Fifth Five-Year Review Report

Anaconda Smelter Superfund Site
Anaconda-Deer Lodge County, Montana

CERCLIS ID: MTD093291656

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9/25/15

Executive Summary

This report documents the fifth five-year review conducted by the U.S. Environmental Protection Agency (EPA), Region 8, for the Anaconda Smelter National Priorities List (NPL) site (the Site) in Deer Lodge County, Montana. The trigger for this review was the fourth five-year review completed in September 30, 2010. An addendum to the fourth five-year review was prepared in December 2013 based on additional information gathered and work completed in the 2010 to 2013 timeframe. This report evaluates and documents response actions designed, in place, or under construction at the Site and assesses whether or not the implemented actions are protective of human health and the environment. The Site Five-Year Review Summary form is included at the end of this Executive Summary.

Large scale smelting and concentrating operations were conducted at the Site for over 100 years. Smelter emissions dispersed contaminants elevated in arsenic and metals over more than 300 square miles. Large amounts of slag and tailings were also produced. Current estimated waste volumes at the Site include 230 million cubic yards (mcy) of tailings, 30 mcy of slag, and 500,000 cy of flue dust. Approximately 20,000 acres of soil were severely impacted by airborne emissions and millions of gallons of ground water were polluted. The milling and smelting contaminants pose well documented risks to human health and the environment.

The Site was placed on the NPL in 1983 and remedies were selected as documented by multiple records of decision (ROD) for the following five operable units (OUs):

- OU 15 Mill Creek - 1987;
- OU 11 Flue Dust - 1991;
- OU 7 Old Works/East Anaconda Development Area (OW/EADA) - 1994;
- OU 16 Community Soils – 1996 and 2013 (ROD Amendment), and;
- OU 4 Anaconda Regional Water, Waste & Soils (ARWW&S) – 1998 and 2011 (ROD Amendment).

To date, remedial action to address Site contaminants has been implemented on more than 340 residential properties and for more than 11,500 acres of open space. Remedial action is ongoing at OUs 7-OW/EADA, 16-Community soils and 4-ARWW&S. In addition, site-wide activities affecting all of the OUs, including final institutional controls (ICs), operations and maintenance (O&M), and ground and surface water remedies, are ongoing. Remedy protectiveness as determined during this five-year review is summarized below.

OU 15 Mill Creek

The remedy for the Mill Creek OU currently protects human health because former Mill Creek residents were permanently relocated from the site and soils were temporarily stabilized to limit fugitive dust. However, for the remedy to be protective in the long term, final soil remediation under ARWW&S OU RDU 6 South Opportunity Uplands must be implemented and the final Institutional Controls Implementation and Assurance Plan (ICIAP) must be completed and implemented (including long-term funding) at the NPL site.

OU 11 Flue Dust

The remedy for the Flue Dust OU currently protects human health and the environment because, the waste has been treated (stabilized) to below Toxicity Characteristic Leachate Procedure (TCLP) standards for arsenic, cadmium and lead, and has been encapsulated within a lined repository with access strictly controlled by fencing, gates, and security. However, for the remedy to remain protective in the long-term, corrective actions must be taken to eliminate seasonal ground water from entering the repository and a leachate management plan must be completed and implemented to properly manage the leachate.

OU 7 OW/EADA

The remedy at OW/EADA OU is expected to be protective of human health and the environment upon completion of remaining remedial actions at the OU, including capping of the following parcels (McDowell, Kittleson, Warner and RDM), and access control of the Historic Structure Area. Additionally, a final ICIAP and final Golf Course O&M plan must be completed and implemented (including long-term funding). In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks in these areas.

OU 16 Community Soils

The remedy for the Community Soils OU is not protective because exposure to lead contamination in residential soil and dust is not currently controlled. The following actions need to be taken (implementation of the 2015 Residential Soil/Dust Remedial Action Work Plan and completion and implementation (including long-term funding of the final ICIAP) to ensure protectiveness.

OU 4 ARWW&S

The remedy at the ARWW&S OU is expected to be protective of human health and the environment upon completion of the remaining remedial actions including soil reclamation and storm water controls for the RDUs (1, 2, 3, 6, 7, 9, 14, 15, and West Galen), and removal of tailings along Warm Springs Creek. Completion and implementation of either a re-use or closure plan for the remaining slag piles (Main Granulated Slag, West Stack Slag, and landfill) must be completed and implemented. Additionally, the final ICIAP must be completed and implemented (including long-term funding) at the NPL site. In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks in these areas.

The 2015 Five-year Review identified seven issues regarding remediation and protectiveness. Table ES-1 presents the recommendations and follow-up actions for these issues and provides a milestone date for their resolution.

Table ES-1 Recommendations and Follow-up Actions for Issues Identified 2015 Anaconda Smelter NPL Site Five-Year Review

Issue	Recommendations and Follow up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future (if not addressed)
1. Long-term effectiveness of ADLC's Institutional Controls program. **OU16 Community Soils, OU7 OW/EADA, OU4 ARWW&S, OU 15 Mill Creek**	A, Finalize ICIAP	Anaconda – Deer Lodge County (ADLC)/Atlantic Richfield	EPA/DEQ	June 2016	No	Yes
	B. Implement and fund ICIAP	ADLC/Atlantic Richfield	EPA/DEQ	June 2016	No	Yes
2. Unexpected leachate production in the Flue dust repository. **OU11 Flue Dust**	A. Implement corrective actions under O&M to address seasonal shallow groundwater influx to the repository.	Atlantic Richfield	EPA/DEQ	June 2017	No	Yes
	B. Develop and implement leachate management plan.	Atlantic Richfield	EPA/DEQ	June 2016	No	Yes
3. Develop slag as a resource, or complete closure of slag piles. **OU4 ARWW&S.**	Assess efficacy of current BMPs. Complete a plan and schedule to develop the Main Granulated, West Stack and Anaconda Landfill Slag piles and initiate closure.	Atlantic Richfield	EPA/DEQ	June 2016	No	Yes
4. Potential ecological risk in upland areas with elevated lead contamination. **OU4 ARWW&S.**	Evaluate terrestrial risk due to lead in surface soils in upland areas.	Atlantic Richfield	EPA/DEQ	June 2016	No	Yes
5. Complete remaining remedial actions, **OU16 Community Soils, OU7 OW/EADA, OU4 ARWW&S OU.**	A. Implement Residential Soils Remedial Action Work Plan.	Atlantic Richfield	EPA/DEQ	December 2021	No	Yes
	B. Complete and implement remaining OW/EADA ISWPs (McDowell, Kittleson, Warner and RDM)	Atlantic Richfield	EPA/DEQ	December 2016	No	Yes

Issue	Recommendations and Follow up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future (if not addressed)
	C. Implement remaining ARWW&S RDU remedial action work plans for RDUs 1, 2, 3, 6, 7, 9, 10, 14, 15, and West Galen.	Atlantic Richfield	EPA/DEQ	December 2025	No	Yes
6. Long-term operations and maintenance of the Old Works Golf Course as a cap over waste. **OU7 OW/EADA**	Complete and implement (including funding) the Old Works Golf Course Operations and Maintenance Plan.	Atlantic Richfield	EPA/DEQ	June 2016	No	Yes
7. Access to Old Works Historic Areas with high concentrations of arsenic in soil. **OU7 OW/EADA**	Complete and implement land management plan for the Old Works.	Atlantic Richfield	EPA/DEQ	June 2016	No	Yes

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Anaconda Smelter NPL Site		
EPA ID: MTD093291656		
Region: 8	**State:** MT	**City/County:** Anaconda/Deer Lodge

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** No

REVIEW STATUS
Lead agency: U.S. EPA **If "Other Federal Agency" was selected above, enter Agency name:** NA
Author name (Federal or State Project Manager): Charles Coleman
Author affiliation: U.S. EPA, Region 8.
Review period: 2/1/2015 – 6/1/2015
Date of site inspection: July, August, September, 2014
Type of review: Statutory
Review number: 5
Triggering action date: Previous five-year review report
Due date *(five years after triggering action date)*: 9/30/2015

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
None

Issues and Recommendations Identified in the Five-Year Review:

OU(s): OU16 Community Soils, OU7 OW/EADA, OU4 ARWW&S, OU 15 Mill Creek	**Issue Category:** Institutional Controls			
	Issue: Long-term effectiveness of Anaconda Deer Lodge County's (ADLC's) Institutional Controls (ICs) program.			
	Recommendation: Finalize the Institutional Controls Implementation and Assurance Plan (ICIAP) and implement program. Ensure that the ICs program has adequate funding.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	ADLC/Atlantic Richfield	EPA/DEQ	June 2016

OU(s): OU11 Flue Dust	**Issue Category:** Operations and Maintenance			
	Issue: Unexpected leachate production in the Flue dust repository.			
	Recommendation: Implement corrective actions under O&M to address seasonal shallow groundwater influx to the repository. Develop and implement leachate management plan.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Atlantic Richfield	EPA/DEQ	June 2016

OU(s): OU4 ARWW&S	**Issue Category:** Remedy Performance
	Issue: Develop slag as a resource, or complete closure of slag piles.
	Recommendation: Assess efficacy of current BMPs. Complete a plan and schedule to develop the Main Granulated, West Stack and Anaconda Landfill Slag piles and initiate closure.

Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	Yes	Atlantic Richfield	EPA/DEQ	June 2016

OU(s): OU4 ARWW&S	**Issue Category:** Remedy Performance			
	Issue: Potential ecological risk in upland areas with elevated lead contamination.			
	Recommendation: Evaluate terrestrial risk due to lead in surface soils in upland areas.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Atlantic Richfield	EPA/DEQ	June 2016

OU(s): OU16 Community Soils, OU7 OW/EADA, OU4 ARWW&S	**Issue Category:** Remedy Performance			
	Issue: Complete remaining remedial actions.			
	Recommendation: (A) Implement Residential Soils Remedial Action Work Plan (RAWP); (B) Complete and implement remaining OW/EADA Individual Site Work Plans; and (C) Implement remaining ARWW&S Remedial Design Units RAWPs.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Atlantic Richfield	EPA/DEQ	December 2025

OU(s): OU7 OW/EADA	**Issue Category:** Operations and Maintenance
	Issue: Long-term operations and maintenance of the Old Works Golf Course as a cap over waste.

	Recommendation: Complete and implement (including funding) the Old Works Golf Course Operations and Maintenance Plan.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Atlantic Richfield	EPA/DEQ	June 2016

OU(s): OU7 OW/EADA	**Issue Category:** Site Access/Security			
	Issue: Access to Old Works Historic Areas with high concentrations of arsenic in soil.			
	Recommendation: Complete and implement land management plan for the Old Works.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Atlantic Richfield	EPA/DEQ	June 2016

Protectiveness Statement(s)		
Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
OU15 Mill Creek	Protective	NA
Protectiveness Statement: The remedy for the Mill Creek OU currently protects human health because former Mill Creek residents were permanently relocated from the site and soils were temporarily stabilized to limit fugitive dust. However, for the remedy to be protective in the long term, final soil remediation under ARWW&S OU RDU 6 South Opportunity Uplands must be implemented and the final Institutional Controls Implementation and Assurance Plan (ICIAP) must be completed and implemented (including long-term funding) at the NPL site..		

Protectiveness Statement(s)		
Operable Unit: OU11 Flue Dust	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* NA
Protectiveness Statement: The remedy for the Flue Dust OU currently protects human health and the environment because, the waste has been treated (stabilized) to below TCLP standards for arsenic, cadmium and lead, and has been encapsulated within a lined repository with access strictly controlled by fencing, gates, and security. However, for the remedy to remain protective in the long-term, corrective actions must be taken to eliminate seasonal ground water from entering the repository and a leachate management plan must be completed and implemented to properly manage the leachate.		

Protectiveness Statement(s)		
Operable Unit: OU7 OW/EADA	*Protectiveness Determination:* Undetermined	*Addendum Due Date (if applicable):* NA
Protectiveness Statement: The remedy at OW/EADA OU is expected to be protective of human health and the environment upon completion of remaining remedial actions at the OU, including capping of the following parcels (McDowell, Kittleson, Warner and RDM), and access control of the Historic Structure Area. Additionally, a final ICIAP and final Golf Course O&M plan must be completed and implemented (including long-term funding). In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks in these areas.		

Protectiveness Statement(s)		
Operable Unit: OU16 Community Soils	*Protectiveness Determination:* Not Protective	*Addendum Due Date (if applicable):* NA
Protectiveness Statement: The remedy for the Community Soils OU is not protective because exposure to lead contamination in residential soil and dust is not currently controlled. The following actions need to be taken (implementation of the 2015 Residential Soil/Dust Remedial Action Work Plan and completion and implementation (including long-term funding) of the final ICIAP) to ensure protectiveness.		

Protectiveness Statement(s)		
Operable Unit: OU4 ARWW&S	*Protectiveness Determination:* Undetermined	*Addendum Due Date (if applicable):* NA
Protectiveness Statement: The remedy at the ARWW&S OU is expected to be protective of human health and the environment upon completion of the remaining remedial actions including soil reclamation and storm water controls for the RDUs (1, 2, 3, 6, 7, 9, 14, 15, and West Galen), and removal of tailings along Warm Springs Creek. Completion and implementation of either a re-use or closure plan for the remaining slag piles (Main Granulated Slag, West Stack Slag, and landfill) must be completed and implemented. Additionally, the final ICIAP must be completed and implemented (including long-term funding) at the NPL site. In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks in these areas.		

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Acronyms

ADLC	Anaconda-Deer Lodge County
ARAR	Applicable or Relevant and Appropriate Requirements
ARWW&S	Anaconda Regional Water, Waste & Soils
Atlantic Richfield	The Atlantic Richfield Company
AMC	Anaconda Minerals Company
BMPs	best management practices
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERLCIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFRTAC	Clark Fork River Technical Assistance Committee
CGWA	controlled groundwater area
cfs	cubic feet per second
COC	contaminants of concern
CPMP	Community Protective Measures Program
DPS	Development Permit System
DEQ	Montana Department of Environmental Quality
EAY	East Anaconda Yards
EPA	U.S. Environmental Protection Agency
GIS	geographic information system
HAA	high arsenic areas
IC	institutional control
ICIAP	Institutional Controls Implementation and Assurance Plan
I&M	inspection and maintenance
ISWP	individual site work plans
LOWESS	locally weighted scatterplot smoothing
MBMG	Montana Bureau of Mines and Geology
MCL	Maximum Contaminant Level
mcy	million cubic yards
MDT	Montana Department of Transportation
mg/kg	milligrams per kilogram
NCP	National Contingency Plan
NPL	National Priorities List
NRDP	Natural Resources Damage Program
NWIS	USGS National Water Information System
NWISweb	USGS National Water Information System website

OCPA	Opportunity Citizens Protective Association
O&F	operational and functional
O&M	operation and maintenance
OU	operable unit
OW/EADA	Old Works/East Anaconda Development Area
ppm	parts per million
POC	point-of-compliance
RAO	remedial action objectives
RAWP	Remedial Action Work Plan/Final Design Report
RCRA	Resource Conservation and Recovery Act
RFC	request for change
RFM	request for maintenance
RI/FS	remedial investigation/feasibility study
RD/RA	remedial design/remedial action
RDU	remedial design unit
ROD	record of decision
SAP	sampling and analysis plan
SHOP	Smelter Hill/Opportunity Ponds
SHRC	Smelter Hill Repository Complex
Site	Anaconda Smelter NPL site
SMP	site management plan
SNOTEL	snow telemetry
TAG	technical assistance group
TCLP	Toxicity Characteristic Leachate Procedure
TI	technical impracticability
TMI	total metal index
USDA	US Department of Agriculture
USGS	U.S. Geological Survey
VMP	vegetation management plan
WET	Water Environmental Technologies
WMA	waste management area
µg/L	micrograms per liter

Section 1
Introduction

This report documents the fifth five-year review conducted by the U. S. Environmental Protection Agency (EPA) Region 8 for the Anaconda Smelter National Priorities List (NPL) site (the Site) in Deer Lodge County, Montana. The Comprehensive Environmental Response, Compensation, and Liability Act Information System (CERCLIS) ID for this Site is MTD093291656.

The purpose of the five-year review is to determine whether the remedies or other response actions in place or under construction at NPL sites are protective of human health and the environment. The methods, findings, and conclusions of these reviews are documented in five-year review reports. In addition, five-year review reports make recommendations to address any deficiencies found.

The *Comprehensive Five-Year Review Guidance* (EPA 2001) states that five-year reviews should be conducted either to meet a statutory mandate or as a matter of EPA policy. The EPA must implement a statutory five-year review to be consistent with Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) section 121(c), which states in part:

> *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….*

EPA interprets this requirement further in the National Contingency Plan (NCP) section 300.430(f) (4) (ii) of the Code of Federal Regulations, which 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.*

Based on both CERCLA and NCP requirements, a statutory five-year review is required in 2015 for the Site. The Anaconda Smelter NPL Site consists of five separate remedial operable units (OUs). Remedial actions (RA) for the Mill Creek OU 15 and Flue Dust OU 11 have been implemented. Remedial action work in the Old Works/East Anaconda Development Area (OW/EADA) OU 7, Community Soils OU 16, and Anaconda Regional Water, Waste & Soils (ARWW&S) OU 4 is ongoing. Monitoring and operation and maintenance (O&M) of all implemented actions at the Site are being conducted under the Flue Dust, OW/EADA, and ARWW&S OUs.

This is the fifth five-year review for the Anaconda Smelter NPL Site. The triggering action for this review is the completion of the fourth five-year review on September 30, 2010. The five-year review is required due to hazardous substances, pollutants, or contaminants that remain at the Site above levels that allow for unrestricted use and unlimited exposure.

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Section 2
Site Chronology

Table 2-1 summarizes the important events and relevant dates in the chronology of the Anaconda Smelter NPL Site.

Table 2-1 Chronology of Site Events

Event	Operable Unit	Date
Placer gold discovered in Silver Bow Creek	NA (Not Applicable)	1864
Large scale underground mining in Butte and open pit mining at Berkeley Pit	NA	1875 - 1982
Smelting operations in Anaconda	NA	1890 - 1980
Smelter shutdown/demolition	NA	1980 - 1986
Anaconda Smelter Site listed on the NPL	NA	1983
Mill Creek Operable Unit OU 15 Record of Decision (ROD)	Mill Creek	October 1987
Mill Creek residents temporary and permanent relocation and site demolition	Mill Creek	1986 - 1988
Flue Dust OU 11 ROD	Flue Dust	September 1991
Anaconda Yards Time Critical Removal Action (TCRA) for residential soil removal	---	1991 – 1992
Flue dust treatment and disposal	Flue Dust	1992
Old Works TCRA soil stabilization	---	1992
Arbiter Non-Time Critical Removal Action (NTCRA)	---	1994
Beryllium NTCRA	---	1994
Stucky Ridge remedial action begins	ARWW&S	1994
First five-year review	All	1994
Old Works/East Anaconda Development Area (OW/EADA) OU 7 ROD	OW/EADA	March 1994
OW/EADA OU ESD	OW/EADA	April 1994
Golf course construction in the Old Works area	OW/EADA	1994 - 1997
Red Sands remedial action completed	OW/EADA	1996
Community Soils OU 16 ROD	Community Soils	September 1996
Aspen Hills and East Anaconda Yards remedial action begins	OW/EADA	1996
Anaconda Regional Water, Waste &Soils (ARWW&S) OU 4 ROD	ARWW&S	September 1998
Drag Strip remedial action completed	OW/EADA	1998
Second five-year review	All	1999
Mill Creek final remedial action completed	OW/EADA	1998
Implementation of RA-related storm water controls	ARWW&S	2000
Smelter Hill (RDU 3) remedial action begins in Nazer Gulch	ARWW&S	2001
Anaconda Ponds remedial action completed	ARWW&S	2002 - 2004
Stucky Ridge Area 4 remedial action completed	ARWW&S	2002
Aspen Hills/Loop Track remedial action completed	OW/EADA	2002
Triangle Waste remedial action completed	ARWW&S	2002
Opportunity Ponds reclamation remedial action begins	ARWW&S	2002
Cashman Concentrate remedial action completed	ARWW&S	2003
Removal of contaminated residential soil begins	Community Soils	2002

Table 2-1 Chronology of Site Events

Event	Operable Unit	Date
West Galen remedial action begins	ARWW&S	2005
Third five-year review	All	2005
Reclamation of areas adjacent to railroad begins	ARWW&S	2006
South Opportunity (RDU 6) remedial action begins	ARWW&S	2006
A1 Lumber Area remedial action completed	ARWW&S	2009
Railroad Right of Way (RDU 5) West Valley Railroad Line Removal completed	ARWW&S	2009
Fourth five-year review	All	2010
North Opportunity (RDU 7) remedial action substantially completed	ARWW&S	2009 - 2010
Fluvial Tailings (RDU 9) remedial action begins	ARWW&S	2010
ADLC Property remedial action completed	OW/EADA	2010
Residential Property Remediation Completed (Phase 1)	Community Soils	2010
ARWW&S OU ROD Amendment	ARWW&S	2011
Smelter Hill Facilities (RDU 14) remedial action begins	ARWW&S	2011
Portion of Yellow Ditch remedial action completed (part of RDU 9)	ARWW&S	2011
Powell Vista Area remedial action	ARWW&S	2011
Adjacent to railroad property in Anaconda remedial action completed	Community Soils	2011
Anaconda Local Development Corporation property remedial action completed	OW/EADA	2011 - 2012
Arbiter Industrial Complex properties remedial action completed	OW/EADA	2005 - 2012
Lower Willow Creek remedial action completed (part of RDU 9)	ARWW&S	2012 - 2013
Finalization of the Anaconda Site Vegetation Management Plan (VMP)	All	2013
Multiple Properties in Old Works; remedial action completed	OW/EADA	2012 - 2014
Active Railroad/Blue Lagoon (RDU 5) waste removal and reclamation completed. Includes the following areas: Mill and Willow Creek trestles; Blue Lagoon; Son of Blue Lagoon; Mill Creek Flood Irrigation Area; a portion of the Yellow Ditch; a portion of the East Anaconda Yards; railroad beds within the main portion of the town of Anaconda; West Anaconda Yards; West Valley line, and; and West Valley Historic Railroad Spurs.	ARWW&S	2010 - 2014
Community Soils OU ROD Amendment	Community Soils	2013
Launderville Area remedial action begins	ARWW&S	2014
Opportunity Ponds (RDU 8) remedial action substantially completed	ARWW&S	2004 - 2014

RDU – remedial design unit

OW/EADA – Old Works/East Anaconda Development Area

ARWW&S – Anaconda Regional Water, Waste & Soil

ROD – record of decision

Section 3
Background

3.1 Location and Setting

The Site is located at the southern end of the Deer Lodge Valley. Figure 3-1 shows the location of the Site and its key features. The Site covers an area of approximately 300 square miles and consists of residential, commercial, agricultural (crops), pasture, rangeland, forests, riparian, and wetland areas which have been impacted by the release of smelter fallout and large volumes of ore-processing wastes such as flue dust, mill tailings, and furnace slag. The towns of Anaconda and Opportunity lie within the Site footprint. The Site is currently divided into five OUs, two of which (ARWW&S and OW/EADA) are further divided into smaller units to facilitate remedial design and action.

3.2 History of Contamination

In 1884 the Anaconda Copper Mining Company (ACM) and its predecessors commenced large copper concentrating and smelting operations at the area presently known as the Old Works. Those facilities were located on the north side of Warm Springs Creek adjacent to the town of Anaconda and operated until about 1901. By 1902, ore processing and smelting operations had begun at the Washoe Reduction Works located on Smelter Hill, south of the Old Works and east of the town of Anaconda. That facility was also known as the Anaconda Smelter, the Washoe Smelter, the New Works, and the Anaconda Reduction Works. In 1977, the Atlantic Richfield Company (Atlantic Richfield) purchased ACM and expressly assumed its liabilities, as well as its assets. Operations at the Washoe Smelter ceased in 1980 and the smelter facilities were dismantled soon thereafter. The only substantial feature remaining from the Washoe Smelter facility is the 585-foot tall brick smelter stack.

The nearly 100 years of milling and smelting in Anaconda resulted in the dispersion of significant quantities of arsenic and metals (principally cadmium, copper, lead and zinc) into the environment over a large area. More than 300 square miles of land surrounding the smelter have been affected by operations at the Old Works and Washoe smelters. Estimated waste volumes at the Site include 230 million cubic yards of concentrated mill tailings, 30 million cubic yards of furnace slag, and 500,000 cubic yards of flue dust. In addition to the millions of cubic yards of these wastes, soils over more than 20,000 acres have been severely contaminated by airborne emissions and large portions of the local aquifers have been polluted via the leaching of contaminants from waste materials and the affected soil. These contaminants pose potential risks to human health, to aquatic life, and to the terrestrial flora and fauna. Arsenic is the primary contaminant of concern (COC) and drives the remediation for human health while copper and zinc are major concerns for plants and animals at the Site.

3.3 Regulatory History Summary

The Anaconda Smelter Site was placed on the NPL in September 1983 under the authority of CERCLA. Atlantic Richfield was identified as the principal potentially responsible party. EPA issued both general and special notice letters to Atlantic Richfield on several occasions and Atlantic Richfield has been actively involved in conducting investigations and performing response actions at the Site since that time. EPA is the lead agency and the Montana Department of Environmental Quality (DEQ) is the support agency for remedial actions being conducted at the Site. Because of the size of the former

facilities, the hundred-years of industrial operation, the large volume of wastes, and the wide area of contamination, the Site has been divided into smaller, more manageable OUs, subareas, and remedial design units (RDUs) for purposes of remediation and long-term management.

Section 4

Progress since the Last Five-Year Review

Table 4-1, excerpted from the 2010 Five-Year Review Amendment prepared in December 2013, lists the ten previously identified issues. Each issue is summarized and any actions taken over the last five years to resolve the issue are discussed. Note that the institutional controls (ICs) issue impacts more than one OU. Issues that remain unresolved are included in the 2015 issues and recommendations table provided in the Executive Summary.

4.1 Issue 1: Long-term Effectiveness of the Anaconda Deer Lodge County's IC program

Issue Overview

ICs are a component of all the remedies at the Site. In 2008, Anaconda/Deer Lodge County (ADLC) adopted an interim institutional controls plan (ICP). Under the fourth (2010) five-year review, EPA recognized a need for Atlantic Richfield and ADLC to complete a final ICP and secure long-term funding for ADLC to fully implement ICs. The records of decision (RODs) for the Community Soils OU and ARWW&S OU identified ADLC's Development Permit System (DPS) and Community Protective Measures Program (CPMP) as ICs that notify, inform and educate the public about reducing their exposure to contamination when soils are disturbs or land use changes.

ADLC has made significant progress implementing the interim ICP over the past five years. Appendix D of this report provides ADLC's 2015 five-year review status report of the IC program and Section 11 summarizes ADLC's status report. Progress includes the following.

- ADLC's Superfund Program works closely with the Planning Department to guide developers through the DPS process to ensure developers understand and adhere to Superfund protocol.
- The public recognizes that new domestic wells require a permit through ADLC's Environmental Health Department. In conjunction with the Well Installation Permit, applicants are now required to obtain an Administrative Development Permit through ADLC's Planning Department.
- ADLC's Soil Swap Program has been expanded to include the option of raised structures for residents who want a vegetable garden and/or play area (e.g., sandbox), or have clean topsoil for existing gardens.
- Residents who would like information on their property can contact ADLC. ADLC maintains a geographic information system (GIS) database that tracks whether properties have been sampled and/or remediated. If a property has not been sampled previously, ADLC, in consultation with Atlantic Richfield, can direct soil and interior dust sampling through the "test by request" program. This program will be incorporated into the forthcoming Community Soils OU remedial action work plan, and will continue after that RA has been completed.

Table 4-1 Recommendations and Follow-up Actions for Issues Identified in the *2010 Anaconda Smelter NPL Site Five-Year Review*

Issue	Recommendations and Follow up Actions	Party Responsible	Milestone Date	Affects Protectiveness (Y/N)		Completed (Y/N)	Carry Over to 2015 (Y/N)
				Current	Future		
1. Long-term effectiveness of the County's IC program. **OU16 Community Soils, OU7 OW/EADA, OU4 ARWW&S, OU 15 Mill Creek**	Finalize Anaconda Deer Lodge County's (ADLC's) Institutional Controls Plan and implement program.	ADLC/ Atlantic Richfield	Dec 2011	No	Yes	No	Yes
2. Unexpected leachate production in the Flue dust repository **OU11 Flue Dust**	Evaluate Flue Dust repository performance to determine if the repository is functioning as designed.	Atlantic Richfield	Dec 2011	No	Yes	No	Yes
3. Risk to trespassers on uncovered wastes left in place for historic preservation. **OU7 OW/EADA**	Determine if uncovered wastes pose an unacceptable risk to users and determine if additional action is necessary.	Atlantic Richfield	Dec 2011	No	Yes	No	Yes
4. Buried waste and debris limiting redevelopment in the East Anaconda Yards. **OU7 OW/EADA**	Investigate nature and extent of buried waste/debris and develop an appropriate redevelopment plan for the East Anaconda Yards.	EPA/ADLC	June 2011	No	No	Yes	No
5. Risk of remaining contaminants in residential settings (lead in soils; arsenic at depth in soil; arsenic and lead in interior dust). **OU16 Community Soils**	Determine if remaining contaminants pose an unacceptable risk to residents and determine if additional remedial action is necessary.	EPA/DEQ	June 2011	No	Yes	Yes	No
6. Uncontrolled use of contaminated ground water. **OU4 ARWW&S**	Develop and implement appropriate controls to prevent exposure to ground water exceeding the arsenic drinking water standard	Atlantic Richfield	Dec 2011	Yes	Yes	Yes	No
7. Unsuccessful treatment of the Milltown Reservoir sediments in providing a vegetative cover for the Opportunity Tailings Ponds. **OU4 ARWW&S**	Complete investigations and determine if the Milltown sediments can be successfully treated and utilized in a cover design.	Atlantic Richfield	Dec 2011	Yes	Yes	Yes	No
8. Concerns with phytotoxicity and the long-term permanence of vegetation in soil areas. **OU4 ARWW&S**	Determine why certain in-situ treated areas have poor plant establishment and determine if reclamation is functioning as designed.	Atlantic Richfield	June 2012	No	Yes	Yes	No

Issue	Recommendations and Follow up Actions	Party Responsible	Milestone Date	Affects Protectiveness (Y/N)		Completed (Y/N)	Carry Over to 2015 (Y/N)
				Current	Future		
9. Buried Yellow Ditch wastes northwest of Fairmont. **OU4 ARWW&S**	Remove waste materials in accordance with approved RAWP.	Atlantic Richfield	June 2011	Yes	Yes	Yes	No
10. Railroad grade from Anaconda to Georgetown built of mine waste. **OU4 ARWW&S**	Evaluate nature and extent of contamination and determine if wastes pose an unacceptable risk. Determine if additional remedial action is necessary under the Anaconda Smelter Site.	Atlantic Richfield	June 2012	No	Yes	Yes	No

The oversight agency for all issues is the U.S. Environmental Protection Agency (EPA) and the Montana Department of Environmental Quality (DEQ)

- In cooperation with the ADLC's Public Health Department, the CPMP now: 1) helps facilitate blood lead and urinary arsenic testing; 2) has a home renovation program, which includes a free HEPA-vacuum loaner program as well as home renovation starter kits; 3) has a potable well water program, developed in conjunction with the DPS, that helps county residents obtain information about the quality of their well water; and 4) is offering a noxious weed spraying reimbursement program to eligible property owners located within and adjacent to the Superfund Overlay District. 2015 will be the first year that the CPMP has been advertised with promotional and educational mailers sent to eligible property owners; so far the public's response has been positive.

Progress/Resolution/Recommendations

Despite progress, the long-term effectiveness of ADLC's ICs program remains questionable until final funding settlements between Atlantic Richfield and ADLC are completed. Given the progress to date on finalizing the Institutional Controls Implementation and Assurance Plan (ICIAP), DPS, and CPMP, EPA believes that the two parties can reach a settlement in 2016; however, ICs are considered an issue for the 2015 five-year review because the final IC program components are not finalized and the settlement has not been reached at this time.

4.2 Issue 2: Unexpected Leachate Production in the Flue Dust Repository

Issue Overview

Groundwater associated with the Flue Dust Repository is monitored annually. Section 6 in this five-year review report provides a discussion of ground water data trends over the monitoring period. Based on elevation trigger levels, contaminated leachate is periodically pumped (i.e., removed) from within the repository. This excess water was initially assumed to be from precipitation that fell during construction or water used to stabilize the waste during construction, and that leachate production would decrease over time and that extraction could be discontinued. However, after more than 10 years of extraction the leachate continues to be produced, indicating that another continuous source of water is likely entering the repository. As an example of the magnitude of this problem, a total of 779,629 gallons of leachate was pumped from the Flue Dust Repository during the third and fourth quarters of 2014.

Progress/Resolution/Recommendations

Several investigations were completed within the last five years but the results have not been definitive in terms of the source of the additional water. Therefore, no plans are currently in-place to attempt to lessen the influx of water to the repository. Atlantic Richfield has submitted a draft alternatives analysis to EPA and DEQ outlining potential corrective action measures to address this issue.

Disposal of large volumes of contaminated leachate will become problematic as RAs are completed for the waste management area currently used to dispose of this effluent. For the remedy to remain protective in the future, the repository must continue to meet the performance requirements and the leachate must be properly managed. To accomplish this, corrective actions should be taken under the existing operations and maintenance program to address excessive leachate production. Because a

work plan to address continued leachate generation has not been completed, contaminated leachate from the Flue Dust Repository is considered an issue for this 2015 five-year review.

4.3 Issue 3: Risk to Trespassers from Uncovered Wastes Left in Place

Issue Overview

The site inspection completed for the 2010 five-year review indicated that the general public has access to historic preservation areas within the OW/EADA OU where ore-processing wastes (e.g., waste rock, mill tailings, and smelter slag) are present and that trespassing has occurred. The report identified Atlantic Richfield as the entity responsible for implementing measures if that was necessary to protect the public from exposure to the waste material.

The area of concern is referred to as the Old Works Historic District. It lies on the hill slope up-gradient of the golf course in Subarea 1 of the OW/EADA OU. Based on historical documentation and the 2010 five-year review inspection, the area contains large volumes of various wastes and debris that originated from copper ore milling, smelting, and refining operations at the Site from 1884 to 1902. The smelters in the area were connected to brick stacks atop adjacent hills by masonry flues. A railroad line was constructed in part with ore-processing wastes and traverses the Site. Dismantling of the facilities started in 1902 and was completed about 1906. Structural remains today consist primarily of building footings and brick rubble. The historical data record indicates that the Old Works Historic District contains a variety of ore-processing waste materials and highly contaminated native soil.

Progress/Resolution/Recommendations

In November 2010, EPA estimated that there were between 60,000 and 75,000 cubic yards of contaminated waste in this area. Previous sampling results located in the historic sampling data base indicate numerous exceedances of the arsenic cleanup level of 1,000 milligrams per kilogram (mg/kg) for recreational/open space/agricultural land use areas. Atlantic Richfield's review of the historic data (published in the Old Works golf course construction completion report shows that while there still may be the potential for waste materials that exceed the 1,000 mg/kg cleanup standard to be present, the majority of the wastes exceeding that level were remediated under previous actions.

Concurrent with ongoing investigations and analysis of the Miscellaneous Waste piles, EPA and Atlantic Richfield evaluated long-term monitoring requirements under the Site Management Plan, which will be attached to the forthcoming Anaconda Consent Decree. In February 2013, EPA and Atlantic Richfield agreed that an Old Works Land Management Plan (attached to the Site Management Plan/Consent Decree) would be used to describe site access, restrictions, fencing/signage, maintenance, inspection, and other land management requirements and activities that will be completed to minimize trespasser exposure to historic contaminated materials. Atlantic Richfield is making considerable progress on the Old Works Land Management Plan and anticipates that it will be completed ahead of the Consent Decree. Accordingly, EPA does not consider this an issue for this 2015 five-year review.

4.4 Issue 4: Buried Wastes and Debris Limiting Redevelopment in the East Anaconda Yards

Issue Overview

Although the East Anaconda Yards is part of a designated Waste Management Area, its proximity to the community led it to be identified in the OW/EADA OU ROD as an area prioritized for future development. In 2004, workers excavating a building foundation in the East Anaconda Yards encountered buried beryllium wastes. While mining wastes are expected to be present at the East Anaconda Yards, encountering wastes that are determined to be hazardous by EPA was unexpected. Consequently, the 2005 Third five-year review identified investigating the potential for additional buried beryllium or other hazardous wastes in the East Anaconda Yards. Because the East Anaconda Yards is property that was conveyed by Atlantic Richfield to ADLC, the 2005 Third five-year review tasked ADLC to resolve this issue.

Progress/Resolution/Recommendations

ADLC conducted an environmental review of the Site and then completed an East Anaconda Re-Use Plan to allow development in the East Anaconda Yards in consideration of existing waste materials and other hazards. Under the plan, any encountered hazardous wastes will be addressed by Atlantic Richfield.

4.5 Issue 4: Risk of Residual Contaminants in Residential Settings

Issue Overview

The 2005 five-year review identified work needed to address human health risks from exposure to lead in soils and arsenic and lead in dust in the residential setting. Work activities included sampling by EPA to evaluate arsenic and lead concentrations in soils from 2 to 18 inches below the surface, interior dust sampling and analysis of a representative 52 homes in the Anaconda area, and the analysis of 10 percent of archived samples collected from unremediated (e.g., residential yards where the 0 to 2 inch soil sample area-weighted average arsenic concentrations were less than 250 mg/kg) yards for lead. Data from these studies were analyzed by EPA and are summarized in the *Residential Soils Data Interpretation and Analysis Report* (CDM 2008).

Progress/Resolution/Recommendations

In 2011, EPA conducted a focused feasibility study to evaluate combinations of excavation and ICs to address the lead contamination in soils. The focused feasibility study also addressed interior dust in living spaces and attics. Different cleanup levels for lead were evaluated based on the acceptable range of lead preliminary remedial goals. The three alternatives that were evaluated in the study were then presented in modified form in EPA's *September 2012 Proposed Plan for an Amendment to the Community Soils Operable Unit Record of Decision* (EPA 2012).

After receiving public comment, EPA identified a Selected Remedy for lead in soils and lead and arsenic in accessible interior dust. The 2013 Community Soils OU ROD Amendment requires cleanup of lead in soils in yard components (e.g., front yards, back yards, gardens) to a depth of 12 inches if the residential action level of 400 mg/kg lead is exceeded. Arsenic concentrations that exceed the area-weighted average cleanup level of 250 mg/kg will continue to be remediated as provided in the 1996 Community Soils OD ROD. Accessible interior dust that exceeds the arsenic and lead cleanup levels will also be remediated. ICs will be expanded to include lead cleanup and public health education and outreach concerning lead.

In May 2015, EPA received the Draft Final Residential Soils/Dust Remedial Action Work Plan/Final Design Report (RAWP/FDR) from Atlantic Richfield that addresses additional soil and dust remediation in residential soils pursuant to the 2013 Community Soils OU ROD Amendment (Atlantic Richfield 2015a). EPA has approved that plan (with comments) and indicated to Atlantic Richfield to revise/finalize the plan and then move forward with the RA work.

Atlantic Richfield has begun gathering data on the presence of sensitive populations within the homes (e.g., pregnant women and/or children 12 years of age or younger) as well as age of homes and activities/circumstances that may result in exposure to attic dust. This information will be used to aid in prioritizing residential yards for sampling, with the highest priority for sampling given to residences with the highest lead concentrations in conjunction with presence of sensitive populations. Following receipt of completed access agreements and surveying of individual residences (if necessary), sampling will be scheduled. Soil and dust sampling requests will be accepted until December 31, 2020. Past this date, additional sampling requests will be addressed by Atlantic Richfield or its contractor in accordance with the requirements of the forthcoming ICIAP. After data validation activities are complete, results for all analyses (arsenic and lead) will be reported to each individual landowner and RA will be initiated following approval of the individual site work plans (ISWPs) by the Agencies and receipt of RA access agreements. Sampling will begin in 2015 and RA construction will begin no later than the 2016 construction season.

Based on the plans being implemented to address the soil and dust contamination in residential settings, EPA does not consider this an issue for the 2015 five-year review. This RA program will, of course, be subject to the next five-year review.

4.6 Issue 6: Uncontrolled Use of Contaminated Ground Water

Issue Overview

The 2010 five-year review report stated that the "use of contaminated ground water (and surface water) is currently not completely controlled in the rural areas of the Site. The full implementation of the well drilling provisions of ADLC's development permit system and designation of a controlled ground water area (CGWA) by the Department of Natural Resources and Conservation are expected to significantly strengthen the ability of the County and State to prevent the use of contaminated water."

In 2009, the Montana Bureau of Mines and Geology (MBMG), under contract to Atlantic Richfield, initiated a program using the interim Domestic Well Monitoring and Well Replacement Plan (Atlantic Richfield 2009) that was agreed upon by EPA, DEQ, and Atlantic Richfield. Components of this plan included the following.

- All domestic wells within the identified Domestic Well Area of Concern, where access is granted, will be sampled, at a minimum, once every five years.

- Domestic wells with a total recoverable arsenic concentration of less than 5.0 micrograms per liter (µg/L) will be sampled once every 5 years. Domestic wells with a total recoverable arsenic concentration between 5.0 and 10.0 µg/L will be sampled annually until the total recoverable arsenic result drops below 5.0 µg/L. Any domestic well with a total recoverable arsenic result greater than 10 µg/L will be a candidate for replacement.

- All confirmed domestic well results over 10.0 µg/L total recoverable arsenic will result in developing a plan and schedule for replacing the well.

Progress/Resolution/Recommendations

To date, 5 wells have been replaced; however, 4 replacement attempts were unsuccessful because either arsenic was greater than 10 µg/L in the new well or the replacement well was unproductive. Thus, EPA has decided that reverse osmosis treatment systems will be installed in residences with well water with greater than 10 µg/L arsenic in lieu of attempting to drill a new well.

Through 2014, MBMG has investigated at least 810 properties and has sampled 606 domestic wells within and outside of the area of concern. Thirteen reverse osmosis point-of-use treatment units have been installed where clean ground water was unavailable.

In May 2015, Atlantic Richfield submitted the *Final Long-Term Groundwater Monitoring Program Plan* and *Draft Final Domestic Well Monitoring Program Quality Assurance Project Plans* (Atlantic Richfield 2015b and c). These documents provide the long-term strategy for managing, monitoring, and evaluating groundwater quality within the ARWW&S OU, including monitoring domestic well water quality and providing alternatively supplied water, if necessary, if water used for domestic consumption exceeds the water quality standards. EPA has approved these documents and expects that they will be attached to the forthcoming site-wide Ground Water Management Plan.

Based on the progress made to date, the monitoring program in place, and the plans being finalized, the uncontrolled use of contaminated ground water at the Site is no longer an issue that could adversely impact human health. Therefore, EPA does not consider this an issue for the 2015 five-year review. Ground water quality in domestic wells will continue to be monitored and those data will be reviewed at the next five-year review.

4.7 Issue 7: Unsuccessful Treatment of the Milltown Reservoir Sediments

Issue Overview

EPA inspections prior to the 2010 five-year review indicated that the latest seeding attempt resulted in very poor germination and virtually no plant establishment in the area of the Opportunity Tailings Pond waste management area (WMA) where Atlantic Richfield had used Milltown Reservoir sediments as cover soil. The 2010 five-year review report stated that for the remedy to be protective in the long-term, remedial design and action activities must include development of a final vegetation cover for the Milltown sediments being disposed of within the Opportunity Tailings Pond WMA. The recommendation was for Atlantic Richfield to complete on-going investigations and determine if the Milltown sediments could be successfully treated and utilized in a cover design.

Progress/Resolution/Recommendations

As a result of the Atlantic Richfield investigations, a final engineered cover remedy was approved by EPA for areas covered with Milltown Sediments (Atlantic Richfield 2012b). That engineered cover would consist of 6 inches of Milltown Sediments treated with alkaline amendments underlying 12 inches of soil meeting cover soil requirements as specified in the ARWW&S OU ROD. Atlantic Richfield's greenhouse studies specifically found that the combination of lime-treated Milltown Sediments and cover soil: 1) supported significantly better plant growth and rooting characteristics than untreated sediments alone, 2) supported plant root and shoot growth comparable to that on a

simulated 18-inch cover meeting ARWW&S ROD soil quality criteria, and 3) was the best performing cover configuration of all layered combinations evaluated.

Cover construction activities associated with the Milltown Sediments began on June 28, 2012 and were completed on January 23, 2014. Reseeding was completed on May 30, 2014 and documented in the construction completion report (Atlantic Richfield 2014a). Atlantic Richfield included these areas in their annual evaluation of revegetated areas at the Site (Atlantic Richfield 2015d) and inspections by EPA in 2014 indicated that the seeded vegetation was becoming established. Operational and functional (O&F) inspections of these areas were conducted in 2015 and determined that all of the areas met the O&F criteria. It is expected that the seeded vegetation will become well-established in all areas and eventually meet the compliance performance standards identified in the vegetation monitoring plan (VMP).

Based on the progress made to date, EPA no longer considers this a protectiveness issue and has not identified it as such in this 2015 five-year review. Atlantic Richfield and EPA will conduct inspections of these areas in the coming years and those findings will be presented in the annual vegetation monitoring reports.

4.8 Issue 8: Concerns with Long-Term Permanence of Vegetation in Treated Soil Areas

Issue Overview

A primary issue for the remedial action areas in RDU 1, RDU 6, and West Galen is the stressed vegetation and barren areas in certain locales. Based on decades of revegetation work at the Site and the results of the 2010 five-year review inspection, impairment of vegetation growth on reclaimed areas may be due to inadequate soil pH control during the reclamation process or the residual concentration of metals in the soil. Research at the Site over the past 30 years indicates that reduced soil pH caused by historic smelting sulfur dioxide fumigation is the primary plant growth limiting factor. Additionally, if the bioavailable soil concentrations of arsenic and metals are highly elevated, there is the potential for adverse effects on plant growth (by both direct and indirect mechanisms) and attainment of remediation goals regardless of soil pH levels.

Progress/Resolution/Recommendations

Due to these concerns, an investigation was undertaken at the Anaconda Smelter Site in 2011 to evaluate plant and soil relationships, residual (i.e., post-soil treatment) soil phytotoxicity, and remedy permanence on in-place remediated lands. Specific objectives of the investigation included an attempt to determine the 1) low concentrations of soil metals and arsenic at which plant effects can be observed or measured and 2) the concentration of soil metals and arsenic that may imperil the success of reclamation efforts in upland.

Results of the study are documented in a final report (EPA 2013a). The results of the study were used to develop a soil total metal index and revise the VMP (Atlantic Richfield 2013b). The final VMP includes the categorization of remediated upland properties within the ARWW&S OU based on land use and the residual total metals present in remediated soils. These categories identify specific vegetation performance standards, as well as long-term inspection, monitoring and maintenance requirements, for the remediated areas within the Site

4.9 Issue 9: Buried Yellow Ditch Wastes

Issue Overview

The Yellow Ditch is a historic ditch that was used by the Anaconda Copper Mining Company to transport tailings from Silver Bow Creek to the Opportunity Tailings Pond for disposal during the first half of the 20th century. Those operations left significant amounts of tailings within the ditch and in adjacent berms generated from cleanout. The 1998 ARWW&S OU ROD Selected Remedy required remediation of contaminated portions of the Yellow Ditch, specifying an engineered soil cover. During remedial design, excavation and removal plans for portions of the Yellow Ditch were developed as part of the RA work plans for RDU 5 Active Railroad/Blue Lagoons and RDU 9 Silver Bow Creek Fluvial Tailings.

In 2009, DEQ conducted soil borrow operations on the Peterson Ranch (in RDU 5 Active Railroad/Blue Lagoons) as part of their ongoing remediation and restoration efforts for the nearby Streamside Tailings OU of the Silver Bow Creek/Butte Area NPL Site. DEQ encountered buried Yellow Ditch waste materials in their borrow operations and hauled approximately 16,000 cubic yards of wastes to the Opportunity Ponds for disposal. However, significant amounts of buried waste remained outside the reclaimed borrow area, leading EPA to identify this as an issue under the 2010 five-year review.

Progress/Resolution/Recommendations

In 2011 EPA amended the ARWWS OU Record of Decision to remove the entire Yellow Ditch waste material. Yellow Ditch waste materials located within RDU 5 Active Railroad/Blue Lagoons have been removed since the last (2010) five-year review. For the Yellow Ditch waste materials located on the Peterson Ranch, Atlantic Richfield implemented RA work and produced a construction completion report in 2013 (Atlantic Richfield 2013b). In 2014, EPA conducted an O&F inspection of the construction areas and found that the reestablishment of vegetation following the removal of waste material and cover soil application had been successful. Therefore, EPA no longer considers this a protectiveness issue and has not identified Yellow Ditch waste material as an issue in this 2015 five-year review. Atlantic Richfield and EPA will conduct inspections of the Yellow Ditch reclamation area and those findings will be presented in the next five-year review report.

4.10 Issue 10: Georgetown Railroad Grade Built of Mine Waste

Issue Overview

The historic Georgetown Railroad is an abandoned railroad bed that was used from approximately 1912 to 1924 to haul materials from the Southern Cross mine near Georgetown Lake to the Anaconda Company smelter in Anaconda, Montana. Soil sampling showed that the entire railroad bed was constructed using mill tailings and other ore-processing wastes, in addition to the cut and fill of native soil and rock. For RA purposes, the railroad line has been separated into a section referred to as the West Valley Line that runs from the western edge of Anaconda to the Lime Quarry located north of North Cable Road, a distance of approximately 5.1 miles. The second section, referred to as the Georgetown Railroad Bed, extends from the West Valley Line to the historic Georgetown/Silver Lake area, a distance of approximately 10.5 miles. From there the railroad bed has been remediated as part of the Southern Cross Removal Action (EPA/US Department of Agriculture [USDA]).

Progress/Resolution/Recommendations

Since the 2010 five-year review, RA has been completed on the West Valley Line. That work, performed on what are called the Montana Department of Transportation (MDT) and non-MDT

sections, began on June 15, 2009 and was completed on November 16, 2010. It was conducted from the western edge of Anaconda westward for approximately 5.1 miles, terminating at the Lime Quarry located north of North Cable Road. The work included the removal and disposal of contaminated waste materials, re-contouring affected areas so that they drain properly, installing storm water ditches and other erosion control structures and material, and reseeding. In 2013, EPA performed O&F inspections and found that the vegetation was well established.

For the Georgetown Railroad Bed section, Atlantic Richfield prepared a site investigation work plan (Atlantic Richfield 2013d) and has completed the sampling to characterize the remaining unreclaimed portion of the historic railroad beds administered by the Beaverhead-Deerlodge National Forest and several private residential yards adjacent to the rail bed.

In 2014, Atlantic Richfield completed the *Site Investigation Report* (Atlantic Richfield 2014b). Atlantic Richfield then prepared individual site work plans (Atlantic Richfield 2014c) for EPA and DEQ to address the residential yards; and an *Engineering Evaluation/Cost Analysis (EE/CA) Report* (Atlantic Richfield 2014d) for the U.S. Department of Agriculture (USDA) to address portions of the railroad within the national forest.

Based on the EE/CA and anticipated actions for the Georgetown Railroad Bed section, EPA does not consider this an issue for the 2015 five-year review.

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Section 5

Five-Year Review Process

5.1 Five-Year Review Administration and Schedule

The Anaconda Smelter NPL Site five-year review team was led by Charlie Coleman, the EPA remedial project manager with support from Joel Chavez, the State of Montana project manager. The interview team was Kathy Ericksen, EPA community involvement coordinator, and Karen Ekstrom, CDM Smith community involvement specialist. Technical expertise in areas of hydrogeology, civil and environmental engineering, land reclamation, and community involvement was provided by EPA's contractor CDM Smith. The five-year review was initiated in late summer of 2014 when site inspections were performed for areas where the remedial action involved soil treatment and revegetation. The other components of the five-year review process included the following:

- Community notification
- Identification and interviews with key persons and general public
- Document review
- Analysis of potential climate change effects
- Data review
- Issues identification
- Site Inspection (additional)
- Review of applicable or relevant and appropriate requirements (ARARs)
- Risk evaluations
- Five-year review report development and review

5.2 Community Involvement/Notification

As in previous five-year reviews, EPA's goals in conducting community interviews for the Anaconda Site 2015 five-year review were to obtain the local perspective on the implemented remedy and to identify issues that directly relate to the protectiveness of completed and/or to be completed remedies. Appendix A provides a summary of comments and concerns expressed by the interviewees. Those comments and concerns cover a wide array of subjects. EPA and DEQ have carefully considered all issues brought forth; however, not all are germane to the protectiveness of remedial actions implemented at the Anaconda Smelter NPL Site. Issues raised by interviewees that may have a direct effect on the protectiveness of the Selected Remedy have been carried forward into the Issues and Recommendations sections of this 2015 five-year review to ensure that they are tracked and addressed within the next review period.

The community was notified of the five-year review process with an advertisement that ran in the Anaconda Leader on December 24 and 31, 2014. A second advertisement will announce the completion of the five-year review process and will run in the paper in October 2015. Individuals listed in Table 5-1 were called and asked to participate in the interviews.

Most of the interviews were conducted in groups in Anaconda. One interview was conducted by telephone to accommodate the schedule of the interviewee. Interviewees were contacted at least a week in advance. Individuals known to be interested or actively involved at the Site were encouraged to invite other participants to the meetings. Contacts included the Arrowhead Technical Assistance Group (TAG), Anaconda Local Development Corporation (ALDC), Clark Fork River Technical Assistance Committee (CFRTAC), Opportunity Citizens Protective Association (OCPA), Water Environmental Technologies (WET), and Anaconda Deer Lodge County staff and commission.

Table 5-1 Interviewees 2015 Anaconda Smelter NPL Site Five-Year Review

Name	Affiliation
Connie Ternes Daniels	Anaconda Deer Lodge County (ADLC), Chief Executive
Jim Davison	Anaconda Local Development Corporation (ALDC), Executive Director Arrowhead Foundation, Board Secretary
Jamie Roessler	Arrowhead Foundation, Junior Technical Advisor
Darryl Barton	Clark Fork River Technical Assistance Committee (CFRTAC), member
Serge Myers	Opportunity Citizens Protective Association (OCPA) , member
George Niland	OCPA, member
Carl Nyman	ADLC Superfund Coordinator, consultant
Virginia Loran	Water Environmental Technologies, contractor
Terry Vermeire	ADLC, Commissioner
Elaine Lux-Burt	ADLC, Commissioner
Katherine Basirico	ADLC, Public Health Director

Comments and concerns that have been identified by the community that have been included in the issues and recommendations in this five-year review include long-term funding of institutional controls and the Old Works Golf Course, and the potential for re-contamination of remediated areas by dust blowing off of the slag piles.

5.3 Effects of Climate Change on Hydrology

Climate change is based on the observation that surface ambient air temperatures have increased in recent decades and modeling suggest that the increases will continue for the foreseeable future. Whether and how this temperature change affects watershed hydrology and the remedy at ARWW&S is discussed below.

Increased air temperatures due to climate change are expected to delay the onset of snow accumulation in the fall and accelerate the rate of snowmelt in the spring (EPA 2014). Using multiple indicators including flower blooms and stream flow for the period 1955 to 1995, Cayan et al. (2001) found that the onset of spring is coming earlier in the Rocky Mountains. They predict that this trend will continue.

EPA (EPA 2014) evaluated four metrics to evaluate climate change on surface water hydrology in the United States:

- Seven-day low flow
- Three-day high flow
- Average annual flow
- Timing of winter-spring runoff

Although these metrics indicated some climate change effects in some areas of the U.S., the northern Rocky Mountains generally showed no change in these indicators over the period of 1940 to 2012. These results are in conflict with those of Cayan et al. (2001), indicating that drawing conclusions regarding effects of climate change on hydrology is not straightforward.

Using snow telemetry (SNOTEL) data, Oyler et al. (2014) found that widespread systematic inhomogeneities in the SNOTEL network have artificially amplified the warming signal in the western U.S. data. This makes accurate predictions of climate change in the mountainous areas difficult. In order to evaluate changes in the hydrology of the area, monthly discharge and peak runoff data were obtained for the Clark Fork River above Missoula (USGS Station 12340500). This station is downstream of the ARWW&S OU and has a long period of record.

The monthly average discharge for station 12340500 is shown on Figure 5-1. There is a somewhat consistent base flow between 800 and 1,200 cubic feet per second (cfs) and high flows ranging from 5,000 to 15,000 cfs each year. A locally weighted scatterplot smoothing (LOWESS) function was applied to the data to represent a moving annual average discharge. As can be seen in Figure 5-1, the lowest flows occurred during the 1930s and early 1990s. Higher flows have occurred in the 1960s and 2010s. There is no apparent trend, rather a multi-decadal fluctuation in discharge.

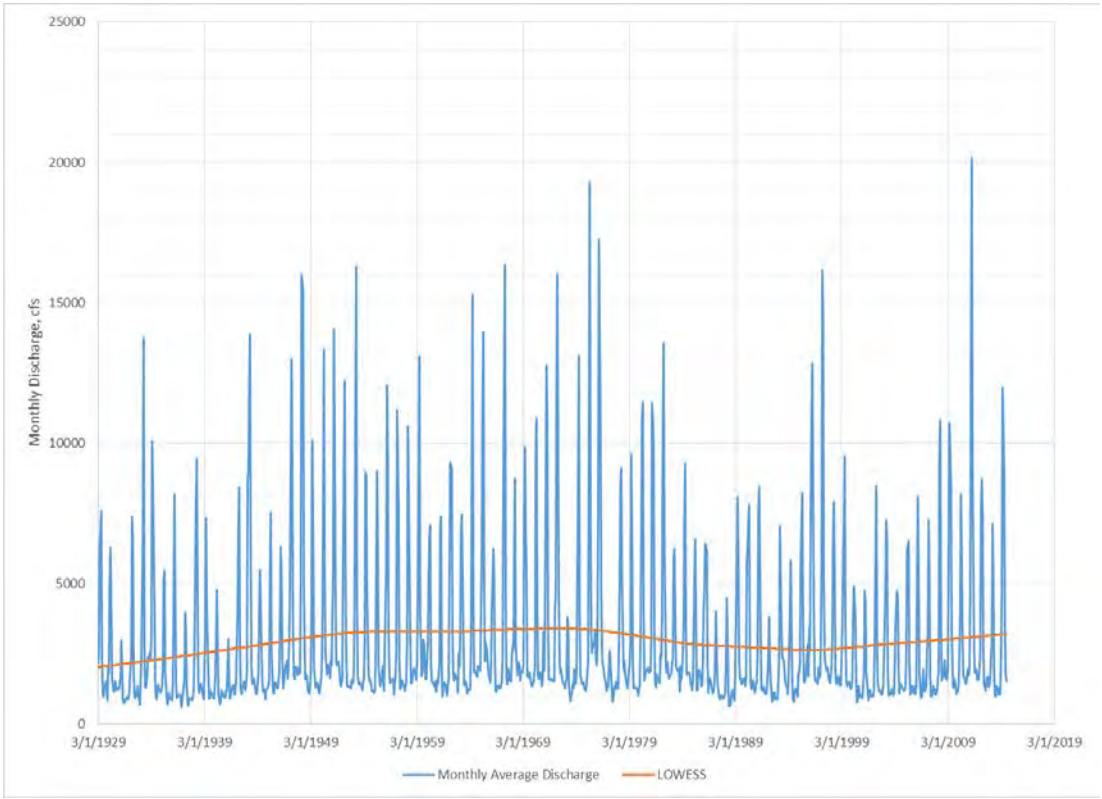

Figure 5-1 Monthly Discharge at USGS Station 12340500: 1929-2014

In order to evaluate if runoff is occurring earlier, the date of the peak flow at station 12340500 was compiled in Figure 5-2. In the 1930s, peak flow occurred around May 20 and this increased to around May 30 in the 1960s. Peak discharge has averaged around May 23 since 1984. Overall, the data do not indicate a significant trend in the peak runoff data, rather a multi-decadal fluctuation.

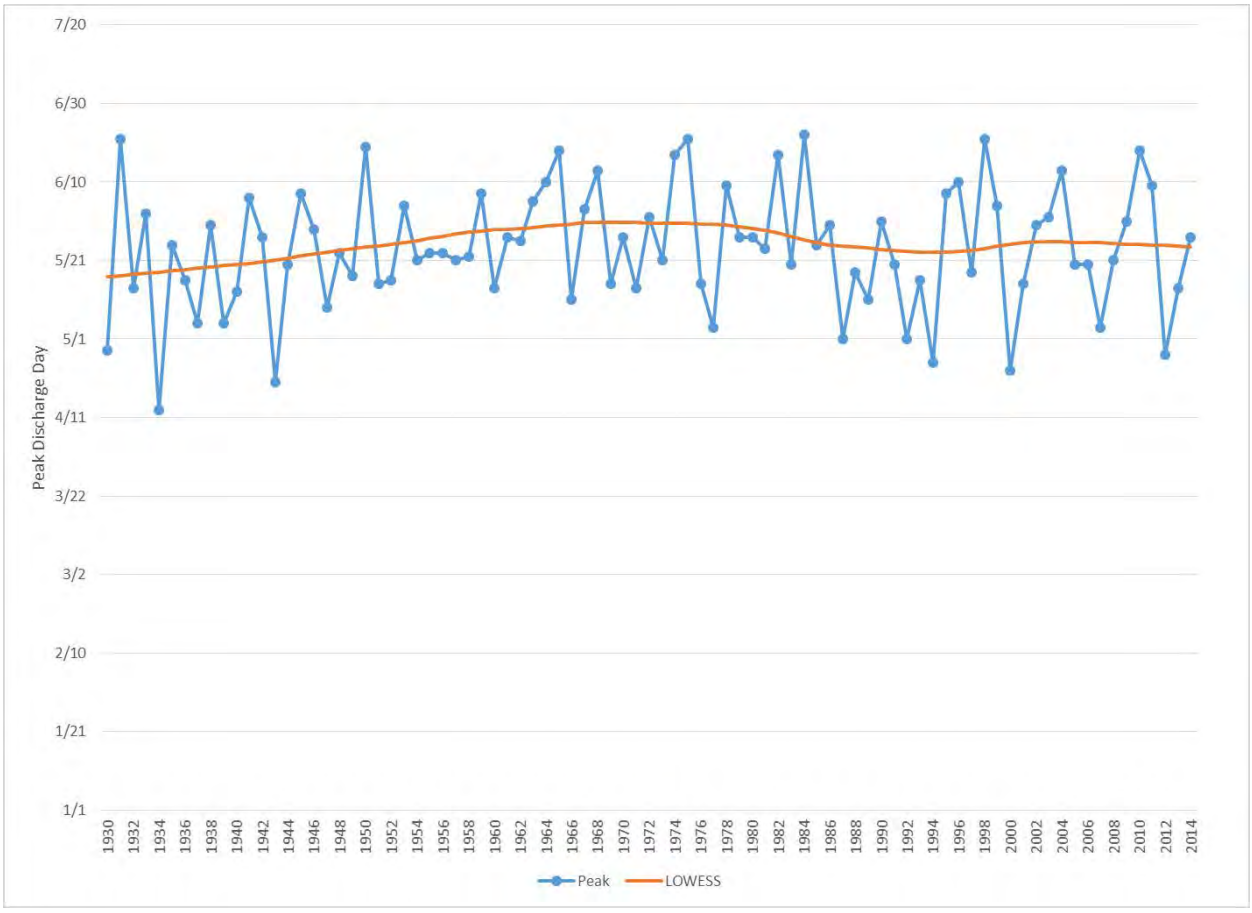

Figure 5-2 Peak Discharge Dates at USGS Station 12340500: 1929-2014

The remaining metrics include 7-day low flow and 3-day high flow. These are presented for station 12340500 from 1929 to 2014 on Figure 5-3 along with curves produced by LOWESS smoothing. The seven day low flow generally occurs at two different times: early winter from late December to early February (approximately 80 to 150 days after September 30); or late summer from late August to late September (approximately 330 to 365 days after September 30). Low flow was generally split between these two period in the 1930s and 1980s to 1990s while low flow generally occurred in winter from the 1950s to 1970s and since the late 1990s. No long-term trend is apparent. The Clark Fork basin is not heavily influenced by irrigation or storage reservoirs.

The three day high flow is also shown on Figure 5-3. High flow routinely occurs from 210 to 260 days after September 30 or May and June. High flow often occurred in May in the 1930s and occurred more often in June in the 1940s through the 1980s. Since the 1990s, high flows have varied from early May to mid-June. Overall there is not long-term trend in the occurrence of the 3-day high flow at this station.

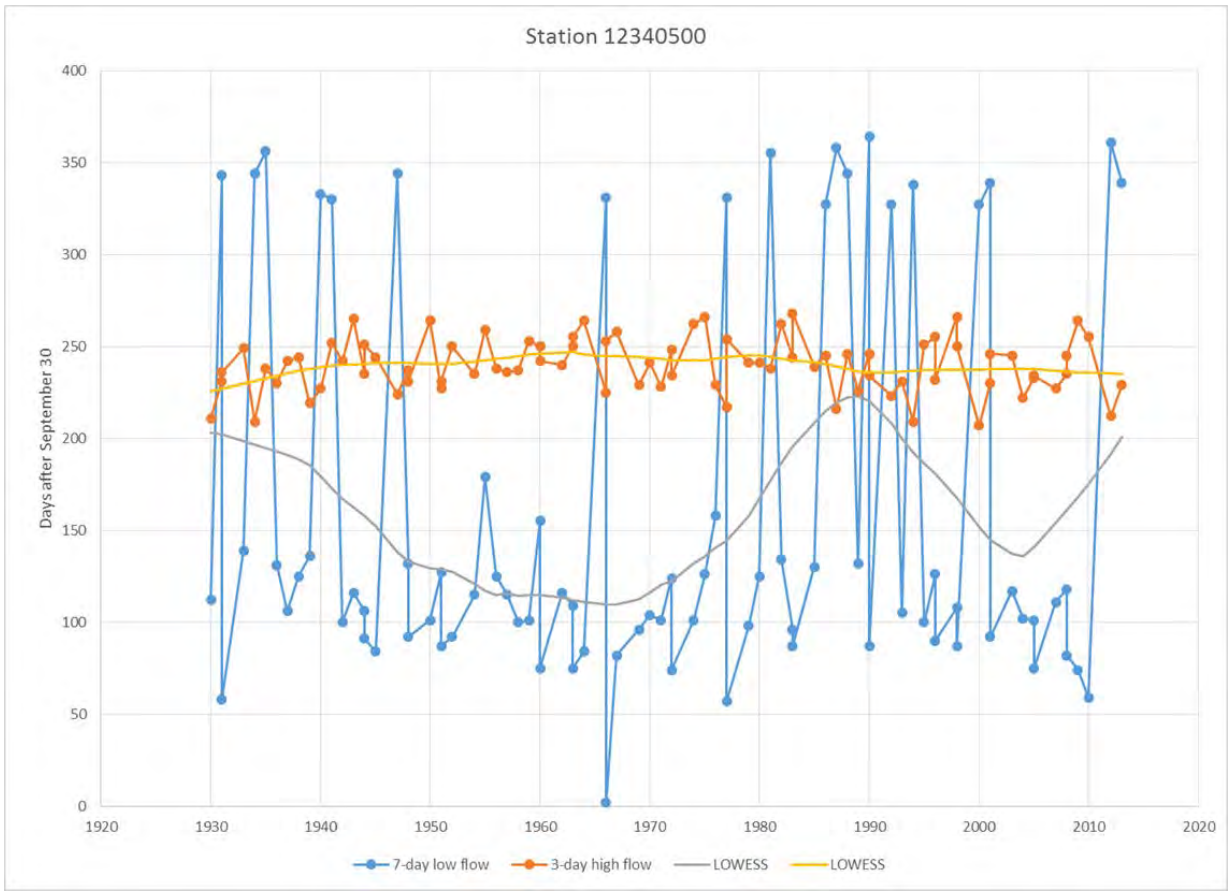

Figure 5-3 7-Day Low Flow and 3-Day High Flow at Station 12340500 1929-2014

Summary

Although long-term changes in ambient air temperatures appear to be occurring globally, the data are unclear for the northern Rocky Mountains. Analysis of hydrologic data by EPA (2014) and herein do not indicate any trends in discharge or runoff.

5.4 Document Review and Site Inspections

Documents reviewed as part of the five-year review include the most recent inspection, monitoring, operations and maintenance annual reports prepared by Atlantic Richfield and its contractors, including, but not limited to, vegetation, engineered controls, repositories, and ground water. Surface water data and reports produced by the U.S. Geological Survey (USGS) were also reviewed.

Site inspections were conducted in 2014, the year of the last recent inspection reports, to verify the accuracy of the completed reports. The results of the inspections and document review are documented in Section 5, 6, 7, 8 and 9 of this report.

5.5 ARARs Review

A review of ARARs was conducted to determine if there were any changes in the ARARs that could affect the validity of the cleanup. The results of this review are presented in Appendix B.

5.6 Risk Review

As part of the technical assessment, EPA conducted an analysis of the current methods of risk assessment and toxicology data compared to the human health and ecological risk assessments that were performed as part of the 1996 Community Soils OU and 1998 ARWW&S OU RODs, respectively. This assessment will include the following elements:

- Evaluate human health exposure pathways and ecological exposure pathways/receptors and determine if any new pathways should be considered.
- Evaluate exposure assumptions used to estimate human health and ecological risks and determine if any of these exposure parameters need to be updated based on new site data or new information in the literature or in risk assessment guidance.
- Evaluate changes to toxicity criteria (human health) and effects concentrations (ecological) and determine if new toxicity information might affect risk estimates significantly.

The results of these assessments are presented in Appendices C-1 (human health) and C-2 (ecological).

Section 6

Mill Creek OU15

The Mill Creek OU is located 1.5 miles east of Anaconda, adjacent to the Smelter complex, and was formerly a community of 37 families. Although the initial remedial action was completed under the Mill Creek OU, follow-on remedial work was performed under Subarea 5 of the OW/EADA OU. That work is summarized here and discussed in greater detail in Section 8.2.3. Because of the close proximity of these areas to the South Opportunity Uplands (RDU 6 of the ARWW&S OU), additional remedial work in the Mill Creek town site will likely be performed in association with the remaining remedial work for RDU 6. Currently, Atlantic Richfield conducts the monitoring and maintenance of the old Mill Creek town site area, and discusses the findings under RDU 6 in the vegetation monitoring annual report.

6.1 Selected Remedy

The remedial objectives for the Mill Creek OU were to immediately protect public health through the relocation of families and complete the initial cleanup and stabilization of the area. Beginning in May 1986, EPA and the Federal Emergency Management Agency relocated residents of Mill Creek to address the immediate public health concerns of exposure to high concentrations of contaminants in the residential setting. That effort was focused on families with young children and individuals with special health problems. That action was accompanied by stabilizing flue dust waste on Smelter Hill, which was adjacent to the community, and controlling dust from unpaved roads in the community. Testing demonstrated that urine arsenic concentrations of the relocated children decreased to normal levels after leaving Mill Creek. At that time, Atlantic Richfield purchased several properties and relocated all but eight families.

The EPA selected remedy for Mill Creek Record of Decision (EPA 1987) featured:

- Permanently relocating all remaining Mill Creek residents
- Temporarily stabilizing the soil to prevent fugitive dust
- Storing demolition debris and contaminated soils for later disposal
- Regrading and replanting areas disturbed by relocation/demolition activities
- Monitoring and maintaining the vegetation and the fence installed around the area
- Imposing short-term controls on access and land use

6.2 Remedial Action Implementation

EPA entered into a consent decree with Atlantic Richfield to implement the permanent relocation remedy for Mill Creek residents on January 7, 1988. Resident relocation occurred by the fall and home demolition and site stabilization were finished in late 1988. Demolition debris and contaminated soils were disposed of on Smelter Hill. Foundations were buried on-site and the area was regraded and vegetated. Fencing was installed along with signage to control access and maintain the vegetation.

6.2.1 Construction Status

Construction activities related to the 1987 ROD (EPA 1987) have been implemented. Adjacent contaminated soil areas were incorporated into the OW/EADA OU and further evaluated under that OU. The OW/EADA ROD, signed in March 1994, provided that soils exceeding 1,000 parts per million (ppm) arsenic be addressed with engineered covers or soil treatment and revegetation techniques (EPA 1994). Groundwater and surface water issues were deferred to remedial action for the ARWW&S OU as was the final revegetation of the Mill Creek area.

6.2.2 Operations and Maintenance Status

Remediated soil areas are actively monitored and maintained in accordance with the ARWW&S OU VMP. In-place ICs include ADLC's DPS.

6.2.3 Data Evaluation

Evaluations of remediated areas completed for the Mill Creek OU are performed and reported under Subarea 5 of the OW/EADA OU (see Section 8.2.3). Atlantic Richfield requested EPA compliance determinations for several areas in 2011 and 2014 (Atlantic Richfield 2011and 2014x). These areas are located at the Mill Creek Triangle and are areas that received soil covers. EPA reviewed the compliance request reports and verified that they contained the required information. This was followed up by EPA in-field evaluations that confirmed that the vegetation was well established and providing substantial cover and protection of the soil surface. Based on the field inspections, EPA concluded that these areas met the vegetation and site stability compliance performance standards established by the VMP. As with other compliant areas at the Anaconda Smelter Site, EPA has allowed these areas be administered under the long-term inspection and maintenance program but is awaiting a long-term O&M (land management) plan from Atlantic Richfield that covers these areas.

Atlantic Richfield currently conducts annual vegetation and site (soil) stability monitoring in three areas in the Mill Creek Triangle and Industrial Park areas (Atlantic Richfield 2015d). According to the report, these areas have good vegetation cover.

6.2.4 Site Inspection

The 2014 EPA five-year review inspection confirmed that the Mill Creek areas are still compliant with the performance standard. Vegetation in other areas of the Mill Creek OU is the short-term monitoring program and progressing well.

6.3 Progress Since the Last Five-Year Review

No issues or recommendations concerning the protectiveness of the Mill Creek OU remedy were identified under the last (2010) five-year review. Therefore, no additional actions concerning this remedy were implemented.

6.4 Technical Assessment

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

Yes. The remedy was relocation of the Mill Creek town site residents, which has been completed. Vegetation covers completed under the ARWW&S OU work are also functioning as designed.

Question B - Are the assumptions used at the time of remedy selection still valid?

Yes. The assumptions used at the time of remedy selection were the risk to human health from high arsenic concentrations in soils and dust. As discussed further in Section 8 and Appendix C-1, the selection of human health risk-based cleanup levels for arsenic in soils and dust was reviewed independently by the Agency for Toxic Substance and Disease Control in 2008, and was confirmed to be protective of human health. Since the arsenic concentrations in residential soils and dust at the Mill Creek town site were much higher than the current cleanup level for residences set in Anaconda, the decision to relocate the residences remains valid.

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

No. At this time, EPA is not aware of other information that would affect the protectiveness of the remedy.

6.5 Issues and Recommendations

The only issue identified for this OU that affects protectiveness is the long-term effectiveness of ADLC's IC program to protect the remedy. The recommendation is for ADLC to finalize and fully implement the IC program.

Table 6-1 Recommendations and Follow-up Actions

Issue	Recommendations and Follow up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future (if not addressed)
1. Long-term effectiveness of ADLC's IC program. **OU16 Community Soils, OU7 OW/EADA, OU4 ARWW&S, OU 15 Mill Creek**	A, Finalize ICIAP	Anaconda – Deer Lodge County (ADLC)/Atlantic Richfield	EPA/DEQ	June 2016	No	Yes
	B. Implement and fund ICIAP	ADLC/Atlantic Richfield	EPA/DEQ	June 2016	No	Yes

6.6 Protectiveness Statement

The remedy for the Mill Creek OU currently protects human health because former Mill Creek residents were permanently relocated from the Site and soils were temporarily stabilized to limit fugitive dust. However, for the remedy to be protective in the long term, final soil remediation under ARWW&S OU RDU 6 South Opportunity Uplands must be implemented and the final ICIAP must be completed and implemented (including long-term funding) at the NPL site.

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Section 7

Flue Dust OU11

7.1 Selected Remedy

Flue dust is a by-product of copper smelting and at Anaconda the flue dust contains an average of 14.6 percent copper 4.9 percent arsenic, and 0.14 percent cadmium, and contains significant concentrations of magnesium, mercury, zinc, and other metals. This material is a characteristic hazardous waste, as defined under the Resource Conservation and Recovery Act (RCRA), because it failed the toxicity characteristic leaching procedure (TCLP) criteria for arsenic and cadmium. Most of the flue dust generated by smelter operations in Anaconda was reprocessed; however, approximately 316,500 cubic yards was stockpiled at nine locations on and near Smelter Hill.

EPA selected a remedy for Flue Dust Record of Decision (EPA 1991) that featured 1) stabilizing approximately 316,500 cubic yards of material using cement and lime and 2) placing the treated material in an engineered repository (EPA 1991). The approach was to excavate and treat (such that the flue dust was no longer a characteristic hazardous waste) each of the nine piles of flue dust and then transport the material to the on-site repository for disposal. Design requirements for the repository would meet all Montana Solid Waste Management Act and RCRA Subtitle D provisions and some relevant and appropriate Montana Hazardous Waste Act and RCRA Subtitle C provisions. At a minimum the repository was to include a liner, leak detection and collection system, groundwater monitoring wells upgradient and downgradient of the repository, and a cap. Long-term maintenance and monitoring, and limiting site access and use, were also required.

7.2 Remedial Action Implementation

7.2.1 Construction Status

EPA entered into a consent decree with Atlantic Richfield to implement the flue dust remedy in December 1992 (Civil Action No. CV-92-76-BU-PGH (D.MT). Treatment of more than 500,000 cubic yards of flue dust, including flue dust from the main Washoe Smelter flue, was completed in December 1993. All treated flue dust passed the TCLP criteria. The on-site RCRA repository was constructed using a bentonite/high density polyethylene liner, leachate collection and detection system, and a cap consisting of the same bentonite/HPDE liner, cover soil and vegetation. Closure of the repository was completed in November 1994. The flue dust repository is part of the Smelter Hill Repository Complex (SHRC), which also includes the Arbiter, Beryllium, 2004 Beryllium, and Aspen Hills repositories.

7.2.2 Operation and Maintenance Status

A pre-final inspection of the remedial action at the SHRC was completed in March of 1995, with a final inspection completed during the summer of 1996. In 1996, EPA approved both an Interim Post-Closure O&M plan and the remedial action construction completion report for the SHRC.

Current operation and maintenance activities for the Flue Dust Repository are described in the *Draft Final Smelter Hill Repository Complex Post-Closure O&M Plan* (Atlantic Richfield 2004a). These activities include monitoring vegetation and erosion conditions of the engineered cap, conducting reclamation (cap) maintenance, evaluating the condition of the Flue Dust Repository storm water

channel, monitoring ground water levels, monitoring repository leachate levels, and pumping and disposing of leachate within the WMAs when required. Operation and maintenance work in 2014 specifically included: monitoring leak detection and collection equipment; measuring water elevations at critical locations, pumping leachate from the Flue Dust Repository; spraying weeds, and; evaluating vegetation/erosion conditions.

The latest monitoring, inspection, and maintenance activities for the Flue Dust Repository (and for all of the remediated areas within the Smelter Hill Facility Complex) are documented in the *2014 Smelter Hill Repository Complex (SHRC) Monitoring and Maintenance (M&M) Report* (Atlantic Richfield 2015e). The report includes results from the sampling of ground water wells associated with the Flue Dust Repository and the assessment and management of repository leachate. Leachate reaching specified levels is required to be pumped so it does not impact the integrity of the repository, and then disposed of at a temporary on-site leachate disposal area. In addition to the evaluation of ground water levels and quality, the condition of the vegetation and stability of the soil surface of the Flue Dust Repository is evaluated annually and results provided in the SHRC M&M report. Atlantic Richfield's 2014 annual report concluded with the following recommended O&M activities for areas in the SHRC, including the Flue Dust Repository in calendar year 2015:

- Continue monitoring repository leachate levels and pump/dispose of as required.
- Continue monitoring the water elevation in the Flue Dust Repository collection sump and surrounding wells as needed.
- Repair erosion along the storm water ditch side slopes, remove sedimentation buildup, and remove unwanted vegetation.
- Monitor and collect samples from monitoring wells.
- Conduct spot spraying for noxious weeds.
- Fertilize bare areas of the south-facing slope of the Flue Dust Repository and in other locales.
- Inspect and monitor the Flue Dust Repository storm water channel.
- Conduct annual repository cover and vegetation evaluation.

7.2.3 Data Evaluation

Discussed below are the inspection results and recommendations provided by Atlantic Richfield that are specific to the Flue Dust Repository. Please refer to Section 10.2.14 for a discussion of all the mine waste repositories within the SHRC.

Well Sampling and Temporary Leachate Management

Annual ground water samples were collected from the monitoring wells associated with the Flue Dust Repository in 2014 by the Montana Bureau of Mines and Geology and by Pioneer Technical Services, Inc. The ground water monitoring analytical results during the 2014 annual sampling event indicated that all constituents in the wells were consistent with historic background levels. Dissolved arsenic in MW-3 was detected at 25.8 µg/L, which is greater than the EPA Maximum Contaminant Level (MCL) of 10 µg/L.

EPA has leachate pumping trigger levels for the Flue Dust Repository. As outlined in the Final Smelter Hill Repository Complex Post-Closure O&M Plan (Atlantic Richfield 2004a), pumping is required when the leachate rises to a specific elevation. The Flue Dust Repository leachate collection sump water level was monitored during all four quarters of 2014 and during weekly M&M activities. Leachate monitoring results indicated that no pumping of leachate was required in 2014 for the Arbiter or Beryllium Repositories, but was required for the Flue Dust Repository which has continued to unexpectedly produce leachate.

Engineered Stormwater Controls

The latest available Engineered Controls Inspection and Maintenance (I&M) Report (Atlantic Richfield 2015f) provides the results for inspection and maintenance of 7 storm water intercept and conveyance channels at the SHRC in 2014. The ditch adjacent to the Flue Dust Repository, denoted as the A-1 Storm Water Ditch, was reconstructed in February and March of 2012. The 2014 Atlantic Richfield report indicated that:

- Plant establishment was successful as indicated by the density of the seeded species.
- Total vegetation cover ranged from 10 to 19 percent.
- Bare soil ranged from approximately 5 to 10 percent.
- Litter accumulations were light.
- *Kochia scoparia*, an ADLC listed noxious weed, was still prevalent on the south facing slope of the channel and in areas with un-incorporated organic matter.

Revegetated Areas

Annual qualitative vegetation and erosion inspection results for the repositories are provided in the latest SHRC M&M Report. In general, the 2014 data indicate that cover of perennial grasses was good on the Flue Dust Repository. Weeds were present but are being regularly managed. Soils are reported as generally stable with slight erosion noted in some areas.

In October 2012, Atlantic Richfield applied for a compliance determination for the mine waste repositories within the SHRC (Atlantic Richfield 2012a). The report contained the results of quantitative assessments of these areas and all other information required for EPA to conduct a compliance determination. EPA noted that the compliance request report submitted by Atlantic Richfield did not include a long-term O&M plan, as required by the VMP. In the following field season (2013), EPA conducted in-field evaluations. For each area, the evaluator specifically checked whether it was meeting the VMP performance standards for WMAs. The field evaluation by EPA verified the accuracy of most of Atlantic Richfield's data and concluded that the Flue Dust Repository was compliant with the performance standards.

7.2.4 Site Inspection

The 2015 five-year review site inspection for the Flue Dust Repository was conducted by EPA during the 2014 field season in conjunction with the other inspections for the SHRC. The inspection confirmed that Atlantic Richfield reports (discussed above) provide accurate representations of conditions at the Flue Dust Repository. Maintenance of RA elements is required and is being

implemented for the A-1 Storm Water Ditch, the leachate management systems and the revegetated area. Upon inspection, EPA verified that the maintenance issues do not affect the protectiveness of the remedy and can be addressed through Atlantic Richfield's maintenance programs.

Upon review of the alternatives analysis report (Atlantic Richfield 2015j), EPA believes that shallow ground water is entering the repository and is thereby threatening the integrity of the repository.

7.3 Progress Since the Last Five-Year Review

To determine the source of water entering the Flue Dust Repository, Atlantic Richfield prepared and EPA approved Request for Maintenance (RFM) and Request for Change (RFC) documentation to allow leachate in the sump to rise over the pumping trigger level and to establish a new, temporary pumping trigger level. Prior to 2014, the Flue Dust Repository was last pumped during the second and third quarter of 2011. During the first and second quarters of 2014, leachate was not pumped due to the ongoing Flue Dust Repository Investigation. In the third quarter Atlantic Richfield received approval to pump leachate from the Flue Dust Repository and discharge it through a sprinkler system at the temporary on-site leachate disposal area northeast of the Arbiter and Beryllium Repositories. Pumping was initiated on September 8, 2014 and was completed on October 29, 2014. A total of 779,629 gallons was pumped from the Flue Dust Repository during the third and fourth quarters of 2014. The Flue Dust Repository investigation and general monitoring at the SHRC continued through December 2014.

No additional issues/recommendations concerning the protectiveness of the Flue Dust OU remedy were identified in the last (2010) five-year review and no issues have been identified since. Therefore, no additional recommendations concerning the remedy for this OU have been made.

7.4 Technical Assessment

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

No. The Selected Remedy for the Flue Dust Repository included a leachate level monitoring and pumping/collection system, and the protocol for disposing of the leachate. However, the amount of leachate being generated far exceeds the volume anticipated during design. Large volumes of leachate were pumped and disposed of in 2011 and again is 2014. Although the system is currently operating as intended and no leachate has been detected in the groundwater monitoring wells, leachate disposal will become an issue in the future.

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

Yes. For the 2015 five-year review, EPA re-examined the ARARs and the assumptions used in the original human health risk assessment. In accordance with the preamble to the National Contingency Plan, ARARs are frozen at the time of the ROD unless "a new or modified requirement calls into question the protectiveness of the selected remedy" (55 FR 8757 [March 8, 1990]). Appendix B notes that certain contaminant specific water quality ARARs that have changed since completion of the previous five-year review for the Site, as documented in the 2011 ARWW&S OU ROD amendment. The most significant ARAR change was the lowering of the arsenic human health standard for surface water and ground water from 18 to 10 μg/L in the 2011 ARWW&S OU ROD Amendment.

In 2013, EPA finalized performance standards for reclaimed areas at the Anaconda Smelter NPL Site. Those standards, as described in the VMP (Atlantic Richfield 2013a), were used to determine compliance for the Flue Dust Repository and will be used in subsequent five-year reviews to verify that this repository still meets the compliance standards.

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

Yes. Large volumes of contaminated leachate continue to be generated and that trend has not diminished within the last few years. Recently collected data indicate that there is a source of ground water entering the repository and that influx of water must be stopped for the Selected Remedy to be protective in the long-term. The repository will continue to be monitored for any changes in leachate volume until the water source can be located and prevented from entering the repository. At the time of this five-year review, Atlantic Richfield is in the process of designing measures to limit groundwater flux in this area (Geyser Gulch Pond Removal, Storm Water Ditch Construction, and Site Regrading), as well as a temporary evaporation pond to dispose leachate until ground water reduction measures prove to be successful in limiting leachate generation within the repository.

7.5 Issues and Recommendations

To ensure long-term protection, corrective action under the ongoing operations and maintenance program should be taken to address the large volume of contaminated leachate.

7.6 Protectiveness Statement

The remedy for the Flue Dust OU currently protects human health and the environment because, the waste has been treated (stabilized) to below TCLP standards for arsenic, cadmium and lead, and has been encapsulated within a lined repository with access strictly controlled by fencing, gates, and security. However, for the remedy to remain protective in the long-term, corrective actions must be taken to eliminate seasonal ground water from entering the repository and a leachate management plan must be completed and implemented to properly manage the leachate.

Table 7-1 Recommendations and Follow-up Actions

Issue	Recommendations and Follow up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future (if not addressed)
2. Unexpected leachate production in the Flue dust repository. **OU11 Flue Dust**	A. Implement corrective actions under O&M to address seasonal shallow groundwater influx to the repository.	Atlantic Richfield	EPA/DEQ	June 2017	No	Yes
	B. Develop and implement leachate management plan.	Atlantic Richfield	EPA/DEQ	June 2016	No	Yes

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Section 8

Old Works/East Anaconda Development Area OU7

The OW/EADA OU contains large volumes of various wastes and debris that originated from copper ore milling, smelting, and refining operations at the Old Works site (Upper and Lower Works) from 1884 to 1902. The Upper Works industrial area was constructed in 1883 and 1884. The Lower Works structural area was completed in 1888, approximately one mile east of the Upper Works. Old Works structures included a concentrator, boiler house, "slum" houses, and other factories. The smelters were connected to brick stacks atop adjacent hills by masonry flues. Dismantling started in 1902 and was completed about 1906. Structural remains today consist primarily of massive sandstone blocks and brick rubble.

The smelting process consisted of several steps that generated different types of waste materials. Lower grade ore was crushed and screened and then jigged (agitated) to concentrate the ore material. The Jig Tailings were discarded onto the floodplain. The Heap Roast Slag, composed of partially vitrified slag, was generated by an air cooling process. Jig tailings and slag were sluiced across Warm Springs Creek between 1890 and 1901 to form the Red Sands. Portions of the Red Sands were reworked on several occasions between 1913 and 1943. There are approximately 440,000 cubic yards of floodplain wastes (including jig tailings), 300,000 cubic yards of Heap Roast slag, 600,000 cubic yards of Red Sands, and 32,000 cubic yards in the miscellaneous waste piles.

During Old Works operations, a portion of the Warm Springs Creek channel within the Site was realigned and straightened, and levees were installed. All operations ceased at the Old Works when, in 1902, the much larger and more modern Washoe Works (later known as the Anaconda Reduction Works) began production across the valley on Smelter Hill, south of Warm Springs Creek.

In 1991, EPA addressed the immediate concern of releases of contaminants to Warm Springs Creek and to human health through stabilization of the Red Sands adjacent to Warm Springs Creek, repair of breaks in Warm Springs Creek levees, and the installation of fencing to limit access to certain areas of the Old Works site. Further cleanup actions relating to the Red Sands, as well as the remainder of the Old Works OU, were included in the OW/EADA OU ROD in March 1994.

8.1 Selected Remedy

In 1994, EPA selected a combination of engineering and ICs as the remedy in the OW/EADA OU ROD (EPA 1994). The remedy also established action levels for arsenic within the OU. Major components of the remedy include requirements to:

- Preserve historic features in the Old Works Historic District.
- Construct engineered covers over waste materials.
- Treat soils and use innovative revegetation techniques.
- Construct and revegetate cover soil caps over waste materials.

- Remediate potential future residential or commercial/industrial areas to the appropriate soil arsenic action levels through the ADLC DPS.
- Construct controls to manage surface water runoff from Stucky Ridge, Smelter Hill, and throughout the operable unit to minimize discharge to Warm Springs Creek.
- Upgrade or repair levees adjacent to Warm Springs Creek to contain the 100-year peak flood event and prevent erosion of waste materials into Warm Springs Creek.
- Replace bridges or culverts to ensure the safe passage of the 100-year peak flood event.
- Implement ICs to protect engineered controls and manage future land and water use.
- Implement long-term monitoring.

ISWPs have been prepared to present the RA requirements specific to each individual property parcel or lot. These ISWPs are based on the approved remedial designs but were prepared to present the detailed construction requirements for each parcel or lot that are required to satisfy the design and any landowner requirements. The ISWPs were submitted to and approved by the Agencies prior to construction.

8.2 Remedial Action Implementation

The ROD divided the OU into six subareas based on similarities of waste characteristics and present/future land uses.

- Historic Structures
- Golf Course
- West Industrial Area
- East Industrial Area (includes Red Sands, Arbiter, and sewage treatment facility)
- East Anaconda Yards (includes Benny Goodman Park)
- Drag Strip

Since the anticipated land uses, site characteristics, and COCs are similar to areas in the OW/EADA OU, the Mill Creek OU areas (Aspen Hills Addition, repositories for Old Works waste located on Smelter Hill, and Mill Creek Addition (town site)) were included in the Selected Remedy for the OW/EADA OU as part of the 1995 *Explanation of Significant Differences (ESD)* (EPA 1995). These areas are shown on Figure 8-1. Based on remedy similarities and how areas are monitored, the following areas were originally included in the OW/EADA OU7 but are discussed in the following sections:

- Aspen Hills Addition (loop track area) is discussed in the RDU 3 - Smelter Hill Uplands section (Section 10.3)

- Old Works waste repository (Smelter Hill Repository Complex - SHRC) areas are discussed in the RDU 14 - Smelter Hill Facility Areas section (Section 10.14)

- Mill Creek Addition area (Mill Creek town site) is discussed in the RDU 6 - South Opportunity Uplands section (Section 10.6)

Most land reclamation remedial action work has been accomplished to date within the OW/EADA OU. Remedial action work is on-going in Subarea 4 and this is discussed below. Reclamation of several areas located inside the boundary of the OW/EADA OU is addressed under the ARWW&S OU and CS OU for logistical reasons. The inactive railroad lines and residential areas are addressed under the CS OU. The active railroad lines within the East Anaconda Yard, impacted soils along the southern portion of Stucky Ridge, and the remaining impacted soils within the Aspen Hills and Mill Creek Addition, are addressed under the ARWW&S OU.

Atlantic Richfield prepared the vegetation monitoring annual report which provides plant cover and other site data (Atlantic Richfield 2015d). For remediated areas that are being monitored, the report provides the acreage and the range of vegetation cover for sites having at least three growing seasons since they were reclaimed. The report also discusses the degree to which there are erosion, weed, or barren area problems, and summarizes remedy performance. The status of construction, O&M, and remedy performance based on the Atlantic Richfield report and on direct observation by EPA are discussed below for the subareas within the OW/EADA OU.

8.2.1 Historic Structures and the Golf Course (Subareas 1 and 2)

Subarea 1 is defined by sloped areas above the golf course and contains historic flues and oven foundations, which were remnants of the Upper and Lower Works. Drainage controls were completed with the golf course construction in the mid-1990s. Subarea 2 historically consisted of tailings and contaminated soils and the adjacent uplands where remnants of the historic Old Works smelter remain. These areas include areas containing Heap Roast Slag, material known as the Miscellaneous Waste Piles, and portions of the Warm Springs Creek Floodplain.

8.2.1.1 Construction Status

Construction of storm water controls and revegetation are complete in Subarea 1. Final reclamation of steep slope areas has been deferred to remedial actions under the ARWW&S OU.

Construction of the Old Works Golf Course and remediation in other areas of this subarea began in June 1994 with the grading of the site and the movement of over 600,000 cubic yards of material. The course was constructed in part to preserve and highlight the historical significance of the Old Works smelter area. Therefore, various waste materials, including piles of bricks and clinker-type slag, were left in place without engineered covers but were regraded to promote drainage off of the piles. The Upper and Lower Works foundations, as well as the historic flue and chimney structure were also preserved. Concurrent with site grading and surface reclamation was the construction of eight sedimentation ponds to control surface water run-on from the adjacent uplands and placement of riprap along the banks of Warm Springs Creek to protect against erosion.

Storm water controls were installed to control sediment transport to Warm Springs Creek and to limit surface water infiltration into underlying waste materials within the golf course. Sediment ponds were constructed at 7 locations: 3 located at the base of Stucky Ridge along the northern boundary of the golf course to control surface water runoff and sediment transfer from the western portion of Stucky

Ridge and 4 ponds located to the east of the golf course to control surface water runoff and sediment transfer from the eastern portion of Stucky Ridge. The water control system included the installation of extensive under-drain piping at the golf course, totaling approximately 32,000 linear feet. The above and below ground drainage system collects water from the golf course area and routes it to two constructed lakes (Old Works Golf Course Lakes #1 and #2) where the water is recycled for irrigation. A cover consisting of 18 inches of soil (approximately 600,000 cubic yards) over 2 inches of lime rock (47,000 cubic yards) was placed over the graded golf course site. The final work on the golf course (tee boxes, greens, irrigation, etc.) was completed in 1996. After a one year grow-in period, the golf course was opened to the public in May of 1997.

Warms Springs Creek bank erosion protection included the removal and disposing of existing debris along the streambank, reconstructing the channel, and installing riprap. Erosion protection was generally required in areas of sparse vegetation that were susceptible to erosion during storm and seasonal runoff events. A section of Warm Springs Creek was reconstructed to remove debris located within the channel and to protect the banks from erosion under flood conditions. Riprap-lined erosion protection consisting of 18 to 24-inch diameter rock was installed for the 100-year flood conditions along the north and south banks of Warm Springs Creek.

In 2011, unusually high groundwater table conditions in late spring/early summer caused upward bulging of the Old Works Golf Course Lake #2 liner, resulting in rupturing of the liner and deflection of the influent and effluent pipes for the underdrain and irrigation systems. In response, the lake was dewatered in early 2012 and inspected, and temporary repair of the liner was made. A geotechnical investigation was conducted to design a final repair, which began in September 2013 and completed in July 2014. This work was documented in the *Draft Final Old Works Golf Course (OWGC) Lake #2 Liner Repair Construction Completion Report* (Atlantic Richfield 2014e).

8.2.1.2 Operations and Maintenance Status

Active monitoring and maintenance for Subarea 1 includes evaluating the effectiveness of storm water controls and revegetated soils, and is performed on an annual basis. Site access controls for Subarea 1 are though engineered trails, barriers, and signage.

The golf course has been operated and maintained by the Golf Course Authority (under the oversight of ADLC) since it was opened. Atlantic Richfield has monitored and performed maintenance in small areas, such as areas west of the golf course and north of the bowling alley, and major repairs, such as the aforementioned Lake #2 liner repair. Access controls to the golf course include fencing and are in place.

8.2.1.3 Data Review and Evaluation

The latest available Engineered Controls Inspection and Maintenance Report (Atlantic Richfield 2015f) provides the results for inspection and maintenance activities for Subareas 1 and 2 that were conducted in 2013. The report lists maintenance issues that EPA considers minor and not a threat to the remedy; these were the need to spray for noxious weeds, repair minor rills, and reseed areas with poor vegetation establishment.

In 2009, Atlantic Richfield applied for a compliance determination for revegetated areas within Subarea 1 (Atlantic Richfield 2009). EPA evaluated that report and conducted in-field compliance determinations in 2009, the results of which were discussed in the 2010 five-year review. In short, the inspection indicated that the vegetation in Subarea 1 was well established and providing substantial

cover and protection of the soil surface. EPA concluded that the reclaimed areas within the Historic Structures subarea were compliant with the vegetation and soil performance standards established by the Agency. As with the other candidate compliance areas at the Anaconda Smelter Site, EPA is awaiting a long-term O&M (land management) plan from Atlantic Richfield before making a final decision regarding letting these areas be administered under the long-term inspection and maintenance process.

Monitoring data provided in the latest vegetation monitoring annual report (Atlantic Richfield 2015d) document annual inspections of Subarea 1 by Atlantic Richfield from 2008 through 2013. Those results are for Area7 and the Landfill, and indicate that vegetation canopy cover by perennial grasses has remained steady in the 30 to 39 percent category. Furthermore, the report indicates that soil in the Subarea 1 RA areas has remained stable during this time.

As stated above, the latest inspection of water conveyance structures in Subarea 2 (Atlantic Richfield 2015f) indicates only minor maintenance issues that do not threaten the remedy. In terms of monitoring vegetation, the golf course currently operates under a separate Operations and Maintenance Plan under the responsibility of the Old Works Golf Course Authority Board and is therefore not part of Atlantic Richfield's annual evaluation of reseeded areas. Presently, there are no M&M reports generated by the Golf Course Authority and the reporting requirements for golf course monitoring and maintenance is currently being reviewed by EPA. The annual vegetation monitoring report (Atlantic Richfield 2015d) does, however, provide data for the area north of the bowling alley (in Subarea 2) that was revegetated using a drought tolerant native upland grass mixture. That area was included in the compliance determination conducted by EPA in 2009 and the Atlantic Richfield data collected since then indicates that the vegetation is performing well and the soils are stable.

8.2.1.4 Results of Site Inspections

The 2015 five-year review inspections of Subareas 1 and 2 conducted by EPA during the 2014 field season confirmed the accuracy of the data and other information provided in the annual vegetation and storm water control M&M reports. Some minor maintenance was recommended in the reports and those should be implemented, however, the implemented RAs are functioning as intended and the remediated areas are meeting the vegetation and soil performance criteria developed by EPA. The Agency is awaiting a long-term O&M (e.g., land management) plan before making a final decision regarding letting these areas be administered under the long-term maintenance/five-year review process.

8.2.2 West and East Industrial Areas (Subareas 3 and 4)

The Industrial areas are defined by those properties in private ownership within the OW/EADA OU, including the Anaconda Industrial Park and the former Arbiter Industrial Complex, as well as the area containing the Red Sands waste material (red sands and jig tailings) located adjacent to the golf course subarea and the sewage treatment pond area located east of the Arbiter (Figure 8-1).

8.2.2.1 Construction Status

Engineered covers have been constructed on approximately 230 acres within Subareas 3 and 4. An 18-inch engineered cover was constructed on approximately 200 acres that included areas of in-place lime amended contaminated soil and areas where cover soil was placed over waste materials. The Type B1 gravel cover was constructed on approximately 30 acres of commercial/industrial properties within Subarea 4. The type B1 gravel cover consists of a compacted 6-inch layer of 1-inch minus lime

rock placed across a regraded surface to promote surface water drainage and to limit infiltration. A portion of the Red Sands waste material was left unreclaimed as an historic feature.

Ore process waste and contaminated soil material encountered during RA activities were excavated and consolidated to a designated WMA. Storm water controls were constructed to control sediment transport to Warm Springs Creek, eliminate surface water ponding, and promote surface water drainage away from existing structures. Multiple storm water controls were constructed within Subareas 3 and 4, consisting of approximately 21,600 linear feet of storm water channels, 3,500 linear feet of culverts/piping, and 3 sediment ponds. Streambank armoring consisting of a gabion wall and riprap was installed along Warm Springs Creek adjacent to the Red Sands Waste Pile. The streambank armoring was installed to contain flows for the 100-year flood event.

Properties where RA reclamation work occurred in Subareas 3 and 4 since the 2010 five-year review and for which Atlantic Richfield prepared construction completion reports are listed below. Dates indicate when the final construction element (usually seeding) was implemented.

- ADLC property (2010)
- Sewage Treatment Plant area (2012)
- Anaconda Land Development Company work (includes KANA radio station property (2012)
- Northwoods Enterprises property in the Arbiter Industrial Complex
- AWARE property (2012)
- Stokan property (2013)

The condition of storm water engineered controls and the seeded vegetation were evaluated each year following construction and those results are discussed below. Also since the 2010 five-year review, Atlantic Richfield applied for a compliance determination for 2 properties: Area 1 within Subarea 3 and the Red Sands Originally Seeded Area within Subarea 4. Results of the compliance determination performed by EPA are also discussed below.

8.2.2.2 Operations and Maintenance Status

Active monitoring and maintenance for RA areas within Subareas 3 and 4 includes evaluating the effectiveness of storm water controls and the condition of revegetated cover soiled and sodded areas. These activities are generally performed annually. Site access controls, where necessary to protect the remedy, are provided through the construction of engineered roads, trails, and barriers and the placement of signage. Potential site impacts from climate change have been assessed, and the performance of the remedy is currently not at risk due to the expected effects of climate change in the region and near the Site.

8.2.2.3 Data Review and Evaluation

The latest available Engineered Controls Inspection and Maintenance Report (Atlantic Richfield 2015f) provides the results for inspection and maintenance of engineered control best management practices (BMPs) for Subareas 3 and 4 conducted in 2013. The report indicates that all the BMPs are functioning as designed and lists maintenance issues that include the need to spray for noxious weeds,

repair rills, and reseed areas with poor vegetation establishment. Upon inspection, EPA verified that these issues are not a threat to the RA and can be addressed through the regular maintenance program.

As discussed above, Atlantic Richfield prepared construction completion reports for 6 areas within Subareas 3 and 4 since the 2010 five-year review was performed. For areas that received a seeding treatment, EPA conducted O&F evaluations of these areas to determine if vegetation had become established (as expected) and if the sites were physically stable. Target O&F criteria are:

- Perennial Plant Cover >20 percent
- Perennial Plant Uniformity: Moderate or Higher
- Perennial Plant Density >20 plants per square foot
- Erosional Condition: Very Low to Low

Based on the data collected by EPA, all areas met the target criteria and were therefore moved into the monitoring program performed by Atlantic Richfield each year.

Atlantic Richfield currently conducts annual vegetation and site (soil) stability monitoring in 2 remediated areas within Subarea 3 and 11 areas in Subarea 4; the last report was for the monitoring work performed in 2013 (Atlantic Richfield 2015d). Some of these areas have been remediated since the last five-year review (as discussed above) while other were first reclaimed prior to 2008. A few of the older RA areas have had additional work that has included upgrading the ground surface from temporary caps to the planned final, long-term cap.

The latest annual vegetation report (Atlantic Richfield 2015d) showed that the perennial grass cover across most of these RA areas was at least 20 percent and they often had cover that fell into the 30 to 39 percent cover class. According to the M&M report, these areas had good vegetation cover but there were some small sparsely vegetated areas observed. Photograph 856, 955, and 494 show the generally good vegetation cover in Subareas 3 and 4. However, as can be seen in Photograph 254, a portion of the Sewage Pond Area had sparse cover by the seeded perennial grasses and the plant community is dominated by weedy species. This area was inspected by EPA and determined to not be O&F. Based on additional soil sampling, Atlantic Richfield is developing a plan to re-reclaim this area in 2015/2016. There were also impacts from off road vehicle trespass in Subarea 4 and Atlantic Richfield is evaluating the options for supplemental maintenance activities designed to improve vegetation cover in those areas. Weeds were present in the RA areas but were infrequently encountered during the annual evaluation and were reportedly being sprayed on a regular basis. Since there was no observed evidence of soil movement, rills, or gullies, these RA areas were considered stable by Atlantic Richfield.

Within Subareas 3 and 4, Atlantic Richfield applied for compliance for Area 1 within Subarea 3 and the Red Sands Originally Seeded Area (Atlantic Richfield 2011 and 2012). EPA reviewed the compliance request reports and verified that they contained the required information. This was followed up by EPA in-field evaluations in 2011 and 2013 that confirmed that the vegetation in these areas was well established and providing substantial cover and protection of the soil surface. Only a few very small areas within the compliance area boundaries were considered sparsely vegetated. EPA also observed

that soil erosion was not an issue for the sloped areas. The compliance areas also contained very few noxious weed species and these were being monitored and regularly sprayed with herbicide by Atlantic Richfield. As with the other candidate compliance areas at the Anaconda Smelter Site, EPA is awaiting a long-term O&M (land management) plan from Atlantic Richfield before making a final decision regarding letting these areas be administered under the long-term inspection and maintenance process.

8.2.2.4 Results of Site Inspections

The 2015 five-year review inspections of Subareas 3 and 4 conducted by EPA during the 2014 field season confirmed the accuracy of the data and other information provided by Atlantic Richfield in the storm water control M&M, annual vegetation/soil, and compliance request reports. With the exception of the Sewage Pond Area, the reclaimed areas within Subareas 3 and 4 have generally good cover, which is providing stability to the soils and preventing wind and water erosion (see Photograph 856, 955, and 494). The storm water BMPs are functioning as intended to manage surface water and the vegetation and soil performance standards developed by EPA are being met. Some minor maintenance issues were noted in the reports and those are being addressed by Atlantic Richfield as part of the established maintenance programs. In short, the implemented RAs are functioning as intended. EPA is awaiting long-term O&M (i.e., land management) plan for specific areas before making a final decision regarding letting those areas be administered under the long-term maintenance/five-year review process.

8.2.3 East Anaconda Yards and Aspen Hills/Mill Creek Areas (Subarea 5)

This subarea is defined by the areas known as the East Anaconda Yards, located adjacent to the community of Anaconda, and areas previously included in the Mill Creek OU. The latter areas are collectively known as the Aspen Hills Monitoring Areas and include sites located adjacent to the Mill Creek Road known as the Mill Creek Triangle, Mill Creek Industrial Park, and the Aspen Hills Railroad Loop. Remedial actions for Subarea 5 have been completed and included constructing engineered covers, excavating and removing waste materials, and installing storm water controls.

8.2.3.1 Construction Status

Remediated areas within Subarea 5 are shown on Figure 8-1 for the East Anaconda area and the Aspen Hills Monitoring Areas, which include the Mill Creek Triangle, Mill Creek Industrial Park, and the Aspen Hills Railroad Loop sites. Remediation has consisted of constructing engineered covers over waste materials using different types of soil/gravel material that ranged in thickness from 18 to 22 inches. In addition, beryllium and laboratory wastes were removed from the East Anaconda Yard. Approximately 22 tons of solid hazardous waste and 28 drums were disposed of at a RCRA hazardous waste Treatment, Storage and Disposal facility located in Grand View, Idaho. Non-hazardous wastes were disposed of in the Aspen Hills Expansion Repository and the 2004 Beryllium Repository located within the Smelter Hill WMA.

Storm water controls have been constructed to control sediment transport and convey storm water from Smelter Hill, Nazer Gulch, AFFCO Gulch, and Sheep Gulch through the East Anaconda Yards during storm and seasonal runoff events. Approximately 9,900 linear feet of storm water channels and 480 linear feet of culverts/piping were constructed during the Subarea 5 RA. Storm water controls have also been constructed in and adjacent to remediated areas in the Aspen Hill Railroad Loop area.

8.2.3.2 Operations and Maintenance Status

Active monitoring and maintenance for RA areas within Subarea 5 includes evaluating the effectiveness of storm water controls and the condition of revegetated cover soiled and sodded areas. These activities are generally performed annually. Site access controls, where necessary to protect the remedy, are provided through the construction of engineered roads, trails, and barriers and the placement of signage.

8.2.3.3 Data Review and Evaluation

The latest available *Engineered Controls Inspection and Maintenance Report* (Atlantic Richfield 2015f) provides the results for inspection and maintenance of engineered control BMPs within and adjacent to remediated areas of Subarea 5. The report indicates that all the BMPs, including the Mill Creek Sediment Detention Pond, are functioning as designed and lists maintenance issues that include the need to spray for noxious weeds, repair rills, repair a collapsed wooden culvert, and reseed areas with poor vegetation establishment. Upon inspection, EPA verified that these issues are not a threat to the RA and can be addressed through the regular maintenance program.

Atlantic Richfield requested EPA compliance determinations for several areas in 2011 and 2014 (Atlantic Richfield 2011 and 2014f). These areas are located at the Mill Creek Triangle and are areas that received a vegetated soil covers/ EPA reviewed the compliance request reports and verified that they contained the required information. This was followed up by EPA in-field evaluations that confirmed that the vegetation was well established and providing substantial cover and protection of the soil surface. Based on the field inspections, EPA concluded that these areas met the vegetation and site stability compliance performance standards established by the VMP. As with the other compliant areas at the Anaconda Smelter Site, EPA has allowed these areas be administered under the long-term inspection and maintenance program but is awaiting a long-term O&M (land management) plan from Atlantic Richfield.

Atlantic Richfield currently conducts annual vegetation and site (soil) stability monitoring in 4 remediated areas in the East Anaconda Yards, three areas in the Mill Creek Triangle and Industrial Park, and at three sites in the Aspen Hills Railroad Loop area (Atlantic Richfield 2015d). The annual report indicated that the perennial grass cover across most of these RA areas was at least 20 percent and most areas had cover that fell into the 30 to 39 percent cover class. According to the M&M report, all areas had good vegetation cover but there were some sparsely vegetated areas observed in the Aspen Hills Railroad Loop sites that received vegetative covers. Weeds were present in the RA areas but are being actively controlled.

8.2.3.4 Results of Site Inspections

The 2014 five-year review inspections of Subarea 5 (East Anaconda Yards and Aspen Hills Areas) confirmed that the Mill Creek Triangle areas are still compliant with the performance standard. The inspections also confirmed the accuracy of the data and other information provided by Atlantic Richfield in the 2014 storm water control and annual vegetation/soil monitoring reports. The storm water BMPs are functioning as intended to manage surface water and the vegetation attributes are generally performing well to protect the sites. As mentioned, the perennial grass cover across most of these RA areas was at least 20 percent with many areas falling into the 30 to 39 percent cover class. Photograph 910 of the Mill Creek Industrial Park area provides a good example of the abundant perennial grass cover throughout much of Subarea 5.

According to the annual vegetation monitoring report, all areas had good vegetation cover. However, some re-reclamation is needed in portions of the Aspen Hills Railroad Loop area and some minor maintenance issues were noted in the reports. Those are expected to be addressed by Atlantic Richfield as part of the established RFM and standard maintenance programs.

8.2.4 Drag Strip (Subarea 6)

The Drag Strip Subarea contains more than 350 acres of contaminated soil owned by a local drag racing organization and located in the north-east portion of the OW/EADA OU (Figure 8-1).

8.2.4.1 Construction Status

Remedial actions in Subarea 6 have been completed and included grading and consolidating existing waste/soil, constructing engineered covers, in-place soil treatment, and constructing storm water controls. Waste materials were excavated and consolidated during site grading activities for the implementation of storm water control BMPs and to provide for gravel placement within the Lost Creek Raceway parking lot. All waste materials were consolidated in the Old Works WMA.

Engineered covers were constructed on approximately 200 acres in the portion of Subarea 6 within the OW/EADA OU boundary. The covers ranged in thickness from 18 to 24 inches and were a combination of in-place lime amended soil material and cover soil. In-place soil treatment was used to remediate soil with low contaminant concentrations with the goal of establishing a vegetative cover without placing cover soil. It was completed on approximately 33 acres and consisted of deep tilling to a depth of 24 inches with incorporation of lime amendment. Cover soil was used where contaminants were substantially elevated.

Storm water BMPs were constructed to control sediment transport from Stucky Ridge and the Drag Strip areas into Warm Springs Creek and Gardner Ditch. Approximately 4,350 linear feet of storm water channels were constructed during the Subarea 6 RA. The Drag Strip retention basin was constructed to collect storm water conveyed from the channels.

8.2.4.2 Operations and Maintenance Status

Active annual monitoring for RA areas within Subarea 6 includes evaluating the effectiveness of storm water controls and the condition of revegetated areas that were treated in-place or had cover soil applied. Maintenance has included removing debris from channels and spraying noxious weeds. Site access controls are provided through fencing and locked gates and the placement of signage.

8.2.4.3 Data Review and Evaluation

The latest available Engineered Controls Inspection and Maintenance Report (Atlantic Richfield 2015f) provides the results for inspection and maintenance of engineered control BMPs within and adjacent to remediated areas of Subarea 6. These are the Drag Strip sediment retention pond and water conveyance Channels A, B, and C. The report indicates that the BMPs are functioning as designed and recommended, in addition to weed spaying and debris removal, that some areas may need to be reseeded due to poor vegetation cover. Upon inspection, EPA verified that these issues are not a threat to the RA and can be addressed through the regular maintenance program.

In 2014, Atlantic Richfield requested EPA compliance determinations for two areas in the Drag Strip subarea. For compliance, these areas are subject to the WMA compliance standards. As a whole, this area was compliant with the WMA standards. The southern part had high perennial grass cover and

was dominated by Great Basin wildrye and wheatgrasses, but also had some sparsely vegetated and small bare areas. The northernmost area is located at the far northern end of the Lost Creek Raceway Association property and lies adjacent to the junk cars located on the Lon Zimmerman property. According to the 2014 report, this area had high perennial grass cover and otherwise met the WMA compliance standards.

In addition to these two areas, Atlantic Richfield conducts annual vegetation and site stability monitoring in two other areas in Subarea 6 (Atlantic Richfield 2015d). The annual report indicated that the perennial grass cover across these polygons was very good (30 to 40 percent), soils were generally stable on these relatively flat sites, and weeds were being actively managed.

8.2.4.4 Results of Site Inspections

The 2014 five-year review inspections for Subarea 6 (Drag Strip) confirmed that two areas are still compliant with the performance standard. Contaminated soils and weeds were observed in some areas during the field inspection; however, the Agency inspection verified that the areas as a whole pass the vegetation compliance standards.

The inspections also confirmed the accuracy of the data and other information provided by Atlantic Richfield in the 2014 storm water control and annual vegetation/soil monitoring reports. As can be seen in Photographs 464 and 002, there is generally high vegetation cover in the Drag Strip polygons. The storm water BMPs are functioning as intended and the vegetation attributes are performing well in all areas to limit overland water flow and protect the remedy. Some minor maintenance is needed and those are expected to be addressed by Atlantic Richfield as part of the established maintenance program.

8.3 Progress Since The Last Five-Year Review

The primary RA work since the 2010 five-year review has occurred in Subareas 3 and 4. As mentioned, Atlantic Richfield completed six individual construction completion reports for property within these subareas. The condition of storm water engineered controls and the seeded vegetation were evaluated each year following construction and those results were discussed above. Also since the 2010 five-year review, Atlantic Richfield applied for a compliance determination for two remediate areas in Subarea 6 and those parcels were determined by EPA to be compliant with the performance standards.

The previous (2010) five-year review identified the following issues concerning the OW/EADA OU.

- Long-term effectiveness of ADLC's IC program
- Risk to trespassers from uncovered wastes left in place for historic preservation
- Buried waste and debris limiting redevelopment in the East Anaconda Yards

ADLC's IC Plan is in the final stages of being completed and EPA expects to approve the plan in 2015

The recommendation for the second issue was to determine if uncovered historic wastes pose an unacceptable risk to users and determine if additional action is necessary. Upon further review it was determined that additional measures to restrict access are needed to minimize the public's exposure

to contaminants. Restrictions will be identified in the OW/EADA OU land management plan. This plan is currently being developed and will be completed by December 2015.

The recommendation for buried waste and debris in the East Anaconda Yards was to investigate the nature and extent of this material and develop an appropriate redevelopment plan. ADLC conducted a preliminary engineering report to assess the compatibility of redevelopment with the in place wastes. As discussed above, the land management plan will incorporate access restrictions and, in the case of the East Anaconda Yards, guide future redevelopment in accordance with buried waste/debris protocols provided in the Anaconda DPS.

8.4 Technical Assessment

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

Yes. The remedial actions implemented to date are functioning as intended. Waste material and contaminated soil have been removed, and the revegetated areas and other areas covered by an approved industrial cover material are meeting the performance standards, indicating that the implemented remedy is successfully meeting the RAOs established for the OW/EADA. The establishment of a golf course has proven successful, but its long-term economic viability is in doubt.

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

Yes. EPA re-examined the ARARs and the assumptions used in the 1996 original human health risk assessment (see Appendix C-1) during the 2015 five-year review. In accordance with the preamble to the National Contingency Plan, ARARs are frozen at the time of the ROD unless "a new or modified requirement calls into question the protectiveness of the selected remedy" (55 FR 8757 [March 8, 1990]). Appendix B notes that certain contaminant specific water quality ARARs that have changed since completion of the previous five-year review for the Site, as documented in the 2011 ARWW&S OU ROD amendment. No other new or modified requirement calls into question the protectiveness of the selected remedy for this OU. Since completion of the previous five-year review for the Site, ARARs (Appendix B) have not changed in ways that would significantly affect the remedy implemented within this OU. Changes in land use, exposure assumptions, exposure pathways, and COC toxicity have not increased potential risks since the last five-year review. Within the last five years, EPA established performance standards for reclaimed areas. Those standards, as described in the final VMP (Atlantic Richfield 2013a), were used to determine compliance for revegetated areas and will be used in subsequent five-year reviews to evaluate reclamation success.

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

At the golf course there are currently no exposure pathways for workers or users. The course is within a ground water technical impracticability zone. EPA expects the golf course to continue to protect human health and reduce contaminant flux to ground and surface water. However, questions regarding the financial viability of the golf course have come to light over the last five years. Since the grass on the fairways and green provide a brake in the source/receptor pathway, it is crucial that the maintenance requirements of the vegetation be fulfilled. User fees have not been enough to cover this expense, so a funding stream must be found to ensure that this maintenance is continued. The Agencies are continuing to work with Atlantic Richfield and ADLC to develop a final long-term plan for

funding, operations, maintenance, and management of the golf course, and these issues are expected to be resolved in 2016.

Impacts of climate change on stream flows and the stability of the Warm Springs Creek stream channel were evaluated and found not to be an issue of concern. See Section 4.3.

8.5 Issues and Recommendations

Issues identified for the OW/EADA OU that affect protectiveness are:

- The long-term effectiveness of ADLC's IC program to protect the remedy
- Long-term operations and maintenance of the Old Works Golf Course as a cap over waste
- Access to Old Works Historic Areas with high concentrations of arsenic in soil

It is anticipated that the IC program will be effective in protecting the remedy when it is finalized and fully implemented, the issues related to the Golf Course will be resolved by Atlantic Richfield and ADLC, and a land management plan will be completed to address site access and security.

Table 8-1 Recommendations and Follow-up Actions

Issue	Recommendations and Follow up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future (if not addressed)
1. Long-term effectiveness of ADLC's IC program. **OU16 Community Soils** **OU7 OW/EADA** **OU4 ARWW&S** **OU15 Mill Creek**	A, Finalize ICIAP	Anaconda – Deer Lodge County (ADLC)/Atlantic Richfield	EPA/DEQ	June 2016	No	Yes
	B. Implement and fund ICIAP	ADLC/Atlantic Richfield	EPA/DEQ	June 2016	No	Yes
5. Complete remaining remedial actions: **OU16 Community Soils** **OU7 OW/EADA** **OU4 ARWW&S OU**	B. Complete and implement remaining OW/EADA ISWPs (McDowell, Kittleson, Warner and RDM)	Atlantic Richfield	EPA/DEQ	December 2016	No	Yes
6. Long-term operations and maintenance of the Old Works Golf Course as a cap over waste. **OU7 OW/EADA**	Complete and implement (including funding) the Old Works Golf Course Operations and Maintenance Plan.	Atlantic Richfield	EPA/DEQ	June 2016	No	Yes
7. Access to Old Works Historic Areas with high concentrations of arsenic in soil. **OU7 OW/EADA**	Complete and implement land management plan for the Old Works.	Atlantic Richfield	EPA/DEQ	June 2016	No	Yes

8.6 Protectiveness Statement

The remedy at OW/EADA OU is expected to be protective of human health and the environment upon completion of remaining remedial actions at the OU, including capping of the following parcels (McDowell, Kittleson, Warner and RDM), and access control of the Historic Structure Area. Additionally, a final ICIAP and final Golf Course O&M plan must be completed and implemented (including long-term funding). In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks in these areas.

Section 9

Community Soils OU 16

9.1 Selected Remedy

The Community Soils OU ROD (EPA and DEQ 1996) was issued by EPA and DEQ in October 1996. The ROD addressed all remaining residential and commercial/industrial soils of the Site, and brought closure to previous actions conducted at residential properties within the Site; these include Community Soils Time Critical Removal Actions (TCRAs) and actions taken through the Anaconda-Deer Lodge County's (ADLC's) Development Permit System, as well as action for commercial/industrial properties and in-town railroad beds. Major components of the remedy for residential soils as outlined in the Community Soils OU 1996 ROD are as follows.

- Clean up current residential soils that exceed the residential action level of 250 ppm soil arsenic concentrations through removal and replacement with clean soil and placement of a vegetative or other protective barrier.
- In areas where specific site conditions dictate that removal is not implementable, treatment or take other measures (e.g., capping, tilling, or ICs) to reduce arsenic concentrations to below the 250 ppm action level or to prevent exposure.
- Clean up all future residential soils at the time of development that exceed the residential action level of 250 ppm soil arsenic concentration through the ADLC DPS.
- Implement ICs to provide information to all residents describing potential risks and make recommendations to reduce exposure to residual contaminants in soils and ensure the long-term viability of this remedy.

Major components of the remedy for commercial and industrial property adjacent to the railroad beds as identified in the 1996 ROD are as follows.

- Clean up current commercial or industrial areas that exceed the commercial/industrial action level of 500 ppm soil arsenic concentration through a combination of revegetation techniques and engineered covers.
- Clean up all future commercial or industrial areas at the time of development that exceed the commercial/industrial action level of 500 ppm soil arsenic concentration through the ADLC DPS.

Please note that remedial components specific to the railroad beds within Anaconda are discussed in Section 10.2.5 (RDU 5 - Active Railroads).

In 2013, EPA and DEQ issued a ROD Amendment for the Community Soils OU (EPA and DEQ 2013). The amendment adds a cleanup level for lead in soils and cleanup levels for arsenic and lead in accessible interior dust, as well as expands the scope of the institutional controls implemented through the CPMP to provide for a health education program, and for the DPS to address lead in residential soils. All other components of the 1996 ROD remain unchanged.

Changes to the ROD were due primarily to concentrations of lead in residential soils being significantly higher than those originally reported in the remedial investigation/feasibility study. Additionally, a better site conceptual model was developed based on the large amount of remedial action and other sample data collected since 1996. And although smelter emissions remain the primary source of contamination, it is clear that some properties contain other sources of contamination, such as imported fill material used by residents to level yards and driveways. It was also found that some yards were not constructed or landscaped until the 1940s and 1950s (after nearly 60 years of smelter operations) and this is believed to have resulted in cleaner surface soils being placed over contaminated soils in some locations. Lead contamination in soil has also been caused by sources unrelated to the smelter. For example, many houses were painted with lead-based paint that has deteriorated and contaminated surrounding soils. Sometimes this paint has been scraped and the house repainted at least once in the past. This additional knowledge led to the main components of the 2013 ROD Amendment, which are as follows:

Residential Soils

- Clean up of all remaining soil >400 ppm lead to a maximum of 12 inches and replace with clean soil and a barrier (sod, seed, concrete, asphalt, etc.).
- Clean up of future residential soil through ADLC DPS.
- Expansion of the CPMP to provide for a lead health education program.

Residential soils include: yards; parks; school grounds (including daycares and preschools); all other play areas; and barren driveways, alleys, or other common areas adjacent to yards that may contribute to the contamination of yards and may be frequented by children.

Interior Dust

- Development of an interior dust abatement program to sample and cleanup interior dust exceeding the lead or arsenic concentrations of 400 ppm and 250 ppm, respectively in all living spaces.
- Expansion of the CPMP to reduce exposure to provide dust control and removal services as requested by homeowners planning a remodeling effort.

The 2013 ROD Amendment changed only those provisions of the 1996 ROD that address residential soils; remedies applicable to commercial/industrial areas adjacent to railroad beds, or the actual bed itself, within the Community Soils OU were not modified by the 2013 Community Soils OU ROD Amendment.

9.2 Remedial Action Implementation

All RA requirements associated with the original (1996) Community Soils OU ROD have been satisfied with the exception of the DPS and CPMP, which are being finalized. A supplemental RAWP/FDR for residential soils and interior/attic dust to address the 2013 ROD Amendment is currently being prepared by Atlantic Richfield and is anticipated in 2015. Residential properties with available "screening level" lead data above the residential soils action level will be sampled to verify lead concentrations and to assess the need for RA. Additionally, those residences with no available lead data or screening level data below the residential soils action level for lead will be sampled at the

landowner's request. Similarly, any resident within the Superfund Overlay District can request sampling of their accessible attic dust for arsenic and lead analyses. Attic dust will be sampled by Atlantic Richfield if it is determined that a pathway exists between the attic and interior living space (e.g., the attic is used as a living space, on average the resident enters the attic more than once a week, the ceilings in the living space immediately below the attic are in a condition of disrepair with obvious exposure to the attic, or the resident has contacted ADLC (per CPMP public outreach programs) regarding concerns about attic dust, which may result from a home remodeling project).

The Community Soils OU has been separated into two types of areas to facilitate the discussion of remedial activities in this five-year review: 1) residential soils throughout the Anaconda Smelter Site, and; 2) commercial and industrial property adjacent to the railroad beds in Anaconda. These areas are shown on Figure 9-1.

9.2.1 Residential Soils

Prior to the implementation of RAs under the 2002 RAWP/FDR, residential soil remediation was completed at the Teresa Ann Terrace and Cedar Park Homes subdivisions, located on the northeast side of Anaconda, under a 1991 TCRA. Remedial action within these residential areas included removing residential soils exhibiting arsenic concentrations above 250 mg/kg to a depth of 18 inches. Excavated areas were then backfilled with clean soil and finished with appropriate surfacing materials (e.g., sod on lawns, aggregate on driveways). The 250 mg/kg arsenic concentration was considered a "guideline" cleanup level at that time, only applicable to this specific TCRA.

The approved 2002 RAWP/FDR provided the design approach and basis for remediating residential soils pursuant to the requirements of the 1996 ROD. That design included removal of soils to the depth at which the arsenic action level was exceeded, or to a maximum depth of 18 inches.

The preferred RA alternative identified in the 2013 ROD Amendment includes the following specific actions:

- Conduct systematic soil sampling at those residences where existing (screening-level) lead data indicate the presence of > 400 mg/kg lead in soils.
- Conduct cleanup of residential soils having lead concentrations > 400 mg/kg to a maximum depth of 12 inches.
- Cleanup residential soils consistent with past residential arsenic cleanup (removal of contaminated soil and disposal in an approved waste management area).
- Conduct interior residential dust and attic dust sampling when requested by landowners.
- Cleanup attic dust (negative pressure dust removal/disposal followed by encapsulation) exceeding 250 mg/kg arsenic and/or 400 mg/kg lead.

9.2.1.1 Construction Status

As mentioned, residential soil remediation was completed at the Teresa Ann Terrace and Cedar Park Homes subdivisions under a 1991 TCRA. Construction activities pursuant to the 1996 ROD began in 2004 and continued on an annual basis throughout each construction season until August 2010, when construction activities were deemed complete. A total of 268 residential yards and two alleys in

Anaconda and 73 residential yards located in Opportunity and the surrounding area were remediated under this project. Remedial activities pursuant to the 2013 ROD Amendment have not yet commenced.

9.2.1.2 Operations and Maintenance Status

As there is no residual contamination in placed for the remediated yard components, Superfund O&M is not required. Future development of residential properties, including remediated properties, will be addressed through the DPS process under ADLC's ICs program.

9.2.1.3 Data Review and Evaluation

Because Superfund O&M is not required, there are no data to review for these properties.

9.2.1.4 Site Inspections

Information regarding the remedial status of residential property was obtained from property owners and others during the interview process for this five-year review. No protectiveness issues were identified during those discussions.

9.2.2 Adjacent to Railroad Properties (Commercial/Industrial)

Commercial and industrial properties adjacent to the historic railroad line running through the town of Anaconda are shown in Figure 9-1. Arsenic and metal contamination within the railroad bed is the result of the use of mining and smelting waste as general embankment and ballast material during bed construction. Pre-design analytical results indicated that arsenic concentrations were elevated through the entire cross-section of the railroad beds. Those results also showed that the underlying native soils were not significantly impacted and therefore did not exceed the EPA action level. Given the inability to predict the location and depth of waste material in the Anaconda area, a design assumption was that areas with known contaminated soils (determined by sample results), would have pockets of visible waste materials. Waste material (typically slag type material, but also tailings and waste rock) can be identified visually by experienced personnel. Both contaminated soils and visible wastes were, therefore, addressed during the RA for the adjacent to railroad property.

The FDR and RAWP for the Final Historic Railroad Beds and Commercial/Industrial Areas was completed in by Atlantic Richfield 2005 and then approved by EPA. These areas were divided into three distinct groups based on location and types of RA to be implemented:

- Historic West Valley Railroad Spurs
- Historic Railroad Beds within and nearby the Community of Anaconda
- Commercial/Industrial Areas located adjacent to the currently active RARUS railroad line within Anaconda

EPA determined that visual waste materials located throughout the Anaconda Smelter Site, including wastes associated with (adjacent to) historic/abandoned railroad beds within the Community Soils OU, would be addressed as miscellaneous wastes in accordance with the selected remedy identified in the ARWW&S OU ROD. That ROD required that miscellaneous waste materials located outside a designated WMA be removed and consolidated within a WMA. Therefore, areas containing waste and contaminated soil adjacent to historic or active railroad beds would be completely removed to the depth at which action levels were no longer exceeded, or to a maximum depth of 18 inches. The design

called for all excavated wastes and contaminated soils to be hauled to the Opportunity Ponds WMA for disposed. Those actions are discussed below (remedial action associated with the Historic West Valley Railroad Spur and the Historic Railroad Beds within and nearby the Community of Anaconda are discussed in Section 10.2.5 (RDU 5 of the ARWW&S OU).

9.2.2.1 Construction Status

Remedial construction activities for the commercial/industrial areas adjacent to railroad beds (and for the beds themselves) were completed by Atlantic Richfield in 2006, 2008, 2009, 2010 and 2011. Work typically began in May or June of each construction season and ended in the October/November timeframe. Borrow material was stockpiled and transported from the Community Soils OU soil stockpiles located within the Opportunity Ponds RDU 8 and from S&N Concrete and Materials, Inc. property. Approval of the borrow soils was based on analytical data and the technical specifications and construction quality assurance plan associated with the Agency-approved 2005 FDR and RAWP for the Historic Railroad Beds and Commercial/Industrial Areas prepared by Atlantic Richfield.

Excavated areas were backfilled with clean soil or aggregate materials in accordance with the approved design. For areas designed to be revegetated, cover soil was hauled to the excavated areas and applied at a minimum depth of 6 inches and graded to match the surrounding topography while maintaining positive drainage. The upper 6 inches of backfilled soil was not compacted and was prepared for vegetation (fertilizing, seeding, and mulching) in accordance with the technical specifications found in the RAWP/FDR. Type B material (coarse/structural material) was hauled from the soil stockpiles, placed at the design depth, and compacted in accordance with the specifications for excavations greater than 6 inches deep. Anaconda reclamation seed mixture 4 was used to revegetate the cover soil.

9.2.2.2 Operations and Maintenance Status

To date, no status reports have been issued so the types of O&M activities are unknown. The O&M requirements are pending approval of the construction completion report. It is likely that there will be no O&M requirements since it is believed that all contaminated wastes and soils have been removed under this RA. Any future development of these areas is to be addressed under ADLC's DPS.

9.2.2.3 Data Review and Evaluation

In 2014, EPA conducted an O&F inspection for RA areas described in the following construction completion report: *Draft Final Community Soils Operable Unit Historic Railroad Beds and Commercial/Industrial Areas Construction Completion Report* (Atlantic Richfield 2013e), prepared by Atlantic Richfield Corporation on January 11, 2013. Based on the May 2014 inspection, all areas identified as 'commercial and industrial areas adjacent to historic railroad areas' were found to be O&F with the exception of the following land parcels.

- Northern Portion of Hospital Property (2010/2011)
- Adjacent Area #5 (2006)
- North of Cedar Park Homes (2011)
- Area West of North Western Energy Substation (2010)
- McCarthy Property (2011)

As can be seen in Photographs 364, 709, and 677, portions of these areas are sparsely vegetated and the overall cover by the seeded perennial plant species is relatively low. The presence of the abundant, but now dead, summer cyprus (*Kochia scoparia*) in some areas is an indication of the intense competition that the seeded plants faced as they were germinating and trying to become established. These areas do not currently meet O&F criteria. It was recommended to Atlantic Richfield that sparsely vegetated areas be interseeded with grass seed so that these areas will meet the O&F criteria in a relatively short time frame. EPA anticipates that that maintenance work will be carried out in 2015.

9.2.2.4 Results of Site Inspections

The O&F evaluations conducted in 2014 serve as the current five-year review inspections for the remediated property adjacent to the railroad beds. The primary reason some areas did not meet the O&F criteria was the low cover of the seeded grasses. This was likely caused by the intense competition from *Kochia scoparia*, the most prolific weed species at the Site. EPA's primary maintenance recommendation to Atlantic Richfield was to retill and reseed areas where the original seeding is unlikely to succeed. That work can be addressed through the standard RFM process. Another recommendation was to restrict the general public's access to specific areas to allow the seeded vegetation time to become fully established. It was also recommended that Atlantic Richfield consider applying gravel to areas that are popular places for the public to park vehicles in order to access the creek for fishing and for other activities.

Despite these shortcomings, EPA has concluded that the RA implemented for the adjacent to railroad properties within the Community Soils OU is meeting the short-term (O&F) performance criteria. Some areas need to be reseeded, but any residual waste is covered with clean soil or gravel and that cap has interrupted the source-receptor pathway for the general public and the aquatic biota of Warm Springs Creek.

9.3 Progress Since The Last Five-Year Review

Residential property remediation pursuant to the Community Soils OU 1996 ROD was completed in August 2010. Remedial action activities for the commercial and industrial property were completed in the fall of 2011 and resulted in approximately 38.6 acres being addressed through the removal of contaminated soil/waste removal, backfilling excavation areas with clean soil, and either revegetating the areas or installing aggregate surface materials, depending on the post-remediation land use.

The previous (2010) five-year review identified one issue for the Community Soils OU: human health risks from exposure to contaminants (lead in soils; arsenic at depth in soil; arsenic and lead in interior dust) remaining in residential settings. The recommendation was to determine if the remaining contaminants pose an unacceptable risk to residents and determine if additional RA is necessary. The release of the 2013 ROD Amendment addresses this issue and the implementation of the additional RA work will mitigate potential risks from residual lead and arsenic contamination within the Community Soils OU.

EPA has recently approved Atlantic Richfield's RAWP/FDR (Atlantic Richfield 2015k) to implement the requirements of the 2013 ROD Amendment. Sampling will begin in 2015 and RA construction is expected to begin no later than the 2016 construction season. This RA work is expected to be completed prior to the next (2020) five-year review.

9.4 Technical Assessment

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

No. The remedial actions implemented to date are functioning as intended; however, the additional remedial action to address lead and arsenic in residential soil and dust has yet to be implemented. Revegetated areas and other areas covered by approved aggregate are performing as expected and therefore meeting the remedial action objectives (RAOs) established for the Community Soils OU. The small areas where the seeded species have not established well will be addressed through the regular maintenance program.

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

Yes. EPA re-examined the ARARs and the assumptions used in the 1996 original human health risk assessment during this 2015 five-year review. In accordance with the preamble to the National Contingency Plan, ARARs are frozen at the time of the ROD unless "a new or modified requirement calls into question the protectiveness of the selected remedy" (55 FR 8757 [March 8, 1990]). Appendix B sets forth certain contaminant specific water quality ARARs that EPA has changed since completion of the previous five-year review for the Site. Additionally, the 2013 Community Soils OU ROD Amendment requires cleanup of lead in soils in yard components if the residential action level of 400 mg/kg lead is exceeded. Arsenic concentrations that exceed the area-weighted average cleanup level of 250 mg/kg will continue to be remediated as provided in the 1996 Community Soils OU ROD. Accessible interior dust that exceeds the arsenic and lead cleanup levels will also be remediated.

No other new or modified requirement calls into question the protectiveness of the selected remedy for this OU. Since completion of the previous five-year review for the Site, ARARs (Appendix B) have not changed in ways that would significantly affect the remedy implemented within this OU. Changes in land use, exposure assumptions, exposure pathways, and COC toxicity have not increased potential risks since the last five-year review.

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

No. It should be noted that other sources of lead, such as old lead-based paint, will be addressed in the CPMP by ADLC.

9.5 Issues and Recommendations

Issues identified for the Community Soils OU that affect protectiveness are:

- Implement and complete residential soil/dust RA; and
- Finalize and Implement ADLC's long-term IC program to protect the remedy.

Table 9-1 Recommendations and Follow-up Actions

Issue	Recommendations and Follow up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future (if not addressed)
1. Long-term effectiveness of ADLC's IC program. **OU16 Community Soils, OU7 OW/EADA, OU4 ARWW&S, OU 15 Mill Creek**	A, Finalize ICIAP	Anaconda – Deer Lodge County (ADLC)/Atlantic Richfield	EPA/DEQ	June 2016	No	Yes
	B. Implement and fund ICIAP	ADLC/Atlantic Richfield	EPA/DEQ	June 2016	No	Yes
5. Complete remaining remedial actions, **OU16 Community Soils, OU7 OW/EADA, OU4 ARWW&S OU.**	A. Implement Residential Soils Remedial Action Work Plan.	Atlantic Richfield	EPA/DEQ	December 2021	No	Yes

9.6 Protectiveness Statement

The remedy for the Community Soils OU is not protective because exposure to lead contamination in residential soil and dust is not currently controlled. The following actions need to be taken (implementation of the 2015 Residential Soil/Dust Remedial Action Work Plan and completion and implementation (including long-term funding) of the final ICIAP)) to ensure protectiveness.

Section 10

Anaconda Regional Water, Waste & Soil OU4

Aerial deposition of acidic and metalliferous smelter emissions and the spreading of waste materials in fluvial zones have resulted in several thousand acres of land contaminated with elevated levels of arsenic and metals at the ARWW&S OU. The remedial action specified in the ROD (EPA and DEQ 1998) and the 2011 ROD Amendment (EPA and DEQ 2011) and subsequently described in design documents prepared by Atlantic Richfield are intended to ameliorate human health and environmental threats from this contamination by minimizing or eliminating contaminant movement to surface and ground water, and through the re-establishment of functioning ecosystems in the affected areas. The ARWW&S OU has been delineated into several types of land units, including upland soil areas and WMAs. Upland areas have been further segregated into steep and non-steep areas for remediation and management purposes.

10.1 Remedial Actions

The final remedial actions at the Anaconda Smelter NPL Site are being completed under the ARWW&S OU. These actions address all remaining contamination and impacts to surface and ground water, waste source areas (e.g., slag and tailings), and non-residential soils not remediated under prior response actions, including those under the OW/EADA. The ARWW&S OU will also bring closure to all previous OUs and removal actions.

The Selected Remedy from the 1998 ARWW&S OU ROD is described below followed by a description of the components of the 2011 ROD Amendment.

Ground Water

- For alluvial aquifers underlying portions of the Old Works and South Opportunity Subareas, clean up to applicable State of Montana water quality standards through the use of soil covers and removal of sources (surface water) to ground water contamination and natural attenuation.

- For the bedrock aquifers and a portion of the alluvial aquifer in the Old Works/Stucky Ridge and Smelter Hill Subareas, waive the applicable ground water standard. The aquifers underlying these subareas are impractical to clean up through reclamation, soil cover, or removal of the sources (wastes, soils, and tailings) of the ground water contamination. Reclamation of soils and waste source areas with revegetation is required, which will contribute to minimizing arsenic movement into the aquifers.

- For portions of the valley alluvial aquifers underneath the Old Works/Stucky Ridge, Smelter Hill, and Opportunity Ponds Subareas where ground water is underlying waste-left-in-place, point-of-compliance (POC) monitoring to ensure contamination is contained at the perimeter boundary of the designated WMA. Should POC monitoring show a spread of contaminants beyond the boundary of a WMA, institute treatment options for the ground water where practicable.

Surface Water

- Reclamation of contaminated soils and engineered storm water management options to control overland runoff into surface waters.
- Selective source removal and stream bank stabilization to minimize transport of COCs from fluvially deposited tailings into surface waters. Removed material will be place within a designated WMA.

Soils and Waste Materials

- Reduction of surficial arsenic concentrations to below the designated action levels of 250 ppm, 500 ppm, and 1,000 ppm through a combination of soil cover or in-place treatment.
- Reclamation of the soils and waste area contamination by establishing vegetation capable of minimizing transport of COCs to ground water and windborne and surface water erosion of the contaminated soils and waste areas. This vegetation will also provide habitat consistent with surrounding and designated land uses.
- Partial removal of waste materials followed by soil cover and revegetation for areas adjacent to streams. Removed material will be placed within designated WMAs.
- The remedy will employ ICs and long-term O&M for the OU to ensure monitoring and repair of implemented actions. These actions will be coordinated through development of an ICs Plan and O&M Plan and will allow for communication with local government and private citizens. The plans will function as a tracking system for the agencies and describe and plan for potential future land use changes.
- The remedy calls for a fully-funded ICs program at the local government level. It is anticipated that ADLC will be responsible for implementation of a county-wide DPS, and provision of public information and outreach through a CPMP.
- In addition, the remedy will bring closure to previous response actions within the site that are already implemented, such as the Flue Dust remedy or the Old Works remedy, primarily through long term O&M for some or all of those actions which are integrated into this remedy.

Remedial Design/Remedial Action Management

The ARWW&S OU encompasses a very large area and remedial action was slated for approximately 20,000 acres in the ROD. The size of the OU and the focus on land reclamation as the key remedy required management tools during remedial design and remedial action activities to help direct, prioritize, and sequence response actions and allow for changing community interests. As envisioned in the ROD, management of the OU can be accomplished with the following elements:

- Site Management Plan (SMP) - The SMP will provide a framework for future Remedial Design/Remedial Action (RD/RA) activities and will incorporate remedial unit designations and sequencing criteria for the RD/RA actions.

- Historic Preservation and Mitigation Plan - Final implementation of the Regional Historic Preservation Programmatic Agreement will be accomplished. Separate agreements to address tribal cultural resources will be included.

- Wetlands Mitigation - Assessment and mitigation of impacts to wetlands from implementation of the remedy and communications with U.S. Fish and Wildlife Service will be coordinated.

The Selected Remedy would achieve reduction of risk to human health and the environment through the following:

- Preventing human ingestion of, inhalation of dust from, or direct contact with, contaminated soil and/or waste media where such ingestion or contact would pose an unacceptable health risk for the designated land use.

- Stabilization of contaminated soil and waste material against wind and surface erosion.

- Minimizing transport of contaminants to ground water and surface water receptors.

In 2011, EPA and DEQ issued a ROD amendment (EPA and DEQ 2011) that modified the ROD selected for the ARWW&S OU in September 1998. The ROD Amendment was based on the Administrative Record for the ARWW&S OU, including the 1998 ROD, four TI evaluations, the Proposed Plan, the public comments received, and EPA responses to comments. The Amendment explains the factual and legal basis for modifying the remedy for this OU and the revised remedy was selected in accordance with CERCLA as amended (42 U.S.C. § 9601 et seq.), and in accordance with the NCP [40 C.F.R. Part 300]. The ROD Amendment has three purposes.

- Describe the changes to the remediation requirements of the 1998 Selected Remedy, including RAOs, ARARs, and cleanup levels.

- Certify that the remedy selection process was carried out in accordance with the requirements of CERCLA, and, to the extent practicable, the NCP.

- Provide the public with a consolidated source of information about RD investigations and data evaluations completed since the original ROD was signed in 1998, which led to the changes presented in the ROD Amendment, as well as EPA's consideration of, and responses to, the comments received.

The basis for the revisions to the selected remedy identified in the 1998 ARWW&S OU ROD are twofold: 1) fundamental changes resulting from the Agencies' decision to waive the arsenic human health standard in certain ground and surface waters at the Site, based on the arsenic human health standard of 10 μg/L, which has resulted in expanded and new TI Zones; and 2) additional design investigations and work completed which has led to better site characterization and subsequent changes to the 1998 Selected Remedy. The first basis results in fundamental changes to the 1998 ROD, while the second basis results in significant changes to the 1998 ROD.

Based on protectiveness of ARARs, the ROD Amendment changes the human health standards for arsenic and zinc in ground and surface water, and the aquatic standards for cadmium, copper, and lead in surface water. The Amendment also waives the arsenic human health standard in certain

ground and surface waters at the Site. The waiver is the only fundamental change to the Selected Remedy with respect to contaminant specific standards. The contaminant specific ARAR changes since the 1998 ARWW&SOU ROD was issued are summarized in Table 3-1 of the Amendment. Other than those changes, there are no changes to the remedial action goals set forth in the 1998 ROD.

Numerous investigations have been conducted to fill data gaps and complete RDs. These data have led to a better characterization of the extent of contamination for waste, soils, ground water, and surface water. The lowering of the arsenic standard prompted a re-definition of the volume and spatial distribution of contaminated ground and surface waters at the Site. Thus, the performance standard changes and additional Site characterization led to a modification of the remedy with regard to addressing sources of contamination and to the expected measure of performance. The new data and design analyses, as well as the data and analyses which formed the basis for the 1998 ROD, together provide the basis for the ROD Amendment.

The RAOs identified in the 1998 ROD remain unchanged by the ROD Amendment. The fundamental and significant changes to the ROD for each media are summarized below; fundamental changes are to ground water and surface water components.

- Ground Water - In addition to the expansion of the bedrock aquifer TI zone boundaries, a waiver of the arsenic human health standard has been identified for alluvial aquifers in the North Opportunity and South Opportunity areas. Although the ROD Amendment requires more source control measures (e.g., removal of miscellaneous wastes and reclamation of contaminated soils) than the 1998 Selected Remedy, TI evaluations have concluded that the human health arsenic standard will not be achieved within a reasonable period of time within the areas. A domestic well monitoring and replacement plan has been developed to ensure that domestic well users within or adjacent to these TI zones will have drinking water that, at a minimum, meets standards.

- Surface Water - The arsenic human health standard for surface water is waived to the chronic and acute aquatic life federal and state standards of 150 and 340 ug/L, respectively, within the surface water TI zone. These surface waters have been impacted by ground water discharges from the bedrock TI zone.

- WMAs - WMA boundaries have been revised to include adjacent waste left in place.

- Miscellaneous Wastes - Certain of the miscellaneous wastes will now be removed and consolidated, or incorporated into WMAs, or are addressed under long-term operations and maintenance plans as dedicated developments.

- Contaminated Soils - Areas of reclamation have been expanded to the north and east. Additionally, two high arsenic areas (soil arsenic concentrations between 1,000-2,500 mg/kg) have been designated where steep slopes prevent safe operation of conventional reclamation equipment (Smelter Hill) and where well vegetated areas with wetlands and unique wildlife habitat are present (Dutchman). These high arsenic areas will be managed to minimize human exposure to arsenic.

10.2 Remedial Action Implementation

Substantial progress has been made implementing the Selected Remedy for the ARWW&S OU since the last (2010) five-year review was performed. Because of the size and complexity of the ARWW&S

OU, it has been subdivided into 16 RDUs to facilitate design and implementation of the selected remedy.

- RDU 1 - Stucky Ridge Uplands
- RDU 2 - Lost Creek Uplands
- RDU 3 - Smelter Hill Uplands
- RDU 4 - Anaconda Ponds
- RDU 5 - Active Railroad/Blue Lagoon
- RDU 6 - South Opportunity Uplands
- RDU 7- North Opportunity Uplands
- RDU 8 - Opportunity Ponds
- RDU 9 - Fluvial Tailings
- RDU 10 – Warm Springs Creek
- RDU 11- Cashman Concentrate
- RDU 12 - Slag
- RDU 13 - Old Works WMA
- RDU 14 - Smelter Hill Facility Areas
- RDU 15 - Mount Haggin Uplands
- West Galen Expansion Area
- Dutchman Area

Ground water and surface water issues are being addressed separately since those resources cross RDU boundaries. A summary of the status of site work completed for each RDU is provided below. Also, the maps in this section show the areas within each RDU slated for RA and those areas where the RA has been implemented to date.

10.2.1 RDU 1 - Stucky Ridge Uplands

The final remedial design report for RDU 1 was prepared by Atlantic Richfield in 2005. The revegetation design includes approximately 3,868 acres of remedial polygons (Table 10-1). Approximately 2,309 acres require implementation of the selected remedy while no physical remediation (primarily in-place soil treatment) is require for the remaining 1,559 acres because these areas are classified as facilities (e.g., motocross track) or designated as well vegetated areas by EPA that require only monitoring and weed spraying. To date, RA has been implemented for

approximately 1,052 acres. The implemented acres include 572 acres remediated by Atlantic Richfield and 480 acres remediated by the state of Montana Natural Resource Damage Program (NRDP).

Figure 10-1 shows the remedial design areas, the type of remediation, and where the remedial action has been implemented to date for RDU 1 - Stucky Ridge Uplands. In addition to the RA areas, 2 facilities have been designated within RDU 1: the East Knob Borrow area and a motorcycle track. The borrow area is located west of Galen Road and north of Highway 1 and is approximately 74 acres in size. The motorcycle track is approximately 23 acres and is owned by the Anaconda Motocross Association, Inc. and it is located on the north east side of RDU 1 just off of Lost Creek Road.

10.2.1.1 Construction Status

To date, approximately 572 acres requiring RA have been implemented by Atlantic Richfield under multiple projects and an additional 480 acres of State owned property is in the process of being remediated by the State under the Montana NRD program (Figure 10-1).

Remedial Action Prior to the Last (2010) Five-Year Review

Approximately 145 acres of RDU 1 were remediated prior to the 2002 ROD as part of reclamation demonstration projects implemented by Atlantic Richfield and the Agencies, and an additional 358 acres were remediated by Atlantic Richfield following the ROD but prior to the implementation of the final design (in the 2002 to 2007 time frame).

The initial reclamation work on Stucky Ridge was performed in the 1990s at the Tillage Demonstration Plots. Additional RA work conducted by Atlantic Richfield included in-place soil reclamation and revegetation at the 1994-1996 Reclamation Areas, the 2002/03 Moto Cross Demonstration (East End) Reclamation Areas, the Stucky Ridge RFC 3 – 2005/06 Reclaimed Areas, and the Stucky Ridge RFC 4 – 2007 Engineered Controls Punchlist Areas. In addition to land reclamation, storm water drainage channels, sediment ponds, and other BMPs were installed prior to 2010 as part of several storm water runoff control projects.

Remedial Action Since the Last (2010) Five-Year Review

Remediation of the approximately 480 acre State-owned portion of Section 36 at the top of Stucky Ridge was initiated in 2010 by the Montana NRDP with EPA oversight (Figure 10-1 shows this parcel). The majority of the State-owned property has had a T12 (tillage to 12 inches) remedy implemented as prescribed under the RDU 1 design documents prepared by Atlantic Richfield. The RA was implemented in three areas: SA1, SA2, and SA3. The remaining areas consist of Steep Slope Reclamation, BMP, and No-Action areas primarily located along the parcel boundary and within interior drainageways, some of which contain abundant plant growth. Implementation of the RA work has occurred from 2010 through the 2014 construction season and additional work is planned for 2015. Maintenance (primarily weed spraying) and the installation of erosion control BMPs has been on-going. The RA work can be separated into:

Table 10-1 Remedial Design/Action and Compliant Acres ARWW&S OU 2015 Five Year Review

Total Remedial Design Acres[1]	Acres Not Requiring a Direct Remedial Action[2]	Acres Requiring a Direct Remedial Action[3]	Remediated Acres[4]	Remaining Remedial Design Acres[5]	Acres Meeting Compliance Performance Standards[6]	Acres Meeting O&F Criteria (areas in Short-term Monitoring Program)[7]	Acres Not Meeting O&F Criteria[8]
RDU 1 - Stucky Ridge							
3,888	1,632	2,256	1,052	1,204	357	183	512
The 2014 EPA site inspections indicated that most areas where the in-situ RA was implemented on Stucky Ridge had well established perennial vegetation, were erosionally stable, and had limited weed growth; however, some areas had not produced perennial plant cover necessary to meet the Anaconda O&F criteria or long-term performance standards. Those areas include the 2002/03 Moto Cross Demonstration Areas, the RFC No 3 2005/2006 Reclaimed Areas, and the State owned parcel being remediated by the Montana NRDP. Contributing factors to the slow development of the seeded species include drought, competition with weeds, inadequate (incomplete) soil pH control, and the high concentration of arsenic and metals in the soil. Time is required to determine if these struggling areas can eventually meet performance standards and EPA will continue to monitor these areas annually.							
RDU 2 - Lost Creek Uplands							
1,480	650	830	0	830	0	0	0
Remedial action has not been implemented so no site inspections were conducted in this RDU.							
RDU 3 - Smelter Hill Uplands							
3,453	1,622	1,831	99	1,732	28	71	0
All remediated areas have passed either the compliance performance standard and are in the long-term/5 year review program or have passed the O&F criteria and are in the short-term monitoring program. With few exceptions, the remediated areas in the Smelter Hill Uplands have good perennial plant cover and stable soils. Areas that continue to struggle vegetatively are Nazer Gulch Evaluation Area 2 and Aspen Hills Loop Track Evaluation Area 3. These remediated polygons are expected to eventually meet the performance standard and are being watched each year by EPA. Some minor maintenance needs to be conducted for the storm water control structures and seeded areas.							
RDU 4 - Anaconda Ponds WMA							
662	0	662	662	0	610	52	0
Remedial action has been implemented for the entire Anaconda Ponds RDU. With the exception of one small area, the entire RDU has met the compliance performance standard and is now in the long-term/5 year review monitoring phase. The outstanding polygon has met the O&F criteria and is currently in short-term monitoring. The 2014 EPA inspection confirmed that all areas have good vegetation cover, little soil movement (even on steep slopes), and that weeds are being effectively controlled.							
RDU 5 - Active Railroads/Blue Lagoon							
80	25	55	55	0	0	45	10
The majority of land within this RDU has been remediated and RA is on-going. EPA's 2014 inspection confirmed that most areas have good vegetation cover, little to no soil movement, and that the weeds are being actively managed. All areas, with the exception of the on-going work areas at Blue Lagoon, are O&Fs and in short-term monitoring. EPA concluded that the completed RAs in this RDU are protective, even the five small areas that require some additional reseeding work.							

Total Remedial Design Acres[1]	Acres Not Requiring a Direct Remedial Action[2]	Acres Requiring a Direct Remedial Action[3]	Remediated Acres[4]	Remaining Remedial Design Acres[5]	Acres Meeting Compliance Performance Standards[6]	Acres Meeting O&F Criteria (areas in Short-term Monitoring Program)[7]	Acres Not Meeting O&F Criteria[8]
RDU 6 - South Opportunity Uplands							
956	266	690	236	454	130	77	29
Most of the approximately 236 acres of remediated land in the South Opportunity Uplands RDU has been successfully remediated. Much of this acreage has passed the compliance performance standard and is in the long-term/5 year review monitoring phase of the Anaconda Smelter site work and most of the remaining RA areas are in short-term monitoring. The exception to this success is Evaluation Area 2, which after reseeding and two additional growing seasons still has very poor vegetation conditions. Currently, the RA for Evaluation Area 2 is not functioning as intended and therefore does not meet the remedial action objectives to be protective of human health or the environment. EPA is in discussions with Atlantic Richfield and has recommended either stripping of the highly contaminated soil or the application of cover soil to this area. Some minor storm water channel and vegetation maintenance should be conducted as recommended in the annual inspection reports.							
RDU 7 - North Opportunity Uplands							
798	35	763	651	112	406	245	0
Most of the RA areas in the North Opportunity Uplands RDU have been successfully remediated. A substantial portion of this acreage has passed the compliance performance standard (LRES>115) and is in the long-term/5 year review monitoring phase of the Anaconda Smelter site work. The remaining RA acres have passed the O&F criteria and are being monitored under the short-term program. No areas within this RDU have failed either the O&F criteria or compliance performance standard so all areas are functioning as intended and therefore meet the remedial action objectives to be protective of human health or the environment. This RDU continues to be monitored by Atlantic Richfield and weeds are actively sprayed for control.							
RDU 8 - Opportunity Ponds							
7,388	2,556	4,832	4,535	297	2,585	1,950	0
The 2014 five year review inspection conducted by EPA confirmed that the remediated areas within RDU 8 are either O&F (and therefore in the short-term annual monitoring program conducted by Atlantic Richfield) or continue to meet the compliance performance standards. The latter will continue in the long-term/5 year review monitoring program. Based on the site inspections, the RAs implemented within the Opportunity Pond WMA are functioning as intended and, as such, are protective of human health and the environment.							
RDU 9 - Fluvial Tailings							
5,015	2,924	2,091	525	1,566	0	390	135
The 2014 five year review inspection conducted by EPA confirmed that most remediated areas within this RDU are developing as expected. Most areas have passed the O&F criteria and those are now in the short-term monitoring program. EPA and Atlantic Richfield have agreed to allow the areas not meeting the O&F criteria several more years to become better established before planning a new reclamation strategy. Competition from weeds is likely a major reason why the seeded species have not developed well in some areas, although soil contaminant levels may also be a factor.							
RDU 10 - Warm Springs Creek							
80	36	44	0	44	0	0	0
Remedial action has not been implemented so no site inspectionwere conducted for this RDU in 2014.							
RDU 11 - Cashman Concentrate							
2	0	2	2	0	0	2	0
The Cashman removal area was inspected and found to be vegetated and erosionally stable.							

Total Remedial Design Acres[1]	Acres Not Requiring a Direct Remedial Action[2]	Acres Requiring a Direct Remedial Action[3]	Remediated Acres[4]	Remaining Remedial Design Acres[5]	Acres Meeting Compliance Performance Standards[6]	Acres Meeting O&F Criteria (areas in Short-term Monitoring Program)[7]	Acres Not Meeting O&F Criteria[8]
RDU 12 - Slag							
197	0	197	0	197	0	0	0
The Slag areas were inspected by EPA in 2014 as part of the inspection for OW/EADA OU. Erosional control BMPs are in place and generally functional, although strong winds continue to entrain and move slag into adjacent areas.							
RDU 13 - Old Works WMA							
0	0	0	0	0	0	0	0
Administratively, there are no RD/RA areas in RDU 13. The RD for this area was prepared and the RA implemented under the OW/EADA OU.							
RDU 14 - Smelter Hill Facility Area							
1,368	443	925	332	593	222	100	10
The EPA 2014 five year review inspections of the RA areas within RDU14 verified Atlantic Richfield's characterization of site conditions and determined that the minor maintenance issues were not a threat to the remediated areas and can be addressed through the established maintenance programs. However, based on the site inspections, the Original Beryllium Repository and Previously Reclaimed Areas 7 and 8 have poor vegetation establishment and may not develop sufficient cover to meet the cover standard of 30 percent, and may also not meet one or more of the other standards for WMAs. Atlantic Richfield is developing a scope of work to implement another RA for the Original Beryllium Repository that involves an enhanced cover soil. For Previously Reclaimed Areas 7 and 8, EPA intends to meet with Atlantic Richfield in 2015 to develop a scope of work designed to improve vegetation conditions in those areas. The issues with some portions of those areas may be addressable through the established maintenance program; however, more aggressive actions, such as deep tillage or stripping/removal of highly contaminated material, may be required in some areas. Re-reclamation of these areas using current approaches, which are based on the 30+ years of reclamation experience at this site, may be the only way to set them on a trajectory to meet WMA vegetation performance standards.							
RDU 15 - Mount Haggin Uplands							
776	639	137	0	137	0	0	0
Based on the EPA inspection conducted for RDU 15 in 2014, some erosion control BMPs and weed spraying to improve vegetation, as well as planting of trees and shrubs have been implemented so the potential risks to aquatic biota in Cabbage Gulch has likely been reduced							
West Galen Expansion Area							
6,367	1,863	4,504	3,354	1,150	2,370	901	83
The five year review inspections of the remediated areas within the West Galen Expansion Area conducted by EPA during the 2014 field season confirm that the majority of the remediated areas are compliant with the performance standard of 115 LRES points and, as such, meet the remedial action objectives to be protective of human health or the environment. A relative small number of acres (83 acres) have poor or no plant establishment. EPA plans to continue monitoring these areas for improvement and is working with Atlantic Richfield to implement additional remediation, where appropriate, that will set these areas on a course to meet the O&F criteria and eventually pass the LRES compliance performance standard.							
Total Acres							
32,510	12,691	19,819	11,503	8,316	6,708	4,016	779

1 Number of remedial design acres (includes areas designated No Action).

2 Number of acres not requiring a direct remedial action because of the high quality of the vegetation cover, historic value, land use, of another remedial decision modifying factor.

3 Number of acres where a remedial design was prepared to perform a direct remedial action.

4 Number of acres that have received a remedial action through 2014.

5 Number of acres where a remedial design has been prepared and the remedial action will be implemented.

6 Number of acres meeting the long-term compliance performance standards. These are the acres that meet the compliance standard of 115 LRES points for non-steep/non-WMA Upland areas or meet specific criteria for areas defined as either WMA or Steep Slope Reclamation (SSR) areas. These areas are in the long-term/5 year review monitoring program. Compliance performance standards are discussed in the Anaconda Vegetation Management Plan (VMP).

7 Number of acres that have passed the Operational and Functional (O&F) criteria and are in the short-term (e.g., yearly) monitoring program.

8 Number of acres that have not passed the O&F criteria and require either additional time for the vegetation to develop or are designated for additional remedial action work.

- Large open space areas that were tilled generally to 12 inches with a tractor and an off-set disk or chisel plow and seeded using both drill and broadcast seeding;
- Steep slope areas where plant material consisting of shrubs and trees was installed and the ground broadcast seeded, and;
- Areas on slopes and within drainageways where engineered erosion control structures were installed. These BMPs include catchment basins, spillways, dozer basins, coir check structures, slash filters, woody debris, rock and earthen check dams, and contour furrowing.

The work has been performed by NRDP contractors with EPA oversight. To date, all upland areas have been tilled and seeded and a total of 30,949 trees and shrubs have been planted.

The NRDP project manager indicated during a meeting with EPA in January 2015 that additional reseeding will take place in 2015. This work will occur where grasses have struggled to establish from the seedings done in 2013 and 2014.

Atlantic Richfield has not implemented further RA in this RDU since the last (2010) five-year review report was prepared.

10.2.1.2 Operations and Maintenance Status

Active monitoring and maintenance for RA areas within the Stucky Ridge Uplands includes evaluating the effectiveness of storm water controls, the condition of vegetation, and the stability of the soils. These activities have been performed annually by Atlantic Richfield or the State and maintenance requirements are addressed as needed. Site access controls are maintained through the erection of new fences and the repair of existing fences, and the placement of signage.

10.2.1.3 Data Review and Evaluation

Remedial Action Areas Addressed by Atlantic Richfield

The latest available Engineered Controls Inspection and Maintenance Report (Atlantic Richfield 2015f) provides the results for inspection and maintenance of storm water intercept channels and sediment ponds in 2013. The report indicates that all engineered storm water controls are functioning as designed and lists maintenance issues that include the need to spray for noxious weeds, clean sediment out of specific areas, remove debris, repair small erosion areas, and reseed areas showing poor vegetation establishment. Upon inspection, EPA verified that these issues are not a threat to the RA and can be addressed through Atlantic Richfield's regular maintenance program.

In 2011, Atlantic Richfield applied for a compliance determination for 6 revegetated areas within RDU 1 - Stucky Ridge (Atlantic Richfield 2011). The report indicated that the subject areas underwent quantitative assessments by AR twice, as required. Uplands were evaluated using the land reclamation evaluation system (LRES) and steep slope areas were evaluated for erosion using the BLM method as defined in the EPA-approved VMP.

Following the review of the annual report, EPA conducted in-field evaluations in 2011 of the subject remediated areas. For each area, the evaluator specifically checked whether it was meeting the VMP performance standards. The field evaluation indicated that these RA areas were meeting the vegetation and site stability compliance performance standards and indicated to Atlantic Richfield

that these areas could go into the long-term/five-year review monitoring phase. Four (4) of these areas are in the Category 3 land class and therefore underwent performance evaluations by Atlantic Richfield in 2014 as required for the five-year review. Two (2) other areas (the Tilling Demonstration Plots) are Category 2 parcels and do not require further monitoring other than for weed management.

Data provided by Atlantic Richfield indicated that the Category 3 RA areas in the long-term monitoring program (i.e., those that were determined by EPA to be compliant) had excellent vegetation cover and stable soils in 2014. For the 5 areas in the short-term monitoring program, Atlantic Richfield conducted annual M&M evaluations up through the 2014 growing season. The latest annual vegetation monitoring report (Atlantic Richfield 2015d) indicated little success in the establishment of the seeded species in these areas despite having more than 8 growing seasons to develop. Remedial action work was completed for these areas under RFC No. 3 – 2005/2006 Remediation Areas and RFC No. 4 – 2007 Engineered Controls Punchlist Areas. According to the 2015 vegetation monitoring report, these areas continue to have low to moderate vegetation cover, areas of particularly sparse vegetation growth, and erosion and weed problems. Total perennial plant canopy cover for some of these areas is as low as 10 percent. In many locales the vegetation is dominated by redtop, a non-native volunteer species, and the seeded species are virtually absent. The vegetation and soil data, as well as other general observations, suggest that conditions may not improve in some areas to the point where they will meet the performance standards for upland (i.e., >115 LRES points) or steep (BLM score <45 points) areas.

State of Montana Remedial Action Areas

Since 2013, the Montana NRDP has released several reports summarizing soil conditions, vegetation establishment from seed in the large open space upland areas, and plant material survival and growth on the steep slope areas (NRDP 2013, 2014, and 2015). Based on data from the reports, from meetings held with State personnel each year, and from direct observations since RA work began, the RAs implemented by the State have had variable success to date in establishing species from seed. Acceptable seedling establishment has occurred in some areas, while other areas are very sparsely vegetated. Contributing factors to poor plant establishment include drought, competition from weeds (especially *Kochia scoparia*), and the high concentration of arsenic and metals, particularly copper, in the soil surface where seeds germinate. It should be noted that the EPA has not performed an O&F inspection for the NRDP remediated areas; that inspection will occur once construction is complete. It is anticipated that some areas will undergo O&F inspection in 2015.

The NRDP seed mixtures are some of the most diverse mixtures used to date in the Anaconda area. Unfortunately, only the hardiest, metal tolerant grasses have been able to become established. The poor establishment by grasses and the complete lack of forb establishment are consistent with the conclusions of the EPA phytotoxicity investigation, which found that metal concentrations have a dramatic impact on all but the most adapted, hardiest perennial grasses, even when the soil is amended with lime and has a circumneutral pH (EPA 2013). The seeded species that performed best was Copperhead slender wheatgrass, which appears to have good metal as well as acid tolerance.

Monitoring data collected by the NRDP indicate little success in establishing trees and shrubs using nursery stock on the steep open areas and gully slopes. Reasons for this include high soil metal and low pH levels, droughty conditions (due to weather and soil moisture holding capacities), low soil nutrient content, wind scour, soil movement (erosion and sloughing), and animal browse. Some success was noted by NRDP in the tree and shrub planting areas that included:

- Douglas fir establishing in a few places along the top of gullies
- Riparian and wetland species establishing in drainage ways where there is additional moisture due to check dams and other erosion control structures
- Desirable shrubs such as chokecherry and rose colonizing side slopes and tops of gullies
- Good increase in aspen and other species in areas fenced off and protected from wildlife browse
- Erosion control BMPs have been effective in keeping runoff and sediment from reaching perennial surface water and increasing the establishment and growth of vegetation

10.2.1.4 Results of Site Inspections

The 2015 five-year review inspections of the RA areas within RDU1 - Stucky Ridge conducted by EPA during the 2014 field season confirmed the accuracy of the data and other information provided in the Atlantic Richfield vegetation and storm water control M&M reports (for the non-State property). Some minor maintenance needs to be conducted for the storm water control structures as recommended. Some upland reclaimed areas have well established perennial vegetation, are erosionally stable, and have limited weed growth. In the less contaminated areas, community diversity can be relatively high and include a variety of wheatgrass and other species. However, near the old smelter complex where soil metals remain high, plant communities are dominated by Great Basin wildrye (*Leymus cinereus*) and redtop (*Agrostis alba*). In fact, the vegetation in some RA areas may not be robust enough to provide the cover and litter necessary to protect the soil surface from erosion. Even after more than 12 growing season, sparsely vegetated areas were noted in the 2002/03 Moto Cross Demonstration Areas and in the RFC No 3 2005/2006 Reclaimed Areas (see Photographs 5814 and 444). These areas are dominated by only the most metal-tolerant grass, have sparsely vegetated/bare areas, and contain a variety of noxious and other weedy species. EPA is currently watching these areas closely to determine if additional time will enable them to pass the performance standard or if direct intervention is needed.

The 2014 EPA inspections also confirmed conditions within the State property: seeded forb species failed to establish and the perennial grasses have established in most areas but their cover is still very low. The NRDP plans on interseeding upland areas where grass establishment is sparse. Some rill and gully erosion is present and is being addressed by the State. Shrub and tree plantings have had little success except is specific locales, such as drainageways where soil moisture is readily available. Erosion control structures, such as sedimentation barriers within drainageways, are functioning to control off-site migration of sediment. EPA will perform O&F inspections in 2015 in areas where the NRDP has declared construction complete.

In summary, the 2014 EPA site inspections indicated that most of the older areas addressed by Atlantic Richfield have been successfully remediated and are compliant with the performance standards. The vegetation on a small number of Atlantic Richfield acres (approximately 32) and all of the land remediated by NRDP (480 acres) continues to develop. Contributing factors to the slow development of the seeded species include drought, competition from weeds, inadequate (incomplete) soil pH control, and the high concentration of arsenic and metals in the soil. Due to very poor plant establishment in some areas, the State has initiated a reseeding program in 2015. EPA will continue to

monitor the Montana NRDP reclamation efforts because the State is required to meet the same reclamation performance standards as Atlantic Richfield.

10.2.2 RDU 2 - Lost Creek Uplands

The revegetation design for RDU 2 - Lost Creek Uplands includes approximately 1,468 acres of remedial polygons. Approximately 825 acres of these polygons require implementation of a remedial action while the remaining 643 acres do not require physical remediation (e.g. treatment) as they are facilities or well vegetated and may only require monitoring and weed spraying. To date, no land has had a RA implemented (Table 9-1). Designed RA includes revegetation and soil treatments to reduce arsenic concentrations to applicable action levels and engineered storm water controls/BMPs to reduce transport of COCs to waterways. The approved RD for this RDU is dated January 2005 (CD Register Document 602-05-24) and the RAWP is dated June 2005 (CD Register Document 602-05-23). Additionally ISWPs exist for two facilities within RDU 2; these area a privately owned gravel pit/disturbance located west of Galen Road and north of Lost Creek Road (approximately 0.7 acres in size) and the second facility is a private roadway on private land (approximately 2 acres in size) that is currently associated with a ranching/calving operation and a private junkyard.

10.2.2.1 Construction Status

Implementation of land reclamation work has not been started in this RDU, however, ground and surface water are being monitored and ICs are being utilized to limit potential exposures to contaminants.

10.2.2.2 Operations and Maintenance Status

Remedial action has not been implemented so no O&M is being conducted.

10.2.2.3 Data Review and Evaluation

Remedial action has not been implemented so no evaluation data are available for review.

10.2.2.4 Results of Site Inspections

Remedial action has not been implemented so no site inspections were conducted for this RDU.

10.2.3 RDU 3 - Smelter Hill Uplands

The RD for RDU 3 - Smelter Hill Uplands includes approximately 3,354 acres of remedial polygons (Figure 9-3). Approximately 1,723 acres of these polygons require implementation of a RA while the remaining 1,631 do not require physical remediation (e.g. treatment) as they are facilities or well vegetated areas that may only require monitoring or weed spraying. Approximately 99 acres of RDU 3 were remediated as part of the Aspen Hill Loop Track Project (approximately 23 acres), the Aspen Hills and East Anaconda Yards Project (approximately 32 acres), the Nazer Gulch Project (approximately 32 acres), and the Silver Lake Pipeline Project (approximately 12 acres). The approved FDR and final RAWP were completed in 2013.

10.2.3.1 Construction Status

Remedial Action Prior to the Last (2010) Five-Year Review

Remediation work within RDU 3 has been completed under 3 RAs: the 1996-1998 Aspen Hills Remedial Action; the 1998 Silver Lake Pipeline Remedial Action, and; the Cashman Concentrate (RDU

11) Remedial Action. The latter is discussed in detail in Section 10.2.11, entitled RDU 11 – Cashman Concentrate.

The Aspen Hills RA consisted of approximately 30 acres and was remediated under the Old Works East Anaconda Yards Development Area (OW/EADA) OU. During this RA, railroad ballast was removed to a depth of two feet and consolidated. The consolidation areas were constructed to contain ballast material and to control storm water using a Type "A" (i.e., high quality soil) engineered cover. Engineered covers were also constructed over remaining railroad waste material exceeding the open space arsenic levels of 1,000 ppm. Construction began December 1995 and was completed March 1997. This work included constructing storm water controls in strategic locations. A second project was implemented in the Aspen Hills area in the summer of 2003 and spring of 2004. Referred to as the Aspen Hills Railroad Loop Track project, this RA covered approximately 167 acres of several different upland areas and a portion of the former railroad grade (a portion of this project area lies within RDU 14 while the remainder is within RDU 3). The RA work involved completing remediation of the loop track using cover soil capping (18 inches), remediation of the adjacent upland areas through in-place soil treatment (e.g., tillage and lime addition), and planting trees and shrubs on sleep slopes. Engineered controls were implemented to convey surface water drainage to the Smelter Hill drainage system.

The alignment of the Silver Lake Pipeline was reclaimed by Butte-Silver Bow County in 1998. This reclaimed easement includes approximately 12 acres of RDU 3. Future maintenance of the pipeline is the responsibility of Butte-Silver Bow County.

Removal of the Smelter Hill Cashman Concentrates (under RDU 11 as discussed in Section 10.2.11) was performed in 2003 adjacent to the northern boundary of RDU 3. As identified in the RAWP/FDR for Relocation/Reprocessing of the Cashman Concentrate (CD Register Document 611-05-6), final reclamation of the hillside adjacent to the pile will be performed during implementation of the RDU 3 RA following regrading and interim seeding completed as part of the RDU 11 work.

Remedial Action Since the Last (2010) Five-Year Review

No RA work was performed within RDU 3 – Smelter Hill Uplands since the 2010 five-year review report was prepared.

10.2.3.2 Operations and Maintenance Status

Active monitoring and maintenance for RA areas within this RDU includes evaluating the effectiveness of storm water controls, the condition of vegetation, and the stability of the soils. These activities have been performed annually by Atlantic Richfield and maintenance (weed spraying and erosion control BMPs) is ongoing. Site access controls are maintained through the erection of new fences and the repair of existing fences, the use of locked gates, and the placement of signage. Monitoring data for the RA areas are discussed below.

10.2.3.3 Data Review and Evaluation

The latest available *Engineered Controls Inspection and Maintenance Report* (Atlantic Richfield 2015f) provides the results for inspection and maintenance of 6 storm water intercept and conveyance channels in 2014; these are the Nazer Gulch Storm Water Channel, Aspen Hills Loop Track (LT) 1, and

Channels 1, 2, 3 and 4. The report stated that all engineered storm water controls are functioning as designed and lists maintenance issues that include the need to spray for noxious weeds in each area and remove the significant amount of sediment from the Aspen Hills Loop Track (LT) 1 channel. Upon inspection, EPA verified that these issues are not a threat to the RA and can be addressed through Atlantic Richfield's regular maintenance program.

In August 2011, Atlantic Richfield applied for a compliance determination for 4 revegetated areas in the Nazer Gulch area of RDU 3 – Smelter Hill Uplands (Atlantic Richfield 2011). The report indicated that the subject areas underwent quantitative assessments by AR twice, as required. Three areas were classified as uplands and 1 area was classified as steep slope. The 3 upland areas were thus evaluated by Atlantic Richfield using LRES methodology while the steep slope area was evaluated for erosion using the BLM method as defined in the EPA-approved VMP. The report contained all other information required for EPA to conduct a compliance determination. (However, EPA noted that the compliance request report submitted by Atlantic Richfield did not include a long-term O&M plan, as required by the VMP). Following the review of the report, EPA conducted in-field evaluations in 2011. For each area, the evaluator specifically checked whether it was meeting the VMP performance standards. The field evaluation indicated that 3 areas were meeting the vegetation and site stability compliance performance standards and indicated to Atlantic Richfield that they could be evaluated in the future under the requirements of the long-term/five-year review monitoring program.

One (1) area in Nazer Gulch (Evaluation Area 2), was not submitted for a compliance determination and that area has remained in the short-term monitoring program. As such, Atlantic Richfield conducted annual M&M evaluations for this area up through the 2014 growing season. The latest annual vegetation monitoring report (Atlantic Richfield 2015d) indicates that this steep slope area is an environmentally inhospitable site where the seeded plant species have struggled to become well established. The following is taken directly from the 2014 report and provides a good characterization of the site.

> *Evaluation Area 2 is a steep slope, 5.1 acre area with dozer basins installed in the northeast part of the site. Vegetation cover by acceptable species is increasing and approaching 10 to 15 percent. The vegetation is continuing to develop with new seedlings of red top, some of the wheatgrass species and Great Basin wildrye. In general, the seeded species occur in association with the dozer basins, but perennial grasses have also become established on the slopes between the dozer basins. The most successful planted species are Rocky Mountain juniper, Woods rose (Rosa woodsii) and limber pine.*
>
> *The substrate in this area is composed of a light gray rhyolitic material that is very soft and easily eroded. Minor problems with rills and sheet wash erosion noted in previous years are continuing, but there are no actively eroding gullies and limited rill development; many of the rills are inactive. Some pedestalled plants occur and there are small deposition terraces at the base of the slope next to the old drill rows. Recent deposits of translocated material tend to be less than three inches deep. Although the rate of vegetation expansion in this area is slow, the stability of the site is improving.*
>
> *Most of the dozer basins are breached or full, although most are still intact. The BLM score for this site is 45; however, the score has the potential to be higher due to the unique soil characteristics, low vegetation cover and erosion potential; therefore, qualitative*

evaluation suggests that this area does not meet the steep slope erosion performance criterion of a BLM score less than or equal to 45.

The other areas in the short-term monitoring program are the 3 Aspen Hills Loop Track evaluation areas. These areas have different performance criteria because each falls into a different classification: WMA, Uplands, or Steep Slope. The following is a general summary of these areas and is taken largely from the latest annual monitoring report (Atlantic Richfield 2015d).

The WMA area (Evaluation Area 1) has developed good stands of perennial species; cover ranged from approximately 20 to 39 percent in 2015. Some small, infrequent bare areas occur on the steep east-facing slope and rills were present, but these are inactive. This site is generally stable. The qualitative evaluation showed that this area would not pass the performance standard of 30 percent vegetation cover for WMAs. The annual report recommended this area for possible supplemental activities to improve perennial vegetation cover.

The Upland tillage area (Evaluation Area 2) has excellent vegetation cover (30 to 39 percent). Weeds are not common but continued control is recommended in the annual report. There are no gullies observed; however, there are a few rills and some deposition from sediment washing down from adjacent slopes in the eastern part of the area. In 2014, the LRES score was well in excess of the performance standard of 115 points.

The Steep Slope site (Evaluation Area 3) has a BLM erosion score of 36, indicating that erosion is present but the area meets the performance standard of <45 BLM points. Although small, infrequent bare areas occur on the steep east-facing slope and rills (inactive) are present, these site are considered relatively stable. The qualitative evaluation showed that this area would not pass the performance standard of 30 percent vegetation cover for WMAs. The annual report recommends this area for possible supplemental activities to improve perennial vegetation cover.

10.2.3.4 Results of Site Inspections

The 2015 five-year review inspections of the RA areas within RDU3 – Smelter Hill Uplands conducted by EPA during the 2014 field season confirmed the accuracy of the data and other information provided in the Atlantic Richfield storm water control M&M and annual vegetation reports. Some minor maintenance needs to be conducted for the storm water control structures as recommended in the report. With the exception of Evaluation Area 2, the reclaimed areas in Nazer Gulch have abundance perennial plant cover, relatively stable soils, and limited amounts of weeds. And although conditions seem to be improving in Evaluation Area 2, vegetation cover remains low and the soil continues to erode. Because of its location at the upper reaches of Nazer Gulch, however, eroded sediment continues to be deposited in the upper portion of the drainageway and therefore does not discharge to surface water. This site may eventually meet the performance standard (i.e., <45 BLM points) but the site will always be highly erodible due to the nature of the soil substrate, which is fine textured and lacks the nutrient cycling capability to produce abundant plant growth. If any additional RA work is contemplated for this area, the focus should be on engineered erosion control BMPs and not additional revegetation efforts.

Of the 3 Aspen Hills Loop Track areas being monitored, Evaluation Area 3 continues to show substantial erosion and less perennial plant cover than the required 30 percent for WMAs. Since this

RA area is more than 10 years old, EPA will meet with Atlantic Richfield to discuss the need for supplemental activities to improve perennial vegetation cover and meet the performance standard.

10.2.4 RDU 4 - Anaconda Ponds

This RDU consists of the Anaconda tailings ponds which contain approximately 97 million cubic yards. The total remedial design acreage for this RDU is approximately 710 acres. Originally, these tailings ponds are part of the Smelter Hill/Opportunity Ponds WMA.

10.2.4.1 Construction Status

The agencies approved the final RAWP/FDR in December 2000. Remedial action for this RDU was completed in 2002 and is documented in the construction completion report (Atlantic Richfield 2003). The primary RA components was the application of cover soil to the surface and dike faces to isolate the waste followed by seeding to establish a vegetation cover and limit soil erosion, and the construction of the North Anaconda Ponds and South Anaconda Ponds perimeter storm water ditches.

To construct the engineered cover on the surface of the Anaconda Ponds, 18 inches of soil was used from the Mill Creek Borrow Area located immediately south of the Anaconda Ponds. The perimeter side slopes (dikes) of the ponds were also remediated with cover soil. All engineered covers were vegetated utilizing a combination of organic matter, fertilizer, seed, and mulch. The Anaconda Ponds WMA is currently being monitored annually.

10.2.4.2 Operations and Maintenance Status

Since the last five-year review, M&M activities have occurred for both the Surface Cells and Dike Faces that includes monitoring vegetation and erosion conditions of the RA areas, evaluating the condition of engineered storm water control channels, conducting soil and channel maintenance, and spaying weeds. The latest Engineered Controls I&M report (Atlantic Richfield 2015f) provides the results for inspection and maintenance of the 7 storm water intercept and conveyance channels within the Smelter Hill Facility Area. These channels are the NAP 2 and 3 Channels; SAP 1, 2, 3, and 4 Channels, and; the Repository Storm Water Runon/Runoff Control Channels. Annual vegetation and site stability (soil erosion) data for the revegetated surface cells and side slopes are provided and discussed in the Vegetation Monitoring Annual Report (Atlantic Richfield 2015d).

10.2.4.3 Data Review and Evaluation

EPA has completed compliance inspections of all RA areas within the Anaconda Ponds WMA and determined that all areas are compliant with the performance standards. The inspections and compliance determinations were completed in 2009 and 2011 following the submission of compliance request reports by Atlantic Richfield (Atlantic Richfield 2009 and 2011).

The compliance request reports contained the results of quantitative assessments of the RA areas and all other information needed by EPA to conduct the compliance determinations. The in-field evaluations by EPA verified the accuracy of Atlantic Richfield's data and concluded that all were compliant with the performance standards, which include measures of perennial plant cover, the size and distribution of areas bare of vegetation, the degree of soil erosion, and weed abundance. Despite passing the WMA performance standards, EPA noted in correspondence with Atlantic Richfield that the compliance request report did not include a long-term O&M plan, as required by the VMP. To date, the long-term O&M plan has not been submitted to EPA.

Atlantic Richfield has continued to monitor the revegetated RA areas each year. The surface of the ponds is currently evaluated in 11 areas and the dike faces evaluated in 12 areas. Data from the latest Vegetation Monitoring Annual Report (Atlantic Richfield 2015d) indicate that perennial plant cover is significant and is greater than the 30 percent performance standard. Bare areas are virtually non-existent, soils are generally stable, and weeds are of low cover and infrequent across the landscape.

10.2.4.4 Results of Site Inspections

Monitoring data collected by Atlantic Richfield and the results of the 2014 inspection conducted by EPA for this five-year review confirm that these area have good vegetation cover, little soil movement on these steep slopes, and that weeds are being effectively controlled. EPA concluded that the WMA RA performance standards and thus the RA goals for the Anaconda Ponds continue to be met.

10.2.5 RDU 5 – Active Railroads/Blue Lagoon

The East Portion of RDU 5, defined as the Active Railroad line, extends from the east end of the East Anaconda Yards to the east end of the RDU boundary near Fairmont (Figure 10-5), and contains the following main work areas: Mill and Willow Creek trestles, Blue Lagoon, Son of Blue Lagoon, Mill Creek Flood Irrigation Area, and a portion of the Yellow Ditch. The West Portion of RDU 5 includes the following main work areas: East Anaconda Yards, railroad beds within the main portion of the town of Anaconda, West Anaconda Yards, West Valley line, and the historic spurs at the western end of RDU 5.

10.2.5.1 Construction Status

All RA work conducted within this RDU has occurred since the last (2010) five-year review. The approved RD design elements include the following:

- Excavating, removing, consolidating and disposing of mine and ore-processing wastes
- Maintaining the active railroad line as a dedicated development with wastes remaining in place and covered in specific areas
- Removing waste and reconstructing irrigation ditches to improve surface water quality
- Removing source material to allow the natural attenuation of ground water contamination
- Mitigating the loss of wetlands from the RA work through the Anaconda Smelter site-wide wetlands mitigation process approved by the Agencies
- Applying cover soil or performing in-place soil treatment, followed by seeding
- Preparing and implementing a storm water runoff control plan
- Conducting monitoring to determine the effectiveness of the remedy
- Conducting maintenance including weed spraying and storm water BMP management

For the East Portion, Atlantic Richfield implemented RA work and produced construction completion reports to date for the following areas: Blue Lagoon and Yellow Ditch 2012/2013; Son of Blue Lagoon; Mill Creek Flood Irrigation; and Willow Creek Trestle. Remedial action work is on-going for the Blue

Lagoon area; that work is anticipated to be completed in 2015 followed by a construction completion report that will cover 2014 and 2015. In the West Portion of RDU 5, Atlantic Richfield has implemented RA work and produced construction completion reports for the following railroad bed sections and associated areas: East Anaconda Yards South Parcel; West Anaconda Yards 2010/2011railroad areas; West Valley/MDT Transfer section, and; West Valley (non-MDT) section.

10.2.5.2 Operations and Maintenance Status

Maintenance of the active railroad line, which includes all of the East Portion of RDU 5 and the West Portion west to Sycamore Street, is being conducted by the railroad owner to maintain the line. This includes all sections east of the West Valley line (West Anaconda Yards 2010/2011railroad areas; East Anaconda Yard areas; Blue Lagoon and Son of Blue Lagoon railroad bed sections, Mill Creek Flood Irrigation section, and the Willow Creek and Mill Creek Trestle areas). Superfund monitoring and maintenance requirements for the active railroad bed sections and associated areas will be documented in the Active Railroad Superfund Operation and Maintenance Plan, which is in preparation. Atlantic Richfield currently provides monitoring and maintenance for the West Valley and West Valley/MDT sections, and the Quarry Spur areas. As these remediated areas were removals and left no elevated contaminant concentrations in place, they will fall out of Superfund monitoring and maintenance once operational and functional criteria for revegetated areas are met.

The latest Engineered Controls I&M report (Atlantic Richfield 2015f) provides the results for inspection and maintenance of the 5 storm water intercept and conveyance channels within the East Anaconda Yards (EAY); these are referred to as EAY3, EAY4, EAY5, EAY6, and EAY Storm Water Pipe. Annual vegetation and site stability (soil erosion) data for the revegetated West Valley and West Valley/MDT sections (where the railroad tracks were removed) are provided and discussed in the Vegetation Monitoring Annual Report (Atlantic Richfield 2015d).

10.2.5.3 Data Review and Evaluation

The Engineered Controls I&M report (Atlantic Richfield 2015f) states that all engineered storm water controls are functioning as designed and lists maintenance issues that include the need to spray for noxious weeds in each area and to possibly reseed areas of poor vegetation. The report also indicates that the wooden box culvert at the start of the EAY4 channel had collapsed and requires maintenance. Upon inspection, EPA verified that these issues are not a threat to the RA and can be addressed through Atlantic Richfield's regular maintenance program.

In 2014, EPA performed in-field evaluations of all areas for which Atlantic Richfield prepared construction completion reports. Photograph 1070 shows thin but adequate establishment of the seeded species on the north-facing side of the railroad embankment at the Son of Blue Lagoon area. It should be noted that this photograph was taken in the very early part of the first full growing season so plants are just becoming established. Photograph 1080 shows very thin and sparsely vegetated areas at the Blue Lagoon. Vegetation on this site failed to fill-in during the 2014 growing season. Photograph 1089 shows the very good establishment of vegetation at the Mill Creek Flood Irrigation site.

Atlantic Richfield has monitored the West Valley railroad line sections since the RA work was completed in 2009. EPA's 2014 evaluation of these areas confirmed the high perennial plant cover and low erosion in these areas and declared that they meet the O&F criteria. Photographs 163 and 867 show the generally high perennial plant cover along the reclaimed portion of the West Valley railroad

line. These Category 1 properties are now in long term maintenance and are only required to be monitored as part of the five-year review process.

Based on the data collected by EPA, all areas met the target criteria except portions of the Blue Lagoon RA area. The RA work at the Blue Lagoon is on-going and some areas have yet to be seeded. That work is anticipated to be completed in 2015 and the next O&F inspection would take place in 2016.

10.2.5.4 Results of Site Inspections

The results of EPA's inspections for RDU 5 in 2014 confirm that the RAs were implemented in accordance with the approved RAWPs and that the areas have good industrial or vegetation cover, little to no soil movement, and low amounts of weeds because of active control.

10.2.6 RDU 6 – South Opportunity Uplands

This area is located east of the Mill Creek Road and south of Montana Highway 1 (Figure 10-6). The South Opportunity Uplands RD contains approximately 1,017 acres of remedial polygons (Table 10-1). Approximately 920 acres require implementation of a RA while the remaining 97 acres do not require physical remediation (e.g. treatment) as they are facilities or well vegetated areas that may only require monitoring and weed spraying. Final reclamation of the remaining impacted soils within the Mill Creek Addition of the OW/EADA OU will be addressed under the ARWW&S OU RDU 6 remedy. The Mill Creek Addition RA includes removing and consolidating waste materials, constructing Engineered Covers, in-place soil treatment, and constructing storm water controls.

In contrast to other upland RDUs, the South Opportunity Uplands is relatively level and as such does not have steep slope areas where substantial storm water engineered BMPs are required. Sediment and erosion control will be accomplished primarily through the establishment of vegetation using land reclamation practices. Storm water BMPs, therefore, are being employed on a limited basis in this RDU. Due to the close proximity of the Anaconda tailings ponds and the many years of fugitive dust emissions, certain areas within RDU 6 are more contaminated than other upland RDUs. The following RA elements have been or will be employed in this RDU:

- Stripping of highly contaminated soil and placement of that material within a WMA
- Removal of the inactive railroad grade and placement of that material within a WMA
- Land reclamation using cover soil or in-place soil treatment techniques followed by seeding
- Limited use of engineered storm water controls BMPs
- Monitoring and maintenance
- ICs consistent with the Final Institutional Controls Implementation and Assurance Plan (ICIAP)

10.2.6.1 Construction Status

Remedial action work was initiated in RDU 6 in 2008 and is on-going. Most work completed to date occurred prior to the last (2010) five-year review. A total of approximately 238 acres have been remediated to date. Because of poor vegetation establishment, a 31 acre area was re-worked in the fall

of 2011 and seeded in the spring of 2012. As can be seen on Figure 10-6, the majority of work within RDU 6 is in-place soil tillage with amendments. It should be noted that a small portion of the RA work performed under the Mill Creek Addition to the OW/EADA OU is located within the RDU 6 boundary. Reclamation activities for this area were completed in 1999 and consisted of soil treatment and reseeding. This area is evaluated as part of RDU 6 because of the reclamation technique used and because of its location immediately adjacent to the RDU 6 RA areas.

ISWP have been prepared by Atlantic Richfield for active and inactive sand and gravel pit operations designated as Facilities. The ISWPs include discussions of land ownership, land use, and soil characterization data, and propose RAs. Based on EPA's review of the ISWPs, the sand and gravel pit operations require land reclamation that includes tillage to various depths, the addition of amendments, and the treatment of existing soil stockpiles. This work is to be implemented prior to the next (2020) five-year review.

The Mill Creek electric substation and gas turbine electricity generation Facilities owned by NorthWestern Energy also lie within the boundary of RDU 6 (Figure 10-6). Monitoring and performance assessments of the RAs implemented in these dedicated developments are conducted by Atlantic Richfield and then verified by EPA. Once these areas pass the performance standards, long term maintenance will be the responsibility of NorthWestern Energy.

10.2.6.2 Operations and Maintenance Status

Since the last (2010) five-year review, I&M activities have included monitoring vegetation and erosion conditions, evaluating the condition of engineered storm water control channels, conducting soil and channel maintenance, and spaying weeds. The latest Engineered Controls I&M report (Atlantic Richfield 2015f) provides the results for inspection and maintenance of the three storm water intercept and conveyance channels in RDU 6; these are designated Channels A, B, and C. Annual vegetation and site stability (soil erosion) data are collected for seven evaluation areas where RAs have been implemented and discussed in the Vegetation Monitoring Annual Report (Atlantic Richfield 2015d).

10.2.6.3 Data Review and Evaluation

The latest available Engineered Controls I&M Report (Atlantic Richfield 2015f) states that the storm water controls channels are functioning as designed and lists maintenance needs that include spraying noxious weeds and possibly reseeding areas of poor vegetation development. Upon inspection, EPA verified that these issues are not a threat to the RA and can be addressed through Atlantic Richfield's regular maintenance program.

Atlantic Richfield applied for a compliance determination in April 2014 for 5 revegetated areas in RDU 6 – South Opportunity Uplands (Atlantic Richfield 2014f). As Upland areas, these revegetated polygons must meet the LRES 115 point performance standard and other requirements under the Anaconda VMP. The compliance request report indicated that the subject areas underwent quantitative assessments by Atlantic Richfield and passed the performance standards in two successive years, as required by the VMP. Following confirmation that the report contained the required data and other information, EPA conducted inspections of each of the subject areas. Specifically, the evaluator checked whether the VMP performance standards were being met in each area. The field evaluation indicated that all areas were meeting the vegetation and site stability compliance performance standards and communicated to Atlantic Richfield that in the future these areas could be evaluated under the requirements of the long-term/five-year review monitoring program.

The latest Vegetation Monitoring Annual Report (Atlantic Richfield 2015d) provides the most current data for the areas that are still in the short-term monitoring program: NorthWestern Energy Parcels 6 and 7, and Mill Creek Road Evaluation Areas 1 and 2. The NorthWestern Energy Parcels and Evaluation Area 1 have fair to good perennial plant cover that continues to develop. In contrast, the seeded vegetation in Evaluation Area 2 continues to struggle to become well established. The original RA in this area was in-place soil treatment without lime but this area was re-treated with lime in 2011/12 after the initial seeding was deemed a failure. The 2014 O&F inspection of this area by EPA indicated that perennial plant cover and density, as well as community compostion, remain poor to very poor. Some perennial plants have become established as a result of the reclamation completed in 2012, but conditions have not improved to any significant degree and the area remains non-O&F. As can be seen in Photograph 324, the polygon continues to be dominated by summer cyprus (*Kochia scoparia*) and poverty sumpweed (*Iva axillaris*). Based on the very low establishment of perennial grasses after two complete growing seasons, this area is unlikely to improve in a reasonable timeframe without additional direct input. EPA has instructed Atlantic Richfield to prepare an RFM containing a new strategy and schedule for reclaiming this polygon. In-place reclamation is unlikely to be successful so the recommendation is for either stripping and removal of highly contaminated soil or the use of cover soil. These approaches are believed to be the only techniques that can set this area on a trajectory to eventually meet the performance standards.

10.2.6.4 Results of Site Inspections

The 2015 five-year review inspections of the RA areas within RDU6 – South Opportunity Uplands conducted by EPA during the 2014 field season confirm that the data and other information provided in the Atlantic Richfield storm water control M&M and annual vegetation monitoring reports are accurate representations of current conditions. To date, 236 acres have been remediated in RDU 6 and of these approximately 130 are compliant with the performance standard and approximately 77 acres are in short-term monitoring (Table 10-1). Some minor storm water channel and vegetation maintenance should be conducted as recommended in the reports. Field work in 2014 also confirmed that the vegetation in the vast majority of remediated areas within RDU 6 is well established and providing substantial cover (see Photograph 5775). Since vegetation conditions remain poor in Evaluation Area 2 after two full growing seasons, its prospects of becoming O&F and eventually passing the Anaconda performance standards (LRES>115 point) is unlikely without further maintenance activities. EPA and Atlantic Richfield continue to discuss how to proceed with the maintenance work in Evaluation Area 2, and EPA has recommended either stripping of the highly contaminated soil or the application of cover soil to this area.

10.2.7 RDU 7 – North Opportunity Uplands

The North Opportunity Uplands RDU is divided into two areas by Warm Springs Creek (Figure 10-7). The south portion is located north of Highway 48, east of Galen Road, and south of Warm Springs. The north portion of the remedial area is east of Galen Road and north of Warm Springs Creek, and includes a portion of the Anaconda-Deer Lodge Regional Airport. In total, there are approximately 798 acres of remedial polygons. To date, a total of approximately 651 acres have been remediated (Table 10-1).

Remedial action for the majority of this RDU has been completed using tillage with lime and organic matter amendments (e.g., soil treatment), soil stripping with consolidation into a WMA, cover soil placement, seeding, and minor areas where storm water control BMPs were implemented. Within

RDU 7 is a 13 acre parcel that was remediated for the construction of the new Community Counseling and Correctional Services facility.

10.2.7.1 Construction Status

Construction commenced in the fall 2008 in the south portion of the RDU and was completed in the north portion in November 2010.

10.2.7.2 Operations and Maintenance Status

EPA conducted O&F inspections of all RA areas in 2012 and determined that all areas met the O&F criteria. As a result, all areas were entered into the short-term M&M program beginning in 2013. Since then M&M activities have included monitoring vegetation and erosion conditions, and spaying weeds.

10.2.7.3 Data Review and Evaluation

In April 2014, Atlantic Richfield applied for a compliance determination for 4 revegetated areas in RDU 7 (Atlantic Richfield 2014f). As Upland areas, these revegetated polygons must meet the LRES 115 point performance standard and other requirements under the Anaconda VMP. The compliance request report indicated that the subject areas underwent quantitative assessments by Atlantic Richfield and passed the performance standards in two successive years, as required by the VMP. Following confirmation that the report contained the required data and other information, EPA conducted inspections of each of the subject areas. The in-field compliance determination by EPA confirmed that these areas were meeting the vegetation and site stability compliance performance standards and communicated to Atlantic Richfield that in the future these areas could be evaluated under the requirements of the long-term/five-year review monitoring program. It should be noted that Atlantic Richfield's compliance request report did not contain a long-term O&M plan for RDU 7. EPA communicated to Atlantic Richfield that this is a requirement of the VMP and the company has indicated that one will be forthcoming.

The latest Vegetation Monitoring Annual Report (Atlantic Richfield 2015d) provides the most current data for the areas that are still in the short-term monitoring program; these are referred to as Evaluation Areas 5 and 6. Data from the report and the narrative indicate that these areas have fair to good perennial plant cover that continues to develop.

Remediation in Evaluation Areas 5 and 6 consisted of soil treatment to 6 or 12 inches and incorporation of lime and organic matter. Overall vegetation cover by acceptable species in 2014 ranged from approximately 10 to 29 percent and was comparable to what was observed in previous years. The density of seeded perennial grasses is low in some parts of the area and there are some large bare areas Evaluation Area 6 that require a few more years of development to determine if repair work is needed Acceptable vegetation may continue to develop and expand, especially if adequate moisture is available. The abundance of *Kochia scoparia* continues to be reduced as the seeded perennial species develop. Spotted knapweed, Canada thistle and field bindweed are present in these areas, but plants are scattered and occur infrequently. Cheatgrass was noted in some areas. Whitetop occurs infrequently in these areas, but is expanding and requires control. These RA areas are relatively flat and are without visible evidence of rills, gullies or other signs of erosion; the site is considered stable.

10.2.7.4 Results of Site Inspections

The 2015 five-year review inspections of the RA areas within the North Opportunity Uplands conducted by EPA during the 2014 field season confirm that the data and other information provided

in the Atlantic Richfield annual vegetation monitoring reports are accurate representations of current conditions. The inspections also confirmed that conditions have not deteriorated in the areas deemed compliant with the revegetation/soil stability standard of 115 LRES points. Of the approximately 651 acres that have been remediated, approximately 406 have passed the compliance standard and 245 acres are in short-term monitoring (Table 10-1). Photograph 219 demonstrates that the vegetation is generally in good condition n RSU 7; small "hot spot" areas were mapped during the 2014 inspection for future reference and maintenance work (see Photographs 983 and 277). The RDU continues to be monitored by Atlantic Richfield and weeds are actively sprayed for control. Currently, the RAs implemented in RDU 7 are functioning as intended and therefore meet the remedial action objectives to be protective of human health or the environment.

10.2.8 RDU 8 – Opportunity Ponds

The design for RDU 8 addresses almost 7,400 acres within and adjacent to this RDU (Figure 10-8). Remedial action was implemented between 2002 and 2012 in accordance with seven approved FDR/RAWPs and is now considered completed, except for areas currently be used to place material from on-going actions outside RDU 8. The area are the long-term ADLC Development Repository located in the A9 Cell and two other areas (B2.12 Cell and the D1 Cell) where mine wastes are being consolidated from nearby Atlantic Richfield and DEQ projects. This waste consolidation is consistent with approved designs and these cells are to be cover soiled and revegetated when waste placement is completed.

The Opportunity Ponds waste disposal cells alone cover approximately 3,000 acres, have a thickness ranging from 5 to 50 feet, and contain approximately 130 million cubic yards of tailings. The waste cells are grouped into sets of cells designated as A, B, C and D, and the Triangle Waste Area (TWA). There were approximately 1,845 well-vegetated acres identified during the design. Those areas are being monitored and there are no plans to perform remediation of these areas in the future. Cover soil material was borrowed from approximately 1,029 acres within RDU 8 and those areas have been converted into wetlands; these lie primarily on the east and south sides of the tailings ponds (Figure 10-8).

To date, approximately 4,535 acres have received a land reclamation type of RA (Table 10-1). This includes approximately 680 acres of in-place tillage with soil amendments plus seeding, 3,705 acres cover soiled and seeded, and 150 acres where soil stripping/removal/seeding was conducted.

10.2.8.1 Construction Status

Construction activities began in 2002 at the Triangle Waste Area in the western corner of the RDU and generally proceeded to the east. The majority of the Agency-approved remediation work within the Opportunity Ponds RDU has been completed and in 2014 the last of the D Cells were cover soiled and reseeded. The RA included the following work elements:

- Grading and the constructing haul roads
- Removing and consolidating waste from adjacent areas into the WMA
- Developing borrow soil areas

- Constructing cover soil and rock material engineered covers over waste material
- Performing in-place soil treatment using lime, organic matter, and other amendments
- Constructing storm water run-on and runoff BMP controls
- Constructing a passive ground water treatment system
- Constructing and enhancing wetlands
- Implementing public access controls

Controlling fugitive dust was recognized as an important activity during the preparation of the design documents. Because of this, a dust management plan for Opportunity Ponds RA construction was developed (Atlantic Richfield 2007a). Key components of this plan include construction BMPs, temporary polymer surfactant cover, ongoing ambient air monitoring, and continual adjustment of dust management protocol to achieve effective control.

10.2.8.2 Operations and Maintenance Status

Since the last (2010) five-year review, M&M activities have included monitoring vegetation and erosion conditions, evaluating the condition of engineered storm water control channels, conducting soil and channel maintenance, and spaying weeds. Managing surface water run-on and runoff is a major component of the RA performed in this RDU. The latest annual Engineered Controls I&M report (Atlantic Richfield 2015f) provides the results for inspection and maintenance of the 9 storm water intercept and conveyance channels, ditches, and swales. Annual vegetation and site stability (soil erosion) data are collected for more than 125 evaluation areas where RAs have been implemented, and the results are discussed in the Vegetation Monitoring Annual Report (Atlantic Richfield 2015d).

10.2.8.3 Data Review and Evaluation

The latest available Engineered Controls I&M Report (Atlantic Richfield 2015f) states that the storm water control channels are functioning as designed. That report also lists maintenance needs, which are primarily the spraying of noxious weeds although reseeding is recommended in some BMP areas to improve vegetation establishment.

Atlantic Richfield has performed annual monitoring of each RA area within the Opportunity Ponds WMA. Since 2009, the company has applied for compliance determinations for 71 remediated areas. Because the remediated areas are within a defined WMA, they must meet numeric performance standards prescribed in the Anaconda VMP. Compliance for WMAs is determined by achieving the following performance standards twice over a 10-year period:

- Vegetation Cover - A minimum value of 30 percent mean canopy cover.
- Barren Areas - Total bare areas (i.e., areas with less than 10 percent cover) must be <10 percent of the evaluation area and no single bare area may be >1,000 square feet.
- Landscape Stability (erodability) - BLM modified method score of less than or equal to 45 points.
- Weeds - Noxious weeds must be widely spaced and infrequently observed, with the goal that they contribute <5 percent of the total live vegetation cover within the monitoring area.

Compliance request reports were submitted to EPA by Atlantic Richfield in 2009, 2011, 2012, 2013 and 2014 for various areas. EPA determined that each report contained quantitative results and all other information needed by EPA to conduct compliance determinations. The in-field evaluations by EPA verified the accuracy of Atlantic Richfield's data and concluded that all areas were compliant with the WMA compliance performance standards. Despite passing the WMA standards, EPA noted in correspondence to Atlantic Richfield that the compliance request report did not include a long-term O&M plan, as required by the VMP. To date, the long-term O&M plan has not been submitted to EPA.

The latest Vegetation Monitoring Annual Report (Atlantic Richfield 2015d) provides the most current data for areas still in the short-term monitoring program. Data from the report and the narrative indicate that these areas have fair to good perennial plant cover that continues to develop. For the more than the 100 areas being monitored annually, canopy cover by acceptable species is generally greater than 30 percent, erosion is virtually non-existent, and weeds are insignificant components of the plant communities. A small number of recently seeded areas have perennial plant cover in the range of 5 to 10 percent; these areas are being monitored frequently and are expected to develop and meet the O&F criteria in the next one to two growing seasons. Summer cyprus (*Kochia scoparia*) has been a problem in RDU 8, as elsewhere, for establishing grasses because it germinates very early in the spring and can provide strong competition for the often limited soil moisture. However, because of its auto-allelopathic nature, Kochia growth in the second growing season is greatly reduced and the extant grasses are then able to grow relatively unimpeded. By year three, Kochia is nearly absent and the perennial grasses usually put on enough growth to meet the O&F criteria. Spotted knapweed, Canada thistle, and other weeds are scattered throughout the RA areas and are being activity controlled in accordance with the weed management plan. The RA areas are considered stable as the relatively flat land in the RDU is generally without visible evidence of rills, gullies or other signs of erosion.

To date, dust control measure, as described in the dust control plan (Atlantic Richfield 2007a), have been effective in controlling the dust generated during construction activities as well as dust from the surface of unremediated areas. In the few instances when operations were suspended due to dust, the BMPs were re-evaluated and modified as needed prior to resuming activities. The success of the revegetation efforts implemented to date (described above) has effectively controlled potential fugitive dust in the reclaimed areas. Currently, there are very few open soil areas that have the potential to generate fugitive dust, and these are being carefully monitored. Ambient air quality around the perimeter of RDU 8 will continue to be monitored to measure fugitive dust levels, evaluate the effectiveness of BMPs, and allow for implementation of appropriate dust mitigation measures if needed.

10.2.8.4 Results of Site Inspections

The 2015 five-year review inspection conducted by EPA in 2014 confirmed that the remediated areas within RDU 8 are either O&F, and therefore in the short-term annual monitoring program conducted by Atlantic Richfield, or meet the compliance performance standards. The latter will continue in the long-term/5 year review monitoring program. Of the 4,535 acres remediated to date, approximately 2,585 acres have met the compliance standard and 1,950 acres are in short-term monitoring (Table 9-1). Based on the site inspections, the RA for the Opportunity Ponds ROU are functioning as intended and as such are protective of human health and the environment.

Photographs 056 and 674 show the typically excellent vegetation on the B, D, and C Cells, respectively. A portion of the D Cells was used to dispose of the material excavated from behind the Milltown Dam. Those areas now have an engineered cap and have been vegetated as seen in Photograph 056. Outside of the footprint of the cells, Photograph 400 shows the excellent perennial vegetation in the North Uplands area. The South Uplands area generally has good cover as well (Photograph 451), although the seeded vegetation in some areas has been slow to become established (Photograph 788).

It should be noted that the development of wetland areas northeast, east, and south of the footprint of the tailings disposal cells has been a great success. Photographs 052, 059, and 907 show the well-established wetland vegetation and habitat in these areas. It should be noted though, that some areas are slated for re-seeding because the level of surface water in the wetland ponds did not rise to the level anticipated during design. Photograph 608 shows the early stage of wetland development and is in an area where EPA has recommended reseeding to Atlantic Richfield.

10.2.9 RDU 9 – Fluvial Tailings

The RDU 9 Fluvial Tailings RD includes approximately 5,015 acres of remedial polygons (Table 10-1). The design estimated that 2,091 acres of these polygons required implementation of RA while the remaining 2,924 acres did not require physical remediation (e.g. treatment) as they are facilities or well vegetated areas that only require monitoring and weed management. This RDU contains 1) large well vegetated areas that are and will be monitored, 2) large areas of in-place treatment, 3) small areas remediated using cover soil, 4) areas designated as Facilities (e.g., areas having a different land use than recreational/open space,/grazing), 5) the Lower Willow Creek project area, and 6) the Yellow Ditch remediation area (Figure 10-9). The approved FDR and RAWP for RDU 9 were completed in 2007 and a significant amount of RA work has been implemented to date.

Atlantic Richfield has prepared site characterization reports for 9 Facilities within RDU 9. Each report provides a recommendation for a RA given the site specific data, land use, and land ownership. Seven of the Facilities are current or former gravel pits and the two others are a salvage yard and an agricultural field. EPA is in the process of determining the final remedy for the Facilities.

The Lower Willow Creek project area, located between MT Highway 1 and Stewart Street, was originally designated as RDU 9 and was later incorporated into RDU 10 with other proposed Montana Natural Resource Damage Program (NRDP) restoration projects. In early 2012, the Lower Willow Creek project area was re-incorporated into RDU 9 when Atlantic Richfield agreed to implement actions to address RAOs for soils and surface water specifically identified for that reach in the 1998 ARWW&S OU ROD.

Remedial activities in RDU 9 also included addressing contamination in a portion of the Yellow Ditch. The remediated section of the ditch extends from Willow Glen Road to MT Highway 1 and is shown on Figure 10-9.

10.2.9.1 Construction Status

Remediation within RDU 9 is ongoing; however, approximately 658 acres requiring RA have been addressed by Atlantic Richfield under multiple projects, discuss below. Approximately 1,268 acres still require the implementation of the selected remedy.

The portion of RDU 9 addressed by the 2010/2011 RA included approximately 490 acres of property owned by Atlantic Richfield and the MDT. The project included stripping 19 acres followed by in-place

soil treatment and reseeding. A portion of project area was later developed as a borrow area to support ongoing RA within RDU 8 and elsewhere in the ARWW&S OU. Stockpiled soils will be used to reclaim this area when borrow material is no longer needed for remediation projects at the site.

Construction activities associated with the 2011 Yellow Ditch RA encompassed approximately 40 acres and consisted of the removal of ore-process waste, consolidation of waste within the Anaconda Smelter Hill RDU 14 WMA, backfill placement, ditch reconstruction, culvert installations, site grading, and revegetation. Approximately 38,000 cubic yards of waste were consolidated in the RDU 14 WMA with roughly 34,000 yards of backfill placed to reconstruct the ditch and ensure proper drainage.

The 2012/2013 Lower Willow Creek RA included stripping and consolidation of fluvially deposited tailings and impacted soils from approximately 35 acres of the Lower Willow Creek corridor followed by floodplain backfilling and revegetation. In conjunction with tailings removal activities, approximately 4,200 linear feet of actively eroding streambanks were stabilized with bioengineered treatments and planting of native riparian grasses and woody species.

10.2.9.2 Operations and Maintenance Status

Since the last (2010) five-year review, M&M activities have included monitoring vegetation and erosion conditions, and spaying weeds. Annual vegetation and site stability (soil erosion) data are collected for the RA areas and discussed in the Vegetation Monitoring Annual Report (Atlantic Richfield 2015d). This report includes recommendations for routine maintenance, such as weed spraying, and for enhanced reclamation work for those areas needing reseeding because of poor grass establishment.

10.2.9.3 Data Review and Evaluation

Atlantic Richfield has not applied for a compliance determination for the areas in RDU 9. Most areas have passed the O&F inspection and are therefore monitored annually as part of the short-term monitoring program for RA areas. In contrast, several RA areas have displayed very poor plant establishment and have not yet passed the O&F determination, despite having more than four years to develop. Of the approximately 658 acres remediated to date, approximately 390 acres have passed the O&F inspection and are in short-term monitoring and the remaining 268 acres have not yet passed the O&F criteria (Table 10-1).

The original O&F inspections for RDU 9 took place in July 2013 and indicated that all areas passed the O&F evaluation criteria (as dictated by the ARWW&S OU VMP) with the exception of five polygons (FT 9.02-A, FT 9.02-B, FT 9.03-D, FT 9.03E, and FT 017-B). Soils in these non-O&F areas were impacted by fluvially deposited tailings from historic irrigation practices and flooding of Silver Bow Creek, as well as by smelter fallout from the Washoe and the Upper and Lower Works smelters at Anaconda. In 2014, 1 polygon (FT 17-B) had enough perennial plant cover and density to meet the target criteria, and the site was erosionally stable. Conditions in the remaining 4 have not improved substantially since 2013 and are still not considered O&F.

The latest Vegetation Monitoring Annual Report (Atlantic Richfield 2015d) provides the most current data for the areas that are in the short-term monitoring program: Evaluation Areas 1, 2 and 3; 2 areas in the Lower Willow Creek area, and; Yellow Ditch. After two full growing seasons, vegetation cover in the upland RA areas is rated good (>20 percent) and the plants continue to develop as expected. The

relatively flat terrain in these upland areas is generally stable without excessive rills or sheet erosion. The report indicates that summer cyprus (*Kochia scoparia*) continues to be dominant in much of the upland RA areas and is at least partially responsible for the slow development of the seeded species. Photograph 1093 shows a section of Yellow Ditch in the spring of 2014; banks are stable and vegetation is emerging. Vegetation monitoring along the riparian corridor of Lower Willow Creek is expected to begin in 2015; sampling protocol is provided in the Riparian Area Vegetation/Bank Stability Monitoring Plan for Willow Creek and Warm Springs Creek (Atlantic Richfield 2015g).

10.2.9.4 Results of Site Inspections

The 2015 five-year review inspections of the RA areas within the Fluvial Tailings RDU confirmed that the data and other information provided in the Atlantic Richfield report present an accurate representation of current vegetation and soil conditions. Most of the RA areas are developing as expected and have passed the O&F inspections. Of the 525 acres remediated to date, no acres have yet been evaluated for compliance. Approximately 390 acres are in short-term monitoring and 135 acres have not yet passed the O&F criteria (Table 10-1). It is assumed that most areas will pass the compliance performance standards before the next (2020) five-year review. At that point, the RAs in these areas will be protective of human health and the environment and be monitored in the long-term/five-year review monitoring program. The 2014 inspection by EPA indicates that the growth of summer cyprus has been greatly diminished over the last year and that the seeded species in some area now have a chance to proliferate. Photograph 242 shows perennial grasses growing among summer cyprus plants. As mentioned earlier, summer cyprus is allelopathic to itself and normally is only a small part of plant communities after two or three growing seasons. EPA and Atlantic Richfield have agreed to allow the vegetation in the non-O&F areas time to develop and the expectation is that the seeded grasses will eventually develop enough cover to pass the O&F criteria. If significant improvements in vegetation conditions are not realized in the next 2 to 3 years, EPA will direct Atlantic Richfield to develop and implement and new RA strategy in these areas.

10.2.10 RDU 10 – Warm Springs Creek

RDU 10 Warm Springs Creek stretches from the Galen Road, north of Highway 48, and terminates when the creek enters the Clark Fork River floodplain; it encompasses approximately 2.5 miles of streambank and portions of the floodplain impacted by fluvial transport of mine wastes associated with past smelting operations (Figure 10-10). The project area is divided into two areas: Section 32 and Lower Warm Springs Creek (primarily in Sections 23 and 27). Land use in this area includes agriculture, grazing, open space wildlife habitat, and recreation. The FDR was approved by the Agencies in 2012 and contained approximately 36 monitor-well vegetated acres that would not receive a direct, physical RA and approximately 29 acres where mixed soil/wastes would be removed. Additionally, an ISWP exists for the 65-acre Gochanour 2 facility land parcel. This area is currently used for livestock grazing and the RA will be to implement tillage with amendments to reduce the level of metals in surface soil and raise soil pH to promote revegetation following its use as a soil staging area during RA construction work for the banks of Warm Springs Creek. It is estimated that approximately 15 acres of the Gochanour property will require RA.

10.2.10.1 Construction Status

Studies have shown that the fluvially deposited tailings located in streambanks and on the floodplain along sections of Warm Springs Creek contribute significantly to elevated COCs in surface water during high flow conditions. In 2009 and 2010 remediation was completed within sections of the floodplain in the Section 32 reach as part of the adjacent RDU 7 RA. During that work, approximately

640,000 cubic yards of impacted material was removed and consolidated within the Opportunity Ponds WMA and the area was revegetated. That work did not, however, addressed streambank contamination. The main goal of the remaining RA for RDU 10 Warm Springs Creek is to minimize erosion of fluvially deposited tailings by implementing selective waste removal and stream stabilization techniques. The RA construction for the RDU 10 portion of Warm Springs Creek is anticipated to commence in 2015.

10.2.10.2 Operations and Maintenance Status

Remedial action has not been implemented for the streambank areas within RDU 10. The area reclaimed in Section 32 in 2009/2010 is currently in the short-term monitoring program and O&M activities for that area are performed by Atlantic Richfield along with other M&M activities for RDU 7.

10.2.10.3 Data Review and Evaluation

Remedial action has not been implemented so no evaluation data are available for review.

10.2.10.4 Results of Site Inspections

Remedial action has not been implemented so no site inspections were conducted for this RDU.

10.2.11 RDU 11 – Cashman Concentrate

RDU 11 Cashman Concentrate consisted of approximately 20,000-22,000 tons of copper ore concentrate. Approximately 18,000 – 20,000 tons were located adjacent to the East Anaconda Yards while approximately 2,000 tons were located at the Cashman (Apex) Mill site in Skykomish, Washington. The FDR/RAWP for RDU 11 was approved in 2003. The primary focus of the RDU 11 RA was to relocate the Cashman Concentrates and adjacent contaminated soils for disposal or reuse/processing to protect human health and the environment from this material.

The Cashman Concentrates were produced at the Anaconda Company Weed Concentrator plant in Butte, Montana, and made from Berkeley Pit ores using a flotation process common in the mining industry. The concentrates were transported to the Anaconda Smelter Hill site and stored in holding pits for several years until they were later relocated to their East Anaconda Yard location during demolition of the Smelter Hill facilities. Materials stockpiled in Skykomish, Washington, were shipped from the Smelter Hill site and were to be reprocessed using a proprietary technology to recover the precious and base metals. Processing of the Skykomish materials did not occur and the materials were relocated via rail to Anaconda, Montana.

10.2.11.1 Construction Status

Remediation within RDU 11 began in October 2003 and was completed in December of that year. Unloading and hauling of the Skykomish concentrate material began in November 2003 and was completed in December 2004. Construction activities for the RDU 11 RA consisted of removing abandoned power line poles along the active Rarus rail line, constructing a staging area, and hauling and consolidating the concentrates along with impacted soils and debris in the B2.12 cell at Opportunity Ponds Repository. Final reclamation of the former stockpile area will be performed in accordance with the East Anaconda Yards (Subarea 5 of the OW/EADA OU) design and RA documents. Final reclamation of the hillside adjacent to the old stockpile location will be performed during implementation of the RDU 3 Smelter Hill RA. Detailed summaries of the completed work pertaining

to relocation and reprocessing of the Cashman Concentrates at the Anaconda Smelter NPL and Skykomish, WA sites are provided in the Apex Mine Site Removal Action and the 2004 Cashman Concentrates RDU 11Construction Completion Reports.

10.2.11.2 Operations and Maintenance Status

No O&M requirements for RDU 11 are required, as this was a removal operation. Final reclamation of the former Cashman stockpile location will occur under East Anaconda Yards (Subarea 5 of the OW/EADA OU).

10.2.11.3 Data Review and Evaluation

No data are available for this area.

10.2.11.4 Results of Site Inspections

The Cashman removal area was inspected as part of the inspection for East Anaconda Yards (Subarea 5 of the OW/EADA OU). The area was found to be erosionally stable.

10.2.12 RDU 12 - Slag

This RDU is divided into three sites: West Stack Slag, Anaconda Landfill Slag, and Main Granulated Slag. Collectively, the three slag piles cover 197 acres and consist of approximately 25.5 million cubic yards of smelter slag. In lieu of remediation but to be consistent with the ARWW&S OU ROD, the slag may be reused/processed for use as a product. EPA has approved slag for use as blasting media, manufactured roofing material, other building materials, underground pipe bedding material, aggregate material for concrete, an additive in the manufacturing of Portland cement, and for use in controlled landscaping, such as that constructed at the Old Works golf course. Currently, the Main Granulated Slag pile is being processed for reuse and it is anticipated that additional developers will be identified for processing or reuse of this material. Any waste or debris found during processing will be disposed of in the B2.12 cell of the Opportunity Ponds Repository or in an assigned debris area. The RDs for these slag piles were documented in final operation and closure/reclamation plans and approved in 2003. Those plans, which were prepared to support requirements of the 1998 ARW&S OU ROD, included BMPs to limit the migration of slag due to wind and water erosion during processing and during periods when processing is not occurring.

10.2.12.1 Construction Status

No construction has occurred at this RDU.

10.2.12.2 Operations and Maintenance Status

U.S. Minerals began slag reprocessing at the Main Granulated Slag pile in 2014. No reprocessing has occurred at the West Stack Slag and Anaconda Landfill Slag since the last five-year review. Atlantic Richfield has constructed wind and water erosion control BMPs, and has been performing regular inspection and maintenance on those controls.

10.2.12.3 Data Review and Evaluation

No data are available for this area.

10.2.12.4 Results of Site Inspections

The slag areas were inspected by EPA in 2014 as part of the inspection for OW/EADA OU. Erosional control BMPs were in place and functional, although high winds do entrain slag particles and move them to adjacent areas.

10.2.13 RDU 13 - Old Work Waste Management Area

RDU 13 addresses surface water and ground water associated with the Old Works WMA. No remedial construction activities (e.g., land reclamation) are required for RDU 13 Old Works; all surface reclamation activities within the RDU 13 are addressed as part of RA work conducted for the OW/EADA OU. The FDR for RDU 13, approved in 2010, presents a conceptual site model that specifies which wells must be sampled to monitor the ground water beneath and adjacent to the Old Works WMA, and presents a conceptual monitoring plan that was incorporated into the Ground Water Management Plan (in progress).

10.2.13.1 Construction Status

No construction activities are required under RDU 13 Old Works since all construction activities are addressed in the OW/EADA OU. Figure 5-13 shows the location of the Old Works RDU 13 and the ground water monitoring wells; refer to Figure 8-1 for a depiction of the types of land reclamation implemented in the Old Works area.

10.2.13.2 Operations and Maintenance Status

The construction status of the various Old Works source control measures within RDU 13 is discussed in Section 8 of this 2015 five-year review report.

10.2.13.3 Data Review and Evaluation

The site conceptual model presented in the RDU 13 Old Works WMA FDR identified non-point sources of contamination as having a major impact on ground water within the Old Works WMA. This non-point source exists within the soil underlying this area and is dispersed and widespread. In addition to the non-point source of contamination, other sources have been identified that consist of: miscellaneous wastes, flue debris, Red Sands, heap roast piles, Former Old Works Tailings Pond, Former Arbiter Tailings Pond, floodplain wastes, Upper and Lower Works, landfill slag, ground water inflows from upgradient of the Old Works RDU 13, Stucky Ridge bedrock aquifer, and losses from Warm Springs Creek 2010). The site conceptual model also identifies the contaminant transport and release mechanisms associated with the elevated contaminants concentrations in the aquifer.

The current principal point source of elevated copper, cadmium, and zinc concentrations in ground water in the Old Works area is the Red Sands. Most of the Red Sands waste was consolidated and covered with a soil cap but a small portion was left exposed as an historic feature. Ground water monitoring has identified a plume of copper, cadmium and zinc in ground water downstream of the Red Sands with the highest concentrations occurring immediately downgradient of the waste. Precipitation percolates through the soil cover and through the waste mobilizing the metals. As the wetting front moves downward through the waste, metals concentrations increase in the pore water. Beneath the waste, metals attenuate in the soil by adsorption and formation of oxyhydroxides. The highest concentrations have also occurred during years with high precipitation and a high water table. During high water table conditions, the contaminated soil beneath the waste becomes saturated and

mobilizes the previously attenuated metals. The contaminated ground water distributes the metals in a downgradient direction where they are attenuated onto aquifer materials. So whenever high water table conditions occur, metals are remobilized, transported, and then re-attenuated. This has resulted in a seasonal widespread plume of contaminated ground water during high precipitation/water table conditions.

The Old Works WMA contains 20 monitoring wells, 14 of which were sampled in 2013. The 2009 Monitoring Program included a provision requiring additional groundwater sampling when water levels reached a predetermined elevation in monitoring well MW-213. EPA and DEQ determined that once the water level reached the critical elevation, leaching of cadmium from waste left in place might occur. The 14 monitoring wells sampling in 2013 included the 4 POC wells.

The latest ground water monitoring report (MBMG 2014) provides ground water quality data for the 14 wells and identifies wells having results that exceeded the Montana DEQ-7 water quality standards. According to the report, there were no COC exceedances in any of the 4 POC wells. All the water quality standard exceedances occurred in the event-sampled wells, which are within the WMA boundary where water quality standards do not apply. These included cadmium exceedances in five wells and copper and zinc exceedances in one well. Arsenic concentrations remained below DEQ-7 standards in 2013. The long-term average for arsenic in all wells also remained below the standard.

10.2.13.4 Results of Site Inspections

See Section 8 for the OW/EADA OU.

10.2.14 RDU 14 - Smelter Hill Facility Area

The RD for RDU 14 - Smelter Hill Facility Area was approved in 2004 and is currently being implemented. It includes constructing engineered covers consisting of both cover soil and tillage with amendments, constructing storm water runon and runoff controls, developing borrow areas, and constructing haul roads. The Smelter Hill Facility Area encompasses the former Washoe smelter facilities and includes the Previously Reclaimed areas, Iron Pond Slope, Railroad Triangle areas, and the SHRC (Figure 10-14). The latter consists of the Flue Dust, Arbiter, Original Beryllium, Aspen Hills, and the New Beryllium repositories. Other remedial activities include the monitoring of repository leachate and its pumping and disposal. Of the total of approximately 1,368 RD acres in RDU 14, approximately 925 require remediation (Table 10-1).

10.2.14.1 Construction Status

Construction work was completed for Previously Reclaimed areas and the Flue Dust, Arbiter, Original Beryllium, and Aspen Hills repositories in the 1990s and for the New Beryllium repository in 2004. To date, approximately 332 acres have been remediated out of a total of 925 acres requiring remediation (Table 10-1). Design requirements for the Previously Reclaimed areas were consistent with those ultimately prescribed in the final RD report. The design requirements for the repositories were that they meet all Montana Solid Waste Management Act and RCRA Subtitle D provisions and some relevant and appropriate Montana Hazardous Waste Act and RCRA Subtitle C provisions. As such, the repositories were constructed with liners, leak detection and collection systems, ground water monitoring wells upgradient and downgradient, and cover soil caps. Remedial action activities pursuant to the 2004 FDR/RAWP were initiated in 2011 and are ongoing. Several projects have been completed that include constructing a haul road network, constructing engineered storm water controls, steep slope grading, installing engineered covers, and consolidation of waste and debris.

The 2011 Haul Road Construction project included the construction of haul roads necessary to facilitate future hauling and placing of engineered covers within the site. This work was initiated in October 2011 and completed in May 2012. Existing haul roads were widened and in some locations new haul roads were constructed. In association with this, storm water controls were installed to convey runoff around the haul roads and a minor amount of waste consolidation was completed.

The 2012 Storm Water Controls Construction project was initiated in July 2012 and was completed in April 2014. Construction activities primarily included installing storm water control channels, structures, and ponds, regrading steep slopes, installing engineered covers, and consolidating wastes near the constructed storm water controls.

10.2.14.2 Operations and Maintenance Status

Operation and maintenance activities within this RDU include monitoring vegetation and erosion conditions of the construction and RA areas, conducting reclamation maintenance, evaluating the condition of engineered storm water control BMPs, monitoring ground water levels, monitoring repository leachate levels, and capturing and disposing of leachate from the SHRC in the Opportunity Ponds WMA. Operation and maintenance work in 2014 specifically included: monitoring leak detection and collection equipment; measuring water elevations at critical locations, pumping leachate from the Flue Dust Repository; performing site-wide monitoring well sampling; spraying weeds; performing road maintenance; evaluating vegetation/erosion conditions, and; cleaning areas of sedimentation and trash accumulation.

The latest monitoring, inspection, and maintenance activities within the Smelter Hill Facility Area are documented in the following reports:

- *2014 Smelter Hill Repository Complex (SHRC) Monitoring and Maintenance (M&M) Report* (Atlantic Richfield 2015h)
- *2014 Engineered Controls Inspection and Maintenance (I&M) Report* (Atlantic Richfield 2015f)
- *2014 Vegetation Monitoring Annual Report* (Atlantic Richfield 2015d)

The SHRC M&M report includes results from the sampling of ground water wells associated with waste repositories and the assessment and management of repository leachate. Sampling is performed by Atlantic Richfield. Leachate reaching specified levels is required to be pumped so it does not reach uncontaminated ground water, and disposed of in accordance with specific criteria set forth in the existing O&M Plan. In addition to the evaluation of ground water levels and quality, the condition of the vegetation and stability of the soil surface of the repositories is evaluated annually and results provided in SHRC M&M report.

The latest Engineered Controls I&M report (Atlantic Richfield 2015f) provides the results for inspection and maintenance of the 7 storm water intercept and conveyance channels within the Smelter Hill Facility Area. These channels are the NAP 2 and 3 Channels; SAP 1, 2, 3, and 4 Channels, and; the Repository Storm Water Runon/Runoff Control Channels.

Annual vegetation and site stability (soil erosion) data for the Previously Reclaimed, Iron Pond Slope, and Railroad Triangle areas are provided and discussed in the Vegetation Monitoring Annual Report (Atlantic Richfield 2015d).

Atlantic Richfield's 2014 annual report (Atlantic Richfield 2015e) concluded with the following recommended M&M activities for 2015:

- Continue monitoring repository leachate levels and pump/dispose of as required.
- Continue monitoring the water elevation in the Flue Dust Repository collection sump, Geyser Gulch Pond, and surrounding piezometers and wells as needed.
- Repair erosion along storm water ditch side slopes, remove sedimentation buildup at culvert inlet and outlets, and remove unwanted vegetation in riprap sections of storm water ditches.
- Monitor and collect samples from site-wide monitoring wells (MW-1, MW-2, MW-3, MW-4, and MW-65).
- Conduct spot spraying for noxious weeds on and around all five repositories.
- Fertilize bare areas of the south-facing slope of the Flue Dust Repository and along the A-1 Storm Water Ditch.
- Perform maintenance on the engineered cover for the Beryllium Repository per RFM No. SHRC 2014-1 (Appendix G).
- Inspect and monitor the site storm water run-on/runoff ditches.
- Conduct annual repository cover and vegetation evaluation for the SHRC.

10.2.14.3 Data Review and Evaluation

Discussed below are the inspection results and recommendations provided by Atlantic Richfield in the annual reports.

SHRC Well Sampling and Leachate Management

Annual ground water samples were collected from the SHRC monitoring wells in 2014 by the MBMG and Geology and by Pioneer Technical Services, Inc. for Atlantic Richfield; latest results are provided in the *Smelter Hill Repository Complex (SHRC) M&M Report* (Atlantic Richfield 2014g). The ground water monitoring analytical results during the 2014 annual sampling event indicated that all constituents in MW-1, MW-2, MW-3, MW-4 and MW-65 were consistent with historic background levels. Dissolved arsenic in MW-3 was detected at 25.8 ug/L, which is greater than EPA MCL of 10 ug/L.

EPA has leachate pumping trigger levels for the Flue Dust, Arbiter, and Beryllium Repositories; the Aspen Hills and New Beryllium Repositories do not have or require leachate management. As outlined in the *Final Smelter Hill Repository Complex Post-Closure O&M Plan* (Atlantic Richfield 2004a), pumping is required when the leachate rises to specific elevations. Quarterly leachate monitoring results indicated that no pumping of leachate was required in 2014 for the Arbiter or Beryllium Repositories.

The Flue Dust Repository leachate collection sump water level was monitored during all four quarters of 2014 and during weekly SHRC M&M activities. To complete the investigation of the source of water entering the Flue Dust Repository, Atlantic Richfield prepared and EPA approved a RFM to allow leachate in the sump to rise over the pumping trigger level and to establish a new, temporary pumping trigger level. Prior to 2014, the Flue Dust Repository was last pumped during the second and third quarter of 2011. During the first and second quarters of 2014, leachate was not pumped due to the ongoing Flue Dust Repository investigation. In the third quarter Atlantic Richfield received approval to pump the Flue Dust Repository and discharge the leachate through a sprinkler system at the onsite leachate disposal area northeast of the Arbiter and Beryllium Repositories. Pumping was initiated on September 8, 2014 and was completed on October 29, 2014. A total of 779,629 gallons was pumped from the Flue Dust Repository during the third and fourth quarters of 2014. The Flue Dust Repository Investigation and general monitoring at the SHRC continued through December 2014.

RDU 14 Engineered Stormwater Controls

The latest available Engineered Controls I&M Report (Atlantic Richfield 2015f) provides the results for inspection and maintenance of 7 storm water intercept and conveyance channels in 2014; these are the NAP 2 and 3 Channels; SAP 1, 2, 3, and 4 Channels, and; the Repository Storm Water Runon/Runoff Control Channels. The report stated that all engineered storm water controls are functioning as designed and listed maintenance issues that include the need to monitor and spray for noxious weeds in each area, reseed poor vegetation on some side slopes, and remove sediment deposits.

The A-1 Storm Water Ditch (Repository Channel) was reconstructed in February and March of 2012. The 2014 Atlantic Richfield report indicated that:

- Plant establishment was successful, as indicated by the density of the seeded species.
- Total vegetation cover associated ranged from 10 to 19 percent.
- Bare soil ranged from approximately 5 to 10 percent.
- Litter accumulations were light.
- *Kochia scoparia* was still prevalent on the south facing slope of the channel and in areas with un-incorporated organic matter.

RDU 14 Revegetated Areas

Annual monitoring results for the repositories are provided in the latest SHRC M&M Report. For the Previously Reclaimed, Iron Pond Slope, and Railroad Triangle areas the annual data are provided and discussed in the Vegetation Monitoring Annual Report.

Annual vegetation inspections for the Flue Dust, Arbiter, Original Beryllium, New (2004) Beryllium, and Aspen Hills Repositories included qualitative vegetation and erosion assessments. In general, the 2014 data indicate that cover was between 30 and 59 percent for the 5 repositories, with the best cover being present on the Arbiter Repository that was re-worked in 2007 and 2008. Infrequent occurrences of spotted knapweed, Hoary Cress (or white top), and leafy spurge exist on the

repositories. Soils are reported as generally stable with slight erosion noted in some areas. The 2014 annual report noted that low plant cover, weeds, and bare soil is present on the south-facing slopes of the Original Beryllium Repository and stated that these areas would be repaired in 2015 per RFM No. SHRC 2014-1. These poor conditions were also noted by EPA during the compliance determination conducted in 2013.

In October 2012, Atlantic Richfield applied for a compliance determination for the mine waste repositories within the SHRC (Atlantic Richfield 2012a). The report contained the results of quantitative assessments of these areas and all other information required for EPA to conduct a compliance determination. EPA noted that the compliance request report submitted by Atlantic Richfield did not include a long-term O&M plan, as required by the VMP. In the following field season (2013), EPA conducted in-field evaluations. For each area, the evaluator specifically checked whether it was meeting the VMP performance standards for WMAs. The field evaluation by EPA verified the accuracy of most of Atlantic Richfield's data and concluded that all areas, except the Original Beryllium Repository, were compliant with the performance standards. The Original Beryllium Repository has acceptable perennial grass cover over a large area of the site, but the southwest side of the repository has very low density and cover of plant species considered acceptable to the EPA. Overall, the average cover by acceptable species on the cap of the Original Beryllium Repository is less the 30 percent, due to the barren and sparsely vegetated areas present on the southwest slope of the repository. Because of these significant problems, the Original Beryllium Repository was determined not compliant with the performance standards.

The Previously Reclaimed, Iron Pond Slope, and Railroad Triangle areas within RDU 14 are associated with the closure of the smelter which was performed from 1992 through 1994. These areas have been monitored throughout their history and data since 2009 are presented and discussed in the most recent annual monitoring report. That report indicates that conditions in these reclaimed areas have not changed significantly over the past five-years. The monitoring data collected by Atlantic Richfield in 2014 demonstrate that most areas have vegetation cover in the 30 to 39 percent range, so are exceeding that criteria for WMAs. Vegetation cover in one area, Previously Reclaimed Area 9, actually fell into the 40 to 59 percent cover class. These areas are also meeting the erosion, weed, and bare ground performance standards. The areas that have less than adequate vegetation cover and other issues that would preclude them from passing the performance standards are Previously Reclaimed Area 7 and 8.

Perennial vegetation cover has always been relatively low in Previously Reclaimed Areas 7 and 8, and in 2014 cover still averaged less than 20 percent in these areas. Contributing to the low overall cover in Previously Reclaimed Area 7 are the large areas considered barren (i.e., those areas with less than 10 percent cover) found in some locales. An important issue identified in the annual report is the need for weed control. Over the past five-years, spotted knapweed, and in some areas Canada thistle and leafy spurge, have been increasing. The lack of abundant growth by perennial species is likely contributing to the vigorous growth of the weeds. The recommendation for Previously Reclaimed Area 7 is that the area be re-tilled and reseeded. The low perennial plant cover in Previously Reclaimed Area 8 is likely due to the physical condition of the weathered bedrock soil substrate. The application of herbicide in this area has helped the seeded perennial species. Erosion is classified as moderate and continues to degrade the site. The annual report recommends that this polygon be reevaluated for additional RA work in order to set it on trajectory to meet the performance standards.

In 2012 and 2014, Atlantic Richfield applied for compliance determinations for Previously Reclaimed Areas 1, 2, 4 and 9, and the Iron Pond Slope area (Atlantic Richfield 2012a and 2014). The reports contained the results of quantitative assessments and all other information required for EPA to conduct the compliance determinations. It should be noted that Atlantic Richfield's compliance request reports do not include a long-term O&M plan, as required by the VMP. During the field seasons following the release of the compliance request reports (2013 and 2014), EPA conducted in-field evaluations. Those evaluations verified the accuracy of Atlantic Richfield's data and concluded that all areas, approximately 222 acres, were compliant with the WMA performance standards. Additionally, approximately 100 acres have passed the O&F criteria and are in short-term monitoring while about 10 acres have been remediated but are not O&F (Table 10-1).

10.2.14.4 Results of Site Inspections

The 2015 five-year review inspections of the RA areas within RDU14 – Smelter Hill Facility Areas was conducted by EPA during the 2014 field season and confirmed that Atlantic Richfield reports (discussed above) provide accurate representations of conditions within the RDU. Minor maintenance of RA elements is required and is being implemented for the storm water control structures, the leachate management systems, and the revegetated areas. Upon inspection, EPA verified that these issues are not a threat to the RA and can be addressed through Atlantic Richfield's regular maintenance programs. Photographic examples are provided showing the generally good vegetation cover in various areas of RDU 14. Photographs 986 and 470 show some of the Previously Reclaimed areas while Photograph shows the 2003 RA Area 2. The excellent vegetation cover on the Flue Dust Repository and the Arbiter Repository are shown in Photographs 848 and 852.

Based on the site inspections, the following RA areas have poor vegetation establishment and may not develop sufficient cover to meet the cover standard of 30 percent and are also unlikely to meet one or more of the other standards for WMA:

- Original Beryllium Repository (see Photograph 852)
- Previously Reclaimed Areas 7 and 8

Subsequent to meetings held in late 2014, Atlantic Richfield has prepared RFM No. SHRC 2014-1 to perform reclamation work at the Original Beryllium Repository in 2015. The main element will be the placement of additional cover soil followed by reseeding. For Previously Reclaimed Areas 7 and 8, EPA intends to meet with Atlantic Richfield in 2015 to develop a scope of work designed to improve vegetation conditions. The issues with some portions of these areas may be addressable through the established maintenance program; however, more aggressive actions, such as deep tillage or stripping/removal of highly contaminated material, may be required in other areas. Re-reclamation of these areas using current approaches, which are based on the 30 plus years of reclamation experience at the Site, may be the only way to set them on a trajectory to meet WMA vegetation performance standards.

10.2.15 RDU 15 – Mount Haggin Uplands

RDU 15 Mt. Haggin Uplands lies south of Anaconda, Montana and southeast of Mill Creek Road (Figure 10-15). This RDU is characterized by moderate to steep forested slopes. It is public land managed by the Montana Department of Fish, Wildlife and Parks as the Mount Haggin Wildlife Management Area.

It has seasonal public access restrictions and designated road accessibility, and continues to be used for recreation and open space/wildlife habitat. The area was impacted primarily by smelter fallout from the Washoe Smelter.

The RD for RDU 15 encompasses a total of 776 acres. Approximately 137 acres require implementation of a RA while the remaining 639 acres do not require physical remediation (e.g. treatment) as they are well vegetated and may only require monitoring/weed spraying. The FDR and RAWP for this RDU were prepared in 2007 and have been approved by EPA.

Remedial action objectives for impacted soils are to be met through the reduction of arsenic to the applicable standards through in-place treatment of soils (tilling with amendments), vegetation enhancement, and natural recovery. The Selected Remedy mostly includes the implementation of surface water controls/BMPs in steep slope areas. Only about 20 acres in the work plan called for tillage and amendments. Remediation technologies have been selected based on arsenic and other COC concentrations, land use, topography (slope steepness), soil pH, lime rate requirements, and rock content.

The responsibility for RA in RDU 15 has been transferred from Atlantic Richfield to the State of Montana, which has begun RA work under the NRDP.

10.2.15.1 Construction Status

Since approximately 2010, work by the NRDP in the Smelter Hill/Opportunity Ponds (SHOP) 19 polygons on the north side of Cabbage Gulch has consisted primarily of tree and shrub planting, on-slope and gully BMP's, grass seeding and aerial fertilization. Over 50 gully BMP structures were installed in the primary gullies of the project area and an additional 2000 feet of sediment retention berms were constructed to limit sediment discharge to the local streams. These structures to date have captured a minimum of 25,000 cubic feet of sediment from hill slopes. A half-acre of steep gully walls were re-graded, and the area planted heavily with containerized plant stock and mechanically transplanted grasses that have all re-established. Fertilization by air occurred in 2011 on approximately 31 acres which significantly improved the density and verity of perennial grasses. Also, NRDP has performed biannual weed control via backpack spraying at Cabbage Gulch since 2010, which has also significantly improved vegetation in all areas, including the 20 acres previously slated for tillage.

In 2010, approximately 12 acres of the SHOP 20.04, 20.14, and 20.10 polygons were planted with shrubs and trees, and the areas grass seeded. Ground-based assessments by NRDP were conducted of the SHOP 20 polygons on the south side of Cabbage Gulch. Polygons were determined to not be sediment contributors to nearby streams and are significantly vegetated since delineated in 2002. The status of the 70 acres of SHOP-20 polygons are planned to be documented for EPA review in 2015.

10.2.15.2 Operations and Maintenance Status

Maintenance of SHOP 19 polygons has been ongoing since 2011, involving building additional sediment BMPs as they fill up, as well as monitoring and protecting plant survival.

10.2.15.3 Data Review and Evaluation

The NRDP has issued periodic progress reports regarding vegetation enhancement and erosion control BMP work that has been conducted to date. Weed spraying in Cabbage Gulch has reduced the

prevalence of noxious weeds while allowing native grasses to become re-established. Test plots results where seed and fertilizer (both organic and inorganic) were applied have been promising.

10.2.15.4 Results of Site Inspections

Based on continuing EPA inspections and oversight conducted for RDU 15, the potential risks to aquatic biota in Cabbage Gulch has likely been reduced somewhat due to implementation of erosion control BMPs. Tree and shrub plantings conducted to date have been modestly successful. Additional work in RDU 15 will likely be predicated on the outcome of the ongoing surface water technical impracticability evaluation (see Section 10.2.19.2).

10.2.16 West Galen Expansion Area

The West Galen Expansion Area Uplands RD includes approximately 6,367 acres of remedial polygons (Table 10-1). Approximately 4,504 acres of these polygons require implementation of a remedial action while the remaining 1,853 acres do not require physical remediation (e.g. treatment) because they area Facilities or are well vegetated and may only require monitoring/weed spraying (Figure 10-16). To date, approximately 3,354 acres have received a RA and 1,150 acres remain to be addressed in accordance with the 2005 FDR/RAWP and an RFC to refine the area of RA work along the northern border of the RDU (Table 10-16). Additionally, ISWPs and exist for three former gravel pits (total of approximately 15.5 acres) and four agricultural fields totaling approximately 512 acres.

10.2.16.1 Construction Status

The West Galen Expansion Area is divided into two areas to better manage the implementation of the RA. Area 1 is property not owned by Atlantic Richfield or the Ueland Ranch Company and Area 2 properties are owned either by Atlantic Richfield or the Ueland Ranch Company. To date, all 2,963 remediated acres have received an in-place soil treatment ranging from light tillage to 12 inch deep tillage. All treated soils received organic matter, lime, and fertilizer amendments followed by seeding.

Most of the West Galen RA work has been implemented in open space areas used for agricultural purposes, such as livestock grazing. Remediation has also been implemented in the open space areas of two residential subdivisions: Powell Vista and Launderville. The Powell Vista Subdivision RA was completed in 2011 and consisted of 43 residential parcels, various easements, and open common spaces representing approximately 143 acres. This work did not include the remediation of existing residential yard areas which are addressed separately under the Community Soils OU using the ADLC Development Permit System process. Remediation in Powell Vista consisted of soil tilling to as deep as 12-inches (T6 or T12), lime application, fertilizer application, and seeding. The Launderville Subdivision received similar soil treatment in over 300 acres and the work was performed in 2014. In addition to this subdivision work, RA for the 250 acres of the Kelley property, which lies adjacent to the Launderville Subdivision, was begun in 2014 and completed in 2015 using in-place soil treatment.

10.2.16.2 Operations and Maintenance Status

Since the last (2010) five-year review, M&M activities have included monitoring vegetation and erosion conditions, reseeding areas, fertilizing areas, and weed spaying. Atlantic Richfield collects vegetation and site stability (erosion) data each year and discusses the results in the Vegetation Monitoring Annual Report (Atlantic Richfield 2015d).

10.2.16.3 Data Review and Evaluation

Atlantic Richfield applied for compliance determinations in 2011, 2012, and 2013 for large tracts of remediated land in the West Galen Expansion Area. The compliance request reports were reviewed by EPA and it was determined that the subject areas had undergone quantitative assessments by Atlantic Richfield and passed the performance standards in two successive years, as required by the VMP. (It should be noted that EPA found that the compliance request report submitted by Atlantic Richfield lacked a long-term O&M plan for a portion of the West Galen Expansion Area, which is also required by the VMP.) Following confirmation that the reports contained all other required data and information, EPA conducted inspections of each of the subject areas. Specifically, the evaluator checked whether the VMP performance standard was being met in each area. For these upland areas, the performance standard is an LRES score exceeding 115 points. The in-field inspections by EPA indicated that all areas were meeting the compliance performance standard and communicated to Atlantic Richfield that in the future these areas could be evaluated under the requirements of the long-term/five-year review monitoring program. In total, approximately 2,370 acres of land in the West Galen area currently meet EPA's RA compliance standard (Table 10-1).

The latest Vegetation Monitoring Annual Report (Atlantic Richfield 2015d) provides the most current data for areas that are still in the short-term monitoring program. Approximately 590 remediated acres are monitored under this program. Data from the annual report indicate that the majority of this land (approximately 510 acres) is O&F. EPA's in-field inspection of these areas in 2014 confirmed that the vegetation is progressing as expected. In contrast, there are approximately 83 acres where the seeded vegetation has not established and these areas are currently not O&F. These land parcels, which are located near the Anaconda water treatment ponds south of Lost Creek, were originally remediated in November 2007 and April 2008 using in-place soil treatment. Very low perennial plant density and cover in 2009 and 2010 prompted Atlantic Richfield to perform additional soil tests and develop a new strategy to address these areas (this was documented in a RFM for Non-Functional Polygons in Remedial Action Areas of West Galen No. 2, dated December 17, 2010). Photographs 564 and 214 provide examples of the poor vegetation establishment in these polygons.

The corrective actions implemented by Atlantic Richfield in July 2012 included more intensive soil treatment than what was originally implemented. In general, the original reclamation approaches used tillage to 6 inches in depth, no lime (or relatively low rates), and virtually no additions of organic matter. In contrast, the corrective actions generally used tillage to 12 inches, lime rates based on the new data, and 1.5 percent organic matter in most areas. All areas were reclaimed in accordance with the final RAWP prepared by Atlantic Richfield in 2006 and as modified by a RFC that called for the use of a special seed mixture requested by the landowner.

The current level of perennial plant establishment and cover (observed by EPA in 2014) indicates that these polygons still do not meet the O&F criteria. These areas have very low seeded species cover and are dominated by Kochia scoparia. Atlantic Richfield has suggested that the lack of perennial plant establishment is due to the heavy use by cattle during the seedling establishment period. This may explain the lack of good establishment in some areas but does not explain the complete lack of plants in other less frequently grazed areas. The patterns of no grass or weed growth observed in the early 2014 growing season suggest that the application of concentrated herbicide in the spring may have made the soil phytotoxic, at least temporarily. By the end of the growing season Kochia scoparia had rebounded and was growing well, but the seeded grasses had failed to establish.

EPA recommended to Atlantic Richfield that a complete soil analysis be performed to ensure that all chemical constituents (metals, non-metals, cations, pesticides, herbicides, etc.) are known and do not exceed plant growth thresholds before additional reclamation work is attempted. Following additional soil testing, for herbicides in particular, EPA will direct Atlantic Richfield to prepare an RFM to re-seed the barren and sparsely vegetated areas. Once areas are reseeded, EPA expects that Atlantic Richfield will work with the landowner to limit cattle use until the seeded species have had a chance to become well established.

10.2.16.4 Results of Site Inspections

The 2015 five-year review inspections of the remediated areas within the West Galen Expansion Area conducted by EPA during the 2014 field season confirm that the majority of the remediated areas are compliant with the performance standard of 115 LRES points and, as such, meet the remedial action objectives to be protective of human health or the environment. Approximately 2,370 acres have passed the compliance standard, 901 acres are in short-term monitoring, and a relative small number of acres (83 acres) have poor or no plant establishment. Some of the poorly vegetated areas are shown in Photographs 564, 214, 793, 521, 375, and 311. EPA plans to continue monitoring these areas for improvement and is working with Atlantic Richfield to implement additional remediation, where appropriate, that will set these areas on a course to meet the O&F criteria and eventually pass the LRES compliance performance standard.

10.2.17 Dutchman Area

The RD design for the Dutchman Area was presented in the Dutchman Area FDR. The boundary of the Dutchman Area, associated high arsenic area (HAA), and wetlands are shown on Figure 10-17. The FDR established a HAA within the Dutchman Area but did not require any RA as existing vegetation was adequate to meet the performance standard for high arsenic areas documented in the VMP. That standard is that the area must achieve greater than 115 LRES points. Wetlands are also present within the Dutchman Area and these are being monitored under the four-step wetlands process.

10.2.17.1 Construction Status

No RA work is required and therefore no work has been conducted in this area. However, some infrastructure construction is proposed under the Dutchman Land Management Plan to facilitate safe public access.

10.2.17.2 Operations and Maintenance Status

Remedial action has not been implemented so no O&M is being conducted.

10.2.17.3 Data Review and Evaluation

Remedial action has not been implemented so no evaluation data are available for review.

10.2.17.4 Results of Site Inspections

Remedial action has not been implemented so no site inspections were conducted for this RDU.

10.2.18 Ground Water

10.2.18.1 Operations and Maintenance Status

Significant activities involving ground water during the current five-year review period have included alteration of some points of compliance, completion of TI evaluations leading to waivers, and on-going ground water monitoring using a revised monitoring plan. These activities are documented in the 2011 ROD Amendment and summarized below.

Ground Water Points of Compliance

Ground water points of compliance were designated in the 1998 ROD along the downgradient boundaries of waste management areas. Through the course of remedial design and on-going monitoring, significant changes occurred affecting points of compliance:

- The Smelter Hill WMA, which had a series of POC wells, was merged with the Triangle Waste into the Opportunity Ponds WMA. With these WMAs now being contiguous, the need for POC wells at the Anaconda Ponds on Smelter Hill was relieved.

- The ROD remedy for the Opportunity ponds was installation of a final cover and ground water monitoring with a contingency for a ground water containment system. Through remedial design, the contingency was implemented as a preemptive action. The containment system occupies an area previously designated as a point of compliance and several POC wells were removed during construction. The contingency remedy as implemented altered the location where POC wells were needed.

- The Old Works WMA boundary was expanded to include additional areas of waste left in place. The expansion required the designation of new POC wells.

- The addition of the North Opportunity and South Opportunity TI zones spawned the need for POC wells along the downgradient edges of these areas.

Ground Water TI Zones and Waivers

During the current five-year review period, there was considerable activity involving ground water TI zones.

- The TI zones established in the ROD waiving the arsenic human health standard were re-evaluated in light of the change in that standard established in the ROD Amendment. The lowering of the standard necessitated re-evaluating conclusions of the previous TI evaluation, which resulted in an increase in the area deemed TI to meet the ARAR, and what was three similar but separate TI Zones became a larger single TI zone referred to as the Bedrock Aquifer TI Zone.

- Additional information was gathered in the wetland area north of the Opportunity Ponds which led to the discovery of a significant area with ground water exceeding the human health standard for arsenic. A TI evaluation was prepared and a waiver was granted for the North Opportunity Areas of Concern in the ROD Amendment.

- The South Opportunity Areas of Concern was designated in the 1998 ROD as an area with ground water exceeding the human health standard for arsenic and the remedy was to modify irrigation practices and allow natural attenuation to work. With the change in the arsenic standard, this area

was reviewed to verify that the selected remedy was still appropriate. This review resulted in a TI evaluation and a determination that the new standard was not attainable and a waiver was granted in the ROD Amendment.

Ground Water Monitoring

Ground water monitoring during the review period has been conducted following the *Final Short-Term Groundwater Monitoring Sampling and Analysis Plan Addendum No. 1* (SAP Addendum) approved in March 2009. The SAP Addendum modified the previous short-term monitoring plan (AERL 2000) by reducing the number of wells sampled semi-annually, adding wells and springs to be sampled twice per five years, made adjustments to POC wells identified in the ROD that no longer existed including provisions to install new POC wells, added a series of wells to be sampled based on specific hydrologic conditions, and added domestic well monitoring. The SAP Addendum was completed in anticipation of the changes formalized in the 2011 ROD Addendum.

Monitoring involves the following categories:

- Points of Compliance – Wells designates as points of compliance are intended to ensure that contaminated ground water is not exiting the waste management areas. These wells are monitored semi-annually.
- Town of Opportunity – This is a series of wells located along the downgradient edge of the South Opportunity TI zone. A large number of domestic wells are located just outside the TI zone and the edge is monitored to verify that arsenic is not exiting the TI zone.
- Event-Driven Wells – This is a series of wells within the Old Works WMA that are sampled when the water table rises to a benchmark elevation. The purpose is to aid in understanding how periodic increases in ground water COC concentrations are related to hydrologic conditions and waste within the WMA.
- Engineered Cover Wells – This is a series of wells installed within the Opportunity Ponds WMA to evaluate changes in ground water conditions resulting from the installation of a final cover on the 2,200 acre tailings ponds.
- 5-Year Performance Wells – This includes wells, springs, and surface expressions of ground water designed to monitor the performance of the remedy over the remainder of the Site. Monitoring from 1999 to 2008 determined that most of the Site does not display long-term changes and that a five-year frequency would be sufficient to observe changes in ground water conditions including verifying that the TI zone plumes are not expanding. These locations are sampled at high water and low water conditions as seasonal variations are common at the Site.

Results of ground water monitoring are summarized in annual reports and discussed below.

10.2.18.2 Data Review and Evaluation

Points of Compliance

Of the 24 POC wells monitored or install during the five-year review period, no exceedances of remedial action goals occurred for ground water. Nearly all wells have very low concentrations of

arsenic, the primary COC. Well MW-262 has arsenic concentrations greater than 1 µg/L and had a concentration of 7.3 µg/L in 2013. All arsenic data for monitoring well MW-262 are shown in Figure 10-18. Although there are no exceedances, recent data indicate that there may be a trend toward higher arsenic concentrations. For the period of record, cadmium and lead have not been detected and zinc has only been detected twice at concentrations three orders of magnitude lower than the remedial action goal. Copper has been detected in all samples at concentrations three orders of magnitude less than the remedial action goal and no trend is evident. The highest copper concentration occurred in the same sample as the highest arsenic concentration on August 2, 2013.

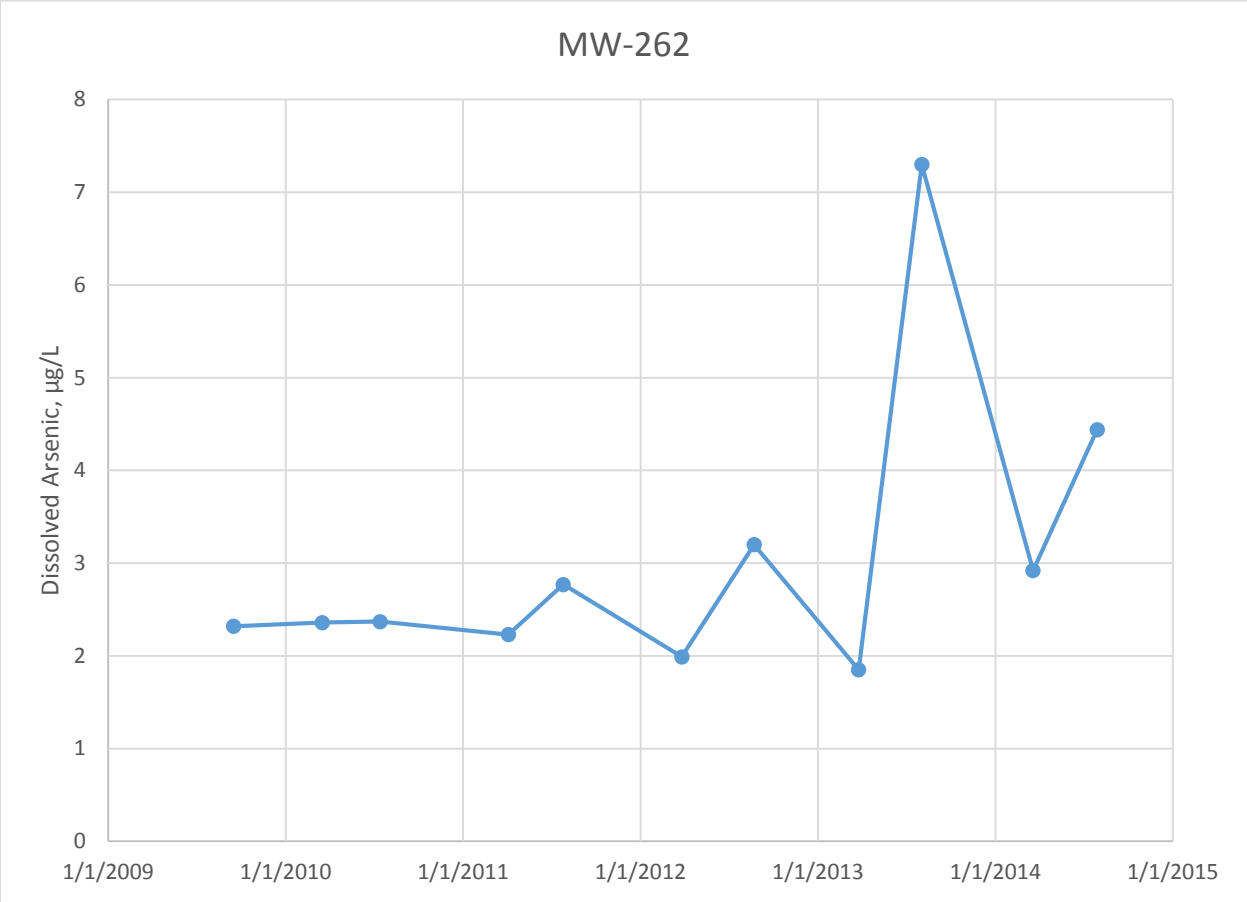

Figure 10-18 Arsenic Concentrations in Well MW-262

Town of Opportunity Wells

Similar to the POC wells, none of the Town of Opportunity wells showed exceedances of remedial action goals for any COCs. In addition, there were no obvious trends in the arsenic data. Cadmium, copper, lead, and zinc were mostly not detected.

Event Driven Wells

The water table reached the trigger elevation in 2009, 2010, and 2011 and wells were sampled. In June 2009, MW-213 exceeded 15 µg/L cadmium which triggers semi-annual sampling until the concentration is less than 15 µg/L cadmium. The cadmium concentration was less than 15 µg/L in August 2009 and the sampling frequency returned to normal. No wells exceeded 15 µg/L cadmium in

2010 or 2011, so no follow-up sampling was conducted other than the required point of compliance sampling.

Engineered Cover Wells

Installation of the final cover on Opportunity Ponds was expected to reduce infiltration of water and oxygen and potentially change the leachate quantity or quality generated in the tailings. Shallow and mid-depth wells were monitored to evaluate changes in ground water conditions under the covered area. Two mid-depth wells were installed in 2011 at the locations of existing shallow wells.

Monitoring results for wells installed prior to 2011 are shown in Figure 10-19. Arsenic concentrations are increasing in MW-31 and decreasing in MW-90 and MW-82. Cadmium, copper, and lead are generally not detected and zinc concentrations are very low.

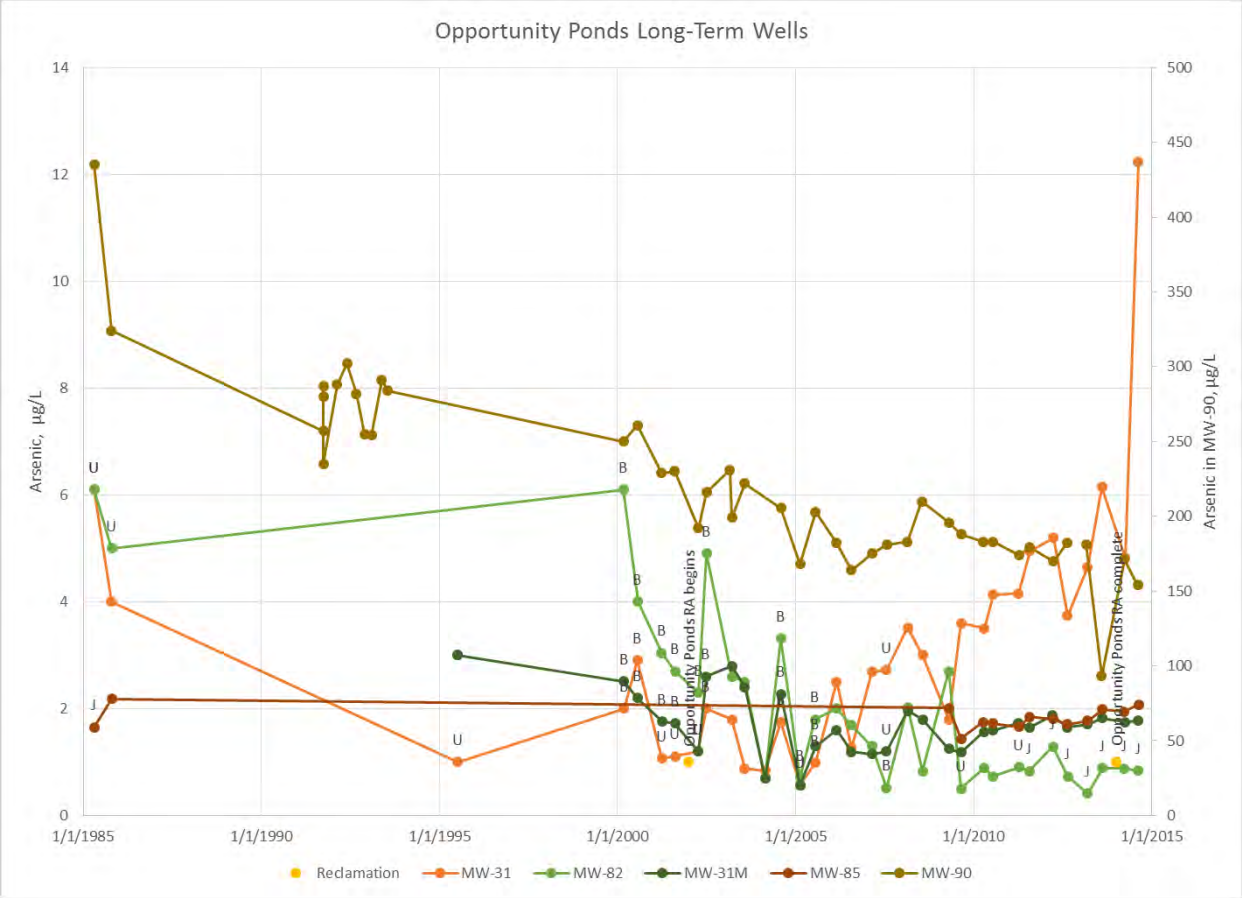

Figure 10-19 Arsenic Concentrations in Opportunity Ponds Monitoring Wells

Sulfate concentrations in four shallow wells and one mid-depth well in the Opportunity Ponds are shown in Figure 10-20. There is an overall decline in sulfate since 1985. Wells installed in 2011 do not indicate trends for arsenic, metals, or sulfate.

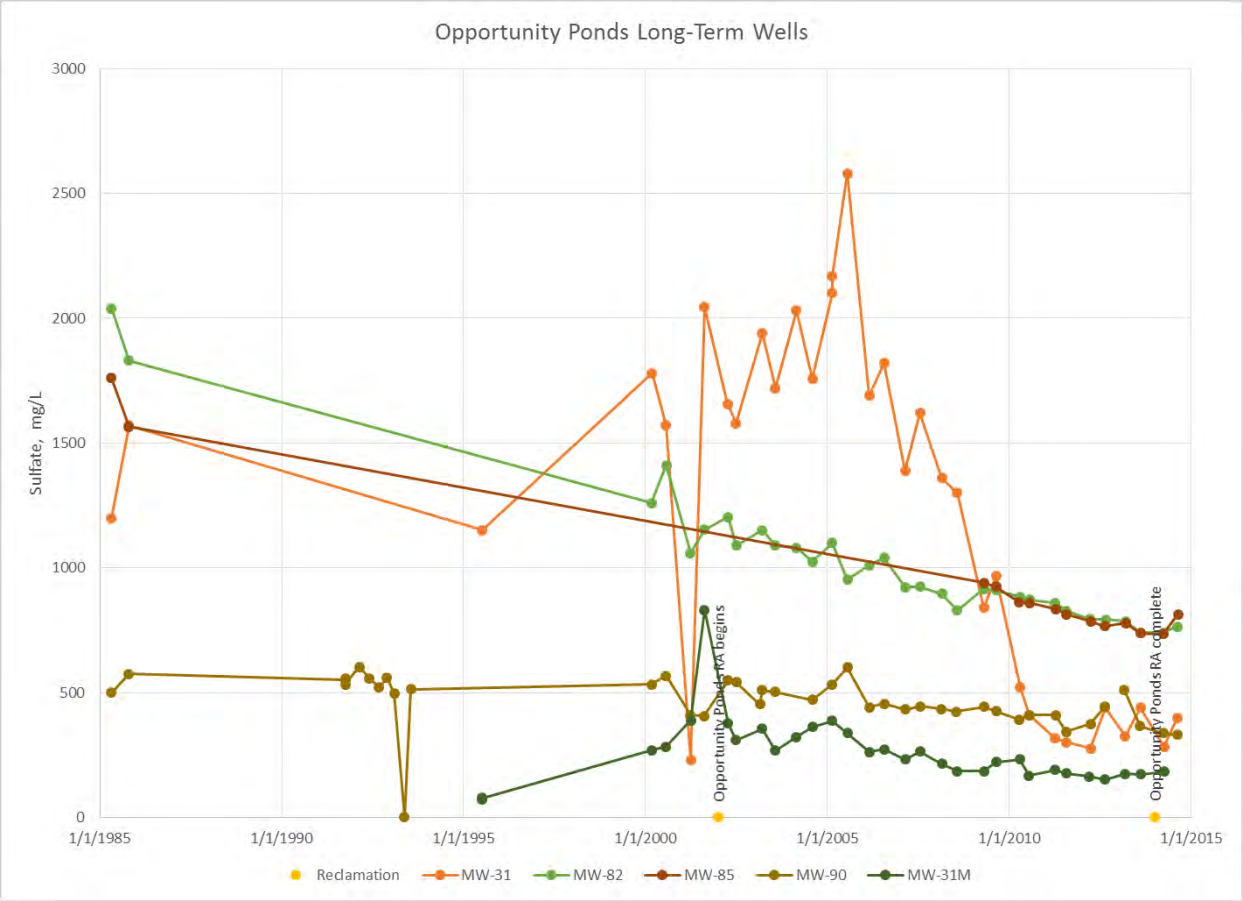

Figure 10-20 Sulfate Concentrations in Opportunity Ponds Long-Term Wells

Five-Year Performance Wells

Most of the wells to be monitored on a five-year basis were sampled twice in 2014 and twice in 2009 with a wide variety of sampling frequencies prior to 2009. In order to evaluate how the arsenic concentrations are changing in various areas, concentrations were compared from 2009 to 2014. Many of the arsenic concentrations were low and comparison of results less than 5 µg/L was not conducted.

Changes in ground water were evaluated by comparing the low water table data from 2009 to the low water table in 2014 to derive a percent change. The same was done for high water table data. The changes were then averaged and are presented in Table 10-2 along with the average arsenic concentration from 2009. Overall, the concentrations declined during this period.

Table 10-2 Changes in Arsenic Concentrations in Ground Water in the Bedrock TI Zone 2009-2014

Well ID	Average Arsenic 2009 µg/L	Change 2009 2014
NGP-1	185	-26%
MW-233	14.6	-20%
MW-244	5.6	6%
MW-245E	21.6	-87%
MW-245S	1058	8%
MW-248D	6.2	-48%
MW-248E	5.7	-86%
MW-249S	51.8	55%
MW-250S	55.5	-12%
FH-2	13.0	-13%
Average	142	-22%
Median	18	-16%

Results from piezometer WGP-1 were not included in Table 10-3 due to an extreme difference in concentrations. Samples collected in 1993 and 2009 have similar arsenic, cadmium, copper, and zinc concentrations. Samples collected in 2014 were approximately two orders of magnitude higher. Changes of this magnitude are not seen elsewhere and it appears that the 2014 data are in error.

Table 10-3 Arsenic and Metal Concentrations in WGP-1

Date	Arsenic	Cadmium	Copper	Zinc
9/24/1993	4.3	<0.11	<1.15	21.9
5/27/2009	6.06	<0.25	<2.02	<4.55
8/11/2009	5.76	<0.25	<2	<4.5
5/22/2014	510.4	7.73	25.92	179.9
7/17/2014	627.1	8.43	47.87	174.4

A summary of the changes in arsenic concentrations in the Smelter Hill area is shown in Table 10-4. Again, only arsenic concentrations greater than 5 µg/L are included. Most wells showed a slight decline, but MW-218s had a significant increase. The long-term arsenic data are shown on Figure 10-21. One anomalously low value was reported in 2009 leading to the high change percentage shown in Table 10-4. Overall, arsenic concentrations in MW-218S for 2014 are very similar to historic data.

Table 10-4 Changes in Arsenic Concentrations in Ground Water in the Smelter Hill Area 2009-2014

Well ID	Average Arsenic 2009 µg/L	Change 2009 2014
MW-253	18.0	-5%
MW-211	47.8	-11%
MW-218S	25.2	187%
MW-210	57.8	-5%
AMW-227	37.0	-9%

Well ID	Average Arsenic 2009 µg/L	Change 2009 2014
C2-AL	1462	-9%
A1-BR-2	4930	-9%
A2-BR	1254	-16%
B4-BR	1143	5%
D3-AL-1	74.4	-5%
Average	1003	14%
Median	74	-9%

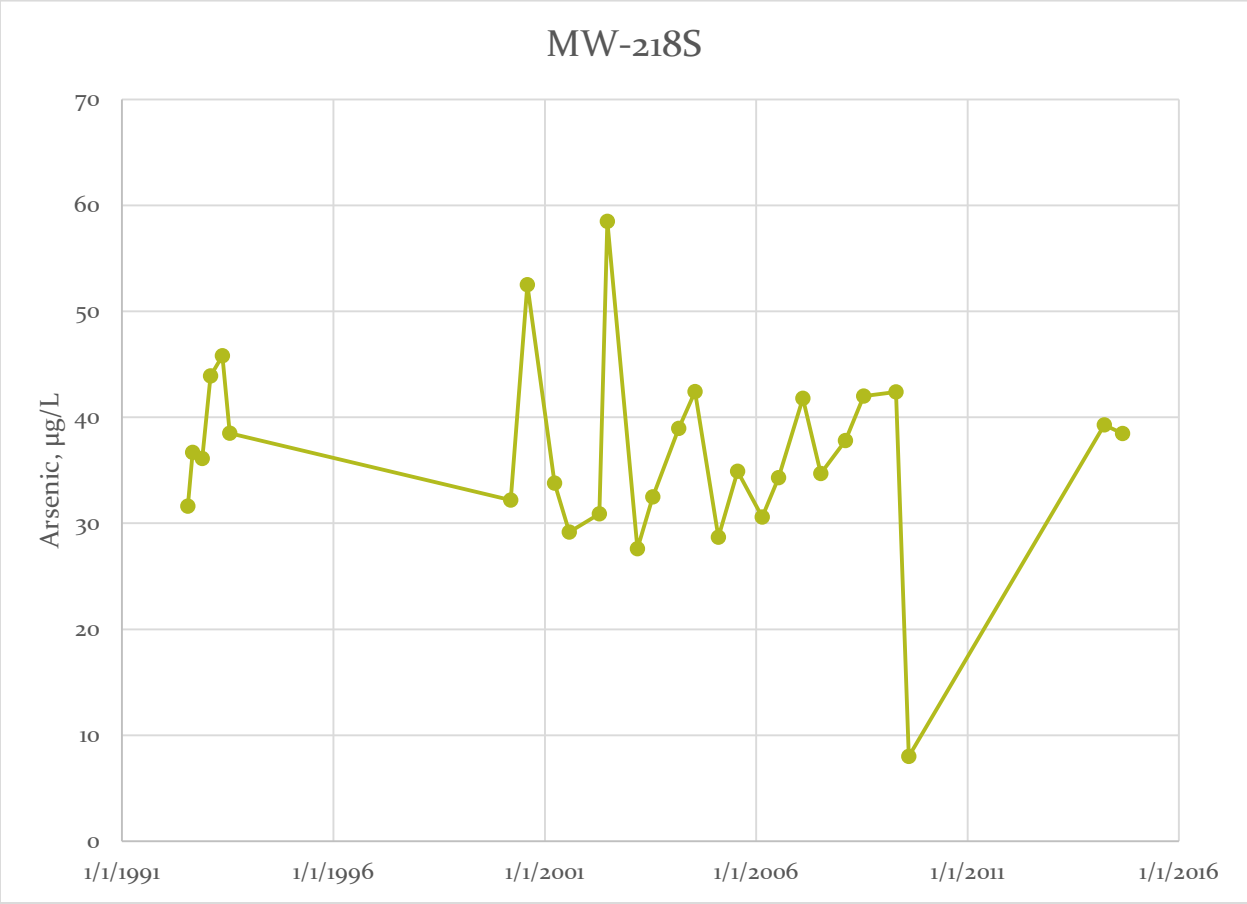

Figure 10-21 Arsenic Concentration in MW-218S

The changes in arsenic concentrations in spring samples are shown in Table 10-5. Greater variance is expected from spring samples than monitoring well samples because the spring samples represent the top of the water-bearing zone while well samples represent the screened interval. The top of the water-bearing zone, or water table, receives recharge from contaminated soil above the spring which is expected to vary considerably seasonally. On average, arsenic concentrations in springs have not significantly changed since 2009.

Table 10-5 Changes in Arsenic Concentrations in Spring Samples 2009-2014

Spring ID	Average Arsenic 2009 (µg/L)	Change 2009 2014
MT. HAGGIN/SMELTER HILL * SP97-12	455	240%
NORTH OPPORTUNITY * SP-07-02	354	-71%
STUCKY RIDGE * SP97-20	285	-54%
MT. HAGGIN/SMELTER HILL * SH-3	283	-75%
MT. HAGGIN/SMELTER HILL * SST-30	250	-10%
MT. HAGGIN/SMELTER HILL * SP98-37	89.2	9%
NORTH OPPORTUNITY * SP-07-01	64.3	43%
MT. HAGGIN/SMELTER HILL * SP98-36	49.7	28%
NORTH OPPORTUNITY * SP-07-03	46.9	72%
STUCKY RIDGE * SP98-32	38.4	-36%
LOST CREEK EXPANSION AREA * SP98-27	30.2	-37%
MT. HAGGIN/SMELTER HILL * SST-1	28.4	55%
LOST CREEK EXPANSION AREA * SP98-26	18.7	11%
STUCKY RIDGE * SP99-01	18.6	-56%
MT. HAGGIN/SMELTER HILL * SST-26	13.3	-82%
STUCKY RIDGE * SP98-34	12.7	33%
LOST CREEK EXPANSION AREA * SP98-30	8.97	41%
MT. HAGGIN/SMELTER HILL * SST-29	6.37	39%
MT. HAGGIN/SMELTER HILL * SP98-16	6.01	26%
Average	108	9%
Median	38	11%

Domestic Wells

Prior to the ROD, domestic well sampling occurred for the purposes of characterization (CDM Smith 1994). Additional sampling in the Opportunity area was conducted by Anaconda-Deer Lodge County in 2001-2005 (WET 2005) and 2008-2009 (Kuipers 2008 and 2009). In order to establish a domestic well area of concern surrounding the existing and expanded TI Zones, additional sampling was conducted by Atlantic Richfield in 2004-2008 (Atlantic Richfield 2004b, 2005, 2006, 2007b and 2008).

In 2009 Atlantic Richfield contracted with MBMG to conduct domestic well and short-term ground water monitoring. This necessitated the completion of the SAP (Atlantic Richfield 2009a), which contained an EPA- and DEQ-approved Domestic Well Monitoring and Replacement Plan. Since the plan was implemented in 2009 through 2014, MBMG reports the following statistics.

- MBMG has investigated at least 810 properties that may have a water supply well based on the Cadastral data and aerial photographs. MBMG has contacted or attempted to contact the owners of all of these properties.
- 606 wells have been sampled, including replacement wells drilled by MBMG.

- Owners of 134 properties have been contacted at least three times without getting a response. Many of these properties do not have a well, a residence, or the residence was abandoned/not used when MBMG visited the property.
- 38 properties were included in the program, but the owners refused access.
- 32 properties were included, but later found to have no well or were using city water.
- 5 wells have been successfully replaced, and 4 attempts were unsuccessful (either arsenic was greater than 10 µg/L or the replacement well was unproductive).
- 14 reverse osmosis treatment units have been installed.
- 52 wells had arsenic concentrations between 5 and 10 µg/L.

The *2009 Domestic Well Monitoring and Replacement Plan* required analysis for cadmium for domestic wells two miles downgradient of the vicinity of the Old Works. In addition, no exceedances of cadmium are noted for domestic wells downgradient of the Old Works facility (or site-wide) since domestic well monitoring began in 2004.

The 2011 ROD Amendment addressed domestic wells as follows:

> "*To prevent human exposure to arsenic from drinking ground water within and adjacent to the TI zones that exceeds human health standards, a domestic well sampling and replacement program will be established to periodically test all domestic wells within the domestic well area of concern…*" (EPA and DEQ 2011)

The well replacement program was used and, as mentioned, 5 wells were replaced since the last five-year review. However, since 4 attempts to locate deeper water below the arsenic trigger were unsuccessful due to suspected naturally occurring sources, EPA has determined that residents with water having arsenic concentrations greater than 10 µg/L will have their drinking water treated using point-of-use treatment systems.

10.2.19 Surface Water

10.2.19.1 Operations and Maintenance Status

Surface water monitoring is conducted by the USGS in the four major streams within the ARWW&S OU: Lost Creek, Warm Springs Creek, Mill Creek, and Willow Creek. A long-term surface water monitoring plan is currently being developed as part of the ARWW&S OU RA. The overall approach to long-term surface water monitoring at the Site is to continue monitoring at four core monitoring stations where surface waters exit the operable units for water quality and discharge. This monitoring is consistent with the Upper Clark Fork Basin Long-Term Monitoring Plan, currently being implemented by the USGS. In addition to these stations, eight additional stations (two per stream) are monitored six to eight times per year for water quality and gauged flow.

Water quality includes COCs, dissolved organic carbon, instantaneous discharge measurements, and common ions. The specific list of analytes is consistent with monitoring currently performed at the eight USGS stations within the ARWW&S OU. Sampling for each stream is conducted on the same day with all streams being sampled as close together temporarily as possible. Discharge includes stage and

calculated discharge measured at 15-minute intervals. Field discharge measurements are conducted during each water quality sampling event plus additional measurements as needed to maintain the stage-discharge relation curve.

Stations equipped to measure and record 15-minute discharge are housed in a permanently-established gauging station to protect instruments and telemetry equipment. Telemetry is used to transmit data offsite for regular updates to the USGS National Water Information System (NWIS) website (NWISWeb) database. Turbidity has been collected at one station on each stream at daily intervals during non-freezing conditions since 2013 (in Mill Creek, Willow Creek, and Warm Springs Creek) or 2006 (in Lost Creek).

As the USGS is implementing the long-term surface water monitoring program, all QA/QC procedures follow established USGS procedures. All data, including provisional data, are published to NWISWeb and is publicly accessible.

10.2.19.2 Data Review and Evaluation

Surface water monitoring is performed by USGS and is ongoing. As mentioned, the data are published on USGS's NWISWeb. USGS publishes an annual report which presents data for each monitoring site, but does not offer any data interpretation. As with ground water, these data were thoroughly evaluated during the TI evaluations performed by EPA.

A tabulation of exceedances of chronic aquatic life standards is shown in Table 10-6. There have been no exceedances for arsenic or zinc at any of the monitoring locations in the last five years, and there were no exceedances of any COC in Lost Creek near Galen (station 12323850). Cadmium, copper and lead exceed the chronic standard at times (except at station 12323850).

Table 10-6 Exceedances of Chronic Aquatic Standard 2010-2014

Station	Arsenic	Cadmium	Copper	Lead	Zinc
USGS 12323840 Lost Creek near Anaconda MT	0	0	9	4	0
USGS 12323850 Lost Creek near Galen, MT	0	0	0	0	0
USGS 12323760 Warm Springs Creek near Anaconda MT	0	0	3	1	0
USGS 12323770 Warm Springs Creek at Warm Springs MT	0	2	12	4	0
USGS 12323710 Willow Creek nr Anaconda, MT	0	3	9	7	0
USGS 12323720 Willow Creek at Opportunity, MT	0	2	13	8	0
USGS 12323670 Mill Creek nr Anaconda, MT	0	2	10	9	0
USGS 12323700 Mill Creek at Opportunity, MT	0	8	13	12	0

Generally, metals concentrations in surface water increase during high flow conditions with the highest flows causing some exceedances of chronic aquatic standards. For example, total recoverable and dissolved copper concentrations since 1993 for station 12323770 on Warm Springs Creek at Warm Springs, are shown on Figure 10-18 along with discharge (Q). Total recoverable copper increases significantly with large changes in discharge corresponding with annual peak runoff which typically occurs in May to July. Samples collected during the remainder of the year display lower metals concentrations with no exceedances of chronic standards. Dissolved copper concentrations increase somewhat during higher flows indicating dissolved copper is related to suspended copper

that occurs during high flows. There is no indication of increases in dissolved metals in surface water as a result of ground water discharge.

Because the exceedances of total recoverable copper and other metals for chronic aquatic standards occur in reaches where no work has been proposed, or proposed work is not anticipated to be sufficient to reduce loading to achieve standards, in 2013 Atlantic Richfield, in collaboration with EPA, DEQ, and NRD, initiated a TI evaluation. To support the evaluation, additional sampling was conducted in 2013 (primarily storm water in the four major streams and their tributaries) and 2014 (Hoodoo Creek, a tributary of Mill Creek, to evaluate loading sources). Data are currently being used to refine the conceptual site model and additional remedial alternatives are being evaluated as part of the TI evaluation, which is anticipated to be completed by mid-2016. Following completion of the evaluation, the EPA and DEQ will review the TI evaluation to determine whether a TI waiver of certain surface water standards is appropriate.

Also note that there is no apparent long-term trend in copper concentrations at this station during the period of record. Sources identified in the RI include Old Works which was largely addressed in the early 1990s and stream bank waste between Galen Road and Warm Springs which is in the process of being addressed (See Section 10.2.10). Decreases in metals concentrations as a result of recent actions

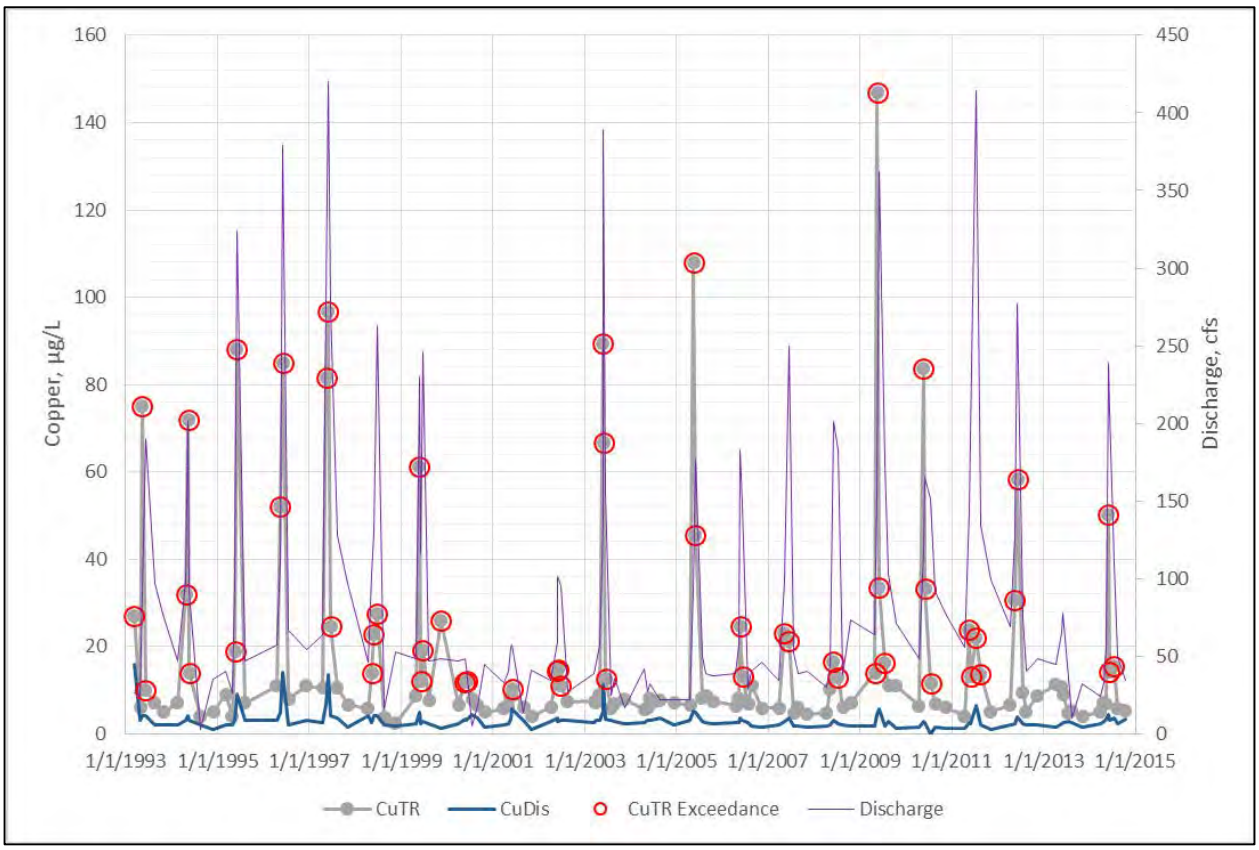

Figure 10-22 Copper Concentrations Trend at Station 12323770, Warm Springs Creek
TR=total recoverable, Dis=dissolved

are not expected until all stream bank actions are complete. Although records begin in 2003 and 2004, surface water quality patterns in Mill and Willow Creeks and middle Lost Creek are similar to Warm Springs Creek with exceedances of chronic aquatic standards during high flow conditions. Lower Lost

Creek is dissimilar to the other streams due to significant diversion for irrigation and large ground water gains resulting in no exceedances of chronic standards during the five-year review period.

10.3 Progress Since The Last Five-Year Review

A great deal of progress has been made in remediating contaminated open space areas within the ARWW&S OU since the last (2010) five-year review, as described above. Major land reclamation work has been implemented in the following RDUs:

- RDU 1 - In-place soil treatment, installation of trees and shrubs, and installation of erosion control BMPs on approximately 480 acres.
- RDU 5 - Waste removal and land reclamation for: Mill and Willow Creek trestles; Blue Lagoon; Son of Blue Lagoon; Mill Creek Flood Irrigation Area; a portion of the Yellow Ditch; a portion of the East Anaconda Yards; railroad beds within the main portion of the town of Anaconda; West Anaconda Yards; West Valley line, and; and West Valley Historic Railroad Spurs.
- RDU 6 - Re-reclamation of 31 acres that failed to pass the O&F inspection.
- RDU 8 - Completion of land reclamation work, including in-place waste treatment and construction of engineered covers, over approximately 4,800 acres, and the creation of approximately 852 acres of wetlands.
- RDU 9 - Completion of the in-place soil treatment of approximately 658 acres of contaminated soil and remediation of the Lower Willow Creek stream corridor.
- RDU 14 - Construction of engineered storm water controls, steep slope grading, installation of engineered covers, and consolidation of waste and debris.
- RDU 15 - Work by the NRDP has consisted primarily of installing storm water erosion control BMPs, applying fertilizer, and conducting vegetation field trials.
- West Galen - In-place soil treatment of more than 700 acres in the Powell Vista, Launderville, and Kelley open space areas.

In total, remediation was completed for more than 6,700 acres and wetlands were created on more than 850 acres within the ARWW&S OU since the last (2010) five-year review.

In addition to the on-the-ground land reclamation, administrative accomplishments since the last five-year review include completing the ARWW&S OU ROD Amendment, the purpose of which is to:

- Describe the changes to the remediation requirements of the 1998 Selected Remedy, including RAOs, ARARs, and cleanup levels.
- Certify that the remedy selection process was carried out in accordance with the requirements of CERCLA, and, to the extent practicable, the NCP.

- Provide the public with a consolidated source of information about RD investigations and data evaluations completed since the original ROD was signed in 1998, which led to the changes presented in the ROD Amendment, as well as EPA's consideration of, and responses to, the comments received.

The ROD Amendment is based on: 1) fundamental changes to the 1998 ARWW&S OU ROD resulting from the Agencies' decision to waive the arsenic human health standard in certain ground and surface waters at the Site, and; 2) improved site characterization based on the additional design investigations and work completed at the Site.

Other significant accomplishments since the last (2010) five-year review include completion of the soil/vegetation (i.e., phytotoxicity) investigation and the finalization of the VMP. The latter is key to performing RA performance assessments and the long-term management of the remediated areas. The VMP describes the requirements that EPA and DEQ have established for the ARWW&S OU and are based on the revegetation/site stability goals and objectives set forth in the 1998 ROD and 2011 ROD Amendment. Specifically, the plan describes the vegetation management process and identifies the performance targets and quantitative standards used to determine when a remediated property has achieved compliance. Furthermore, it identifies the requirements for conducting monitoring and maintenance activities, and for performing site inspections and evaluations.

As discussed throughout Section 9, remediated sites are monitored to demonstrate that they are stable (no excess erosion) and that the vegetation is on a trajectory to meet RA goals, ARARs, and performance standards. Site evaluations are performed at four stages: 1) during O&F assessments shortly after the construction (reclamation) is implemented, 2) during the short-term monitoring and maintenance phase, 3) at the compliance determination step, and 4) as part of long-term inspection and maintenance for the on-going five-year reviews.

Based on the wide range of post-RA soil contaminant concentration levels, land ownership, and the various types of anticipated land uses, the VMP has categorized properties for the purposes of reclamation, monitoring, maintenance, implementing ICs, and determining compliance.

- Category 1. Unrestricted Use Properties – soil less than 250 mg/kg arsenic
- Category 2. Upland Properties - Low to Moderate (up to 1,700 mg/kg) total metal index (TMI) having enhanced reclamation
- Category 3. Upland Properties - Moderate to High (>1,701 mg/kg) TMI having enhanced reclamation and design
- Category 4. Upland Properties - Moderate to High (>1,701 mg/kg) TMI having enhanced reclamation and a land management plan where enhanced design is not feasible
- Category 5. HAAs
- Category 6. WMAs

Details regarding how land in these various categories are managed is described in the VMP.

With the exception of the finalization of the IC program, the issues identified in the last five-year review for the ARWW&S OU have been addressed; the other 2010 five-year review issues were:

- Uncontrolled use of contaminated ground water
- Unsuccessful treatment of the Milltown Reservoir sediments in providing a vegetative cover for the Opportunity Tailings Ponds
- Concern over long-term permanence of vegetation in certain treated soil areas
- Buried Yellow Ditch wastes northwest of Fairmont
- Railroad grade from Anaconda to Georgetown built of mine waste

These issues and the how they have been addressed was discussed in Section 4.3.

10.4 Technical Assessment

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

No. The RAs implemented to date are functioning as intended; however, the erosion control best management practices installed in RDU 12 – Slag have not prevented slag from being blown into other areas of the Site. Revegetated areas are performing as expected throughout most of the ARWW&S OU and the small number of acres where the seeded species have not established well are being addressed through the regular maintenance program. Access restrictions and interim ICs are functioning as intended. Monitoring and maintenance of completed RA areas is ongoing and is consistent with the approved design documents and the VMP.

Question B - Are the exposure, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid?

Yes. For the 2015 five-year review, EPA re-examined the ARARs and the assumptions used in the original human health risk assessment (see Appendix C-1). In accordance with the preamble to the NCP, ARARs are frozen at the time of the ROD unless "a new or modified requirement calls into question the protectiveness of the selected remedy" (55 FR 8757 [March 8, 1990]). Appendix B notes that certain contaminant specific water quality ARARs were changed under the 2011 ARWW&S OU ROD Amendment. No other new or modified requirement calls into question the protectiveness of the selected remedy. Land use has changed in some areas, but those changes have not increased potential risks; exposure assumptions, exposure pathways, and COC toxicity used previously remain valid for human receptors. Lowering of the arsenic drinking water standard has resulted in a larger area of concern and a greater chance of exposure to contaminated drinking water.

As part of this 2015 five-year review, Atlantic Richfield prepared an evaluation and summary of wildlife ecological risk data collected since the 1998 ARWW&S OU ROD was issued. This document, entitled *Evaluation of Remedy Effectiveness for Terrestrial Wildlife Ecological Protection at the Anaconda Regional Water, Waste and Soils (ARWW&S) Operable Unit (OU): Five Year Review* (Atlantic Richfield 2015i), concluded that there are no unacceptable risks to terrestrial wildlife populations

from residual Pb or other metals in soils, based on an integrated weight-of-evidence assessment of data and information from the 1997 Baseline Ecological Risk Assessment and subsequent follow-up site-specific biomonitoring investigations conducted by the U.S. Fish and Wildlife Service and Texas Tech University. While EPA is in somewhat agreement with those conclusions, EPA believes that there is some uncertainty with regard to the remedy sufficiently addressing the total metals load on the environment. As discussed in Ecological Risk Technical Memorandum (Appendix C2), some future monitoring is warranted to monitor the effectiveness of the remedy to mitigate impacts to aquatic and terrestrial organisms.

In 2013, the VMP was completed and with it the final performance compliance standards for areas that receive a land reclamation treatment. Those standards are being used to determine if newly reclaimed areas are progressing as expected and whether mature areas meet the compliance standards and can be monitored under the long-term/five-year review monitoring program. To date, more than 6,700 acres are compliant with the standards and another 3,800 acres have well-established vegetation and being monitored each year.

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

Yes. Additional information indicates that wind continues to entrain slag material from RDU 9 and contaminate remediated areas of the Site.

10.5 Issues and Recommendations

Issues identified for the ARWW&S OU that affect protectiveness are the long-term effectiveness of ADLC's IC program to protect the constructed remedies, and slag material that continues to be released from RDU 9 and is impacting remediated areas of the Site, including ADLC's wastewater treatment plant. It is anticipated that the IC program will be effective in protecting the remedy when it is finalized and fully implemented. Since the last five-year review the owners of the slag have not demonstrated that the slag is a resource nor have measures been taken to limit the slag from contaminating other areas. EPA is in discussions with Atlantic Richfield and the owners of the slag and this issue is expected to be resolved before the next five-year review.

Table 10-7 Recommendations and Follow-up Actions

Issue	Recommendations and Follow up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future (if not addressed)
1. Long-term effectiveness of ADLC's IC program. **OU16 Community Soils, OU7 OW/EADA, OU4 ARWW&S, OU 15 Mill Creek**	A, Finalize ICIAP	Anaconda – Deer Lodge County (ADLC)/Atlantic Richfield	EPA/DEQ	June 2016	No	Yes
	B. Implement and fund ICIAP	ADLC/Atlantic Richfield	EPA/DEQ	June 2016	No	Yes

Table 10-7 Recommendations and Follow-up Actions

Issue	Recommendations and Follow up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future (if not addressed)
3. Develop slag as a resource, or complete closure of slag piles. **OU4 ARWW&S.**	Assess efficacy of current BMPs. Complete a plan and schedule to develop the Main Granulated, West Stack and Anaconda Landfill Slag piles and initiate closure.	Atlantic Richfield	EPA/DEQ	June 2016	No	Yes
5. Complete remaining remedial actions, **OU16 Community Soils, OU7 OW/EADA, OU4 ARWW&S OU.**	C. Implement remaining ARWW&S RDU remedial action work plans for RDUs 1, 2, 3, 6, 7, 9, 10, 14, 15, and West Galen.	Atlantic Richfield	EPA/DEQ	December 2025	No	Yes

10.6 Protectiveness Statement

The remedy at the ARWW&S OU is expected to be protective of human health and the environment upon completion of the remaining remedial actions including soil reclamation and storm water controls for the RDUs (1, 2, 3, 6, 7, 9, 14, 15, and West Galen), and removal of tailings along Warm Springs Creek. Completion and implementation of either a re-use or closure plan for the remaining slag piles (Main Granulated Slag, West Stack Slag and landfill) must be completed and implemented. Additionally, the final ICIAP must be completed and implemented (including long-term funding) at the NPL site. In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks in these areas.

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Section 11

Institutional Controls

ICs ensure that remedial actions are protected and that development at the Site is conducted in a manner protective of human health and the environment. The selected remedy calls for an ICs program developed and administered at the local government level. ADLC has made significant progress in the implementation the Interim Institutional Controls Plan over the past five years. Appendix D provides the ADLC's 2015 five-year review status report of the IC program. The following is summarized based on ADLC's status report.

ADLC's Superfund Program works closely with the Planning Department to guide developers through the DPS process to ensure developers understand and adhere to Superfund protocol. In the past five years, the Superfund program has reviewed 724 local permit applications of which 594 or 82 percent were located within the Superfund Overlay District. One hundred and five of these permit applications affected existing Superfund remedies.

An interior and attic dust characterization study was completed in 2007 and the selected remedy was included in the 2013 ROD amendment to the Community Soils OU ROD. Currently, residents who contact the Superfund program with dust concerns are added to a waiting list for sampling and remedial action to be completed in accordance with Atlantic Richfield's Community Soils OU RAWP. In the interim, residents are referred to the CPMP (see below) for information on reducing risks associated with lead and arsenic exposure.

Construction of new domestic wells within the county requires a permit through ADLC's Environmental Health Department. In conjunction with the Well Installation Permit, the applicant is required to obtain an Administrative Development Permit through the ADLC Planning Department. The Superfund program is notified of the well permit application and provides well drilling guidance to the resident. After processing the permit application Atlantic Richfield and their contractors are notified of the new well; all new wells within the Domestic Well Area of Concern are sampled prior to use. If elevated levels of arsenic are present, the well is addressed under the Domestic Well Monitoring Plan. ADLC periodically follows up with Montana's Ground Water Information Center for completed well logs and on-going sampling results. The Superfund program also provides well information on existing wells if a resident or potential property purchaser inquires.

The CPMP was in its infancy in 2011 and had not been fully implemented or developed. During the past several years, the Superfund program has been developing the CPMP and increasing the information and services it provides to the public. Initially, the program provided residents with Atlantic Richfield soil sample results and administered a small Soil Swap Program, but the program offered limited soil screening on uncharacterized properties and provided a limited amount of clean soil for vegetable gardens and play areas. In 2014, the CPMP program expanded the Soil Swap Program to include the option of raised structures for residents who wanted a vegetable garden and/or play area (e.g. sand box), or clean topsoil for existing gardens. The CPMP administrator, who is an EPA Certified Lead Risk Assessor and understands domestic lead risks, conducts educational home visits to help people protect their families from possible lead and arsenic sources. Through cooperation with the ADLC's Public Health Department, the CPMP helps facilitate blood lead and urinary arsenic testing. The CPMP now has a home renovation program, which includes a free HEPA-

vacuum loaner program as well as home renovation starter kits. A potable well water program has been developed in conjunction with the DPS that helps county residents obtain information about the quality of their well water. This year (2015), the CPMP is offering a noxious weed spraying reimbursement program to eligible property owners located within and adjacent to the Superfund Overlay District. The number of public inquires that received follow-up support and educational guidance from the CPMP has varied from 36 to 55 per year during the 2011 to 2014 period. Soil Swap Program inquiries have increased every year since 2011. This will be the first year that the CPMP has been advertised with promotional and educational mailers sent to eligible property owners and the public's response has been positive.

The Superfund staff and the ADLC Planning Department conduct weekly DPS meetings to review all permits submitted the previous week and all data developed in conjunction with those permits is managed and maintained within the GIS database. The GIS database also maintains Superfund information such as soil, dust, and water sampling results; areas of remedial action; final cover types; and other data pertinent to future development needs. Following the weekly meetings, the Superfund staff reviews all CPMP inquiries received the previous week. The GIS staff attend these weekly meetings to provide timely supporting information that facilitates the decision-making process. In addition to soil handling oversight and project development guidance, meetings with homeowners, contractors, developers, committees, and agencies regarding their inquiries or development questions are also a major part of the ADLC's IC program.

ADLC and Atlantic Richfield are finalizing the ICIAP and EPA anticipates it will be completed in 2016.

Section 12

Next Review

The next five-year review for the Anaconda Smelter NPL Site is scheduled for 2020, and will be completed within five years of the completion of this report.

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Section 13
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Figures

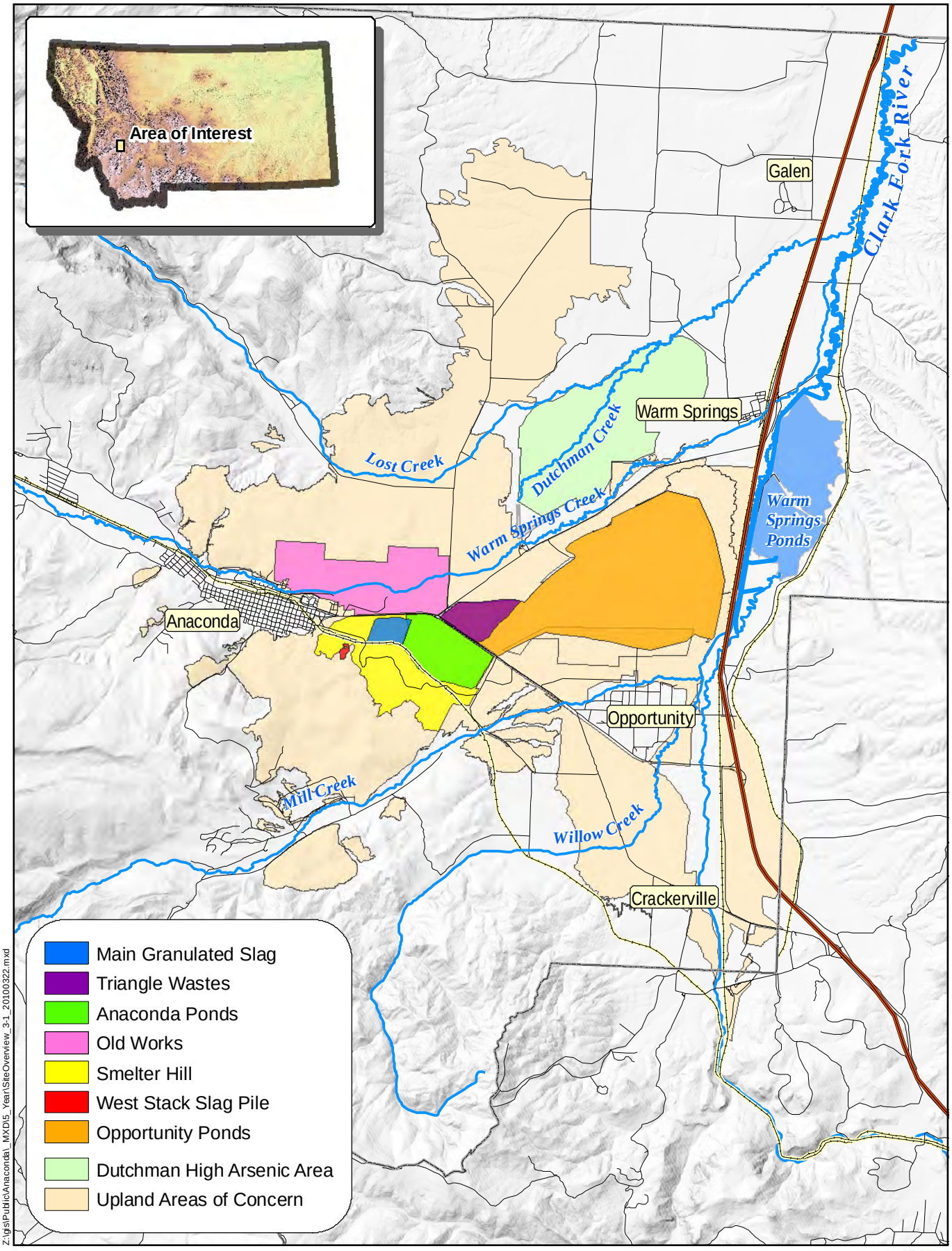

Figure 3-1. Site Location Map
Anaconda Regional Water and Waste OU
Anaconda Smelter NPL Site, Montana

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OW/EADA OU Boundary
Section Line
Construction Complete
Failed O&F Area
Sedimentation Pond
Storm Water Controls
T12
Steep Slope Reclamation
Removal
To Be Determined

Sub-Area #1
ARWW&S OU RDU 1
Landfill Boundary
Sub-Area #6
Sub-Area #2
Sub-Area #3
Sub-Area #4
Arbiter
ARB TER
Sub-Area #5
ARWW&S OU RDU 5
Mill Creek Triangle
ARWW&S OU RDU 6
Remediated under RDU 3
of ARWW&S OU
Consolidated Waste
ARWW&S OU RDU 3
Aspen Hills Add.
ARWW&S OU RDU 3

Sub Area #1
Sub Area #2
Sub Area #3
Sub Area #4
Sub Area #5
Sub Area #6
MILL CREEK ADD
MILL CREEK ADD
ASPEN HILLS ADD

Sources:
High-resolution aerial imagery courtesy of Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community. Topographic coverage courtesy of USGS and National Geographic. PRLU Design Polygons courtesy of TREC, Inc.

Figure 8-1
OW/EADA OU
ARWWS Operable Unit
Anaconda, MT

N

CDM Smith

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Feet

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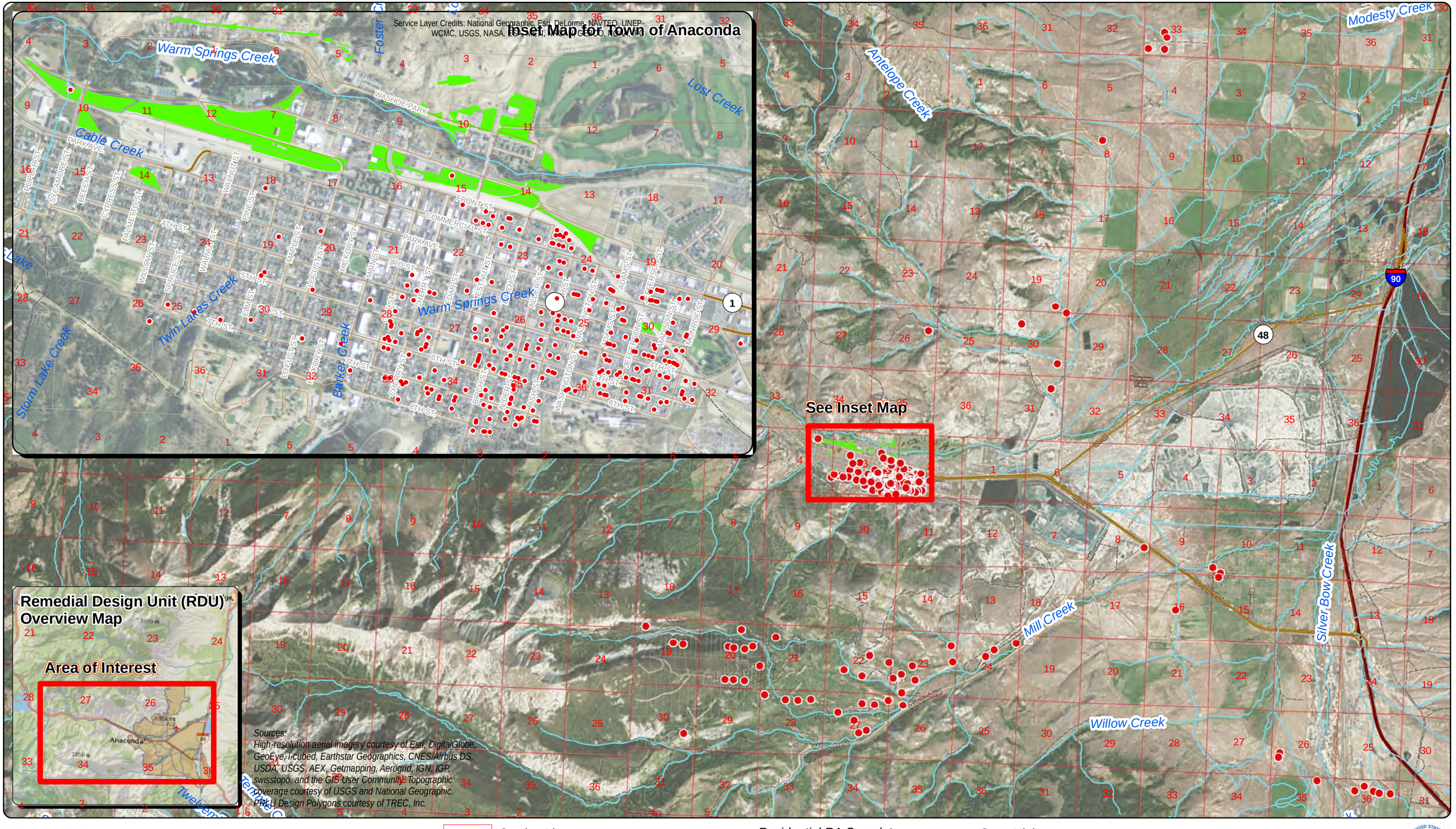

Figure 9-1
Community Soils Remedy Status
ARWWS Operable Unit
Anaconda, MT

- Section Line
- Parcel Boundary
- Historic Railroad Beds & Commercial/Industrail RA Areas
- Residential RA Complete (Based on 2002 ROD)
- Hydrologic Features
- Interstate
- State Highway
- Street or Road
- 4WD Road

N

0 1 2 3 Miles

CDM Smith

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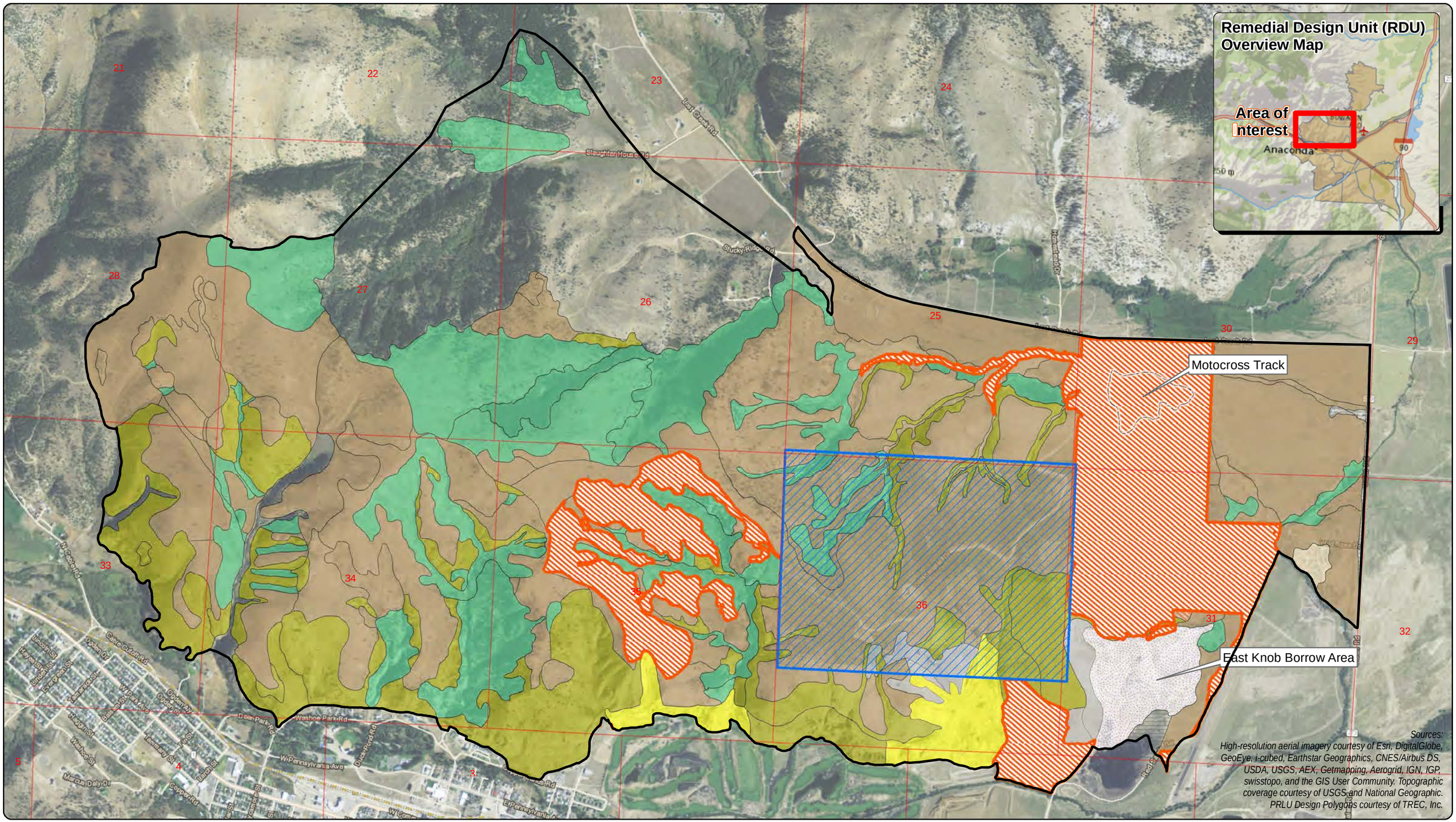

Figure 10-1
RDU 1: Stucky Ridge Uplands
ARWWS Operable Unit
Anaconda, MT

- Section Line
- RDU 1 Boundary
- Montana NRDP Area
- Borrow Area
- Rock Armoring
- Cover Soil
- Tillage
- Monitor-Well Vegetated
- Steep Slope Reclamation
- No Action
- Historic Area
- Construction Complete

N

0 1,000 2,000 3,000 4,000 5,000 Feet

CDM Smith

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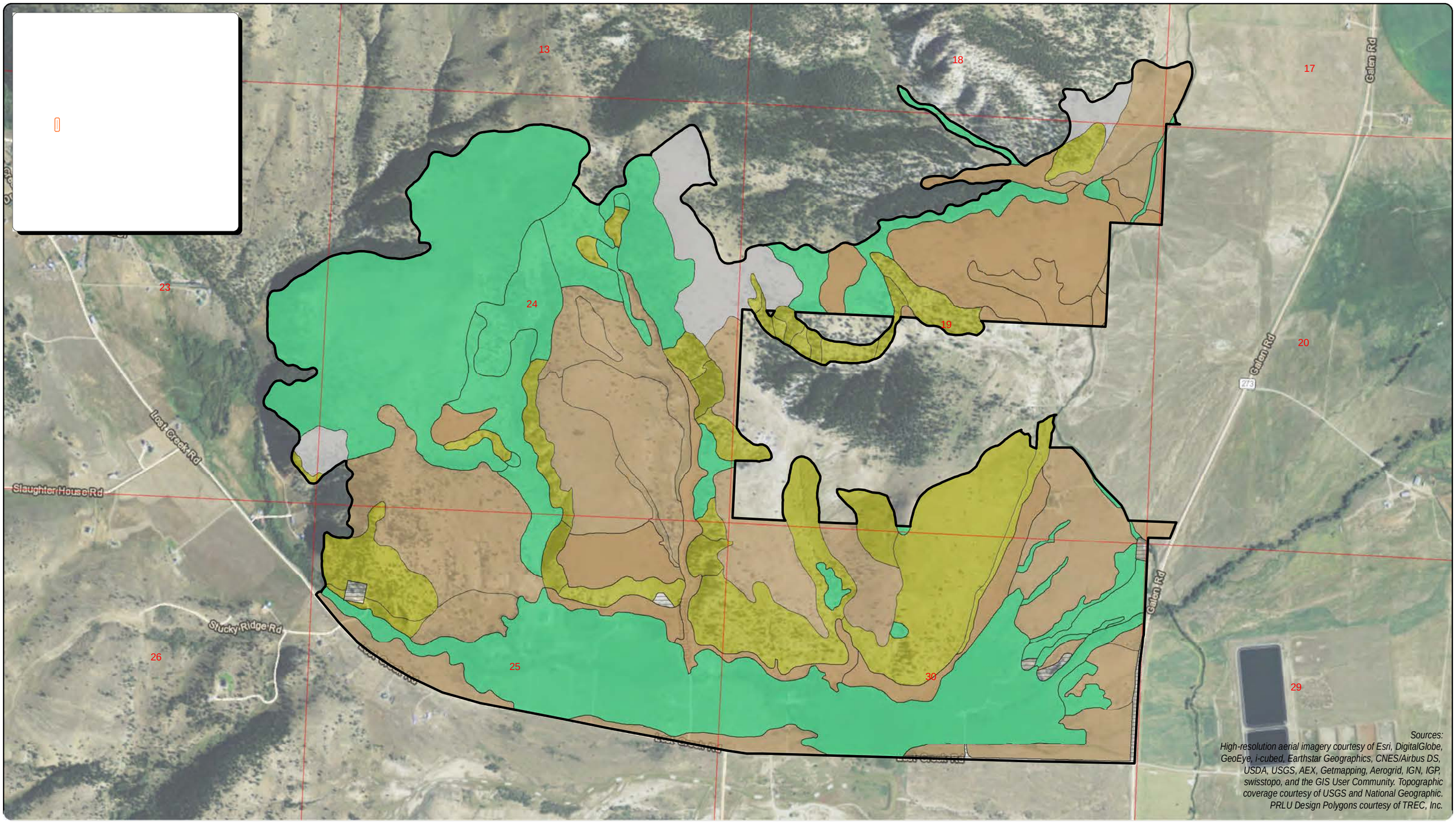

Figure 10-2
RDU 2: Lost Creek Uplands
ARWWS Operable Unit
Anaconda, MT

RDU 2 Boundary
Section Line
Rock Armoring
Tillage
Monitor-Well Vegetated
Steep Slope Reclamation
No Action

N

0 1,000 2,000 3,000 4,000 5,000 Feet

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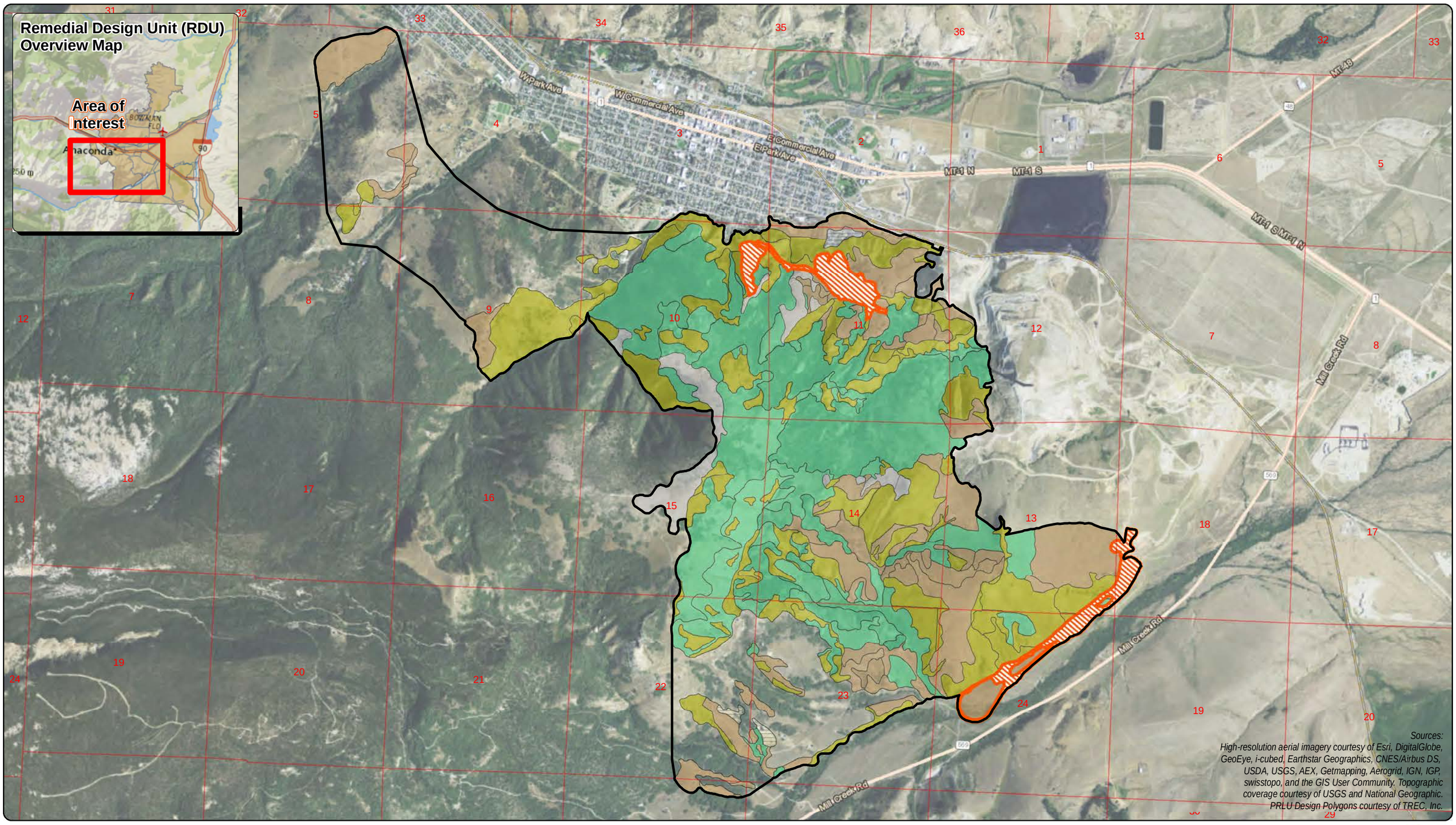

Figure 10-3
RDU 3: Smelter Hill Uplands
ARWWS Operable Unit
Anaconda, MT

- Section Line
- RDU 3 Boundary
- Construction Complete
- Rock Armoring
- Cover Soil
- Tillage
- Monitor-Well Vegetated
- Steep Slope Reclamation
- No Action

N

0 2,000 4,000 6,000 Feet

CDM Smith

Path: Z:\gis\Public\Anaconda_MXD\Five_Year_2015\RDU4_AnacondaPondsWMA_11x17L.mxd

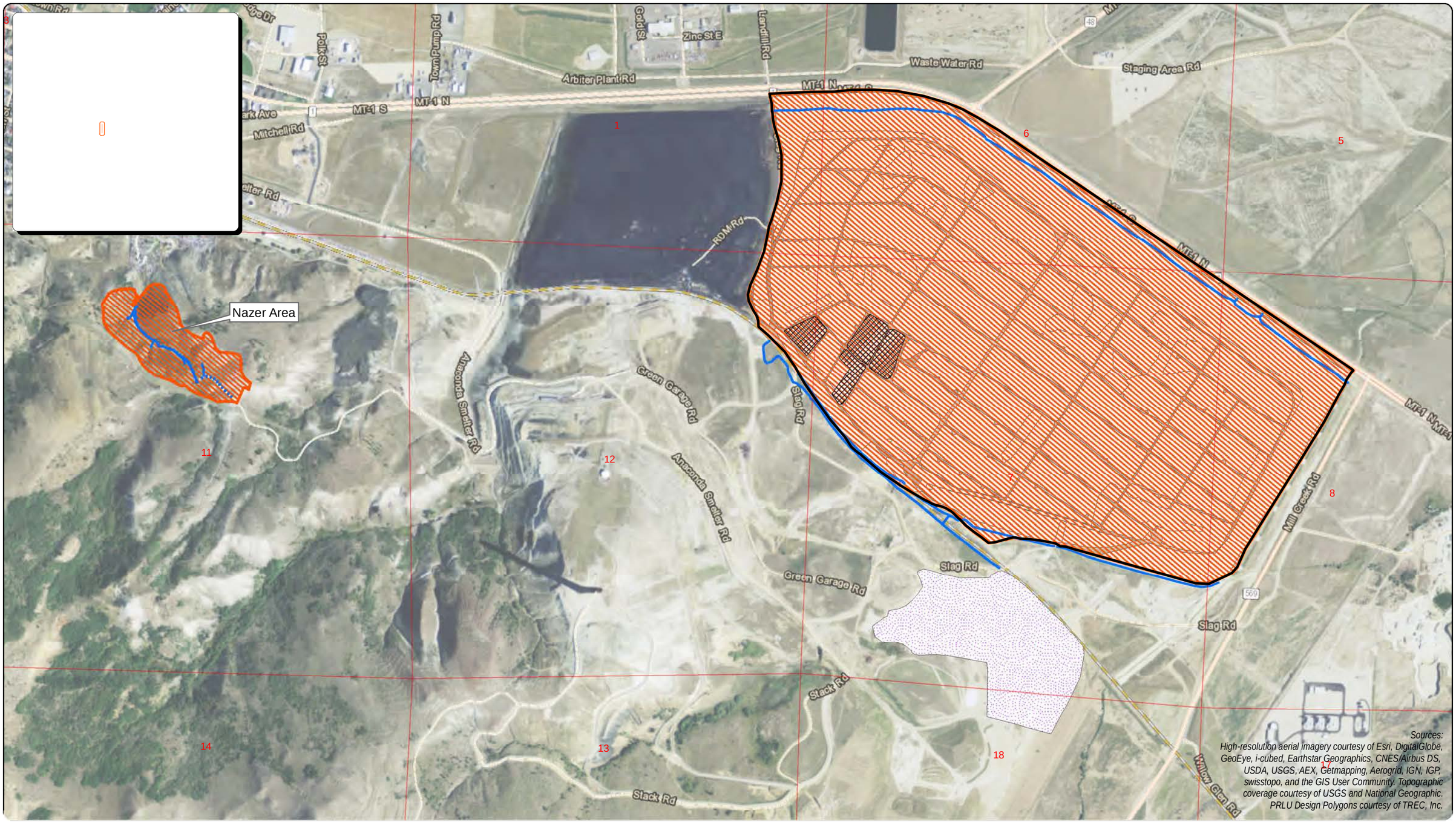

Figure 10-4
RDU 4: Anaconda Ponds WMA
ARWWS Operable Unit
Anaconda, MT

- Section Line
- RDU 4 Boundary
- Storm Water Control
- Waste Consolidation Area
- Construction Complete
- Mill Creek Borrow Area

N

0 1,000 2,000 3,000 Feet

Path: Z:\gis\Public\Anaconda_MXD\Five_Year_2015\RDU5_ActiveRR_BlueLagoon_11x17L.mxd

Spur Area

West Valley

West Anaconda Yards 2010/2011

Historic Railroad Beds and Commercial/ Industrial Areas

Sycamore Street

Part of the Community Soils OU Remediation

East Anaconda Yards (includes South Parcel)

Mill Creek Trestle

Mill Creek Flood Irrigation

Willow Creek Trestle

Yellow Ditch

Blue Lagoon

Son of Blue Lagoon

Remedial Design Unit (RDU) Overview Map

Area of Interest

Anaconda

Sources:
High-resolution aerial imagery courtesy of Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community. Topographic coverage courtesy of USGS and National Geographic. PRLU Design Polygons courtesy of TREC, Inc.

Figure 10-5
RDU 5: Active Railroads/Blue Lagoons
ARWWS Operable Unit
Anaconda, MT

Remedial Action Areas

- RDU 5 West RA
- In Town RA*
- East Anaconda Yards RA
- RDU 5 East RA

- Construction Complete Boundary
- Section Line

* Part of the Community Soils OU

N

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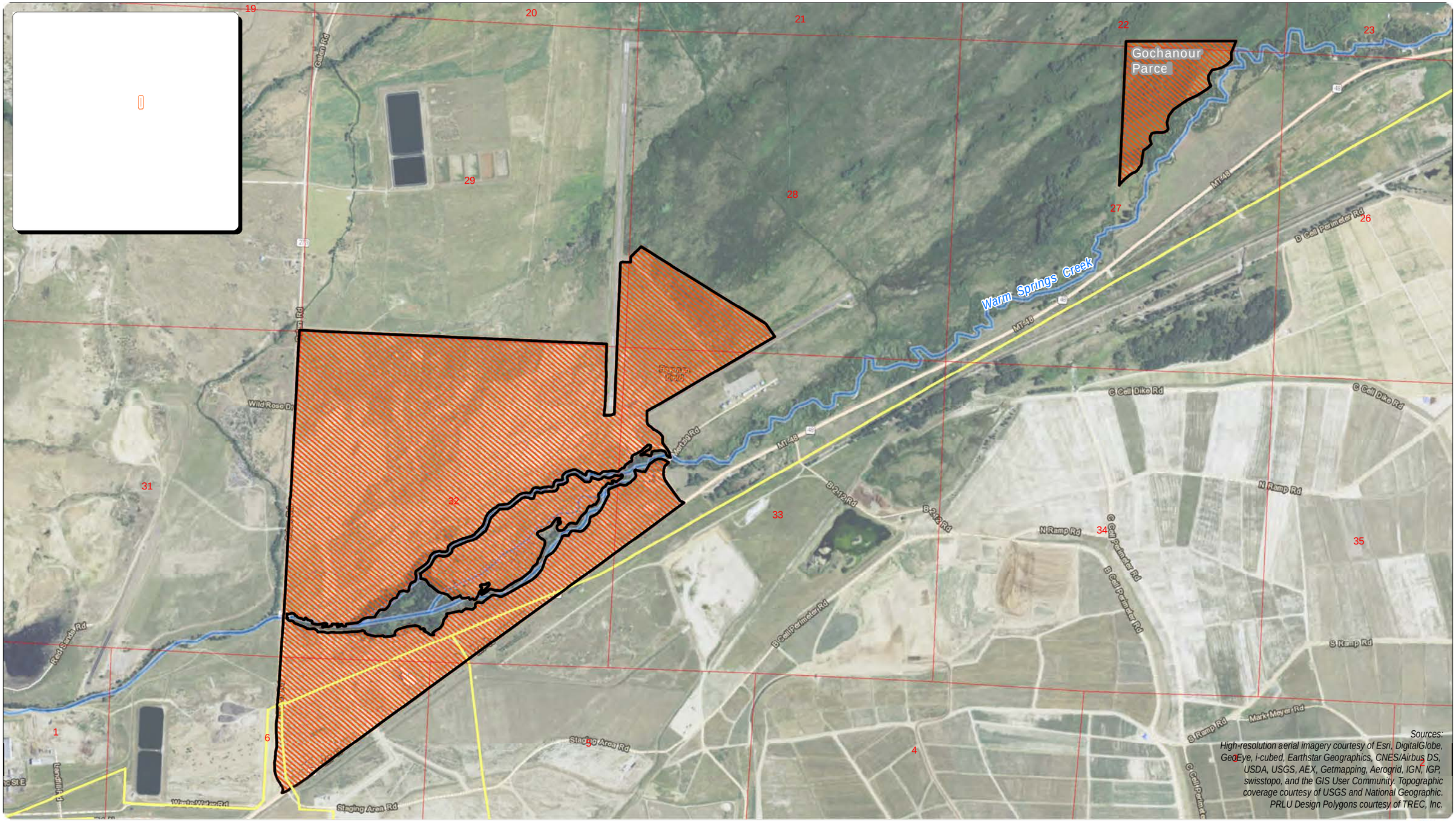

Figure 10-7
RDU 7: North Opportunity Uplands
ARWWS Operable Unit
Anaconda, MT

Section Line
RDU 7 Boundary
Construction Complete
Utility Line

N

CDM Smith

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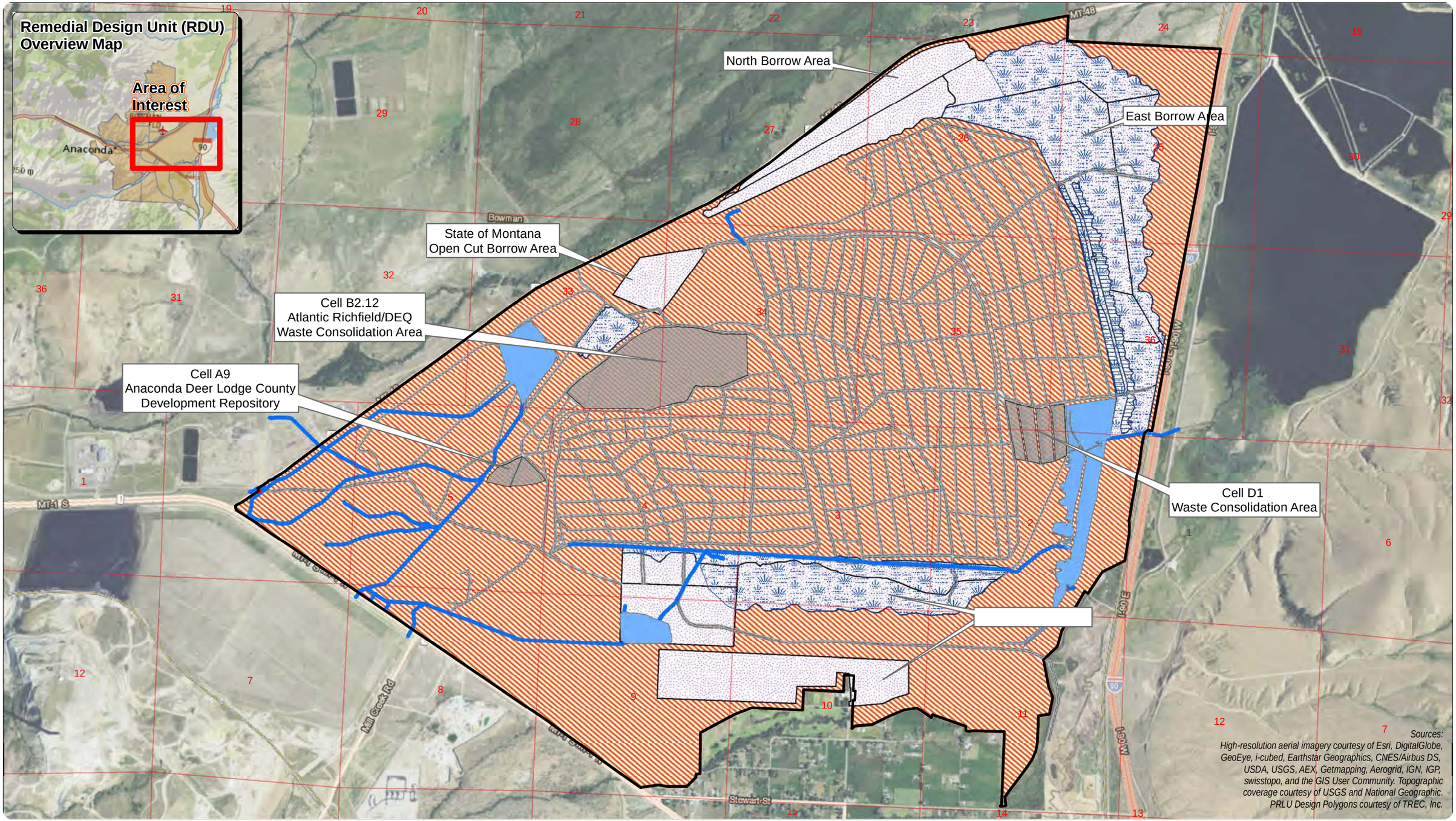

Figure 10-8
RDU 8: Opportunity Ponds WMA
ARWWS Operable Unit
Anaconda, MT

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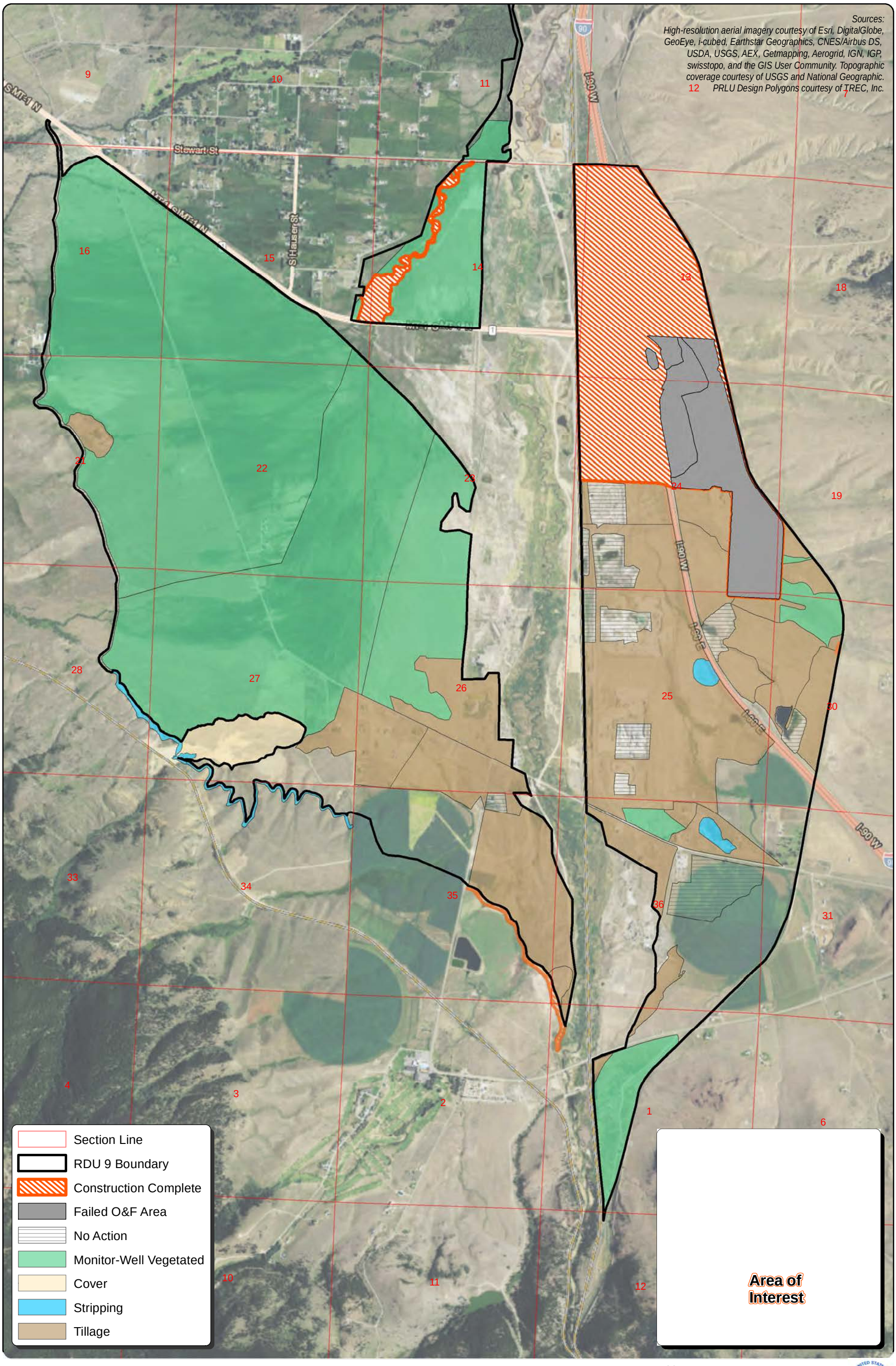

Figure 10-9
RDU 9: Fluvial Tailings
ARWWS Operable Unit
Anaconda, MT

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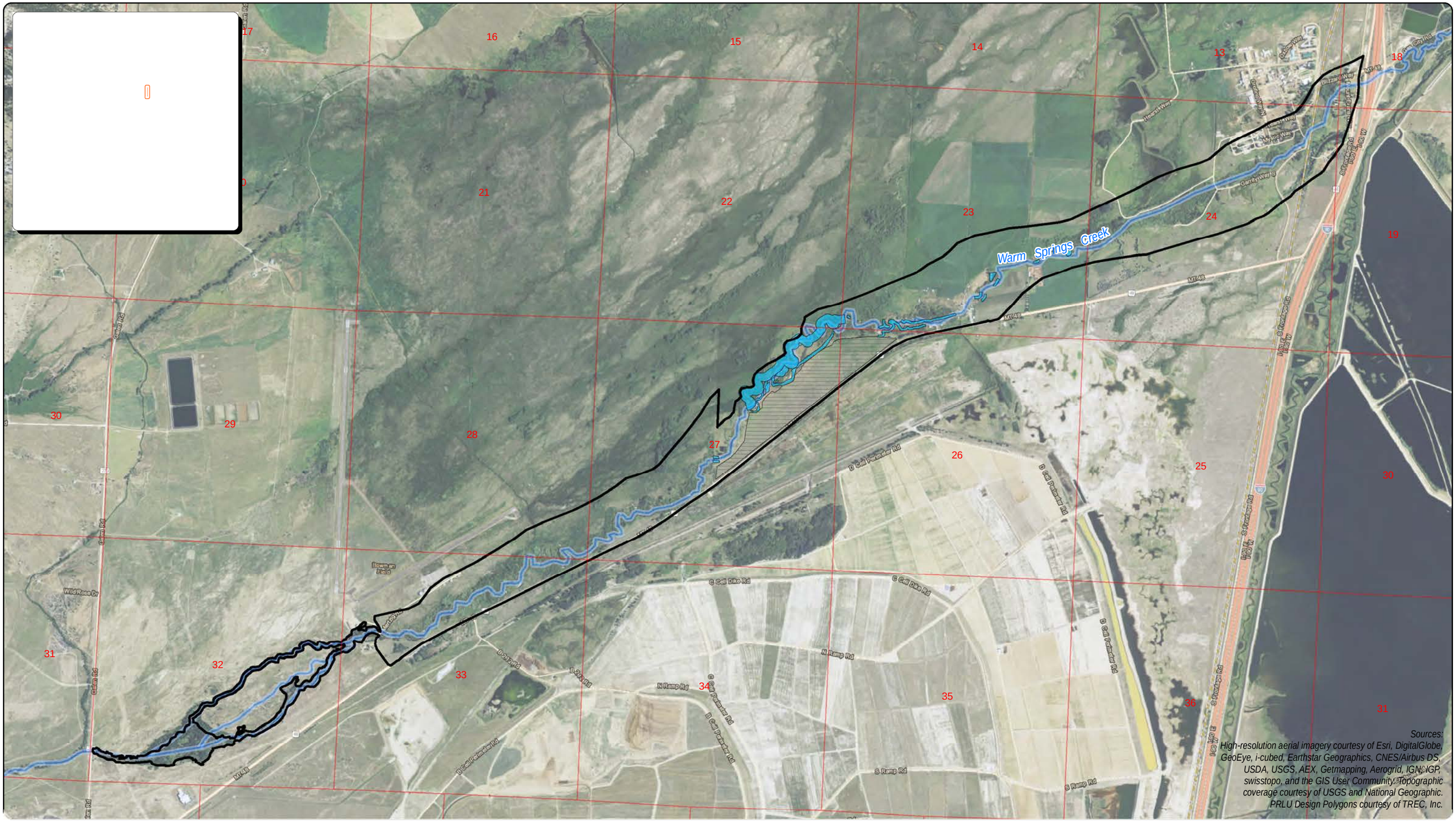

Figure 10-10
RDU 10: Warm Springs Creek
ARWWS Operable Unit
Anaconda, MT

Path: Z:\gis\Public\Anaconda_MXD\Five_Year_2015\RDU11_CashmanConcentrate_11x17L.mxd

Figure 10-11
RDU 11: Cashman Concentrate
ARWWS Operable Unit
Anaconda, MT

Section Line | RDU 11 Boundary | Construction Complete

N

CDM Smith

0 200 400 600 800 1,000
Feet

Path: Z:\gis\Public\Anaconda_MXD\Five_Year_2015\RDU12_Slag_11x17L.mxd

Figure 10-12
RDU 12: Slag
ARWWS Operable Unit
Anaconda, MT

Path: Z:\gis\Public\Anaconda_MXD\Five_Year_2015\RDU13_OldWorksWMA_11x17L.mxd

Figure 10-13
RDU 13: Old Works WMA
ARWWS Operable Unit
Anaconda, MT

Section Line

RDU 13 Boundary

N

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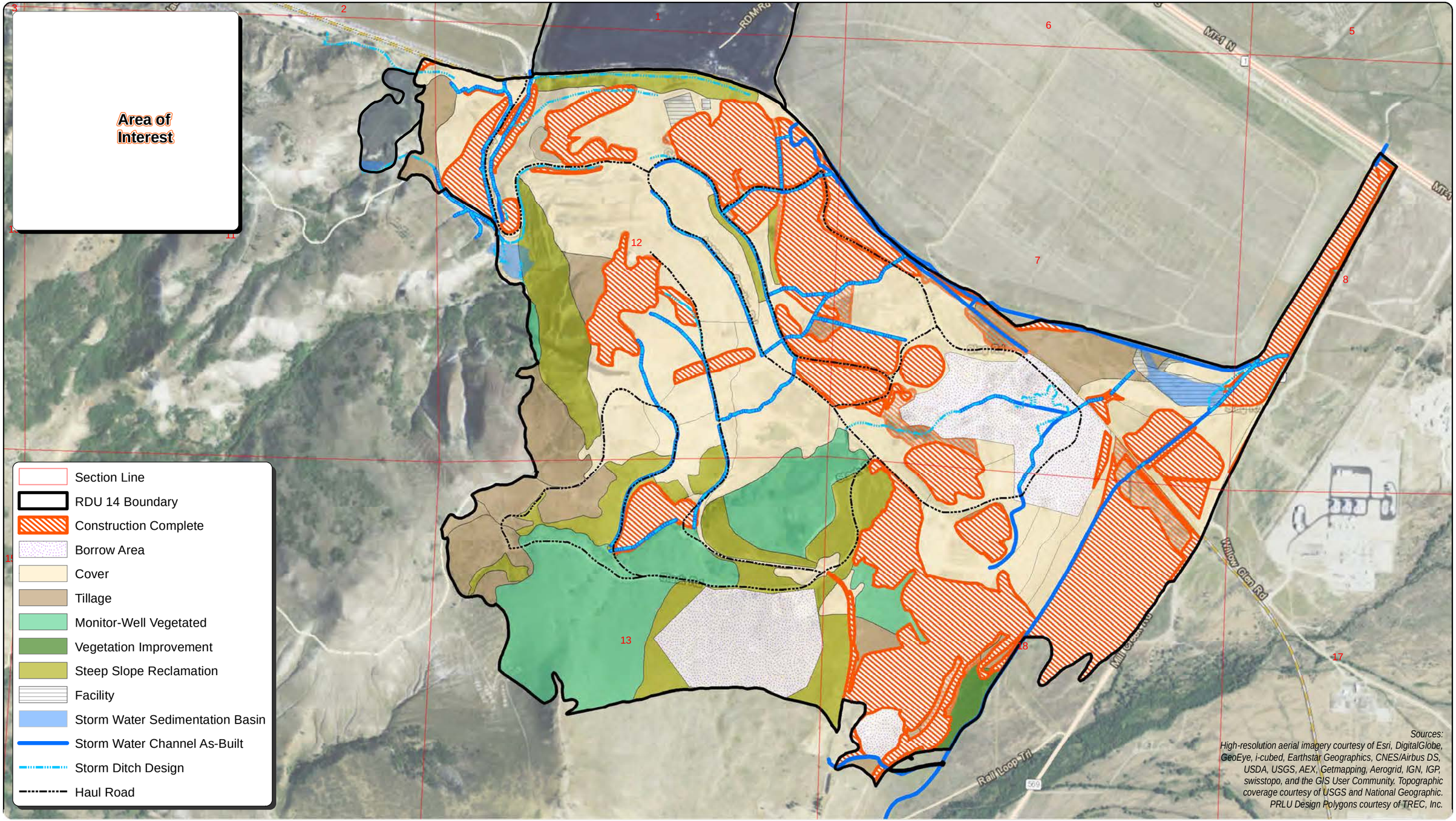

Figure 10-14
RDU 14: Smelter Hill Facility WMA
ARWWS Operable Unit
Anaconda, MT

N

0 1,000 2,000 3,000 Feet

Path: Z:\gis\Public\Anaconda_MXD\Five_Year_2015\RDU15_MountHaggin_11x17L.mxd

Area of Interest

Silica Trl
Aspen Hills Trl
Alpha Lode Trl
Bear Paw Trl
Clear Creek Trl
Beaver Pond Trl
Mill Creek Rd
Woodstock Trl
Rail Loop Trl
Cabbage Gulch Rd
Silver View Trl

24
19
27
26
25
30

Sources:
High-resolution aerial imagery courtesy of Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community. Topographic coverage courtesy of USGS and National Geographic. PRLU Design Polygons courtesy of TREC, Inc.

Figure 10-15
RDU 15: Mount Haggin
ARWWS Operable Unit
Anaconda, MT

Section Line
RDU 15 Boundary
Monitor-Well Vegetated
Steep Slope Reclamation
Tillage

N

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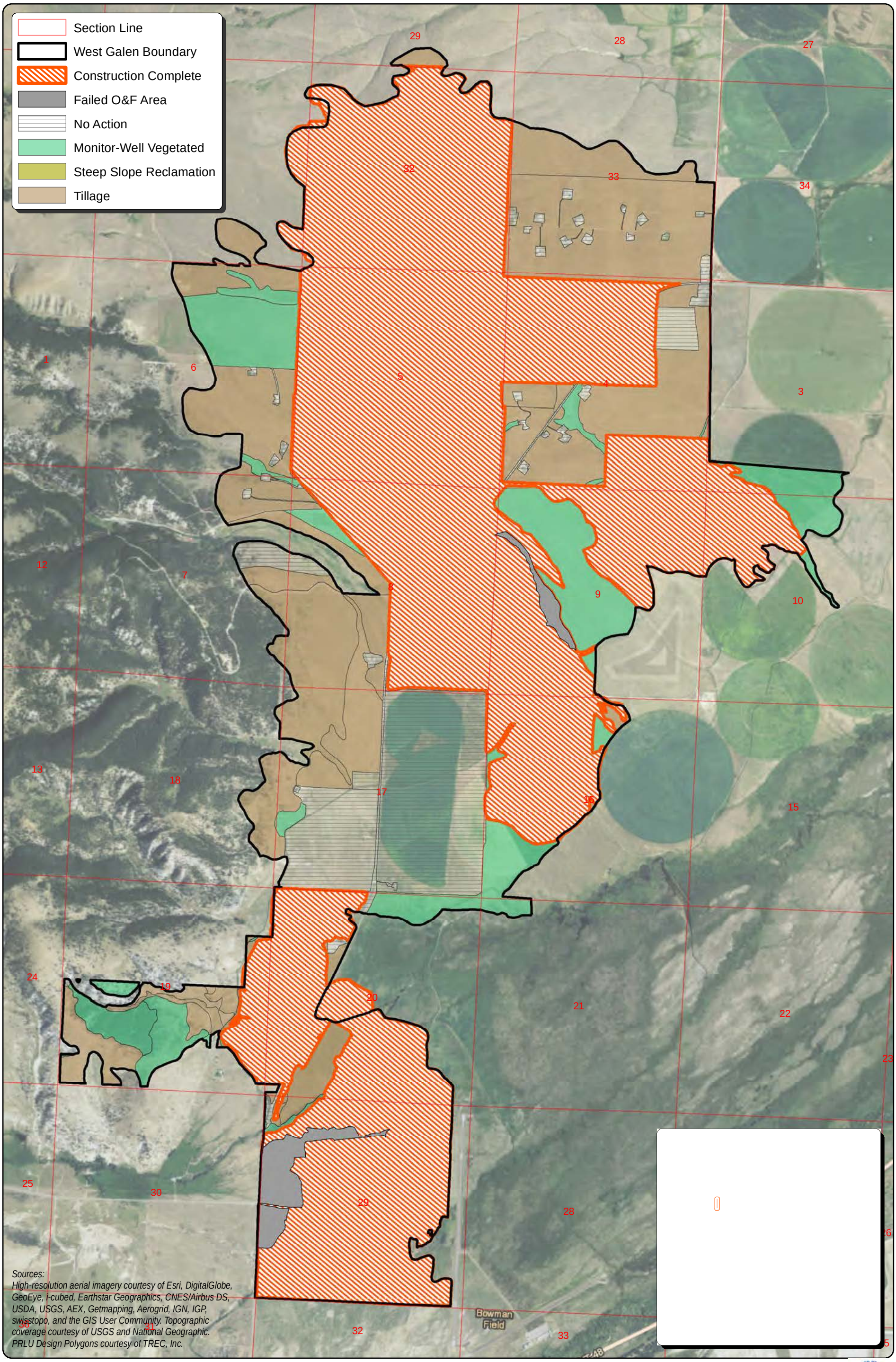

Figure 10-16
West Galen Expansion Area
ARWWS Operable Unit
Anaconda, MT

N

CDM Smith

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Feet

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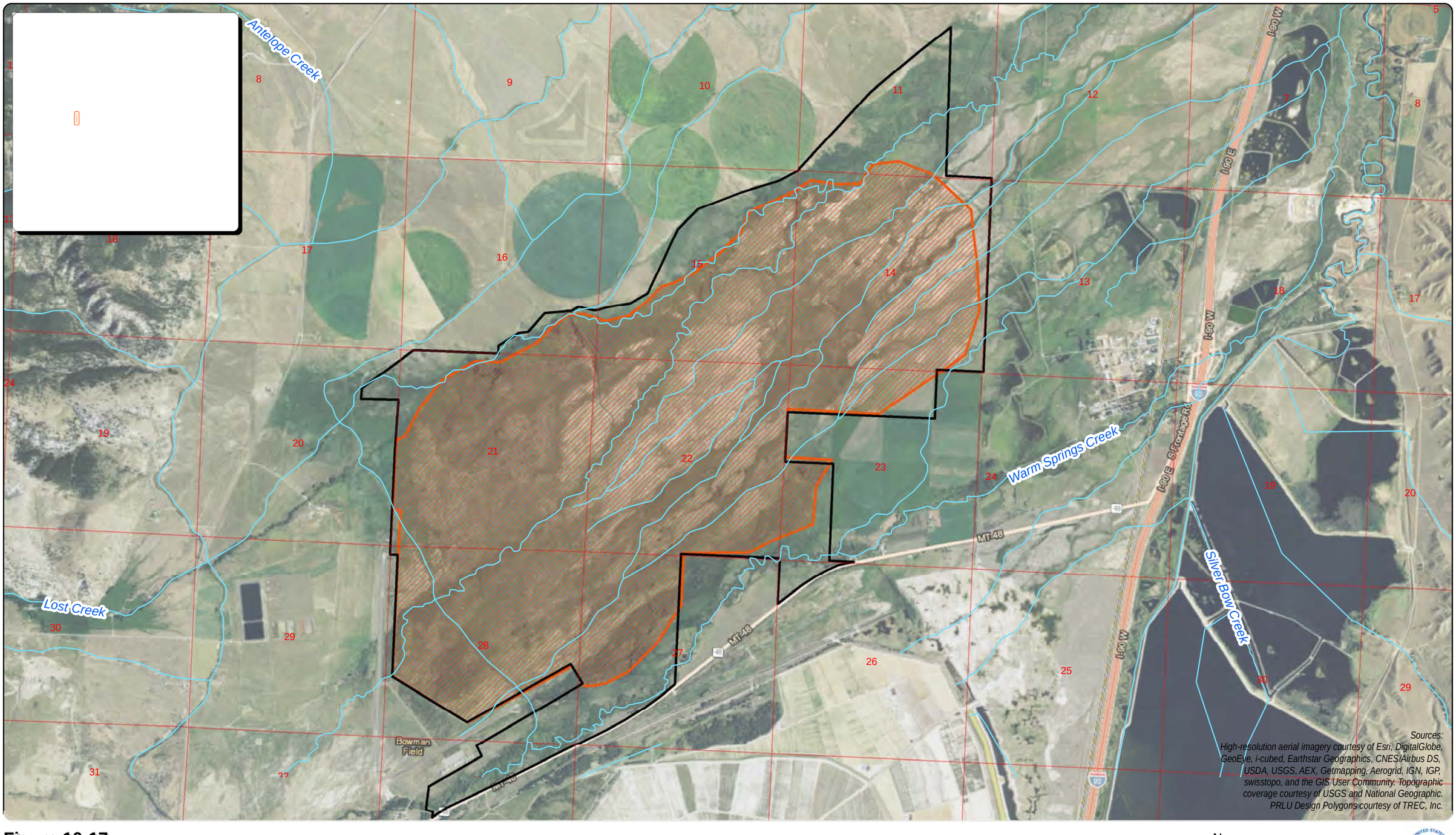

Figure 10-17
Dutchman
ARWWS Operable Unit
Anaconda, MT

Block Management Area

Dutchman High As Area (2011 ROD Mod.)

US Public Land Survey Section Line

N

0 1,000 2,000 3,000 4,000 5,000 6,000 Feet

Photographs

Photograph 002. Dragstrip: Subarea 6 (northern area). Shows very low perennial grass cover and prolific whitetop, which are indicative of contaminated soils. Note that this small area is surrounded by ample growth by Great Basin wildrye.

Photograph 052. Show well-established wetland vegetation and habitat in the northeast portion of the Opportunity Ponds in the reconstructed wetland habitat area.

Photograph 056. RDU 8 - Opportunity Tailings Pond, D Cells. This photograph shows the excellent overall perennial plant cover in these cells.

Photograph 163. RDU 5 - Anaconda Active Railroad Bed portion of the West Valley Line lying between Sycamore and Pennsylvania Streets. Shot toward the east, this shows good perennial grass cover, some weeds, and no erosion. This area is O&F.

Photograph 214. West Galen, Polygons near the Lost Creek Water Treatment Ponds. Looking north, this photograph shows the vegetation contrast between OWSR 1.03 on the left (non-O&F) and OWSR 1.01 on the right (O&F). OWSR 1.03 is dominated by Kochia scoparia and has low cover by perennial grasses. In contrast, OWSR 1.01 has a healthy stand of perennial grasses. This indicates that it is possible to get the reclamation plant species established in OWSR 1.03, and once established they should be able to grow well and be productive in this location. EPA recommended reseeding OWSR 1.03 and limiting cattle use of this area until the grasses are well-established.

Photograph 219. RDU 7 - North Opportunity Uplands, Evaluation Area 3 and 4. Shot toward the east from the Galen road, this photograph shows generally good perennial grass cover in Evaluation Area 3 (foreground) and Evaluation Area 4 (background, on the right).

Photograph 242. RDU 9 - Fluvial Tailings. Looking west with the Washoe Smelter stack in background, this photograph shows large areas dominated by Kochia scoparia (summer cyprus). This portion of 9.02B was recommended for reseeding.

Photograph 254. Old Works Area 1, Sewage Pond Area. Looking east, this photograph shows sparse perennial grass and abundant weed cover in the non-O&F portion of this site.

Photograph 277. RDU 7 - North Opportunity Uplands, Evaluation Area 1. Looking east toward the START building. This photograph shows a "hot spot" dominated by Kochia scoparia and no perennial grasses established. It appears that the surface soil in this area was not stripped deep enough or at all. This is a very small area surrounded by the generally good perennial grass cover and density within this polygon.

Photograph 324. RDU 6 – South Opportunity, SHOP 2.02B. Looking north, this photograph shows some establishment of perennial grass but the area is still not O&F. Most plants in this area are weeds: Kochia scoparia and Iva axillaris.

Photograph 364. Adjacent to Railroad Areas. Direction is toward the east. Photograph shows adequate but thin perennial plant cover in center of this land parcel for an area seeded in 2006. Coarse substrate could be contributing to the thin cover.

Photograph 400. RDU 8 - Opportunity North Uplands, Evaluation Area 2. Looking northwest, this photograph shows excellent perennial plant growth.

Photograph 375. West Galen, Launderville Boundary Line. Looking east from the ridgeline where the Anaconda Site outer boundary line is located. This photograph shows primarily bare soil areas where smelter impacts have been followed by many years of wind and water erosion, and livestock grazing.

Photograph 444. Moto Cross, Evaluation Area 1 Looking southeast, this photograph shows faint plow lines indicating that it was historically reseeded in-situ. This area is to the east of the Moto Cross site access road. It is dominated today by redtop and there are frequent, small barren areas.

Photograph 464. Old Works, Dragstrip, Subarea 6 Type D Cap (northern area). Aspect is south toward the Washoe Smelter stack. This photograph shows high perennial grass cover, no weeds and no barren areas. The soils are erosionally stable.

Photograph 451. RDU 8, Opportunity South Uplands, Evaluation Area 6. Looking south toward the trap shooting club, this photograph shows excellent perennial grass cover. Great Basin Wildrye dominates this plant community.

Photograph 470. RDU 14 - Smelter Hill Facilities. Excellent plant cover in Previously Reclaimed.

Photograph 494. Old Works, ALDC RA Areas. Looking SW across Lot C1, this photograph shows abundant perennial grass cover. There was no erosion on this level site.

Photograph 521. West Galen Expansion Area 2, Evaluation Area 33. This photograph was shot toward the south from underneath the power line. It shows abundant whitetop on the left and what appears to be a plow line. The area in the center has relatively low perennial grass cover (20-25%), the likely result of the soil being underlined compared to the area on the left. The center area still has an abundance of summer cyprus.

Photograph 564. West Galen Expansion Area, Polygons near the Water Treatment Ponds Adjacent to Lost Creek. Looking north, this photograph shows that the strip next to the access road has some plant establishment but poor establishment in the field. This suggests that the different reclamation techniques or time of seeding had different results and that some perennial plants can be established at the site, which has had a history of seeding failures.

Photograph 608. Early stage of plant establishment following seeding in a wetland habitat area adjacent to the Opportunity tailings Ponds (RDU 8).

Photograph 674. RDU 8 - Opportunity Ponds, C1 Cells, Seed Mixture 4, Type 12 Cap. Shot toward the Mt Powell (northwest). Shows excellent perennial plant cover indicative of this group of cells.

Photograph 677. Adjacent to Railroad Properties, Southern Portion of Hospital Property. This area was seeded in 2011. Shot toward the east, this photograph shows sparse perennial plant cover and old Kochia scoparia litter. EPA's recommendation for this area was interseeding with Seed Mixture 4.

Photograph 709. Adjacent to Railroad Properties, North of Cedar Park Homes. Shot towards the west, this area has sparse perennial plant cover that does not meet O&F criteria. This area was seeded in 2011. Old (dead) Kochia scoparia plants are present suggesting intense competition for the perennial seedlings and that the area would benefit from being interseeded at this time.

Photograph 788. RDU 8 - Opportunity South Uplands, Evaluation Area 7. Looking west with the Washoe Smelter stack in the background. Photograph shows an area that is barren of perennial plants in a 20 x 20 foot area. Low perennial grass cover, rocky, and with abundant cheatgrass brome and summer cyprus in this portion of the site; this is west of the trap shooting club.

Photograph 793. West Galen Expansion Area 2, Evaluation Area 33. This photograph was taken in the northern portion of the polygon. It is shot toward the southwest and shows the generally good perennial grass cover and the Washoe Smelter stack in the background. A patch of leafy spurge can be seen in the foreground. This noxious weed is scattered throughout the polygon.

Photograph 848. Excellent plant growth on the Flue Dust Repository

Photograph 852. South side of Arbiter Repository (upper left) shows very good perennial grass cover. In contrast, the south side of Original Beryllium Repository (center) has very sparse vegetation cover.

Photograph 856. Old Works, Northwoods Enterprises property. Looking west across the site, this photograph shows abundant perennial plant growth and cover. Site is dominated by alfalfa.

Photo 867. This is the Non-MDT Transfer portion of the West Valley Railroad line between Pennsylvania and Linden Streets. Photograph shot toward the east. Shows high cover by alfalfa and perennial grasses. No erosion. This area is O&F.

Photograph 907. Very high perennial plant cover and species diversity in the reconstructed wetland habitat area northeast of the Opportunity Tailings Ponds.

Photograph 910. Mill Creek Industrial Park. Looking southwest, this photograph shows abundant perennial grass cover; this site has virtually no soil erosion.

Photograph 955. Old Works, ADLC Property in Subarea 4. Looking east across the western portion of the ADLC property. This photograph shows high intermediate wheatgrass growth and cover. Some smooth brome and alfalfa are present. Level site with no erosion.

Photograph 983. RDU 7 - North Opportunity Uplands, Evaluation Area 4. Shot toward the southwest with the Washoe Stack in the background, this photograph shows a good stand of Great Basin wildrye interspersed with barren soil areas indicative of low pH or high metals. Noxious weeds such as whitetop and summer cyprus tend to occupy the sparsely vegetated and barren areas.

Photograph 986. Smelter Hill Facilities, Previously Reclaimed Area 9. Looking north, this photograph shows abundant perennial grass cover (approximately 80%). This site has abundant litter and virtually no soil erosion.

Photograph 1070. Thin but adequate perennial plant establishment on a north-facing slope at the Son of Blue Lagoon.

Photograph 1080. This shows a very thin and sparsely vegetated area at the Blue Lagoon. Vegetation on this site failed to full-in during the 2014 growing season.

Photograph 1089. This photograph shows the very good establishment of vegetation at the Mill Creek Flood Irrigation site.

Photograph 1093. This photograph shows a section of Yellow Ditch in the spring of 2014; banks are stable and vegetation is emerging.

Photograph 5775. Stripped and in-situ treated area with abundant perennial plant growth. RDU 6 – South Opportunity.

Photograph 5814. Sparsely vegetated and barren areas on Stucky Ridge (RDU 1) in the RFC No 3 2005/2006 Reclaimed Areas.

Appendix A

Public Comments and Concerns

A.1 Introduction

This appendix summarizes the process used to obtain community input for the Anaconda Smelter NPL Site 2015 Five-Year Review and provides a summary of all comments received during this process. The comments/concerns received cover a wide array of subjects and the Agencies have carefully considered all issues raised during the public interviews. Those comments that relate to remedial decisions the Agencies have made or will make regarding the functionality or protectiveness of the Selected Remedy for the Anaconda Smelter NPL Site are discussed in Section 4 of the 2010 Five-Year Review report. A summary of all the comments and concerns brought forth by the interviewees is provided herein.

A.2 Community Notification

As in previous five-year reviews, EPA's goals in conducting community interviews for the Anaconda Site 2015 five-year review were to obtain the local perspective on the implemented remedy and to identify issues that directly relate to the protectiveness of completed and/or to be completed remedies. Appendix B provides a summary of comments and concerns expressed by the interviewees. Those comments and concerns cover a wide array of subjects. EPA and DEQ have carefully considered all issues brought forth; however, not all are germane to the protectiveness of remedial actions implemented at the Anaconda Smelter NPL Site. Issues raised by interviewees that may have a direct effect on the protectiveness of the Selected Remedy have been carried forward into the Issues and Recommendations sections of this five-year review to ensure that they are tracked and addressed within the next review period.

The community was notified of the five-year review process with an advertisement that ran in the Anaconda Leader on April 16, 2015. A second advertisement will announce the completion of the five-year review process and will run in the paper in October 2015. Individuals listed in Table 4-1 were called and asked to participate in the interviews.

A.3 Obtaining Input

As described in Section 4, the interview pool was a mix of local government representatives and representatives of local interest groups. Most of the interviews were conducted in groups in Anaconda. One interview was condiucted by telephone to accommodate the schedule of the interviewee. Interviewees were contacted at least a week in advance. Individuals known to be interested or actively involved at the Site were encouraged to invite other participants to the meetings. Contacts included the Arrowhead TAG, Anaconda Local Development Corporation (ADLC), Clark Fork River Technical Assistance Committee (CFRTAC), Opportunity Citizens Protective Association (OCPA), and Anaconda Deer Lodge County staff and commission.

A.4 Community Interview Questions

1. Do you know what is being done at the site? What work are you most interested in?

2. Where do you get your information about the site? What is the best way for us to get information to you?

3. Do you have any specific concerns about cleanup?

    a. Atlantic Richfield Land Management Areas
    b. Old Works – (East Anaconda Yards, Golf Course, Industrial Area, Mill Creek, Red Sands)
    c. Smelter Hill/Slag (left in place to be developed as a commercial resource)

    d. Upland Areas
    e. Community Soils
4. Do you feel concerns you express are heard and addressed?
5. Do you believe that the remedy is working and is protective?
6. What are your expectations of clean up?
7. Anaconda Deer Lodge County is working on Institutional Controls as part of the site remedy. Are there any issues or ideas about Institutional Controls that you'd like to ask or talk about?
8. Are you aware of any new information that would affect the protectiveness of the remedy?
9. Do you have any concerns about future land use? Other ideas about redevelopment?
10. Is there anything you'd like to add?

A.5 Community Interview Responses

Input received during the interviews, including both oral responses and written materials given to the interviewers is summarized below. Unless permission was granted, direct quotes are not provided nor is the input attributed to an individual. The information is reported as it was received to reflect public opinion. No effort was made to verify the accuracy of the statements. For the sake of continuity with the rest of the five-year review report, the PRP is referred to as "Atlantic Richfield", even though they are generally referred to as "ARCO" by the interviewees.

A.5.1 Do you know what is being done at the site? What work are you most interested in?

Being from Anaconda or Opportunity, everyone who was interviewed was aware of what was being done in at least one portion of the site. Some people had a general understanding of most of the site and some people had a detailed understanding of one or more specific areas.

Areas of interest mentioned during the interviews are:

- ADLC's relationship with Atlantic Richfield
- Institutional controls (funding and implementation) and their relationship to redevelopment
- Stucky Hill (access and contamination from A and C Hill)
- Opportunity (incomplete cleanup)
- The timeline of site activities (who is doing what and when)
- Public access to recreational property
- Lack of access to information regarding current remedial actions (making it difficult to inform the public)
- Community soils
- All remedial actions

- Areas that are accessed by residents and visitors for recreational purposes.

A.5.2 Where do you get your information about the site? What is the best way for us to get information to you?

A.5.2.1 Sources Used to Obtain Information

- **RPM**. Several people listed conversations with Charlie Coleman as a primary source of getting information. Charlie was easy to get in touch with by phone and would attend meetings when requested. However, they had to initiate the contact and often they did not know what to ask about.
- **Fact Sheets**. EPA fact sheets were noted as being useful by many people. People remembered that the fact sheets generally summed up what had happened at the site over the previous year. However, they noted that did not think that there had been a fact sheet for several years. Also, the fact sheets were geared towards explaining what has already happened. While that was useful, it didn't help with questions from the public about what is currently happening.
- **Advertisements**. Most people had seen ads in the *Anaconda Leader* announcing upcoming events.
- **Documents**. Several people got their information from reports, charts, the record of decision (ROD), and other documents from EPA, but it was noted that this is generally not timely and it explains what has already happened. One interviewee appreciated having extra copies of documents to give to the public to reinforce conversations she had with them.
- **Other People**. Several people noted that they received information from the ADLC Superfund Coordinator, Carl Nyman, and Water Environmental Technologies. At least one interviewee noted getting information from Ken Brockman.
- **Internet**. Two people mentioned getting information from the internet (including EPA's website).

A.5.2.2 Preferred Ways for EPA to Provide Information

Interviewees generally wanted the current sources of information listed above to continue. They liked having multiple ways to receive information.

- **Fact Sheets.** Interviewees preferred that fact sheets be prepared and distributed in a more timely fashion. Many people thought that semi-annually would be a good schedule.
- **Timely Flyer or Email Notice**. The most common request was for an informational update from EPA that would allow the interviewees to answer questions from other people in Anaconda and Opportunity on what was happening at the site in the next 30 days. A preferred format would be one page with a list of bulleted items briefly explaining what was planned. No special format, pictures, or graphics were necessary. The page could be emailed to a list of interested parties who could pass the email on to others. EPA could consider running a monthly ad during construction season that would note this same information for the general public – again, nothing fancy.
- **Website**. Two persons mentioned the EPA website as a good way to get information to the public.
- **Emails**. Several people thought that quick emails on specific topics was a good way for EPA to get information to stakeholders. The emails should have a phone number for follow-up questions.

People being interviewed were not members of the general public but were involved in Superfund issues through their work or specific interests. As at many sites where work has been ongoing for many

years, there was a sense that the general public was not worried about the work being done and that their interest was piqued only when work would impact their property or their access to a property. The public also wanted to know what was happening when they saw large trucks and other equipment in town. The interviewees stressed that information provided to the public needed to be very easy to read, with minimal text with lots of pictures and figures. At least one interviewee noted that the information provided by Arrowhead was too dense for the general public to read.

A.5.3 Do you have any specific concerns about cleanup?

A.5.3.a Atlantic Richfield Land Management Areas

- The materials that have been hauled to the ponds were safe as long as they were covered with water. Now that they have dried, there is concern that ponds are leaching into the aquifer.
- The revegetation has worked well and there are now issues with managing the wildlife that is attracted to the area. There needs to be some sort of limited hunting access to cull the growing herds of animals that are beginning to be a threat to drivers. Maybe handicap hunting access?
- Why is the county getting no compensation for being the waste repository for the area? The trucks use our roads and Anaconda Deer Lodge County (ADLC) has to field questions from the public and from developers.
- Taking waste from Silver Bow Creek and Milltown have created a stigma needs to be overcome.
- How can the groundwater in Opportunity be safe when the water all around it is contaminated?
- The area needs to be managed properly with appropriate vegetation.
- There was a desire to have portions of this RDU made available for development someday.

A.5.3.b Old Works – (East Anaconda Yards, Golf Course, Industrial Area, Mill Creek, Red Sands)

- The golf course needs more development in order to succeed. The community wants it to work, as do the other stakeholders. There needs to be more cooperation regarding the path forward. If maintenance doesn't continue, there will be a concern with leaching down the road.
- There is hammered soil on South facing slope.
- Put the emphasis on addressing highly visible areas. Land owners wonder when they will get taken care of.
- There is a need for jobs along with hotel and golf course planning.
- Two acres by the golf course (the old Evans' Homestead) were never reclaimed.
- Historic preservation issues and recreational access need to be addressed. People want access to the areas of historical significance on the golf course (such as the Red Sands).
- The storm water system has created problems with development. There are storm run-off issues next to the school in ditches.
- ARCO has blocked off access to Norton Road.

- Red Sands, contamination should be hauled away. Why not clean it up?
- Redevelopment is very difficult in this area, as Atlantic Richfield has passed hauling costs for contaminated soils on to others, which is wrong. Shopko is a good example.

A.5.3.c Smelter Hill/Slag

- Atlantic Richfield has been allowed to leave the slag pile uncovered for too long. Their excuse was that this was a resource to create jobs. This has not happened. Also, if it IS a resource it should be taxed as such. The slag is blowing across the highway and recontaminating nearby areas and damaging the pumps at the water treatment plant.
- There is a lack of communication about what is happening in real time with Atlantic Richfield. Smelter Hill was all lit up a few weeks ago and no one knew what was going on.
- The back side of Stucky Ridge needs to be revegetated for developers and tourists.
- Historic preservation issues and recreational access need to be addressed. There should be controlled access to Smelter Hill. It could be a great historic resource that locals and tourists would like to visit. Safety precautions could be taken to keep people far enough away to avoid any falling bricks.
- There is the potential for waste off from C Hill to be transported in storm water to previously remediated areas.
- There are 400,000 cubic yards of arsenic in vaults in Smelter Hill area.

A.5.3.d Upland Areas

- A trail system is needed that is safe and that doesn't use gates to keep people out. There are lots of gates now, but people ignore them and that makes them more likely to ignore other rules. Neither the county nor Atlantic Richfield can adequately police the area.
- Atlantic Richfield was previously supportive of the planned trail system; however, promises made have been forgotten. They appear to be very liability conscious now. Public access is being denied and they are not providing supporting information requests for trails needed for grant applications. These grant opportunities have been missed because of Atlantic Richfield's continuing refusal to provide needed information.
- People want access.
- Ask people in Lost Creek what they want.
- Is the cleanup safe? The public doesn't understand why deep plowing is an adequate substitute for removal.
- Why did some properties only have their front yards cleaned up? Some people think this means that kids can't play in the backyard.
- Concerns with cache basins need to be addressed. Who will maintain them?

A.5.3.e Community Soils Operable Unit (CSOU)

- There are lots of questions about what work is planned in 2015 and not many answers. EPA and Atlantic Richfield need to be proactive in getting information to stakeholders so that they can pass it on to the general public. People have questions about timelines, who to contact, etc.
- There is an appearance that work on the CSOU has ground to a halt. There is no communication with Atlantic Richfield anymore.
- The biggest issue is dealing with the development permit system (DPS) on institutional controls (ICs).
- The "weighted average" used in the risk assessment is hard for the public to accept. It doesn't seem protective intuitively. Perhaps EPA could develop a postcard or one page flyer that explains it?
- Not enough is being done to clean up Opportunity properties. People in Opportunity can't garden because of contamination.
- Priority for cleanup should be placed on property owners who have waited a long time.
- The Arrowhead Foundation feels that the public has expressed confusion related to the revised ROD for the CSOU and its associated remediation schedules.
- Sampling and remediation must be done as efficiently and with as little inconvenience to the residents as possible. Sampling must be accurate and community education and involvement is paramount.

A.5.4 Do you feel concerns you express are heard and addressed?

People generally felt that their comments were being heard by EPA. They believed that EPA was genuinely trying to address their issues and was doing what they could, given budget and staffing cuts at EPA.

The biggest source of frustration seems to be communication with Atlantic Richfield. Many interviewees felt Atlantic Richfield has switched to a mode of actively ignoring issues raised about the site. They speculated that this was likely due to the falling price of oil and their expenses in the Gulf Coast area.

EPA RPM, Charlie Coleman, was cited as by several interviewees as being approachable, responsive, and willing to listen. Joel Chavez of Montana Department of Environmental Quality (DEQ) and Ken Brockman of the Bureau of Land Management were both praised for their ability to listen to and address concerns.

The Arrowhead Foundation reported that communication with both the ADLC Superfund Coordinator and Atlantic Richfield was difficult and limited which made it hard for the concerns of the public to be heard and addressed.

A.5.5 Do you believe that the remedy is working and is protective?

- The remedy is protective as it was envisioned, but it is not always working. For instance, in theory the gates at Lost Creek keep people off the property; but, in reality, people just go around them. Hikers and bikers are kicking up a lot of dust and are damaging the vegetative cover.
- The golf course is protective now, but unless changes are made to the way it is funded, the county will not be able to maintain it and it will fail.

- Yes, it is protective now, but in the future the acids and metals in the soils at the Opportunity ponds will work their way to the surface.
- The remedy is working in regards to arsenic in soils. Lead must be addressed in order for the remedy to be protective.
- There is a lack of adequate funding for the ICs. When the program was envisioned, no one involved (EPA, ADLC, DEQ, or Atlantic Richfield) had experience with implementing a long-term program at such a big site. The money needed to run the program and make necessary repairs was underestimated. There needs to be a way to fix this, or the remedy will fail and Atlantic Richfield will have to come and take out the waste left in place.
- The dust issues off of many open areas have been greatly reduced and the trains carrying contaminated streamside soils to Opportunity are now covered so they are not blowing contamination. This is a positive step. Slag is still being transported by wind from the piles to previously remediated areas across the Highway 1.
- The remedy is protective overall. There are some concerns with leaving hot spots in yards. The weighted average approach does not seem protective when a hot spot that is accessible to children remains. The commenter believes this will be addressed in the ROD modification.
- Durant Canyon is looking good.

A.5.6 What are your expectations of clean up?

- **ICs.** The IC system would not hinder development. There would be funding and resources in place to guide developers through the process and to pay for additional costs of transporting wastes to the repository. Atlantic Richfield would commit to being accessible to potential developers to answer questions. The remedy needs to be practical and workable. EPA should remove any liability from the community and the developer, as long as they are following the guidelines in the ICs.
- **Golf course remedy.** The golf course should be funded at a level that would allow all systems to be maintained (liner, water conveyance, etc.).
- **Access**. People would be able to use areas of open space where they were used to recreating in the past. This might mean keeping them on trails instead of being able to travel anywhere, but it would not mean shutting off large tracts of land. This doesn't work and just causes people to ignore gates and signs, which makes those tools less effective.
- **Community outreach**. Cleanup would include an educational component that would let people know what was going to happen and when. Also, it would provide a contact who can explain issues to them, such as the weighted yard average and the efficacy of removal versus deep plowing.
- **Compliance**. The Arrowhead Foundation has stated that it expects "compliance with all remedies illustrated in each OU/RDU record of decision, so as to ensure the protection of humans, wildlife, and the environment both immediately and long-term." Arrowhead also expects "full compliance with all Historic Preservation Plans, as a desire to preserve the region's smelting past has been expressed by the public."
- **Protectiveness.** The cleanup should be as protective as possible for the people who visit and work and live in Anaconda. It should be done in such a way that it lasts through time.

- **Total cleanup.** The site should be returned to the way it was before the smelter was operating.

A.5.7 Anaconda Deer Lodge County is working on institutional controls as part of the site remedy. Are there any issues or ideas about institutional controls that you'd like to ask or talk about?

- **ICs Implementation**. There are issues with how the ICs are implemented that need to be cleared up with Atlantic Richfield. Some of Atlantic Richfield's requirements are creating problems that were not anticipated. A few examples are shown below:

    - NW Energy is replacing gas lines under properties. The ICs require that the contaminated material be placed back in the excavation to limit the amount of material that needs to go to the repository and the number of trips on the repository. That seemed to make sense originally, but in practice, there have been problems. In the winter, this material is frozen and does not make good fill. After the frozen contaminated material is put back and the asphalt blacktop is repaired, things look fine. However, once the material thaws as the weather warms, it compacts further creating a pothole in the asphalt that needs to be repaired. Allowing clean, unfrozen fill to be used instead of the frozen contaminated material would prevent this problem.

    - Property owners with contaminated fill are supposed to be able to bring their fill to the repository, but Atlantic Richfield does not want vehicles traveling on the site out of safety concerns with other larger truck traffic. This creates scheduling issues. Allowing for there to be a stockpile location would eliminate this problem. If a small location could be carved out on the edge of the Atlantic Richfield Land Management Areas residents could drop off their contaminated soils without having to cross the site. This would also be useful for companies who have to deal with small to medium amounts of contaminated soils, such as Northwestern Energy when it replaces telephone poles or for the issue described in the previous bullet. It would also be useful for ADLC when handling materials from grave digging, pipeline relation, etc.

- **ICs funding.** Existing funding for the ICs is not adequate and there is not enough money in the ADLC budget to provide additional funding, nor is there an expectation that this will change in the future. Atlantic Richfield needs to provide additional funding long-term. The agreement made with Atlantic Richfield was based on a lack of experience and was not sufficient to maintain the remedy in the fashion that is required to be protective under Superfund. Unless more funding is provided, there is the potential for a major failure of protectiveness at this site and even recontamination of previously remediated areas.

- **Community issues.** Community issues are being addressed by the CPMP. People were apprehensive at first about ICs, but now they see it works and protects the community. It is hoped that the ICs could ultimately be a normal part of the daily routine for people in Anaconda and that there would be an educational component to facilitate that. The public health department hopes to help increase awareness of the importance of ICs for the community.

A.5.8 Are you aware of any new information that would affect the protectiveness of the remedy?

- **Golf course failure**. The golf course has the potential to fail as a remedy if the county is not given the funding needed to maintain it. It has proven to be much more costly than was initially envisioned,

and the county does not have the tax base that would provide the revenues to do the maintenance. The county wants the golf course to stay, if the wastes are going to stay. If the golf course fails, they will refuse to allow the wastes to remain in place.

- **Unauthorized access causing damage to the remedy.** Atlantic Richfield has a significant amount of revegetated open space land gated and posted to prevent access and protect the remedy. People are ignoring the signs and going around the gates to hike, ride bikes, or ride ATVs. The county does not have the money or personnel to police these areas and this unauthorized access is creating a widespread pattern of wear and tear on the revegetated surface. Adding a trail system to the remedy would serve to ensure that it was protective by funneling the random traffic onto an engineered surface. This would reduce erosion and destruction of vegetation.

- **Blowing of slag across Highway 1.** It was noted that the fine-grained slag from the unvegetated piles below Smelter Hill was being eroded and deposited across Highway 1. This deposition was re-contaminating an area that had been remediated and was also damaging the County's water treatment system by getting into the machinery in the pump house. The agencies haven't investigated this. It is easiest to see when there is snow on the ground.

- **C Hill**. There is the potential for waste off from C Hill to be transported in storm water to previously remediated areas.

- **Red Sands and the floodplain.** The waste in place in Red Sands is too close to the creek and has the potential to migrate, especially if the monitoring and maintenance currently done under the golf course operations changes. Wastes left in place in the flood plain would also need to be removed.

- **Development Permit System.** The final working draft of this system is to be approved in April 2015. "The Arrowhead Foundation believes that it omits sections pertinent to Superfund issues such as soil, sampling and analysis, protective covers, etc." Arrowhead believes that this omission will affect health and safety of humans, wildlife, and the environment as the project moves forward.

A.5.9 Do you have any concerns about future land use? Other ideas about redevelopment?

- **Compensation for costs associated with waste handling**. As long as wastes are left in place, the county needs to be compensated for the long-term costs that go with managing those wastes. The wastes impact new development. For example, Shopko is looking at developing in Anaconda. If they do, the county will have to run a gas line through a contaminated area. This will require additional handling of material and will require resources that the county does not have in its budget. Atlantic Richfield, who was allowed to leave wastes in place on a grand scale, should have to pay for the extra costs associated with handling the wastes in these situations.

- **Dedicated personnel to deal with development.** The county needs funding to have a person dedicated to answer questions from developers. This is an expense that cannot be covered with ADLC revenues. Developers, especially those from major companies (like ShopKo) who are more sophisticated about Superfund liability issues, have LOTS of questions that need to be answered. Atlantic Richfield is no help in providing that information. ADLC can't even get Atlantic Richfield to commit to having a person to whom ADLC can refer potential developers for help answering questions.

- **Golf course viability and development**. The golf course was supposed to be self-supporting and a major draw for development in the area, which was why ADLC agreed to the remedy. In a major city, this remedy approach may have worked. However, Anaconda has not been able to draw the development needed to secure tax revenues needed to maintain the golf course and support redevelopment infrastructure. Atlantic Richfield has refused to assist in redevelopment issues (such as providing needed information to potential developers or paying the cost for handling of wastes). If the golf course fails as a remedy, Atlantic Richfield will have to pay much more to implement a remedy that IS effective and workable in a community the size of Anaconda.

- **Redevelopment issues.** There are concerns that redevelopment or access will not be possible in several areas of the site because of Atlantic Richfield. Will there be someone a purchaser can go to at Atlantic Richfield to talk about property?

- **Wildlife management**. Wildlife management was not addressed in remedial designs. Given issues with big game within site boundaries, there is a need for investigating options such as hunting access and big game wildlife management.

- **Failure of Atlantic Richfield to provide agreed upon access**. Major areas of the site were remediated to higher cleanup levels based on future use as open space/recreational. This was agreed upon with the understanding that there would be public access to this land. However, it is clear that Atlantic Richfield has been shutting off areas from public use and will continue to do so in the future. Atlantic Richfield has also rebuffed attempts by the community to organize a trail system, which would serve to protect the remedy.

A.5.10 Is there anything you'd like to add?

- **Global agreement.** EPA could help in the process by refusing to enter into a consent decree with Atlantic Richfield until the global agreement between Atlantic Richfield and the county is finalized. Without a global settlement, it is hard to communicate the reality of this site. The Atlantic Richfield personnel changes when ADLC and Atlantic Richfield were almost at the point of reaching an agreement on the global agreement indicate that Atlantic Richfield was not negotiating in good faith.

- **Funding of ICs.** As part of that agreement, the county will require that ICs be funded for all properties, including those in the 1994 conyenace agreement. The county also wants a redevelopment fund for developers who want to build near the golf course to compensate them for additional expenses incurred due to dealing with wastes left in place. This will allow the type of development that was originally envisioned when the golf course was first proposed as a remedy. Such development would bring needed revenue and could eventually make the golf course financially viable and able to function on its own.

- **Wildlife issues.** Some portions of the remedy have caused unintended costs for the county. For example, the success of the revegetation at the Atlantic Richfield Land Management Areas has resulted in a much higher level of wildlife in the area. The estimated cost for a wildlife fence around the airport is $900,000. ADLC does not have that money in the budget. Atlantic Richfield should be required to cover at least part of such costs.

- **Concessions granted in exchange for the golf course.** Atlantic Richfield took advantage of the inexperience of ADLC in the settlement. Atlantic Richfield got a great deal by being allowed to leave so much waste in place and they knew it. They convinced ADLC that the golf course would create growth that would more than pay for any related costs. Were it not for the golf course, the

community would have wanted Warm Springs Creek and its floodplain remediated and restored, capping or removal of mine waste, further action on Stuckey Ridge, and a more robust stormwater system. The economic benefit promised be the golf course was never realized and is unlikly to without intervention. Therefore, the remedy doesn't work and will not work in the future under the current funding scenario.

- **Five-year review scope**. As part of the five-year review, ADLC specifically requests the agencies to consider the possibility of future closure of the golf course and to provide feedback on the scope of additional remedial action that would be anticipated with that closure and the expected operations and maintenance requirements that would be needed.
- **Compensation for serving as a waste repository**. Anaconda is still the de fact waste repository for Atlantic Richfield-related wastes from a wide area. Neither Butte nor Missoula would have accepted these wastes. Anaconda receives no payment or other compensation, even though the importation of the wastes created wear and tear on county roads and is likely to use other resources in the future.

Appendix B

ARARs Evaluation

APPENDIX B

DISCUSSION CONCERNING
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
ANACONDA SMELTER SUPERFUND SITE,

September 2015

At this time there have been no changes to any potential applicable or relevant and appropriate requirement (ARAR) that would raise issues about the protectiveness of any remedial action at the Anaconda Smelter NPL Site. This includes ARARs for remedial actions at Mill Creek (OU 15), with a ROD issued in 1987; Flue Dust (OU 11), with a ROD issued in 1991; Old Works/East Anaconda Development Area (OU 7), with a ROD issued in 1994; Community Soils (OU 16) with a ROD issued originally in 1996 and amended in 2013; and Anaconda Regional Water, Waste & Soils (OU 4), with a ROD issued originally in 1998 and amended in 2011.

The EPA modified the 1998 Anaconda Regional Water, Waste, and Soils ROD in 2011 because of changes to regulatory standards for surface and groundwater standards that had been adopted in approximately 2001. The 2011 ROD amendment therefore updated the human health standards for arsenic and zinc in ground and surface water, and the aquatic standards for cadmium, copper, and lead in surface water. There have been no other changes to any legal or regulatory requirement that would cause the EPA to modify ARARs for any ROD or ROD amendment at the Anaconda Smelter NPL.

Federal regulations provide that all ARARs are "frozen" as of the date of a given ROD unless the EPA determines that new standards are "necessary to ensure that the remedy is protective of human health and the environment." 40 CFR 300.430(f)(1)(ii)(B)(1). Such a protectiveness determination was made by the EPA and DEQ for the ARWW&S OU, where it was determined that the ground water and surface water performance standards in the original ROD were not consistent with the revised arsenic standard, and not protective.

EPA's rationale for freezing ARARs as of the date of any given ROD is to prevent "continually changing remedies to accommodate new or modified requirements," which would "adversely affect the operation of the CERCLA program, [and] would be inconsistent with Congress' mandate to expeditiously clean up sites…" 55 Fed.Reg. 8666, 8757 (1990). Federal regulations require that changes in applicable or relevant and appropriate requirements do not apply to remedies already documented and/or implemented unless those changes cause a reconsideration of the protectiveness of the original remedy. Further, ARARs effective at the time of a ROD amendment, but not at the time of the original ROD, apply only to remedial components that are newly described in the ROD amendment. Assuming there is no question as to protectiveness, the newly promulgated standards do not apply to the original ROD. See 40 C.F.R. § 300.430(f)(1)(ii)(B).

Appendix C-1

Final Human Health Risk Assessment Technical Memorandum

Anaconda Smelter NPL Site 2015 Five-Year Review

RESPONSE ACTION CONTRACT
FOR REMEDIAL, ENFORCEMENT OVERSIGHT, AND NON-TIME CRITICAL REMOVAL ACTIVITIES AT SITES OF RELEASE OR THREATENED RELEASE OF HAZARDOUS SUBSTANCES IN EPA REGION VIII

U. S. EPA CONTRACT NO. EP-W-05-049

HUMAN HEALTH RISK ASSESSMENT TECHNICAL MEMORANDUM

Anaconda Smelter NPL Site
Anaconda, Montana

January 2015

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Acronyms

ACM Anaconda Copper Mining Company

ABS absorption factor

AF adherence factor

AOC administrative order on consent

AWQC Ambient Water Quality Criteria

ARAR applicable or relevant and appropriate requirements

ARCO Atlantic Richfield Company

AT averaging time

BW body weight

CD Consent Decree

CDI Chronic Daily Intake

CERCLAComprehensive Environmental Response, Compensation and Liability Act

CGWA controlled groundwater area

COPCs chemicals of potential concern

CSF cancer slope factor

CT central tendency

CWL critical water level

cy cubic yard

DEQ (Montana) Department of Environmental Quality

DNRC Montana Department of Natural Resources and Conservation

ED Exposure Duration

EF Exposure Frequency

ET Exposure Time

EPA (U. S.) Environmental Protection Agency

ESD explanation of significant differences

FWP (Montana Department of) Fish, Wildlife, and Parks

FS Feasibility Study

GIS Geographic Information System

ICs Institutional Controls

HEAST Health Effects Assessment Summary Tables

HHRA Human Health Risk Assessment Summary

HI Hazard Index

HQ Hazard Quotient

ICTS Institutional Controls tracking system

IEUBK Integrated Exposure Uptake Biokinetic Model

IRIS Integrated Risk Information System Database

MBMG Montana Bureau of Mining and Geology

MCL Maximum Contaminant Level

MPTP Montana Pole Treating Plant

mg/kg milligrams per kilogram

NPL National Priority List (Site)

NRWQC National Recommended Water Quality Criteria

OU operable unit

PRP potentially responsible party

RAOs Remedial Action Objectives

RCRA Resource Conservation and Recovery Act

RfC Reference Concentration

RfD Reference Dose

RI remedial investigation

RI/FS remedial investigation/feasibility study

ROD record of decision

RPM (EPA) remedial project manager

SCEM Site Conceptual Model

SDs settling defendants

TI technical impracticably (zone)

TRV toxicity reference value

TRW technical review work group

UAO Unilateral Administrative Order

USEPA U. S. Environmental Protection Agency

WSP Warm Springs Ponds

Section 1
Introduction

1.1 Overview of Five-Year Risk Assessment Review

The primary purpose of a baseline human health risk assessment is to provide risk managers with an understanding of possible risks to people that live, work, recreate or otherwise visit a Site where hazardous materials have been released, and of any important uncertainties associated with the assessment. As a general policy and in order to operate a unified Superfund program, USEPA may use results of baseline risk assessments to determine whether a release or threatened release poses an unacceptable risk to human health or the environment that warrants remedial action and to determine if a Site presents an imminent and substantial endangerment. The National Contingency Plan for Oil and Hazardous Substances (NCP) states that the baseline risk assessment should "characterize current and potential future threats to human health and the environment that may be posed by contaminants migrating to groundwater or surface water, releasing to air, leaching through soil, remaining in the soil, and bioaccumulating in the food chain" (Section 300.430(d)(4)).

The review of risk assessment assumptions and toxicological criteria are required tasks in the five-year review process. This five-year review is a statutory requirement for the Anaconda Smelter NPL Site under the Comprehensive Environmental Response, Compensation Liability Act (CERCLA), 42 U.S.C. 9601 et. seq., and the NCP, 40 U.S.C. Part 300. The purpose of a five-year review is to evaluate the implementation and performance of a remedy to determine if the remedy is or will be protective of human health, and to recommend ways to attain or maintain that protection. Please note that the five-year review of the ecological risk assessment is provided under separate cover.

In addition, five-year review reports identify issues found, if any, during the review that could suggest that the remedy may not be sufficiently protective and makes recommendations to address such issues. Protectiveness is generally defined in the NCP separately for cancer risk and noncancer hazard quotients (HQ) or hazard indices (HI). Generally, the human health determination is based on whether cancer risk is greater than 10-4 and /or HI is greater than 1. Where cancer risks exceed 10-4, clean up goals are often established using a point of departure of 10-6. For ecological receptors, a HQ greater than 1 often represents a threshold of concern. Remedial actions are selected with the intent of mitigating unacceptable risks and being protective. Once a remedial action is implemented in accordance with an approved remedial design, risks are assumed to be migrated. Risks are also assumed to remain mitigated if the five-year review finds that the remedy is intact and functioning as intended.

1.2 Risk Assessment Guidance

The overall approach to human health risk assessments (HHRA) for the Community Soils and Anaconda Regional Water, Waste and Soils OUs (CSOU and ARWW&S OU) under evaluation followed guidance provided in Risk Assessment Guidance for Superfund: Volume I – Human Health Evaluation Manual (Part A) (USEPA 1989). That document provides guidance on all

aspects of HHRA, including evaluating available data and identifying chemicals for quantitative analysis, developing exposure scenarios that depict expected exposure conditions, assessing toxicity of chemicals, combining this information to estimate potential carcinogenic and non-carcinogenic health risks, and addressing uncertainties. That guidance and additional applicable federal, regional and state guidance have been used as deemed appropriate in this review. It should be noted that USEPA released additional HHRA guidance after finalization of the ROD and after the previous five-year review in September 2010. That additional HHRA guidance includes, but is not limited to:

- Exposure Factors Handbook 2011 Edition (Final). USEPA, Washington, DC, EPA/600/R-09/052F, 2011.
- Integrated Exposure Model for Lead in Children (IEUBK) for Windows. IEUBKwin1.1, Build 11. February 2010.
- Risk Assessment Guidance for Superfund, Volume I. Human Health Evaluation Manual. (Part F, Supplemental Guidance for Inhalation Risk Assessment). Final. Office of Emergency and Remedial Response. USEPA/540/R/070/002. OSWER 9285.7-82. USEPA. Washington, D.C. January 2009.
- Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, (Part E, Supplemental Guidance for Dermal Risk Assessment), Final. OSWER 9285.7-02EP PB99-963312. July 2004.
- Recommendations of the Technical Review Group for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil. January 2003.
- EPA Memorandum, "Human Health Toxicity Values in Superfund Risk Assessments." Michael B. Cook, Director of Superfund Remediation and Technology Innovation, OSWER Directive 9285.7-53. December 5, 2003.
- Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24. 2002.

1.3 Objectives and Approach

This analysis is limited to the review of current methods of risk assessment and toxicological data noting any changes from assumptions used in the RODs for the OUs under evaluation. This memorandum provides information to meet the USEPA's Tier 1 data collection effort for risk assessments for the Community Soils and Regional Water, Waste and Soils OUs of the Anaconda Smelter NPL Site.

The technical assessment of a remedy examines three basic five-year review questions:

- Question A: Is the remedy functioning as intended by the decision documents?
- Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy still valid?

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

The main focus of this memorandum is to answer the Question B: Are exposure assumptions, toxicity data, cleanup levels and RAOs used at the time of the remedy still valid? Question C is also examined to a limited extent.

To answer Question B, an evaluation was conducted to identify if changes in exposure pathways, changes in land use, new contaminants and/or contaminant sources, remedy byproducts, changes in standards, newly promulgated standards and TBCs (to be considered), and changes in toxicity and other contaminant characteristics (e.g., bioavailability) occurred since the ROD was issued. The validity of original assumptions regarding current and future land/groundwater uses and contaminants of concern, and whether any physical features (or understanding of physical Site conditions) have changed (e.g., changes in anticipated direction or rate of groundwater or identification of a new groundwater divide) are evaluated. These changes could include new land uses, including zoning changes, changed or new routes of exposure or receptors, changed physical site conditions that may affect the protectiveness of the remedy, new contaminants, new or updated toxicity criteria for contaminants of potential concern, or a new understanding of geologic conditions.

Cleanup levels at a Site may be based on calculated risk for chemicals and/or media where no promulgated standards (e.g., Site-specific soil and sediment action levels) exist or where existing standards are not sufficiently protective for Site-specific conditions. In addition to toxicity, other contaminant characteristics that determine the nature and extent of contaminant migration and effects on receptors (e.g., sorption, ability to bioaccumulate, bioavailability) are examined. The effects of significant changes in risk assessment parameters used to support the remedy selection, such as reference doses, cancer potency factors, toxicity reference values (TRVs), understanding of other chemical characteristics, and exposure pathways of concern are identified. All of these factors may have a bearing on the validity of the remedial action objectives and may affect the protectiveness of the remedy.

Initial steps in this evaluation include the review of risk assessment reports, RODs, recent updates on current site conditions, and investigation of current and proposed land uses. This information is then assessed considering current risk assessment methods and current toxicological information.

This memorandum will:

- Determine if risk assessment conclusions are still valid and will consider any changes that may affect the validity of cleanup levels;
- Identify if changes in land use or in the anticipated land use within or near the OUs could affect remedy implementation;
- Identify if changes in physical site conditions have occurred at the OUs;
- Determine if new human health or ecological exposure pathways or receptors have been identified;

- Determine if new contaminants or contaminant sources have been identified;
- Determine if any changes in the toxicity values for contaminants of concern might affect risk estimates significantly, and;
- Identify any other information that could call into question the protectiveness of the remedy.

1.4 Report Organization

This report is composed of four sections listed below. Tables and figures presented at the end of Section.

Section 1 Introduction

Section 2 Site Background

Section 3 Community Soils and Anaconda Regional Water, Waste and Soils Operable Units

Section 4 References

Section 2
Site Background

Marcus Daly bought a small silver mine called Anaconda near Butte, Montana in 1881. Daly built a smelter at Anaconda in 1882 and connected the smelter to Butte by railroad. The mines at Butte were the primary source of copper ore for smelter operations. Daly continued to buy neighboring mines, and when huge amounts of copper were discovered in the area, his Amalgamated Copper Mining Company, later renamed Anaconda Copper Mining Company, contributed to making Butte "the Richest Hill on Earth". Following the death of Daly and the other Butte "Copper Kings" (William A. Clark and F. Augustus Heinze), the Anaconda Copper Mining Company consolidated their holdings and continued underground copper mining until the early 1950s.

In 1977, Atlantic Richfield Company (ARCO) bought the Anaconda Copper Mining Company, but shut down mining at Butte only a few years later because of falling metal prices. In Anaconda, the smelter was demolished after its closure in 1981. The smelter stack remains in place and is a well-known landmark in western Montana. Heavy metals from historical smelting operations in the area contaminated a large area around the smelter at Anaconda. This contamination resulted in the inclusion of the Anaconda Smelter on the NPL for environmental cleanup in the 1980s.

2.1 Location and Setting

The Anaconda Smelter NPL Site (Site) is located at the southern end of the Deer Lodge Valley, at and near the location of the former Anaconda ore processing facilities. The Site covers an area of approximately 300 square miles. It has a temperate climate and includes a variety of terrain - from steep slope uplands to level valley floors. A variety of creeks and drainages are included within the Site. Major mining-related features at the Site include two very large tailings ponds (the Anaconda Ponds and the Opportunity Ponds) and the former Anaconda smelter stack. At 585 feet tall, the stack is a local landmark and is the largest freestanding brick chimney in the world. Two communities (Anaconda and Opportunity) are located within the Site footprint. US Interstate 90 and the Clark Fork River border the Site. The Site is divided into a number of OUs, including Mill Creek, Old Works/East Anaconda Development Area, Flue Dust, Community Soils and Anaconda Regional Waste Water & Soil (ARWW&S). Two of the OUs, ARWW&S and the Old Works/East Anaconda Development Area, are further divided into smaller units.

2.2 Regulatory History Summary

Remedial actions have been taken in five OUs within the Anaconda Smelter NPL Site. The first remedial action, taken at the Mill Creek OU, involved the relocation of residents from the community of Mill Creek after other initial stabilization and removal efforts. The second remedial action, taken at the Flue Dust OU, addressed flue dust at the Site through removal, treatment, and containment. At approximately the same time, removal actions were undertaken, including permanent removal and disposal of Arbiter and Beryllium wastes and the selective removal of contaminated residential yard materials from the community of Anaconda. The third remedial action addressed various waste sources found within the Old Works/East Anaconda Development Area (OW/EADA) OU. This area, located adjacent to the community of Anaconda, contains areas

of future development. Certain wastes within the OW/EADA OU received an engineered cover, including the Red Sands waste material and the Heap Roast slag piles, while others were consolidated and/or covered, including the floodplain wastes and miscellaneous waste piles. In addition, the third action allowed economic development (i.e., construction of a golf course in the Old Works area) and provided the final response action at the Mill Creek OU. The fourth remedial action, the Community Soils OU, addresses all remaining residential and commercial/industrial soils within the Anaconda Smelter NPL Site. The principal contaminant of concern (COC) identified in the Community Soils OU ROD is arsenic in surficial soils from past aerial emissions and railroad beds constructed of waste material. The ARWW&S OU is the fifth OU to receive remedial action at the Anaconda Smelter NPL Site. These actions address all remaining contamination and impacts to surface and ground water, waste source areas (e.g., slag and tailings) and non-residential soils not remediated under prior response actions, including those under the OW/EADA.

2.3 Summary of Remedy

Remedies for the Community Soils and ARWW&S OUs are similar. A brief summary is provided below to provide context for considering protectiveness.

2.3.1 Soils, Dust, and Waste Material

Major components of the remedy for contaminated soils and waste material include the following.

1. Reduction of surficial arsenic concentrations to below the designated action levels of 250 ppm, 500 ppm, and 1,000 ppm through removal and replacement with clean soil; placement of a vegetative or other protective barrier (e.g. engineered barrier); or a combination of soil cover or in situ treatment, depending on location and land use.

2. Clean up all future residential soils at the time of development that exceed the residential action level of 250 ppm soil arsenic concentration, through the Anaconda-Deer Lodge County (ADLC) Development Permit System (DPS);

3. Clean up all future commercial or industrial areas at the time of development that exceed the commercial/industrial action level of 500 ppm soil arsenic concentration through the ADLC-DPS.

4. Cleanup of lead in residential soils and cleanup of arsenic and lead in accessible attic dust based on the 2013 ROD Amendment. The lead action level is 400 ppm.

5. Implement ICs to control land uses, provide educational information to all residents describing potential risks and recommendations to reduce exposure to residual contaminants in soils, and to ensure the long-term viability of the remedy.

6. Reclamation of the soils and waste area contamination by establishing vegetation capable of minimizing transport of COCs to ground water and windborne and surface water erosion of the contaminated soils and waste areas. This vegetation will also provide habitat consistent with surrounding and designated land uses.

7. Partial removal of waste materials followed by soil cover and re-vegetation for areas adjacent to streams. Removed material will be placed within designated Waste Management Areas (WMAs).

8. Construct an engineered cover over all contaminated railroad bed material within the community of Anaconda to prevent direct contact with, and reduce potential for erosion and transport of, contaminated materials to residential and commercial/industrial areas;

9. Separate the rail bed from residential and commercial/industrial areas with a barrier to restrict access to the rail bed and to control surface runoff from the rail bed through the use of retaining walls and/or curbing; and,

10. Maintain existing ICs to restrict access.

2.3.2 Groundwater

Major components of the remedy for ground water include the following.

1. For alluvial aquifers underlying portions of the Old Works and South Opportunity Subareas, clean up to applicable State of Montana water quality standards through use of soil covers and removal of sources (surface water) to ground water contamination and natural attenuation.

2. For the bedrock aquifers and a portion of the alluvial aquifer in the Old Works/Stucky Ridge and Smelter Hill Subareas, waiver of the applicable ground water standard. The aquifers underlying these subareas cannot be cost effectively cleaned up through reclamation, soil cover, or removal of the sources (wastes, soils, and tailings) of the ground water contamination. Reclamation of soils and waste source areas with revegetation is required, which will contribute to minimizing arsenic and cadmium movement into the aquifers.

3. For portions of the valley alluvial aquifers underneath the Old Works/Stucky Ridge, Smelter Hill, and Opportunity Ponds Subareas where ground water is underlying waste-left-in-place, point-of-compliance (POC) monitoring to ensure contamination is contained at the perimeter boundary of the designated WMA. Should POC monitoring show a spread of contaminants beyond the boundary of a WMA, institute treatment options for the ground water where practicable.

2.3.3 Surface Water

Major components of the remedy for surface water include the following.

1. Reclamation of contaminated soils and engineered storm water management options to control overland runoff into surface waters.

2. Selective source removal and stream bank stabilization to minimize transport of COCs from fluvially deposited tailings into surface waters. Removed material will be placed within a designated WMA.

3. Institutional Controls (ICs) and Operations and Maintenance (O&M). The remedy will employ ICs and long-term O&M for the OU to ensure monitoring, and repair of implemented actions. These actions will be coordinated through development of an ICs Plan and O&M Plan and will

allow for communication with local government and private citizens. The plans will function as a tracking system for the agencies and describe and plan for potential future land use changes.

4. The remedy calls for a fully-funded ICs program at the local government level. The Anaconda-Deer Lodge County (ADLC) government will be responsible for on-going oversight of O&M in the OW/EADA OU, implementation of a county-wide Development Permit System (DPS), and provision of public information and outreach through a Community Protective Measures program.

5. In addition, the remedy will bring closure to previous response actions within the Site that are already implemented, such as the Flue Dust remedy or the Old Works remedy, primarily through long term O&M for some or all of those actions which are integrated into this remedy.

Section 3
Risk Evaluation

The primary document on which this review is based is Final Baseline Risk Assessment for the Site (CDM Federal Programs Corporation 1996). In addition, the 2013 ROD Amendment for the Community Soils Operable Unit (USEPA and DEQ 2013) was also reviewed.

3.1 Summary of the Human Health Baseline Risk Assessment

The Final Baseline Human Health Risk Assessment for the Site addressed operable units at the Site that had not been previously addressed, including Community Soils and ARWW&S OUs in Anaconda and a large surrounding area. That assessment is the last comprehensive risk assessment developed for the Site, and forms the basis for current target clean-up levels being used to guide continuing remediation.

The risk assessment evaluated a variety of possible exposure scenarios, and developed risk-based screening levels for arsenic for residential, agricultural, commercial, and recreational (dirt bike riders and swimmers). No quantitative clean-up targets were established in records of decision for the Site for surface water. All quantitative clean-up targets are thus for soils in and around Anaconda.

To evaluate residential soils pathway, the risk assessment used data on surface soils and dust collected by Bornschein in 1992 and 1994. These data were focused on arsenic, but substantial data for cadmium, copper, lead and zinc in soil were also collected. Arsenic and lead were selected as COPCs and were evaluated quantitatively in the risk assessment. Risks from lead were determined to be within EPA's acceptable range even for young children in residential situations. Risks due to arsenic in soils and indoor dust were deemed unacceptable, and therefore arsenic was identified as the sole chemical of concern (COC).

Based on this risk assessment, and consistent with other assessments developed previously for other operable units, clean-up targets for arsenic in soils were identified as 250 mg/kg for residential land use, 500 mg/kg for commercial/industrial land use and 1,000 mg/kg for all other land uses (agricultural, recreational). More recently, the 2013 ROD Amendment set a 400 ppm lead cleanup level for residential soil and interior dust.

3.2 Technical Review of Human Health Risk Assessment

Review of the 1996 EPA risk assessment involved evaluation of chemicals of potential concern, identification of changes in land use, re-assessment of exposure scenarios and exposure parameters, review of exposure point concentrations and the data supporting those concentrations, evaluation of changes in toxicity criteria, and discussion of other information pertinent to the Five-Year Review. The review did not include checking calculations performed in the risk assessment; however, calculation of screening levels were re-assessed.

3.2.1 Review of Chemicals of Concern

The risk assessment in 1996 assumed, based on previous risk assessments for the Site, and on experience at other mining Sites, that arsenic, cadmium, copper, lead and zinc were the only soil constituents that needed to be considered as chemicals of potential concern (COPCs). A similar assumption was made in the 1993 risk assessment for the Old Works/East Anaconda OU. However, a more complete selection of COPCs was performed for the risk assessment for the Flue Dust OU in 1990. The last Five-Year Review (September 2010) concluded that no additional data that would challenge COPC selection were available. That conclusion holds true for the current review. Additional data have been reported for arsenic and lead, but no substantive data for other inorganic soil constituents is available.

3.2.2 Review of Land Use

Land uses evaluated in the 1996 risk assessment were evaluated in generic fashion, and these same land uses are likely for parts of the Site for the foreseeable future. In this sense, land uses have not changed. Remedies for the Site involve the use of ICs to prevent land uses incompatible with residual contamination (see Section 10 of the Five-Year Review Report). For example, ICs are in place to prohibit residential development in current commercial locations (action level of 500 mg/kg arsenic in soil) unless the area under consideration meets or is cleaned up to the residential action level (250 mg/kg). Likewise currently undeveloped or agricultural lands (action level of 1000 mg/kg) would not be developed for either commercial or residential without meeting or being cleaned up to the appropriate action level. In this way, the selected remedy is currently protective and will remain so in the future should land use change.

3.2.3 Review of Human Receptors of Concern

As is the case for land uses, human receptors were evaluated generically and included residents, workers (including those associated with agriculture), and recreational visitors. These general receptor groups appear to cover the range of receptors that might use the Site.

For some receptor groups, subgroups of receptors could have been identified and evaluated. For example, workers could have included indoor office workers, workers involved in outdoor jobs such as landscaping and maintenance, excavation and construction, etc. No information from the Site or in recent guidance suggests that nuances for commercial workers are likely to change the basic conclusions of the risk assessment and associated action levels. Likewise, nuances of exposure for other recreational subgroups (hikers, hunters) are not likely to change conclusions of the assessment. Scenarios addressed are likely to be protective; evaluation of other scenarios would not result in lower estimates of risk-based screening levels. Thus, no additional information was uncovered that would question the original selection of exposure scenarios.

3.2.4 Review of Exposure Parameters

Residents

As part of the five-year review process, exposure parameter values were examined for any changes that may affect protectiveness for residential land use. Values for some parameters used to estimate health risks from exposure to Site COPCs have become available since the 1996 ROD. For example, estimates for efficiency of transfer of soil to indoor dust, soil ingestion by young children, dietary lead concentrations, and maternal blood lead concentrations have all changed

since the 1996 ROD was issued. In these cases, estimates for these exposure parameters would result in lower estimates of health risks and therefore would not, if adopted, affect the protectiveness of the remedy.

GI absorption of arsenic was based on bioavailability data from a study using Cynomolgus monkeys (Freeman et al 1995). This study used soil and dust collected within the Community Soils OU. No additional data on bioavailability for Anaconda soils was located, and this study is still provides the best information available.

For all receptors exposed to soil, dermal exposure to arsenic was not considered. EPA guidance (2004) for assessment of dermal exposure recommends an absorption fraction of arsenic from soil of 0.03 (3 percent). This absorption fraction is sufficiently high to affect risk calculations and clean-up targets. However, more recent studies published since EPA guidance was developed indicate that this value is more appropriate for arsenic in solution, and absorption of arsenic from soil may be minimal (Lowney et al. 2007). If this more recent research is accepted, the impact of arsenic exposure via dermal contact would not significantly affect the conclusions of the risk assessment.

Finally, the latest USEPA guidance (2011) for exposure parameters does suggest modest changes to some parameters such as body weights, lifetime, and other common body metrics. Use of these parameters would make some difference in estimates reported in the risk assessment, but such changes are likely to be small. Exposure calculations would have to be performed to demonstrate the magnitude of any changes.

Commercial Workers

As discussed above for residents, modest changes to some exposure parameters such as body weights, lifetime, and other common body metrics are provided in the latest guidance (USEPA 2011). Again, such changes are not likely to make substantial differences in risk estimates, but exposure calculations would have to be performed to demonstrate the magnitude of any changes.

Agricultural Workers

Some key exposure parameters for these workers were based on either site-specific information or on professional judgment. Exposure frequency was based on typical growing seasons in the area, and dust loading during field preparation and harvest was based on professional judgment. These factors still seem appropriate. Soil ingestion rates chosen for this scenario also remain valid. No studies on agricultural workers are available and the ingestion rates chosen cannot be second guessed using more recent information.

The inhalation rate used for workers is appropriate for short-term, heavy activities and could overestimate likely exposure. Workers are unlikely to sustain heavy activity over an 8 hour period for many days. An inhalation rate of 1.5 for moderate activity could be more appropriate for long-term exposure. Reducing the inhalation rate would decrease risks and increase screening levels. Thus, such a change would not compromise the protectiveness of the remedy.

Two aspects of the evaluation of exposure via inhalation need mention. First, inhalation exposures are typically significant only for individuals engaged in activities that generate dust.

Agricultural workers and dirt biked riders are two such groups and were the focus of evaluation of inhalation exposure in the risk assessment. Second, risk estimates for these workers were low as reflected in the relatively high action level (1,250 mg/kg) for arsenic in soil.

The current method for evaluating inhalation exposure is different from that used in the risk assessment. Inhalation risks are now estimated by comparing an exposure concentration with unit inhalation risk factors (UIR) or reference concentrations (RfC). These criteria also have units of concentration – (ug/m3)-1 and ug/m3, respectively. Using these more recent calculation methods, inhalation risks are typically similar to, or lower than, estimates generated by the older methods. Although changes in methodology for assessing risks due to inhalation exposure have been substantial, they are not likely to affect the results of the risk assessment.

Dirt Bikers

Key assumptions for dirt bikers (representative recreational users for exposure to arsenic in soil/waste) are either Site-specific or based on professional judgment. Exposure frequency, exposure time, soil ingestion rate and dust loading are all based on judgments made in the 1996 assessment or in the previous risk assessment in 1993. No new data exist on which to question these judgments was uncovered. The inhalation rate used for dirt bikers was 2.5 m3/hr, which is an appropriate rate for heavy activities over the short term. This inhalation rate still remains reasonable for occasional strenuous activity. See also the discussion of inhalation risk under "Agricultural Workers" above.

Lead

Risks due to exposure to lead were calculated using the IEUBK model (USEPA 1994) and model defaults recommended in 1996. Several inputs to the model would be updated if the lead risk assessment for young children were re-run using current methods. Some default parameters in the model have changed in recent updates. Dietary lead intake has been reduced for each year from age 0 to 7 based on new NHANES (National Health and Nutrition Examination Survey) data and maternal blood lead concentration at birth has been reduced. Both of these changes would reduce lead exposure and risk. Additional discussion of lead in Site soils is provided in Section 3.2.5 below.

3.2.5 Review of Exposure Point Concentrations

Current methods for evaluating lead risks to young children do not involve calculation of EPCs for large Site areas. Instead, the recommended approach examines lead risks on a yard-by-yard basis. Summary data for lead in soil suggest a wide range of lead concentrations in 302 yards in the data set used in the 1996 assessment. Lead concentrations varied from 75 +/- 13 to 582 +/- 282 mg/kg among 10 areas of the Community Soils OU, and individual data points varied from 14 to 2,152 mg/kg. A screening level for lead in soil for residential conditions is 400 mg/kg. Some of these data points exceed the screening level and may merit further Investigation. If arsenic and lead concentrations are highly correlated, current clean-up targets for arsenic may be protective for lead risks also. This issue of soil arsenic and lead concentrations and their correlation was identified in the last five-year review, and a recent amendment to the ROD (September 2013) was recently finalized.

3.2.6 Review of Recently Collected Data for Groundwater

The Montana Bureau of Mines and Geology recently collected data from groundwater in the Anaconda and Opportunity areas. These data provide a summary of arsenic and other metals in shallow groundwater and domestic wells in some areas. A brief review of these data indicate that elevated concentrations of contaminants are generally found in groundwater beneath source areas (e.g., tailings) and in other areas of the Site affected by high levels of smelter fallout.

The remedy for contaminated groundwater recognizes that remediation of the groundwater in the source areas, such as Old Works and Smelter Hill, is not technically practicable. The remedy for ground water includes monitoring groundwater quality in domestic wells and at point of compliance wells near source areas to detect movement of contaminants into adjacent locations. Current data indicate that contaminant plumes beneath WMAs and in technical impracticability (TI) zones are not expanding. In accordance with the 2011 ARWW&S OU ROD Amendment, the domestic well monitoring program is on-going to ensure that ground water users are not exposed to arsenic concentrations that exceed standards. Thus, these data (presented in Section 9.2.18 of the 2015 Five-Year Review report) indicate that the selected remedy for ground water remains protective of human health.

3.2.7 Review of Toxicity Values

Arsenic

Oral toxicity values (references doses) and cancer slope factors (SFs) for arsenic were examined for any changes that may affect protectiveness. No changes to these toxicity criteria for arsenic have occurred in USEPA's Integrated Risk Information System (IRIS 2014) since the 1996 risk assessment.

It should be noted, however, that California EPA's Office of Environmental Health Hazard Assessment (OEHHA) has developed toxicity criteria for arsenic that differ from criteria currently available on IRIS. Guidance from USEPA (2003) recognizes OEHHA criteria as a Tier 3 source of toxicity values for use in Superfund risk assessments. Generally, EPA suggests the use of values from IRIS for use in the Superfund program. Thus, the existence of criteria outside of IRIS does not indicate that the current remedy lacks protectiveness.

For completeness only, if the oral slope factor developed by OEHHA (9.5 (mg/kg-d)-1) was used in place of the factor currently listed on IRIS (1.5 (mg/kg-d)-1), cancer risk estimates in the 1996 risk assessment would increase by a factor of up to 6, depending on how exposure point concentrations are calculated for different areas of the Site. A change of this magnitude could affect risk management in the Community Soils and ARWW&S OUs.

USEPA is still in the process of re-evaluating the toxicity of arsenic, and it is unclear if and when new toxicity values might be validated and listed in IRIS. The issue is controversial, and a schedule for agency action is difficult to predict. For perspective, the USEPA oral slope factor for arsenic (1.5 (mg/kg-d)-1) is currently low enough that PRGs for screening are already lower than naturally occurring arsenic concentrations for almost all soils and for residential land use. In groundwater used for drinking, screening values could fall into the parts per trillion range.

Finally, a calculation for the dirt biker scenario in the 1996 risk assessment using the current unit risk factor for arsenic (USEPA 2014) substantiates the protectiveness of current remediation goals. Inhalation exposure makes a much smaller contribution to cancer risks than do other exposure scenarios, and risks associated with specific target soil concentrations would remain essentially unchanged if they were based on new inhalation toxicity criteria and associated exposure and risk calculations (USEPA 2009a).

Lead

USEPA did not recommend typical toxicity criteria (cancer slope factor and/or reference dose) for lead in 1996 and still has not provided such criteria. Thus, the approach used in the 1996 risk assessment that utilized the IEUBK lead model is still appropriate. The target blood lead criterion for evaluation of lead exposure for young children, a probability of less than 5 percent of blood lead exceeding 10 ug/dL, has not changed since 1996.

USEPA is however, still evaluating lead toxicity information and target blood lead criteria such as 5 percent of child blood levels exceeding 5 ug/dL have been discussed. Again, this issue is controversial and it is not clear if and when USEPA will move forward with a new definition of target blood lead concentrations.

Finally, OEHHA has developed an alternative means of addressing target blood lead concentrations based on the assumption that lead may impact the developing nervous system at any level of exposure. Thus, the OEHHA definition of a target blood lead level is an increase in blood concentrations of 1 ug/dL above background. This definition results in quite low screening values for lead in soil depending on the blood lead concentration assumed to be typical young children without any unusual source of lead exposure (e.g., 80 mg/kg for residential land use). This soil concentration does not take into account the bioavailability of lead. However, bioavailability of lead in soil at the Site appears to be similar to the default value used in IEUBK modeling.

Overall, toxicity information on arsenic and lead from USEPA may need to be monitored in the next several years. Some of the changes that have been suggested by USEPA and developed by OEHHA, if adopted, could have important impacts on remedy protectiveness for the Community Soils and ARWW&S OUs.

Section 3.3 Summary of Risk Assessment Evaluation and Protectiveness Statement

Risk-based target clean-up goals were set for the Anaconda Smelter NPL Site in a series of risk assessments that culminated in a comprehensive assessment in 1996 that addressed all areas surrounding primary sources areas (Smelter Hill, Opportunity Ponds, Old Works area, etc.). Clean-up targets for arsenic in soil of 250 mg/kg, 500 mg/kg, and 1,000 mg/kg were established for residential, commercial, and agricultural/recreational land uses, respectively. These targets were used in the ROD to define, in part, the remedy for non-source areas. No other quantitative clean-up targets (e.g., for protection of ecological receptors) were defined in remedies for Community Soils and RWW&S OUs.

Review of risk assessments focused on several issues, as discussed in Section 1. Each of these issues and results of the analyses are summarized below.

- Identify if changes in land use or in the anticipated land use within or near the Site could affect remedy implementation.

Remedies for the Site include ICs to prevent, for example, residential development in areas that have been remediated to the commercial target for arsenic. Thus, land use could change, but as long as ICs are in place and enforced to ensure these areas are cleaned up to the residential standard, the remedy will remain protective.

Risk assessment efforts examined communities and other areas within the Site in generic fashion. That is, they looked at whole communities and/or large areas of communities or other Site area. The results of the risk assessment, therefore, do not apply to specific small areas. Thus, if land use within larger areas, which were addressed generically, changed, the results of the risk assessment would not change.

- Identify if changes in physical site conditions have occurred at the Site that could affect risk.

Many changes in physical site conditions have occurred within the Site, much as part of remediation activities. For example, a large part of the Old Works/East Anaconda Development Area OU has been remediated and re-developed as a golf course. Since the major changes to the Site are a result of remediation, these changes should not compromise the protectiveness of the remedy.

- Determine if new human health or ecological exposure pathways or receptors have been identified.

The human health risk assessment examined a range of exposure scenarios (residential, commercial, agricultural, dirt biker (recreational) and wader/swimmer (recreational)). Such designations could be further divided to provide activity-specific risks. For instance, hikers and hunters could be addressed as recreational exposure scenarios. Such parsing of scenarios is, however, unlikely to yield significantly higher risks. For recreational exposures, the dirt biker scenario includes rather intense exposure via ingestion and inhalation. Reasonable exposure assumptions for other recreational scenarios would likely result in lower levels of exposure. Thus the range of exposure scenarios addressed remains reasonable and protective.

- Determine if new contaminants or contaminant sources have been identified.

Risk assessment efforts for the Site have been focused, since the early 1990's, on arsenic, cadmium, copper, lead and zinc. No recent data were uncovered that suggest that this focus is inappropriate.

- Determine if any changes in the toxicity values for contaminants of concern might affect risk estimates significantly.

No changes in oral or inhalation toxicity criteria for arsenic have occurred since the 1996 risk assessment was developed. Similarly, targets for blood lead levels for assessing lead risks for young children have not changed since 1996.

California EPA has developed a more restrictive oral cancer slope factor for arsenic. This value is not currently used by USEPA to evaluate risk associated with cancer exposure. If the California EPA (OEHHA) oral slope factor was used in the development of remediation goals these goals would be up to six times more restrictive (lower) than those currently being used at the Site. Since at least one regulatory agency has developed a peer reviewed and more restrictive toxicity criterion, and since USEPA continues to re-assess arsenic toxicity, this issue should be watched carefully and assessed in future five year reviews.

Similarly, California EPA has developed a different approach for evaluating exposure of young children to lead. This method results in significantly lower remediation goals for lead in soil. USEPA has not yet adopted this approach, and may not consider this method appropriate in the future. However USEPA continues to evaluate the impact of lead exposure on young children and, again, the issue of lead toxicity needs to be a focus of future five year reviews.

- Determine if exposure parameters used in the risk assessment remain valid.

Review of default and Site-specific exposure parameters used in the calculation of human health risks did not reveal any instances where such parameters did not appear valid. In particular, no information was uncovered to suggest that exposure parameters based on Site-specific information and/or professional judgment should be reconsidered.

- Identify any other information that could call into question the protectiveness of the remedy.

No other such information has been identified.

Section 4
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Appendix C-2

Final Ecological Risk Assessment Technical Memorandum

Anaconda Smelter NPL Site 2015 Five-Year Review

Appendix C-2

Final Ecological Risk Assessment Technical Memorandum

Anaconda Smelter NPL Site 2015 Five-Year Review

RESPONSE ACTION CONTRACT
FOR REMEDIAL, ENFORCEMENT OVERSIGHT, AND NON-TIME CRITICAL REMOVAL ACTIVITIES AT SITES OF RELEASE OR THREATENED RELEASE OF HAZARDOUS SUBSTANCES IN EPA REGION VIII

U. S. EPA CONTRACT NO. EP-W-05-049

ECOLOGICAL RISK ASSESSMENT TECHNICAL MEMORANDUM

Anaconda Smelter NPL Site
Anaconda, Montana

Work Assignment No.: 240-FREE-0818

September 2015

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Acronyms

ADLC	Anaconda-Deer Lodge County
AWQC	Ambient Water Quality Criteria
ARCO	Atlantic Richfield Company
As	arsenic
BERA	baseline ecological risk assessment
BMI	benthic macroinvertebrates
CCC	criterion continuous concentration
Cd	cadmium
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	contaminant of concern
COPCs	chemicals of potential concern
Cu	copper
DEQ	(Montana) Department of Environmental Quality
DPS	Development Permit System
EC	exposure concentration
Eco-SSL	ecological soil screening levels
EPA	(U. S.) Environmental Protection Agency
ERL	effective range-low
ERM	effect range median
ESL	ecological screening level
Fe	iron
ICs	Institutional Controls
HQ	Hazard Quotient
LEL	low effect level
LOAEL	lowest-observable-affects-level
LRES	Land Reclamation Evaluation System
mg/kg	milligrams per kilogram
NEC	no effect concentration
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no-observable-affects-level
NPL	National Priority List (Site)
NRWQC	National Recommended Water Quality Criteria
POC	point-of-compliance
Pb	lead
OU	operable unit
PEC	probable effect concentration
RA	remedial action
RAO	Remedial Action Objective
ROD	record of decision
SLERA	screening level ecological risk assessment
TEC	threshold effect concentration
TEL	threshold effect level
TRV	toxicity reference value
USEPA	U. S. Environmental Protection Agency
WMA	Waste Management Area
Zn	zinc

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Section 1
Introduction

1.1 Overview of Five-Year Risk Assessment Review

The primary purpose of a baseline ecological risk assessment is to provide risk managers with an understanding of possible risk to ecological receptors, and of important uncertainties in risk estimates. As a general policy and in order to operate a unified Superfund program, USEPA may use results of baseline risk assessments to determine whether a release or threatened release poses an unacceptable risk to human health or the environment that warrants remedial action and to determine if a site presents an imminent and substantial endangerment. The National Contingency Plan for Oil and Hazardous Substances (NCP) states that the baseline risk assessment should "characterize current and potential future threats to human health and the environment that may be posed by contaminants migrating to groundwater or surface water, releasing to air, leaching through soil, remaining in the soil, and bioaccumulating in the food chain" [Section 300.430(d) (4)].

The review of risk assessment assumptions and toxicological information are critical tasks in the five-year review process. This five-year review is a statutory requirement for the Anaconda Smelter NPL Site under the Comprehensive Environmental Response, Compensation Liability Act (CERCLA), 42 U.S.C. 9601 et. seq., and the NCP, 40 U.S.C. Part 300. The purpose of a five-year review is to evaluate the implementation and performance of a remedy in order to determine if the remedy is or will be protective of human health and the environment and to recommend ways to attain or maintain that protection.

In addition, Five-Year Review reports identify issues found, if any, during the review that could suggest that the remedy may not be sufficiently protective and makes recommendations to address such issues. In assessing protectiveness for ecological receptors, an HQ equal to or greater than 1 often represents a threshold of concern. An HQ is the ratio of an exposure level by a contaminant (e.g., maximum concentration) to an ecological screening value selected for the risk assessment for that substance.

1.2 Risk Assessment Guidance

Ecological risk assessments (ERAs) are most often conducted using a phased approach that follows USEPA guidance (Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (USEPA 1997)) for conducting ERAs at Superfund sites. This guidance post-dates the most recent risk assessment efforts for the OUs. USEPA (1997) and others typically recognize that methods for conducting ERAs must be site-specific. USEPA guidance for conducting ERAs at Superfund sites is therefore not a detailed step-by-step "cookbook" but instead provides recommendations on ERA components to be considered and general approaches for performing ERAs.

The first phase of the ERA is a Screening Level ERA (SLERA). The SLERA is used to determine if further investigation is warranted, that is, if there is a reasonable potential for ecological receptors to suffer adverse effects as a result of exposure to site-related contamination. If the SLERA determines that adverse effects are likely, then the next phase of the ERA process is warranted. This second phase is the baseline ecological risk assessment (BERA). Where

indicated by the results of the SLERA, a BERA is performed to better describe ecological risks and to reduce uncertainties associated with conservative risk estimations in the SLERA.

1.3 Objectives and Approach

This analysis focuses on review of current methods of ecological risk assessment and of toxicological data noting any differences from assumptions used in the RODs for the OUs under evaluation. This memorandum provides information to meet the USEPA's Tier 1 data collection effort for risk assessment for the Regional Water, Waste and Soils OUs of the Anaconda Smelter NPL site.

The technical assessment of a remedy examines three basic questions:

- Question A: Is the remedy functioning as intended by the decision documents?
- Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy still valid?
- Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

The main focus of this memorandum is to answer the Questions B and C: Are exposure assumptions, toxicity data, cleanup levels and RAOs used at the time of the remedy still valid? Has any other or new information come to light that could call into question the protectiveness of the remedy?

To answer Question B, an evaluation was conducted to identify changes in exposure pathways; changes in land use; identification of new contaminants and/or contaminant sources; release of remedy byproducts; changes in standards; newly promulgated standards and TBCs (to be considered); and revisions to toxicity values and to other contaminant characteristics (e.g., bioavailability) since the last five-year review. The validity of original assumptions regarding current and future land/groundwater uses and contaminants of concern, and whether any physical features (or understanding of physical site conditions) have changed (e.g., changes in anticipated direction or rate of groundwater flow or identification of a new groundwater divide) are evaluated. These changes could include changed or new land uses, including zoning changes, changed or new routes of exposure or receptors, changed physical site conditions that may affect the protectiveness of the remedy, new contaminants, new or updated toxicity criteria for contaminants of potential concern, or a new understanding of geologic conditions.

Cleanup levels at a site may be based on calculated risk for chemicals and/or media where no promulgated standards (e.g., site-specific soil and sediment action levels) exist or where existing standards are not sufficiently protective for site-specific conditions. In addition to toxicity, other contaminant characteristics that determine the nature and extent of contaminant migration and effects on receptors (e.g., sorption, ability to bioaccumulate, bioavailability) are examined. The effects of significant changes in risk assessment parameters used to support the remedy selection, such as reference doses, receptor assumptions, toxicity reference values (TRVs), understanding of other chemical characteristics, and exposure pathways of concern are identified. All of these factors may have a bearing on the validity of the remedial action objectives and may affect the protectiveness of the remedy.

Initial steps in this evaluation include the review of risk assessment reports, RODs, recent updates on current site conditions, and investigation of current and proposed land uses. This information is then assessed considering current risk assessment methods and current toxicological information.

This memorandum will:

- Determine if ecological risk assessment conclusions are still valid and will consider any changes that may affect the validity of cleanup levels.
- Identify if changes in land use or in the anticipated land use within or near the OUs could affect remedy implementation.
- Identify if changes in physical site conditions have occurred at the OUs.
- Determine if new ecological exposure pathways or receptors have been identified.
- Determine if new contaminants or contaminant sources have been identified.
- Determine if any changes in the toxicity values for contaminants of concern might affect risk estimates significantly.
- Identify and evaluate any other or new information that could call into question the protectiveness of the remedy.

1.4 Report Organization

This report is composed of four sections listed below. Tables and figures presented at the end of Section.

Section 1 Introduction

Section 2 Site Background

Section 3 Risk Evaluation

Section 4 References

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Section 2
Site Background

Marcus Daly bought a small silver mine called Anaconda near Butte, Montana in 1881. Daly built a smelter at Anaconda in 1882 and connected the smelter to Butte by railroad. The mines at Butte were the primary source of copper (Cu) ore for smelter operations. Daly continued to buy neighboring mines, and when huge amounts of Cu were discovered in the area, his Amalgamated Copper Mining Company, later renamed Anaconda Copper Mining Company, contributed to making Butte "the Richest Hill on Earth". Following the death of Daly and the other Butte "Copper Kings" (i.e., William A. Clark and F. Augustus Heinze), the Anaconda Copper Mining Company consolidated their holdings and continued underground Cu mining until the early 1950s.

In 1977, ARCO bought the Anaconda Copper Mining Company, but shut down mining at Butte only a few years later because of falling metal prices. In Anaconda, the smelter was demolished after its closure in 1981. The smelter stack, a well-known western Montana landmark and the largest free standing brick chimney in the world at 585 feet tall, remains in place. Heavy metals from historical smelting operations in the area contaminated a large area around the smelter at Anaconda. This contamination resulted in the inclusion of the Anaconda Smelter on the NPL for environmental cleanup in the 1980s.

2.1 Location and Setting

The site is located at the southern end of the Deer Lodge Valley, at and near the location of the former Anaconda Minerals Company (AMC) ore processing facilities. The site covers an area of approximately 300 square miles. It has a temperate climate and includes a variety of terrain - from steep slope uplands to level valley floors. A variety of creeks and drainages are included within the Site. Major mining-related features at the site include two very large tailings ponds (the Anaconda Ponds and the Opportunity Ponds) and the former Anaconda smelter stack. Two communities (Anaconda and Opportunity) are located within the site footprint. US Interstate 90 and the Clark Fork River border the site. The site is divided into a number of OUs, including Mill Creek, Old Works/East Anaconda Development Area, Flue Dust, Community Soils and Anaconda Regional Waste Water & Soil (ARWW&S). Two of the OUs, ARWW&S and the Old Works/East Anaconda Development Area, are further divided into smaller units.

2.2 Regulatory History Summary

Remedial actions have been taken in five OUs within the Anaconda Smelter NPL Site. The first remedial action, taken at the Mill Creek OU, involved the relocation of residents from the community of Mill Creek after other initial stabilization and removal efforts. The second remedial action, taken at the Flue Dust OU, addressed flue dust at the site through removal, treatment, and containment. At approximately the same time, removal actions were undertaken, including permanent removal and disposal of Arbiter and Beryllium wastes and the selective removal of contaminated residential yard materials from the community of Anaconda. The third remedial action addressed various waste sources found within the Old Works/East Anaconda Development Area OU. This area, located adjacent to the community of Anaconda, contains areas of future development. Certain wastes within the Old Works/East

Anaconda Development Area OU received an engineered cover, including the Red Sands waste material and the Heap Roast slag piles, while others were consolidated and/or covered, including the floodplain wastes and miscellaneous waste piles. In addition, the third action allowed economic development (i.e., construction of a golf course in the Old Works area) and provided the final response action at the Mill Creek OU. The fourth remedial action, the Community Soils OU, addresses all remaining residential and commercial/industrial soils within the Anaconda Smelter NPL Site. The principal contaminant of concern (COC) identified in the Community Soils OU ROD is arsenic (As) and lead (Pb) in surficial soils from past aerial emissions and railroad beds constructed of waste material. The ARWW&S OU is the fifth OU to receive remedial action at the Anaconda Smelter NPL Site. These actions address all remaining contamination and impacts to surface and groundwater, waste source areas (e.g., slag and tailings) and non-residential soils not remediated under prior response actions, including those under the Old Works/East Anaconda Development Area.

2.3 Summary of Remedy

A brief summary of the ARWW&S OU remedy is provided below to provide context for considering protectiveness. It is assumed that risks to the aquatic receiving environment are being handled via another program or action.

2.3.1 Soils and Waste Material

Major components of the remedy for contaminated soils and waste material include:

1. Reduction of surficial As concentrations to below the designated action levels of 250 ppm, 500 ppm, and 1,000 ppm through removal and replacement with clean soil; placement of a vegetative or other protective barrier (e.g. engineered barrier); or a combination of soil cover or in situ treatment, depending on location and land use.

2. Clean up all future residential soils at the time of development that exceed the residential action level of 250 ppm soil As concentration, through the Anaconda-Deer Lodge County (ADLC) Development Permit System (DPS);

3. Clean up all future commercial or industrial areas at the time of development that exceed the commercial/industrial action level of 500 ppm soil As concentration through the ADLC-DPS.

4. Implement institutional controls (ICs) to control land uses, provide educational information to all residents describing potential risks and recommendations to reduce exposure to residual contaminants in soils, and to ensure the long-term viability of the remedy.

5. Reclamation of the soils and waste area contamination by establishing vegetation capable of minimizing transport of COCs to groundwater and windborne and surface water erosion of the contaminated soils and waste areas. This vegetation will also provide habitat consistent with surrounding and designated land uses.

6. Partial removal of waste materials followed by soil cover and re-vegetation for areas adjacent to streams. Removed material will be placed within designated Waste Management Areas (WMAs).

7. Construct an engineered cover over all contaminated railroad bed material within the community of Anaconda to prevent direct contact with, and reduce potential for erosion and transport of, contaminated materials to residential and commercial/industrial areas;

8. Separate the rail bed from residential and commercial/industrial areas with a barrier to restrict access to the rail bed and to control surface runoff from the rail bed through the use of retaining walls and/or curbing; and,

9. Maintain existing ICs to restrict access.

2.3.2 Groundwater

Major components of the remedy for groundwater include:

1. For alluvial aquifers underlying portions of the Old Works and South Opportunity Subareas, clean up to applicable State of Montana water quality standards through use of soil covers and removal of sources (surface water) to groundwater contamination and natural attenuation.

2. For the bedrock aquifers in the Old Works/Stucky Ridge and Smelter Hill Subareas alluvial aquifers in the South Opportunity and North Opportunity Subareas, waiver of the applicable As groundwater standard. The aquifers underlying these subareas cannot be cost effectively cleaned up through reclamation, soil cover, or removal of the sources (wastes, soils, and tailings) of the groundwater contamination. Reclamation of soils and waste source areas with revegetation is required, which may contribute to minimizing As, cadmium (Cd), and Pb movement into the aquifers. This minimization could be via metals in solution complexing with organic matter in the top portion of the soil profile and onto roots and the vegetation using water as it percolates through the soil profile, thereby leaving metals less mobile in the soil.

3. For portions of the valley alluvial aquifers underneath the Old Works/Stucky Ridge, Smelter Hill, and Opportunity Ponds Subareas where groundwater is underlying waste-left-in-place, point-of-compliance (POC) monitoring is conducted to ensure contamination is contained at the perimeter boundary of the designated WMA. Should POC monitoring show a spread of contaminants beyond the boundary of a WMA, treatment options for the groundwater where practicable will be instituted.

2.3.3 Surface Water

Major components of the remedy for surface water include:

1. Reclamation of contaminated soils and engineered storm water management options to control overland runoff into surface waters.

2. Selective source removal and stream bank stabilization to minimize transport of COCs from fluvially deposited tailings into surface waters. Removed material will be placed within a designated WMA.

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Section 3
Risk Evaluation

The primary document on which this review is based is *Final Baseline Risk Assessment, Anaconda Smelter NPL Site, Anaconda, MT, January 24, 1996* prepared by CDM Federal Programs Corporation for EPA (EPA 1996). In addition, two previous risk assessments were reviewed, primarily to evaluate the assumption in the above assessment that As, Cd, copper (Cu), Pb and zinc (Zn) are primary COPCs for the site (*Baseline Risk Assessment for the Old Works/East Anaconda Development Area, August 19, 1993* prepared by Life Systems, Inc. and *Final Draft Baseline Risk Assessment for the Flue Dust Operable Unit, November 15, 1990* also prepared by Life Systems, Inc.).

3.1 Technical Review of Ecological Risk Assessment

The following sections discuss important aspects of the Ecological Risk Assessment for the ARWW&S OU.

3.1.1 Review of Chemicals of Potential Concern

COPCs considered in the evaluation of ecological risks include As, Cd, Cu, Pb, and Zn. These constituents were the same as those identified for human health risk assessments for the Site. The list of COPCs identified in the BERA appears to be appropriate and complete based on available data, and no additional COPCs are likely to contribute substantially to ecological risks.

3.1.2 Review of Receptors of Concern

Ecological receptors identified in the BERA include qualitative general descriptions of likely receptors, such as "plants, grazing herbivores, and other wildlife". Potential ecological receptors include plants, invertebrates, fish [including the endangered bull trout (*Salvelinus confluentus*) as detailed in the Remedial Design Unit (RDU) 10- Warm Springs Creek Remedial Actions-Bull Trout Biological Assessment (BA) (CDM Smith 2014)], amphibians, reptiles, birds, and mammals. Specific wildlife receptors selected as representative receptors comprising a variety of trophic levels for quantitative risk estimations include terrestrial plants, white-tailed deer (*Odocoileus virginianus*), deer mouse (*Peromyscus* sp.), red fox (*Vulpes vulpes*), American robin (*Turdus migratorius*), and kestrel (*Falco sparverius*). Protection of these receptors should provide adequate protection of all other taxa not specifically identified, based on adequate consideration of most major trophic levels (e.g., primary producers, herbivores, omnivores, carnivores). The only major categories of potentially important ecological receptors not specifically identified in the BERA are fish (as consumers of aquatic invertebrates) and piscivorous wildlife. Fish that consume aquatic invertebrates and birds and mammals that consume fish could be at risk if invertebrates and fish have accumulated contaminants from water, sediment, or prey. This pathway is of most concern for chemicals with greater bioaccumulation potential (e.g., Cd).

3.1.3 Review of Exposure Pathways

The BERA identifies the following exposure pathways as those of concern:

- Terrestrial plants exposed to soil (uptake)

- Aquatic plants exposed to surface water and sediments (uptake)
- Aquatic animals exposed to contaminants in surface water and sediments (uptake and direct contact)
- Herbivores and insectivores exposed to contaminated plants, soil, and sediment via incidental ingestion.
- Wildlife exposed to contaminants in surface water via drinking
- Ingestion of plants and insects by primary consumers
- Top or upper trophic level predators exposed to contaminants in prey via ingestion

As stated previously, the most important exposure pathway not considered in the BERA is the ingestion of aquatic invertebrates by fish and ingestion of fish by piscivorous predators. This pathway is critical for bioaccumulative contaminants in sediments and surface water. This pathway may not be critical if it can be demonstrated that aquatic invertebrates and fish have not accumulated site-related contaminants to any significant degree.

3.1.4 Review of Effects Assessment

Surface Water Effects Values

Toxicity of selected metals to aquatic organisms was evaluated and used to estimate risks based upon no-observable-affects-level (NOAELS), lowest-observable-affects-level (LOAELS), and USEPA Ambient Water Quality Criteria (AWQC) (EPA 1992). AWQC for some metals were adjusted based on hardness.

The State has designated uses for Mill, Willow, Warm Springs and Lost Creeks, which flow through the Anaconda Smelter Site, and has promulgated specific Montana Numerical Water Quality Standards accordingly (Table 3-1). These standards are as stringent as, or more stringent than, federal water quality criteria. The most stringent human health or aquatic water quality criterion is applied. The four major creeks must meet human health standards and not allow zones of acute aquatic life toxicity (i.e., mixing zones) or allow aquatic life chronic 4-day average and acute 1-hour (instantaneous) concentrations to exceed DEQ-7 aquatic life criteria.

Table 3-1 Ambient Water Quality Criteria (AWQC) and Montana Numerical Water Quality Standards

COC	AWQC Criterion Acute Concentration (µg/L) [a] (based on values used in the 1996 BERA)	AWQC Criterion Chronic Concentration (µg/L) [a] (based on values used in the 1996 BERA)	Montana Numeric Water Quality Standards (Acute) (µg/L) [b]	Montana Numeric Water Quality Standards (Chronic) (µg/L) [b]
Arsenic	360	190	**340**	**150**
Cadmium	0.8*	0.4*	**0.52***	**0.097***
Copper	4.6*	3.5*	**3.79***	**2.85***
Lead	14*	0.5*	**13.98***	0.545*
Zinc	36.2*	32.3*	37*	37*

Ambient Water Quality Criteria (AWQC) value (value adjusted for site-specific hardness)
[a] AWQC Federal Register. 57 FR 246.60911-60923. December 22, 1992.
[b] Montana Numeric Water Quality Standards – Circular DEQ-7. February 2008.
*Values adjusted to 25 mg/L as $CaCO_3$.
Bolded values are lower than those used in the BERA

As shown in Table 3-2, current AWQC (currently referred to as National Recommended Water Quality Criteria or NRWQC) for As, Cd, and Cu are lower than values used in the BERA. EPA has updated surface water quality criteria since the BERA was completed. The most recent major update is provided in the NRWQC (EPA 2009). For comparison purposes, the table below presents the chronic EPA water quality criteria from 1992 (as described above) and the chronic criteria from the 2009 update, based on hardness of 100 mg/L $CaCO_3$.

Table 3-2 Comparison of AWQC from 1992 and 2009 for Selected Inorganic Constituents

Surface Water COPCs	1992 Chronic AWQC, µg/L (EPA) (based on values reported in 1997 BERA)	2009 Chronic NRWQC, µg/L (EPA)
Arsenic	190	**150**
Cadmium	1.0*	**0.25***
Copper	11.4*	**9.0****
Lead	2.5*	2.5*
Zinc	104.5*	120*

EPA – United States Environmental Protection Agency
COPCs - chemicals of potential concern
AWQC – ambient water quality criteria
NRWQC – national recommended water quality criteria
*Values adjusted to 100 mg/L as $CaCO_3$.
**Value does not follow the aquatic life ambient freshwater quality criteria – copper biotic ligand model (BLM) but rather is value adjusted to 100 mg/L as $CaCO_3$.
Bolded values are lower than those used in the BERA

Sediment Effects Values

The BERA considered a variety of effects values for sediment. These include values from National Oceanic and Atmospheric Administration (NOAA), Ontario, Ingersoll et al. (1996), and several regional values from Milltown Reservoir and the Clark Fork River. The NOAA screening levels are based primarily on marine sediments, and therefore are not fully

applicable to this site. The Ontario low effect level (LEL) and the Ingersoll et al. (1996) effect range-low (ERL) and threshold effect level (TEL) values are relatively similar and are generally considered useful for screening sediments. The regional values are in general substantially higher (less conservative) than those of Ontario or Ingersoll et al. (1996).

Since completion of the BERA, the most well-accepted sediment screening levels are the consensus-based threshold effect concentrations (TECs) and probable effect concentrations (PECs) derived by MacDonald et al. (2000). The table below presents the MacDonald TECs as well as the final sediment effects values used in the BERA. These are the ERM (selected as the NOAEL) and NEC (no effect concentration) (selected as the LOAEL) derived by Ingersoll et al. (1996). As shown below, incorporation of the more current TEC values into the BERA evaluation would likely alter the results of the BERA for screening sediments, and provide a useful comparison to help evaluate 'clean' vs. contaminated sediments (Table 3-3).

Table 3-3 Comparison of Sediment Screening Levels from 1992 to 2009 for selected inorganic chemicals

Chemical (in mg/kg)	MacDonald 2000 Consensus based TEC	MacDonald 2000 Consensus based PEC	Ingersoll 1996 ERM (used in BERA)	Ingersoll 1996 NEC (used in BERA)
Arsenic	**9.79**	**33**	50	100
Cadmium	**0.99**	**4.98**	3.9	8
Copper	**31.6**	**149**	190	580
Lead	**35.8**	**128**	99	130
Zinc	**121**	**459**	550	1300

TEC (threshold effect concentration)
PEC (probable effect concentration)
BERA (baseline ecological risk assessment)
ERM (effect range median)
NEC (no effect concentration)
Bolded values are lower than those used in the BERA

Surface Soil Effects Values

Surface soil effects values used in the BERA include Soil Effects Concentrations taken from the terrestrial Montana Natural Resource Damage Program report (RCG/Hagler, Bailly 1995). These values were derived from site-specific phytotoxicity tests, and are considered relevant and useful for assessing risks to terrestrial plants onsite.

No surface soil effects values or screening levels are included in the BERA that can be used to estimate risks to other ecological receptor categories. Since the BERA has been completed, EPA has developed Eco-SSLs (ecological soil screening levels) for a variety of metals and for a few organic chemicals. Each chemical specific Eco-SSL includes up to four values, depending on data availability. These are screening levels for (1) terrestrial plants, (2) soil invertebrates, (3) birds, and (4) mammals. Site specific phytotoxicity values should take precedence over the phytotoxicity Eco-SSLs for screening purposes. However, Eco-SSLs for the other three receptor categories can be used to screen contaminants in surface soil specifically to consider these receptors. Eco-SSLs for birds and mammals are generally quite low because they consider bioaccumulation and food web effects. In summary, Eco-SSLs are currently viewed as relevant and useful soil screening levels for selecting COPCs in surface soil. It is recommended that Eco-SSLs be used as conservative screening values for comparison to metals concentrations in surface soil. Eco-SSLs, as well as phytotoxicity values from the BERA and

more recent CDM Smith work for EPA (CDM Smith 2012a and USEPA 2013), for selected inorganic chemicals have been listed in Table 3-4 below.

Table 3-4 Eco-SSLs and Phytotoxicity Values for selected inorganic chemicals

Chemical (in mg/kg dw)	Eco SSL Plant	Eco SSL Invertebrate	Eco SSL Bird	Eco SSL Mammal	Soil Effects Concentrations (Phytoxicity Values) Range (pH < 6.5) (in mg/kg) (from BERA)	Soil Effects Concentrations (Phytoxicity Values) Range (pH > 6.5) (in mg/kg) (from BERA)	EPA (CDM Smith 2012a) (in mg/kg)
Arsenic	18	NV	43	46	136-315	224-315	Arsenic=250/ Total of Arsenic, Cadmium, Copper, Lead, and Zinc=1,200
Cadmium	32	140	.77	.36	5.1-20	8.6-40	
Copper	70	80	28	49	236-750	1062-1636	
Lead	120	1,700	11	56	94-250	179-250	
Zinc	160	120	46	79	196-240	379-500	

dw (dry weight)

3.1.5 Review of Background Levels

Soils

Several thousand soil samples were collected prior to remedial action (RA) in the ARWWS OU to determine concentrations of As, Cd, Cu, Pb, and Zn (ARCADIS 2015). Prior to RA, the mean As concentration in surface soils was determined to be 624 mg/kg, though individual values ranged up to 37, 238 mg/kg (Table 3.5). Cadmium, Cu, Pb, and Zn averaged 11 (1.0-964); 2,290 (1.4-183,200); 459 (2.7-20,000); and 1,698 (2.6-61,600) mg/kg, respectively. Several hundred samples were collected and analyzed following the RA to track changes in concentrations of these COPCs, notably As. Samples analyzed post-RA showed that COPCs concentrations decreased by 52 to 77 per cent. Samples collected from RA As-Built centroids, representing greater coverage of the sampling polygons, showed even greater decreases of COPCs, with reductions averaging between 65 and 94 per cent relative to pre-RA conditions. Despite reductions in soil concentrations, there are still elevated concentrations of Pb (refer to Figure 3-3 of the ARCADIS report).

While background values for Montana, as well as the United States, vary based on the reference study, reference values for As typically range between 5 and 30 mg/kg in soil (Table 3-5). Samples from the low and high contamination areas had soil As concentrations between 10 and 30 times greater than the regional and national averages. The specific magnitudes for Cd, Pb, Cu, and Zn differed, though the patterns were comparable as with As, with concentrations in the contaminated sites being three to 30 times greater than national averages. The greatest exception was for Cu for which concentrations were approximately 50 times greater than national averages, though these were specific to areas with pH above 6.5.

Elevated concentrations of COPCs in the ARWWS OU influence the success and persistence of revegetated areas. The relationships between soil properties, COPC concentrations, and vegetation parameters were assessed at 30 sites in 2011 (USEPA 2013). Overall, no specific COPC was negatively correlated with the Land Reclamation Evaluation System (LRES) scores.

LRES scores are a measure of remediation success based on vegetation and a score for erosion and potential transfer of contaminants. However, total vegetation cover by acceptable species was negatively correlated with the sum of total soil metals (e.g., As, Cd, Cu, Pb, and Zn), suggesting that the total metal load is much more influential in remediation success than any individual COPC. Both total As and Pb were significantly, negatively correlated with the vegetation component of the LRES score (i.e., excluding the erosion and contaminant transport components). These relationships were strongest at near-neutral soil pH values, but were subtle at lower pH values as acidic soils influence which plants can colonize and subsequently survive, as well as influencing the bioavailability of metals. In conjunction with the 2011 investigation, EPA developed the arsenic and soil metal indices (CDM Smith 2012a), which are being used for on-going remedial decisions and to manage remediated land at the Site using the Agency-approved vegetation management plan (Atlantic Richfield 2013).

Vegetation

Background levels of COPCs in vegetation are not provided, though there are NOAELs and LOAELs related to herbaceous and shrub layers. Concentrations in shrubs did not exceed their respective LOAELs determined in the final BERA (CDM 1997), in which concentrations from vegetation and soil sampling areas (VA) from the site were determined. The two VAs with concentrations exceeding NOAELs were VA17 and VA21. VA17 is adjacent to Mill Creek Road in the South Opportunity RDU 6 subarea and historically received stack emissions and windblown tailings. VA21 is adjacent to Highway 1 and south of the A Cells of the Opportunity Tailings Pond. It is 2.8 miles east-southeast of the Lower Works portion of the Old Works area and 2.1 miles northeast of the Washoe stack. Arsenic concentrations in shrubs from VA17 (5.2 mg/kg) exceeded the NOAEL (4.01 mg/kg) but not the LOAEL (12.1 mg/kg) (Table 3-5). Within the herbaceous layer, As concentrations from VA17 and VA21 were 19.6 and 13.9 mg/kg, respectively, exceeding the LOAEL. Herbaceous Cu concentrations in VA21 (41.5 mg/kg) were greater than the NOAEL (39.7 mg/kg) but lower than the LOAEL (99.3 mg/kg).

Surface water

Nearly all of the surface water samples from Dutchman Creek showed elevated concentrations of As well above the human health risk-based surface water standard of 10 µg/L (CDM Smith 2012b) (Table 3-5). Of the ten samples collected by the United State Fish and Wildlife Service (USFWS) in 2000, seven exceeded 10 µg/L, ranging from 11 to 45 µg/L in ponds and channels around Dutchman Creek. None exceeded the 2009 Chronic NRWQC level of 150 µg/L.

Groundwater

Similarly, groundwater sampling by Atlantic Richfield in 2007 revealed As concentrations ranging from 63.7 to 354 µg/L. All these samples exceeded the state and EPA drinking water limits of 10 µg/L and many exceeded the 2009 Chronic NRWQC level of 150 µg/L.

Wildlife

Stomach contents from deer mice (*Peromyscus maniculatus*) had As and Cu concentrations of 6.0 and 21 mg/kg, respectively, yielding HQs of 13.5 and 11.1 (Hooper et al. 2002) based on the dietary LOAELs established by CDM (1997). Rodent carcasses as food for red foxes (*Vulpes vulpes*) had mean As concentrations of 1.3 mg/kg, exceeding the LOAEL of 0.2 mg/kg and the associated HQ of 5.9. For passerines, Cu and Pb concentrations in food items were 45 and 4.9 mg/kg, respectively, yielding HQs >1, regardless of the source of the dietary LOAEL (Hooper

at al. 2002). NOAELs for Cu and Pb ranged from 4.6 to 6.1 and from 1.0 to 1.8 mg/kg, respectively. The USFWS analyzed macroinvertebrates used as food by passerines in the Dutchman area and only found that Cu concentrations (11 mg/kg) resulted in an HQ > 1 (HQ=1.4-1.7; NOAEL=4.6-6.1 mg/kg).

Table 3-5 Summary of COPCs values in soils, vegetation, and water

	As (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Zn (mg/kg)
Range of US Soil Mean Values	5-**30**	**0.53-2.9**	24-25	**20-40**	**50-64**
Soils[1] Pre/Post RA	**624**±1,759/ **152**±176	**11**±32 /**5.2**±3.3	**2,990**±7,847 /**550**±728	**459**±936 /**104**±476	**1,698**±4,030/ **398**±675
Vegetation-Herbaceous[2] VA17/VA21	**19.6**[3]/13.9[3]	1.2/0.55	39.3/41.5[4]	14.5/5.2	81.9/55.9
Vegetation-Shrubs[2] VA17/VA21	5.2/3.6[4]	0.54/0.53	38.5/7.7	6.8/1.4	57.1/22.3
Surface Water[5]	<1–**256** µg/L	<0.1 µg/L	1.6-6 µg/L	<1-2 µg/L	<5-10.6µg/L
Groundwater[5]	0.5-82.6 µg/L	0.03-0.61 µg/L	1.4-5.07 µg/L	0.7-1.3 µg/L	5.1-380 µg/L

[1] Values represent mean ± SD of value before and after remediation activities and were obtained from Table 3.1 from the ARCADIS 5-year review.
[2] Data are reported means from Table 3-2 from the ARCADIS 5-year review. Those data are summarized from the ROD (1998).
[3] Mean exceeds wildlife ingestion LOAEL EC (12.1 mg As/kg) from the BERA (CDM 1997).
[4] Mean exceeds wildlife ingestion NOAEL EC (4.01 mg As/kg) from the BERA (CDM 1997).
[5] Data are from Tables E-1 and E-2 in the Dutchman Creek Final Design Report (CDM Smith 2012b)
Bolded values exceed values listed in Table 3-2 or Table 3-4

3.1.6 Review of Atlantic Richfield Evaluation of Remedy Effectiveness at the ARWW&S Operable Unit (OU): Five Year Review

The current five-year review, which represents the fifth five-year review since the initial ROD in 1998, summarizes cumulative data on soils, vegetation, water, and biota to date as presented in a series of five-year review summary reports. These summaries also included a technical memorandum provided by Atlantic Richfield that presents an evaluation of additional data collected based on recommendations from the previous five-year reviews, the BERA, and the post-ROD BERA risk modelling analysis. Biomonitoring reports from Texas Tech (Hooper et al. 2002), Montana Tech (Black 2011), and the USFWS assessment of the Dutchman Riparian Lands (USFWS 2014) were incorporated into the 2015 five-year review as were the results of the 2013 investigation by ARCO and EPA on phytotoxicity (USEPA 2013). Data from these reports were evaluated, compared to literature values for COPCs, and used to evaluate risk to multiple receptors as well as the remedy effectiveness determinations, and updating/integrating results for ecological risk. Dale Hoff, the US EPA Region 8 Toxicologist at the time of the Texas Tech study, identified Pb as the primary COPC for wildlife, and determined that As and other heavy metals were not bioaccumulating to a significant degree

in upper trophic levels. As such, the current ARCADIS review of the remedy effectiveness focuses mainly on Pb.

Combining the cumulative soils, sediment, vegetation, and biomonitoring data, ARCADIS concluded that none of the COPCs would yield deleterious effects on terrestrial receptors. Based on their multiple lines of evidence, including biomonitoring studies, historical data, literature reviews, and updated food web assumptions, none of the terrestrial populations discussed are stated to be at risk. In fact, ARCADIS states that risks to the various populations are determined to be *de minimis*. As such, ARCADIS concludes that no on-going, long-term monitoring is required as areas are becoming vegetated, risks to terrestrial receptors are low, and there appears to be no lasting population effects.

Concerns with Ecological Risk Summary Technical Memorandum: CDM Smith

In their evaluation of the five-year review ecological risk summary technical memorandum prepared by ARCADIS, CDM Smith scientists identified several components of the review that contradicted the assumptions made by ARCADIS. Essentially, CDM Smith does not agree with conclusions of *de minimis* risk and that on-going monitoring is no longer needed. Rather, concentrations of some COPCs in soils and sediments, vegetation, and groundwater and surface water, particularly Pb, As, and Cu, are still elevated relative to selected benchmark concentrations. Exposures to these elevated concentrations could lead to direct adverse effects as well as indirect effects as these contaminants migrate between exposure media (i.e., surface water, groundwater, soils, sediments), and through food webs to upper trophic levels (e.g., bull trout or piscivorous predators).

The ecological risk summary technical memorandum prepared by ARCADIS focused on terrestrial ecological risk. Aquatic ecological risk was determined to be beyond the scope of the Atlantic Richfield review, as discussed during a February 2015 meeting between EPA and Atlantic Richfield. Aquatic systems that may be indirectly linked to the Anaconda Smelter NPL site remains an ecological risk concern. According to the bull trout biological assessment (CDM Smith 2014), a portion of Warm Springs Creek is listed as impaired by Montana DEQ due to multiple stressors, including elevated concentrations of heavy metals (i.e., As, Cd, Cu, Fe, Pb, and Zn). Within that same report, it is stated that remedial actions are being implemented due to tailings adjacent to Warm Springs Creek eroding and impairing water quality. Concentrations of Cu entering the surface water exceed chronic aquatic life water quality standards. Situated higher up the food chain, bull trout can be impacted by cumulative bioaccumulation of COPCs across multiple media. As such, impacts to the bull trout could result from detrimental conditions in terrestrial habitats to which these aquatic systems are connected.

Such effects are not limited to bull trout. A benthic macroinvertebrate bioassessment was performed in the Upper Clark Fork River in 2012 (AECOM 2013). Regardless of assessment methodology, all sites sampled along Silver Bow Creek exhibited some degree of impairment, and this held true based on metals tolerance indices as well as biointegrity/bioassessment rankings. Locations along Warm Springs Creek and Lost Creek were “slightly impaired” based on EPA rankings, while all 9 sites in Lost, Mill, Warm Springs and Willow Creeks were either “slightly impaired” or “moderately impaired” based on Montana DEQ rankings. The Dutchman Creek High Arsenic Area Final Design Report (CDM Smith 2012b) also points out that surface water concentrations of As exceed drinking water quality standards at many locations, and groundwater As concentrations are elevated in the shallow portion of the alluvial aquifer and

in geothermal water close to the Warm Springs State Hospital. Groundwater is contaminated by nearby soils. The contaminated groundwater plume transports contaminants which then influence stream reaches, which can then flow offsite. Another possibility is that the surface water contaminated by groundwater may be used for irrigation, thereby keeping the COPCs, particularly As, within the system.

Other concerns include interpretation and analysis of the bioassessment studies in the five-year review. For example, there are weak relationships between passerines and prey items analyzed by Hooper et al. 2002. Concentrations of COPCs in prey items, blood, liver, and kidney tissue were compared to soil concentrations. However, some of the prey items have aquatic larval/juvenile stages, indicating that those prey items would be more exposed to contaminated sediments than soils. Similarly, in the 2014 USFWS report on the Dutchman Riparian Lands, waterfowl blood COPCs concentrations were compared to concentrations in invertebrates, though plants (which were not analyzed) comprise a significant portion of waterfowl diets. Further, statistical interpretations of the USFWS data are of concern. Additionally, the relationship between As concentrations in invertebrates and in soil appear to be minimized, despite the R^2 value of 0.53 (the report stated that that 48% of the variability is explained by factors other than soil).

In section 4.1 of the 2015 ARCADIS evaluation, COPCs concentrations in food were used to estimate risks to different receptors based on dietary TRVs. There doesn't appear to be a transparent approach for selection of TRVs, which can lead to either elevated or suppressed HQs. For example, when BERA TRVs are exceeded, Eco-SSL LOAEL TRVs are included for comparison, though when the BERA TRV is not exceeded, no other values are included. It would be beneficial to include a range of TRVs in the report, including species-specific values where available, to provide a range of HQs. However, ARCADIS states that the HQ values in some instances still are equal to or exceed 1.0.

Section 4.2 includes the literature review that describes a background soil Pb concentration at a site in North Idaho of 1300 mg/kg. Although this value is not stated to be fully relevant for the Anaconda site, it is implied that it may be applicable. Use of this excessively high value as background is inappropriate and unacceptable.

In section 4.3, ARCADIS justifies the use of specific TRVs based on studies with soluble salts in drinking water, which could be more bioavailable and more toxic. It may not be appropriate to base assumptions of terrestrial risk to total metals on toxicity of soluble salts in aquatic systems.

In section 4.4 of this report, correlation coefficients are reported as "weak," though no statistical support (i.e., p values) is provided. This comment also applies to the reported R^2 values in section 5, which discusses weight-of-evidence risk by metal.

Overall, there are multiple instances of elevated levels of individual COPCs in different receptors, including food items, tissue, blood, etc. Based on the phytotoxicity report which concluded that the total metal load may be more influential on an ecosystem scale than individual concentrations alone, the potential for risk still exists and warrants continued biomonitoring.

<u>Concerns with Ecological Risk Summary Technical Memorandum: USFWS</u>

The USFWS reviewed the ARCADIS document and offered comments. Comments are focused on Pb, the COPC the USFWS appears to believe is most likely to have impacts to ecological receptors on the site. The USFWS did not comment on interpretations of other metals and As. CDM Smith agrees that Pb that is an important COPC, but other metals should not be excluded from evaluation. The findings of the 2013 report on phytotoxicity (USEPA 2013) reveal that total metal concentrations (i.e., the sum of all total metal concentrations) adversely affect the established of vegetative cover by desirable species. Therefore, a rationale exists for including all COPCs.

In the Texas Tech bird and mammal biomonitoring study (Hooper at el. 2002), all small mammal study sites were located on areas where remedies were already achieved (e.g., in naturally vegetated areas previously subject to remediation). No unremediated areas were assessed, potentially underestimating risk. CDM Smith agrees with the USFWS's assessment here. While ARCADIS states that naturally vegetated areas have comparable ranges of COPCs in the soil, the fact that these sites are presently vegetated suggest a different set of cumulative factors influencing recovery trajectories.

The USFWS stated that the footnote on the bottom of page 13 with respect to the sub-clinical effect range in bird blood is reflective of Columbiformes only, and excludes Anseriformes, Falconiformes, and Passeriformes, thereby not likely being protective of certain taxa. ARCADIS responded to this comment saying that the lower end of the range was the same for other bird types (i.e., Anseriformes and Falconiformes). ARCADIS further states that the reference did not provide a range for Passeriformes, and that no evidence or insinuation was available that the range would differ for these birds. CDM Smith agrees with the USFWS on this issue that the lack of data for Passeriformes cannot support conclusions that Passeriformes sensitivity to metals is similar to that of other birds. Avian toxicity data are sparse for several metals and a goal of protection of non-tested taxa suggests a degree of conservatism is prudent. At a minimum, ARCADIS should state that toxicity data on sub-clinical effects due to metals exposures were unavailable for Passeriformes.

The USFWS stated that true risks associated with exposure to site COPCs were not captured by the Texas Tech report (Hooper et al. 2002), primarily based on the different feeding strategies of the passerines (e.g., soil foraging, invertebrates taken from air or trees, etc.). Specifically, of the four passerines sampled, only the European starling forages in soil, and no starlings were collected in the Smelter Hill area. This applied also to the weight-of-evidence risk by metal. ARCADIS stated that food items were collected directly from birds and are therefore representative of what the birds were actually eating. ARCADIS further responded to the USFWS's comment by stating that starlings were found nesting in at least one site in 1999 that was unremediated, unvegetated, and had elevated soil COPC concentrations, and no morphological or reproductive effects were noted in this location or any other. CDM Smith agrees with the USFWS in that it is difficult to make assumptions based on starlings in "at least one" location with elevated soil COPC concentrations.

In section 3.2.3 (2014 USFWS Dutchman Assessment), it is reported that the Texas Tech (Hooper et al. 2002) study "provided clear empirical evidence that wildlife populations were not at risk (ARCADIS 2015)." However, the Dutchman Riparian Lands were not sampled in that study, and risks have not been evaluated previously in that location. ARCADIS justified this conclusion by stating that although elevated concentrations of Pb (>650 mg/kg) were detected in Dutchman soils, wildlife populations in the Texas Tech study (Hooper et al. 2002) were unaffected by Pb soil concentrations similar to or greater than those in Dutchman. CDM

Smith agrees with the USFWS and disagrees with the rational provided by ARCADIS. With the Dutchman area being >70% jurisdictional wetlands, it will have different soil physicochemical properties, vegetation, and animal communities. The finding of apparent low or no ecological risk in other areas dominated by upland soils does not support conclusions of no ecological risk in areas dominated by wetland soils.

Based on information in Section 4, the USFWS states that risk is not being accurately characterized using the currently selected food items. All food items within the Dutchman area were collected from locations where Pb was <650 mg/kg; a value that EPA considers a risk threshold for passerines. Only one site out of 60 XRF readings exceeded this threshold (675 mg/kg). Further, in regards to the small mammal studies, no samples were collected from areas that were not remediated, which exist on Smelter Hill. All samples were collected from remediated/vegetated sites, thereby presenting a data gap in the risk characterization. ARCADIS responded that risk was adequately characterized since blood and invertebrate samples were collected where birds were found. Further, soil Pb concentrations in the small mammal study ranged as high as 3,650 mg/kg in some sites, and that after full remediation only a few locations will have elevated Pb concentrations. However, this assumption is based on the spatially interpolated map, which is generated solely based on concentration and distance from other sampling points. CDM Smith does not fully support making assumptions based on the spatially interpolated map, since those maps do not take into account temporal lag, spatially complex processes, or landscape-level activities (e.g., erosion, fires, development, etc). CDM Smith agrees with the USFWS on this particular point.

In section 4.3 ARCADIS states that no blood Pb level exceeded 0.5 mg/L, though the USFWS feels that, as stated above, the subclinical poisoning value of 0.2 mg/kg should have been used for migratory bird protectiveness. Again ARCADIS stated in response that there is no evidence to suggest that the subclinical level differs between passerines and other birds, and that most of the blood samples had Pb concentrations below this level. CDM Smith supports the use of the 0.2 mg/kg threshold for all birds, including Passerines, unless Passerine-specific toxicity data are provided to support higher values. Absence of evidence is not evidence of absence and Passerines should not be assumed to be more or less sensitive to metals exposures than any other avian group. CDM Smith therefore supports the USFWS's position on the use of the 0.2 mg/kg value for protection of migratory birds.

The USFWS states that the bioavailability of Pb can change following ingestion by passerines through pH-interactions in the gut. ARCADIS responded that the specific text was focused only on soil bioavailability. CDM Smith suggests that risk associated with ingestion (due to the acidic gut environment) should at least be noted even if it is not the primary focus of this portion of the evaluation

Overall, the USFWS disagrees with ARCADIS, and feels that additional risk-based chemical- and bio-monitoring are warranted. The USFWS cites the Statutory Determination in the Record of Decision (EPA and MTDEQ 1998), "Since hazardous substances above health-based risk levels will remain on site (in WMAs), periodic reviews will be conducted throughout the remedial action and upon its completion to ensure that the remedy continues to provide adequate protection of human health and the environment." The USFWS emphasizes that based on new information on risks of Pb to passerine birds that feed on ground dwelling insects, especially vermivores, monitoring of the remedy needs to be completed to ensure protection of the environment. CDM Smith agrees with the USFWS on the need for future chemical and biological monitoring. This agreement is based primarily on significant

uncertainties and data gaps, and not solely on concerns over ecological risk from Pb exposure. A number of factors point to the need for future monitoring. For example, there were elevated COPCs in soils, along with detectable levels in multiple media and receptors, apparent impacts to vegetation in some areas with higher metals concentrations, and findings that fish seem affected by multiple metals in Warm Springs Creek. Collectively, this suggests that COPCs may be transported from one location to another, and between media. The possibility of such transport supports the need to monitor future exposures and risk over time.

3.2 Summary of Risk Assessment Evaluation and Protectiveness Statement

Risk-based target clean-up goals were set for the Anaconda Smelter NPL Site in a series of risk assessments that culminated in a comprehensive assessment in 1996 that addressed all areas surrounding primary sources areas (Smelter Hill, Opportunity Ponds, Old Works area, etc.). The Final Baseline Ecological Risk Assessment (BERA) was completed in 1997.

Clean-up targets for As in soil of 250 mg/kg, 500 mg/kg and 1,000 mg/kg were established for residential, commercial and agricultural/recreational land uses. These targets were used in the ROD to define, in part, the remedy for non-source areas. No other quantitative clean-up targets (e.g. for protection of ecological receptors) were defined in remedies for ARWW&S OU.

Review of risk assessments focused on several issues, as discussed in Section 1. Each of these issues and results of the analyses are summarized below.

- Identify if changes in land use or in the anticipated land use on or near the OU could affect remedy implementation.

Risks to soil-associated ecological receptors (e.g., terrestrial plants, soil invertebrates, small burrowing mammals) are evaluated based on land uses and areas that, for the most part, appear to be currently relevant. It is important to recognize that risks to ecological receptors (in this case, soil-associated organisms) consider population- and community-level impacts, and adverse effects to individual organisms are not considered critical unless the organism in question is a species with special status (e.g., threatened or endangered). Therefore, some loss of individual organisms can generally be tolerated as long as populations and communities are protected from adverse effects.

Risks to other types of ecological receptors that may be exposed indirectly to soil-associated contaminants are either incompletely evaluated or ignored altogether. These receptors may include (1) higher trophic level organisms exposed to bioaccumulative contaminants through dietary pathways (e.g., consumption of metals-contaminated plants and/or animals), and (2) aquatic and semi-aquatic receptors living in or closely associated with down gradient surface water and sediment that may have received contaminated soil via wind or surface erosion.

- Identify if changes in physical site conditions have occurred at the Site that could affect risk.

Many changes in physical conditions have occurred within the Site, primarily due to remediation activities. For example, a large part of the Old Works/East Anaconda OU has been remediated and re-developed as a golf course and large parts of the ARWW&S OU have been remediated for use as livestock pasture. Since the major changes to the Site are a result of remediation, these changes should not compromise the protectiveness of the remedies.

With regard to ecological risks, changes in physical condition have in some cases affected risks in a complex manner. Suitable habitat for some receptors has been reduced or eliminated, which is generally considered a negative outcome. However, reducing the amount of suitable habitat in this case reduces exposure potential. For example, a golf course can be deemed suitable foraging area for some species such as American robin (*Turdus migratorius*), but most other ecological receptors will avoid the developed golf course area because cover and foraging areas are limited. Conversely, many acres have been reclaimed in the ARWW&S OU and this has improved wildlife habitat, potentially exposing wildlife to residual COCs (e.g., burrowing mammals). Based on the site-specific wildlife study conducted after the BERA, an increase in risk to wildlife is not anticipated based on changes in the physical conditions at the Site due to implementation of the Selected Remedy.

- Determine if new ecological exposure pathways or receptors have been identified.

The ecological risk assessment addressed a range of receptors including plants and terrestrial and aquatic biota. Exposure pathways evaluated in the BERA included direct contact with contaminated media and indirect exposure via ingestion of contaminated prey (i.e., food web effects). In some cases these evaluations appear to be incomplete. For example, risks to herbivorous birds and mammals associated with soil exposures are not fully evaluated. Also insufficiently evaluated in the BERA are risks to piscivorous predators [including aquatic piscivores such as bull trout and others such as mink (*Neovision vision*), great blue heron (*Ardea Herodias*), belted kingfisher (*Megaceryle alcyon*), osprey (*Pandion haliaetus*), and bald eagle (*Haliaeetus leucocephalus*)] These receptors may be indirectly exposed to contaminants originating onsite because of contaminant migration to downgradient surface water and sediment. This omission may not be important if it can be demonstrated that fish have not significantly accumulated site-related contaminants and are not exhibiting behavioral changes such as stream avoidance or inhibited predator-avoidance. If fish tissues have accumulated significant concentrations of bioaccumulative COPCs (e.g., Cd or Pb) or behavioral anomalies are suspected, then this pathway may warrant further investigation.

- Determine if new contaminants or contaminant sources have been identified.

Since the early 1990s BERAs for the Site have been focused, on As, Cd, Cu, Pb, and Zn. To date there is no evidence that this focus is inappropriate.

Ecological risks associated with primary COPCs identified for this site (As, Cd, Cu, Pb, and Zn) are likely to be the major contributors to ecological risk. High As is frequently associated with other elevated COPCs. Any incremental risks contributed by other less well identified contaminants (e.g., other inorganic chemicals such as barium, manganese, thallium, or vanadium) are likely to be low and relatively unimportant. Addressing risks from the major COPCs identified will likely address any risks associated with other contaminants not fully described or identified.

- Determine if any changes in the toxicity values for contaminants of concern might affect risk estimates significantly.

Several changes have occurred in the derivation and use of media- and chemical-specific ecological screening levels (ESLs) since the BERA was completed. As described previously (Table 3-1), EPA has modified and in general lowered the chronic water quality criteria for several inorganic chemicals, especially Cd. Of major concern for this evaluation is the substantial reduction in the criterion continuous concentration (CCC) for Cd in surface water.

Well-accepted freshwater sediment ESLs are now available to allow for a more certain assessment of risks for sediment-associated biota, primarily benthic macroinvertebrates. Specifically, the consensus-based threshold effect concentrations (TECs) of MacDonald et al. (2000) can be used to verify the results of the screening and preliminary risk estimation as presented in the BERA. Probable effect concentrations (PECs) from the same source can be used to evaluate the likelihood of significant or more severe effects on benthic macroinvertebrate communities. Finally, the regional phytotoxicity values used in the BERA for screening surface soil contaminant concentrations are valid and relevant. Ecological soil screening levels (Eco-SSLs) derived by EPA since the BERA was completed could provide another useful source of soil screening values to ensure that risks to other soil associated organisms (i.e., other than terrestrial plants, and including soil invertebrates, birds, and mammals) are adequately evaluated.

- Determine if exposure parameters used in the risk assessment remain valid.

Review of default and site-specific exposure parameters used in the calculation of ecological risks did not reveal any instances where such parameters did not appear valid. Sediment ingestion rates for various passerines could be used to update calculations from the BERA and identify other potential pathways of exposure. Uncertainties, discussed previously, coupled with professional judgment suggest that exposure parameters be reconsidered at some future time as new biomonitoring results become available.

- Identify any other information that could call into question the protectiveness of the remedy.

Based on all the studies referenced earlier, there does appear to be some uncertainty with regard to the remedy sufficiently addressing the total metals load on the environment. Failure to continue monitoring could result in the failure to identify and mitigate currently unrecognized ecological risks.

3.2.1 Recommended Biomonitoring

Currently, the condition of re-established plant communities in remediated areas is monitored and inspected in accordance with the Agency-approved Anaconda Smelter Site vegetation management plan (Atlantic Richfield 2013). A key aspect of the inspection of remediated areas is assessment of whether areas meet remedial action performance standards. Sites that are compliant with standards are considered successfully reclaimed. To date, remedial action to address soil contamination and contaminant movement has been implemented on more than 11,500 acres of open space. Of this area, approximately 10,724 acres (93%) meet performance standards and thus meet remedial action goals set forth in the ROD. These areas are considered protective of human health and the environment. It is expected that full implementation of the remedial action for the ARWW&S OU within the next five-year review period will result in a reclamation remedy that is fully protective.

Elevated concentrations of hazardous metals continue to be observed in some surface soils (in both remediated and unremediated areas), sediments, and surface water within or near the Anaconda Smelter NPL site. These observations along with the environmental persistence of metals indicate the need for long-term monitoring. Although the extensive remediation conducted to date has significantly limited contaminant movement, it is likely that metal contaminants will migrate over time, potentially affecting nearby terrestrial and aquatic

environments. A focused program for biomonitoring of these environments is therefore prudent and necessary to evaluate the success of current and future remediation efforts.

Biomonitoring of aquatic environments can likely be integrated into existing monitoring programs. For example, current monitoring of salmonid fish (known to be sensitive to metals exposures) downstream of Anaconda (see State of Montana, Natural Resource Damage Program [Geum 2015], Montana's State Wildlife Action Plan 2014) can be used to support evaluations of the success of remediation of Anaconda Smelter NPL site. Salmonid fish are considered appropriate representative receptors for monitoring the downstream aquatic system because they integrate exposures to sediment, groundwater, surface water, and prey. Also, metals concentrations in salmonid fish can be used to help evaluate risks to piscivorous upper trophic level receptors such as osprey, mink, and bald eagle. Useful salmonid fish-related metrics for such evaluations might include, for example, behavioral anomalies such as reduced predator avoidance and increased stream avoidance, abundance and diversity of fish communities downstream of Anaconda, and concentrations of metals in fish tissue collected downstream of Anaconda. Comparisons to similar data collected from reference/upstream locations can be used to help determine sources/locations of metals in abiotic exposure media to which fish are/can be exposed. Current and recent monitoring data will provide useful information, not only to the effectiveness of remediation on-site, but across greater spatial and temporal scales of connectivity.

Alternatively, or additionally, benthic macroinvertebrates (BMI) can serve as useful representative aquatic receptors in a long term biomonitoring program. Being less mobile than fish, they can be linked more closely to exposure areas; therefore, location by location comparisons of BMI community metrics (e.g., those associated with abundance and taxa richness) can provide insight into likely sources of metals to downstream aquatic environments.

Biomonitoring of terrestrial environments is associated with greater challenges than biomonitoring of aquatic environments because there is no clearly defined end receptor (such as higher trophic level fish or BMI in aquatic environments) that can be linked to source areas of concern (i.e., Anaconda Smelter NPL site). A wide variety of reptiles, birds, and mammals are likely to be linked to Anaconda soils via direct contact and/or dietary exposures. No single species of reptile, bird, or mammal is likely to be strongly or primarily linked to metals in site soils or metals in likely food items. In contrast to aquatic systems, biomonitoring of terrestrial environments may be best focused on lower trophic level receptors. For example, monitoring of metals concentrations in terrestrial plants and/or soil-associated invertebrates, or direct measurement of metals in soils, will likely result in higher confidence results than monitoring avian or mammalian tissues for metals.

Section 4
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Appendix D

Anaconda-Deer Lodge County Institutional Controls Status Report

2015 Five Year Review
Summary of Institutional Controls Process since Last (2010) Five Year Review
Anaconda-Deer Lodge County (ADLC)

Anaconda-Deer Lodge County – Status report to:
EPA, MDEQ & AR
ADLC Chief Executive: Connie Ternes-Daniels, 406-563-4000,
ctdaniels@anacondadeerlodge.mt.gov
Period of Performance: 2011 - 2015

Development Permit System and other local permits

The Interim Institutional Controls Plan (IICP) has greatly advanced over the last five years. Previously, the Superfund program focused its attention on residential soil sampling and creating an ADLC Soil Sampling and Analysis Plan (SAP) for unclassified properties within the Community Soil Operable Unit (CSOU). Since 2011, the program has focused on providing field oversight and performing soils routing for projects authorized through the Development Permit System (DPS) and other local permitting (i.e. General Utilities and Street Opening Permit (GUS)). The Superfund program discontinued lab based soils analysis and began utilizing a Field Portable X-Ray Fluorescence (FPXRF) tool according to its Soil Sampling and Analysis Plan (SAP). The Superfund Program uses the FPXRF as the primary soil-screening tool for determining soil arsenic and lead concentrations, and subsequent decision-making requirements associated with the DPS and draft Institutional Controls Management Plan (ICMP). The Superfund Program works closely with the County's Planning Department to guide developers through the Superfund protocols required for their specific development. This process was developed to both encourage re-development of properties and protection of human health and the environment. In the past five years, the Superfund program has reviewed 724 local permit applications of which 594 or 82% were located within the Superfund Overlay. One hundred and five (105) of these permit applications affected existing remedial structures. During this time, the number of permits reviewed has increased yearly. Through continued cooperation with the Planning Department, the Superfund Program expects that trend to continue. A summary of the local permits are detailed below in **Tables 1 & 2**. Attached Figures 1 through 4 show the locations of permits within the Anaconda Urban Area and countywide that were reviewed by the Superfund Program.

Currently, IICP sampling and FPXRF results are used for field oversight and soils routing. This data has been spatially incorporated into the County GIS database and is available upon request. The goal of the County's DPS and GUS permits is provide guidance for development in areas with known or suspected elevated concentrations of arsenic and lead within or surrounding the Anaconda Smelter Superfund Site.

Table 1. 2011 - 2015 DPS Summary

Anaconda - Deer Lodge County
Interim Institutional Controls Program (IICP)
Administrative Development Permits, Major Development Permits

Description	2011	2012	2013	2014	4/8/2015
Total number of Development Permits	108	113	140	152	21
Total number of Major Development Permits	2	1	6	4	3
Number of permits within the Superfund Overlay	79	80	120	129	19
Number of new residential construction	9	5	5	5	2
Number of permits on remediated property	29	9	23	19	2
Number of permits requiring an ICWP	12	17	25	24	4
Number of permits requiring a Certificate of Compliance	25	36	36	29	7
Number of commercial/industrial permits	25	26	32	34	4
Total number of site visits performed	271	559	794	688	204
Number of permits incorporated into GIS	0	114	146	156	24

Table 2. 2011 - 2015 GUS Summary

Anaconda - Deer Lodge County
Interim Institutional Controls Program (IICP)
General Utilities and Street Opening Permit (GUS)

Description	2011	2012	2013	2014	4/8/2015
Total number of General Utility Street Opening Permits	NA	32	58	65	19
Number of permits within the Superfund Overlay	NA	30	56	62	19
Number of permit on remediated property	NA	6	8	7	2
Number of permits requiring ICWP	NA	6	11	7	2

Note: County Ordinance No. 222 creating the GUS permit was adopted in September, 2011.
IICP started reviewing these permits in 2012.

Dust

An interior and attic dust characterization study was completed in 2007 and the selected remedy was included in a 2013 ROD amendment to the CSOU Record of Decision (ROD). Currently residents who contact the Superfund program with dust concerns are added to a waiting list for sampling and remedial activities to be completed under Atlantic Richfield's (AR) CSOU Remedial Action Work Plan (RAWP) which is currently undergoing agency review. In addition, residents are referred to the CPMP Program for information on reducing risks associated with lead and arsenic exposure.

Domestic Wells

New domestic wells within the county require a permit through the County's Environmental Health Department. In conjunction with the Well Installation Permit the applicant is required to obtain an Administrative Development Permit (ADP) through the County's Planning Department. The Superfund program is notified of the well permit application and provides well drilling guidance to the resident. After processing the permit application the Montana Bureau of Mines and Geology (MBMG) is notified of the new well and all new wells are sampled prior to use. If elevated levels

of arsenic are present well is addressed under the Domestic Well Monitoring Plan. The county periodically follows up with MBMG and Montana's Ground Water Information Center (GWIC) for completed well logs and the associated sampling results. The Superfund program also provides well information on existing wells if a resident or potential property purchaser inquires. A summary of Well Installation Permits are detailed below in **Tables 3**.

Table 3. 2011 - 2015 Well Installation Permit Summary

Anaconda - Deer Lodge County
Interim Institutional Controls Program (IICP)
Well Installation Permts

Description	2011	2012	2013	2014	4/8/2015	Total
Total number of Well Installation Permits	9	9	12	15	5	50

Community Protective Measure Program (CPMP) and Soil Swap

The Community Protective Measure Program was in its infancy in 2011 and had not been fully implemented or developed. During the past several years, the Superfund program has been developing the CPMP and increasing the information and services it provides to the public. Initially, the program provided residents with AR soil sample results and administered a small Soil Swap Program. The program offered limited soil screening on uncharacterized properties and provided a limited amount of clean soil for vegetable gardens and play areas. In 2014, the CPMP program expanded the Soil Swap Program to include the option of raised structures for residents who wanted a vegetable garden and/or play area (i.e. sand box), or clean topsoil for existing gardens. The CPMP administrator has been trained on lead based household hazards; and is an EPA Certified Lead Risk Assessor who conducts educational home visits to help people protect their families from possible lead and arsenic sources. Through cooperation with the County's Public Health Department, the CPMP helps facilitate blood lead and urinary arsenic testing. CPMP now has a home renovation program, which includes a free HEPA-vacuum loaner program as well as home renovation starter kits. A potable well water program has been developed in conjunction with the DPS that helps county residents obtain information about the quality of their well water. This year the CPMP is offering a noxious weed spraying reimbursement program to eligible property owners located within and adjacent to the Superfund Overlay. The number of public inquires that have received support and educational guidance from the CPMP has varied from 2011 to 2014 with as many as 55 inquiries to as few as 36 inquires. Soil Swap Program inquiries have increased every year since 2011; fourteen eligible properties received at least one raised structure last year. This year (2015) is the first year that the CPMP has been advertised with promotional and educational mailers sent to eligible property owners; and public response has been positive. So far, in 2015, the CPMP has received 20 general inquiries and 12 soil swap inquiries.

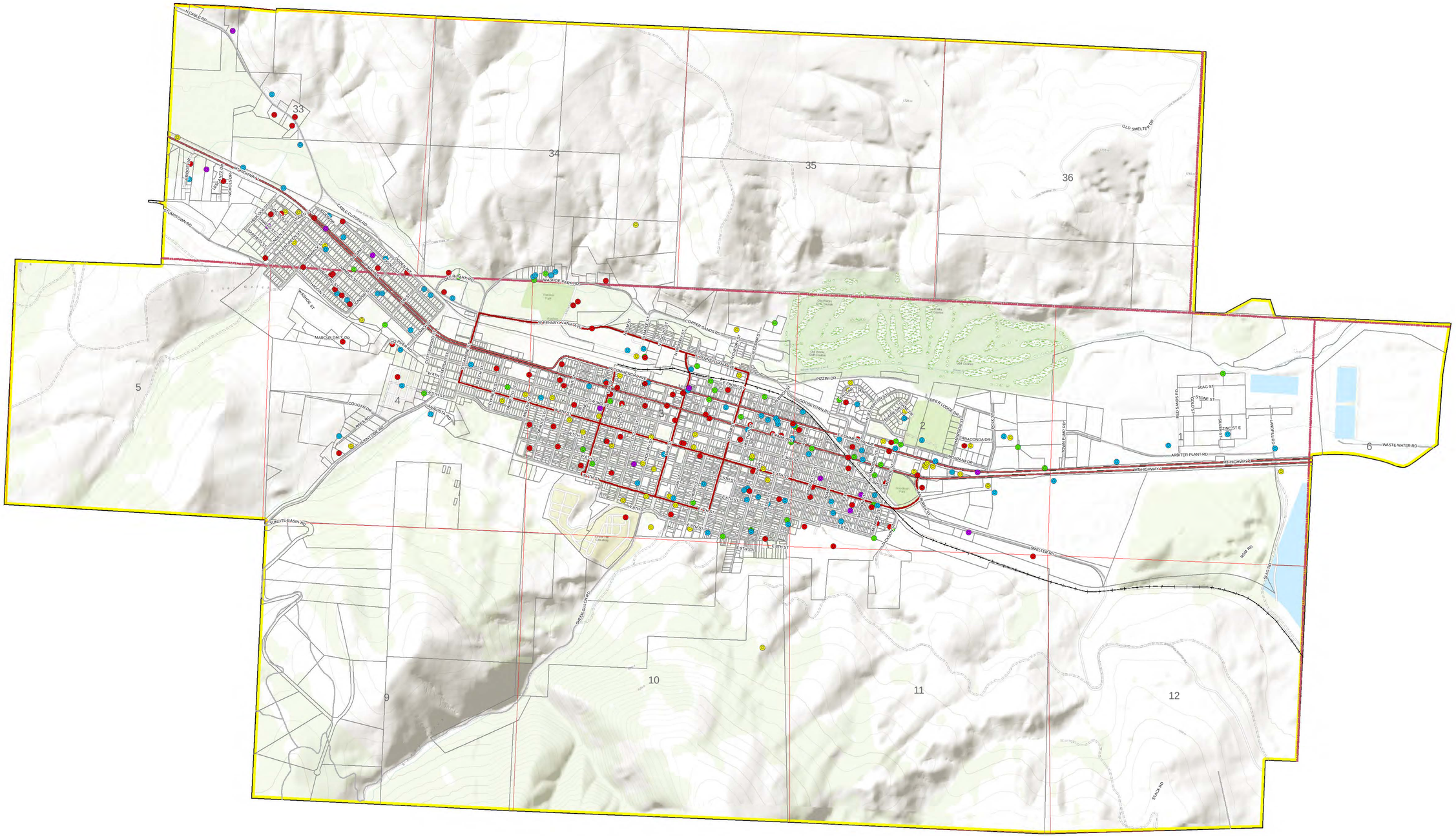
Data Management/GIS

The Superfund staff and the ADLC Planning Department conduct weekly DPS meetings to review all ADP, MDP, and GUS permits submitted the previous week and all data developed in conjunction with these permits is managed and maintained within the GIS database. Following the weekly DP meetings, the Superfund staff reviews all CPMP inquiries received the previous week. GIS has been integrated into these weekly meetings to provide timely supporting information to facilitate the administrative decision-making process. In addition to soil handling and development oversight activities, meetings with homeowners, contractors, developers,

committees, and agencies regarding their inquiries or development questions are also a major part of the program.

Figures

Development Permits - Anaconda Urban Area



Development Permits

- 2015 - 18 ADP/MDP
- 2014 - 93 ADP/MDP
- 2013 - 90 ADP/MDP
- 2012 - 51 ADP/MDP
- 2011 - 48 ADP/MDP

Anaconda Urban Area

Cadastral Boundaries

N
W E
S

Miles

0 0.125 0.25 0.5

ADLC Planning Department

Water & Environmental Technologies, PC

Development Permits - Anaconda Urban Area

Deer Lodge County - Anaconda, MT 59711

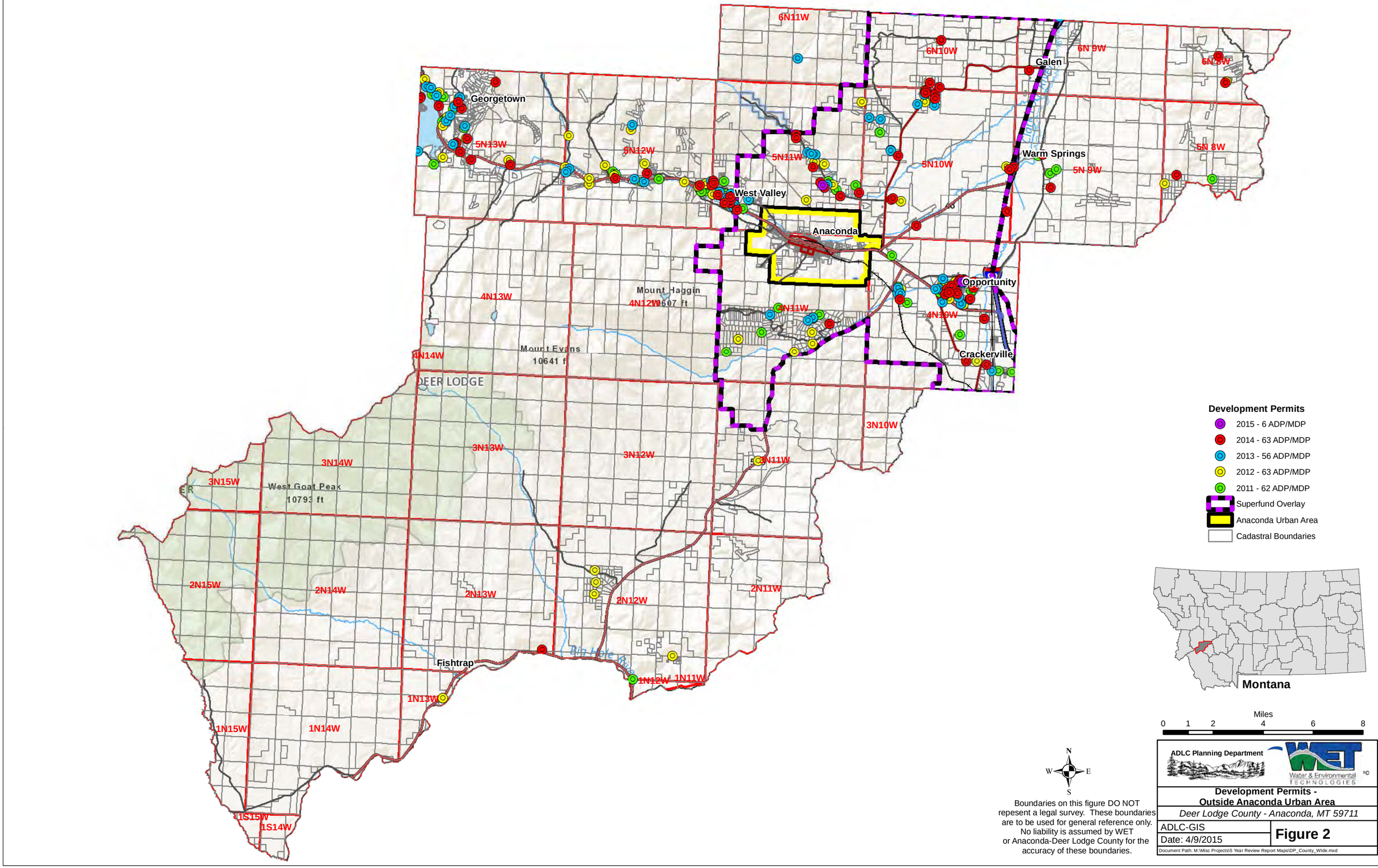
ADLC-GIS

Date: 4/9/2015

Figure 1

Document Path: M:\Misc Projects\5 Year Review Report Maps\DP_Urban_Area_Map.mxd

Development Permits - Outside Anaconda Urban Area



Boundaries on this figure DO NOT repesent a legal survey. These boundaries are to be used for general reference only. No liability is assumed by WET or Anaconda-Deer Lodge County for the accuracy of these boundaries.

ADLC Planning Department

Water & Environmental Technologies

Development Permits - Outside Anaconda Urban Area

Deer Lodge County - Anaconda, MT 59711

ADLC-GIS

Date: 4/9/2015

Figure 2

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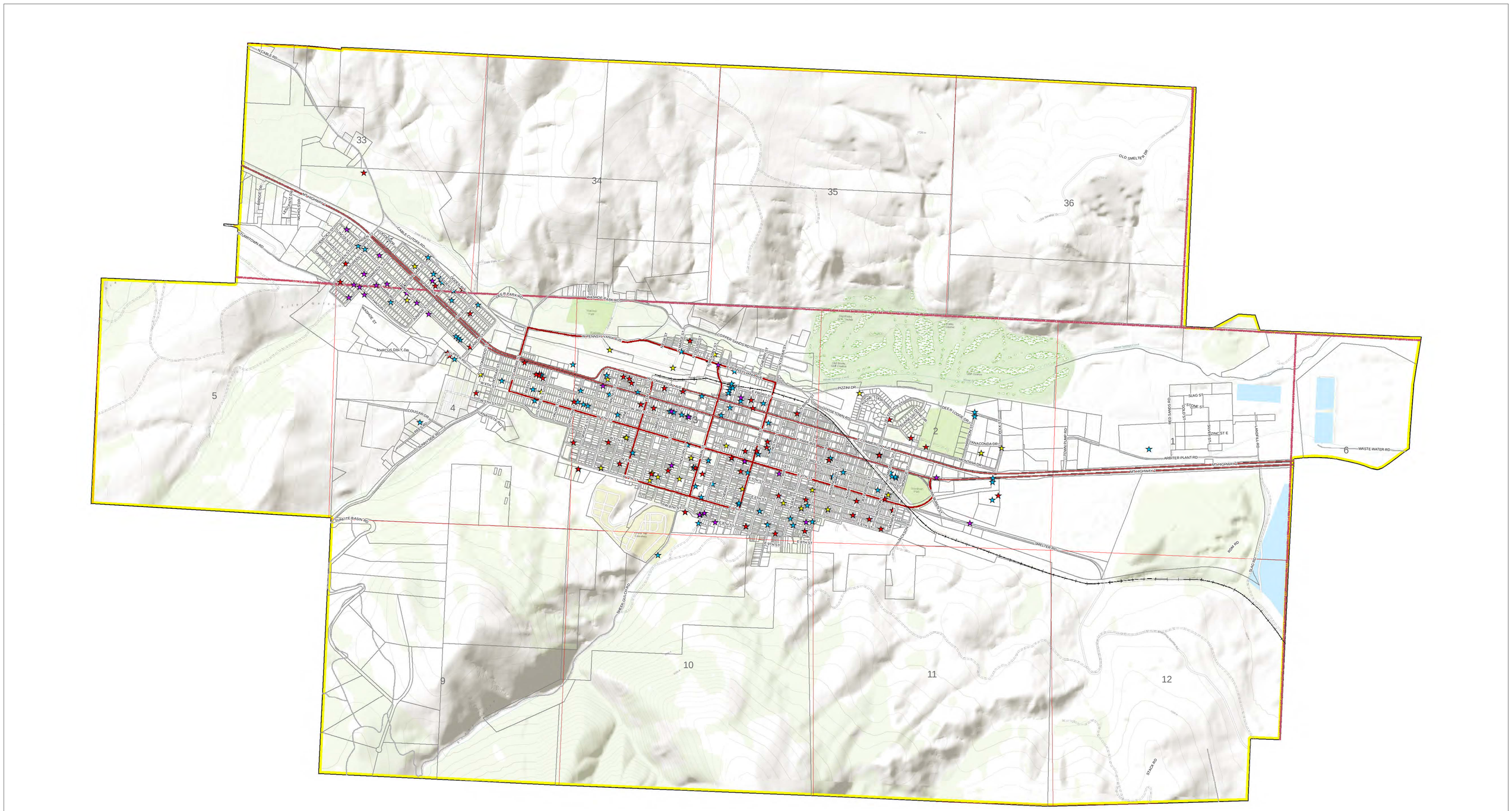
General Utilities/Street Opening Permit (GUS) - Anaconda Urban Area



Deer Lodge County

Montana

General Utilities/Street Opening Permit (GUS)

- 2015 - 19 GUS
- 2014 - 59 GUS
- 2013 - 56 GUS
- 2012 - 26 GUS

Anaconda Urban Area

Cadastral Boundaries

Boundaries on this figure DO NOT represent a legal survey. These boundaries are to be used for general reference only. No liability is assumed by WET or Anaconda-Deer Lodge County for the accuracy of these boundaries.

N W E S

Miles

0 0.125 0.25 0.5

ADLC Planning Department

Water & Environmental Technologies, PC

General Utilities/Street Opening Permit (GUS) - Anaconda Urban Area

Deer Lodge County - Anaconda, MT 59711

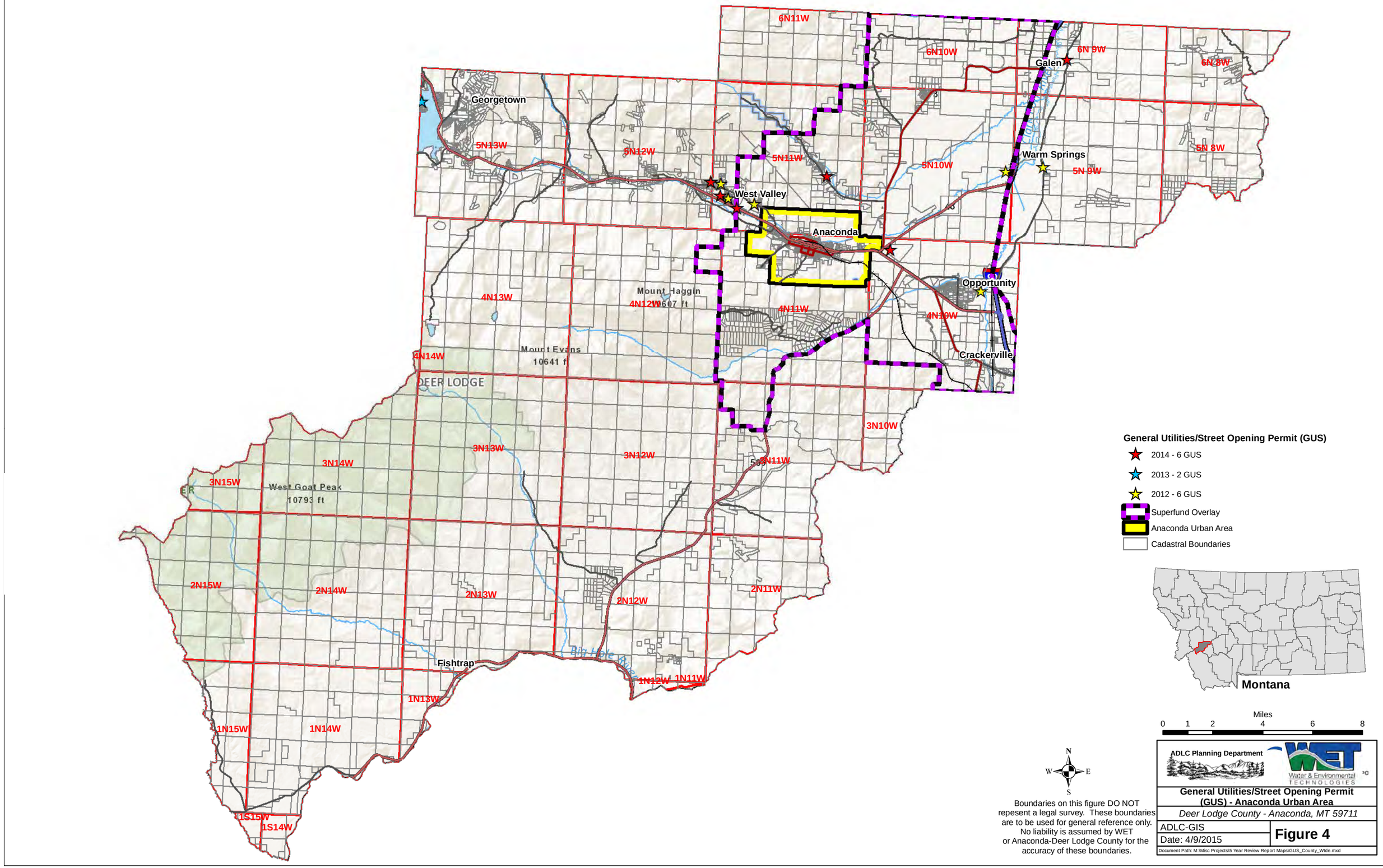
ADLC-GIS

Date: 4/9/2015

Figure 3

Document Path: M:\Misc Projects\5 Year Review Report Maps\GUS_Urban_Area_Map.mxd

General Utilities/Street Opening Permit (GUS) - Outside Anaconda Urban Area



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ADLC Planning Department

Water & Environmental Technologies

General Utilities/Street Opening Permit (GUS) - Anaconda Urban Area

Deer Lodge County - Anaconda, MT 59711

ADLC-GIS

Date: 4/9/2015

Figure 4

Document Path: M:\Misc Projects\5 Year Review Report Maps\GUS_County_Wide.mxd