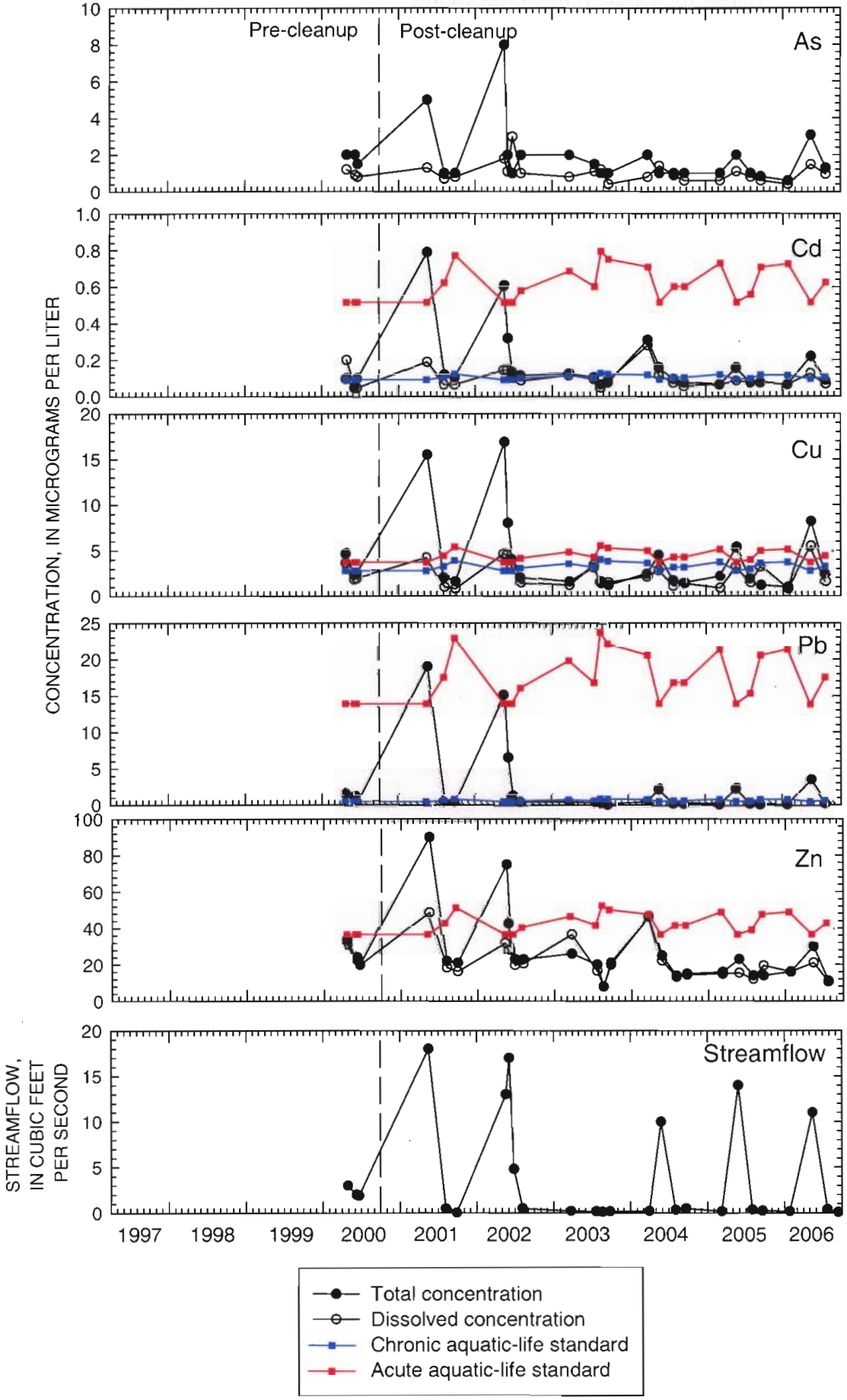
DATE
AUGUST 2007

FIGURE
2

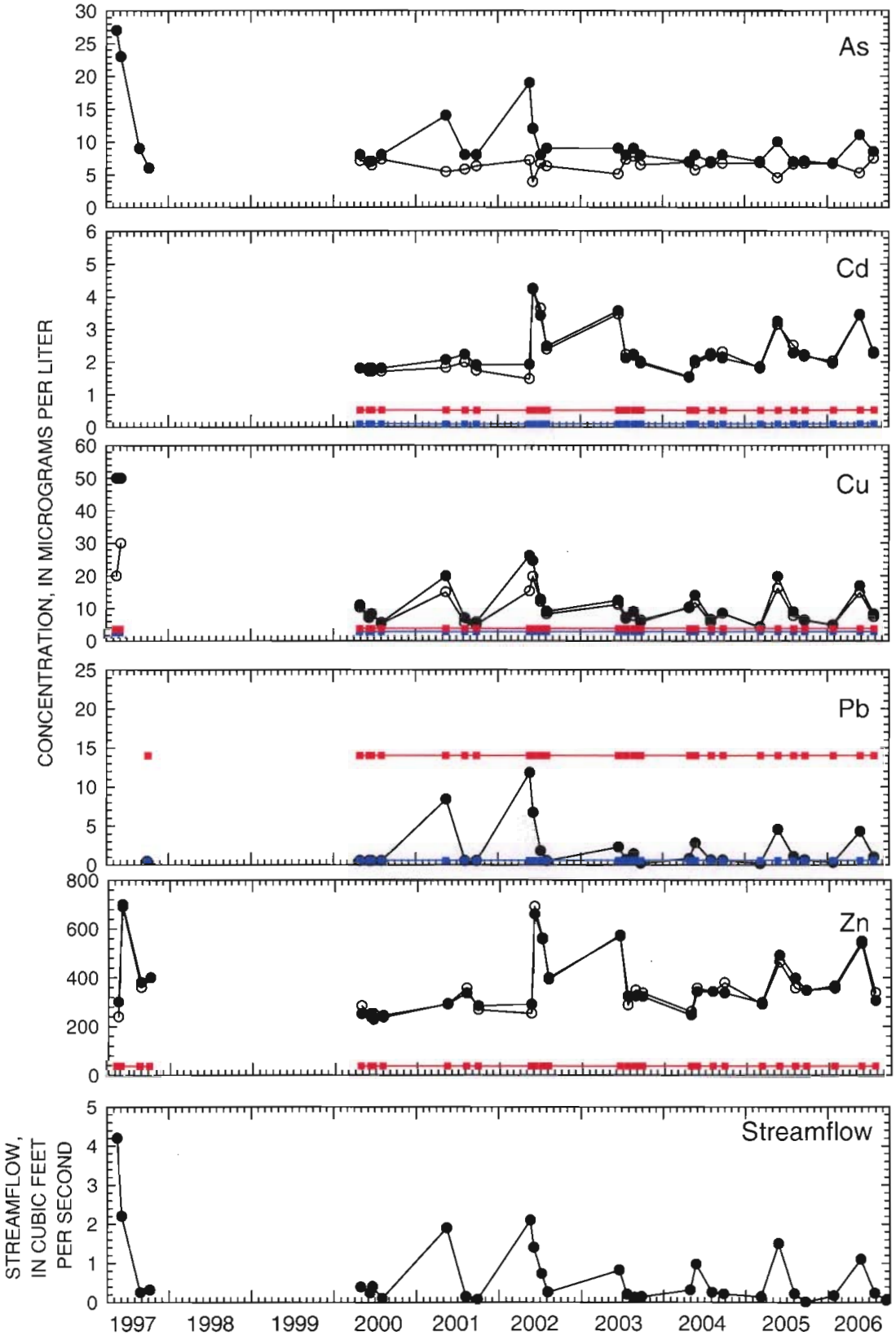
APPENDIX B

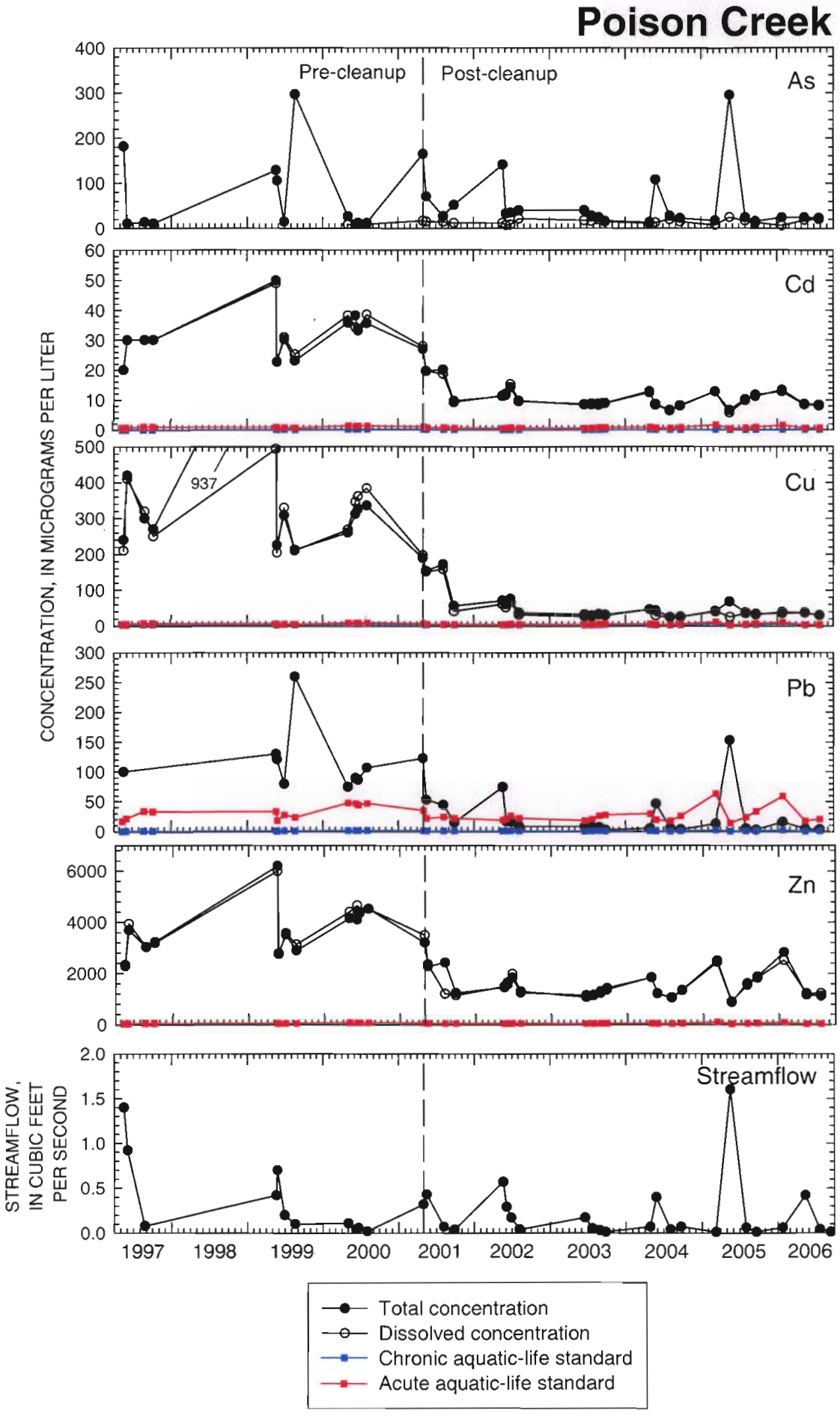
Time Trends
Surface Water Chemistry

Banner Creek

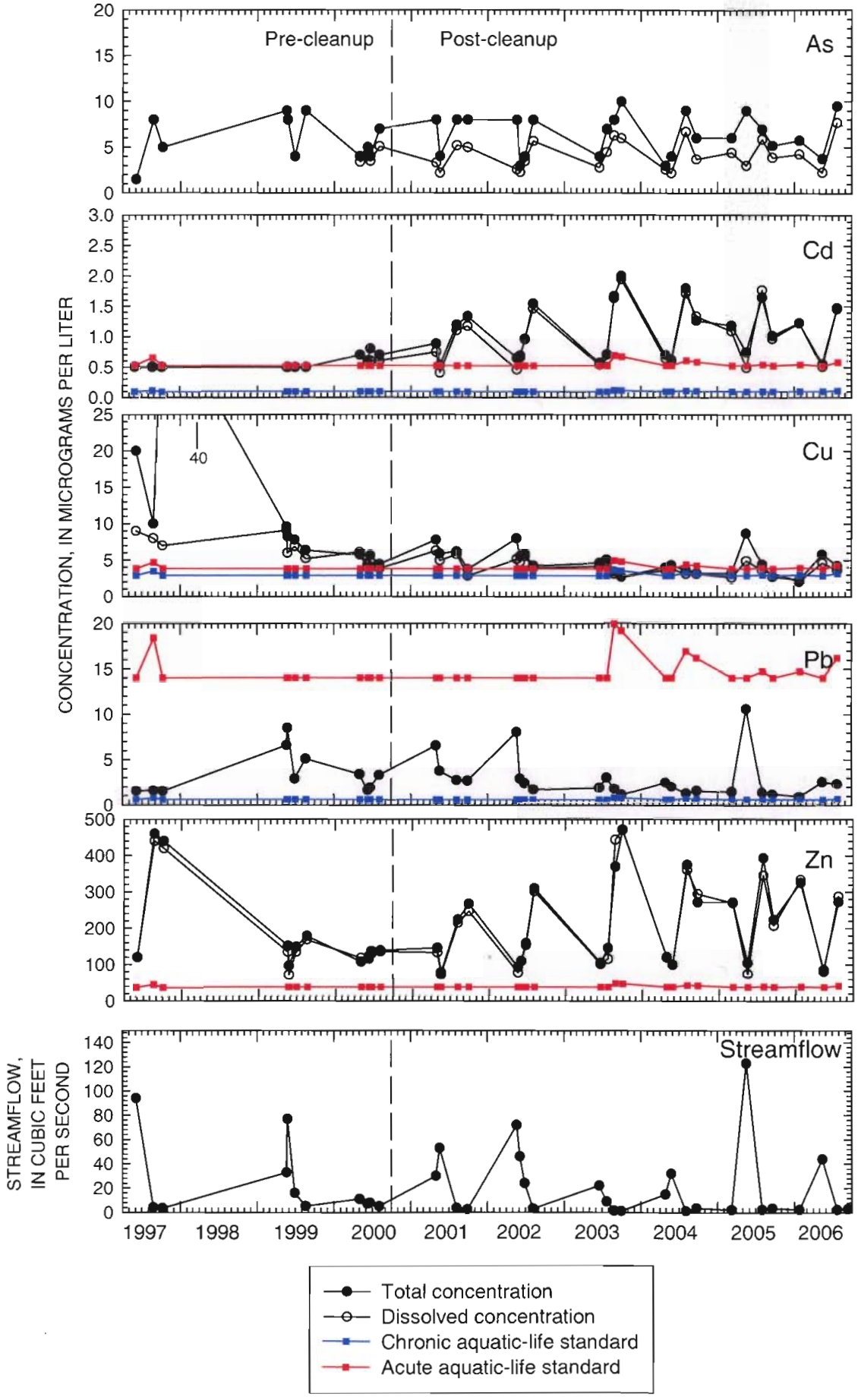


Beaver Creek Trib #2

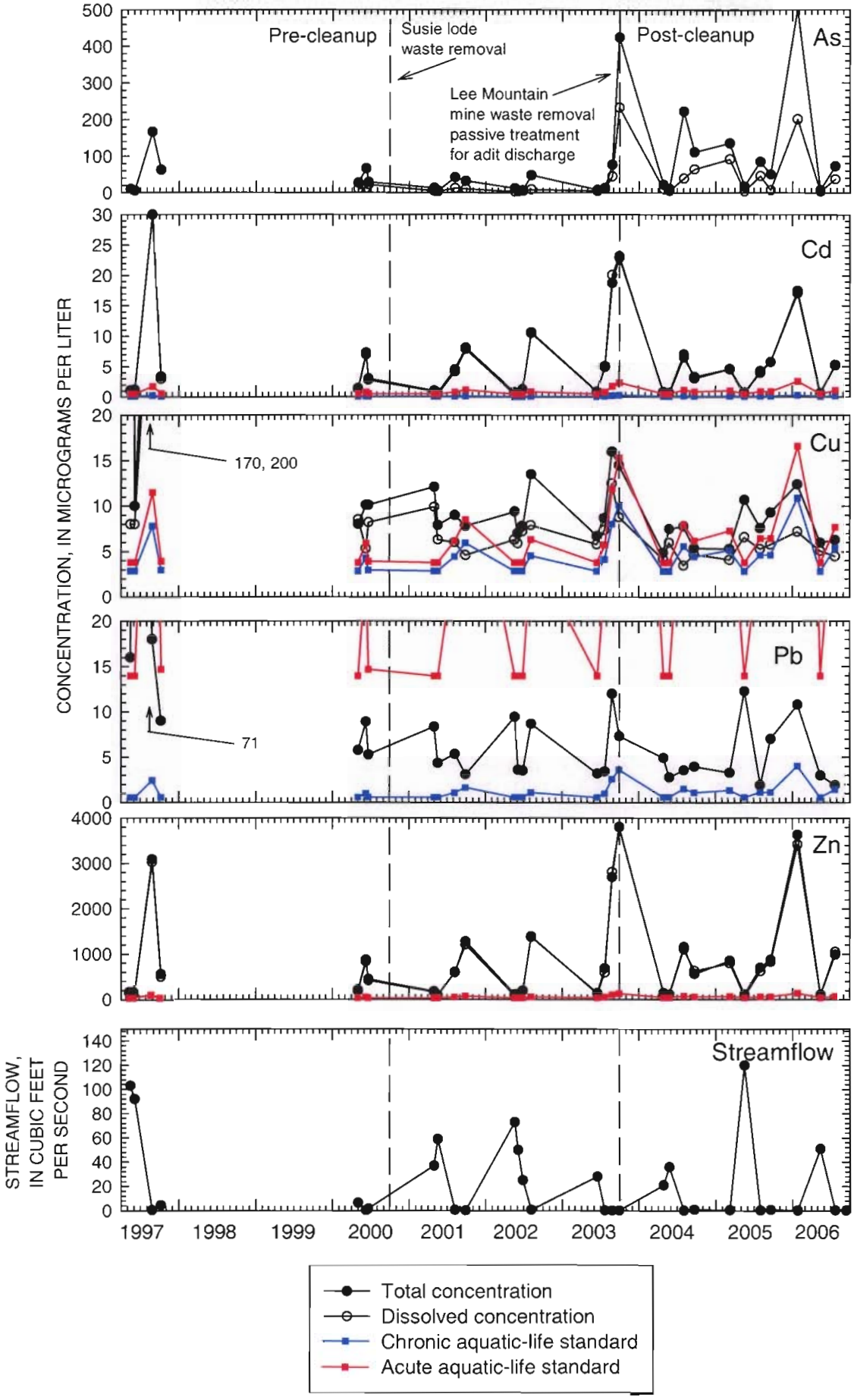



Poison Creek
Pre-cleanup
Post-cleanup
As
Cd
Cu
Pb
Zn
Streamflow
937
CONCENTRATION, IN MICROGRAMS PER LITER
STREAMFLOW, IN CUBIC FEET PER SECOND
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Total concentration
Dissolved concentration
Chronic aquatic-life standard
Acute aquatic-life standard

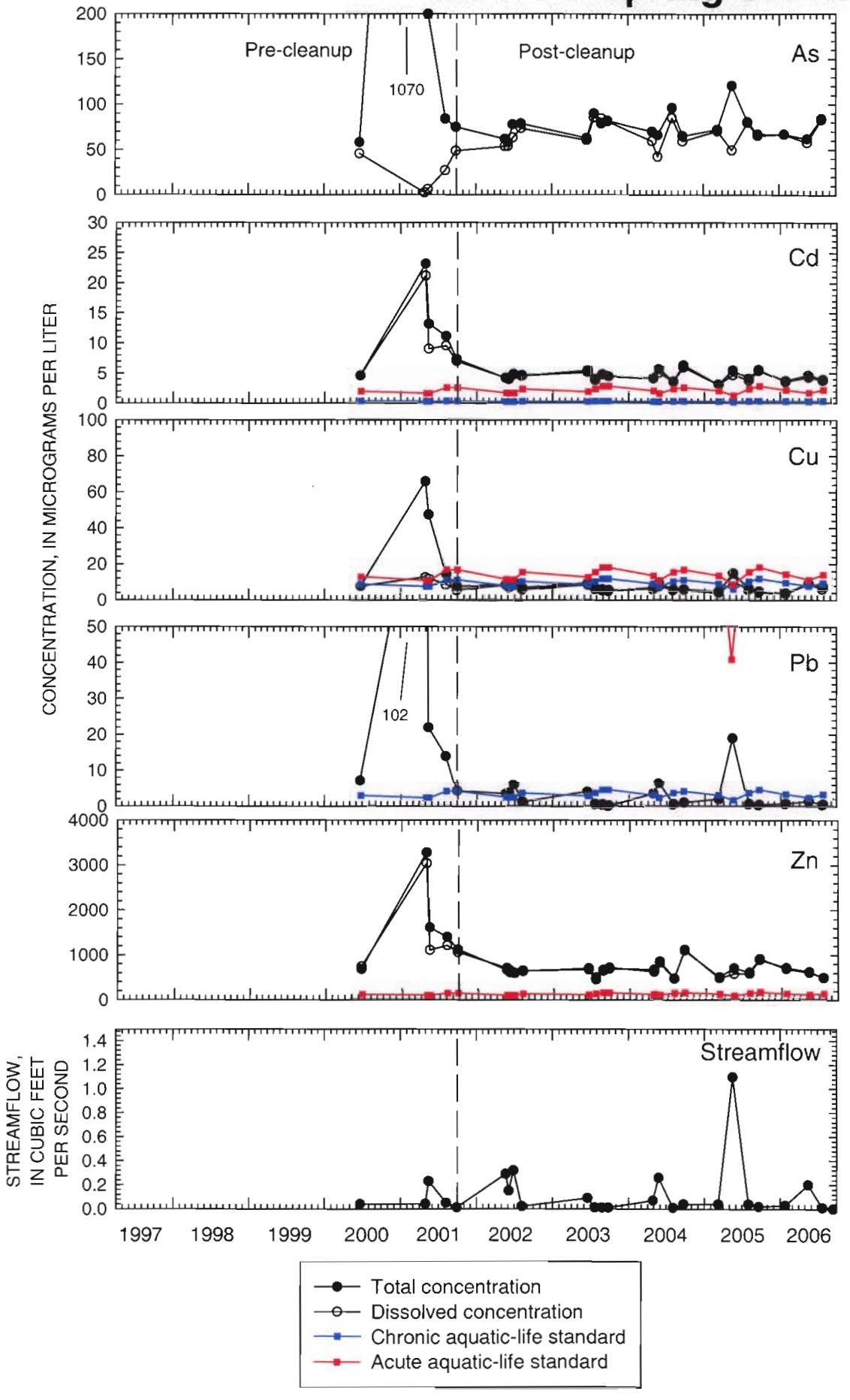
Tenmile Cr ab City Diversion



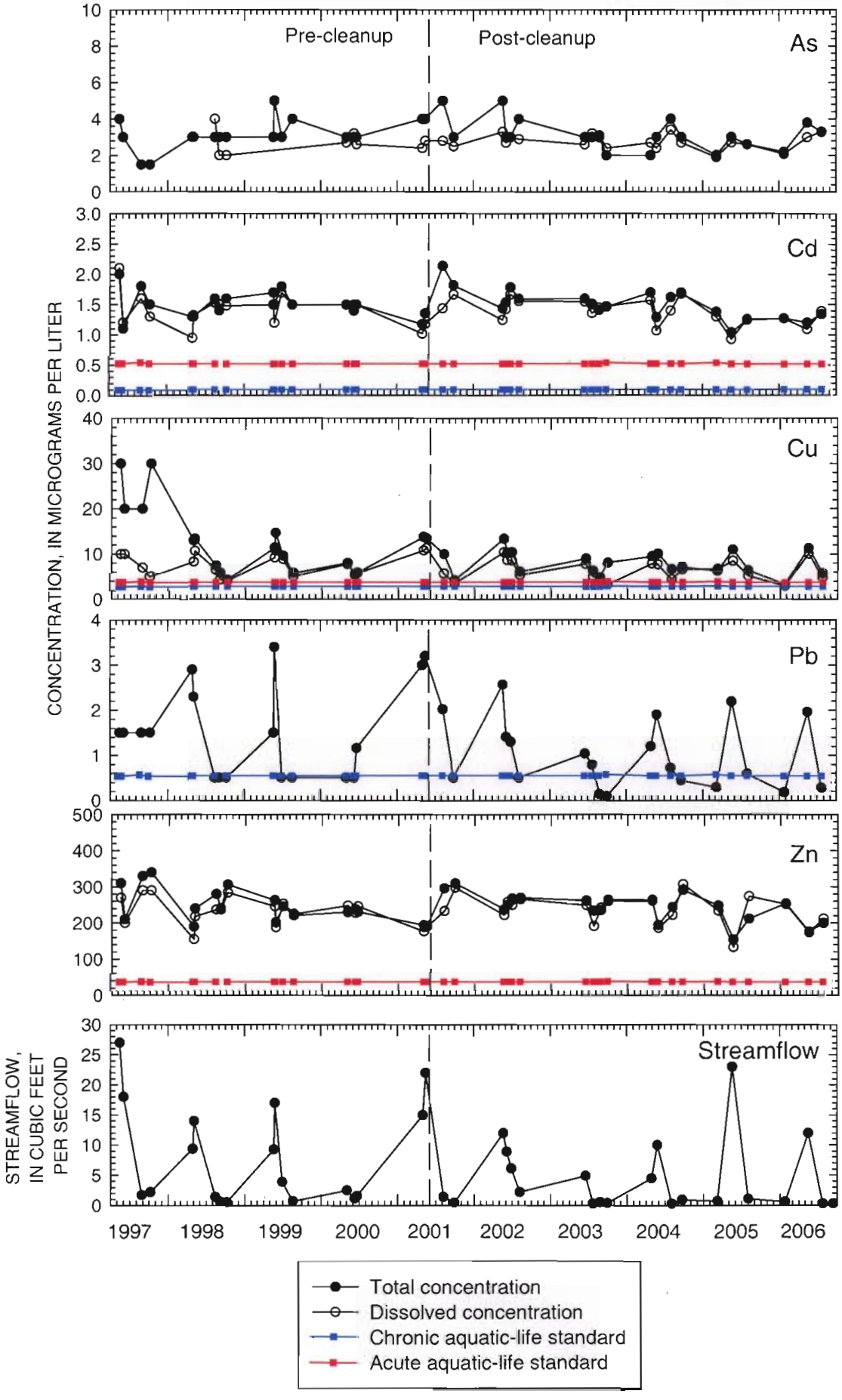
Tenmile bl Spring Creek



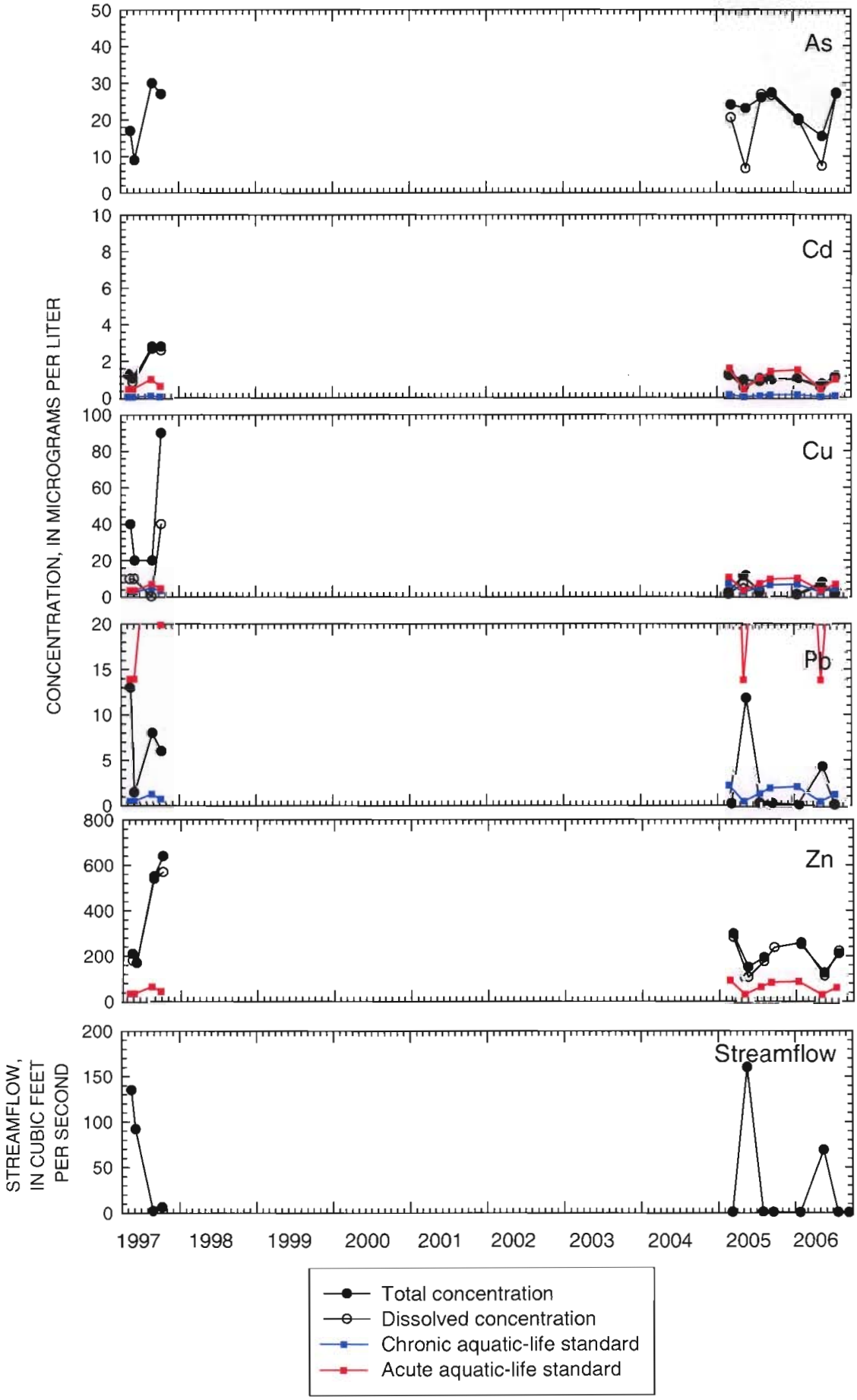
Moore's Spring Creek



Minnehaha Creek above City Diversion



Tenmile Creek near Rimini (at Moose Creek)



APPENDIX C

Calculations of Area-Weighted Mean Arsenic and Lead Concentration

Residential Yards

Rimini and Landmark

RIMINI COMMUNITY
AREA-WEIGHTED ARSENIC AND LEAD CONCENTRATION
Conditions as of October 2007

1. Purpose

The Record of Decision (ROD) for the Upper Tenmile Creek Mining Area Site (Site) was issued by EPA and DEQ in June 2002. The selected remedy, as declared in the ROD, included a residential yard remediation project for the Community of Rimini. This project consisted of excavation and disposal of the contaminated yard soils, placement of clean backfill, and re-vegetation of the disturbed yards. The Rimini residential yards remediation was performed in 2006. For various reasons detailed in Section 2, some properties were not remediated to the extent originally intended under the design documents. As part of the five-year review process, an evaluation of the protectiveness of the Rimini residential yard cleanups performed to date was conducted to determine if additional contaminated soils removal is required in order to achieve protectiveness.

CDM provided all inputs to the calculations performed as part of this protectiveness evaluation.

2. Evaluation of Protectiveness to Human Health

In order to evaluate remedy protectiveness to human health, area-weighted concentrations of arsenic and lead remaining on residential properties were calculated based on the following information provided by CDM, as exhibited in Tables 1and 1A:

1. Design Excavation Area - The design excavation area is the area of a property for which remediation was deemed necessary. This was based on chemical characterization of each residential property through composite sampling of "quandrants". Arsenic and lead concentrations in quadrants were then compared with the corresponding action levels (120 milligram per Kilogram (Mg/Kg) and 1,000 mg/Kg, respectively). The design area included many features such as trees, hedges and sheds that in reality, were never intended to be removed. As a result, the design excavation area overestimates the area requiring excavation.

2. Actual Area Excavated – This is the actual area of a given property that was excavated and backfilled. The actual area excavated may be greater or less than the design excavation area for the following reasons:

Actual excavation is less than design excavation:

- Avoidance of trees, shrubs, and heavily wooded areas
- Avoidance of drain fields
- Denied access

Actual excavation exceeds design excavation:

- Identification of incorrect property boundary.
- Visual observation of suspect material.
- Other

3. Additional Area Outside of Design – Property-specific areas, contaminated or uncontaminated, that were not included in the original design excavation (area intended to be excavated) due to one or more of the following:

    - Previously remediated area through EPA Removal Program
    - Denied access
    - Avoidance of woodland area.
    - Access physically not possible due to steep slopes.

    These areas, treated as untouched at the time of remedy construction, remain significant to this analysis in order to obtain area-weighted average concentrations of arsenic and lead over the exposure unit in its current condition. Table 1A summarizes the additional areas outside of remedial design, provided as supplemental information from CDM.

4. Pre-Excavation Concentrations for Arsenic and Lead - The pre-excavation, area-weighted average concentrations of arsenic and lead were provided by CDM for each property. This is a property-specific, area weighted mean based on composite samples collected from "quadrants" within a specific property. Only those quadrants where soil remains in place (as of October 2007) were used to develop arsenic and lead concentrations. In this exercise, these values serve as the concentrations of arsenic and lead in portions of the property-specific design excavation area that ultimately were not remediated for the reasons described in item 2, above.

5. Backfill (Gravel and Growth Media) Concentrations for Arsenic and Lead - The concentration of arsenic and lead in backfill material based on chemical characterization performed prior to placement as backfill. These concentrations vary with the backfill source (replacement material for gravel driveways or for use as growth medium in yard areas) and are used to represent contaminant concentrations in remediated areas.

6. Concentration of Additional Area Outside of Design – The concentrations of arsenic and lead corresponding to property areas not included in the original excavation design (See Table 1A). These concentrations are area-weighted averages, provided by CDM for specific properties. In those properties where the additional area was previously remediated through the EPA Removal Program, standard backfill chemistry was assumed and applied.

Area-Weighted Contaminant Concentrations Analysis

General Equation

Based on the assumptions described above, the general equation for computing the area-weighted average concentration under current site conditions is as follows:

For the area-weighted arsenic concentration,

EQ'N 1:

$$AWA = \frac{C1 \cdot A1 + C2 \cdot A2 + C3 \cdot A3}{A1 + A2 + A3}$$

Where:	A1	=	Area of the yard that has been excavated and replaced with backfill.
	C1	=	Concentration of contaminant in backfill.
	A2	=	Area of residential property originally targeted for remedial action but that remains unremediated.
	C2	=	Concentration of contaminant in area scheduled for Excavation.
	A3	=	Area not scheduled for excavation and that remains untouched at the time of remedy construction (See Table 2A).
	C3	=	Concentration of contaminant in area 3 (See Table 2A).

Values of A1, A2, and A3 are computed from the data as follows:

Let:

D = Area of the yard originally determined to require excavation and replacement
D′ = Actual area of yard excavated

Then:

A1 = D′
A2 = D- D′ (D′ ≤ D)
A2 = 0 (D′ > D)
A3 = See Table 2A

The derivation of A3 and C3 is complex and property specific. Some properties contained additional areas outside of the design that were both previously remediated through the EPA Removal Program and unremediated due to heavily wooded areas or denied access. Therefore, the methods used to obtain A3 and C3, based on supplemental information, are outlined in Table 2A.

Action Levels for arsenic and lead, as designated in the ROD, are 120 mg/Kg and 1000 mg/Kg, respectively. Those properties that contain area-weighted concentrations below the action levels may be considered protective of human health.

2.1 Assumptions

Various assumptions were made to obtain area-weighted concentrations for each property and determine remedy protectiveness.

Backfill Chemistry:

At the time of remedy implementation, two types of backfill (gravel and growth media) were used. Select fill placement was determined by reclamation type. However, exact areas of backfill using (1) gravel fill and (2) growth media fill were not recorded. Prior to fill placement, backfill was analyzed for arsenic and lead concentrations. Since the gravel and growth media backfill types contain different contaminant concentrations, the area-weighted mean calculations were run using two different concentrations terms for arsenic and lead backfill, including:

1. An *average* of the gravel fill and growth media arsenic and lead concentrations.
2. The *greater* of the gravel fill and growth media arsenic and lead concentrations.

Results remained the same for both scenarios; the number of properties with contaminant concentrations above the action level did not vary. Thus, the greatest backfill concentration was applied to maintain conservative results.

Actual Excavation Area vs. Design Excavation Area:

In some cases, the actual excavation area recorded was greater than that of the original design excavation area. In these cases, it is assumed that all of the design excavation area was remediated.

It is possible that in some cases all of the design excavation was NOT remediated. However, resolution of this uncertainty would require careful examination of construction record drawings. This level of review is beyond the scope of this exercise.

2.2 Access Denied Properties

Five properties exist where the owners denied any access. As a result, remedy construction could not be performed on any portion of these properties. These properties are not identified on Table 2.

Three properties exist where access was provided to allow excavation of contaminated soils on driveways (in whole or in part), but not on any other portion of the property. These properties include Nos. 12, 16 and 33 on Table 2.

2.3 Results of Evaluation

Results of the area-weighted mean arsenic and lead calculations are summarized in Table 2.

Table 1: Data Provided by CDM

Property No.	Property Area included in Design Excavation				Backfill Concentration			
	Design Excavation Area	Pre-Excavation AWA Concentrations		Actual Area Excavated	Growth Media		Gravel	
		As	Pb		As	Pb	As	Pb
	(sq ft)	(mg/kg)	(mg/kg)	(sq ft)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
	D	C2	C2	D'	C1	C1	C1	C1
1	14,696	186	235	12,300	14.5	45.6	10.6	14.4
2	11,930	165	413	9,200	14.5	45.6	10.6	14.4
3	10,290	436	223	9,220	14.5	45.6	10.6	14.4
4	20,579	261	172	13,120	14.5	45.6	10.6	14.4
5	13,434	443	256	8,120	14.5	45.6	10.6	14.4
6	12,955	614	417	6,799	14.5	45.6	10.6	14.4
7	15,368	176	145	12,171	14.5	45.6	10.6	14.4
8	13,271	268	255	10,632	14.5	45.6	10.6	14.4
9	25,278	836	631	23,869	14.5	45.6	10.6	14.4
10	25,990	370	430	22,535	14.5	45.6	10.6	14.4
11	32,062	327	247	24,833	14.5	45.6	10.6	14.4
12	1,327	0	0	1,327	14.5	45.6	10.6	14.4
13	3,125	662	528	2,649	14.5	45.6	10.6	14.4
14	4,266	769	687	3,493	14.5	45.6	10.6	14.4
15	5,530	0	0	7,280	14.5	45.6	10.6	14.4
16	10,695	2,118	923	6,420	14.5	45.6	10.6	14.4
17	8,433	0	0	14,512	14.5	45.6	10.6	14.4
18	13,524	323	313	11,750	14.5	45.6	10.6	14.4
19	51,571	195	332	45,940	14.5	45.6	10.6	14.4
20	11,474	554	256	8,259	14.5	45.6	10.6	14.4
21	12,682	140	251	12,377	14.5	45.6	10.6	14.4
22	8,932	174	280	7,944	14.5	45.6	10.6	14.4
23	20,034	149	239	14,753	14.5	45.6	10.6	14.4
24	25,983	852	706	21,886	14.5	45.6	10.6	14.4
25	14,013	556	726	13,738	14.5	45.6	10.6	14.4
26	10,064	8,333	13,500	6,621	14.5	45.6	10.6	14.4
27	5,170	301	204	3,244	14.5	45.6	10.6	14.4
28	29,342	209	220	14,697	14.5	45.6	10.6	14.4
29	24,550	170	190	17,173	14.5	45.6	10.6	14.4
30	10,808	222	180	5,400	14.5	45.6	10.6	14.4
31	32,055	591	1,046	29,395	14.5	45.6	10.6	14.4
32	2,096	0	0	2,347	14.5	45.6	10.6	14.4
33	1,850	0	0	1,850	14.5	45.6	10.6	14.4
34	14,205	480	452	12,230	14.5	45.6	10.6	14.4
35	66,065	462	362	44,638	14.5	45.6	10.6	14.4
36	8,945	213	334	5,681	14.5	45.6	10.6	14.4
37	12,528	940	532	10,177	14.5	45.6	10.6	14.4

As - Arsenic
Pb - Lead
AWA - Area Weighted Average

TABLE 1A: Supplemental Information Provided by CDM

Property No.	Additional Area Outside of Design	Area to Consider	AWA Concentrations	
			As	Pb
		(sq ft)	(mg/kg)	(mg/kg)
12	1. Outside of Design - Unremediated	9,238	272	325
18	1. Previously Remediated under EPA Removal Program	12,000	Unavailable	Unavailable
27	1. Outside of Design - Quadrant 1 Unremediated	2,792	63	164
	2. Outside of Design - Quadrants 2 & 3 Unremediated	4,700	205	813
32	1. Outside of Design - Unremediated	7,380	176	233
33	1. Outside of Design - Unremediated	7,289	169	286
	2. Previously Remediated under EPA Removal Program	30,000	Unavailable	Unavailable

TABLE 2A: Derivation of Area 3 and Concentration 3

Property No.	Additional Area Outside of Design (A3)	Area	AWA Concentrations	
			As	Pb
		(sq ft)	(mg/kg)	(mg/kg)
12	1. Outside of Design - Unremediated	9,238	272	325
18	1. Previously Remediated under EPA Removal Program	12,000	14.5[1]	45.6[1]
27	1. Outside of Design - Quadrant 1 Unremediated	2,792	63	164
	2. Outside of Design - Quadrants 2 & 3 Unremediated	4,700	205	813
	COMBINED AWA of Areas 1 & 2:	7,492	152	571
32	1. Outside of Design - Unremediated	7,380	176	233
33	1. Outside of Design - Unremediated	7,289	169	286
	2. Previously Remediated under EPA Removal Program	30,000	14.5[1]	45.6[1]
	COMBINED AWA of Areas 1 & 2:	37,289	45	93

[1] - EPA Removal program backfill concentrations unavailable; assumed greatest backfill concentration of remedy construction

TABLE 2: Area Weighted Average (AWA) Concentration of Arsenic and Lead

Property No.	Remediated Soil			Design Excavation Area that Was Not Remediated			Additional Area Outside of Design [3]			AREA-WEIGHTED AVERAGE CONCENTRATION		PROPERTY ABOVE ACTION LEVEL?	
	Actual Excavation Area	Greatest Backfill Concentration [2]		Area	Pre-Excavation Concentration		Area	Concentration		As	Pb	As	Pb
	(sq ft)	As (mg/kg)	Pb (mg/kg)	(sq ft)	As (mg/kg)	Pb (mg/kg)	(sq ft)	As (mg/kg)	Pb (mg/kg)	(mg/kg)	(mg/kg)	120 mg/kg	1000 mg/kg
	A1	C1	C1	A2	C2	C2	A3	C3	C3	~	~	~	~
1	12,300	14.5	45.6	2,396	186	235				42.5	76.5	NO	NO
2	9,200	14.5	45.6	2,730	165	413				48.9	129.7	NO	NO
3	9,220	14.5	45.6	1,070	436	223				58.3	64.0	NO	NO
4	13,120	14.5	45.6	7,459	261	172				103.8	91.4	NO	NO
5	8,120	14.5	45.6	5,314	443	256				184.0	128.8	YES	NO
6	6,799	14.5	45.6	6,156	614	417				299.4	222.1	YES	NO
7	12,171	14.5	45.6	3,197	176	145				48.1	66.3	NO	NO
8	10,632	14.5	45.6	2,639	268	255				64.9	87.2	NO	NO
9	23,869	14.5	45.6	1,409	836	631				60.3	78.2	NO	NO
10	22,535	14.5	45.6	3,455	370	430				61.8	96.7	NO	NO
11	24,833	14.5	45.6	7,229	327	247				85.0	91.0	NO	NO
12	1,327	14.5	45.6	0	0	0	9,238	272	325	239.7	289.9	YES	NO
13	2,649	14.5	45.6	476	662	528				113.1	119.1	NO	NO
14	3,493	14.5	45.6	773	769	687				151.2	161.8	YES	NO
15[1]	7,280	14.5	45.6	0	0	0				14.5	45.6	NO	NO
16	6,420	14.5	45.6	4,275	2,118	923				855.3	396.3	YES	NO
17[1]	14,512	14.5	45.6	0	0	0				14.5	45.6	NO	NO
18	11,750	14.5	45.6	1,774	323	313	12,000	15	46	35.9	64.2	NO	NO
19	45,940	14.5	45.6	5,631	195	332				34.2	76.9	NO	NO
20	8,259	14.5	45.6	3,215	554	256				165.7	104.6	YES	NO
21	12,377	14.5	45.6	305	140	251				17.5	50.5	NO	NO
22	7,944	14.5	45.6	988	174	280				32.1	71.5	NO	NO
23	14,753	14.5	45.6	5,281	149	239				50.0	96.6	NO	NO
24	21,886	14.5	45.6	4,097	852	706				146.6	149.7	YES	NO
25	13,738	14.5	45.6	275	556	726				25.1	59.0	NO	NO
26	6,621	14.5	45.6	3,443	8,333	13,500				2,860.3	4,648.5	YES	YES
27	3,244	14.5	45.6	1,926	301	204	7,492	152	571	139.5	380.7	YES	NO
28	14,697	14.5	45.6	14,645	209	220				111.6	132.6	NO	NO
29	17,173	14.5	45.6	7,377	170	190				61.2	89.0	NO	NO
30	5,400	14.5	45.6	5,408	222	180				118.3	112.8	NO	NO
31	29,395	14.5	45.6	2,660	591	1,046				62.3	128.6	NO	NO
32[1]	2,347	14.5	45.6	0	0	0	7,380	176	233	137.0	187.8	YES	NO
33	1,850	14.5	45.6	0	0	0	37,289	45	93	43.3	90.4	NO	NO
34	12,230	14.5	45.6	1,975	480	452				79.2	102.1	NO	NO
35	44,638	14.5	45.6	21,427	462	362				159.6	148.2	YES	NO
36	5,681	14.5	45.6	3,264	213	334				86.9	150.8	NO	NO
37	10,177	14.5	45.6	2,351	940	532				188.2	136.9	YES	NO

[1] - Actual area remediated is greater than design area; assumed 100% design excavation area is remediated.

[2] - Greatest backfill concentration, that of the growth-media, is applied for conservatism.

[3] - Property areas that exist outside of the design excavation area due to denied access, avoidance of heavily wooded areas, or they were previously remediated under the EPA Removal program.

LANDMARK SUBDIVISION AREA WEIGHTED CONTAMINANT CONCENTRATIONS ANALYSIS
Conditions as of October 2007

1. Purpose

The Record of Decision (ROD) for the Upper Tenmile Creek Mining Area Site (Site) was issued by EPA and DEQ in June 2002. The selected remedy, as declared in the ROD, included a residential yard remediation project for the Landmark Subdivision near the north end of the Site. This project consisted of excavation and disposal of the contaminated yard soils, placement of clean backfill, and re-vegetation of the disturbed yards. The Landmark residential yards remediation was performed from 2003 to 2004. For various reasons detailed in Section 2, some properties were not remediated to the extent originally intended under the design documents. As part of the five-year review process, an evaluation of the protectiveness of the Landmark residential yard cleanups performed to date was conducted to determine if additional contaminated soils removal is required in order to achieve protectiveness.

CDM (EPAs remediation contractor) provided all inputs to the calculations performed as part of this protectiveness evaluation.

2. Evaluation of Protectiveness to Human Health

In order to evaluate the remedy's protectiveness to human health, the area-weighted concentrations of arsenic and lead remaining on residential properties were calculated based on the following information provided by CDM, as exhibited in Table 1:

1. Design Excavation Area - The design excavation area is the area of a property for which remediation was deemed necessary. This was based on chemical characterization of each residential property through composite sampling of "quandrants". Arsenic and lead concentrations in quadrants were then compared with the corresponding action levels (120 milligram per Kilogram (Mg/Kg) and 1,000 mg/Kg, respectively).

2. Actual Area Excavated – This is the actual area of a given property that was excavated and backfilled. The actual area excavated may be greater or less than the design excavation area for the following reasons:

Actual excavation is less than design excavation:

- Avoidance of trees, shrubs, and heavily wooded areas
- Denied access
- Incomplete construction due to funding limitations

Actual excavation exceeds design excavation:

- Identification of incorrect property boundary.
- Visual observation of suspect material.
- Other

3. Pre-Excavation Concentrations for Arsenic and Lead - The pre-excavation, area-weighted average concentrations of arsenic and lead were provided by CDM for each property. This is a property-specific, area weighted mean based on composite samples collected from "quadrants" within a specific property. In this exercise, these values serve as the concentrations of the arsenic and lead in the portions of the property-specific design excavation area that ultimately were not remediated for the reasons described in item 2, above.

4. Backfill (Gravel and Growth Media) Concentrations for Arsenic and Lead - The concentration of arsenic and lead in backfill material based on chemical characterization performed prior to placement as backfill. These concentrations vary with the backfill source (replacement material for gravel driveways or for use as growth medium in yard areas) and are used to represent contaminant concentrations in remediated areas.

5. Property Areas Not Included in Design Excavation – The areas where contaminant concentrations were below the clean-up goal, and excavation was not deemed necessary. These areas, though not included in the design excavation (area intended to be excavated), remain significant to this analysis in order to obtain area-weighted average concentrations of the entire property in its current condition, which presently includes:
   - Design excavation area that was not remediated,
   - Remediated soil, and
   - Soil originally determined to be below the clean-up goal.
   - Physical access not possible due to steep slopes.

6. Concentrations of arsenic and lead for the property areas not included in Design Excavation – The arsenic and lead concentrations for the areas originally determined to be below the clean-up goal were provided by CDM for each property. This is a property-specific, area weighted mean based on composite samples collected from "quadrants" within a specific property.

Area-Weighted Contaminant Concentrations Analysis

Based on the data items listed above, area-weighted contaminant concentrations for each property can be obtained. Due to the presence of pre-remedial clean soil, the process is slightly different from that applied to Rimini properties and involves two scenarios including:

Scenario 1

In the case where the actual excavated area is greater than the design excavated area (for the reasons cited in Item 2, above), it is assumed that the entire design excavation area was remediated.

It is also assumed that the excess excavation area (actual excavation area minus the design excavation area) encroached onto the area originally determined to be below the clean-up goals.

Scenario 2

When the actual excavation area is less than that of the design excavation area, it is assumed that the difference between the two exists as an unremediated area within the original design excavation area. Therefore, the area originally determined to be below the clean-up goals remains undisturbed.

General Equation

Based on the assumptions described above, the general equation for computing the area-weighted average concentration under current site conditions is as follows:

$$AWA = \frac{C1 \cdot A1 + C2 \cdot A2 + C3 \cdot A3}{A1 + A2 + A3}$$

where:

A1 = Area of the yard that has been excavated and replaced with backfill
C1 = Concentration of contaminant in backfill
A2 = Area of yard that was scheduled for excavation, but was not
C2 = Concentration of contaminant in area scheduled for excavation
A3 = Area of yard not scheduled for excavation and that remains in place
C3 = Concentration of contaminant in area 3

Values of A1, A2 and A3 are computed from the data as follows:

Let:

D = Area of the yard originally determined to require excavation and replacement
D′ = Actual area of yard excavated
E = Area of the yard originally designated as not requiring excavation

Then:

A1 = D′

A2 = D- D′ (D′ ≤ D)
A2 = 0 (D′ > D)

A3 = E (D′ ≤ D)
A3 = E – (D′ - D) (D′ > D)

Action Levels for arsenic and lead, as designated in the ROD, are 120 mg/Kg and 1000 mg/Kg, respectively. Those properties that contain area-weighted concentrations below the action levels may be considered protective of human health.

Backfill Chemistry:

At the time of remedy implementation, two types of backfill (gravel and growth media) were used. Select fill placement was determined by reclamation type. However, exact areas of backfill using (1) gravel fill and (2) growth media fill were not recorded. Prior to fill placement, backfill was analyzed for arsenic and lead concentrations. Since the gravel and growth media backfill types contain different contaminant concentrations, the area-weighted mean calculations were run using three different concentrations values for arsenic and lead backfill, including:

1. An *average* of the gravel fill and growth media arsenic and lead concentrations.
2. The *greater* of the gravel fill and growth media arsenic and lead concentrations.
3. The *smaller* of the gravel fill and growth media arsenic and lead concentrations.

Results remained the same for all scenarios; the number of properties with contaminant concentrations above the action level did not vary. Thus, the greatest backfill concentration was applied to maintain conservative results.

Results of Evaluation

Results of the area-weighted mean arsenic and lead calculations are summarized in Table 2 below.

TABLE 1: Data Provided by CDM

Property No.	Property Area included in Design Excavation				Backfill Concentration				Property Areas not Included In Design Excavation		
	Design Excavation Area	Pre-Excavation AWA Concentrations		Actual Area Excavated	Growth Media		Gravel		Area	Excluded Area AWA Concentrations	
		As	Pb		As	Pb	As	Pb		As	Pb
	(sq ft)	(mg/kg)	(mg/kg)	(sq ft)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(sq ft)	(mg/kg)	(mg/kg)
	D	C2	C2	D'	C1	C1	C1	C1	E	C3	C3
1	163,879	980	1,120	7,178	5.8	19.3	86.1	52.1	50,000	55	74
2	2,414	5,850	2,530	2,764	5.8	19.3	86.1	52.1	47,851	78	60
3	16,823	271	2,487	30,213	5.8	19.3	86.1	52.1	50,423	27	59
4	18,752	123	294	20,333	5.8	19.3	86.1	52.1	2,353	29	88
5	98,440	1,090	776	57,879	5.8	19.3	86.1	52.1	0		
6	23,311	463	424	15,155	5.8	19.3	86.1	52.1	60,092	74	79
7	1,450	161	1,269	5,755	5.8	19.3	86.1	52.1	86,601	64	69
8	2,777	409	3,763	7,580	5.8	19.3	86.1	52.1	97,362	63	89
9	39,343	131	424	33,607	5.8	19.3	86.1	52.1	0		
10	47,861	537	477	2,063	5.8	19.3	86.1	52.1	32,618	61	79
11	15,565	1,743	2,458	13,435			86.1	52.1	0		

AWA = Area weighted average
As = Arsenic
Pb = Lead

TABLE 2: Property Area-weighted Concentration using *greatest* backfill concentration

Property No.	TOTAL DESIGNATED PROPERTY AREA	Remediated Soil			Design Excavation Area That Was Not Remediated			Soils Not Scheduled for Excavation that Remain Undisturbed			AREA-WEIGHTED CONCENTRATION		ABOVE ACTION LEVEL?	
		Actual Excavation Area	Backfill Concentration (Gravel) [2]		Area	Pre-Excavation AWA Concentration		Area	Concentration		As	Pb	As	Pb
	(sq ft)	(sq ft)	As (mg/kg)	Pb (mg/kg)	(sq ft)	As (mg/kg)	Pb (mg/kg)	(sq ft)	As (mg/kg)	Pb (mg/kg)	(mg/kg)	(mg/kg)	120 mg/kg	1000 mg/kg
	~	A1	C1	C1	A2	C2	C2	A3	C3	C3	~	~	~	~
1	213,879	7,178	86.1	52.1	156,701	980	1,120	50,000	55	74	734	840	**YES**	NO
2[1]	50,265	2,764	86.1	52.1	0	5,850	2,530	47,501	78	60	78	60	NO	NO
3[1]	67,246	30,213	86.1	52.1	0	271	2,487	37,033	27	59	54	56	NO	NO
4[1]	21,105	20,333	86.1	52.1	0	123	294	772	29	88	84	53	NO	NO
5	98,440	98,440[3]	86.1	52.1	0	---	---	0			86.1[3]	52.1[3]	NO[3]	NO[3]
6	83,403	15,155	86.1	52.1	8,156	463	424	60,092	74	79	114	108	NO	NO
7[1]	88,051	5,755	86.1	52.1	0	161	1,269	82,296	64	69	65	68	NO	NO
8[1]	100,139	7,580	86.1	52.1	0	409	3,763	92,559	63	89	65	86	NO	NO
9	39,343	33,607	86.1	52.1	5,736	131	424	0			93	106	NO	NO
10	80,479	2,063	86.1	52.1	45,798	537	477	32,618	61	79	333	305	**YES**	NO
11	15,565	13,435	86.1	52.1	2,130	1,743	2,458	0			313	381	**YES**	NO

[1] - Actual area remediated is greater than design area; assumed 100% of design excavation remediated.Remediation did not occur outside of property boudary, but bled into "Property Areas Not Included in Design Excavation"
[2] - Greatest backfill concentration, that of the gravel, is applied for conservatism.
[3] - Property remediated under EPA Removal Program; backfill chemistry unknown.

APPENDIX D

Photo Log

Upper Tenmile Creek Mining Area Photo Log

Photo No.1: Remediated Residential Yard, Rimini; View to North.

Photo No 2: Remediated Residential Yard, Rimini; View to Southwest.

Photo No 3: Remediated Residential Yard, Rimini; View to Northwest.

Photo No. 4: Unremediated Rimini Road. View to North.

Photo No. 5: Community Waste Water Facility; Under Construction. View to North.