TABLES

TABLE 1
ARWW&S OU PUBLIC COMMENTS SUMMARY TABLE

Date	Author	Key Issues	Action/Response	Notes/Comments
Public and Local Government Comments				
10/31/97	Bob Johnson 4511 Hwy 48 Anaconda, MT 59711	• Opportunity Ponds slum dust storms/dust suppression • Warm Springs Creek channel pollution/Old Works Golf Course • Time span for implementation of remedy	Section 2.1 Responses 2, 3, 21	letter includes attachments regarding legal issues concerning Sadie Johnson property; also, pertinent notes by J. DalSoglio (EPA)
12/12/97	Barbara Andreozzi Deer Lodge County Ext. Office 800 S. Main Anaconda, MT 59711-2999	• "Hot spots" on East Park and their effect on downtown tree planting for Anaconda beautification project	Section 2.1 Response 22	letter includes attachment of ARCO soil sampling results conducted 5/16/97 in front of Thrifty Drug and Park Street Antiques
12/23/97	Carl Stetzner* and William Hickey ADLC/Arrowhead Foundation 800 S. Main Anaconda, MT 59711	• Preclusion of future community land use planning • Proposed plan did not address community concerns • Ground water TI • Financial strain on county government: costs of implementing ICs/ground water use controls and maintaining the DPS/Comprehensive Land Use Plan; multi-layer trust fund scenario • Need for infrastructure in West Valley • Consolidation of wastes left in place/remediation to pre-smelting conditions • Control of wind erosion • Involvement in concurrence and design phase	Section 2.1 Responses 1, 2, 4, 5, 7, 8, 22	*attached letter dated 1/14/98 states the withdrawal of Stetzner as a signatory on this letter
½/98	D. DiFrancesco RDM Multi-Enterprises, Inc. P.O. Box 179 Anaconda, MT 59711	• Continued marketing of the Anaconda Washoe Slag Pile by RDM Multi-Enterprises via a long term contract with ARCO	Section 2.1 Response 16	Statement that slag has caused no concern not true based on other comments and community interviews
1/13/98	Melvin Stokke 1803 Tammany Anaconda, MT 59711	• Use of slag in making Portland Cement at the Trident cement plant	Section 2.1 Response 17	letter includes attachments regarding slag analyses and the purchase of slag for industrial uses
1/13/98	Sandra Stash ARCO 307 East Park, Suite 400 Anaconda, MT 59711	• Revision of restrictive covenants on ARCO land to enable development of a regional prison	Section 2.1 Response 19	

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ARWW&S OU PUBLIC COMMENTS SUMMARY TABLE

Date	Author	Key Issues	Action/Response	Notes/Comments
1/15/98	Terry Wilkinson ADLC 800 South Main Anaconda, MT 59711	• Commends EPA for number of public meetings and "good deal" of info to public through the mail • Use B Cell as a waste disposal area • Dust suppression in remaining waste areas • Ground water TI not acceptable • Lack of specificity in the establishment of a trust fund • Future development/land use limited in East Valley • Time span for implementation of remedy has to be funded • Specified level of community involvement needed in design and implementation • Negative image of long term Superfund site • Need revised (quicker) implementation timeline	Section 2.1 Responses 1, 2, 3, 4, 8, 11	
1/15/98	Gene Vuckovich 1205 West Third Street Anaconda, MT 59711	• Concurrence with the statement made by Terry Wilkinson (see above); Proposed Plan needs to be beneficial to citizens, be cost effective, and comply with EPA regulations and law	Section 2.1 Response 1, 2, 3, 4, 6, 8, 11, 15	
1/15/98	*Transcript of the Proceedings* Nordhagen Court Reporting 1734 Harrison Avenue Butte, MT 59701	Transcript of the Formal Public Hearing held 1/15/98 at Anaconda Senior High School, Anaconda, MT. See list of presenters included in transcript.	Section 2.1 Responses 1, 3, 5, 6, 12, 13, 14, 15, 16, 17, 18, 20, 31	attendance list for Formal Public Hearing included
1/21/98	Herbert Lutey 4616 Hwy 48 Anaconda, MT 59711	• Blowing dust off Opportunity Ponds • Clean water • Proposed actions are insufficient	Section 2.1 Responses 2, 12	Montana Bureau of Mines and Geology water quality analysis is attached
received by EPA 1/21/98	Senator Bea McCarthy 1906 Ogden Anaconda, MT 59711	• Continued ground water monitoring/revegetation • Success of crop production/return of birds and wildlife to the Ponds and Hill areas • Continued high level of cleanup desired	Section 2.1 Responses 3	
1/27/98	Dan Hamilton WH Ranch 700 Willow Glenn Lane Anaconda, MT 59711	• Remedial plans for Hamilton property located in VA13A, in Section 20, T4N, R10W, containing all 5 COCs, including elevated arsenic levels (1,800 ppm)	Section 2.1 Responses 22	
1/28/97	Henry Broers Montanans for Property Rights P.O. Box 130399 Coram, MT 59913-0399	• ARCO's property rights may be jeopardized in the Superfund process (confiscation without compensation)	Section 2.1 Response 14	

TABLE 1
ARWW&S OU PUBLIC COMMENTS SUMMARY TABLE

Date	Author	Key Issues	Action/Response	Notes/Comments
received by EPA 1/29/98	Natalie Fitzpatrick	• School-supported tree-planting projects as a means of revegetation without tremendous cost • Support for soil amendments/revegetation rather than relocation of wastes; deep plowing supported • Support for finding alternate water supplies rather than trying to treat ground water in the TI zone • Needs of community balanced with environmental decisions • Do not try to return area to pristine state	Section 2.1 Response 12, 13, 15, 23	
1/29/98	Jim Davison ALDC P.O. Box 842 Anaconda, MT 59711	• Local government and community groups involvement in remedial design process	Section 2.1 Response 1	
1/29/98	William Hickey Arrowhead Foundation P.O. Box 842 Anaconda, MT 59711	• Local government and community groups, TAG (Arrowhead) specifically, involvement in remedial design process • Group would work with EPA to define public's role in design	Section 2.1 Response 1	
1/29/98	Paul Capps 416 East 7th Street Anaconda, MT 59711	• Lack of specifics in Proposed Plan • TI for Ground water ARARs/conflict with NCP criteria • Use of ICs and future O&M responsibility not wise for an underfunded, understaffed county • Economic development ahead of threshold criteria • Need to settle remediation versus restoration issue • Decries lack of trees in currently remediated areas • Expresses cynicism about Responsiveness Summary	Section 2.1 Responses 4, 5, 6, 7, 9, 10	
1/30/98	James Manning ADLC Planning Department 800 South Main Anaconda, MT 59711	• Involvement of elected officials, ALDC, Arrowhead Foundation, and TAG in the remedial design process • Ground water concerns (other than under the Opportunity Ponds); ground water and development (proposed prison) • Need to re-examine remedy proposed for areas where previously development was not expected • Soil contamination between Lost Creek and Warm Springs • Contamination in old irrigation ditches in the area • Dust problem off the Opportunity Ponds • ICs and O&M/funding levels and actual responsibilities, as they relate to the County	Section 2.1 Responses 1, 2, 4, 19, 24, 25-28	

TABLE 1
ARWW&S OU PUBLIC COMMENTS SUMMARY TABLE

Date	Author	Key Issues	Action/Response	Notes/Comments
1/30/98	Dave Elias ADLC County Engineer 800 South Main Anaconda, MT 59711	• North slag pile as a potential contamination source • Investigation of railroad bed contamination in the Georgetown Lake area • Placement of solid waste by ARCO in a Class-II landfill, rather than at the southeast corner of the main granulated slag pile • Need language in ROD for addressing the "unknowns"	Section 2.1 Responses 25-28	
received by EPA 2/2/98	Bill Masella George Grant Trout Unlimited 1900 Tammany Street Anaconda, MT 59711	• Maintenance and preservation of the Mill-Willow bypass in conjunction with remediation of Warm Springs Creek/Warm Springs Ponds • Threats to Mill-Willow Bypass from Opportunity ground water plume • Warm Springs Creek floodplain tailings removal • Opportunity Ponds ground water plume contamination (sampling responsibility/schedules, exceedance parameters, access to data) • Advocates removal of tailings from Warm Springs Creek flood plain	Section 2.1 Response 29	
received by EPA 2/2/98	John Sevores Box 1456 Anaconda, MT 59711	• Land ownership in Anaconda-Deer Lodge County and potential conflict with private landowners	Section 2.1 Response 30	letter includes multiple attachments pertaining to deed transfers in Aspen Hills and Lost Creek areas; property ownership map

State of Montana Agency Comments

1/28/98	C. Richard Clough MDFWP 3201 Spurgin Road Missoula, MT 59804	• Removal of tailings deposits in flood plain of Warm Springs Creek rather than implementing STARS technique	Section 3.0 Response 1	letter includes attachments regarding the termination of a channel restoration project after discovering tailings in the project area
1/28/98	Greg Mullen NRDLP P.O. Box 201425 Helena, MT 59620-1425	• Remediation of Opportunity and Anaconda Ponds via capping or other measure; need to have capillary fringe layer and adequate growth media • Reclamation of upland areas (i.e., Mt. Haggin area) not addressed in the Proposed Plan; extensive tree planting needed (things the Proposed Plan does not address that the State plan does)	Section 3.0 Response 2	

TABLE 1
ARWW&S OU PUBLIC COMMENTS SUMMARY TABLE

Date	Author	Key Issues	Action/Response	Notes/Comments
1/30/98	Matt Marsh MDEQ P.O. Box 200901 Helena, MT 59620-0901	• Soil cover instead of Reclamation Levels I and II for certain areas • Cost calculations/availability of cover soil borrow sources • B2 Cell of Opportunity Ponds as a waste disposal site • Temporary or permanent cover over Main Slag Pile due to airborne contamination • Alternative remedy for South Lime Ditch and Triangle Wastes • Removal of tailings and waste material from Warm Springs Creek, Willow Creek, and Blue Lagoon areas • Proposed Plan listed 8" of cover soil instead of 18" for the East Anaconda Yard; monitoring to determine if 18" is sufficient • Pro-active approach to ground water/surface water cleanup (i.e., ground water interception trenches) • Storm water control (lined detention basins/ditches)/meeting requirements during remedial action rather than at construction completion/storm water monitoring time limitation • Additional methods for use at Opportunity/Anaconda Ponds • Stucky Ridge Pilot Project/development of LRES or similar system • Commercial reuse of slag • Use of the word "reclamation" to describe proposed remedy • Do not allow ARCO to take the lead on remedy character definition	Section 3.0 Response 3	
1/30/98	Mary Capdeville MDEQ P.O. Box 200901 Helena, MT 59620-0901	• Application of State ground water standards beneath Waste Management Areas • Interpretation of the NCP and CERCLA with regard to ARARs/statutory waivers • Feasibility study ARARs (specifically, FS Deliverable No. 5, Appendix B; list of potential ARARs) • "Other Laws" section in ARARs	Section 3.0 Response 4	
1/30/98	Fred Staedler DNRC 1401 27th Avenue Missoula, MT 59804	Cleanup measures limiting revenue generation in these areas: • Potential for residential or commercial development on Stucky Ridge tract • Productive dry land pasture on North Opportunity Subarea tract	Section 3.0 Response 5	

Other Federal Agency Comments

1/29/98	Robert Stewart USDI P.O. Box 25007 (D-108) Denver, CO 80225-0007	• Surface water NFA does not meet threshold criteria • Water quality monitoring program for Cabbage Gulch and Yellow Ditch; include schedule for meeting water quality criteria (five year time period is appropriate)	Section 3.0 Response 6	letter includes attachment: Summary of Four-Step Process for Addressing Wetland Issues in Upper Clark Fork River Superfund Sites

TABLE 1
ARWW&S OU PUBLIC COMMENTS SUMMARY TABLE

Date	Author	Key Issues	Action/Response	Notes/Comments
ARCO Comments				
1/30/98	ARCO 307 East Park, Suite 400 Anaconda, MT 59711	Includes the following attachments: • Reclamation Plan • An Approach for Establishing Reclamation Performance Standards for the ARWW&S OU • Conceptual Stormwater Runoff Control Plan for the ARWW&S OU • Institutional Controls Management Plan for the ARWW&S OU • ARWW&S OU Anaconda Smelter Superfund Site - Performance Standards • ARWW&S OU Conceptual Remedial Design/Remedial Action Site Management Plan • Comments on EPA Final Baseline Ecological Risk Assessment • Review of the Final Baseline Ecological Risk Assessment, ARWW&S OU • Risk-Based Calculations for Soil Arsenic, ARWW&S OU • Feasibility Study Comments on EPA's Proposed Plan • Conceptual Operations and Maintenance Plan Framework • ARCO Comments Provided to the EPA for ARWW&S OU	Section 4.0	

APPENDIX A

Transcript of the Proceedings
Heard at Anaconda Senior High School
January 15, 1998

ANACONDA SMELTER SUPERFUND SITE

ANACONDA REGIONAL WATER, WASTE AND SOILS OPERABLE UNIT
ANACONDA-DEER LODGE COUNTY, MONTANA
PROPOSED PLAN

TRANSCRIPT OF THE PROCEEDINGS

Heard at Anaconda Senior High School
Anaconda, Montana

January 15, 1998
7:05 p.m.

Reported by: CHERYL ROMSA

NORDHAGEN COURT REPORTING
CANDI NORDHAGEN
1734 Harrison Avenue
Butte, Montana 59701
(406) 494-2083

Registered Professional Reporter
Conference Room
1734 Harrison Avenue

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ANACONDA SMELTER SUPERFUND SITE

ANACONDA REGIONAL WATER, WASTE AND SOILS OPERABLE UNIT
ANACONDA-DEER LODGE COUNTY, MONTANA
PROPOSED PLAN

TRANSCRIPT OF THE PROCEEDINGS

Heard at Anaconda Senior High School
Anaconda, Montana

January 15, 1998
7:05 p.m.

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WHEREUPON, the proceedings were had as follows:

MS. DALSOGLIO. My name is Julie DalSoglio I am the Remedial Project Manager for the Environmental Protection Agency working on this site. First of all, I want to thank all of you for coming. It's just wonderful to see this kind of a turnout.

We've been here basically since the end of October conducting a number of meetings, trying to get the information out about what EPA is proposing as the final cleanup plan for across the site. So I'm really pleased to see this kind of turnout tonight for our last public hearing.

I'm going to talk a little bit about the logistics about what we're going to do this evening, and then I'll turn it over to the individuals who have signed up to provide written -- or excuse me, verbal comment. We have a court reporter here to take your comments, and EPA will be responding directly to all comment received tonight in writing as part of our final Record of Decision on the site.

Again, just briefly, we have been, as most of you know, working on this site now for approximately 15 years. The Agency has put out four previous Records of Decisions which have documented the types of cleanup actions for different areas on the site. We've had a number of removal activities that have gone on. And the attempt here with this final site-wide Record of Decision is basically to wrap up into one

complete package the final sets of decision about how to handle all of the rest of the site, including groundwater, surface water, all of the remaining tailings ponds, and all of the remaining arsenic contaminated soils.

We released the Proposed Plan on October 22nd. We originally had a public comment period that was going to end on December 20th. At the request of several members of this community, we extended the public comment period to January 30th. I want to underscore that if you are not comfortable in providing comment or testimony tonight on the Proposed Plan, we are still accepting written comment through the 30th of January. So those of you who either don't feel comfortable or would like to submit comment in that format, please do.

We held an initial public information meeting, I don't remember the dates now, but the week after the 22nd of October. We had a three-day open house/public information activity going on at the Community Services Center in mid-November and a second open meeting, public information meeting in Opportunity on the 20th of November; and basically have been trying to get the information out about what we would like to do on this site.

Beyond this introduction that I am providing this evening, EPA will sit down and open it up to this public comment process. It will not be a situation where will you have an

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opportunity to question us and us respond to your question during this formal period. But I do want to emphasize, there's a number of individuals from EPA besides myself that are here that would be available after the meeting tonight to try to clarify or address any other issues about the Proposed Plan

Let me introduce very quickly Bob Fox, who is the Superfund Branch Chief; Charlie Coleman -- oh, he's still outside. Charlie is manning the desk, and he's the other Remedial Project Manager from EPA who has been working on this site for almost ten years. I'd like to also introduce Matt Marsh, who is the State Project Officer on the site, and he's also available to try to take some questions and provide answers on things.

We have about 20 people or individuals who signed up to provide comment. I guess just very quickly, is there anybody else that did not get on the signup sheet that would like to provide verbal comment at this point?

UNIDENTIFIED SPEAKER: You indicated initially that that was for written comment?

MS. DALSOGLIO: Yes. And again, another point of clarification, we're still accepting written comment, so you don't have to sign up tonight. I just want to make sure that anybody who wanted to provide verbal comment or testimony, I have them on the list.

UNIDENTIFIED SPEAKER. I'd like to provide verbal

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comment.

UNIDENTIFIED SPEAKER. There's another list out there. Is that the same thing?

MS. DALSOGLIO· No, that's just generally for sign-in here.

Also, I'll check again at the end of the meeting in case somebody said something that prompted you to want to get up and say something to the community at large.

UNIDENTIFIED SPEAKER. Will there be comment made on these written comments--

MS. DALSOGLIO: Yes. Thank you for that point of clarification.

All comments received during this public comment period, both written and the verbal comment received tonight, will be responded to in writing by EPA in the Record of Decision.

Any other points of clarification about logistics that I can make for folks?

Okay. The other thing, I'll just go down the list. As I said, we have 20 people here. If you could come up to the podium, we have the court reporter, Cheryl, sitting here If you could state your name and spell your last name for her so that she knows who is providing comment, that would be helpful.

Anything else on logistics?

I'll play facilitator here, and I'll just kind of go down the list Gene Vuckovich was the first person.

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MR. VUCKOVICH Julie, I'd like to yield my place, at the present time, just temporarily, to Commission Chairman Wilkinson

MS DALSOGLIO. That's fine.

MR. WILKINSON. I'm Terry Wilkinson, and I'm the Chairman of the Anaconda-Deer Lodge County Commission. And we have a report here that we're going to direct towards Julie. Her being the Project Manager, it will be addressed to her

Can everybody hear me all right?

AUDIENCE: No.

MR. WILKINSON: First of all, there's 50 copies of the letter that we're going to send to the EPA sitting out on the desk so you can follow along. If you don't have one, there should be some still out there. So this letter, the cover letter will read as follows.

It says: The Anaconda-Deer Lodge County Commissioners recognize and appreciate the diligent efforts of EPA and ARCO over the past 15 years in addressing the Anaconda Smelter NPL Superfund Site. Past successes have occurred because EPA, ARCO, and Anaconda-Deer Lodge County worked together to address and alleviate the Superfund concerns of Anaconda-Deer Lodge County

Anaconda-Deer Lodge County would like to register the attached concerns so that final decisions can be made regarding the Anaconda site. The following concerns are based on the

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input of a broad representation of many community-based groups who have been studying the Anaconda Smelter NPL Site over the past several years It is our intention that the government of Anaconda and its citizenry, the PRP, and the EPA will work together to achieve cost-effective solutions that fulfill the requirements of the CERCLA and ensure, when all Superfund work is completed in Anaconda-Deer Lodge County, we will be a viable community.

The next things I'm going to cover are the concerns that we're registering with the EPA.

It says: The Anaconda-Deer Lodge County Commissioners appreciate this opportunity to comment on the Proposed Plan for the Anaconda Regional Water, Waste and Soils Operable Unit. At the onset, we would like to commend EPA for conducting a number of public hearings in this area and disseminating a good deal of information to the public through the mail. In addition, we appreciate the time extension you granted for further review and discussion of the plan. All of this activity over the past few months has brought us to the point where Anaconda-Deer Lodge County Commission would like to address the plan for the record.

As community acceptance is one of the nine National Contingency Plan evaluation criteria, we register the following issues be addressed in the Record of Decision for this Operable Unit. We find the plan to be lacking in many respects, some to

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an alarming degree and others to a lesser degree, but still of concern. We offer our comments on those concerns we have and look forward to working with you and the PRP to assure that when this project is complete, Anaconda-Deer Lodge County can be assured of the best possible future given the circumstances.

The first concern, No. 1, will be Waste Disposal Area. Anaconda-Deer Lodge County has indicated in various settings that the Cell B may be a better site for a waste disposal area due to its accessibility. This seems to have been forgotten in the process and needs to be addressed Cell A should be remediated to the extent necessary and Cell B should be recognized as Anaconda-Deer Lodge County's waste disposal area.

No. 2, Dust Suppression, Waste Areas. The plan does not address blowing dust from remaining waste areas. This has been a concern of the community for many years. The Record of Decision must have a concise plan to address this problem if waste areas are not removed.

Groundwater, No Further Action. It is not possible for us to accept the premise that one of the most serious, precious commodities that exists, water, is being treated in an unacceptable manner by this Proposed Plan. There are few assets more important to the lifeblood of people and their community than water. It is a vital part of the present and necessary for a viable future. We seriously question the attitude which seems to portray water contamination as

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acceptable if it does not meet some undefined cost effectiveness standard. It must be kept in mind that this plan identifies substantial water contamination and then proposes that this community live with that contamination forever.

We cannot accept this approach and insist that the subject of groundwater be treated in the plan in a manner which acknowledges its importance as a resource for today and tomorrow, not only for this community, but for those downstream.

No. 3, Funding Issues, Institutional Controls and Land Use Planning. The Proposed Plan relies on institutional controls to support engineered remedies. In particular, the plan sites the utilization of the Anaconda-Deer Lodge County Development Permit System to track the implementation of the final remedy. Although the plan states that the County's DPS will be funded adequately through the establishment of a trust fund, the plan lacks specificity with respect to this issue. The cooperation of the County is imperative to ensuring that this plan remains protective of our human health and our environment.

Land Use. The County has expressed to the Agency the community's lack of developable land for industrial, residential, and commercial purposes. The use classification, ownership, Superfund designation and condition of properties in the East Valley further precludes future development and limits the community's options for development. The current and

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anticipated condition and use of these lands also limits the tax base of our community. The Proposed Plan does not address these concerns.

Short- and Long-Term Effectiveness. The Proposed Plan states that it may take up to 30 years to implement the proposed remedy. Of the three entities involved, EPA, the PRP, and the A-DLC, the only entity with certainty that it will be in operations in the future is Anaconda-Deer Lodge County. Therefore, it is critical that the resources to implement the plan be securely in place with that entity as soon as possible. Furthermore, our community has been taking great strides over the past 18 years to mitigate the negative connotations that are associated with being one of the nation's largest Superfund sites. A remedy that takes 30 years to implement does not mitigate this image, nor does it seem protective from a human health/environmental perspective. The implementation time line should be revised.

Community Involvement. The Record of Decision should specify a meaningful level of involvement the County and community will have in the design and implementation of the remedy.

This final set of Superfund decisions will affect our community for generations to come This -- Thus, it is important that all issues are addressed in this final record. The concerns outlined above must be addressed for the community

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of Anaconda to accept the final Record of Decision for the Anaconda Smelter NPL Site. We are committed and will continue, as we have over the past 15 years, to work with the Agency and the PRP to resolve these issues with the implementation of ethical decision making to see workable solutions to difficult problems. We anticipate and look forward to the Agency's response to these issues.

MR. BEATTY: My name is Dave Beatty, Anaconda-Deer Lodge Commission.

All of us, all of us here present, we, the citizens of Anaconda-Deer Lodge County, have a responsibility in the decision making regarding the information about what is happening. We need feedback and ideas, possible alternative solutions to current situations. Effective communication and mutual respect are essential to develop and maintain teamwork. Inevitably, conflicts will arise. And they must surface so that they can be addressed. We have ownership in the decision making process. Keep hope alive in our community. I encourage all of you people to get involved and to provide comments.

Thank you.

MR. VUCKOVICH: For the record, my name is Gene Vuckovich. I am a life-long citizen of Anaconda-Deer Lodge County. And for the past 11 years, I've been intently involved in Superfund issues as they are related to Anaconda-Deer Lodge County and the rest of the Clark Fork Basin During this time,

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I have served as a local government official and on various boards, committees, organizations, and foundations involved with Superfund issues.

My concerns have always been for the future of Anaconda-Deer Lodge County and its citizens. Thus, I agree with the statement read by Chairman Wilkinson, namely that the proposed EPA plan for the Anaconda Regional Water, Waste and Soils Operable Unit is lacking in many respects as set forth in Mr. Wilkinson's statement. My concern is not for the principal responsible party, the PRP or ARCO, nor for the Agency, the EPA, but rather, for the citizens of Anaconda-Deer Lodge County, now and in the future.

Both the PRP and the Agency will soon be gone. But Anaconda-Deer Lodge County and its citizens will remain. It is thus imperative that a plan be adopted that will -- that will not only ensure compliance with the EPA regulations and laws, but also be cost effective and, most importantly, be beneficial for the citizens for Anaconda-Deer Lodge County, now and into the future. I urge the Agency to work with the PRP and the government and citizens of Anaconda-Deer Lodge County in preparing a plan that will address those issues and be a win/win situation for all, as has been done in the past.

Thank you.

MS. DALSOGLIO: Next, I have Jim Flynn.

MR. FLYNN: My name is Jim Flynn. For the record, I

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am a resident of Anaconda. I've had the opportunity to be involved in reviewing the plan presented by EPA, and I've had the opportunity to review the comments presented by Chairman Wilkinson tonight and would like to go on the record as endorsing those comments. I feel that those are the type of items that need to be addressed with the plan that has been presented. And hopefully, the net result will be something that Anaconda can be comfortable with and live with into the future.

MS. DALSOGLIO: Okay, next, we have Sandy Stash.

MS. STASH For the record, my name is Sandy Stash. I am a Vice President for ARCO. Basically, I'm the senior person here in Montana for the company. And I guess before I get into some more formal thoughts, I guess I couldn't help but thinking back a little bit on at least the almost nine years I've been involved in this process. And I guess I'm real proud to say, when I look back at that nine years, that together, the EPA, the State of Montana, ARCO, and the community of Anaconda-Deer Lodge County collectively have come a very long way.

When I first got here, and I know Charlie Coleman will remember this, I think we had 77 separate operable units and studies that we feared we would have to do. And I think literally, had we followed that model, we probably would be very much still studying this site and not have accomplished

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nearly what we have. And I think through the leadership, primarily of EPA and this county, we've done some pretty amazing things in this county Over a period of eight years, ARCO has spent nearly $350 million in the Basin. Nearly half of that has been in Anaconda-Deer Lodge County. And I'm pretty proud, and I think we all should be very proud, of some of those successes.

The one I think that always stands up kind of front and center, because it is now literally of national significance, is the Old Works Golf Course. And I can't tell you how many phone calls and, and inquiries I get from all around the country on how we, as a PRP, this community, and the agencies were able to, to do that remedy. And I think we all should be very proud of that, as well as the other work we've done.

I also think tonight is an important evening. Although I know we'll have many opportunities to work with each other and talk to each other in the future, this is literally the last formal public hearing in Anaconda. And I think to Gene Vuckovich's comments, that's really important, because I think what that symbolizes is sort of the beginning of the end of what I'm sure has been a difficult process for not only the company, but for the community; and that is, with the Superfund status. And I think this really does indicate that we are nearing the end of a process.

ARCO -- In that, ARCO remains very committed to closing the

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Anaconda site And I use the word "closure" very broadly, because it is closure not only of the environmental issues, but literally closure of an era wherein ARCO and its predecessor, Anaconda, were very integral and a part of the Anaconda community. And I do agree with the comments that Chairman Wilkinson made, that it's critical that we work very thoughtfully together on how we close that final chapter. In that we are committed to this closure, we will offer some very specific comments to EPA on their plan, up to and including some very detailed thoughts on the proposal and on how it could be most effectively implemented.

There are a couple of issues that I think we do need to deal with. First and foremost, it's important to the company that this closure be complete and that the settlements be global. And this, too, goes to some of the concerns raised by Chairman Wilkinson and others. Clearly, this remedy goes beyond cleanup by definition and very much gets into issues of natural resource damages. There are numerous parties, most importantly including federal and state government trustees, who have asked us in various court actions to basically do some of the very same things that EPA is requiring us to do in this plan. And as we've said before, it's going to be critical to us, before we embark on this cleanup, that we know, having completed this, that we have closed out all of those concerns and liabilities.

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Secondly, there are details that need to be worked out. That, again, I think came off some of what others have said before me. From ARCO's perspective, these details have got to make sense They've got to address real risks They have to be cost effective and they've got to be implementable. And I think everyone who has looked at this plan realizes that a site of this size poses some, some difficult technical issues.

We will proceed the best we can with this cleanup. We will only object to spending money for the sake of spending money. We want to be sure that whatever we do in closing this final chapter, we are dealing with real risk and effectuating things that actually mean something. So with that, we look forward to working with everyone in the process.

Thank you.

MS. DALSOGLIO: Next on the list is Chuck Haeffner.

MR. HAEFFNER: I'm Chuck Haeffner. I've been a citizen of Anaconda for the last 30 years. I guess that still makes me a boomer.

I have to go along a little bit with Gene on his, some of his ideas. And Gene was the first one that really got instrumental on getting our golf course going for us. And then he was our, kind of our leader that stepped in and said, "Hey, this is a good idea " And he talked to Bill Williams about it, who was a local Anaconda boy and head of the Anaconda cleanup at the time.

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You know, and we pushed forward on that. And most of our dealings at the time were with ARCO. And I know the EPA was there, but we dealt very strongly with ARCO and we got this golf course. It started out just to be a golf course. There was -- and every day that we kind of dealt with them, more amenities were stuck in with that golf course. And I think our dealings today still have to be very strong with ARCO, because that's, they control the pocketbook.

I know the EPA says, hey, this is the law and this is what has to be followed But our direction that we received while we were on that golf course, our strongest dealings were still with ARCO. And that's where our, I think our ideas have to come from or -- You know, we have to push forward to deal more with ARCO, because somehow, we've kind of pushed them back to be kind of an adversarial group, and I don't know why. Because we started out in a meeting about two years ago and ARCO offered some money and people thought that, oh, yeah, they're out there just trying to bribe the whole damn town and they want to leave and just be gone with it.

But I can honestly say, there's more projects around out there, and if we can deal with these people on a good, honest effort and deal with them with an open mind -- I know we have to follow the ground rules the EPA and the State puts forward, but I still think that our major dealings have to be dealt with with ARCO. I know we did most of it with Bill Williams, and

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Sandy came in and has done a tremendous job in filling his position.

My idea is that we've got to include those people back into our, any of our dealings You know, we can sit and fight with, you know, push them off to the side and deal with the governmental agencies and thinking we're going to get it done. And we will get it done, but I think we have to be more compassionate and we can get a lot more projects done other than just a little cleanup out here. Because when they go, they're gone.

And I, I don't plan on just bailing out tomorrow. I went through a quadruple bypass, and I hope it gives me a few more years to live. And I want to be around to, you know, to see more of that green grass other than just the golf course.

So thank you. And I'd like to see ARCO in our dealings rather than just the EPA.

MS. DALSOGLIO. Thanks, Chuck.

Bill Hickey.

MR. HICKEY: My name is Bill Hickey. I've been a school administrator here in Anaconda for the last 21 years. And 18 years ago, on September 30th, many of us were with Ted Schwinden, soon to be Governor of Montana. And on September 30th, 1980, we were awaiting perhaps news of building a new smelter when we heard that it was to close And our lives in Anaconda fell into the ashes.

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A very positive thing is that we have seen Anaconda, in the last eight to nine years, rise from the ashes. And it is alive and well, and it is a place where people want to go to. I was so thrilled last summer when people from all over Montana wanted to travel to Anaconda. This was no longer a place that was not fun to be at. It was no longer a place of slag, a place of doom; it was a very positive place.

I support the comments made by Terry, as one of the many citizens who work with Terry and county government in trying to come together is expressing one voice. The most important thing that we have to say is that we want Anaconda to continue to grow, to thrive, to come from the ashes, and to be a very, very viable place. ARCO has helped, over the past eight to nine years, at bringing this new vision and this new life to Anaconda. What we hope in this final Record is that the ARCO, EPA, and the citizens of Anaconda and the government of Anaconda can come as one and do the right thing by the environment and the people in a cost effective, meaningful fashion. And I hope that we can have the spirit that has thrived for real winning by all sides.

Thank you.

MS. DALSOGLIO The next individual is Mel Stokke.

MR. STOKKE: I'm Mel Stokke, retired manager of the, general manager of the Anaconda smelter here in Anaconda. And I'm going to say this right off the front. I was kind of

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caught cold, because I didn't know all of you were going to come up with here with written statements and present them and read them to the audience. So I'm going to just speak off the top of my hat.

Now, all of you are saying how good a community Anaconda is and how well it is and so on and so forth. I don't know if any of you can compare with me. I was born in Anaconda and spent my whole life here, except for the time that I went to Montana State University to get an education, and the other time was when I served in the Army in World War II Outside of that, I've lived in Anaconda all my life. And I've worked on the smelter for 34 years. When I graduated from Montana State College with a degree in civil engineering, I went to work for the Anaconda Company as a junior draftsman Over the years, I went through progressive jobs, until I ended up in 1974 as general manager of the Anaconda smelter.

Now, I've been through probably a lot more than you people have ever envisioned as far as environmental problems go. Now, starting in the early '70s, I dealt with the state department and the EPA as far as S02 emissions, the opacity of smoke, arsenic problems, and so on and so forth. Now, in the early days, these things weren't thought of. Everything, everything was do the job, produce the copper, and let it go at that. But starting in the early '70s, when the regulations came out and said that we had to start complying with these things, we --

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Well, just to give you an example, we went to Durham, North Carolina, to meet with the EPA and discuss the regulations on arsenic. And at that point in time, they established a regulation of ten micrograms per cubic meter. Now, do any of you know what ten micrograms per cubic meter is? If you took a paper clip, cut it into a thousand parts, and put it into a one cubic meter box, that's what ten -- that's what one microgram is And, of course, we're looking at ten.

We went back there and discussed this with the EPA. They had a, a board or a group of people that were civilians. And at that point in time, we tried to talk them into 50 micrograms per cubic meter. Now, let me give you some examples. In the converter aisle, the monitoring that we did there showed 19 micrograms per cubic meter. In our casting department, it showed 50. We tried to talk them into a 50 micrograms per cubic meter. We weren't able to. These people had made up their mind and they weren't about to change it. And I still don't know, to this day, how they ever arrived at the figure of ten micrograms per cubic meter. But anyway, that's the regulation that we were held to.

Now, we met with the State, and a big problem was S02. And every year, we went over to Helena and we met with the State Board of Health and we discussed these problems. Starting in 1970, the company committed to $7 million to do some changes on the reverberatory furnaces. This was well and good, because it

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was something that we needed The following year, we went into a program of expansion and we spent $33.5 million And parts of that was productivity, parts of it was production -- or was environment.

In '74 and '75, we spent another 31 million for the electric furnace, the fluosolid, the components that went with that, to cut down the volume of the gas stream, so that we could contain particulates The particulates that came off the reverb was a large volume of gas, and there was no way we could treat it in the bag house. Because we found out that state of the art in 1918, that the way to treat particulates was through an electrostatic precipitator.

The only thing that wasn't taken into account was that the ores coming out of Butte had a lot of arsenic in it. Now, arsenic does not go from the gaseous state to the solid state until it is cooled to 220 degrees. So all the years that that large volume of gas went out through the flues and up through the stack, the arsenic went with it. Some of it deposited in the flue as it cooled. But some of it went out through the stack, because it was still in the gaseous state.

So we met with the State and we spent this money. We put in acid plants to collect S02. We enlarged the acid plant by spending another $8 million, to help this. And before the State ever required it, we had tailings ponds and we treated it with lime so that the solid materials and metallic materials

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would settle out in the bottoms of ponds so we'd get a clear overflow.

So the thing I'd like to tell you is that we're -- we spent a lot of years and a lot of dollars trying to comply with the regulations of the State, and every year, they gave us a variance for another year, basically because we were spending money and we were making improvements.

Now, I didn't know that everybody was going to have a written statement tonight, but I wrote a memo to Julie and I copied Sandy on it. And the slag has been one of my pet projects. And I don't like the connotation that they keep saying it's a waste. Now, in 1977, I went to Japan and I visited seven smelters. There are no slag piles in Japan. All of the slag goes into cement plants. And Japan has put in more concrete than you can believe in their highways and overpasses and their breakwaters and so on and so forth.

Now, the components of slag fit in with the elements that go into cement. The aluminum, the calcium oxide, the iron oxide, all those products are the portions that make up a slag. Now, some people say to me, "Yeah, that's fine, but we're in a place where we can't ship that stuff." I'm not saying that. I'm not saying we have to ship it. Where do we get our cement? Do we get it from Portland? Do we get the sacks of cement to our lumber yards from these different places? Why can't we do it here?

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We sent some of this slag over to Trident, and they ran tests on it and found out that it was a successful project The only reason it didn't come to pass is we had purchasing people in Denver that couldn't come to an agreement with the people in Trident So consequently, the thing was never consummated.

We also at one time did some experimenting with slag to make patio tiles. And the tiles that were made were about 18 inches square and about two inches thick. And when they were polished, they were beautiful.

Now, the only thing about slag is when you're looking for structural strength, instead of a five or six sack cement to a yard of concrete, you have to have ten, because it just doesn't give you the body for structural strength.

I think the project that ARCO has been doing here, working with us, and we're trying to work with them, that the town is a lot better off than it ever was. Now, like I say, I worked 34 years on the smelter And when I was on construction, I walked through all of the departments and around the yards and everything, and I guess I'm still alive. I guess I don't have cancer or all these bad things But the thing about it is, I've often wondered in my mind, and I haven't asked anybody this question, but how did they ever arrive at the number of a thousand parts per million in arsenic? If it was the same way as they did with the micrograms per cubic meter, I think

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there's a lot of fallacy.

Thank you.

MS. DALSOGLIO Thanks, Mel.

The next person is Art McLean.

MR. MCLEAN: I'm Art McLean. I guess I'm here tonight to, to support the community in that I've been a native here since 1951. I teach school, have been for the last 24 years. And I have served on the Anaconda-Deer Lodge County Golf Course Authority Board. It seems as though when we have these community meetings and things, I guess we tend to choose sides one way or another, but my testimony tonight is more along the lines of a partnership than anything else, speaking from that of the Golf Course Authority Board and the trials and the tribulations that we have all gone through there. It required a great amount of cooperation and partnership among many arms from the onset of it, from the Arrowhead Foundation, Anaconda-Deer Lodge County Commissioners, the EPA, the State, and of course, ARCO.

It seems as though we can become cynical when we talk about companies or big companies like ARCO, but without them, we would have had a real tough time It might look like, you know, the golf course is very, very successful And it is. And we didn't get there without a lot of cooperation from all of the arms, the parties involved. And it wasn't easy going, it was pretty tough sledding; and there's still some tough

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sledding ahead. However, it is successful And I'd just like to shoot down the idea that there has to be cynicism to accomplish something. I think if we can turn that, as a community, into teamwork, then we're going to have successes. Partnerships work. And the positive results speak for themselves

Thank you

MS DALSOGLIO: The next individual, I believe, is Joe Jordan.

MR. JORDAN: My name is Joe Jordan. I'm the owner of Jordan Contracting. I've been doing business in Anaconda for more years than I even want to remember, but we've been in business as Jordan Contracting heading for eight years. And in those eight years, we've been involved in practically, one way or another, in practically all the reclamation projects that are going on. We employ 50 to 60 people throughout the year.

I'm very concerned -- I have two major concerns with this upcoming work. No. 1 is, I would like to see this work stretched out in a longer period of time. If we try to do this work in, say, two years or three years, that's going to bring in a lot of outside contractors, a lot of outside people. And I don't think that's good for our local community. In order to have young people here, besides everybody else, we have to have jobs. And that can go on for quite some time if we monitor that

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And the second concern that I have, and I think it's been mentioned earlier by practically everyone, especially Mr. Hickey, that we have to do this work cost effective. We've been out, we've been involved, we've seen the work that's done. We know from experience that there's a lot of things that are done that people don't realize. They go beyond to accomplish these things. But we can't expect anybody, ARCO or anybody else, to do something that doesn't make good common sense. We have to do it in a cost-effective way. And I think the Agency has got to look real hard at that.

In other words, what I'm concerned about, and I've seen it in the past, I've seen it in Streamside, that if we get to an impasse and the thing ends up in court, that could go on for 10 or 15 years The only ones working then is a few attorneys So we have to have that cooperation that the earlier people have mentioned And I want to echo that. We need that cooperating and keep the harmony going, and there could be a lot of good things down the road. I'm sure it will happen.

MS. DALSOGLIO: Okay, next is Natalie Fitzpatrick.

MS FITZPATRICK: I'm Natalie Fitzpatrick. And like Mel Stokke, I was born and raised here. In another month, I'll be twice Jack Benny's 39. And I have managed to survive in what other people have felt is a terrible environment to grow up in, and I have survived very well. I think we have to remember that what we have accomplished, we have accomplished

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through a cooperation with ARCO, with EPA, and with the County. And I think that the only way to, for us to proceed in the future is to sit down together and say, what does Anaconda-Deer Lodge County need and how do we best arrive at that decision?

I'm sorry, I seem to get nervous sometimes.

But in any event, I think that we have before us an opportunity to work together, to say, what is it that we really need? Do we need the impossible? Do we have to sterilize ground, or can we let some of this thing take care of itself, as many things do? You know and I know that many of the trees have come back, our wildlife is returning. And I think Anaconda-Deer Lodge will also return if we work together.

Thank you.

MS. DALSOGLIO. Thank you, Natalie.

I'm going to stumble over this next name. Dan, and I didn't, I can't read the last name, I apologize. It looks like it's about a three- or four-letter last name.

Anybody want to claim that one?

Okay. We'll go through the rest of the names. If you were the person that we skipped over, we can come back Terry Vaughn is next.

Do we have a Terry Vaughn?

UNIDENTIFIED SPEAKER: I don't see him here.

MS. DALSOGLIO: Okay. Tammy Johnson then.

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MS. JOHNSON: For the record, my name is Tammy Johnson. I'm actually here tonight on behalf of two different bodies. I live in Whitehall, so I'm not a member of your community. However, I have been involved with various grassroots organizations throughout this state supporting multiple use concepts, taking a hard look at, at how we're managing our environment, and trying to bring about some reasonable solutions.

I'm Executive Director of a group in Whitehall called CURE, which stands for Citizens United for a Realistic Environment. I'm also currently serving as President of the Montana Resource Providers Coalition, which is a larger umbrella group comprising 20-some organizations from every sector of resource production in the state, from agriculture to farming to timber, mining, private property rights, et cetera

I come today bringing one statement. Some people were not able to be here and asked if I would carry this for them. This statement is from Montanans for Private Property Rights, an organization here in Montana. And with permission, I'd like to introduce this into the record on their behalf.

The right to own property is fundamental to the structure of a free nation and has always been one of the most important rights guaranteed to the citizens of this state and country. Citizens have always defended this right with vigor, and our courts have upheld, time and time again, the right to own

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property and has prohibited the taking of private property for public use without just compensation. Many in this room must feel strongly about this issue as it relates to their own property holdings.

The right to determine the end land use for land that is privately owned by ARCO contained in the EPA's Proposed Plan for remediation of the Anaconda Smelter Superfund Site must be respected and upheld. We know that it is often easy to fool ourselves into thinking that large corporations, like ARCO, should have to live by a different set of rules. And perhaps some are thinking that private property rights only belong to the small, individual owner. But no matter how easy the argument seems, the reality is that, yes, even ARCO's right to own property and to determine the appropriate use for that property within the confines of laws that govern our society must be respected, upheld, and championed. There are no exceptions to this fundamental right and philosophy, no matter whose name is on the deed.

Montanans for Private Property Rights plans to further examine the documents and submit written comments.

Sincerely, Carolyn Selan (phonetic), for Montanans for Private Property Rights.

I'd like to introduce some comments on my own behalf of our organization, CURE. Our organization also supports these private property rights and feels that they must remain a

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primary focus as a final plan of action is developed. End land use appears to be, to me anyway, one of the issues that is receiving a great deal of attention, both within the press and within this type of meeting and within documentation that's being submitted on this Proposed Plan.

All of our rural communities are struggling, trying to define their future, trying to figure how the various pieces come together to make up the larger puzzle of what their economic future and what their culture and history has, has taught them and where they want to go. And that is very important. And while it's true that the ARCO holdings in the East Valley may preclude general growth development in this area, it's also my understanding that that has been the case since the latter part of the last century. These holdings have been owned by the Anaconda Company and ARCO for a good deal of time. And I think that it's, it's imperative for everybody to recognize that these are private property holdings, and as any other landowner should have the right to determine the use of their property within the confines of the law, so should ARCO And that's important to our organization.

I've heard many comments encouraging a cooperative relationship between all parties, and I, too, encourage that relationship. Collectively, there have been many good things to come out of that type of relationship, not only for the community of Anaconda, but for the rest of the citizens of this

state. My husband and I bring our kids over to Warm Springs Ponds fishing on a regular occasion. We've been fortunate to play golf at the Old Works Course, although I will be most up-front and say that my skill is not up to that level yet, but it is something that I hope to aspire to. And that benefits not only this community, but other neighboring communities and the rest of the residents of this state

I heard Sandy Stash comment that $350 million have been spent thus far in environmental remediation. I mean, wow, that is a lot of money. And it's amazing to me sometimes how numb we have become to those types of numbers We start talking about 60 million here and 180 million here, and we're throwing these numbers around like they mean absolutely nothing. And I sit and try to balance my checkbook and figure out, you know, how to come up with the next $200. So it's something that we have to be cognizant of. Maybe we need to kick ourselves a little bit and really realize what kind of dollars we're talking about.

Both human health and environmental health are paramount to everyone in this community, everyone in your surrounding communities, and to the state. And that is essential We all support those type of goals. However, it's our organization's belief that common sense must prevail. Cleanup activities do have to accomplish protection for you, as citizens of this community. I believe that ARCO and the agencies and, and

everyone in this room are also strongly committed to that So I don't -- and I think that there are ways that everybody can work together to ensure that that happens. But I also believe that we have to acknowledge that cost-effective remedies must be included in the final plan. It serves no one's interests if they are not.

Economics have got to be considered. Whether we are balancing our own checkbook for our personal home, for our family, whether it's for our business, whether it's for a larger corporation, such as ARCO, it has got to be considered. And when cost-effective remedies are applied, when human health has been protected, when environmental protection has been accomplished, then it becomes a winning situation for everyone involved.

And believe me, the well can run dry. Just as most of us never believed the Anaconda Company would close down, we were in Livingston and my husband was working for Burlington Northern Railroad in the Shops there, we never believed that could happen. We've all been through this. And we've got to be cognizant of the economics involved.

Thank you very much.

MS. DALSOGLIO: We're going to go back to one that missed over, Joe Saba.

MR. SABA. My name is Joe Saba. First of all -- I've got a little bit of a cold. I'm fairly new at this. I've

lived here most of my life And I've seen Anaconda when this hill was going and when everything was really prosperous, and I've seen it on the down side. And we talk about long-term things. I'll agree with what everybody has said as far as with ARCO and the EPA. So far, I think everybody has worked pretty good together, because from the time I was a kid here and I seen a lot of the destruction of the land and whatnot going on around here, and in the past few years, I've seen a lot of that come back. And I, for one, it makes me very happy.

But one of the other long-term things that I look at as a young member of this community, or a younger member of this community supporting a family and trying to make my living here is that -- Mr. Jordan made a comment on we need to, you know, one of the long-term things that we have to keep in mind isn't just ARCO and it isn't just the EPA and things like that. We want to be able to maintain what these people have done. I want my kids to be able to work and maintain these things. And the only way they can do that is to stay here, to work here, and to look after it like we're all trying to do. And to do this, we've got to have jobs.

Now, for me, you know, I work for a company, RDM Multi-Enterprises. And I would like a little bit of attention brought to them simply for the fact that they're a company, a small company that has came in here. And the concrete thing was brought up, okay Well, RDM came in here, and they're

taking that slag up there, they're making a blasting abrasive out of it, roofing granules out of it. They're supplying jobs to our community. They've brought money into this community. And, and it's a long-term thing. It's not just something that's here and going to be gone in a short time. I mean, look at that pile up there. You know, we've been looking at it for a lot of years.

And, you know, I would kind of like to, I don't know, maybe hear some input or hear some fairly close to for-sure things on, you know, what we can do to support that. Because without the people being able to be here, to work here, everything that we're doing, in a way, goes for naught. Because this is our home. This is my kids' home. I want them to be able to raise their families here. But if there's nothing here for them, and if we don't support companies like RDM, who have taken big chances, fought tooth and nail with different people to put down a foothold like they have, you know, what are we going to have? I think that's something we need to look at.

You know, a lot of times, I talk to different people around town and they ask me, "Who do you work for?" And I say, "I work for RDM up on the hill." And they don't know who I'm talking about. Well, you know, that bothers me a lot. Because if people would stop and take the time and look to see who we are and what we're doing, you know, I mean, we need that involvement, that participation. It's for everybody. And if

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we can, if we can keep that kind of growth going, you know, I mean, like I say, we can do all this cleanup and everything like that And we have to do it. It was let go for too long. But along with that, we have to bring in the new blood and the new industry to support everything that's been done.

Thank you.

MS. DALSOGLIO Thank you, Joe.

The next individual we have is Duane Logan

MR. LOGAN: My name is Duane Logan. I'm a life-long resident of Anaconda. I grew up on a ranch down by Warm Springs, which was one of the, part of the initial reclamation jobs done. And as all, it took time to take in Grass doesn't grow overnight. I worked on the golf course. It takes time, it takes effort, and you've got to work at it to bring it to something But it's something to be proud of. And as the Governor's project, on our place, you can see today what used to be green is now lush grass that the cows eat.

I worked on the golf course, which took a lot of community effort, a lot of planning, a lot of compromise, and a lot of long hours by a lot of people. And it has become a success project. And it's like the guy from RDM said, we have to look into the future and find alternate sources. Because ARCO is going to be gone someday. And I've been lucky enough to work for a subconsultant to ARCO on most of this construction work. And it's been, it's taught me a lot, and I was lucky enough to

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have that experience. So I just hope that we, as a community, try to work with ARCO and continue with the, the process and the success that's been done so far.

MS. DALSOGLIO. Millie Nash is next -- Mike

MR. NASH: Everybody has kind of established their credentials. I come from a six-generation family that's been born and raised and gotten our education and worked within 100 miles of Anaconda for six generations. And we've been involved in extractive industries and all sides of it for all that time. Well, the sixth generation, they're just little, so they...

I know Mr. Stokke says he's been around the world, to Japan. I've never been to Japan. I've been to some foreign lands, though, I've been to San Francisco and Billings. And I like it right here. But in any event, I'm here actually tonight on behalf of a small, nonprofit organization called the Anaconda Environmental Education Institute, which really doesn't take a stand on the, on the issues of ARCO and EPA as to what better plans might be.

This group provides summaries of the technological, the huge technological documents. Meg Hickey does the basic job. These huge technical tomes take up literally shelves of space and provides what we hope are accurate objective summaries for the use of all parties. And as such, we have the opportunity to observe that a lot of community agencies and people and volunteers have been involved in the statement that was

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presented by the Commissioners And that's just a point of fact. While reading the newspaper, I wasn't sure that everybody was aware of that, and I thought it was appropriate that I observe that and that's just a piece of information, I think, that ought to be available

The second thing I do think that we would like to see is that the Record of Decision would contain a mechanism that would allow new opportunities, such as the prison, or any other kind of opportunity that might come along that would provide a remediation and at the same time other benefits, or new technologies, such as innovative uses of the slag or other kinds of waste that might develop in the future; that the mechanism would allow for incorporation and modification of the plan as those things become available; that the community and EPA and ARCO would be able to take of advantage of those kinds of things that really -- and there's no sense being stuck with an old car if you can get a new one. But the, the Institute will continue to provide the service of providing accurate summaries and helping to analyze the technological information within our resources.

Thank you

MS. DALSOGLIO. Thank you, Millie

Don Peoples is next, please.

MR. PEOPLES: I'm Don Peoples from Butte, and I'm feeling a little awkward because I'm violating a basic

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principle of nature in Southwestern Montana, and that's basically, a guy from Butte should never come down to Anaconda and try and tell people what to do. And I'm not going to do that Mike lived in Butte for a long time, and when he moved down to Anaconda, they now call him Millie. I hope you don't call me Donna the next time I'm down here.

But I do feel, I guess a little bit relieved from violating a basic law of nature, because our company is involved in a major development with the prison project. And that is indeed a very, very significant project in, in terms of employment opportunities and in terms of expenditures of dollars. We've expended a lot of money to this point in time. As we speak, or as I speak tonight, there are about 14 architects in a Reno office developing plans for that facility.

It would not have been possible without the great cooperation we've had from the Anaconda-Deer Lodge community and from ARCO. I consider that thinking out of the box. We've done something different here. And frankly, we would not be in this position today if it had not been for what we had seen going on in this community with the development of the golf course The development of the golf course led our company not only to be involved with the prison development, but also was the impetus for getting us involved with the Greenway development. And that Greenway development came out of our company in Butte, along with a lot of other people.

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But I'm here tonight to encourage you to continue to think outside the box. You know, that's a trend that is being used in business all the time today, because you just can't think inside the box. And I think there's a lot of regulations, obviously, you have to adhere to, but let's get outside the box and let's continue to think about all the good things that can happen in Southwestern Montana, if we cooperate and if we work together.

We look forward to becoming a major employer in this area. We're working today with ARCO and with a prospective purchaser's agreement and with EPA and with all of the other agencies that are involved in that and cooperating with the local government here in developing a very worthwhile project. I think that we've got a chance of a lifetime in Southwestern Montana, and we'd better not blow it. If we work together and if we work cooperatively and if we look at making this part of Montana the most livable place in the country, I think we can do it. And I certainly would encourage all you great people down here in Anaconda to continue to think outside the box. We're really looking forward to being a part of your economy down here. And we're looking forward to working with ARCO and working with the community and working with EPA. And all of this cooperation that I've heard tonight and this concept of thinking outside the box leaves me with one closing thought: We're talking about closing out the chapter of ARCO's

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participation here Let's make it a happy ending

Thank you.

MS DALSOGLIO. The last signup I have is Don Kelley.

MR. KELLEY: I listened to everybody tonight, and I'm going to be right up-front with all you people, my purpose for being here is purely self-interest. I want my kids to stay in this community. I want my family to be here for the next 100 years. My family has been in this community since the late 1800s. They worked for the ARCO, the ACM Company, the Daly Company, whatever you wanted to call it back then.

We have to be in tune with the fact that ARCO is closing its chapter on this community. They are no longer going to be involved in this community. In that respect, we need to look out for our own self-interest. I would like to approach ARCO on a non-adversarial basis. I would like us all to approach them on that basis. In the same respect, I think we need to use caution in dealing with anybody that is telling us they are not going to have anything further to do with this community in the long-term future.

As far as the trusteeship that ARCO speaks of with the State, I would rather not approach ARCO or the State or the EPA on a trusteeship basis. I think we need to be aware of our responsibility in the reclamation for this area Our responsibility is as an oversight We're members of the community, we're members of the people that are going to be

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here 100 years from now We need to be aware of what's going on with this project. And the people that have turned out here tonight is a good indication that people are concerned with what's going to happen through the next 100 years.

I think a lot of what's happened in the past with the adversarial point of view that ARCO and the community have had is a fear of ARCO no longer being here. I think we still have a little bit of that company town attitude, that what happens to us when they're gone? Well, it's a real evident situation that ARCO is gone. And we need to be involved in the process in saying that goodbye, you know, that we need to look out for our own interest in the process. And I'd like to encourage everybody to continue in that process.

One comment I would like to make on private ownership of the property. There were some comments that were made that ARCO is a private entity and that the property is theirs. I also own property in the affected area, and the rights of ownership are not limited to ARCO, they're all of ours. We own this property. We are owners of the future of Anaconda. And we need to take part in that.

Thanks.

MS. DALSOGLIO: Okay, I had three more people come in to sign up. I just thought I'd take a quick reading to make sure there isn't anybody else out there that would like to sign up to give public comment tonight.

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Okay, we'll start with Ed McCarthy.

MR. MCCARTHY. My name is Ed McCarthy I work for Jordan Contracting. I've been with Joe for seven years now. I've worked with ARCO's contractors since 1983, at the start, when we demolitioned the smelter up there. And I've been working on and off ever since then.

I was fortunate to be chosen this last fall as one of ARCO's people to be featured in the paper. And a lot of people think I fish all day, but that's not the case. But anyway, I've really enjoyed doing some of the work on the golf course project and the Warm Springs Ponds. And one of the greatest comments this summer is people coming into town and seeing the progress we're doing down by the Arbiter, and seeing all the grasses growing down through there instead of the old red sands. And it's just a great positive attitude with the local people working together on that. We can continue to work together to do great.

MS. DALSOGLIO: Next, we have Wayne Ternes.

MR. TERNES. After listening to a lot of folks talk tonight here and thinking about what was said, a lot of things have been alluded to as far as the business that's been here, things that have come and gone But as a child, I grew up -- I never grew up, I still haven't grown up, but I ran that riverbank and those ponds as a young kid We grew up down there, and I saw the animals come and go. Matt and I, as kids

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down there, eight and nine years old, ran up and down that river, around the ponds, and around Warm Springs and what's going on. And I'd like to just say thank you to all the folks that have been involved in this cleanup so far.

We have a long ways yet to go. This last one is supposedly the last one. And what I have found, from hearing people around Anaconda commenting on our cleanup, is people only notice what they see. It's the design work and all that stuff that people don't really understand what's going on and what's happening behind the scenes. In the last year is when I'm hearing folks say, just like Ed talked about, the grass growing here, the wheat coming into Anaconda. People are wondering why we're planting wheat out there and if we can harvest it. Actually, we did cut hay in the East Anaconda Yards this year. Who would have ever thought that would happen?

But the animals that have come back to this area, and looking at what's going on with cleanup, effective cleanup done right can make a real difference. And we need to do it. Nobody is here to be a bad person. We need laws to make sure that we protect human health and the environment. Let's make it sensible. And look what's happened already. Those of you that have been around here for a long time, 20 years ago, 30 years ago, if somebody had ran over a deer down by the slag pile, it's because it had to have fallen out of some hunter's truck. And nowadays, they hit them regularly down there.

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You know, how many years ago was it when you saw a fox come across the highway down there? I see them regularly on my way to work. And down by Warm Springs and along the river, there's places where it has come across, places where they've done cleanup has made a big difference. Warm Springs Ponds is a great example. I know there's pros and cons, saying, yeah, water levels aren't whatever. But I remember going to that river when it ran orange in the springtime. That's just what it did. The Clark Fork was orange near Warm Springs. You didn't go near it. The only place you fished was Warm Springs Creek, to where it ran into there. Over the years, that's gone. We don't see those big large orange runoffs anymore. Once in a while, there's some problems, but I've seen the fish change. I used to fish down there when there really wasn't any fish to catch, you were just down there running around the river. And now, there's actually fish you can catch. And I just want to say thank you to what's going on and urge everybody to keeping work with us, and we'll get through it.

Thanks.

MS. DALSOGLIO: Next, we have Jim Davison.

MR. DAVISON: This is the last, but certainly not the only site that needed to be cleaned up in our county. Past solutions which have proven to be safe, healthy, clean, provide economic viability, and have been accomplished in an economically reasonable fashion, were a result of EPA, ARCO,

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and the community working together to find those solutions. As the Executive Director of Anaconda Local Development Corporation, we will go on record as supporting the comments made by Commissioner Wilkinson The Anaconda Regional Waste and Water site, ARWW, is huge and diverse. In fact, it's probably really over 30 sites with over 60 problems. The plan presented is not detailed. The real solutions will come and will be answered in the design and in the implementation stage. Community members and the County must have a meaningful role in those design stages if true success is to be made. And I would hope that the ROD would address that and include the community in those planning stages.

MS. DALSOGLIO: Neil Thomas is next.

MR. THOMAS: I'm Neil F. Thomas. Usually, I'm the last speaker, and I hope I am the last one tonight. But I'm the President of the Anaconda Sportsman Club. And we'd like to see something happen year around with this cleanup business, something that we can do year around. And that's recreation. So if we could get some clean water, like Silver Bow Creek and fish in the creek, get some birds down in the Opportunity Ponds, and also have access sites when these projects are completed so we can have access to them. And then I'd also like to mention that we're kind of interested in putting in a shooting range, a modern shooting range. So if that can happen, we'd like to see that happen.

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Thanks.

MS. DALSOGLIO Well, unfortunately, you are the next to the last one. I have one other individual, Bea McCarthy, if you'd like to come up.

And I'll just do another check, anybody else that has changed their mind or wants to be added to the list?

Okay.

MS MCCARTHY: I'm Bea McCarthy, I'm your state senator. I represent you in Helena, try to do what you want and try to give your views when we come I'm also a member of the Environmental Quality Council of the State of Montana And in that capacity, I was meeting last week again with groups from all over the state, when we review all of the projects that are in any way affecting both the environment and our lives and our citizenry. We in Anaconda have been held up as an example of what can be done, both with cooperation of the citizenry and with money. And I think that's something I'm emphasizing at this point. This has not been an inexpensive project to do. Yes, we've got a beautiful golf course; yes, we're working on Greenways. But we also have to realize a lot of money has been expended in that and will continue to be expended in that cleanup.

We've also been very fortunate, I think, in finding contractors and subcontractors that have done a good quality job. Some of the other projects that the EQC has had to

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monitor throughout the state have not been that lucky We've been back over them and over them again. And Anaconda has been fortunate in that respect. We need to continue with that and we need to watch the people that are doing our jobs in the future. If we have to do what Mr. Jordan suggested and stretch the jobs out a little bit longer to get quality contractors, then let's do it. Let's not rush through a project in order to get it finished and then have to have it redone at somebody's expense a few years later.

I think the people that are here tonight are sincerely concerned about their community, or they wouldn't have taken the time to come out on such an evening as this. They need to be commended for that. All I'm trying to do to is bring your ideas to Helena and to the people that are making the decisions. And in that, I try not to form my own opinions or have them influence what I'm doing. I'm trying more to see if I can get both sides of the balance and do it, and I hope that in representing you, I will always continue to do that

I guess I'm a bit prejudiced in what we're doing here, because I've seen it do so much good. And I want to thank ARCO for that, because I think they have really tried to do the very best they can. And we need to thank the contractors in the same respect. And I hope that EPA will look at that when they're making the final decision on this plan and realize that we need to go forward.

COURT REPORTER'S CERTIFICATE

STATE OF MONTANA)
SS.
COUNTY OF JEFFERSON)

I, CHERYL ROMSA, Court Reporter, Notary Public in and for the County of Jefferson, State of Montana, do hereby certify:

That the foregoing proceedings were reported by me in shorthand and later transcribed into typewriting; and that the of my ability

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my notarial seal this 26th day of January 1998.

CHERYL ROMSA
Court Reporter - Notary Public
My Commission Expires 8/4/99
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We need to also think, though, that there are other uses for this land. The prison is an excellent use for this land. The golf course is an excellent use. We've got to use the slag pile for different things as we come up. Let's brainstorm among ourselves We're the people that live here. What type of industry do we want? What do we want to bring for our future and for our children and our grandchildren? So work with it together, and we'll get there.

Thank you.

MS. DalSOGLIO: Thank you, Bea.

I would like to just say thank you also for all of you coming out tonight. We've heard echoed quite a bit that this is a real important time for this community, and I think your attendance at tonight's meeting has really showed EPA your ongoing interests and concerns. So thank you very much. I look forward to receiving written comment again through January 30th.

(The proceedings were concluded at 8:30 p.m.)

* * * * * * * * * * *

APPENDIX C

ARWW&S OU ROD AMENDMENT
(September 29, 2011)

2020 PARTIAL CONSENT DECREE
for the
ANACONDA SMELTER NPL SITE
Anaconda Deer Lodge County, Montana

RECORD OF DECISION AMENDMENT

ANACONDA REGIONAL WATER, WASTE, AND SOILS OPERABLE UNIT

Anaconda Smelter National Priorities List Site
Anaconda – Deer Lodge County, Montana

September 2011

U.S. Environmental Protection Agency

and

Montana Department of Environmental Quality

Record of Decision Amendment

Anaconda Regional Water, Waste & Soils Operable Unit

Anaconda Smelter National Priorities List Site

Anaconda – Deer Lodge County, Montana

September 2011

U.S. Environmental Protection Agency
Region 8, Montana Operations Office
10 West 15th Street, Suite 3200
Helena, Montana 59626

In consultation with and concurrence from:
Montana Department of Environmental Quality
1100 North Last Chance Gulch
P.O. Box 200901
Helena, MT 59620-0901

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Record of Decision Amendment

Preface

Anaconda Regional Water, Wastes and Soils Operable Unit

Anaconda Smelter National Priorities List Site

Anaconda – Deer Lodge County, Montana

The U.S. Environmental Protection Agency (EPA), in consultation with the Montana Department of Environmental Quality (DEQ), presents this Record of Decision (ROD) Amendment for the Anaconda Regional Water, Wastes and Soils (ARWW&S) Operable Unit (OU) of the Anaconda Smelter National Priorities List (NPL) Site in Anaconda – Deer Lodge County, Montana. This decision document modifies the ROD selected for the ARWW&S OU in September 1998. The ROD Amendment is based on the Administrative Record for the ARWW&S OU, including the 1998 ROD, four technical impracticability (TI) evaluations, the Proposed Plan, the public comments received, and EPA responses to comments. This decision document explains the factual and legal basis for modifying the remedy for this Site. The revised remedy was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended (42 U.S.C. § 9601 *et seq*.), and in accordance with the National Pollution Contingency Plan (NCP) [40 C.F.R. Part 300].

The ROD Amendment has three purposes:

- To describe the changes to the remediation requirements of the 1998 Selected Remedy, including remedial action objectives, applicable, relevant and appropriate requirements (ARARs), and cleanup levels.
- To certify that the remedy selection process was carried out in accordance with the requirements of CERCLA, and, to the extent practicable, the NCP.
- To provide the public with a consolidated source of information about remedial design (RDs) investigations and data evaluations completed since the original ROD was signed in 1998 which has led to the changes presented in this ROD Amendment, as well as EPA's consideration of, and responses to, the comments received.

The ROD Amendment is organized into three distinct sections:

1. The Declaration section functions as an abstract and data certification sheet for the key information contained in the ROD Amendment. The signature page for the EPA Region 8 Assistant Regional Administrator and Director of DEQ is located in this section.

2. The Decision Summary section provides an overview of the ARWW&S OU characteristics, basis for the amendment, description of the fundamental and significant changes to the remedy and an evaluation of those differences. The

Decision Summary also describes the Selected Remedy and explains how the remedy fulfills statutory and regulatory requirements.

3. The Responsiveness Summary section addresses stakeholder and public comments received on the Proposed Plan and other information contained in the Administrative Record.

Record of Decision Amendment
Anaconda Regional Water, Waste and Soils Operable Unit
Anaconda Smelter NPL Site

U.S. Environmental Protection Agency

Montana Department of Environmental Quality

September 2011

Part 1: Declaration

Declaration

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Declaration

Site Name and Location

Anaconda Smelter NPL Site

Anaconda, Deer Lodge County, Montana

ARWW&S OU

CERCLIS ID #MTD 093291656

Statement of Basis and Purpose

This decision document presents an Amendment to the ROD for the ARWW&S OU of the Anaconda Smelter NPL Site in Anaconda - Deer Lodge County, Montana. EPA, with the concurrence of DEQ, revised the Selected Remedy in accordance with CERCLA, 42 USC §9601 *et seq.*, as amended, and the NCP [40 CFR Part 300].

This decision is based on the Administrative Record for the ARWW&S OU of the Anaconda Smelter NPL Site. The Administrative Record (on microfilm) and copies of key documents are available for public review at the joint-Deer Lodge County/Arrowhead Foundation Superfund Document Repository at 118 East Seventh Street in Anaconda. The complete written Administrative Record is maintained at the EPA - Montana Office, 10 West 15th Street, Suite 3200, in Helena, Montana and can be viewed there.

The State of Montana concurs with the Selected Remedy, as indicated by its signature.

Assessment of the Site

There are many pathways at the ARWW&S OU site that create unacceptable risks to human health and the environment, as documented in the Administrative Record. The remedial actions selected in the 1998 ROD, as modified by this Amendment, are necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment at the ARWW&S OU site.

Description of the Selected Remedy

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, this 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. This amendment also waives the arsenic human health standard in certain ground and surface waters at the site. The waiver of the arsenic human health standard in certain areas of the site is the only fundamental change to the selected remedy related to changes of the contaminant-specific standards. The contaminant specific ARAR changes since the 1998 ARWW&S OU ROD was issued are summarized in Table 3-1, which identifies the revised remedial action goals/performance standards for surface water and ground water. Other than the changes noted in Table 3-1, there are no changes to the Remedial Action Goals set forth in the 1998 ROD. An updated ARARs analysis is provided in Appendix A.

Also, numerous investigations were conducted to collect data to complete RDs. Data collected 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 has led to a re-definition of the volume and spatial distribution of contaminated ground and surface waters within the site. These performance standard changes, additional site characterization, and design analyses have 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 remedial action objectives identified in the 1998 ROD remain unchanged under this ROD Amendment. The fundamental and significant changes to the ROD for each media are summarized as follows. 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 have been identified for alluvial aquifers in the North Opportunity and South Opportunity areas. Although this 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 µg/L, respectively, within the surface water TI zone. These surface waters have been impacted by groundwater discharges from the bedrock TI zone.

- Waste Management Areas - Waste Management Area (WMA) boundaries have been revised to include adjacent waste left in place.

- Miscellaneous Wastes – Certain of the miscellaneous wastes are now being 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 (soil arsenic concentrations between 1,000 – 2,500 mg/kg) areas have been designated where steep slopes prevent safe operation of conventional reclamation equipment (Smelter Hill) or 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.

Statutory Determinations

The Selected Remedy, as revised in this ROD Amendment, is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, is cost effective and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

Since hazardous substances above health-based risk levels will remain on site, 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.

Authorizing Signatures

Carol L. Campbell

9/29/11
Date

Carol L. Campbell
Assistant Regional Administrator
Ecosystems Protection and Remediation
U.S. Environmental Protection Agency, Region 8

The State of Montana DEQ, as the Supporting Agency for the ARWW&S OU of the Anaconda Smelter NPL Site (MTD093291656), concurs with this *Record of Decision Amendment.*

Richard H. Opper

9/16/11
Date

Richard H. Opper, Director
State of Montana
Department of Environmental Quality

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Record of Decision Amendment
Anaconda Regional Water, Waste and Soils Operable Unit
Anaconda Smelter NPL Site

U.S. Environmental Protection Agency

Montana Department of Environmental Quality

September 2011

Part 2: Decision Summary

Decision Summary

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Acronyms

ADLC	Anaconda-Deer Lodge County
Agencies	EPA and DEQ
ACM	Anaconda Copper Mining Company
AOC	Area of Concern
ARAR	applicable or relevant and appropriate requirement
ARWW&S	Anaconda Regional Water, Waste, & Soils
Atlantic Richfield	Atlantic Richfield Company
BMP	best management practice
CDM	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CGWA	Controlled Ground Water Area
COCs	contaminants of concern
CPMP	community protective measures program
cy	cubic yards
DEQ	Montana Department of Environmental Quality
DNRC	Montana Department of Natural Resources
DPS	development permit system
EPA	United States Environmental Protection Agency
FWP	Montana Department Fish, Wildlife & Parks
GW	ground water
GWSWMS	Ground Water/Surface Water Management System
HAA	high arsenic area
HPS	handling, process, and storage
ICs	institutional controls
LRES	Land Reclamation Evaluation System
MBMG	Montana Bureau of Mines and Geology
MCL	maximum concentration limit
mg/kg	milligrams per kilogram
N/A	not applicable
NCP	National Contingency Plan
NPL	National Priorities List
O&M	operations and maintenance
OU	operable unit
OW/EADA	Old Works/East Anaconda Development Area
POC	points-of-compliance
ppm	parts per million
PRP	potentially responsible party
RA	remedial action
RAG	remedial action goal
RAOs	remedial action objectives

RD/RA	remedial design
RDU	remedial design unit
ROD	record of decision
RRU	Reclamation Research Unit at Montana State University
SAP	sampling and analysis plan
SMP	site management plan
SW	surface water
TI	technical impracticability
USF&WS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WLIP	wastes-left-in-place
WMA	waste management area
µg/L	micrograms per liter

Section 1 Introduction

This document presents an amendment to the record of decision (ROD) for the Anaconda Regional Water, Wastes, & Soils (ARWW&S) Operable Unit (OU) of the Anaconda Smelter National Priorities List (NPL) Site. The site is located in Anaconda - Deer Lodge County (ADLC), Montana and the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) identification number is MTD 093291656. The ROD for this OU was signed by the United States Environmental Protection Agency (EPA) and the Montana Department of Environmental Quality (DEQ) in September 1998.

1.1 Purpose for this Amendment

In compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §117(c), 42 U.S.C. § 9617, and the National Contingency Plan (NCP) 40 CFR §§300.435(c)(2)(i) and 300.825(a)(2), EPA and DEQ (the Agencies) have determined that certain remedy revisions fundamentally and others significantly change the remedy selected in the 1998 ARWW&S OU ROD. EPA is therefore issuing this ROD Amendment. Fundamental changes involve a fundamental change in scope or cost to the remedy, requiring a nine criteria analysis. Significant changes involve a change to a component of a remedy that does not fundamentally alter the cleanup approach. For a ROD Amendment, EPA is required to describe to the public the nature of the fundamental changes in a proposed plan, summarize the information that led to making the changes, afford the public the opportunity to comment on the proposed changes, and revise the remedy and affirm that the revised remedy complies with the NCP and the statutory requirements of CERCLA. For significant changes to the remedy, EPA is required to make the significant differences and supporting information available to the public through issuance of an explanation of significant differences, which EPA has done here through public notice, and issuance of a proposed plan and this ROD Amendment.

There are two principal components of this ROD Amendment. The fundamental changes result 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 micrograms per liter (µg/L). This applicable or relevant and appropriate requirement (ARAR) change has led EPA and DEQ to revise the performance standard for arsenic in certain ground water and surface water under this ROD Amendment.

Technical Impracticability (TI) evaluations were conducted to evaluate whether the arsenic human health standards was achievable in certain areas of the site. The TI determinations result in an increase of the extent of the existing bedrock aquifer ground water TI zones, as well as the creation of new TI zones for alluvial aquifer ground water and a TI zone for certain surface water reaches. The 2011 TI evaluations are part of the Administrative Record for the site, and are as follows:

- Technical Impracticability Evaluation Report, Achievement of Arsenic Human Health Standard in Surface Water, and Ground Water in the North Opportunity Area of Concern, Anaconda Regional Water, Waste, & Soils Operable Unit, Anaconda Smelter NPL Site, Anaconda, Montana (EPA 2011a).
- Technical Impracticability Evaluation Report, Achievement of Arsenic Human Health Standard in Surface Water, and Ground Water in the South Opportunity Area of Concern, Anaconda Regional Water, Waste, & Soils Operable Unit, Anaconda Smelter NPL Site, Anaconda, Montana (EPA 2011b).
- Second Addendum to Technical Impracticability Evaluation Bedrock Aquifer, Anaconda Regional Water, Waste, & Soils Operable Unit, Anaconda Smelter NPL Site, Anaconda, Montana (EPA 2011c).
- Technical Impracticability Evaluation Report, Achievement of Arsenic Human Health Standard in Spring-Fed Tributaries, Anaconda Regional Water, Waste, & Soils Operable Unit, Anaconda Smelter NPL Site, Anaconda, Montana (EPA 2011d).

The EPA guidance document *Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents* (EPA 1999) generally considers new or expanded TI zones to be a fundamental change to the remedy, which requires an amendment to the ROD (page 7-42). In addition to these fundamental changes, several other changes to the 1998 remedy have occurred, which were developed as remedial design (RD) data were collected. These remedy changes are referred to as significant differences.

The ROD revision modifies components of certain remedies due primarily to data collected since the ROD, and for waste management areas, applies a more consistent approach to the management of waste materials at the site.

The Selected Remedy presented in the 1998 ARWW&S OU ROD identified two categories of wastes at the ARWW&S OU: waste management areas and miscellaneous waste material. For the majority of areas, the miscellaneous waste material was to be consolidated into waste management areas, though some waste material remained in place. Under this ROD Amendment, the two wastes-left-in-place (WLIP) areas are merged into waste management areas, as these areas are each adjacent to waste management areas. This results in the Old Works Waste Management Area (WMA) and Old Works Wastes Left-In-Place being merged into a larger Old Works WMA, and the Smelter Hill WMA, Opportunity Ponds WMA, and the Triangle Wastes Left in Place being merged into a Smelter Hill/Opportunity Ponds WMA. The preamble to the NCP states that that remediation levels should generally be attained throughout the contaminated plume, or at and beyond the edge of the waste management area, when the waste is left in place. See 55 Fed. Reg. 8666, 8713, 8753 (March 8, 1990). The ground water remedy remains unaffected beyond the new WMA Boundaries. Data show the continuation of the ground water plume beneath the wastes and beyond.

1.2 Organization

This ROD Amendment Decision Summary is organized as follows:

- Section 1 provides the basis for this ROD Amendment and the organization of this document;
- Section 2 describes the Anaconda Smelter Site and ARWW&S OU;
- Section 3 identifies the basis for the changes to the 1998 ARWW&S OU ROD;
- Section 4 presents the changes to the Opportunity Ponds Subarea;
- Section 5 presents the changes to the North Opportunity Subarea;
- Section 6 presents the changes to the South Opportunity Subarea;
- Section 7 presents the changes to the Old Works/Stucky Ridge Subarea;
- Section 8 presents the changes to the Smelter Hill Subarea;
- Section 9 presents the bedrock aquifer/spring-fed surface water fundamental change;
- Section 10 summarizes the changes to the 1998 ARWW&S OU ROD Selected Remedy;
- Section 11 addresses DEQ comments to this ROD Amendment;
- Section 12 analyzes statutory compliance with CERCLA;
- Section 13 discusses public participation in the Remedial Design/Remedial Action (RD/RA) action process since 1998 leading to this ROD Amendment;
- Section 14 address coordination with restoration activities that may be conducted by the State Natural Resource Trustee;
- Section 15 lists references identified in this ROD Amendment;
- Appendix A provides an ARARs analysis;
- Appendix B is the concurrence letter from Montana DEQ;
- Appendix C summarizes the cost estimates for alternative analyzed under the TI evaluations; and
- Appendix D provides a physical and chemical characterization of the 1988 subareas in the ARWW&S OU.

Section 2 Background

2.1 Anaconda Smelter NPL Site

The site is located in the Deer Lodge Valley in southwestern Montana, in and around the City of Anaconda and about 25 miles northwest of the City of Butte. Milling and smelting activities conducted in the Anaconda area for nearly 100 years resulted in the contamination of various environmental media in the surrounding area, primarily through airborne emissions and disposal practices from smelting operations.

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. The Old Works was located on the north side of Warm Springs Creek, east of Anaconda, and operated until about 1901. In about 1902, ore processing and smelting operations began at the Washoe Reduction Works (also called the Anaconda Smelter, the Washoe Smelter, the New Works, and the Anaconda Reduction Works) on Smelter Hill, south of Warm Springs Creek across from the Old Works which was owned and operated by ACM, its successors, and/or its subsidiaries. In 1977, Atlantic Richfield Company (Atlantic Richfield, formerly also known as ARCO) purchased ACM and expressly assumed its liabilities. Operations at the Anaconda Smelter ceased in 1980 and the smelter facilities were dismantled soon thereafter. The only substantial feature remaining from the smelter facility is the large, 585-foot tall brick smelter stack on Smelter Hill.

The Anaconda Smelter site was placed on the NPL in September 1983, under the authority of CERCLA. Atlantic Richfield was identified as the Potentially Responsible Party (PRP). 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 response actions at the site since that time. A brief summary of cleanup progress at the site is provided in Table 2-1.

The first RA, 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 RA, 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 RA addressed various waste sources found within the Old Works/East Anaconda Development Area (OW/EADA) OU, located adjacent to the community of Anaconda, and in areas of future development. The fourth RA, the Community Soils OU, was established to address all remaining residential and commercial/industrial soils within the Anaconda Smelter NPL site. The principal contaminant of concern (COC) at the Community Soils OU is arsenic in surficial soils from past aerial emissions and railroad beds constructed of waste material.

Table 2-1. Brief Summary of Anaconda Smelter NPL Site Cleanup Progress

Action	Description
Anaconda Smelter Demolition and Initial Stabilization Actions	From 1983-1986, EPA oversaw smelter demolition and initial stabilization efforts. In May 1986, EPA temporarily relocated families with small children from Mill Creek. In 1987-1988, all Mill Creek residents were permanently relocated. The Mill Creek area was cleaned up, graded, and replanted in 1999.
Anaconda Yards Time Critical Removal Action	From 1991-1992, under an emergency removal action, arsenic contaminated soils were cleaned up in three Anaconda neighborhoods: Teresa Ann Terrace, Elkhorn Apartments, and Cedar Park Homes.
Arbiter Non-Time Critical Removal Action	In 1992, approximately 275,000 cubic yards (cy) of waste material (including arsenic, cadmium, lead, and zinc) from the Arbiter Plant were dug up, and moved to a repository on Smelter Hill.
Beryllium Non-Time Critical Removal Action	Beginning in September 1992, previously disposed wastes and contaminated materials from a former beryllium flake metal plant and beryllium oxide pilot plant were excavated and sent to the Smelter Hill repository.
Old Works Stabilization Removal Action	In 1992, EPA and Atlantic Richfield began to address immediate concerns about contaminants released into Warm Springs Creek by stabilizing the Red Sands adjacent to the Creek, repairing breaks in the levees, and installing fencing to limit access.
Flue Dust RA	In 1991, EPA decided to stabilize the flue dust (containing copper, arsenic, and cadmium) with cement and lime, and placed the treated materials in a repository. Treatment of over 500,000 cy of flue dust was completed in December 1993.
OW/EADA RA	EPA selected a remedy in 1994 for this OU which had been divided into sub-areas: 1) Golf Course (construction completed in 1996, golf course opened to the public in 1997); 2) Red Sands (construction completed in 1998); 3) East Anaconda Yards and Aspen Hills (construction completed in 1998); 4) Mill Creek (construction completed in 1999); 5) Drag Strip (construction completed in 1999); and 6) Industrial Area (initiated in 2003, expected to be completed in 2011).
Community Soils RA	In 1996, EPA selected a final remedy for addressing all remaining residential yards and railroads/commercial properties. RA was initiated in 2003.
Anaconda Regional Water, Waste and Soils RA	This last OU addresses all remaining issues. It has been divided into 15remedial design units (RDUs). Designs have been completed at all but one of the RDUs and construction is underway.

2.2 Anaconda Regional Water, Waste & Soils OU

The ARWW&S OU is the fifth and final RA at the Anaconda Smelter site. The ARWW&S OU covers approximately 300 square miles in the southern Deer Lodge Valley and the surrounding foothills area. The area consists of agricultural, pasture, rangeland, forests, and riparian and wetland areas which contain large volumes of wastes, slag, tailings, debris, and contaminated soil, ground water, and surface water from copper and other metal ore milling, smelting, and refining operations conducted on site by the ACM, and its predecessors and successors, from approximately 1884 to 1980. At the time the ROD was prepared, it was estimated that waste disposal occurred over approximately 6,000 acres; 13,000 acres of upland terrestrial soils were contaminated by smelter emissions; 4,800 acres of alluvial ground water contained elevated concentrations of arsenic, cadmium, and copper; and 28,600 acres of bedrock

ground water exceeded the State of Montana standard for arsenic (based on 18 µg/L, the standard at that time).

The Agencies signed the ROD for the ARWW&S OU in 1998. That document specified remedies for the media types found in the ARWW&S OU. The ARWW&S OU was intended to be the last OU at the site requiring a remedy decision and was to 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 and Community Soils OUs. The ARWW&S OU will also bring closure to all previous OUs and removal actions including the Mill Creek OU and Flue Dust OU.

2.3 Description of Subareas

The 1998 ROD separated the ARWW&S OU into five subareas (as shown in Figure 1-1) to facilitate the screening of potential remedial technologies and the evaluation of alternatives. These are the Opportunity Ponds, North Opportunity, South Opportunity, Old Works/Stucky Ridge, and Smelter Hill Subareas. Three of these subareas include a bedrock aquifer system containing elevated arsenic concentrations that discharges into surface water, which is later discussed in Section 9 of this ROD Amendment. The nature and extent of contamination in the subareas is discussed below. Tables from the 1998 ROD that present physical and chemical parameters for various media from the five subareas are presented in Appendix D, and are referenced below. Data indicate that total concentrations of contaminants of concern (COCs) in surface water in some stream segments within the five subareas frequently exceeded the 1998 EPA chronic ambient water quality criteria derived for total metals (Table D-1). Other portions of the subareas containing waste or contaminated media are referred to as "areas of concern", and are summarized in Table D-2.

2.3.1 Opportunity Ponds Subarea

The Opportunity Ponds Subarea encompasses approximately 11 square miles and occupies the central region of the ARWW&S OU, as shown in Figure 1-1. The current and future land use is open space and light commercial/industrial in the Triangle Waste Area. Recreational uses would be allowed after the completion of the remedy in the future.

The 1998 ROD divided the Opportunity Ponds Subarea into three large waste areas: the Opportunity Ponds, Triangle Waste Area, and South Lime Ditch.

1998 Characterization

The Opportunity Ponds contain approximately 129.3 million cy of tailings covering an area of approximately 3,600 acres. The thickness of tailings in the Opportunity Ponds ranges from a few feet to over 50 feet. Table D-3 lists the physical composition of tailings in the Opportunity Ponds Subarea. The tailings ponds were formed by the placement of rock fragments separated from metal bearing minerals that were considered wastes and discarded in the tailings ponds. Ore processed at the Anaconda Reduction Works was predominantly from the Butte Mining District. The Opportunity Ponds were established in 1914. Active disposal of mill tailings at the

Opportunity Ponds was continuous from 1914 through 1964. Subsequent disposal continued intermittently until smelter operations ceased in 1980.

The tailings ponds are divided internally into the Triangle Waste Area, and A, B1, B2, C1, C2, D1, and D2-Cells. Each cell is further divided by a series of internal dikes into subcells (i.e., A1, B1.1, and C1.2). Major dikes divide the A-Cells from B-Cells, the B-Cells from C-Cells, and the C-Cells from the D-Cells. These major dikes range in height from approximately 10 to 44 feet.

Tailings located beyond the east exterior berm of the Opportunity Ponds cover an additional area of approximately 26 acres and constitute an estimated 60,000 cy of wastes. A portion of the wastes at the base of the Opportunity Ponds are in direct contact with ground water of the alluvial aquifer. As a result, tailings contained in the Opportunity Ponds are characterized as a source of ground water contamination to the underlying alluvial aquifer, and are a potential source of ground water contamination to the aquifer underlying a portion of the South Lime Ditch area. Tables C-4 through C-6 show results of chemical analyses and related statistical information for the Opportunity Ponds Subarea.

Wastes in the Triangle Waste Area are diverse, ranging from tailings generated by the Old Works (pre-1900) and Washoe Works (post-1902) smelters to municipal solid waste and sewage sludge material. Wastes in this portion of the subarea encompass an area of approximately 300 acres and range in thickness from less than 1 foot to approximately 10 feet. The total volume of waste material in the Triangle Waste Area is estimated to be approximately 1.4 million cy. Concentrations of metals in sediments from the Triangle Waste Area are shown in Table D-7.

Wastes in the South Lime Ditch Area are contained in a 490 acre area located along the southern perimeter of the Opportunity Ponds. The South Lime Ditch is a drainage ditch which was constructed by the Anaconda Company to capture ground water in the shallow alluvial aquifer and to convey storm water emanating from Smelter Hill to the Warm Springs Ponds. Wastes were deposited in the area during a breach in the exterior berm of the Opportunity Ponds. The thickness of waste material in the South Lime Ditch area is estimated to range from less than 1 foot to approximately 8 feet. The estimated volume of waste material in the South Lime Ditch area is 1.7 million cy. Wastes in the South Lime Ditch area are identified as a potential source of ground water contamination to the underlying alluvial aquifer. Concentrations of metals in soils from the South Lime Ditch Area are shown in Table D-8.

Widespread areas of contaminated soil are identified in the Opportunity Ponds Subarea resulting from deposition of smelter stack emissions and deposition of fugitive dust emissions from large areas of waste. In some portions of the subarea, elevated levels of metals in contaminated soils are phytotoxic to native plant species; thus, a majority of the area with significant soil contamination is also characterized by a poor vegetative cover. A portion of the poorly vegetated area of contaminated soils is considered a potential loading source for metals to surface water and bed sediment of Mill Creek. In addition, approximately 300 acres of contaminated soils in the subarea exhibit arsenic levels greater than the Remedial Action Goal (RAG) (1,000 milligrams per kilogram [mg/kg]) identified by EPA for recreational lands.

Ground water is contaminated in the Opportunity Ponds Subarea in portions of the alluvial aquifer underlying the Opportunity Ponds and South Lime Ditch area. Levels of arsenic and cadmium above the RAGs (see Section 2.5.2.2) are observed in the alluvial aquifer underlying the Opportunity Ponds (Tables D-9 and D-10), and elevated levels of arsenic are observed in the aquifer in the South Lime Ditch area (Table D-10). The vertical extent of ground water contamination is limited to the upper 10 to 25 feet of the aquifer.

Surface water resources in the Opportunity Ponds Subarea include the lower segment of Mill Creek at the site and a drainage ditch network located in the perimeter of the Opportunity Ponds. Surface water contamination in Mill Creek occurs on at least a seasonal basis and includes elevated levels of total and dissolved arsenic, copper, and lead above RAGs (see Section 2.5.3.2) identified by EPA. Potential sources of contamination to Mill Creek include runoff of contaminated storm water from areas of wastes and contaminated soil located in the Smelter Hill Subarea, and runoff of contaminated storm water from poorly vegetated areas of contaminated soils located adjacent to Mill Creek in the Opportunity Ponds Subarea. Surface water contamination in the Opportunity Ponds drainage ditch network includes elevated levels of total and dissolved copper and zinc above RAGs (see Section 2.5.3.2) in ponds located east of the Opportunity Ponds D-2 cell, and elevated levels of dissolved arsenic above the RAG in a small drainage ditch located east of the Opportunity Ponds D-2 cell. A potential loading source of metals to surface water in this area is runoff of storm water and snowmelt from wastes deposited outside the exterior berm of the Opportunity Ponds D-2 cell.

Bed sediment in Mill Creek and portions of the drainage ditch network surrounding the Opportunity Ponds is contaminated with elevated levels of metals. Potential loading sources of metals to bed sediment of Mill Creek include runoff from areas of contaminated soil and waste located upstream of the Opportunity Pond Subarea in the Smelter Hill Subarea, and poorly vegetated areas of contaminated soil located adjacent to Mill Creek in the Opportunity Ponds Subarea. Elevated levels of metals in bed sediment in portions of the drainage ditch network are a result of loading from tailings which are deposited outside the berm of the ponds.

2.3.2 North Opportunity Subarea

The North Opportunity Subarea is located in the northeast portion of the site. The campus for the State of Montana Warm Springs Hospital and the rural community of Galen are located in the North Opportunity Subarea. The current and future land uses are residential, agricultural, and recreational/open space.

1998 Characterization

Widespread areas of contaminated soils are identified in the North Opportunity Subarea as a result of deposition of smelter stack emissions and from fluvially-deposited waste materials adjacent to Warm Springs Creek. Under certain site conditions, elevated levels of metals in contaminated soils in the subarea are phytotoxic to most native plant species, thus, a portion of the subarea is characterized by a poor vegetative cover. Due to its erosive nature, a portion of the poorly vegetated

area of contaminated soils is regarded as a potential loading source for metals to surface water and bed sediment of Warm Springs Creek and Lost Creek. In addition, approximately 320 acres of contaminated soils in the subarea exhibit arsenic levels greater than the RAG (1,000 mg/kg) identified by EPA for recreational lands.

Wastes in the subarea are identified in a portion of the Warm Springs Creek floodplain located near the confluence of the North Drain Ditch with Warm Springs Creek. Tailings in this portion of the subarea cover an estimated area of 0.4 acres and include an estimated volume of 1,116 cy of material. Additional deposits of streamside tailings were discovered in the fall of 1997 during a creek re-naturalization project to restore historic channels.

Surface water contamination, which includes elevated levels of total recoverable copper, lead, and arsenic, is identified in the lower stream reach of Warm Springs Creek during periods of high flow. Potential loading sources for metals to Warm Springs Creek include runoff of contaminated storm water from poorly vegetated areas of contaminated soils, and erosion of floodplain wastes. Surface water quality of Lost Creek is relatively good in the subarea, and does not include significant levels of total recoverable and dissolved metals.

2.3.3 South Opportunity Subarea

The South Opportunity Subarea is located in the southern portion of the site. The rural communities of Opportunity, Crackerville, and Fairmont Hot Springs areas are located in the South Opportunity Subarea. The current and future land uses are residential, agricultural, and recreational/open space.

1998 Characterization

Widespread areas of contaminated soil are characterized in the South Opportunity Subarea as a result of deposition of smelter stack emissions. Under certain conditions, levels of metals in contaminated soils are phytotoxic to native plants, thus, a portion of the subarea is characterized by a poor vegetative cover. The poorly vegetated areas of contaminated soil in the subarea are identified as a potential loading source for metals to surface water and bed sediment to Willow Creek and a portion of Yellow Ditch. In addition, areas of contaminated soils which are presently flood irrigated on a year-round basis are a potential source of ground water contamination to the underlying alluvial aquifer.

Approximately 400,000 cy of wastes are characterized in the South Opportunity Subarea. These wastes include tailings and metal laden sediment of Yellow Ditch (120,000 cy), waste rock in railroad grade material near the Blue Lagoon (67,000 cy), contaminated bed sediment of the Blue Lagoon (4,000 cy), and floodplain tailings located adjacent to Willow Creek (157,000 cy). Analytical results of soil and sediment samples collected from Yellow Ditch and the vicinity of the Blue Lagoon are shown in Tables D-11 and D-12, respectively. Wastes in the subarea are considered a potential source of ground water contamination to portions of the shallow alluvial aquifer. Wastes located along Yellow Ditch and in the floodplain of Willow Creek near MW 225 are considered a potential source of contamination to surface water and bed sediment in the subarea (Tables D-11 and D-13).

Ground water contamination is characterized in portions of the alluvial aquifer underlying areas of contaminated soils which are flood irrigated on a year round basis in the vicinity of Yellow Ditch, and in portions of the aquifer underlying wastes and contaminated soils at the Blue Lagoon. Elevated levels of arsenic above the RAG identified by EPA are characterized in the alluvial aquifer underlying contaminated soils which are flood irrigated (Table D-14). The depth of ground water contamination in this portion of the aquifer is estimated to range from less than 10 feet to approximately 30 feet. Concentrations of arsenic in the ground water adjacent to Yellow Ditch in the MW 232 area are shown in Table D-15. Ground water contamination in the alluvial aquifer at the Blue Lagoon includes elevated levels of cadmium, copper, and zinc above RAGs (see Section 2.5.2.2), as listed in Table D-16. Potential loading sources for metals to the aquifer in this area include leaching of metals from wastes in railroad grade material, from contaminated soils, and from contaminated sediment of the Blue Lagoon (Table D-12). The depth of ground water contamination at the Blue Lagoon is thought to be limited to the upper 10 feet of the aquifer.

Willow Creek is the principal stream located in the South Opportunity Subarea. Surface water and bed sediment in Willow Creek are contaminated with metals throughout the stream's reach in the South Opportunity Subarea. Elevated levels of total recoverable and dissolved arsenic, copper, and lead above the RAGs (see Section 2.5.3.2) occur in Willow Creek during seasonal periods of high flow (Table D-1). Potential loading sources for metals to surface water and bed sediment of Willow Creek include runoff of contaminated storm water from areas of contaminated soil, and runoff of contaminated storm water and erosion of floodplain tailings adjacent to Willow Creek. Contaminated surface water is also characterized in the Blue Lagoon and the active portion of the Yellow Ditch. Surface water contamination in the Blue Lagoon includes very high levels of copper, zinc, and cadmium above RAGs. Potential loading sources of metals to the Blue Lagoon include transport of metals from railroad bed material located upstream of the lagoon and transport of metals from contaminated soils. Surface water contamination in the Yellow Ditch is limited to elevated levels of arsenic above the RAG (see Section 2.5.3.2). Potential loading sources for arsenic to the Yellow Ditch include runoff of contaminated storm water and irrigation water from areas of contaminated soils, and direct contact of surface water with contaminated sediment.

2.3.4 Old Works/Stucky Ridge

The Old Works/Stucky Ridge Subarea is located in the west portion of the site in the area north of the town of Anaconda. This subarea includes the former Old Works smelter location, a portion of the Deer Lodge National Forest, and a small rural residential development located adjacent to Lost Creek. The current and future land uses are residential, agricultural, commercial/industrial, and recreational/open space.

1998 Characterization

A total of 1,400,000 cy of wastes has been identified by EPA in the Old Works/Stucky Ridge Subarea. Table D-17 lists the physical characteristics of waste and solids in this subarea. A remedy for all wastes in the subarea was selected by EPA with completion of the ROD for the OW/EADA OU. The Selected Remedy will allow wastes in the Old Works area to remain in place, and it will utilize a combination of engineering controls ranging from consolidation and grading of wastes to construction of soil covers to promote drainage, minimize infiltration, and prevent erosion of wastes in the Old Works/Stucky Ridge Subarea.

Widespread areas of contaminated soil resulting from deposition of smelter stack emissions characterize the Old Works/Stucky Ridge Subarea. Under certain conditions, metal levels in surface soils in these areas are phytotoxic to most native plant species. As a result, these areas are susceptible to high rates of erosion due to their steep topography (>10 percent slope) and poor vegetative cover. A management strategy for containment of storm water emanating from areas of contaminated soil and waste located near the Upper and Lower Works on Stucky Ridge is included in the OW/EADA OU ROD (EPA and DEQ 1994). Sedimentation ponds will be used to contain storm water runoff in this portion of the subarea.

Ground water contamination is characterized in portions of the bedrock and alluvial aquifers in the subarea. Elevated levels of arsenic above the RAG (see Section 2.5.2.2) identified by EPA are characterized in a portion of the bedrock aquifer underlying areas of contaminated soil on Stucky Ridge (Table D-18). The depth of ground water contamination in this portion of the subarea is not known, but is thought to be limited to the upper 115 feet of the aquifer In addition, elevated levels of cadmium, copper, and zinc above RAGs are characterized in a portion of the alluvial aquifer underlying waste left in place in the Old Works area, and in the area downgradient of the Red Sands in the vicinity of the Arbiter Plant and Drag Strip (Tables D-19). Potential loading sources include leaching of metals from wastes in the Old Works area and from contaminated soils and/or wastes in the vicinity of the former Arbiter Plant and Drag Strip (Table D-20).

Contamination of surface water and bed sediment is characterized in the subarea in Warm Springs Creek, and on an occasional basis in surface water of Lost Creek. Elevated levels of total recoverable copper and lead in surface water of Warm Springs Creek exceed RAGs during seasonal periods of high flow, while levels of total recoverable copper in surface water of Lost Creek are above RAGs on an occasional basis in the subarea subarea (Table D-1). Potential loading sources for copper and/or lead to surface water and bed sediment of Warm Springs Creek and Lost Creek include runoff of contaminated storm water from areas of wastes and contaminated soils located adjacent to Warm Springs Creek, and runoff of contaminated storm water from contaminated soils located adjacent to Lost Creek.

2.3.5 Smelter Hill Subarea

The Smelter Hill Subarea is located in the southwest portion of the site and includes the location of the former Washoe Smelter, a portion of the State of Montana Mount

Haggin Wildlife Management Area and a rural residential development located in the Aspen Hills Area. The current and future land uses are residential, agricultural, commercial/industrial, and recreational/open space.

1998 Characterization

Widespread soil contamination is identified in the Smelter Hill Subarea. Elevated levels of arsenic in soils in a portion of the Smelter Hill Subarea are above the RAG for recreational land-use areas (1,000 mg/kg). Volumes of soil with arsenic concentrations greater than the RAG in the Smelter Hill Subarea are shown in Table D-21. Deposition of historic smelter stack emissions is the primary source of highly elevated concentrations of arsenic, cadmium, copper, lead, and zinc in surface soils. Areas of soil contamination located adjacent to the Mill Creek floodplain are considered a primary source for metal loading to surface water and bed sediment of Mill Creek. Highly elevated arsenic concentrations in soils, and mixed soils and waste in portions of Nazer Gulch, Slag Gulch, and Walker Gulch, are considered to be source areas for elevated levels of arsenic characterized in surface water flow emanating from these drainages to the East Anaconda Yard. In addition, elevated levels of arsenic in soils in the subarea are identified as the primary source of widespread but relatively shallow ground water contamination in the underlying bedrock aquifer.

Wastes identified in the Smelter Hill Subarea include buried wastes in the Disturbed Area of Smelter Hill, the Anaconda Ponds, the Main Granulated Slag Pile, buried wastes in the East Anaconda Yard, West Stack Slag, and debris located in Nazer Gulch. The results of chemical and x-ray fluorescence analyses for slag samples are shown in Tables D-22 and D-23, respectively. Statistical summaries of metals concentrations and physical and chemical parameters for non-reclaimed soil samples in the Disturbed Area of Smelter Hill, tailings in the Anaconda Ponds, soil in the Handling, Process, and Storage (HPS) Area of the East Anaconda Yard, soil in the Disturbed Area of East Anaconda Yard, non-reclaimed soil samples from the Primary HPS Area of Smelter Hill, soil in the stack area of Smelter Hill, and the Loop Track Railroad Beds are shown in Tables D-24 through D-31, respectively. The estimated volume of wastes in the subarea is approximately 125,436,000 cy. A portion of the wastes contained in the Disturbed Area of Smelter Hill and the exterior berm of the Anaconda Ponds have been reclaimed with a cover of clean soil and vegetation. Statistical summaries of metals concentrations in reclaimed soil samples in the Disturbed Area and Primary HPS Area of the Smelter Hill Subarea are shown in Tables D-32 and D-33, respectively. Pore water quality results for wastes in the Smelter Hill Subarea are shown in Tables D-34 and D-35.

Elevated concentrations of arsenic above the RAG are identified in a portion of the bedrock aquifer underlying the Disturbed Area of Smelter Hill and underlying widespread areas of contaminated soils in the subarea (Tables D-36 through D-38). Elevated levels of cadmium above the RAG for cadmium are also observed in portions of the bedrock aquifer underlying the Disturbed Area of Smelter Hill (Tables D-36 through D-38). The approximate depth of ground water contamination in the bedrock aquifer ranges from approximately 115 feet below the top of the aquifer underlying portions of the Disturbed Area to approximately 10 feet underlying areas

of contaminated soils. Potential loading sources of arsenic and cadmium to the bedrock aquifer include leaching of arsenic and cadmium from buried wastes in the Disturbed Area of Smelter Hill and leaching of arsenic from widespread areas of contaminated soils.

The alluvial aquifer underlies a majority of the subarea surrounding Smelter Hill, including the East Anaconda Yard, the Main Granulated Slag Pile, the Anaconda Ponds, a portion of the Disturbed Area located at the base of Smelter Hill, and a portion of the Mill Creek valley. Elevated concentrations of arsenic above the RAG have been delineated or are inferred in a portion of the alluvial aquifer underlying the East Anaconda Yard, Main Granulated Slag, and Anaconda Ponds (Tables D-36 and D-37). The vertical extent of ground water contamination in the alluvial aquifer is limited to the upper 10 to 20 feet of the aquifer. Potential sources of arsenic in the shallow alluvial aquifer include recharge of the alluvial aquifer from contaminated ground water in the surrounding bedrock aquifer; leaching of arsenic from buried wastes located in the East Anaconda Yard, Main Granulated Slag area, and Anaconda Ponds; and recharge of the aquifer by infiltration of contaminated storm water discharging from drainages located on Smelter Hill.

Mill Creek and its associated tributaries, including Cabbage Gulch, and drainages located on Smelter Hill are the primary surface water features identified in the Smelter Hill Subarea. Levels of total and dissolved arsenic in surface water are above the RAG throughout the reach of Mill Creek located in the Smelter Hill Subarea. Levels of total and dissolved copper and lead in surface water are also above the RAG on at least a seasonal basis (spring runoff conditions) in the stream reach of Mill Creek located in the subarea. Potential loading sources for metals to surface water of upper Mill Creek include runoff of contaminated storm water and snowmelt from areas of waste and contaminated soils located in portions of the Smelter Hill Subarea, and arsenic loading from discharge of contaminated ground water to tributaries of Mill Creek such as Cabbage Gulch, Joyner Gulch, Lost Horse Creek, Lapilli Creek, Clear Creek, and Muddy Creek.

2.4 Summary of Human Health and Environmental Risk

Section 6 of the 1998 ROD provides a summary of the risk to human health and the environment. Five primary COCs have been identified at the site: arsenic, cadmium, copper, lead, and zinc. Three primary sources of contamination are generally present at ARWW&S OU: soils impacted by historic aerial emission deposition, tailings/waste piles, and contaminated ground water.

2.4.1 Human Health Risk

The Baseline Human Health Risk Assessment (EPA 1996b) for the site addressed OU at the site that had not been previously addressed, including the Community Soils OU in Anaconda and a large surrounding area. This 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 site 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) scenarios. 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 the 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 contaminants of potential concern and were evaluated quantitatively in the risk assessment. Risks from lead were determined in the risk assessment 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 COC. Reevaluations of potential risk regarding arsenic in soils, and evaluations of potential risk to lead exposure in soils and dust are currently ongoing under the Community Soils OU. Any changes to the remedy due to these evaluations would be set forth in a future Community Soils OU ROD Amendment.

2.4.2 Ecological Risk

The ecological risk assessment for the Site (Final Baseline Ecological Risk Assessment, Anaconda Regional Water, Waste, and Soils OU, Anaconda Smelter NPL Site, Anaconda, Montana, October 1997 prepared by CDM Federal Programs Corporation [CDM]) focused on identification of areas of potential phytotoxicity. This focus was intended to allow for identification of areas within the Site that might require revegetation. The assessment utilized a comprehensive plant stress analysis based on the primary plant growth characteristics of the soil system. Threats to wildlife from COCs in soil, drinking water, and forage were also evaluated, along with threats to aquatic fauna in surface water at the Site. The 2002 biomonitoring study (IEHH/TTU 2002) quantified COC exposure and effects in wildlife inhabiting non-remediated and remediated areas on the Anaconda Smelter NPL Site. That study quantified the level of exposure and effects, and resultant risk, to wildlife inhabiting the site and evaluated the nature of changes in metal and arsenic disposition, and the resulting effects, that occur in wildlife following the implementation of remedial options on the site.

The ecological risk assessment identified the following exposure pathways as those of concern:

- Terrestrial plants exposed to soil (uptake)
- Aquatic plants exposed to sediments (uptake)
- Aquatic organisms exposed to contaminants in surface water and sediments (uptake and direct contact)
- Herbivores exposed to contaminated plants via ingestion and incidentally exposed to soil via ingestion

- Wildlife exposed to contaminants in surface water via drinking
- Insects exposed to plants via ingestion
- Top predators exposed to contaminants in avian and mammalian prey via ingestion

2.5 Summary of 1998 Selected Remedy

The 1998 selected remedy for the ARWW&S OU was comprised of several remedies for the waste media types found throughout the OU. The major components of these remedies are described below.

2.5.1 Soils and Waste Materials

The remedial requirements for soils and waste materials identified in the 1998 ROD are as follow:

- Reduction of surficial arsenic concentrations to below the designated action levels of 250 parts per million (ppm) for residential use, 500 ppm for commercial/industrial use, and 1,000 ppm for recreational/open space/agricultural use, through a combination of soil cover or in situ 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.

2.5.1.1 Remedial Action Objectives (RAO)

The following RAO apply to soils and waste materials:

- Provide a permanent and effective vegetative/soil cover over waste and highly contaminated soil material to prevent direct contact with elevated arsenic concentrations , thus minimizing the potential risk of human exposure;
- Minimize surface water percolation and COC transport to ground water in order to prevent further migration of the plume;
- Minimize surface water erosion and COC transport to surface water in order to meet water quality ARARs as outlined in Appendix A;
- Minimize wind erosion and movement of COCs onto adjacent lands, thus preventing risk of human and wildlife exposure above risk-based levels, and prevent non-attainment of air quality ARARs as outlined in Appendix A;
- Reduce COC levels in waste and highly contaminated soils in order to allow re-establishment of vegetation, thus reducing risk to upland terrestrial wildlife and allow re-establishment of wildlife habitat;
- Allow final closure of waste areas to be compatible with the existing and anticipated future land use with minimal future maintenance activities; and

- Meet State of Montana selective mine closure reclamation ARARs and other ARARs.

2.5.1.2 RAG

Based on the Baseline Human Health Risk Assessment (EPA 1996), and consistent with other assessments developed previously for other OUs, arsenic action levels were selected based on technical and risk management considerations as follows:

Land Use Designation	Media	Concentration	Risk
Residential	Soil and Waste	250 ppm	8E-05
Commercial/Industrial	Soil and Waste	500 ppm	4E-05
Recreational	Soil and Waste	1,000 ppm	4E-05
Agricultural	Soil only	1,000 ppm	1E-04
Steep Slope/Open Space	Soil only	2,500 ppm	1E-05

2.5.2 Ground Water

The remedial requirements for ground water identified in the 1998 ROD are as follow:

- 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.
- 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.
- 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, points-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.

2.5.2.1 RAO

The RAO for ground water are as follows:

- EPA and DEQ expect to return usable ground waters to their beneficial uses wherever practicable through achievement of the RAG, within a time frame that is reasonable given the particular circumstances of the site. When restoration of ground water to beneficial uses is not practicable (within WMAs and TI zones), EPA and DEQ will prevent further migration of the plume, prevent exposure to the contaminated ground water, and further reduce risk by minimizing transport of COCs to the bedrock and alluvial aquifers.

2.5.2.2 RAG

The 1998 ROD identified the following RAG for ground water:

- RAG for cleanup of contaminants in ground water and protection of ground water resources within the ARWW&S OU are established based on the applicable State of Montana numeric water quality standards set forth in Circular WQB-7 (Note that since the 1998 ROD, DEQ has renamed the WQB-7 circular as DEQ-7). The COCs and their associated 1998 standards are listed below.

COC	WQB-7 Standard*
Arsenic	18 µg/L
Beryllium	4 µg/L
Cadmium	5 µg/L
Copper	1,000 µg/L
Lead	15 µg/L
Zinc	5,000 µg/L

*WQB-7 standards for metals in ground water are based on the dissolved metals portion of the sample.

2.5.3 Surface Water

The remedial requirements for surface water identified in the 1998 ROD are as follow:

- 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.

2.5.3.1 RAO

The RAO for ground water are as follows:

- Minimize source contamination to surface waters that would result in exceedances of State of Montana water quality standards.
- Return surface water to its beneficial use by reducing loading sources of COCs.

2.5.3.2 RAG

The 1998 ROD identified the following RAG for surface water:

- RAG for protection of surface waters within the ARWW&S OU are established based on applicable State of Montana numeric water quality standards set forth in Circular WQB-7 which are protective of human health and aquatic life. The COCs and their associated standards are listed below. Cadmium, copper, lead, and zinc are calculated at a hardness of 100 mg/L $CaCO_3$ equivalent. Measurements and compliance of the COCs will be for total recoverable concentrations.

COC	Standard
Arsenic	18 µg/L
Cadmium	1.1 µg/L
Copper	12 µg/L
Iron	300 µg/L
Lead	3.2 µg/L
Zinc	100 µg/L

2.5.4 Institutional Controls (ICs) and Operations and Maintenance (O&M)

Remedial requirements for ICs and operations and maintenance established in the 1998 ROD are as follows:

- 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 called 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 (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.

2.5.5 RD/RA Management

The ARWW&S OU encompasses a very large area and RA 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 RD/RA 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 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 the United States Fish and Wildlife Service (USF&WS) 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.

Section 3 Basis for Revisions to the Selected Remedy

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.

3.1 ARAR Changes

Based on protectiveness of ARARs, this 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. This amendment also waives the arsenic human health standard in certain ground and surface waters at the site. The waiver of the arsenic human health standard in certain areas of the site is the only fundamental change to the selected remedy related to changes of the contaminant-specific standards. The contaminant specific ARAR changes since the 1998 ARWW&S OU ROD was issued are summarized in Table 3-1, which identifies the revised RAG/performance standards for surface water and ground water. Other than the changes noted in Table 3-1, there are no changes to the RAG set forth in the 1998 ROD. An updated ARARs analysis is provided in Appendix A.

Table 3-1. Revised RAG/Performance Standards for Water Quality. Anaconda Regional Water, Waste & Soils OU. ROD Amendment, September 2011

	Surface Water			Groundwater	
	State[(1)]			State[(1)]	Federal [(2)]
Compound	Aquatic Life - Acute (µg/L)	Aquatic Life - Chronic (µg/L)	Human Health Standard (µg/L)	Human Health Standard (µg/L)	MCL, MCLG, or Action Level (µg/L)
Arsenic	340	150	10[a]	10[a]	10[a]
Beryllium	None	None	4	4	4
Cadmium	2.13	0.27	5	5	5
Copper	14	9.33	1,000	1,000	1300[b]
Iron	None	1,000	300	N/A	N/A
Lead	81.65	3.18	15	15	15[b]
Zinc	120	110	2000	2000	N/A

Shaded cells indicate standards changed from the 1998 ROD. See discussion in Appendix A, Introduction.

Note: Hardness-dependent values (cadmium, copper, lead, and zinc) are adjusted for a hardness of 100 mg/L as $CaCO^3$.
a - This standard is waived for surface water and ground water within TI Zones as identified in this ROD Amendment. The Aquatic Life - Acute standard and the Aquatic Life - Chronic standard remain ARARs and performance standards for surface water TI reaches.
b - Indicates value is an action level as defined under the copper and lead rule.
1. Revised standards from Montana Numeric Water Quality Standards - Circular DEQ-7. August 2010. http://deq.mt.gov/wqinfo/Standards/default.mcpx Remaining standards from Montana Numeric Water Quality Standards - Circular WQB-7. December 1995.
2. National Primary Drinking Water Regulations; U.S. Environmental Protection Agency; http://www.epa.gov/safewater/contaminants/index.html; for maximum concentration limit (MCLs), see 40 C.F.R. Parts 141 and 142.

3.2 Revised Ground Water and Surface Water Areas of Concern

The 1998 ROD identified ground water areas of concern based on the existing arsenic RAG and site characterization at the time. Lowering the arsenic standard concentration to 10 µg/L has resulted in a significant increase in the size of the contaminant plume. In addition to the change in the standard, additional site characterization data collected during RD has resulted in better definition of areas of contamination. These investigations include spring and seep sampling in the uplands and wetland areas, installation of monitoring wells in the bedrock aquifer TI zone and around the waste management areas, and installation of piezometers in alluvial aquifer areas of concern. Figure 3-1 compares the new ground water area of concern

to the areas identified in the 1998 ROD.

The 1998 ROD identified surface water (stream reach) areas of concern. These reaches were identified based on arsenic concentrations exceeding the 1998 human health quality standard of 18 mg/L, and copper exceedance of aquatic life criteria in areas impacted by uplands storm water runoff or erosion of fluvially-deposited tailings. Additional sampling of surface water during RD, together with the new arsenic human health standard, has led to the identification of a surface water area of concern based on exceedances of the human health standard. Figure 3-2 displays the new arsenic exceedance-based surface water area of concern in addition to the areas identified in the 1998 ROD.

3.3 Clarification of WMA Designation

The Selected Remedy presented in the 1998 ROD identified two categories of wastes at the ARWW&S OU: waste management areas and miscellaneous waste material. Under this ROD amendment, the two WLIP areas are merged into waste management areas, as these areas are each adjacent to waste management areas. This results in the Old Works WMA and Old Works Wastes Left-In-Place being merged into a larger Old Works WMA, and the Smelter Hill WMA, Opportunity Ponds WMA, and the Triangle Wastes Left in Place being merged into a Smelter Hill/Opportunity Ponds WMA. The preamble to the NCP states that that remediation levels should generally be attained throughout the contaminated plume, or at and beyond the edge of the waste management area, when the waste is left in place. See 55 Fed. Reg. 8666, 8713, 8753 (March 8, 1990). RAO for the WMAs will apply to these wastes-left in–place. Specifically, the human health standard will not be required to be met beneath the WMAs. The ground water remedy remains unaffected beyond the new WMA Boundaries. Data show the continuation of the ground water plume beneath the wastes and beyond.

3.4 Modification of WMA Boundaries

The changes result in the Old Works WMA and Old Works Wastes Left-In-Place being merged into a larger Old Works WMA; and the Triangle Waste area being merged into the Opportunity Ponds WMA. Additional modifications to the WMA boundaries include adding the West Stack Slag to the Smelter Hill WMA and the merging of the Smelter Hill WMA and Opportunity Ponds WMA into one WMA. Rationale for these further changes is set forth below in Sections 4.1 and 8.1. Figure 3-3 compares the new WMA designations to the WMAs identified in the 1998 ROD.

3.5 Revised Soils Area of Concern

Since the 1998 ROD, data collection and LRES evaluations have resulted in a final delineation of Land Reclamation Evaluation System (LRES) polygons during RD. These polygons define the extent of soil remediation at the ARWW&S OU. In addition to the delineated LRES polygons, an alternative remedy has been selected for certain high arsenic areas (HAA) (> 1,000 mg/kg) where arsenic soil concentrations will not be reduced below 1,000 mg/kg due to inaccessibility or environmental concerns.

Figure 3-4 shows the 1998 LRES polygons and the 2011 ROD Amendment soils area of concern. As shown on Figure 3-4, new soil areas of concern were identified in the West Galen area, and near Silver Bow Creek outside of the Streamside Tailings OU of the Silver Bow Creek/Butte Area NPL Site boundary. RDU 9 Silver Bow Creek Fluvial Tailings is discussed in Section 6, while the West Galen Expansion Area is discussed in Section 7. HAAs delineated in the Dutchman and Smelter Hill areas are discussed in Sections 5 and 8, respectively.

Section 4 Significant Changes to the Opportunity Ponds Subarea Remedy

The significant changes to the 1998 Selected Remedy for the Opportunity Ponds Area are the modification of the Opportunity Ponds WMA boundary, implementation of a ground water arsenic plume containment strategy along a portion of the eastern toe of the Opportunity Ponds, and moving the ground water POC.

4.1 Modification of WMA Boundary (Significant Change)

The Opportunity Ponds WMA lies entirely within the Opportunity Ponds Subarea. Miscellaneous wastes identified in the 1998 ROD are the Triangle Waste Area and the Toe Wastes. Toe Wastes have been removed and consolidated into the WMA, as required by the ROD. The 1998 ROD allowed the Triangle Waste to be left in place and covered. This ROD Amendment incorporates the Triangle Wastes into the Opportunity Ponds WMA.

Construction at Triangle Waste Area began in 2002. An industrial cover was placed over approximately 230 acres to facilitate future industrial development. A final vegetative soil cover was placed over the "view shed" areas along Montana Highways 1 and 48. During RD, 40 test pits were excavated along the northern portion of the Triangle Waste Area to determine the edge of wastes, which determined the extent of capping. The extent of soil cover construction over mining wastes determined the WMA boundary in this area, as shown on Figure 4-1. Construction has been completed at the Triangle Waste Area which is documented in the Draft Final Opportunity Ponds RDU 8 Triangle Waste Area RA Construction Completion Report (Atlantic Richfield 2005a).

This ROD Amendment incorporates the Triangle Waste Area into the Opportunity Ponds WMA. Inclusion of the Triangle Waste Area into the Opportunity Ponds WMA leads to a merger of the Smelter Hill and Opportunity Ponds WMAs into one WMA, the Smelter Hill/Opportunity Ponds WMA. Figure 4-1 shows the revised Opportunity Ponds WMA boundary compared to the 1998 boundary, and new ground water POC.

4.2 Implementation of Ground Water Containment Remedy (Significant Change)

The 1998 ROD identified existing monitoring wells along the eastern dike face of the Opportunity Ponds tailings impoundment as ground water POCs for the WMA. As part of the RD for the closure of the WMA, Atlantic Richfield initiated several data investigations at the toe of the Opportunity Ponds to characterize current ground water, surface water, soil, and wetland conditions. Analyses of these data led Atlantic Richfield to propose constructing a Ground Water/Surface Water Management System (GWSWMS) along a section of the D-cell dike to passively treat impacted

waters exiting the WMA. This ground water plume containment system is within the modified WMA boundary. This ROD Amendment incorporates the GWSWMS. The GWSWMS has been constructed, and currently is undergoing shakedown before being declared operational.

The ROD required an analysis of contingency measures in the event that ground water POC are violated. This GWSWMS effectively implements the contingency identified in the 1998 ROD. In the event that POCs are triggered during future monitoring, further evaluations will consider modifications to the GWSWMS as one of the potential corrective measures.

4.3 Modification of Ground Water POC (Significant Change)

New ground water POC are identified as a result of the WMA boundary revisions and RA construction (several POC wells identified in the 1998 ROD were abandoned during the construction of GWSWMS). Most of these monitoring wells have been constructed; however, several wells will require installation east of the Opportunity Ponds WMA after RA construction (wells yet to be constructed are designated as "NW"). New monitoring locations for the GWSWMS have been located as close to the GWSWMS edge as possible.

With the merging of the Smelter Hill and Opportunity Ponds WMAs, several POC wells have been removed from the toe of the Anaconda Ponds. Due to the potential for contaminant plume migration cross-gradient from the ponds, several new POC well locations are also added north and south of the combined Smelter Hill/Opportunity Ponds WMA. This was a community concern.

4.3.1 Remedial Requirements

Remedial requirements for ground water containment at the Smelter Hill/Opportunity Ponds WMA identified in the 1998 ROD are unchanged. The Smelter Hill/Opportunity Ponds ground water POCs are shown on Figure 4-1.

Ground Water POCs: Downgradient point at toe of Opportunity Ponds Cells D1 and D2 as monitored at monitoring Opportunity Ponds toe/flank: NW-1-OPd, NW-1-OPs, NW-2-OPd, NW-2-OPs, NW-3-OPd, NW-3-OPs, NW-4-OPd, NW-4-OPs, MW-216, MW-26, MW-26M, MW-10R/NW-5s, MW-212, MW-214. Triangle Waste Area - MW-256.

Section 5 Fundamental and Significant Changes to the North Opportunity Subarea Remedy

The fundamental change to the North Opportunity Subarea remedy identified in this ROD Amendment is the designation of a ground water and surface water TI zone for the arsenic human health standard in the Dutchman area. Significant changes to the North Opportunity Subarea remedy are the designation of the Dutchman HAA, and additional waste delineation along Warm Springs Creek. A discussion of these changes is provided in this section.

5.1 Designated Dutchman HAA (Significant Change)

The 1998 ARWW&S OU ROD had identified the potential for leaving soils in place that have arsenic concentrations exceeding the recreation/open space/agricultural cleanup level of 1,000 mg/kg.

Several soil sampling investigations have been completed in a large wetland area in the vicinity of Dutchman Creek (the Dutchman Creek area). They include the ARW&W OU remedial investigation (ARCO 1996), outer boundary investigation (Reclamation Research Unit [RRU] Dutchman Creek soil sampling (RRU 2001), and Dutchman Creek High Arsenic Area soil sampling (Atlantic Richfield 2004b) data. Descriptive statistics summarizing these data are as follows:

Table 5-1. Soil Sampling Descriptive Statistics - Dutchman Creek HAA

Constituent	Depth	Number	Max	Min	Mean	Std Dev
Arsenic	0-2	47	3030	117	924.19	653.02
	2-10	24	2780	80	517.13	622.90
Cadmium	0-2	47	53	3.8	18.77	13.99
	2-10	24	36	4.0	8.46	7.76
Copper	0-2	47	6790	272	1975.09	1351.18
	2-10	24	7200	112	1388.42	1832.12
Lead	0-2	47	1750	70	491.89	366.93
	2-10	24	1490	33	225.88	320.83
Zinc	0-2	47	5030	190	1719.47	1269.56
	2-10	24	3480	89	755.88	900.92

As indicated by these data , the Dutchman Creek area is considered to be generally highly contaminated, yet where subsurface water is available to plants, the areas are well vegetated. Brown and white surface salts were observed across most of the western portion of the Dutchman Creek area. Although the Dutchman Creek Project Area, especially the western portion, is considered to be highly contaminated, there is little expression of this contamination in the dominant vegetation community. This

condition of elevated arsenic and metals in soils without visual signs of ecological dysfunction is found consistently in the subirrigated areas of the project area. To the west of the Dutchman Creek area, where subsurface water is less available to the plants, the vegetation becomes much sparser, and bare soil is evident. For the most part, these sparsely vegetated and barren areas have been incorporated into North Opportunity RD, and are mostly beyond the Dutchman Creek wetland area.

This ROD Amendment designates the Dutchman HAA as shown in Figure 5-1. This area is generally located by an area bounded by Lost Creek to the north, near the community of Warm Springs to the east, Warm Springs Creek to the south, and the ADLC airport to the west. Land use in this area includes agriculture, grazing, open space wildlife habitat, and recreational uses such as bird watching and hunting. Three streams traverse the area from southwest to northeast (Lost Creek, Dutchman Creek, and Warm Springs Creek) along with numerous smaller springs or seeps. The Dutchman HAA is a well vegetated wetland that includes a highly functional ecosystem. There are soils that exceed the ARWW&S OU recreational/open space/agricultural action level of 1000 mg/kg arsenic (RRU 2001, Atlantic Richfield 2004b). Because of the ameliorating effects of shallow ground water and abundant surface water resources, the Dutchman HAA is well-vegetated despite high arsenic concentrations in the shallow soil.

A risk calculation similar to that performed for the Smelter Hill HAA was conducted for the Dutchman HAA, and is attached to the Draft Final Dutchman HAA Final Design Report (CDM 2008). EPA has analyzed the potential risk to adult and child users of a proposed Dutchman Wildlife Management Area, and concludes that given the limited time that would be spent by users of the area, and the well-vegetated condition, the alternative cleanup level of 2,500 mg/kg applied to the Smelter Hill HAA would also be protective in the Dutchman HAA.

5.1.1 Remedial Requirements

A HAA is an area that exceeds the 1,000 mg/kg arsenic cleanup standard for recreational/open space/agricultural land use, but will not be remediated due to existing well-vegetated conditions or steep slopes that pose safety concerns. The following remedial requirements apply to HAA:

- Vehicular access by the public will be prohibited. Vehicular traffic will be limited to authorized monitoring and maintenance personnel. Fences, gates, signs, and other constructed controls will be used to maintain vehicle restrictions. Public access roads and parking areas will receive an engineered cover (gravel, asphalt, etc.) to minimize the potential for vehicles to track contaminated mud and thus increase exposure to contaminated soil.
- Development of ground water resources is prohibited, unless it can be demonstrated that proposed actions will not increase or expand the existing ground water contaminant plume.
- Future residential or commercial development in the project area is prohibited, unless the area is cleaned up to meet the appropriate action level.

It is expected that the Dutchman HAA will be incorporated into a wildlife management area that will be used by the public. A management plan shall be developed and implemented for the area should this occur. The Dutchman management plan will include best management practices (BMPs) to reduce public exposure to arsenic-contaminated soils, including access road and parking area requirements and informational signs regarding arsenic contamination. Vegetation, surface water, and ground water monitoring will continue to be required.

5.2 Modification of the Warm Springs Creek Remedy (Significant Change)

Although the 1998 ROD required that the erosion of fluvially-deposited tailings be minimized through selective removal and stream stabilization, only 1,200 cy of tailings, at the RSN Johnson Ranch, were identified for removal. Several RD investigations, including 1999 base and high flow synoptic surface water sampling, Riparian Evaluation System evaluations of streambank condition, and extensive soil/waste sampling conducted in 2001, 2004 and 2005 have led to RAs now being required in two specific areas along Warm Springs Creek (the Section 32 area, and the Guchanour/Johnson Ranches area).

This ROD Amendment includes the two specific Warm Springs Creek areas shown on Figure 5-1. Since the 2005 investigations in the Section 32 area, Atlantic Richfield has completed waste removal in the Warm Springs Creek floodplain under the North Opportunity RA. Approximately 100,000 cy of soil and soil/waste mixed material were removed and transported to the Opportunity Ponds WMA in 2009 and 2010 for disposal. The underlying soil has been treated, amended, seeded, and fertilized. This completed waste removal leaves only minor amounts of waste removal along the stream corridor for the Section 32 reach.

Design elements for Warm Springs Creek Floodplain include the removal of wastes and soils/waste mixtures from the floodplain, transport of these contaminated materials to the Opportunity Ponds WMA for disposal, streambank stabilization, treatment, and backfill, if necessary, of the waste removal areas. An estimated 40,000 cubic yards of soil/waste removal is identified for Lower Warm Springs Creek project area within the area shown in Figure 5-1.

5.3 North Opportunity Ground Water/Surface Water TI Waiver Decision (Fundamental Change)

This section presents the analysis for the fundamental change to the ground water and surface water remedy for the North Opportunity Ground Water/Surface Water Area of Concern, including remedial alternatives analyzed, and a detailed evaluation of those alternatives with respect to nine evaluation criteria required by the NCP.

5.3.1 North Opportunity Ground Water/Surface Water Area of Concern

The North Opportunity Ground Water/ Surface Water Area of Concern is a well vegetated subirrigated area, with the USF&WS estimating 2,270 acres of palustrine wetlands, the largest wetland complex in the upper Clark Fork River basin (USF&WS 2005). Its principal drainage is Dutchman Creek, which flows into Lost Creek. Lost Creek exits the ARWW&S OU boundary at Interstate 90, where it enters the Clark Fork River OU of the Milltown Reservoir/Clark Fork River NPL Site and eventually discharges into the Clark Fork River.

Surface water exceedances of the arsenic human health standard in samples collected by the USF&WS in the Dutchman wetland complex in the fall of 2000 led the Agencies to suspect that a shallow arsenic contaminant plume may be present in the alluvial aquifer down gradient of high arsenic soils that were identified in the 1998 ARWW&S OU ROD. Atlantic Richfield constructed five temporary wells that were installed and sampled in July 2002 and re-sampled in November 2002. These wells were designed to evaluate water quality in the upper five to ten feet of ground water in the area. Arsenic and metals concentrations were low in four of the temporary wells.

Ground water in one well, PZ27, contained arsenic at 54 to 56 µg/L and had low metals concentrations (Atlantic Richfield 2004a). This well location however, was the furthest downgradient location from the Dutchman HAA, and is upgradient of the Warm Springs duck ponds where the previous surface water exceedances were identified. Based on this sample, it appears that ground water does not become contaminated until it flows a significant distance through the shallow contaminated soils within the wetland areas present at the extreme eastern end of the Dutchman HAA.

Another possible source of arsenic contamination may be geothermal waters known to exist in the vicinity of the community of Warm Springs to the south. In October 2004, Atlantic Richfield conducted additional ground water and surface water sampling in part of the North Opportunity Ground Water/ Surface Water Area of Concern. During this sampling event, geothermal sources were sampled, and the results of the sampling indicated that while the arsenic ground water contamination may be contributed in part by "natural" geothermal sources, the most significant source is due to mining/smelting impacts.

In addition to the 2004 event, ground water locations (e.g., monitoring wells and surface expressions of ground water) were sampled in 2006 and 2007. These data show that the contamination is limited to the top of the water-bearing zone. Deeper water is unimpacted. The data also show that the extent of ground water contamination appears to be most prevalent in areas containing elevated arsenic concentration in soil along with very shallow ground water. Surface expressions of ground water along the railroad (SP0701 through SP0703) contain elevated concentrations of arsenic indicating the eastern extent of contamination has not been defined, but appears to lie beyond the OU boundary into the adjacent Clark Fork River OU of the Milltown Reservoir Sediments/Clark Fork River Superfund Site.

The North Opportunity TI Evaluation Report (EPA 2011a) concluded that the source of arsenic contamination in surface water and ground water was a combination of contaminated soil and seasonally saturated conditions. Because the source was present within an important wetland that extends for more than 3,000 acres, removal of the source would cause destruction of the wetland, and evidence did not show that removal of the source would cause standards to be met, the evaluation indicated that it is technically impracticable from an engineering perspective to reduce arsenic concentrations below 10 µg/L in ground water within the North Opportunity Ground Water/ Surface Water Area of Concern.

5.3.2 Description of Remedial Alternatives

As discussed in the North Opportunity TI Evaluation Report (EPA 2011a), this section analyzes remedial alternatives to address arsenic concentrations above the human health standard in surface water and ground water.

5.3.2.1 Surface Water

Contaminated ground water in the wetland areas in the North Opportunity Area of Concern (AOC) discharges to form surface water. Most of the surface water forms tributaries to Dutchman Creek which flows into Lost Creek. There is no inflow of surface water into the Dutchman Creek catchment; therefore, all flow is derived from ground water, most of which is contaminated with arsenic. The extent of contaminated surface water includes all areas of contaminated ground water in the Dutchman Creek Area of Concern and all channels of Dutchman Creek to its mouth. The receiving stream, Lost Creek is also contaminated due to ground water gains within the Area of Concern and inflow from Dutchman Creek. The extent of contamination includes the gaining reach coincident with the ground water Area of Concern and extends to the mouth of Lost Creek. Dutchman and Lost Creeks are considered B class streams with drinking water as a potential beneficial use. No permitted intakes to drinking water currently exist for either stream.

As presented in the 1998 ARWW&S OU ROD, the selected remedy for surface water is source control through removal, land reclamation, and engineered storm water runoff controls. The North Opportunity TI Analysis (EPA 2011a) considered multiple approaches to remediation of the surface water in the North Opportunity AOC. The remedy for surface water in the North Opportunity AOC includes:

> ICs. ICs that are currently being developed will also address potential human consumption of surface water exceeding the arsenic human health standard. Specific ICs components to address this potential risk include the CPMP and the DPS. The CPMP includes educational materials such as brochures and periodic newspaper announcements to inform the public about arsenic present in certain surface water receptors, while the DPS will include provisions that prohibit individuals from using surface water as a drinking water source within the Smelter Overlay District.
>
> ARAR Waiver. Waiver of the arsenic human health standard for certain surface water (10 µg/l) within the North Opportunity AOC due to TI. No other waivers are applied as other ARARs will be or have been met.

Monitoring. Surface water will continue to be monitored, to help ensure compliance with ARARs that have not been waived.

For comparison, two alternatives for surface water restoration are discussed in the TI Analysis.

Alternative 1: Collection of surface water at a single diversion in Lost Creek and a single diversion in the Montana Department of Fish, Wildlife & Parks (FWP) ditch. The water would be treated and returned to the surface water immediately below the diversions.

Alternative 2: Collection of ground water adjacent to Lost Creek and collection of surface water in the FWP ditch. The water would be treated and returned to the surface water immediately below the diversions. This alternative is a ground water action with the purpose of preventing migration of arsenic to surface water receptors.

5.3.2.2 Ground Water

As presented in the 1998 ARWW&S OU ROD, the selected remedy for ground water where restoration of ground water to beneficial uses is not practicable is to: prevent further migration of the plume; prevent exposure to the contaminated ground water; and further reduce risk by minimizing transport of COCs to the bedrock and alluvial aquifers. The remedy for ground water in the North Opportunity AOC includes:

ICs. A controlled ground water area (CGWA) is being developed for the ARWW&S outside of the North Opportunity AOC. The CGWA does not currently anticipate an outright well ban, so the details of the ground water controls will be evaluated to see if this is the appropriate ICs for the North Opportunity AOC.

ARAR Waiver. Waiver of the arsenic human health standard for ground water within the North Opportunity AOC due to TI. No other waivers are applied as other ARARs are met.

Monitoring. Ground water will continue to be monitored, to help ensure compliance with ARARs that have not been waived.

No ground water alternatives were identified that resulted in restoration of the ground water within the North Opportunity AOC.

For protection of receiving waters, two alternatives are discussed in the TI Analysis.

Alternative 1. This includes collection of ground water along the downgradient edge of the North Opportunity AOC to prevent offsite migration of the plume. The water would be treated and returned to the ground water immediately below the collection areas.

Alternative 2. This alternative is a ground water remediation action that protects surface water receptors. This is discussed as surface water alternative 2.

5.3.3 Comparative Analysis of Alternatives

In accordance with the NCP, the relative performance of each alternative is evaluated using the nine criteria (40 C.F.R. § 300.430 (e)(9)(iii)) of the NCP as a basis for

comparison. The purpose of the evaluation process is to determine which alternative: (a) meets the threshold criteria of overall protection of human health and the environment and attainment of ARARs, (b) provides the "best balance" with respect to the five balancing criteria of 40 CFR § 300.430(e)(9)(iii)(C)-(G), and (c) takes into consideration the acceptance of the state and the community.

5.3.3.1 Threshold Criteria

Overall protection of human health and the environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or ICs.

The alternate remedial strategy is protective of human health due to ICs requiring treatment of public surface water supplies and a monitoring program to test (and replace, if necessary) domestic water supply wells.

Surface water meets aquatic standards, so all strategies are protective of the environment. Aquatic standards do not apply to ground water.

Surface water alternative 1 would leave arsenic in the surface water above the point of diversion, so ICs would be needed to be protective of human health.

Surface water alternative 2 would be protective of human health because the arsenic would be prevented from entering surface water in Lost Creek. Arsenic would still enter Dutchman Creek, so ICs would be needed to be protective of human health.

Ground water alternative 1 would leave arsenic in the ground water upgradient of the collection point, so ICs would be needed to be protective of human health. No data are available to determine if ground water is contaminated downgradient of the OU boundary, in the Clark Fork River OU. It is not known if the same conditions that cause the ground water contamination (i.e., contaminated soil and saturated conditions) exist there. Therefore, the efficacy of ground water alternative 1 at controlling off-site migration of contamination is uncertain.

Compliance with ARARs

Section 121(d) of CERCLA and NCP 40 C.F.R. §300.430(f)(1)(ii)(B) require that RAs at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4), 42 U.S.C. 9621(d)(4).

Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, RA, location, or other circumstance found at a CERCLA site. Only those State standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be applicable. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations

promulgated under Federal environmental or State environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, RA, location, or other circumstance at a CERCLA site address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those State standards that are identified in a timely manner and are more stringent than Federal requirements may be relevant and appropriate.

EPA must show whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or must provide a basis for a invoking a waiver.

The alternate remedial strategy meets all ARARs except the human health standard for arsenic in surface and ground water.

Surface water alternative 1 and ground water alternative 1 would leave arsenic in surface and ground water. This would not meet the human health standard ARAR for arsenic. Surface water alternative 2 would prevent arsenic from entering Lost Creek and would be in compliance with the surface water ARAR for that water body. None of the alternatives result in the off-site receiving water body, the Clark Fork River, meeting the arsenic standard.

5.3.3.2 Primary Balancing Criteria

Long Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk that will remain onsite following remediation and the adequacy and reliability of controls.

The remedial strategy does not involve implementation of RAs. The strategy is limited to administrative actions and ICs. These are considered to be very effective and permanent for limiting exposure to arsenic in surface water.

The treatment alternatives rely on active collection and treatment of surface and/or ground water indefinitely. The long term effectiveness and permanence requires a very large commitment to O&M.

Reduction in Toxicity, Mobility or Volume through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

The alternate remedial strategy does not alter the existing toxicity, mobility or volume of arsenic in surface or ground water in the North Opportunity AOC. Source control through removal or dewatering is not acceptable due to compliance with the competing wetland ARAR (see Appendix A.II.G). Natural attenuation is expected to be ineffective. No other methods of reduction in toxicity, mobility or volume are practicable from an engineering perspective. The treatment alternatives are effective at reducing the mobility of arsenic through capture and treatment. If a treatment alternative is not implemented, arsenic will continue to move offsite in surface water.

Although no data are available at the downgradient OU boundary, it is possible that contaminated ground water is currently moving offsite and will continue to move offsite unless a treatment alternative is implemented.

Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

The alternate remedial strategy is easily implemented. The surface water IC is already in place and the ground water IC will be implemented by the County in the near future. Waiver of the ARARs can be implemented by EPA through administrative actions. The waiver is completed here within this ROD Amendment.

The treatment alternatives require construction of collection systems and a very large treatment plant. The plant would require a significant effort to design and construct due to its large required capacity. These alternatives could be implemented, but the feasibility of successful implementation would be challenging.

Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until cleanup levels are achieved.

There is no construction phase to the alternate remedial strategy, so the short-term effectiveness is the same as the long-term effectiveness.

The treatment alternatives would not be effective until after the completion of full scale collection and treatment facilities. Therefore, the short-term effectiveness is the same as current conditions.

Cost

Costs for the remedial alternatives analyzed in the TI Evaluation are provided in Appendix C. The cost of the alternate remedial strategy has not been quantified, since it adds no additional costs to the existing 1998 Selected Remedy requirements for monitoring and ICs. Costs for alternatives 1 and 2 are estimated to range from $159 to $178 million dollars.

5.3.3.3 Modifying Criteria

State Acceptance

Montana DEQ concurs with this remedy modification, as indicated by their concurrence with this ROD Amendment.

Community Acceptance

EPA and DEQ received several comments from the public during the public comment period for the proposed plan. Public comments, and the Agencies' responses to those comments, are summarized in Section 14 and are provided in the Responsiveness Summary.

5.3.4 Alternative Remedial Strategy

The North Opportunity TI analysis (EPA 2011a) showed that the source of arsenic contamination in ground water was the combination of contaminated soil and saturated conditions. The restrictions on RAs due to its wetland character limit any actions that will significantly disturb the soil or hydrologic conditions. Additionally, the geochemical conditions necessary for natural attenuation are not present. Since no actions are available which will remove the source or disrupt the transport pathway, any ground water within or entering the North Opportunity AOC will remain or become contaminated with arsenic. Even if ground water is withdrawn for treatment, the recharge water will become contaminated.

On this basis, the North Opportunity TI Analysis concludes that it is technically impracticable from an engineering perspective to reduce arsenic concentrations below 10 µg/L in ground water within the North Opportunity AOC. The area of TI is shown on Figure 5-1 and generally extends from the Anaconda Airport to the Clark Fork River OU boundary and from Warm Springs Creek to Lost Creek. The lower vertical extent is not well defined, but no wells completed more than ten feet below the top of the water table that have been sampled contain elevated arsenic concentrations. The vertical extent of the TI boundary is defined as the water table to ten feet below the water table.

5.3.4.1 Surface Water

The North Opportunity TI analysis showed that the source of arsenic in surface water is gains from ground water. The TI analysis concluded that it is technically impracticable to remediate arsenic in ground water in the North Opportunity AOC including at the edge of the plume where the contamination enters Lost Creek. Since the source of ground water will not be mitigated, surface water will remain impacted by arsenic within the reaches affected by gaining ground water.

5.3.4.2 TI Zone Boundaries

Figure 4-1 delineates the extent of known ground water and surface water contamination in the North Opportunity AOC. The downgradient/ downstream limits of the TI Zone extend to the OU boundary where the surface and ground water flow into the Clark Fork River OU. The TI Zone applies to all surface water within the TI Zone. The TI zone also applies to ground water within 10 feet of the water table.

Specifically, the North Opportunity TI Zone extends from the edge of the valley bottom along the north side of Lost Creek to Warm Springs Creek on the south and from the 5000 foot elevation contour on the west to the OU boundary on the east.

This TI evaluation focuses on the mainstem named streams and named tributaries because the available data are mostly limited to these water bodies. The results of the analysis are extended to include all surface water within the boundaries of the TI Zone because the loading sources are continuous and the potential exists for arsenic concentrations to occasionally exceed 10 µg/L in surface water throughout the TI Zone.

5.3.5 Remedial Requirements

EPA, in consultation with DEQ, FWP, and the USF&WS, has determined that large-scale soil removal from the North Opportunity Ground Water/ Surface Water Area of Concern will not be further considered due to the value of the wetlands in their existing condition and the uncertainty of the effectiveness and inordinate cost of source removal, as well as other elements set forth in North Opportunity TI Evaluation Report (EPA 2011a). Because the soils will remain in place, shallow ground water interaction with these soils will continue to present a potential contaminant loading source to both ground water and surface water. EPA evaluated the potential for treating the ground water as part of the North Opportunity TI Evaluation Report.

EPA has concluded that water treatment would have no appreciable benefit to the environment, due to the inefficacy of collection and treatment of lower arsenic contaminant levels over such a significantly large area, as well as for the additional reasons set forth in the North Opportunity TI Evaluation Report. Pursuant to Section 121(d)(4)(c) of CERCLA, the Agencies waive the ground water human health standard for arsenic of 10 µg/L for the shallow ground water within the North Opportunity Ground Water/ Surface Water Area of Concern as depicted in Figure 5-1, based on the North Opportunity TI Evaluation. The ground water TI waiver applies to the uppermost portion of the shallow unconfined alluvial aquifer within the North Opportunity Ground Water/Surface Water Area of Concern, where shallow ground water interacts with high arsenic soils. Note that naturally-occurring arsenic is not addressed under CERCLA.

Currently, there are no domestic well users in the North Opportunity AOC. The domestic well monitoring and replacement program will monitor residential well users adjacent to the North Opportunity AOC to ensure that the contaminant plume does not migrate and impact these receptors.

The following remedial requirements for the North Opportunity AOC will protect domestic water users, and provide contingency water systems in the event of newly identified users:

- *Implement ICs to regulate domestic ground water use.* Should the Dutchman HAA be managed as a wildlife management area by the State of Montana, domestic wells in this area will be prohibited where contamination is present. Areas surrounding the Dutchman Wildlife Management Area would be included under a CGWA.
- *Establish a long-term ground water monitoring plan.* A long-term monitoring plan will be designed and implemented to evaluate changes in ground water quality in the TI zones as ICs are implemented during RD/RA. The information will be evaluated during each of EPA's 5-year reviews to ensure that variations in the nature and extent, fate and transport, and changes in land use have not significantly changed EPA's assessment of the exposure of ground water contamination in the TI zones to humans and/or the environment.
- *Provide for alternative water supplies.* Areas adjacent to the Dutchman HAA will be included under a domestic well monitoring and replacement plan. In the event

that domestic water users near the Dutchman HAA are discovered using ground water and/or springs and surface water with arsenic concentrations above Montana human health standards, an alternative water supply for those water users will be implemented. The alternative water supply may consist of newly drilled individual wells, a community-based water supply, or individual home treatment systems, as determined through the processes described in a domestic well monitoring and replacement plan. The alternative water supply will meet all applicable Federal Safe Drinking Water Act MCLs and Montana Numeric Water Quality Human Health Standards.

Section 6 Fundamental and Significant Changes to the South Opportunity Subarea Remedy

The fundamental change to the South Opportunity Subarea remedy identified in this ROD Amendment is the designation of a ground water and surface water TI Zone for the arsenic human health standard in the area referred to as the South Opportunity Alluvial Aquifer Arsenic Plume in the 1998 ROD. Significant changes to the South Opportunity Subarea remedy are expanding the soils areas of concern to include historic Silver Bow Creek Fluvial Tailings, modification of the Blue Lagoon remedy, and the removal of Yellow Ditch. These changes are described below.

6.1 Expansion of Soils AOC (Significant Change)

RD investigations at the South Opportunity Subarea include additional LRES polygon delineation in an area identified under the outer boundary investigation as historic Silver Bow Creek Fluvial Tailings. The 1998 ARWW&S OU ROD identified two miscellaneous wastes associated with past transport from Silver Bow Creek. The Yellow Ditch was historically used by ACM to convey tailings from Silver Bow Creek to the Opportunity Ponds, while lower Willow Creek floodplain tailings were most likely the result of a large Silver Bow Creek flood event which occurred in the early 1900s. During the 1998-1999 LRES evaluations, EPA observed that the extent of soils and waste contamination was significantly greater than the original subareas identified in the ROD. This led the Agencies to initiate and complete a soils/wastes investigation in May 2000 (RRU 2000). This outer boundary investigation included a Sampling and Analysis Plan (SAP) for fluvially-deposited wastes in the South Opportunity area. Further sampling conducted by Atlantic Richfield identified several discrete areas of tailings deposition, which are identified in the *RDU 9 Silver Bow Creek Fluvial Tailings FDR/RAWP* (Atlantic Richfield 2007). Construction was initiated in 2009. A portion of the lower Willow Creek floodplain tailings are now being addressed as part of the Streamside Tailings OU. The portion remaining in the South Opportunity Subarea is shown on Figure 6-1 (designated as the Willow Creek Project Area).

6.2 Changes to the Blue Lagoon Remedy (Significant Change)

The Blue Lagoon is located where a tributary of Willow Creek crosses through the active Butte, Anaconda & Pacific Railway (formerly Rarus) railroad embankment. The embankment was constructed with mining wastes in the late 19th/early 20th century. Surface water and shallow ground water intersecting the embankment have leached copper, cadmium, and zinc from these wastes.

The 1998 ROD selected improvement to the surface water drainage system at the railroad embankment above the Blue Lagoon as the remedy to minimize leaching of COCs from the embankment materials into surface water and ground water. RD investigations at the Blue Lagoon included test pits to define the extent of contaminated outwash and shallow aquifer material impacted by the leached sediments, installation of shallow piezometers and a limited pumping test to evaluate the connection between surface water flow and the shallow ground water present in the alluvial aquifer. These data suggest that ground water inflows beneath the embankment may be occurring, which led to a design change (removal of the embankment instead of the original selected remedy to only improve surface water drainage).

During RD, two other locations (shown on Figure 6-1) where surface water intercepts railroad embankment materials and subsequently results in COCs leaching into surface water were identified and included. These areas, as well as the railroad crossings at Mill and Willow Creeks, will be addressed as part of remedy and are included in the RDU 5 Active Railroad East/Blue Lagoon RA Work Plan/Final Design Report (Atlantic Richfield 2007a). Improvements to minimize surface water contamination at the areas are also required and are identified in this work plan.

6.3 Changes to the Yellow Ditch (Significant Change)

The 1998 ARWW&S OU ROD Selected Remedy for ground water specified construction of an engineered soil cover over wastes within the active portion of the Yellow Ditch (Section 9.5.4), and removal of tailings and soil/tailings mixtures from the abandoned portion of the Yellow Ditch to be consolidated into a WMA (Section 9.2). During RD, significantly more wastes were identified than was identified in the 1998 ROD. As identified in the remedy described below in Section 6.4, these additional wastes and impacted soils associated with the abandoned portion of the Yellow Ditch will be removed to better meet source control remedial requirements.

Yellow Ditch removal will include inactive sections of the Yellow Ditch located south of Highway 1, a section of Yellow Ditch associated with the Blue Lagoon, a section of Yellow Ditch past the Silver Bow Creek headgate near Fairmont, and a section of Yellow Ditch that has been buried southeast of the Blue Lagoon. Portions of the Yellow Ditch north of the Blue Lagoon and south of Highway 1 that remain in operation for irrigation do not require removal at this time; however, a change in use may trigger additional investigations and a new assessment of this area to assess potential impacts to ground water.

6.4 Summary of South Opportunity Ground Water/Surface Water TI Waiver (Fundamental Change)

This section presents the remedial alternatives analyzed for the South Opportunity Ground Water/Surface Water Area of Concern, a detailed evaluation of those alternatives for the South Opportunity Ground Water/Surface Water Area of Concern

with respect to nine evaluation criteria that EPA has developed to address the statutory requirements and preferences of CERCLA, and the revised selected remedy and remedial requirements for the TI zone.

6.4.1 South Opportunity Ground Water/Surface Water AOC

The South Opportunity Ground Water/ Surface Water Area of Concern consists of valley bottom land located within an area generally bounded by Mill Creek to the north, the Streamside Tailings OU to the east, the Silver Bow County line to the south, and uplands associated with the Mount Haggin Wildlife Management Area (also the bedrock TI Zone) to the west. Figure 6-1 shows the South Opportunity Ground Water/ Surface Water Area of Concern.

Ground water quality in the South Opportunity area was investigated during the remedial investigation conducted for the Anaconda Regional Water and of the Anaconda Smelter NPL site during 1991 to 1996. During this investigation, some isolated areas of ground water contamination were identified. These areas are associated with waste areas such as Streamside Tailings, Yellow Ditch, and Blue Lagoon.

In addition to these discrete areas, a large area contaminated with low concentrations of arsenic was also identified. Based on the information collected for the remedial investigation, an area of contamination was identified and given the name South Opportunity Area of Concern.

The 1998 ROD (EPA and DEQ 1998) presented a map showing the South Opportunity alluvial arsenic ground water plume. This delineation was based on sampling and analysis of ground water present in seeps, domestic wells, and temporary piezometers installed after the Anaconda Regional Water and Waste OU remedial investigation was concluded in 1997.

As a part of RD, further investigation of ground water in the South Opportunity Area of Concern was conducted in 2002. This investigation included installing shallow temporary wells and collection and analysis of two ground water samples from each well. Overall, arsenic was the only contaminant that is present in most of the South Opportunity Area of Concern that is widespread and not associated with a specific waste source such as the Yellow Ditch, Blue Lagoon, or Streamside Tailings. Two of the temporary wells along Silver Bow Creek contained ground water very different than other monitoring wells in this area. The South Opportunity alluvial aquifer shallow ground water arsenic plume shown in the 1998 ARWW&S OU ROD was based on data collected from different depths within the alluvial aquifer, from monitoring wells, piezometers, and domestic wells, which were sampled over several years during different remedial investigations. A grid of temporary piezometers was installed during RD to further define the South Opportunity plume in 2002 (Atlantic Richfield 2004a). The 2002 ground water data indicates that the Yellow Ditch remains a potential source of ground water contamination in the South Opportunity area. Additional soil sampling during RD conducted in RDUs 5 (Blue Lagoon) and 9 (Silver Bow Creek Fluvial Tailings) identified waste materials and soils with high levels of COCs (arsenic concentrations often exceeding the recreational/open

space/agricultural human health cleanup level of 1,000 mg/kg). These materials will be removed and disposed into a WMA.

Synoptic surface water sampling was conducted in the South Opportunity area in 1992-1993 and in 2001. DEQ collected several samples in Willow Creek in 2007 and the United States Geological Survey (USGS) conducted hourly sampling in 2008 at the lower gaging station. In 2007 EPA conducted detailed surface water sampling in the South Opportunity area, including Willow Creek, Willow Glen Gulch, ditches, and tile drains. Although there was not a synoptic sampling event in 2007-2008, these data can be used to evaluate the distribution of water and arsenic in the South Opportunity area.

The results of these studies indicate that arsenic is present in the ground water at the top of the aquifer over a large area of South Opportunity at concentrations up to 150 µg/L. This plume is limited to the upper few feet of the aquifer and has not been detected in any domestic wells which tend to penetrate past the top of the aquifer. This plume occupies two general areas: along Willow Creek and between Willow Glen Ranch and the Town of Opportunity. Based on historic mapping, this widespread plume coincides with areas that have been flood irrigated. One monitoring well, MW-232, has contained significantly higher arsenic than the ground water elsewhere in South Opportunity. This monitoring well is downgradient of Yellow Ditch and in an area that was irrigated before 1996. Possible sources of elevated arsenic in the MW-232 area include contaminated sediments in Yellow Ditch, contaminated water flowing into Yellow Ditch, or a combination of the two.

The ground water investigation conducted in 2002 identified elevated arsenic in shallow ground water in one monitoring well in the Crackerville area. Well SOSPZ26 contained 46 to 79 µg/L arsenic in the area between Yellow Ditch and Silver Bow Creek just south of Crackerville. Three domestic wells east of Crackerville contained arsenic concentrations exceeding 10 µg/L during the 2006 domestic well sampling event.

Several ground water investigations have been conducted at the Town of Opportunity. Domestic wells here have arsenic concentrations less than 10 µg/L, with the exception of a few that had faulty surface seals. It is believed that the aquifer here is uncontaminated because the ground water originates in upper Mill Creek, less flood irrigation here compared to the agricultural fields to the south, and some hydraulic diversion by the tile drains south of Highway 1.

The South Opportunity Characterization Report (EPA 2011e) concluded that the source of arsenic contamination in surface water and ground water was a combination of contaminated soil and seasonally saturated conditions. The evaluation indicated that it is technically impracticable from an engineering perspective to reduce arsenic concentrations below 10 µg/L in ground water within the South Opportunity Ground Water/Surface Water Area of Concern. Figure 5-1 identifies a revised ground water area of concern for the South Opportunity area.

6.4.2 Description of Remedial Alternatives

Based on the studies described above, the South Opportunity TI Evaluation Report (EPA 2011b) concluded that Willow Creek is a gaining stream and ground water forms a major portion of the flow. Inflow of contaminated ground water represents 66 to 79 percent of the arsenic load in surface water resulting in exceedances of the human health ARAR. Arsenic concentrations range from 11 to 164 µg/L in the mainstem and from 28 to 307 µg/L in small tributaries. These streams are B class waters with drinking water as a potential beneficial use. No permitted surface water intakes to public water supplies exist on Willow Creek.

As also discussed in the South Opportunity TI Evaluation Report (EPA 2011b), the sections below analyze remedial alternatives to address arsenic concentrations above the human health standard are analyzed for surface water and ground water.

6.4.2.1 Surface Water

As presented in the 1998 ARWW&S OU ROD, the selected remedy for surface water is source controls through land reclamation, selective removal of tailings, engineered storm water runoff controls, and monitoring. The South Opportunity TI Analysis (EPA 2011b) considered multiple approaches to remediation of the surface water in the South Opportunity area. The remedy for surface water in the South Opportunity Area of Concern includes:

> ICs. ICs that are currently being developed will also address potential human consumption of surface water exceeding the arsenic human health standard. Specific ICs components to address this potential risk include CPMP and the DPS. The CPMP includes educational materials such as brochures and periodic newspaper announcements to inform the public about arsenic present in certain surface water receptors, while the DPS will include provisions that prohibit individuals to use surface water as a drinking water source within the Smelter Overlay District.
>
> ARAR Waiver. Waiver of the arsenic human health standard for certain surface water within the South Opportunity Area of Concern. No other surface water standards are being considered for waivers as a result of this TI analysis. No other waivers are applied as other ARARs will be or have been met.
>
> Monitoring. Surface water will continue to be monitored to help ensure compliance with ARARs that have not been waived.

For comparison, two alternatives for surface water restoration are discussed.

Alternative 1: Collection of surface water at a single diversion in Lower Willow Creek. The water would be treated and returned to the surface water immediately below the diversions.

Alternative 2: Collection and treatment of ground water along gaining reaches of Willow Creek. This could be accomplished by collecting and routing ground water to a treatment plant, or by installation of a PRB along Willow Creek. This alternative is a

ground water action with the purpose of preventing migration of arsenic to surface water receptors.

6.4.2.2 Ground Water

As presented in the 1998 ARWW&S OU ROD, the selected remedy for ground water where restoration of ground water to beneficial uses is not practicable is to: prevent further migration of the plume; prevent exposure to the contaminated ground water; and further reduce risk by minimizing transport of COCs to the bedrock and alluvial aquifers. The remedy for ground water in the South Opportunity Area of Concern includes:

> ICs . A CGWA is being developed for the ARWW&S outside of the South Opportunity area. The CGWA does not currently anticipate an outright well ban, so the details of the ground water controls should be evaluated to see if this is appropriate for the South Opportunity Area of Concern.
>
> ARAR Waiver. Waiver of the arsenic human health standard for ground water within the South Opportunity Area of Concern. No other ground water standards are being considered for waivers as a result of this TI analysis. No other waivers are applied as other ARARs will be or have been met.
>
> Monitoring. Ground water will continue to be monitored to help ensure compliance with ARARs that have not been waived.

No ground water alternatives were identified that resulted in remediation of the ground water within the South Opportunity Area of Concern because of the widespread nature of the source. Source control alternatives beyond those already implemented were eliminated during screening. Therefore, all ground water strategies include waiver of the arsenic human health standard for ground water and implementation of ICs. Ground water remediation alternatives that prevent discharge of contaminated ground water to Willow Creek are the same as Surface Water Alternative 2 discussed above. Because the contaminated South Opportunity area ground water discharges to surface water, movement of the plume is hydraulically controlled. Therefore, this remedial strategy does not include a separate ground water capture and treatment component to be evaluated.

6.4.3 Comparative Analysis of Alternatives

In accordance with the NCP, the relative performance of each alternative is evaluated using the nine criteria (40 C.F.R. § 300.430 (e)(9)(iii)) of the NCP as a basis for comparison. The purpose of the evaluation process is to determine which alternative: (a) meets the threshold criteria of overall protection of human health and the environment and attainment of ARARs, (b) provides the "best balance" with respect to the five balancing criteria of 40 CFR § 300.430(e)(9)(iii)(C)-(G), and (c) takes into consideration the acceptance of the state and the community.

6.4.3.1 Threshold Criteria

Overall protection of human health and the environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or ICs.

Protection of human health is ensured through a combination of ICs and monitoring. All alternatives would leave arsenic in the ground water upgradient of the collection point, so ICs would be needed to be protective of human health.

Willow Creek surface water meets aquatic life standards nearly all of the time. One exceedance of the 150 µg/L aquatic life standard for arsenic was measured by the USGS during 5 years of monitoring (164 µg/L). Based on this monitoring record, it is anticipated that aquatic life exceedances will be rare and minor in nature. Aquatic life standards do not apply to ground water.

Existing data compiled during the Baseline Ecological Risk Assessment (EPA 1997) and in fish surveys completed by FWP suggest that although occasional exceedances of Water Quality Bulletin(WQB)-7 (the predecessor to the current DEQ-7 standards) aquatic life standards present a potential risk, the ARWW&S OU streams generally support reasonable populations of aquatic organisms. By diverting surface water to a treatment facility, treating the water to reduce arsenic concentrations below 10 µg/L (well below the aquatic life standard of 150 µg/L), and returning the treated water to the point of collection, significant changes in physical and chemical properties of surface water can be expected. These include temperature, dissolved oxygen, and general chemistry (e.g., total dissolved solids would increase due to the addition of chemical reagents). The cumulative effects of these impacts on downstream aquatic life are not known and would require analysis before a treatment system could be implemented.

Surface water Alternative 1 would leave arsenic in the surface water above the point of diversion for treatment, so ICs would be needed to be protective of human health. Surface water Alternative 1 would not change concentrations in Willow Creek itself; it would only reduce the loading of arsenic from Willow Creek to downstream surface water receptors.

Surface water Alternative 2 (ground water treatment) would also not necessarily achieve the human health standard in Willow Creek. Arsenic concentrations in Upper Willow Creek exceed the human health standard due to contaminated bedrock ground water from the bedrock TI zone. Therefore, any captured and treated ground water would need to be treated to less than 10 µg/L in sufficient quantities to dilute the upgradient surface water so that the mixture met the human health standard. In the case of active treatment of captured ground water, surface water upstream of the treatment plant effluent would not meet the human health standard.

Similarly, treating Willow Creek to meet human health standards would not eliminate exceedances of arsenic in downstream receiving waters (Mill Creek and the Clark Fork River). Calculation of estimated downstream concentrations in the Clark Fork

River if Willow Creek surface water were treated to 10 µg/L showed that the Clark Fork River would still not meet the human health standard.

Compliance with ARARs

Section 121(d) of CERCLA, 42 U.S.C. § 9621(d) and NCP 40 C.F.R. §300.430(f)(1)(ii)(B) require that RAs at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4), 42 U.S.C. 121(d)(4).

Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, RA, location, or other circumstance found at a CERCLA site. Only those State standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be applicable. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, RA, location, or other circumstance at a CERCLA site address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those State standards that are identified in a timely manner and are more stringent than Federal requirements may be relevant and appropriate.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or provides a basis for an invoking waiver.

The alternate remedial strategy meets all ARARs except the 10 µg/L human health standard for arsenic in surface and ground water (as specified in DEQ-7 and 40 CFR § 141.11).

Surface water Alternative 1 would leave arsenic in Willow Creek surface water in excess of the human health standard. Furthermore, the reduction in loading would not result in achievement of human health standards in receiving waters.

Surface water Alternative 2 (collection and treatment of ground water prior to discharge to Willow Creek) would significantly reduce arsenic loading to Willow Creek and would locally reduce arsenic concentrations. However, the extent of this decrease is uncertain. Subsequent arsenic loads transported to downstream receiving waters would also decrease, but treatment of arsenic in Willow Creek alone will not result in downstream receiving waters meeting the arsenic standard.

None of the alternatives is capable of achieving the human health standard for arsenic with certainty. Therefore, a waiver of the human health arsenic standard is necessary.

6.4.3.2 Primary Balancing Criteria

Long Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk that will remain onsite following remediation and the adequacy and reliability of controls.

The remedial strategy does not involve implementation of RAs. The strategy is limited to administrative actions and ICs. These are considered to be very effective and permanent for limiting exposure to arsenic in surface water and ground water.

The treatment alternatives rely on active collection and treatment of surface and/or ground water indefinitely. The long-term effectiveness and permanence of treatment alternatives requires a very large commitment to O&M.

As already discussed, treatment would not result in achieving the human health standard in the receiving waters (Mill-Willow Bypass and Clark Fork River).

Reduction in Toxicity, Mobility or Volume through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

The alternate remedial strategy does not alter the existing toxicity, mobility or volume of arsenic in surface or ground water in the South Opportunity Area of Concern. Source control through removal or dewatering was not compatible with existing land uses and was unimplementable. The treatment alternatives are effective at reducing the toxicity and mobility of arsenic via capture and treatment. The ground water interception and treatment alternative would contain the ground water plume and prevent migration to surface water, resulting in decreased arsenic concentrations in surface water. However, upstream sources of arsenic cause Willow Creek to exceed the arsenic standard upstream of the South Opportunity AOC, and treatment of contaminated ground water would not ameliorate this situation.

Implementability

The alternate remedial strategy of ICs is easily implemented. Waiver of the ARARs can be implemented by EPA through administrative actions. The waiver is completed here within this ROD Amendment.

The treatment alternatives require construction of collection systems and a very large treatment plant, or a very large permeable reactive barrier. While challenging because of the large scale, the treatment alternatives could be implemented.

Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until cleanup levels are achieved.

There is no construction phase to the alternate remedial strategy, so the short-term effectiveness is the same as the long-term effectiveness.

The treatment alternatives would not be effective until after the completion of full scale collection and treatment facilities. Therefore, the short-term effectiveness is the same as current conditions.

Cost

Costs for the remedial alternatives analyzed in the TI Evaluation are provided in Appendix C. The cost of the alternate remedial strategy has not been quantified, since it adds no additional costs to the existing 1998 Selected Remedy requirements for monitoring and ICs. The costs of the treatment alternatives are high, mainly due to the large scale of the impacted area. The treatment plant or permeable reactive barrier capital and 50-year Operations &Maintenance (O&M) costs were estimated to be from approximately $59 million to $104 million dollars. Significant costs such as energy and sludge management were not included. The cost of the collection systems was not prepared because it is expected that the treatment plant represents the largest cost.

6.4.3.3 Modifying Criteria

State Acceptance

Montana DEQ concurs with this remedy modification, as indicated by their signature to concurrence with this ROD Amendment.

Community Acceptance

EPA and DEQ received several comments from the public during the public comment period for the proposed plan. Public comments, and the Agencies' responses to those comments, are summarized in Section 12 and are provided in the Responsiveness Summary.

6.4.4 Alternative Remedial Strategy

6.4.4.1 Ground Water

The South Opportunity TI analysis (EPA 2011b) showed that the source of arsenic contamination in ground water was the combination of contaminated soil and saturated conditions. The previous RAs of reducing irrigation and allowing natural attenuation to work for eleven years has not resulted in significant progress toward meeting the ground water ARAR. Additional RAs which would control the source through removal action or changing the hydrologic conditions are difficult to implement because much of the area of concern is a jurisdictional wetland (i.e., a wetland regulated under Section 404 of the Clean Water Act). Additionally, the geochemical conditions necessary for natural attenuation are not present (EPA 2011b). Since no actions are available which will remove the source or disrupt the transport pathway, any ground water within or entering the South Opportunity Area of Concern will remain or become contaminated with arsenic. Even if ground water is withdrawn for treatment, the recharge water will become contaminated. Because the contaminated South Opportunity TI zone ground water discharges to surface water (Willow Creek), movement of the plume is hydraulically controlled.

The South Opportunity TI analysis concluded that it is technically impracticable from an engineering perspective to reduce arsenic concentrations below 10 µg/L in ground water within the South Opportunity TI. It would be possible to collect and treat ground water just prior to its entry into Willow Creek. Treating ground water at the downgradient edge of the plume would not change the extent, magnitude, or mobility of the ground water plume. This action would benefit the surface water receptors and thus is not a strict ground water RA. On this basis, ground water treatment at the edge of the plume is considered a surface water action.

6.4.4.2 Surface Water

The South Opportunity TI analysis (EPA 2011b) showed that the source of arsenic in surface water is gains from ground water via small tributaries and drain tiles. An additional source of arsenic in surface water is upstream source within the bedrock TI zone. As discussed in Section 6.1.4.1, it is technically impracticable to remediate the ground water to the arsenic human health standard throughout the South Opportunity Area of Concern, and a previous determination has concluded that it is technically impracticable to remediate the upstream source.

6.4.4.3 TI Zone Boundaries

Surface water investigations conducted in 1993 and 2007 attempted to sample all tributaries to lower Willow Creek. All samples exceeded 10 µg/L arsenic confirming the widespread nature of surface water contamination. Figure 6-1 delineates the South Opportunity ground water/surface water TI zone. The area generally includes the valley bottom land located within an area bounded by Mill Creek or Highway 1 to the north, the Streamside Tailings OU to the east, the Silver Bow County line to the south, and uplands associated with the Mount Haggin WMA (also the bedrock TI zone) to the west. Downgradient movement of the plume is hydraulically controlled by discharge into surface water either along Willow Creek or drain tiles. Because of the connection between the extent of wetlands and ground water contamination, wetlands on the north side of Highway 1 are included in the TI zone. Wetlands further north are not included in the TI zone because no data have been collected to indicate that shallow ground water contamination exists in that area. Data from drain tiles and domestic wells indicate very low arsenic concentrations in ground water north of the TI zone.

The surface water TI zone includes all surface water within the ground water TI zone plus all surface water exiting the bedrock TI zone to the confluence of Mill Creek and Willow Creek. The South Opportunity TI evaluation focused on the mainstem named streams and named tributaries because the available data are mostly limited to these water bodies. The results of the analysis are extended to include all surface water within the boundaries of the TI zone because the loading sources are continuous and the potential exists for arsenic concentrations to exceed 10 µg/L in surface water throughout the TI Zone. The arsenic human health standard ARAR waiver applies to all surface water within the TI zone.

6.4.5 Remedial Requirements

EPA, in consultation with DEQ, has determined that large-scale soil removal from the South Opportunity Ground Water/ Surface Water TI Zone will not be further considered, due the inordinate cost of large scale removal and the uncertainty of the effectiveness of source removal, as well as other elements set forth in South Opportunity TI Evaluation Report (EPA 2011b). Because the soils will remain in place, shallow ground water interaction with these soils will continue to present a potential contaminant loading source to both ground water and surface water. EPA evaluated the potential for treating the ground water as part of the South Opportunity TI Evaluation Report. EPA has concluded that water treatment provides no appreciable benefit to the environment, due to the inefficacy of the collection systems, as well as the additional reasons set forth in the South Opportunity TI Evaluation Report.

Pursuant to Section 121(d)(4)(c) of CERCLA, 42 U.S.C. § 9621(d)(1), the Agencies waive the ground water human health standard for arsenic of 10 µg/L for the shallow ground water within the South Opportunity Ground Water/ Surface Water Area of Concern as depicted in Figure 6-1, based on the South Opportunity TI Evaluation. Similar to the North Opportunity Ground Water/ Surface Water Area of Concern, the ground water TI waiver applies to the uppermost portion of the shallow unconfined alluvial aquifer within the South Opportunity TI Ground Water/ Surface Water Area of Concern, where shallow ground water interacts with high arsenic soils. Note that naturally-occurring arsenic in ground water is not addressed under CERCLA.

In addition to the remedial requirements identified in the 1998 ARWW&S OU ROD, the following RAs will be taken for the South Opportunity area of concern:

- Additional source control measures are required by removing waste associated with Yellow Ditch, and other fluvially-deposited tailings in South Opportunity;
- Prevent migration of plume toward the community of Opportunity;
- Performance monitoring of ground water and surface water to evaluate the effects of the source control measures;
- ICs CGWA to manage domestic use of ground water; and
- Testing of domestic well users though the domestic well monitoring and replacement plan, including providing an alternative water supply, if necessary.

Section 7 Significant Changes to the Old Works/Stucky Ridge Subarea Remedy

The three significant changes to the 1998 ARWW&S OU ROD Selected Remedy for the Old Works/Stucky Ridge Subarea are expansion of the soils area of concern in the West Galen area, the modification of the Old Works WMA boundary and ground water POCs, and establishment of remedial requirements for upper Lost Creek. A description of these changes is provided below.

7.1 West Galen Expansion Area (Significant Change)

During the initial RD investigation, it became apparent to the Agencies that adjoining areas outside of the ROD soil area of concern had barren or sparsely-vegetated soils that appeared similar to areas previously assessed. Many of these areas were not included in the original study area, because aerial photography used to identify poorly-vegetated areas was unavailable for these areas and very limited soil sampling had occurred in these areas (as demonstrated by the large variances depicted near the edges of the regional soils kriging grid). Additionally, preliminary mapping by the National Resources Conservation Service had identified soil areas with moderate to severe impact classes from smelter-affected lands for soils beyond the ROD soil area of concern.

In light of these issues, the Agencies initiated a limited soil sampling event for areas outside of the ROD area of concern (RRU 2000) in May 2000. This opportunistic, screening-level sampling was designed to determine whether barren or sparsely-vegetated soils outside of the ROD area of concern have elevated concentrations of COCs. The sampling results were used to delineate the West Galen Expansion Area based on soil arsenic concentrations over 250 mg/kg and sparsely vegetated conditions. This ROD Amendment includes the West Galen Expansion Area in the ROD soil area of concern.

The West Galen Expansion Area covers approximately 6,164 acres north of the town of Anaconda that were impacted primarily by aerial emissions from the smelting facilities. The area consists of relatively level to gently sloping open space used primarily for livestock grazing and hay production.

The Final RAWP/FDR for West Galen was approved in 2005 (Atlantic Richfield 2005b), and provides the methods and procedures being used to implement the Selected Remedy components and conduct monitoring and maintenance for the expansion area. That document sets forth the task-specific methods, approaches, and other provisions aimed at having the Selected Remedy comply with the performance standards and other criteria required by the ROD, and the vegetation management plan and site-wide management plans prepared since the ROD was issued. Construction has been initiated on over 4000 acres.

7.2 Modification of Old Works WMA Boundary (Significant Change)

The Old Works WMA boundary has been expanded to include the Old Works wastes left in place as shown in the 1998 ARWW&S OU ROD, as well as additional waste materials discovered during the OW/EADA OU RA. These waste materials are adjacent to the Old Works WMA, and include additional Red Sands material adjacent to Highway 48 and fluvial tailings in the Drag Strip Subarea. Figure 7-1 shows the new WMA boundary. This area has been or will be capped with vegetative soil or engineered cover to prevent exposure to mining and smelting wastes.

7.3 Modification of Old Works Ground Water POC (Significant Change)

Expansion of Old Works WMA boundary requires moving the ground water POCs. Old Works ground water POCs are shown on Figure 7-1. The new POC consist of monitoring wells MW-207, MW-252, MW-251, and MW-255. The *RDU 13 Old Works Final Design Report* (Atlantic Richfield 2010) also includes a monitoring plan to monitor ground water at the POCs and within the WMA. Ground water will also be monitored during high ground water table conditions during spring runoff occur, which may mobilize precipitated contaminants in the vadose zone between low and high water table events.

7.4 Addition of Lost Creek (Significant Change)

The 1998 ROD identified specific remedial requirements for Warm Springs, Mill and Willow Creeks. No specific remedial requirements were identified for Lost Creek. Several surface water investigations performed at the ARWW&S OU since the ROD was issued in September 1998 form the basis for including Lost Creek within the Surface Water Area of Concern, which was shown on Figure 3-2. These investigations include high and low flow sampling in 1999, and stormwater sampling and analysis that occurred in 2000, 2001, and 2002 to better define the extent of the surface water area of concern. Additionally, the USGS has been collecting samples at two locations on Lost, Mill, Warm Springs, and Willow Creeks (the lower stations since 2003 and the upper stations since 2004). The storm water data provides the basis for including Lost Creek within the Surface Water Area of Concern.

Prior to the ROD, storm event data were limited to a few storm events sampled in 1993 in Mill Creek and Warm Springs Creek with automated sampling devices. After the ROD, several stormwater samples were collected during a July 3, 2000 storm event by DEQ. Although these samples were not collected following a SAP, DEQ standard operating procedures for the collection of surface water samples were followed. These results indicated surface water exceedances of copper and arsenic in Lost Creek where sampled. Stormwater runoff from normally dry, intermittent streams in Lost Creek RDU 2 was noted during this sampling event.

Additional opportunistic stormwater samples were collected by the Agencies on June 4, 2001, during a snow melt runoff event and on July 16, 2001, during a thunderstorm event. Although exact precipitation measurements were not collected during the July

16 thunderstorm, it is believed that this event was significantly more intense and resulted in greater runoff volumes than the storm previously sampled by DEQ in 2000. The results of this surface water sampling during a storm event are provided in the Data Summary Report; Surface Water Sampling During Storm Events; and June 4, 2001 and July 16, 2001 Sampling Events (CDM 2001). These data indicate that total copper concentrations exceeded Montana DEQ-7 acute aquatic life standards by two orders of magnitude in Lost Creek and Gardiner Ditch during the July 16 event. With one exception, all other COC concentrations exceeded applicable state standards at all of the sampling locations at Lost Creek and Gardiner Ditch.

Atlantic Richfield also collected stormwater samples in Lost Creek during that July 16, 2001 event (Atlantic Richfield 2002a). Atlantic Richfield also collected samples in Warm Springs Creek that day and in both creeks the day after. These data, together with the Agency data, include three samples collected over a 90-minute period at Lost Creek sampling station LC-2. The result of this sampling, which indicated that the acute aquatic life standard for copper was exceeded over this time period, suggested a re-evaluation of where engineered controls should be designed and implemented as revegetation and stormwater BMPs alone may not be able to reduce runoff concentration inputs into Lost Creek to meet applicable water quality standards.

7.4.1 Remedial Requirements

The following specific remedial requirements are required for upper Lost Creek:

- Use non-point source BMPs by employing land reclamation technologies to reduce surface water runoff and transport of COCs to surface water receptors; and
- Where BMPs cannot fully minimize non-point source runoff, construct surface controls to manage surface water runoff from ephemeral tributaries to Lost Creek.

Section 8 Significant Changes to the Smelter Hill Subarea Remedy

Significant changes to the 1998 ARWW&S OU ROD Selected Remedy for the Smelter Hill Subarea are modification of the Smelter Hill WMA boundary, designation of the Smelter Hill HAA, and the consolidation of miscellaneous wastes from cleanup of historic abandoned railroad beds into the WMAs. A description of these changes is provided below.

8.1 Modification of Smelter Hill Waste Management Area Boundary and Ground Water POC (Significant Change)

As discussed in Section 3.3, waste management area boundaries have been expanded to include adjacent waste-left-in-place areas which will simplify future management of wastes. EPA and DEQ have expanded the Smelter Hill WMA boundary to include wastes associated with the Anaconda Smelter Handling, Processing and Storage Areas and the West Stack Slag. The modified WMA boundary is shown in the Final Smelter Hill Facilities RAWP/FDR and Figure 8-1.

The 1998 ROD required that the West Stack Slag be removed and consolidated into the Main Granulated Slag pile, or used for EPA-approved uses. Under this ROD Amendment, the Smelter Hill WMA has been expanded to include the West Stack Slag. This material will be allowed to remain in place and be used as a resource as permitted by the state. After resource development, the West Stack Slag area will be remediated in accordance with WMA closure requirements.

With the expansion of the Opportunity Ponds WMA to include the Triangle Wastes Area as discussed in Sections 1.1, 3.3, 3.4, and 4.1, the two WMAs are merged into one WMA, referred to as the Smelter Hill/Opportunity Ponds WMA. The revised Smelter Hill WMA boundary is shown on Figure 8-1. Because the Opportunity Ponds and Smelter Hill WMAs have been merged, previous ground water POCs identified at the toe of the Anaconda Ponds in the 1998 ROD are withdrawn. A new POC at the flank of the Anaconda Ponds (NW- 6s) is identified under this ROD Amendment, as shown in Figure 8-1.

8.2 Designation of Smelter Hill HAA (Significant Change)

The Smelter Hill HAA is shown in Figure 8-1. This area is located in a restricted access uplands area on property owned by Atlantic Richfield and Anaconda-Deer Lodge County. As noted on page DS-74 of the 1998 ARWW&S OU ROD, EPA and DEQ have determined that certain areas exceeding 1,000 mg/kg arsenic, consisting mainly of steep slope areas where it would be impracticable to use conventional reclamation techniques may have an action level of 2,500 mg/kg arsenic, and remain protective of

human health and wildlife in these restricted access areas. This ROD Amendment incorporates the Smelter Hill HAA as shown in Figure 8-1 as part of the remedy.

The following remedial requirements apply to the Smelter Hill HAA:

- Vehicular access by the public will be prohibited. Vehicular traffic will be limited to authorized monitoring and maintenance personnel. Fences, gates, signs, and other constructed controls will be used to maintain vehicle restrictions.
- Development of ground water resources is prohibited, unless it can be demonstrated that proposed actions will not increase or expand the existing ground water contaminant plume.

Future residential or commercial development in the project area is prohibited, unless the area is cleaned up to meet the appropriate action level.

8.3 Consolidation of Railroad Bed Wastes (Significant Change)

The 1998 ROD identified abandoned railroad beds and ties on Smelter Hill as a Miscellaneous Waste and required that these materials be consolidated into the Smelter Hill WMA. During the RD, additional historic railroad beds were identified near the smelter site. Additionally, an active rail line, constructed of waste material, west of Anaconda was abandoned after the 1998 ROD. To be consistent with the 1998 ROD requirements for Miscellaneous Wastes, cleanup of these abandoned and inactive railroad beds is required under this ROD Amendment. This waste will be addressed as Miscellaneous Waste in accordance with the 1998 ROD.

Section 9 Fundamental Changes to the Bedrock Aquifer/Spring Fed Tributaries Ground Water/Surface Water Remedy

The Bedrock Aquifer TI Zone and the associated Spring-Fed Tributaries affect ground water and/or surface water arsenic concentrations in each of the five subareas. Section 9.1 summarizes the fundamental change and associated analysis for expanding the Bedrock Aquifer TI Zone from the 1998 ROD boundaries. Section 9.2 summarizes the fundamental change (TI Waiver) and associated analysis for Spring-Fed Tributaries which is impacted by ground water discharge from the Bedrock Aquifer. Alternative remedial strategies for ground water and surface water are provided at the end of Sections 9.1 and 9.2, respectively. Finally, Section 9.3 describes the Domestic Well Sampling and Replacement Program which is a key component of the alternative remedial strategy for these TI zones and well as the North and South Opportunity TI Zones.

9.1 Summary of Bedrock Aquifer TI Waiver Decision

This section presents the remedial alternatives analyzed for the revision of the Bedrock Aquifer TI Zone boundaries, a detailed evaluation of those alternatives for the bedrock aquifer ground water with respect to nine evaluation criteria that EPA has developed to address the statutory requirements of CERCLA, and the revised selected remedy and remedial requirements for the TI zone.

9.1.1 Bedrock Aquifer TI Zones

The 1998 ROD provided a TI waiver for the bedrock aquifer in the Mount Haggin, Stucky Ridge, and Smelter Hill uplands. The TI evaluation previously indicated that it was technically impractical to remediate the bedrock aquifer to levels below the arsenic human health criterion of 18µg/L. The Second Addendum to TI Evaluation, Bedrock Aquifer (EPA 2011c) updated the 1998 TI evaluation to address the change in the arsenic human health standard to 10 µg/L and incorporate additional data collected to refine the boundaries of the TI Zone. This ROD Amendment revises the bedrock aquifer TI zone, as shown in Figure 9-1.

9.1.2 Description of Remedial Alternatives

The additional data collected since completion of the first addendum to the bedrock aquifer TI evaluation has confirmed the previous site characterization and has not provided any data that would change the previous conceptual site model. Therefore, the sources and pathways previously identified in the original TI evaluation remain valid.

Very little RA has been completed in the bedrock TI zones. Soil treatment and revegetation on a small area of Stucky Ridge surrounding the MW-248 well cluster was completed around 1998 and the wells have shown and improving trend. Although this is a small sample, it provides encouraging data to suggest that soil treatment may positively impact ground water quality as was expected in the ROD:

> "*These source control measures will minimize transport of COCs to the ground water, prevent further migration of the plume, and may improve ground water conditions over time.*" (EPA and DEQ 1998)

Since no changes to the site characterization have been made, no changes to the overall remedial alternatives presented in the original TI are needed for the bedrock aquifers TI Zone.

9.1.3 Comparative Analysis of Alternatives

Based on the lack of change to the site characterization and minimal updates to the remedial alternatives analysis, no changes to the restoration potential analysis are needed. The analysis presented in the 1996 TI evaluation remains valid. Since there were no new remedial alternatives identified in Section 6, the nine criteria analysis from Feasibility Study 3A (EPA 1996a) and the ARWW&S OU ROD (EPA and DEQ 1998) still apply. The following sections, however, discuss the 1996 alternatives with respect to technology changes and corresponding effects to the nine criteria.

9.1.3.1 Source Removal

Although innovative equipment may have become available since 1996, the area to be addressed through removal actions has increased due to a lower ARAR and following additional investigation to refine the TI Zone boundaries. Potential efficiencies obtained from newer technologies are offset by the large area requiring removal. The effectiveness may be slightly lower than previously identified due to the lower water quality standard.

No significant changes to the effectiveness, implementability, or short-term effects need to be made as a result of the availability of new data. It is expected that costs would be higher due to a larger area to be removed and inflation, but no detailed analysis will be conducted.

9.1.3.2 Source Containment

Since the original TI evaluation was conducted, two large and several smaller soil capping projects have occurred in the ARWW&S OU. The 500 acre Anaconda Ponds was covered with 18 inches of soil cover borrowed from a site on the east slope of Smelter Hill in 2000. This borrow area was also used to cover 11 acres of lowlands at the former town site of Mill Creek east of Smelter Hill. A large project was initiated to provide cover soil over the 2,200 acre Opportunity Ponds. An extensive borrow area investigation was completed and no significant sources of low permeability soil were found near the Opportunity Ponds. Based on this information, a borrow source capable of producing a sufficient quality of cover soil capable of supporting adequate vegetation may be difficult to find in the vicinity of Anaconda.

Also, the area requiring cover soil has increased following additional investigation. The effectiveness may be slightly lower than previously identified due to the lower water quality standard.

No significant changes to the effectiveness or short-term effects need to be made as a result of the availability of new data. The TI evaluation previously identified the lack of borrow as a factor for implementability and the new information has confirmed this concern. It is expected that costs would be higher due to a larger area to be removed and inflation, but no detailed analysis will be conducted.

9.1.3.3 Ground Water Extraction and Treatment

Although innovative equipment may have become available since 1996, the area to be addressed through removal actions has increased due to a lower ARAR and following additional investigation to refine the TI Zone boundaries. Potential efficiencies obtained from newer technologies are offset by the large area requiring removal. The effectiveness may be slightly lower than previously identified due to the lower water quality standard.

No significant changes to the effectiveness, implementability, or short-term effects need to be made as a result of the availability of new data. It is expected that costs would be higher due to a larger area requiring extraction and inflation, but no detailed analysis will be conducted.

9.1.3.4 In-Situ Soil Treatment

This alternative was selected in the 1998 ARWW&S OU ROD as the remedy for upland soils and has been partially implemented. Data from monitoring wells installed adjacent to revegetated test plots constructed in 1999 on Stucky Ridge is encouraging and suggests that soil treatment may be effective at reducing arsenic loading to ground water. However, the upper Willow Creek drainage is well-vegetated but arsenic concentrations in ground water still exceed the 10 µg/L standard, so while reductions in arsenic concentrations will be achieved by the soils remedy, achievement of the standard is unlikely.

No significant changes to the effectiveness, implementability, or short-term effects need to be made as a result of the availability of new data. It is expected that costs would be higher due to a larger area requiring treatment and inflation, but no detailed analysis will be conducted.

9.1.4 Selected Remedy

The Second Addendum to the bedrock aquifer TI evaluation (EPA 2011c) presented additional information regarding the lateral and vertical extent of contamination and changes in the degree of contamination over time. This additional information refines the extent of contamination but does not significantly change the characterization of the bedrock aquifer presented in the 1996 TI evaluation. Because no significant changes to the interpretation have occurred, the previous analysis remains valid as does the recommended alternative remedial strategy implemented at the site. Additionally, the conclusions of the 1996 TI evaluation remain valid.

The conclusions for the Smelter Hill TI Zone were (EPA 2011c):

> *"Based on the conceptual model and corresponding assumptions for the bedrock aquifer in the Undisturbed Area of Smelter Hill and adjacent areas* [Smelter Hill TI Zone], *attainment of the ARAR for arsenic in ground water is considered technically impracticable. The principal reasons for this conclusion are: 1) the large volume of source material; 2) the large volume of impacted ground water; 3) the fractured nature of the bedrock aquifer system; 4) the fact that the primary source of arsenic in ground water in the shallow bedrock aquifer of the TI zone is attributed to migration of arsenic from widespread areas of surface soil contamination (non-point source); 5) the time required to implement a removal, containment, and treatment option; and 6) present worth costs associated with implementation of identified restoration alternatives while considering the uncertainty in their ability to attain ground water ARARs in a reasonable time frame."*

The conclusions for the Stucky Ridge TI Zone were (EPA 2011c):

> *"The primary source of arsenic in ground water in the shallow bedrock aquifer of the TI zone is identified as migration of arsenic from widespread areas (3,622 acres) of surface soil contamination (non-point source). The results of this evaluation indicate attainment of the RAG for arsenic in ground water (18 µg/L) in the shallow bedrock aquifer underlying portions of Stucky Ridge is not technically practicable. The principal reasons for this conclusion are: 1) the large volume of source material; 2) the widespread area and large volume of impacted ground water; 3) the complex geology and corresponding hydraulic properties of the bedrock aquifer system; 4) the fact that the primary source of arsenic in ground water in the shallow bedrock aquifer of the Stucky Ridge TI zone is attributed to migration of arsenic from widespread areas of surface soil contamination (non-point source); 5) the time required to implement a removal, containment, and treatment option; and 6) present worth costs associated with implementation of identified restoration alternatives while considering the uncertainty in their ability to attain ground water ARARs in a reasonable time frame."*

9.1.5 TI Zone Boundary Revisions

Based on the additional information presented in the second addendum to the bedrock TI evaluation, the TI zone boundaries are revised as shown in Figure 9-1. Areas where ground water in the bedrock aquifer exceeds the standard of 10 µg/L arsenic are delineated based on direct ground water sampling in wells and springs. While the previous bedrock TI Zone delineations relied on this direct sampling data, this addendum also incorporates surface water data collected from spring-fed tributaries as a surrogate for ground water data. Surface water data collected from tributaries is indicative of ground water quality (due to discharge from springs) and ground water contamination is inferred based on surface water quality. Ground water in the bedrock aquifer beneath alluvium in the Warm Springs Creek valley is known to be contaminated and it is assumed that the bedrock aquifer beneath other alluvial valleys is also contaminated.

The primary changes to all three previous TI Zones include:

- The bedrock aquifer beneath the alluvial aquifer in the valleys has been added to the bedrock TI zone resulting in merging of the previous three TI zones into a single bedrock TI zone;
- The California Creek area has been added based on new spring and surface water data;
- The area from Lost Creek to Modesty Creek has been added based on surface water data and limited spring data;
- The western boundary near Anaconda has been expanded slightly based on data collected from domestic wells; and
- Boundaries with waste management areas are adjusted based on changes to the WMA boundaries

The revised boundaries of the bedrock TI Zone are shown on Figure 6-1. The bedrock TI zone now includes 63,515 acres or 99 square miles, approximately double the area delineated in the ROD.

The depth of the bedrock TI zone remains unchanged at 250 feet below ground surface.

Consistent with the previous TI evaluations, the bedrock TI zone includes ground water within glacial deposits and incidental non-bedrock deposits within the TI zone boundary. The bedrock TI zone does not include the alluvial aquifer within major tributaries valleys including Mill Creek, Warm Springs Creek, and Lost Creek.

9.1.6 Remedial Requirements

The remedial requirements for the bedrock aquifer TI Zones presented in the 1998 ROD remain valid. These requirements include:

- *Implement source control measures through waste consolidation and implementation of in situ revegetation or soil cover treatments.*
- *Implement ICs to monitor and regulate domestic ground water use.*
- *Establish a long-term monitoring plan.*
- *Complete site characterization to better define lateral and vertical extent of TI zones.*
- *Provide for alternate water supplies.*

9.2 Summary of Spring-Fed Tributaries TI Waiver Decision

This section presents the remedial alternatives analyzed for surface water impacted by impacted ground water inflows, a detailed evaluation of those alternatives for the surface water with respect to nine evaluation criteria that EPA has developed to address the statutory requirements and preferences of CERCLA, and the revised selected remedy and remedial requirements for the surface water TI zone.

9.2.1 Spring-Fed Tributaries

The 1998 ARWW&S OU ROD identified the selected remedy for surface water as source control of streamside wastes and contaminated uplands soils. The ARWW&S OU ROD (EPA and DEQ 1998) explained the remedy for upland areas (page DS-62):

> *"For contaminated surface water in Cabbage Gulch and Yellow Ditch, EPA evaluated active treatment of the surface water sources to attain the State of Montana water quality standards. EPA recognizes other major contributions of arsenic to these sources (i.e., contaminated ground water, surface water springs, and seeps) and therefore proposes implementing soils source control measures and monitoring water quality to assess eventual attainment of the standards. EPA, in consultation with the State of Montana, may require the PRP to re-evaluate treatment of the water in the future."*

Through the RD and RA process, the extent of surface water contamination by arsenic has been found to extend far beyond Cabbage Gulch and Yellow Ditch. Arsenic contamination was found in all mainstem streams from Willow Creek in the south to Modesty Creek to the north excluding Warm Springs Creek which has its headwaters outside of the OU. To the extent sampled, all tributaries with headwaters within the OU were also found to be contaminated by arsenic. In addition, arsenic contamination was found in headwaters streams south of the continental divide. The majority of arsenic contamination in surface water is due to ground water inflow from springs and seeps or gaining reaches. The ROD recognized this ground water source, but did not identify a RA to address a ground water source of contamination to surface water. Therefore, significant areas of contaminated surface water will have no RAs initiated under the 1998 ARWW&S OU ROD.

Surface water monitoring conducted since the ARWW&S ROD indicates that the concentrations of arsenic in mainstem streams in the ARWW&S OU are not decreasing and are not expected to attain arsenic human health standard in all surface water bodies. The ARWW&S ROD identified the following potential additional actions for surface water:

> *"If it is determined, on the basis of the preceding RAs and monitoring data, that these water sheds cannot meet the applicable water quality standards, one or more of the following measures involving long-term management may occur for an indefinite period of time as a modification of the remedy:*
>
> > *An analysis of the TI of achieving further contaminant reduction and potential waiver of the water quality standard;*
> >
> > *Re-evaluation of remedial technologies for treatment of surface water; and*
> >
> > *Consideration of additional BMPs."*

Because no planned RAs are expected to reduce arsenic contamination in surface water in the bedrock uplands and monitoring indicates that the State of Montana arsenic standard will not be attained in the foreseeable future, EPA is invoking the above anticipated modifications to the remedy.

9.2.2 Description of Remedial Alternatives

As presented in the 1998 ARWW&S OU ROD, the selected remedy for surface water is source controls through land reclamation, selective removal of tailings, engineered storm water runoff controls, and monitoring. The Spring-Fed Tributaries TI Analysis (EPA 2011d) has considered multiple approaches to remediation of the spring-fed tributaries. The remedy for surface water for the spring-fed tributaries includes:

> ICs. ICs that are currently being developed will also address potential human consumption of surface water exceeding the arsenic human health standard. Specific ICs components to address this potential risk include the CPMP and the DPS. The CPMP includes educational materials such as brochures and periodic newspaper announcements to inform the public about arsenic present in certain surface water receptors, while the DPS will include provisions that prohibit individuals to use surface water as a drinking water source within the Smelter Overlay District.
>
> ARAR Waiver. Waiver of the Montana surface water human health standard and federal MCL for arsenic in the spring-fed tributaries. No other surface water standards are being considered for waivers as a result of this TI analysis. No other waivers are applied as other ARARs will be or have been met.
>
> Monitoring. Surface water will continue to be monitored to help ensure compliance with ARARs that have not been waived.

For evaluation, one alternative for surface water restoration is discussed and compared against ICs and an ARAR waiver.

Alternative 1: Collection of surface water at strategic locations in the Mill, Willow, Modesty, and California Creek watersheds. The water would be treated and returned to the surface water as needed to prevent stream dewatering (i.e., immediately below the diversions, except for the Mill Creek tributary diversions high in the watershed, which will not dewater the mainstem).

9.2.3 Comparative Analysis of Alternatives

In accordance with the NCP, the relative performance of each alternative is evaluated using the nine criteria (40 CFR § 300.430 (e)(9)(iii)) of the NCP as a basis for comparison. The purpose of the evaluation process is to determine which alternative: (a) meets the threshold criteria of overall protection of human health and the environment and attainment of ARARs, (b) provides the "best balance" with respect to the five balancing criteria of 40 CFR § 300.430(e)(9)(iii)(C)-(G), and (c) takes into consideration the acceptance of the state and the community.

9.2.3.1 Threshold Criteria

Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and

describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or ICs.

Protection of human health is ensured through a combination of ICs and monitoring in the selected alternative. All alternatives would leave arsenic in surface water upgradient of the collection points, so ICs would be needed to be protective of human health.

Most of the streams in the bedrock uplands (Lost, Mill, and Willow Creeks) meet aquatic life standards nearly all of the time. Exceedances occur primarily during high water events. However, Cabbage Gulch, Lost Horse Creek, and Lapilli Creek are tributaries closer to the smelter stack and exhibit low flows and higher arsenic concentrations. The arsenic concentrations often exceed the chronic aquatic life standard, and occasionally exceed the acute standard. EPA expects that revegetation and storm water BMPs constructed during RA will result in streams achieving compliance with the aquatic life standards for metals, and that revegetation will result in Cabbage Gulch, Lost Horse Creek, and Lapilli Creek achieving compliance with the aquatic life standard for arsenic.

Existing data compiled during the Baseline Ecological Risk Assessment (EPA 1997) and in fish surveys completed by FWP suggest that although occasional exceedances of DEQ-7 aquatic life standards present a potential risk, the ARWW&S OU streams generally support reasonable populations of aquatic organisms. By diverting surface water to a treatment facility, treating the water to reduce arsenic concentrations below 10 µg/L (well below the aquatic life standard of 150 µg/L), and returning the treated water to the point of collection, significant changes in physical and chemical properties of surface water can be expected. These include temperature, dissolved oxygen, and general chemistry (e.g., total dissolved solids would increase due to the addition of chemical reagents). The cumulative effects of these impacts on downstream aquatic life are not known and would require analysis before a treatment system could be implemented.

Surface water Alternative 1 would leave arsenic in the surface water above the point of diversion for treatment, so ICs would be needed to be protective of human health. Surface water Alternative 1 would not change concentrations in these creeks and tributaries above the points of diversion; it would only reduce the loading of arsenic to downstream surface water receptors.

Treating Mill Creek and upper Willow Creek to meet human health standards would not eliminate exceedances of arsenic in downstream receiving waters (the Clark Fork River). Arsenic concentrations in the Clark Fork River will not meet the human health standard unless there is a basin-wide effort to remediate these widespread sources of contamination. Further, Silver Bow Creek is the largest source of loading to the Clark Fork River, and treating Mill and Willow Creeks will not achieve the human health standard.

Compliance with ARARs

Section 121(d) of CERCLA, 42 U.S.C. § 9621(d), and NCP 40 C.F.R. § 300.430(f)(1)(ii)(B) require that RAs at CERCLA sites at least attain legally applicable

or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4), 42 U.S.C. § 9621(d).

Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, RA, location, or other circumstance found at a CERCLA site. Only those State standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be applicable. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, RA, location, or other circumstance at a CERCLA site address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those State standards that are identified in a timely manner and are more stringent than Federal requirements may be relevant and appropriate.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or provides a basis for an invoking waiver.

The alternate remedial strategy meets all ARARs except the 10 µg/L human health standard for arsenic in surface and ground water (as specified in DEQ-7 and 40 CFR 141.11). These spring-fed tributaries are discharges of bedrock ground water, which has already been addressed under the bedrock TI evaluation. Surface water in Lost Horse Creek and Cabbage Gulch will not meet the aquatic life standards under any scenario.

Surface water Alternative 1 would leave arsenic in surface water in excess of the human health standard above diversion points. Furthermore, the reduction in loading would not result in achievement of human health standards in downstream receiving waters, such as the Clark Fork River. Additionally, the treated water is likely to become recontaminated if it is used for irrigation of contaminated soils (as discussed in the South Opportunity TI evaluation (EPA 2011b)). The treatment alternatives are not capable of achieving the human health standard for arsenic with certainty. Therefore, a waiver of the human health arsenic standard is necessary.

9.2.3.2 Primary Balancing Criteria

Long Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk that will remain onsite following remediation and the adequacy and reliability of controls.

The remedial strategy does not involve implementation of RAs. The strategy is limited to administrative actions and ICs. These are considered to be very effective and permanent for limiting exposure to arsenic in surface water and ground water

The treatment alternatives rely on active collection and treatment of surface and/or ground water indefinitely. The long-term effectiveness and permanence of treatment alternatives requires a very large commitment to long-term O&M, including periodic replacement of the treatment systems.

As already discussed, treatment would not result in achieving the human health standard in the receiving waters.

Reduction in Toxicity, Mobility or Volume through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

The alternate remedial strategy does not alter the existing toxicity, mobility or volume of arsenic in surface water in the bedrock uplands throughout the ARWW&S OU. Source control through removal is unimplementable. The treatment alternatives are effective at reducing the toxicity and mobility of arsenic via capture and treatment. However, treatment is only effective to receptors below the point of diversion.

Implementability

The alternate remedial strategy of ICs is implementable and administratively feasible. Waiver of the human health standard for arsenic can be implemented by EPA through administrative actions. The waiver is completed here within this ROD Amendment.

The treatment alternatives require construction of collection systems and a very large treatment plant. While challenging because of the large scale, the treatment alternatives could be implemented. However, issues such as obtaining right-of-way for large pipelines, private land ownership, and large surface water impoundments may make implementation administratively difficult.

Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until cleanup levels are achieved.

Short-term effectiveness is not ensured until the ICs and monitoring are in place. The treatment alternatives would not be effective until after the completion of full-scale collection and treatment facilities. There may be hazards to workers during construction of the capture systems and treatment plant.

Cost

The cost of the alternate remedial strategy is within the range of costs identified in the 1998 ARWW&S OU ROD. Because all actions are administrative in nature or monitoring, the costs are expected to be relatively small compared to treatment alternatives. Monitoring is required regardless of the type of RA or waiver.

The costs of the treatment alternatives are high, mainly due to the large flow rates estimated for treatment. The capital and 50-year O&M costs for treatment plants for all the tributaries are $326 million dollars (present value). Significant costs such as energy and sludge management were not included. The costs of the collection structures and storage reservoirs were not prepared because it is expected that the treatment plant and O&M represent the largest readily-identifiable cost. It should be noted that the costs for impoundments can be significantly higher than plant construction costs if dam construction is required.

9.2.3.3 Modifying Criteria

State Acceptance

Montana DEQ concurs with this remedy modification, as indicated by their concurrence with this ROD Amendment.

Community Acceptance

EPA and DEQ received several comments from the public during the public comment period for the proposed plan. Public comments, and the Agencies' responses to those comments, are summarized in Section 12 and are provided in the Responsiveness Summary.

9.2.4 Alternative Remedial Strategy

9.2.4.1 Spring-Fed Tributaries

The Spring-Fed Tributaries TI Analysis (EPA 2011d) showed that the source of arsenic in surface water is gains from ground water. The Bedrock Aquifer TI (EPA 2011c) concluded that ground water is technically impracticable to remediate arsenic to the standard in the bedrock uplands. Since the ground water source will not be mitigated, surface water in spring-fed tributaries will remain impacted by arsenic within the reaches affected by gaining ground water. Most of the tributaries evaluated exceed the human health standard for arsenic, but three also exceed the chronic aquatic life standard and two exceed the acute aquatic life standard. EPA expects that proposed revegetation and storm water BMPs constructed during RA will result in these streams achieving compliance with the aquatic life standards.

This surface water evaluation concluded that it is technically impracticable from an engineering perspective to reduce arsenic concentration in spring-fed tributaries of Willow, Mill, California, and Modesty Creeks as well as intermittent flow tributaries below 10 µg/L in surface water within the bedrock TI zone delineated in Figure 7-1. The alternative remedial strategy includes ICs and monitoring that would be protective of human health should the arsenic standard be waived.

9.2.4.2 TI Zone Boundaries

The Bedrock Aquifer TI Analysis identifies the extent of known and probable surface water contamination in the bedrock uplands. The area includes bedrock uplands and minor areas of glacial and alluvial deposits occurring within bedrock upland areas. Figure 7-1 shows the revised bedrock aquifer TI Zones. The TI waiver addresses all surface water bodies with the Bedrock Aquifer TI Zones. The contamination and

potential waiver areas extend to the mouths of these surface water bodies or the downstream end of the ARWW&S OU.

The Spring-Fed Tributaries TI Analysis focuses on the spring-fed tributaries to mainstem named streams because the available data are mostly limited to these water bodies. Figure 9-1 shows the surface waters addressed in the TI Analyses. The results of the analysis are extended to include all state surface water within the boundaries of the TI Zone shown in Figure 9-1 because the loading sources are continuous and the potential exists for arsenic concentrations to occasionally exceed 10 µg/L in surface water throughout the TI Zone.

9.2.4.3 Remedial Requirements

In addition to the specific remedial requirements for surface water set forth in Section 9.6 of the 1998 ARWW&S OU ROD, requirements for surface water also include:

ICs. ICs that are currently being developed will also address potential human consumption of surface water exceeding the arsenic human health standard. Specific ICs components to address this potential risk include the CPMP and the DPS. The CPMP includes educational materials such as brochures and periodic newspaper announcements to inform the public about arsenic present in certain surface water receptors, while the DPS will include provisions that prohibit individuals to use surface water as a drinking water source within the Smelter Overlay District.

ARAR Waiver. Waiver of the arsenic human health standard for certain surface water within the South Opportunity Area of Concern. No other surface water standards are being considered for waivers as a result of this TI analysis. No other waivers are applied as other ARARs will be or have been met.

Monitoring. Surface water will continue to be monitored to help ensure compliance with ARARs that have not been waived.

9.3 Domestic Well Sampling and Replacement

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, which is shown in Figure 9-2. Elements of this program will include a SAP; initial monitoring schedule; re-sampling in the event that initial samples exceed human health standards; and procedures and schedules to provide alternative water supplies if the exceedance is confirmed and is related to the site contamination.

Under Montana law, a CGWA may be designated to limit certain types of water appropriations due to water quality problems (MCA 85-2-501 et. seq). CGWAs are administered by the Montana Department of Natural Resources (DNRC), and any new domestic wells drilled within the area require a permit from the DNRC. DEQ will petition for designation of the domestic well area of concern shown in Figure 9-2 as a CGWA. Under a domestic well sampling and replacement program, the Montana Bureau of Mines and Geology (MBMG) would coordinate the drilling of any new well with the property owner and the well driller to minimize the potential for

constructing a well within ground water that could potentially exceed human health standards. After well completion, MBMG will sample the new well, and if an exceedance is detected and confirmed, another new well will be drilled or another alternative water supply will be provided.

In addition to regulating new wells, existing wells within the CGWA will be tested on a regular basis, and replaced if the exceedance is confirmed and related to the site contamination. Sampling schedule, frequency, procedures, and analyses will be provided in the domestic well sampling and replacement program. Domestic well sampling by the MBMG will be coordinated with the ADLC health department to allow sampling for non-Superfund related contamination.

Section 10 Summary of Remedy and Remedy Changes

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 □g/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.

The RAO identified in the 1998 ROD remain unchanged under this ROD Amendment. The fundamental and significant changes to the ROD for each media are summarized as follows. Fundamental changes are to ground water and surface water components.

Wastes and Soils

1. The Opportunity Ponds WMA has been expanded, as shown in Figure 4-1.
2. The Smelter Hill WMA has been expanded, as shown in Figure 8-1.
3. The Opportunity Ponds and Smelter Hill WMAs have been merged into a single WMA, as shown in Figure 3-3.
4. The Old Works WMA has been expanded, as shown in Figure 7-1.
5. The Uplands Soils Areas of Concern has been expanded, as shown in Figure 3-4.
6. A Dutchman HAA has been designated, as shown in Figure 5-1
7. A Smelter Hill HAA has been designated, as shown in Figure 8-1.
8. Additional abandoned railroad wastes have been identified for disposal into a WMA, as described in Section 8.3.

Ground Water

9. New POC locations have been established for the Smelter Hill/Opportunity Ponds WMA, as shown in Figure 4-1.
10. A GWSWMS has been constructed along a portion of the toe of the Opportunity Ponds tailings impoundment to address potential arsenic ground water plume movement.
11. New POC locations have been established for the Old Works WMA, as shown in Figure 7-1.
12. The arsenic human health standard for ground water has been waived for the North Opportunity Alluvial Aquifer TI Zone, as shown in Figure 5-1.

13. The arsenic human health standard for ground water has been waived for the South Opportunity Alluvial Aquifer TI Zone, as shown in Figure 6-1.
14. The Bedrock Aquifer TI Zone has been expanded, as shown in Figure 9-1.
15. The remedy for the Blue Lagoon has been changed from drainage control improvements to removal, as discussed in Section 6.2.
16. The remedy for the Yellow Ditch requires significantly more areas of removal than that originally anticipated under the ROD, as discussed in Section 6.3.
17. A Domestic Well Monitoring and Replacement Program is being implemented to ensure that domestic well users do not drink ground water above human health standards, as shown on Figure 9-2 and discussed in Section 9.3.
18. Revised ground water standards to meet current state and federal requirements are adopted, as identified in Table 3-1.

Surface Water

19. The Warm Springs Creek remedy has been significantly expanded compared to the quantities originally identified in the ROD, as described in Section 5.2.
20. Surface water remedial requirements have been established for Lost Creek, as identified in Section 7.4.
21. The arsenic human health standard for surface water has been waived for certain streams and tributaries, as shown in Figure 9-1. 21. Revised surface water standards to meet current state and federal requirements are adopted, as identified in Table 3-1.

Table 10-1 summarizes the changes to the 1998 ARWW&S OU ROD Selected Remedy that were presented in Sections 4 through 9.

Table 10-1. Fundamental and Significant Differences between ARWW&S OU Selected Remedy and 2010 ROD Amendment.

Media/Change	1998 ARWW&S OU ROD	2011 ARWW&S OU ROD Amendment	2 Basis for Difference and Expected Outcome
Waste Management Areas (Opportunity Ponds, Old Works/Stuck Ridge, and Smelter Hill Subareas)			
Waste Management Area (WMA) Boundaries **- *SIGNIFICANT***	WMA and waste left-in-place boundaries are identified in Figures 9-2, 9-3, and 9-4 of the 1998 ROD.	Revised WMA boundaries are identified in Figure 9-1 of the ROD Amendment.	Based on previous delineations of wastes left in place and waste investigations conducted during the RD, it was determined that the WMA boundaries should be revised to incorporate WLIP and newly identified waste areas. Because the expanded areas were previously designated as Wastes Left In Place, the boundary revisions should not result in a change of land use.
Ground Water Remedy for WMAs (Opportunity Ponds, Old Works/Stuck Ridge, and Smelter Hill Subareas)			
Ground water POC **- *SIGNIFICANT***	The ROD identified ground water POC based on the WMA boundaries. Opportunity Ponds: MW-214, MW-26, MW-26-M, MW-28, MW-28M, MW-215, MW-81, MW-31, MW-31M, and MW-216 Smelter Hill: MW-211, MW-36, MW-36D, MW-218S, MW-218D, MW-75 and MW-219 and MW-220. Old Works: MW-213 and MW-204.	With the revision of WMA boundaries, accordingly, the POC are revised: Opportunity Ponds/Smelter Hill: Opportunity Ponds toe/flank: NW-1-OPd, NW-1-OPs, NW-2-OPd, NW-2-OPs, NW-3-OPd, NW-3-OPs, NW-4-OPd, NW-4-OPs, MW-216, MW-26, MW-26M, MW-10R/NW-5s, MW-212, MW-214. Triangle Waste Area - MW-256. Anaconda Ponds flank: NW-6s. Old Works: MW-207, MW-252, MW-251, MW-255	The new POC are or will be established in areas downgradient from WMAs, as close to the WMA as practicable. Ground water compliance is still expected at the POCs.

Media	1998 ARWW&S OU ROD	2011 ARWW&S OU ROD Amendment	Basis for Difference and Expected Outcome
Miscellaneous Wastes (Smelter Hill and Opportunity Ponds Subareas)			
West Stack Slag - ***SIGNIFICANT***	The ROD required this material to be removed and consolidated into the Main Granulated Slag Pile, or used for EPA-approved purposes.	The Smelter Hill WMA boundary is revised to include the West Stack Slag, which will be allowed to be commercially processed.	Additional evaluations indicated that this slag material could potentially be reprocessed. All slag will eventually be processed or capped. WMA boundaries are revised to include all Wastes Left In Place.
Railroad Beds and Ties - ***SIGNIFICANT***	The ROD required that waste and railroad ties associated with the abandoned line on Smelter Hill be removed and consolidated into a WMA. The ROD expected that the other abandoned railroad waste would be identified in the future and also be removed and consolidated into a WMA.	Since the ROD, abandonment of the West Valley railroad line has been proposed. Similar to the Smelter Hill line, it has been determined that the waste and railroad ties associated with the West Valley line will be removed and consolidated into a WMA. Additionally, wastes associated with the remnants of abandoned railroads and/or spurs south of Highway 1 and within or adjacent to Anaconda are required to be removed and consolidated into a WMA.	Data collected since the ROD was issued indicate that contaminants are present above the recreational/open space arsenic cleanup level of 1,000 mg/kg, and wastes are present in the West Valley line. Similar data were collected for the abandoned historic railroad beds. Eventually, all contaminated abandoned railroad bed materials within the OU will be removed and consolidated within a WMA.
Triangle Wastes - ***SIGNIFICANT***	The ROD allowed these wastes to remain in place and permanently closed as a Waste Left In Place.	These wastes have been incorporated into the Opportunity Ponds WMA.	The WMA boundary is revised to include Wastes Left In Place. The Triangle Waste area will become an industrial area (e.g., dedicated development) or will be closed similar to other cells of the Opportunity Ponds WMA.

Media	1998 ARWW&S OU ROD	2011 ARWW&S OU ROD Amendment	20 Basis for Difference and Expected Outcome
Contaminated Soils (North Opportunity, South Opportunity, Old Works/Stucky Ridge and Smelter Hill Subareas)			
Area of Concern - ***SIGNIFICANT***	The ROD identified the contaminated soils area of concern on Figure 9-5 of the 1998 ROD document.	The area of concern has been expanded as shown on Figure 9-2 of this 2011 ROD Amendment.	Data obtained from RD field efforts including the Delineation of Outer Boundary Investigation and Phase III of the LRES. This results in more area being treated and revegetated within the OU.
High Arsenic Soils - ***SIGNIFICANT***	The ROD allowed a portion of Smelter Hill to have soil arsenic concentrations in excess of 1000 ppm based on equipment implementability (steep and rocky slopes). The area was required to have soil arsenic concentrations below 2500 ppm and ICs to limit ownership and access. The ROD did not address the Dutchman area.	During the RD, the Dutchman area and another area within the Smelter Hill area were identified as HAA. The Dutchman area is a well vegetated area with wetlands and unique wildlife habitat and it was determined that certain reclamation techniques, such as removal or deep tillage to reduce arsenic concentrations below 1000 ppm, were not appropriate for this area. The other area within the Smelter Hill area had similar characteristics to the area identified in the ROD.	A review of remedial technologies for these areas indicates that RA would result in significant damage to the environment in the Dutchman area. Furthermore, a risk assessment addendum to the 1996 Human Health Risk Assessment indicated that land use restrictions would allow these areas to remain in unremediated conditions and be protective of human health. The Dutchman HAA may offer limited recreational opportunities.

Media	1998 ARWW&S OU ROD	2011 ARWW&S OU ROD Amendment	200Basis for Difference and Expected Outcome
Ground Water (All Subareas)			
Arsenic Performance S**tandard - *SIGNIFICANT***	The ROD identified the State's WQB-7 Standard of 18 μg/L as the arsenic performance standard.	The ground water human health standard has been revised to 10 μg/L.	Since the ROD was issued in 1998, the Federal Drinking Water and State of Montana DEQ-7 human health standards have been lowered to 10 μg/L based on protectiveness. This change will increase the protectiveness of remedy by implementing ICs and by providing cleaner drinking water to the community.
Bedrock Aquifer TI Zones - ***FUNDAMENTAL***	The ROD identified three bedrock aquifer TI Zones: Stucky Ridge, Smelter Hill, and Mount Haggin TI Zones	The bedrock aquifer TI Zones have been re-delineated, (see Figure 9-1). Expansion of the plumes is based primarily on the lowering of the arsenic performance standard.	Additional investigations conducted during RD, including sampling of springs/seeps, surface waters fed by ground water discharge in the uplands, and monitoring well installation to determine the depth of contamination have led to the present delineation. Domestic well users in the TI Zone will be protected through implementation of the Domestic Well Monitoring and Replacement Plan.
Domestic Well Area of Concern - ***SIGNIFICANT***	The ROD identified several types of ground water use controls and community protective measures that may be used to minimize the risk of public consumption of drinking water that exceeds human health standards.	A domestic well monitoring and replacement plan will be completed to provide for periodic testing of domestic wells and, if necessary, replacement of impacted drinking water within an established domestic well area of concern (see Figure 9-2).	Ground water and surface water sampling since the ROD form the basis for the delineation of the domestic well area of concern. Occasional domestic well exceedances have led to development of testing protocols and procedures. Domestic well users will be protected through implementation of the Domestic Well Monitoring and Replacement Plan.

Media	1998 ARWW&S OU ROD	2011 ARWW&S OU ROD Amendment	200Basis for Difference and Expected Outcome
Yellow Ditch - ***SIGNIFICANT***	The ROD required the implementation of an engineered soil cover over the active portions of the Yellow Ditch and removal of wastes from the abandoned portion of the Yellow Ditch.	Additional wastes within the Yellow Ditch will be removed and consolidated in to a WMA.	Soil sampling during RD determined that arsenic concentrations in Yellow Ditch often exceed the open space action level of 1,000 mg/kg. Buried Yellow Ditch wastes were discovered in an agricultural field during borrow operations conducted by NPL Site RA. Contaminated portions of the Yellow Ditch will be removed and consolidated in to a WMA.
South Opportunity Alluvial Aquifer Arsenic Plume - ***FUNDAMENTAL***	The ROD identified the remedy for this shallow arsenic contaminant plume as source control/monitored natural attenuation.	EPA and DEQ have determined the South Opportunity surface water/ground water area of concern to be technically impracticable to remediate within a reasonable period of time for the arsenic human health standard. Because this plume is upgradient of the community of Opportunity, POC monitoring wells will be established beyond the northern edge of the plume.	Additional ground water and surface water investigations conducted during RD that were used in preparing the South Opportunity TI Evaluation form the basis for the determination. The FS indicated that natural attenuation would restore ground water to its designated use and attain ground water ARARs in 5-1/2 to 28 years. Eleven years of monitoring clearly showed that this estimate was inaccurate and the ARAR might not ever be attained. Also, additional ground water investigation identified the extent of the plume to be more extensive than previously thought. Additional surface water investigation and monitoring identified significantly more surface water contamination than previously thought. . Domestic well users in these TI Zones will be protected through implementation of the Domestic Well Monitoring and Replacement Plan.

Media	1998 ARWW&S OU ROD	2011 ARWW&S OU ROD Amendment	200Basis for Difference and Expected Outcome
North Opportunity Alluvial Aquifer Arsenic Plume - ***FUNDAMENTAL***	This area was not identified in the ROD.	EPA and DEQ have determined the North Opportunity surface water/ground water area of concern to be TI to remediate within a reasonable period of time.	Additional ground water and surface water investigations conducted during RD that were used in preparing the North Opportunity surface water/ground water area of concern TI Evaluation. The North Opportunity AOC was not known at the time of the ROD. Extensive soils sampling identified an area containing significantly elevated arsenic concentrations and a HAA was delineated indicating the extent of soils contamination exceeding the highest ROD remedial goal. Additionally, USF&WS discovered surface water contamination in the wetlands that led to a surface water/ground water investigation that delineated extensive contamination within and downgradient of the High Arsenic Area. Ground water contamination was found to extend past the OU boundary and continue into the adjacent OU. Domestic well users in these TI Zones will be protected through implementation of the Domestic Well Monitoring and Replacement Plan.
Blue Lagoon Copper Plume - ***SIGNIFICANT***	The ROD required the installation of a culvert at the railroad fill base to promote surface drainage upgradient from the Blue Lagoon, and excavation of contaminated sediments and waste that will be placed within a WMA.	In addition to the 5,100 cy of contaminated sediments and wastes identified in the 1998 ROD, the waste associated with the railroad embankment shall be removed and consolidated into a WMA.	Ground water investigations conducted during RD identified this as a potential source of contamination to ground water and surface water. Domestic well users near the Blue Lagoon will be protected through implementation of the Domestic Well Monitoring and Replacement Plan.

Media	1998 ARWW&S OU ROD	2011 ARWW&S OU ROD Amendment	200Basis for Difference and Expected Outcome
Surface Water (All Subareas)			
Arsenic Performance Standard - ***SIGNIFICANT***	The 1998 ROD identified the State of Montana's then current WQB-7 Standard of 18 μg/L as the surface water performance standard.	The surface water human health standard has been revised to 10 μg/L. The human health arsenic standard of 10 μg/L is waived in certain creeks set forth below. The DEQ-7 aquatic life water quality standard of 340μg/L (acute) and 150μg/L (chronic) will be the new surface water arsenic performance standards.	Since the ROD was issued in 1998, the Federal Drinking Water and State of Montana DEQ-7 human health standard have been lowered to 10 μg/L based on protectiveness. Three TI evaluation reports from the bases for the waivers in certain creeks. ICs will minimize the possibility of human consumption of surface water above human health standards. The aquatic life water quality performance standards are protective of the environment.
Upper Lost Creek - ***SIGNIFICANT***	The ROD did not identify specific RAs for Lost Creek, other than identifying upper Lost Creek as a surface water area of concern.	Based on surface water investigations conducted during RD, Lost Creek periodically exceeds surface water quality standards, and it has been determined that the remedial requirements of the ROD (Section 9.6) for surface water apply to Lost Creek (i.e., BMPs and storm water engineered controls).	Storm water sampling conducted in 2001-2, and base and high flow sampling conducted in 1999. Revegetation, BMPs, and storm water engineered controls should eventually allow the streams to meet water quality standards.

Media	1998 ARWW&S OU ROD	2011 ARWW&S OU ROD Amendment	200Basis for Difference and Expected Outcome
Lower Lost Creek/Dutchman Creek - ***FUNDAMENTAL***	The ROD did not include these reaches in the surface water area of concern.	These reaches, which are fed by shallow ground water in contact with the Dutchman HAA, frequently exceed the human health surface water standard for arsenic of 10 μg/L. EPA and DEQ have determined that it is technically impracticable to treat surface water to the arsenic human health standard of 10 μg/L in these reaches.	Several RD investigations and ongoing USGS monitoring were used to complete a TI Evaluation for the North Opportunity surface water/ground water area of concern, which includes Dutchman and lower Lost Creeks. The TI determination does not affect protectiveness of aquatic life, because state and federal aquatic life water quality standards for arsenic and metals remain effective as performance standards for streams within the OU. ICs will minimize the possibility of human consumption of surface water above human health standards
Upper Willow Creek/Mill Creek - ***FUNDAMENTAL***	The ROD identified specific actions for these stream reaches impacted from ground water discharge and runoff from the Mount Haggin and Smelter Hill Bedrock Aquifer TI Zones, including the completion of source control measures and mass loading studies.	Several factors, including the lowering of the arsenic human health standard from 18 μg/L to 10 μg/L and additional RDs/data collection, have led EPA and DEQ to conclude that it is technically impracticable to achieve the arsenic human health standard in these reaches.	RD data including mass loading studies were used to complete a TI Evaluation for Upper Willow Creek, Mill Creek, and their tributaries. The TI determination does not affect protectiveness of aquatic life, because state and federal aquatic life water quality standards for arsenic and metals remain effective as performance standards for streams within the OU. ICs will minimize the possibility of human consumption of surface water above human health standards
Lower Willow Creek- ***FUNDAMENTAL***	The ROD identified partial tailings removal and revegetation as source control measures for lower Willow Creek.	Ground water discharge from the South Opportunity surface water/ground water area of concern has been identified as the primary source of arsenic exceedances, leading EPA and DEQ to conclude that it is technically impracticable to achieve the arsenic human health standard of 10 μg/L in this reach.	RD data collection and mass loading studies were used to complete the South Opportunity surface water/ground water area of concern characterization report and TI Evaluation. The TI determination does not affect protectiveness of aquatic life, because state and federal aquatic life water quality standards for arsenic and metals remain effective as performance standards for streams within the OU. ICs will minimize the possibility of human consumption of surface water above human health standards.

Section 11 Support Agency Comments

This ROD Amendment has been prepared in consultation with the Montana Department of Environmental Quality. Support agency concerns were addressed informally through the consultation process, prior to the issuance of this ROD Amendment, although DEQ continues to advocate its position with regards to WMAs that it advocated at the time of the 1998 ROD. DEQ's concurrence letter is included in Appendix B.

Section 12 Statutory Determinations

Remedy Changes outlined in this ROD Amendment will continue to meet the statutory requirements of CERCLA Section 121, 42 U.S.C. § 9621 and the NCP. The remedy changes are protective of human health and the environment, comply with ARARs, except where a waiver is issued, are cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The following sections discuss how the remedy changes in this ROD Amendment, meet these statutory requirements.

12.1 Protection of Human Health and the Environment

The Remedy Changes will continue to protect human health and the environment through the following:

- For the modified WMAs, prevention of human ingestion of, inhalation of dust from, or direct contact with high arsenic soils and waste sources where such ingestion or contact would pose an unacceptable health risk by the use of reclamation, or engineered covers;
- For expanded soil areas of concern, risk reduction for protection of ecological and agricultural systems by stabilization of soil against wind and surface water erosion, and reducing surface soil COC levels to allow re-establishment of vegetation, thus reducing risk to upland terrestrial wildlife and allowing re-establishment of wildlife habitat through selective removal, reclamation, or engineered cover;
- For the ground water underneath modified WMAs, protection of human health through minimization of COC transport to ground water, containment of the plumes, and implementation of ICs to prevent consumption of ground water with arsenic above the human health standard;
- For areas in which the ground and surface water ARARs are waived, protection of human health through implementation of ICs to prevent consumption of ground and surface water with arsenic above the human health standards; and
- Continued prevention of release of contaminated material to ground and surface waters and protection of aquatic resources by implementing source control measures through removal, reclamation, or soil cover, and use of engineered storm water control structures.

There are no short-term threats associated with the Remedy Changes that cannot be readily controlled through applicable health and safety requirements, monitoring, and standard construction practices.

12.2 Compliance With ARARs

A revision of the ARARs by EPA and DEQ is provided in Appendix A of this ROD Amendment. The Remedy Changes are expected to meet federal and State

requirements that are legally applicable or relevant and appropriate. A waiver of the arsenic human health standard for certain areas is necessary based on the determination that compliance with this standard is technically impracticable from an engineering perspective. ARAR compliance that is affected by the Remedy Changes is discussed below.

12.2.1 Contaminant-Specific ARARs

For ground water, the contaminant specific ARARs for these RAs are the standards specified in the State of Montana Circular DEQ 7. For areas of bedrock aquifer contamination and areas of shallow alluvial aquifer contamination in the North and South Opportunity areas the human health standard for arsenic is waived due to TI from an engineering perspective. Accordingly, EPA, in consultation with DEQ, invokes the ARAR waiver provided by CERCLA Section 121(d)(4)(D), 42 U.S.C. § 9621(d)(4)(D). The justification for a finding that a waiver is justified due to TI from an engineering prospective in the 1998 ROD was documented in FS Deliverable No. 3A (EPA 1996a). The justification for the findings in the ROD Amendment is found in the TI evaluation reports referenced in Section 1 (EPA 2011a, 2011b, 2011c and 2011d). For areas in which large volumes of waste material will be left in place, and in accordance with the preamble to the NCP, EPA, and DEQ are setting the compliance boundary for ground water standards at the edge of the waste management areas. Two of the WMAs, the Opportunity Ponds WMA and the Smelter Hill WMA are now been combined. Ground water will not be required to be restored in the alluvial aquifers underneath the WMAs.

For surface water, the contaminant specific ARARs for these RAs are the standards specified in the State of Montana Circular DEQ 7. For contamination in certain surface waters with a hydrologic connection to the bedrock aquifer contamination, the surface water standard for arsenic is waived due to TI from an engineering perspective. The Aquatic Life - Acute standard and the Aquatic Life - Chronic standard remain ARARs and performance standards for surface water TI reaches. For all other surface water, the remedy will attain the federal and State surface water quality standards listed in Appendix A, throughout the OU. The surface water remedy requires implementation of source control measures and storm water BMPs. The remedy is expected to achieve significant reduction of COC movement into surface water.

12.3 Cost Effectiveness

EPA and DEQ have determined that the Remedy Changes are cost effective in mitigating the principal risks posed by contaminated wastes and soils. Although the soils areas of concern and some waste removal areas have increased the cost of the remedy, these costs are not expected to exceed the estimated cost range of $88,000,000.00 to $150,000,000.00 in the 1998 ROD.

Section 13 Public Participation

Since the ROD was issued in 1998, EPA and DEQ have met regularly with site stakeholders to keep the community up to date on RD progress and cleanup status, including those modifications identified in Section 3.

Since 1998, EPA has published fourteen Superfund fact sheets in the local newspaper (the *Anaconda Leader*) discussing the ARWW&S OU RD, and proposed, ongoing, and complete RAs within the site. These fact sheets have discussed, in part, several of the remedy modifications identified in Section 3 and have provided the community contacts at the Agencies to obtain further information.

The Proposed Plan for this ROD Amendment was sent to the public on November 18, 2009 as an insert in the local newspaper (*Anaconda Leader*) and was mailed to individuals who had signed up for more information about the Anaconda Smelter Site at previous public meetings.

EPA held a public meeting, advertised in the *Anaconda Leader* and in the Proposed Plan, on December 3, 2009 to discuss the Proposed Plan. A transcript of that meeting is attached to the Responsiveness Summary. At the public meeting, EPA agreed to extend the public comment period from 45 days to 75 days. Public comments were accepted by EPA until February 1, 2010.

On January 22, 2010, EPA met with representatives of Anaconda – Deer Lodge County, the Clark Fork River Technical Assistance Committee, and the Clark Fork Coalition to answer questions pertaining to the Proposed Plan and the four draft final TI evaluations.

Written public comments received by EPA are attached to the Responsiveness Summary. The Responsiveness Summary presents EPA's and DEQ's response to the written comments. The comments generally expressed concern for public health with the proposed decisions to leave well-vegetated soils impacted with arsenic from past smelter emissions deposition intact, and the waiver of the arsenic human health standard of 10µg/L, for ground water and surface water in North Opportunity, South Opportunity, Smelter Hill uplands, and Stucky Ridge uplands areas. Commenters felt that additional characterization and cleanup measures should be completed before the arsenic human health standard is waived.

Section 14 Coordination with Natural Resource Damage Restoration Actions

The ARWW&S OU has received attention from the State Natural Resource Trustee, as described in section 107(f) of CERCLA. The State has undertaken efforts to develop restoration plans and/or secure restoration money from potentially responsible parties to restore the ARWW&S to baseline conditions, or the condition that would exist absent the release of hazardous substances. The State developed and will further refine a restoration plan which, if implemented, would provide for certain actions to restore the injured resources or replace the loss of use of such resources.

The Selected Remedy is not intended to and will not restore natural resources in the ARWW&S to baseline conditions.

The State Trustee may select restoration actions applicable to portions of the ARWW&S OU. If this occurs, EPA will work with the Trustee in the design and implementation of the remedial action to coordinate the implementation of the Selected Remedy with these restoration actions to avoid duplication of effort and unnecessary costs and to maximize benefits to the area, where feasible and practical, and where coordination will not result in substantial delays to remedy implementation.

Section 15 References

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Figures

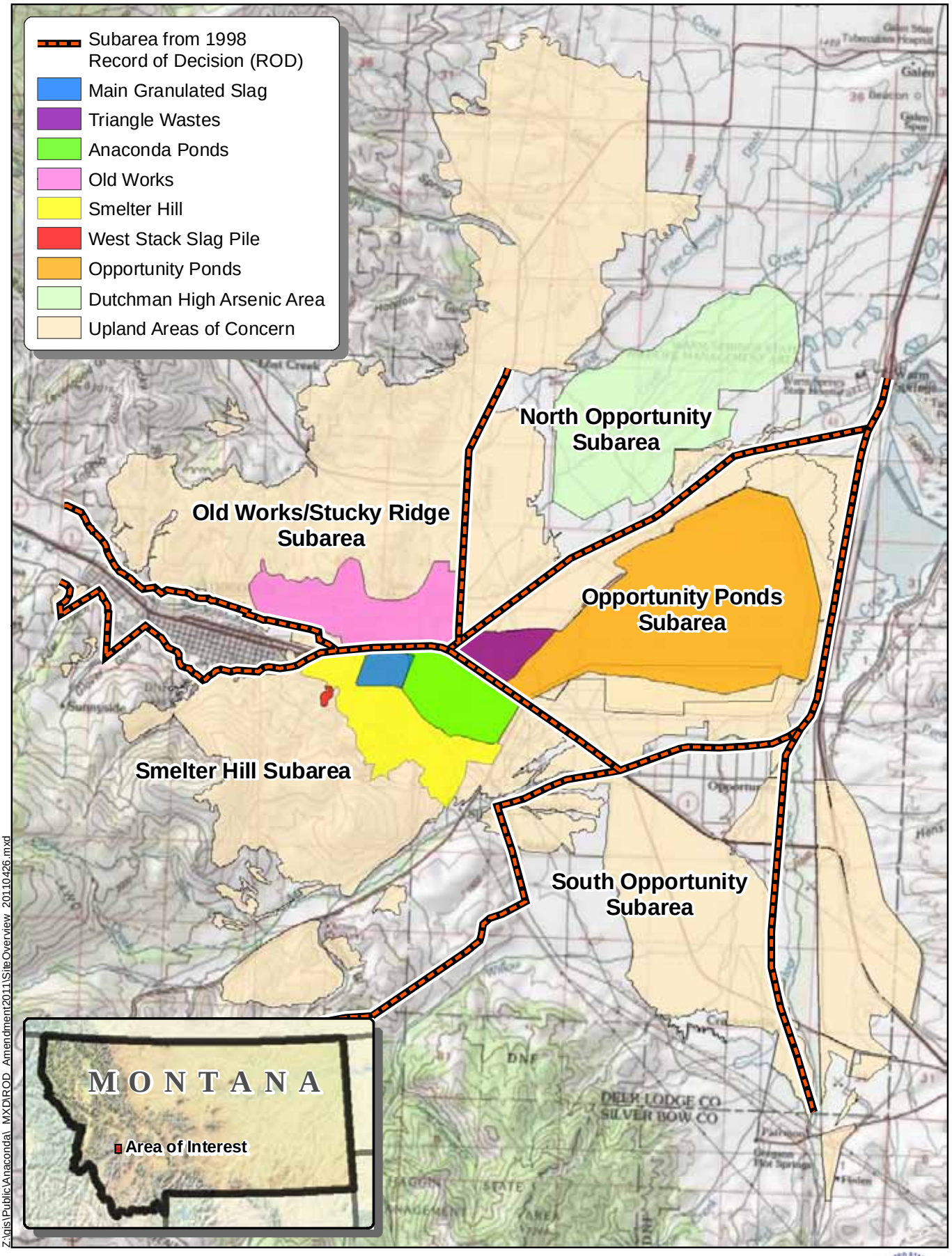

Figure 1-1. Site Location Map

Anaconda Regional Water, Waste, & Soils OU
Anaconda Smelter NPL Site, Montana

0 0.5 1 2
Scale of Miles

N

Montana Department of Environmental Quality

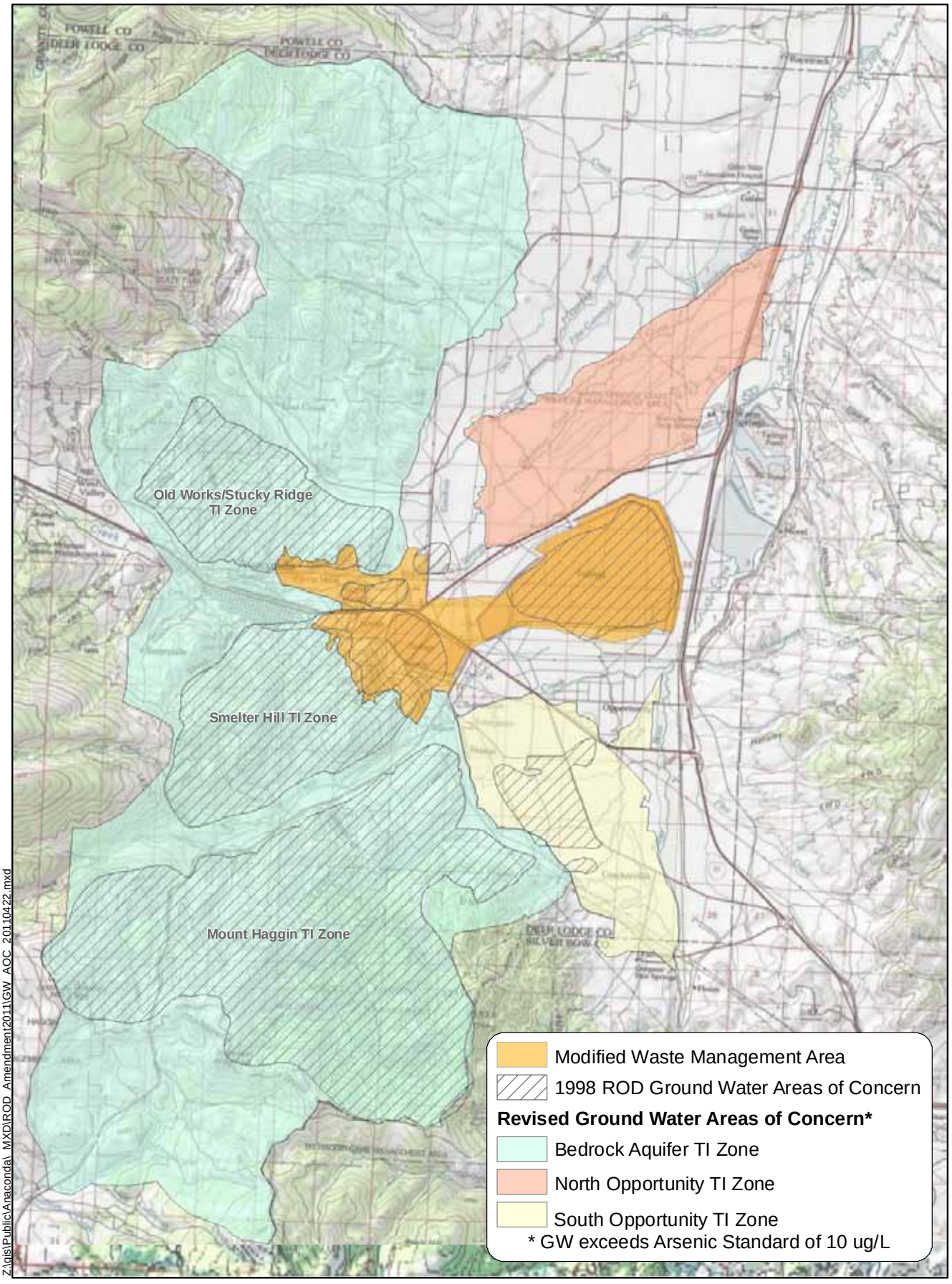

Figure 3-1. Revised Ground Water Area of Concern
Anaconda Regional Water, Waste, & Soils OU
Anaconda Smelter NPL Site, Montana

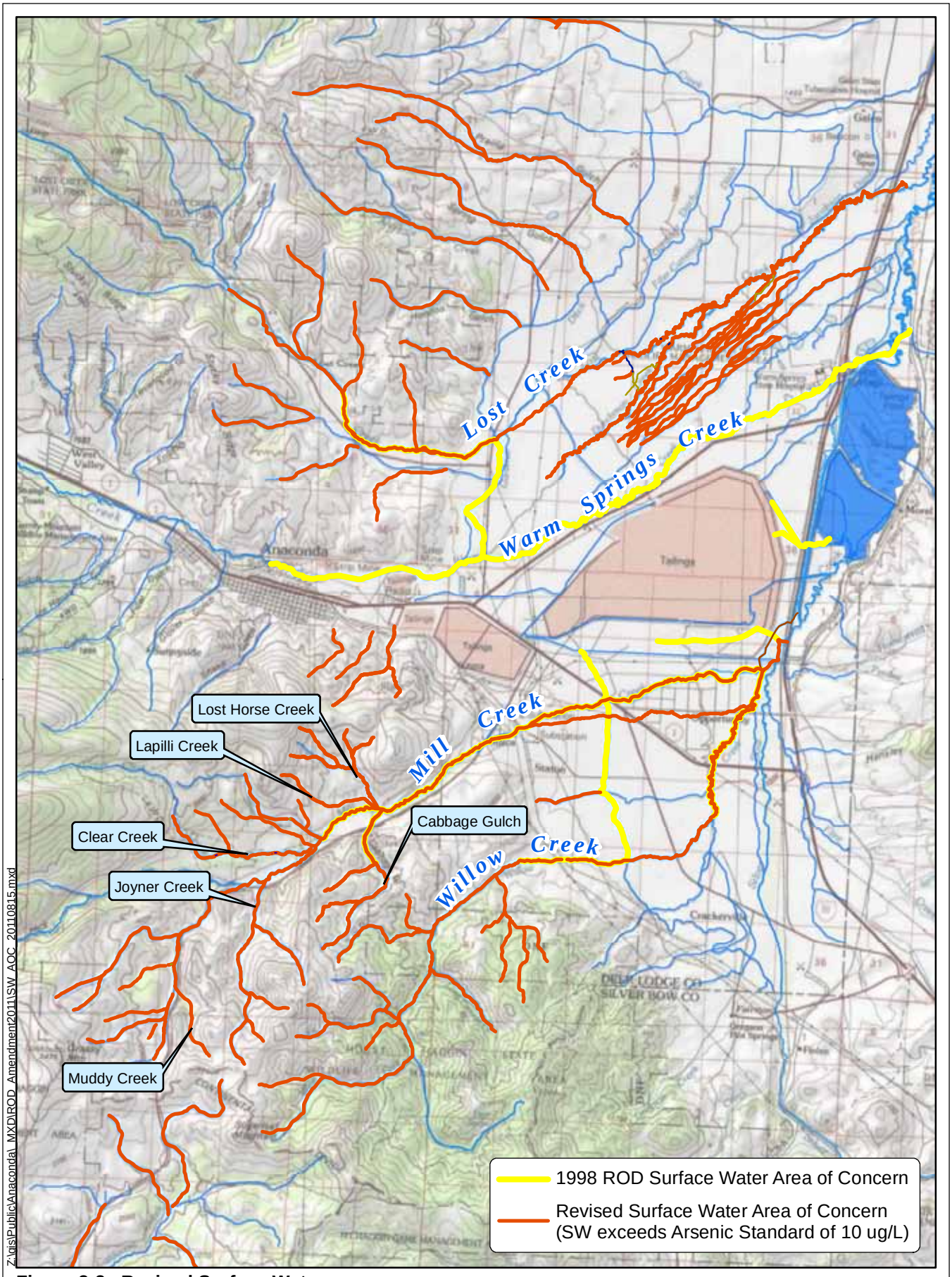

Figure 3-2. Revised Surface Water Area of Concern
Anaconda Regional Water, Waste, & Soils OU
Anaconda Smelter NPL Site, Montana

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Scale of Miles

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Montana Department of Environmental Quality

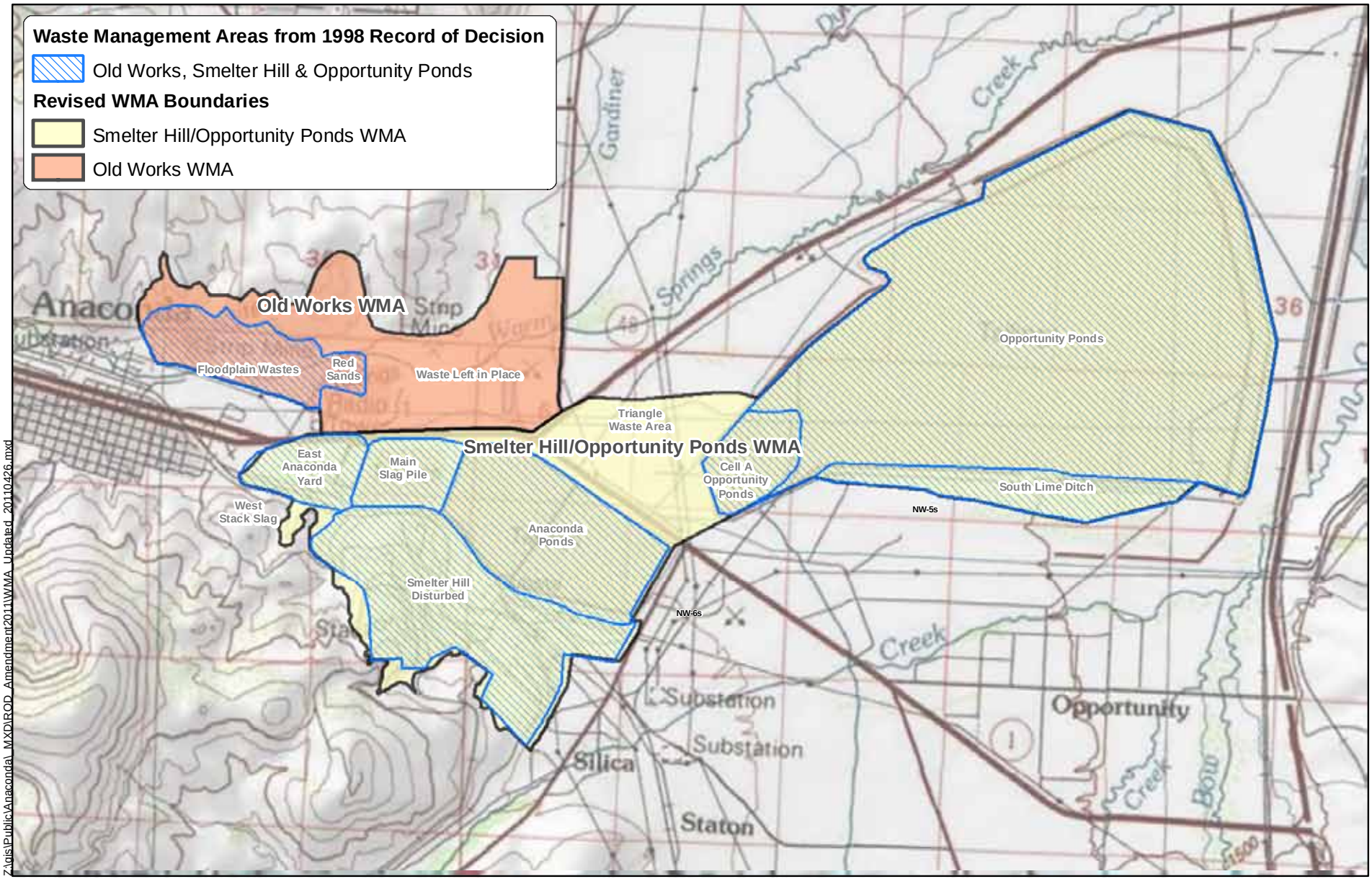

Figure 3-3. Waste Management Areas

Anaconda Regional Water, Waste, & Soils OU
Anaconda Smelter NPL Site, Montana

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Miles

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Montana Department of Environmental Quality

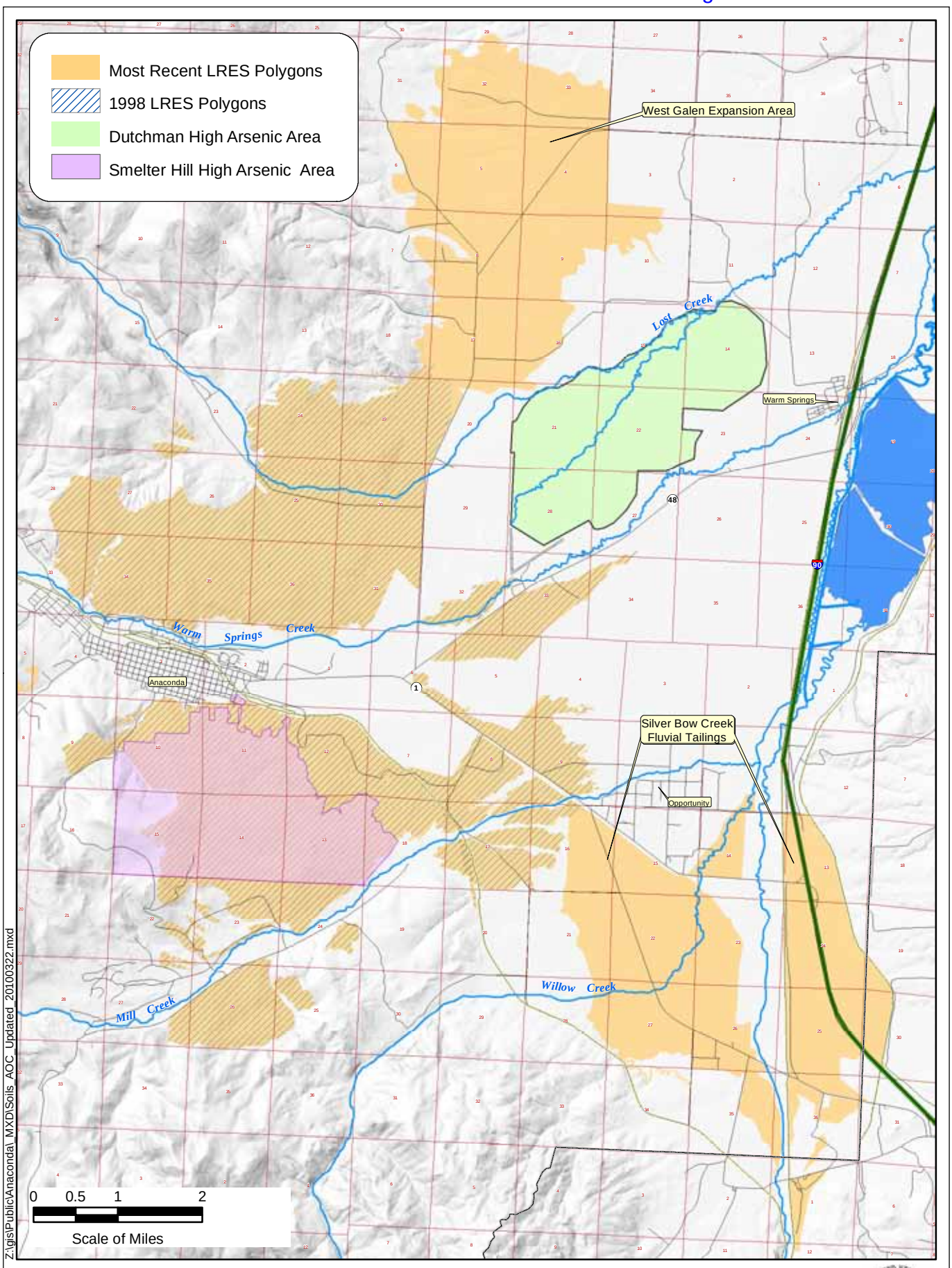

Figure 3-4. Soils Areas of Concern and High Arsenic Areas

Anaconda Regional Water, Waste, & Soils OU
Anaconda Smelter NPL Site, Montana

Montana Department of Environmental Quality

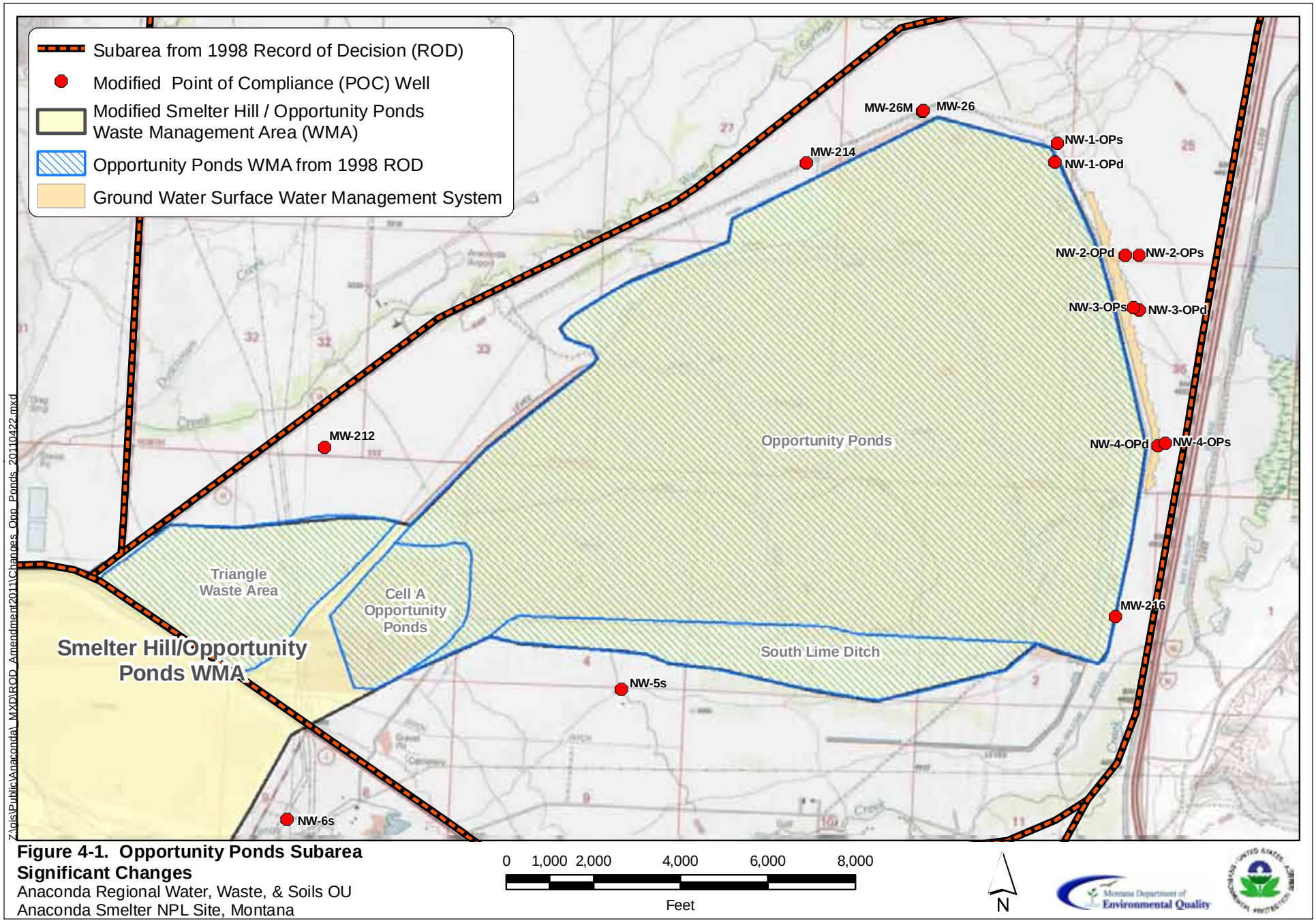

Figure 4-1. Opportunity Ponds Subarea Significant Changes
Anaconda Regional Water, Waste, & Soils OU
Anaconda Smelter NPL Site, Montana

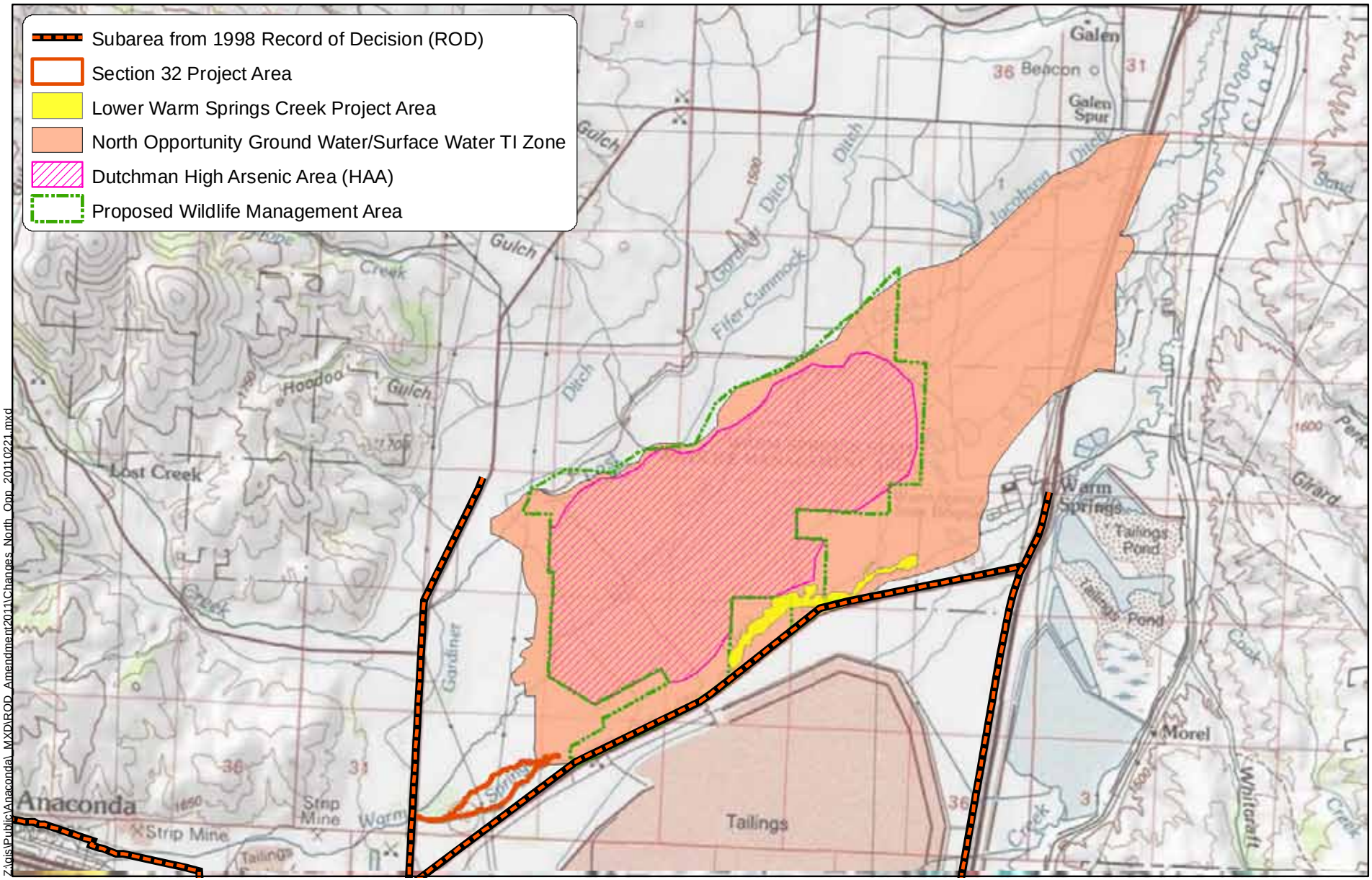

Figure 5-1. North Opportunity Subarea Fundamental and Significant Changes
Anaconda Regional Water, Waste, & Soils OU
Anaconda Smelter NPL Site, Montana

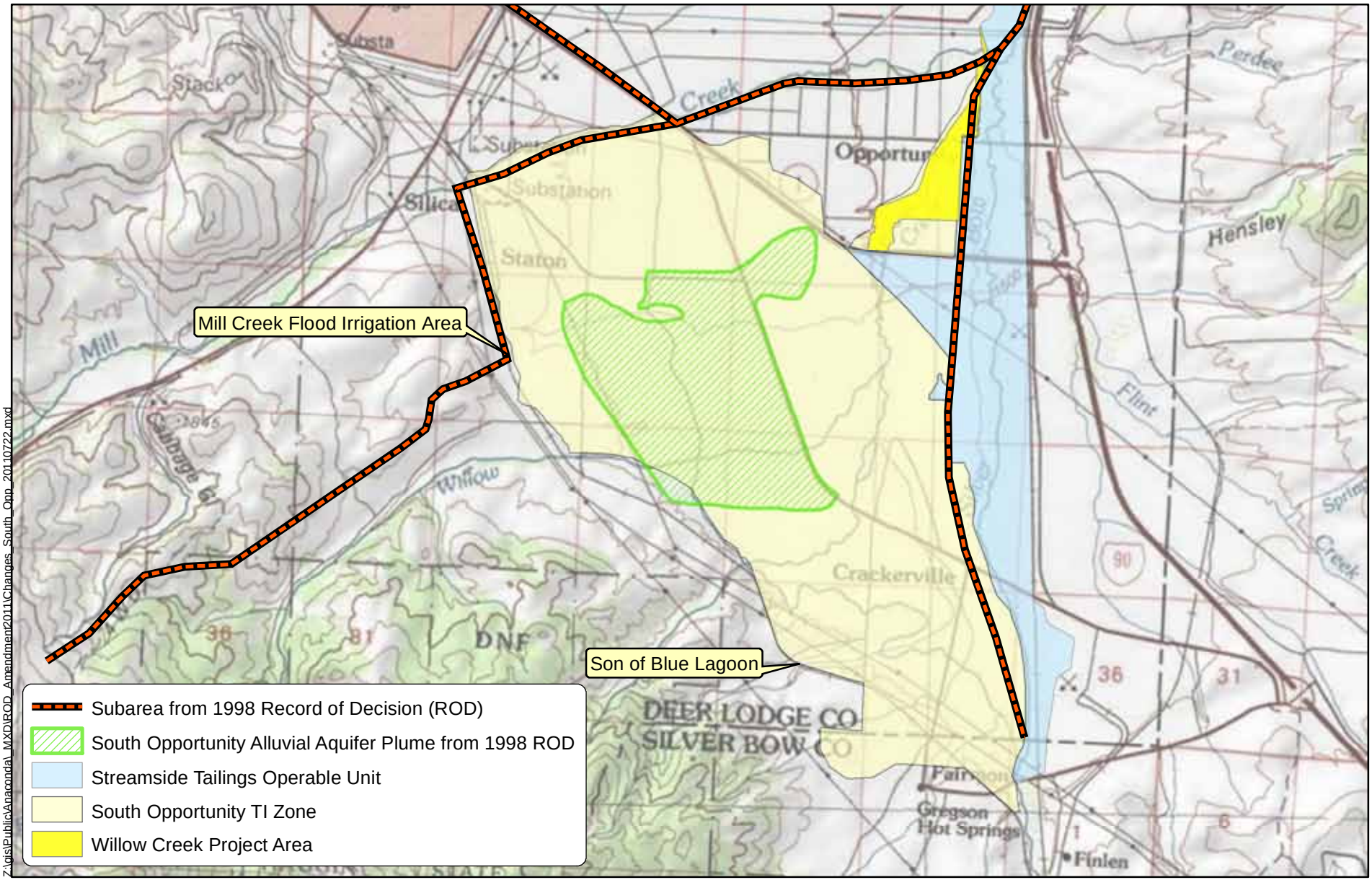

Figure 6-1. South Opportunity Subarea Fundamental Changes
Anaconda Regional Water, Waste, & Soils OU
Anaconda Smelter NPL Site, Montana

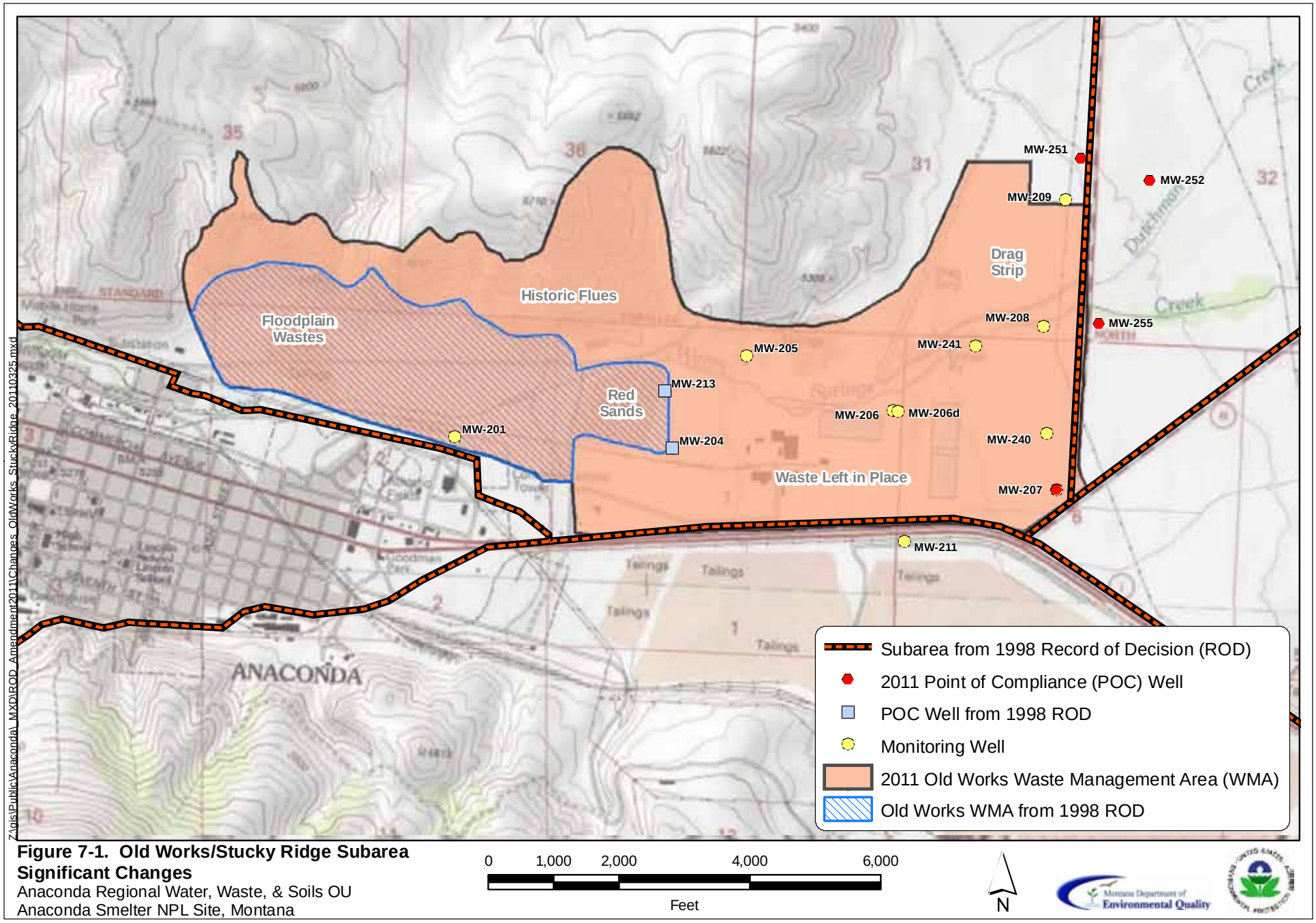

Figure 7-1. Old Works/Stucky Ridge Subarea Significant Changes
Anaconda Regional Water, Waste, & Soils OU
Anaconda Smelter NPL Site, Montana

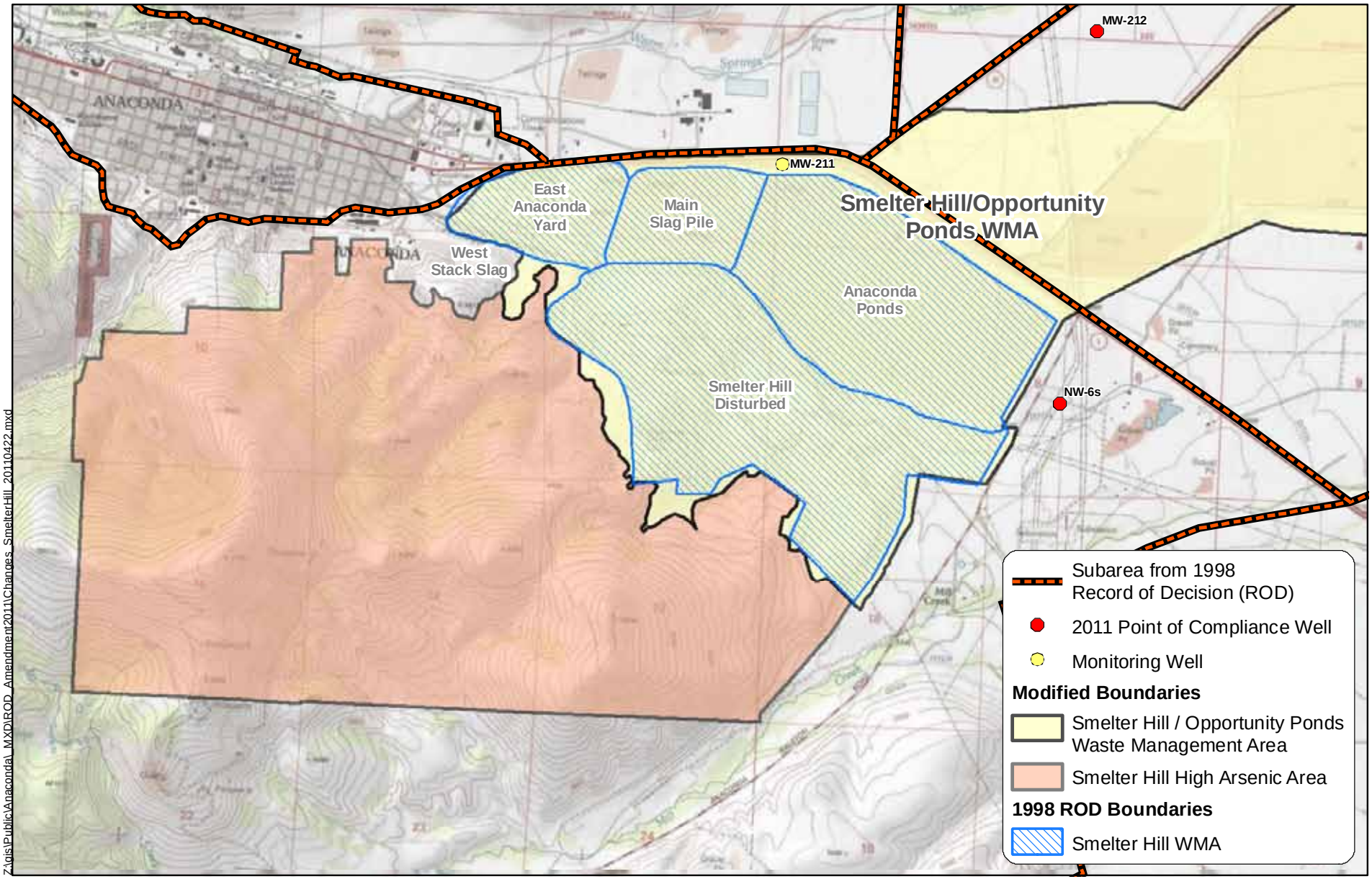

Figure 8-1. Smelter Hill Subarea Significant Changes
Anaconda Regional Water, Waste, & Soils OU
Anaconda Smelter NPL Site, Montana

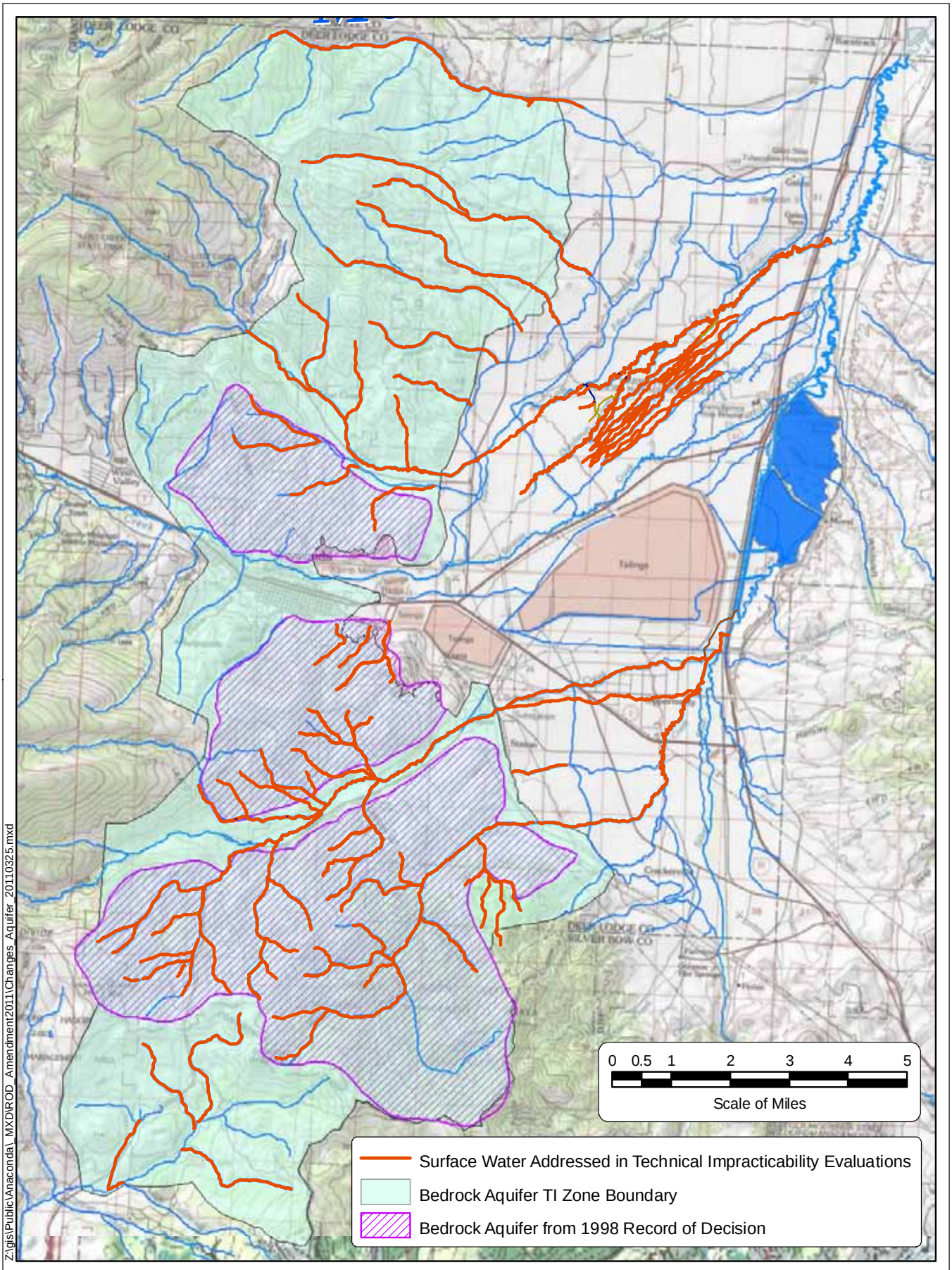

Figure 9-1. Bedrock Aquifer/Spring-Fed Tributaries Fundamental Changes

Anaconda Regional Water, Waste, & Soils OU
Anaconda Smelter NPL Site, Montana

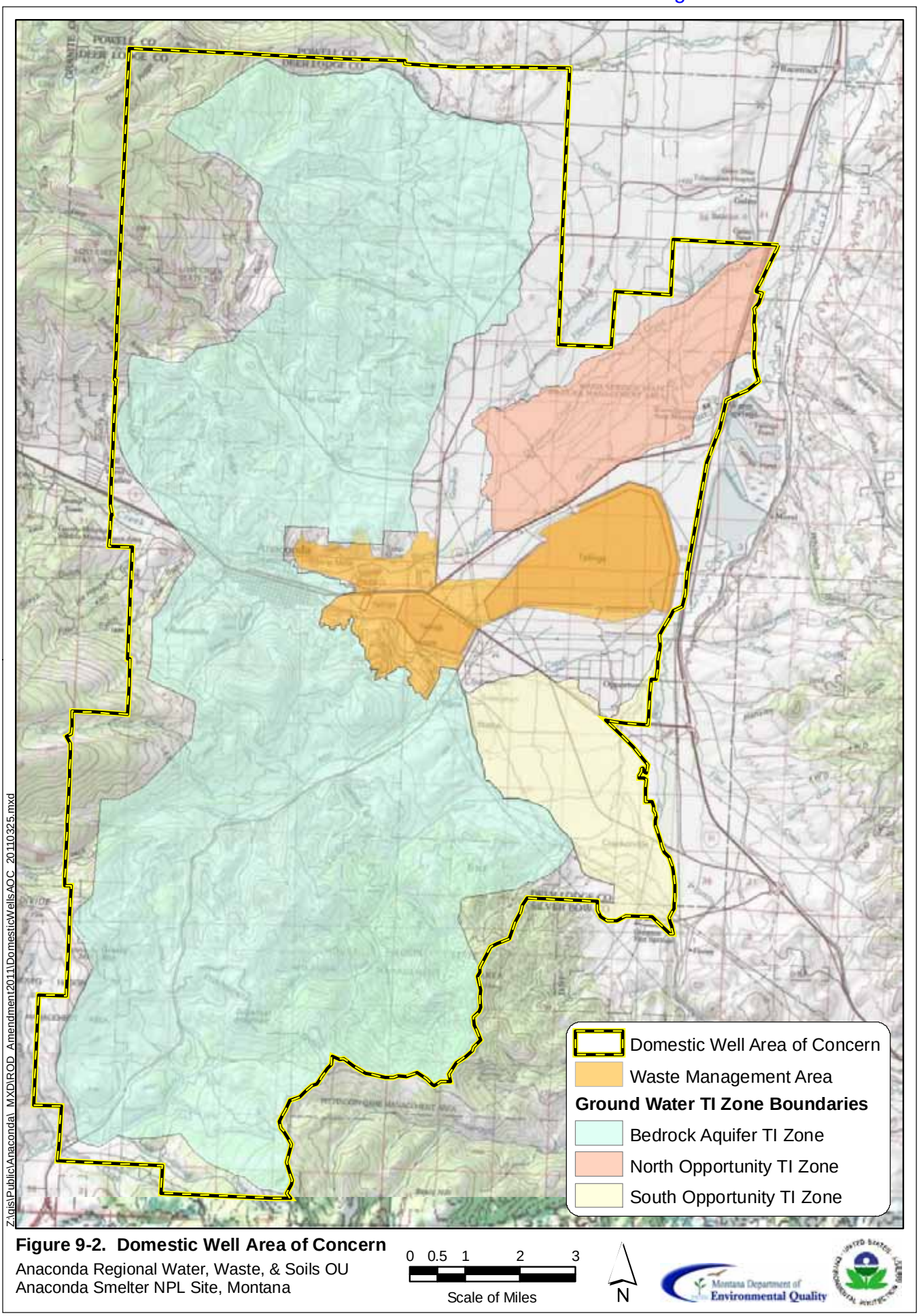

Figure 9-2. Domestic Well Area of Concern
Anaconda Regional Water, Waste, & Soils OU
Anaconda Smelter NPL Site, Montana

Appendix A
Identification and Description of Applicable or Relevant and Appropriate Requirements

APPENDIX A

IDENTIFICATION AND DESCRIPTION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ANACONDA SMELTER SUPERFUND SITE, REGIONAL WATER, WASTE, AND SOILS OPERABLE UNIT

September 2011

INTRODUCTION

Federal regulations provide that all ARARs are "frozen" as of the date of the ROD unless 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 EPA and DEQ for the ARWW&S OU, where it was determined that the ground water and surface water performance standards in the ROD were not consistent with the revised arsenic standard, and not protective.

EPA's rationale for freezing ARARs as of the date of the 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).

Each component of the ROD Amendment was previously described in the 1998 ROD. Rather than describe a new component, the principal effects of this ROD Amendment are to 1) expand areas over which technologies described in the original ROD will be applied, or 2) apply technologies described in the original ROD to additional areas.

EPA and DEQ have reviewed both the original list of ARARs set forth in Appendix A to the 1998 ROD, and its current revisions. After reviewing the ARARs, EPA and DEQ have determined that, except for the contaminant specific ground water and surface water standards listed in Table 5-1, there is no change to any ARAR that would call into question the protectiveness of the original remedy. The updates are set forth in Part 2 below. Part 1 of this Appendix A of this ROD Amendment sets forth the ARARs as presented in Appendix A to the 1998 ROD.

APPENDIX A, PART 1

Identification and Description of Applicable or Relevant and Appropriate Requirements

Anaconda Smelter Superfund Site, Regional Water, Waste, and Soils Operable Unit

APPENDIX A

Identification and Description of Applicable or Relevant and Appropriate Requirements

Anaconda Smelter Superfund Site,
Regional Water, Waste, and Soils Operable Unit

September 1998

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INTRODUCTION

Section 121(d) of CERCLA, 42 U.S.C. § 9621(d), the National Oil and Hazardous Substances Pollution Contingency Plan (the "NCP"), 40 CFR Part 300 (1990), and guidance and policy issued by the Environmental Protection Agency (EPA) require that remedial actions under CERCLA comply with substantive provisions of applicable or relevant and appropriate standards, requirements, criteria, or limitations (ARARs) from State of Montana and federal environmental laws and State facility siting laws during and at the completion of the remedial action. These requirements are threshold standards that any selected remedy must meet, unless an ARAR waiver is invoked.

This document identifies final ARARs for the activities to be conducted under the Anaconda Regional Water, Waste, and Soils Operable Unit (ARWW&S OU) remedial action. The following ARARs or groups of related ARARs are each identified by a statutory or regulatory citation, followed by a brief explanation of the ARAR and how and to what extent the ARAR is expected to apply to the activities to be conducted under this remedial action.

Substantive provisions of the requirements listed below are identified as ARARs pursuant to 40 CFR § 300.400. ARARs that are within the scope of this remedial action must be attained during and at the completion of the remedial action.[1] No permits are anticipated for the remedial action for the ARWW&S OU in accordance with Section 121(e) of CERCLA.

TYPES OF ARARs

ARARs are either "applicable" or "relevant and appropriate." Both types of requirements are mandatory under CERCLA and the NCP.[2] Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria or limitations promulgated under federal environmental or state environmental and facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable.[3]

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1 40 CFR Section 300.435(b)(2); Preamble to the National Oil and Hazardous Substances Pollution Contingency Plan, 55 Fed. Reg. 8755-8757 (March 8, 1990).

2 CERCLA § 121(d)(2)(A), 42 U.S.C. § 6921(d)(2)(a). See also, 40 CFR § 300.430(f)(1)(i)(A).

3 40 CFR § 300.5.

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to hazardous substances, pollutants, contaminants, remedial actions, locations, or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate.[4]

The determination that a requirement is relevant and appropriate is a two-step process: (1) determination if a requirement is relevant and (2) determination if a requirement is appropriate. In general, this involves a comparison of a number of site-specific factors, including an examination of the purpose of the requirement and the purpose of the proposed CERCLA action; the medium and substances regulated by the requirement and the proposed requirement; the actions or activities regulated by the requirement and the remedial action; and the potential use of resources addressed in the requirement and the remedial action. When the analysis results in a determination that a requirement is both relevant and appropriate, such a requirement must be complied with to the same degree as if it were applicable.[5]

ARARs are contaminant, location, or action specific. Contaminant specific requirements address chemical or physical characteristics of compounds or substances on sites. These values establish acceptable amounts or concentrations of chemicals which may be found in or discharged to the ambient environment.

Location specific requirements are restrictions placed upon the concentrations of hazardous substances or the conduct of cleanup activities because they are in specific locations. Location specific ARARs relate to the geographical or physical positions of sites, rather than to the nature of contaminants at sites.

Action specific requirements are usually technology based or activity based requirements or limitations on actions taken with respect to hazardous substances, pollutants or contaminants. A given cleanup activity will trigger an action specific requirement. Such requirements do not themselves determine the cleanup alternative, but define how chosen cleanup methods should be performed.

Many requirements listed as ARARs are promulgated as identical or near identical requirements in both federal and state law, usually pursuant to delegated environmental programs administered by EPA and the state. The Preamble to the NCP provides that such a situation results in citation to the state provision and treatment of the provision as a federal requirement.

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[4] 40 CFR § 300.5.

[5] CERCLA Compliance with Other Laws Manual, Vol. I, OSWER Directive 9234.1-01, August 8, 1988, p. 1-11.

Also contained in this list are policies, guidance or other sources of information which are "to be considered" in the selection of the remedy and implementation of the record of decision (ROD). Although not enforceable requirements, these documents are important sources of information which EPA and the State of Montana Department of Environmental Quality (MDEQ) may consider during selection of the remedy, especially in regard to the evaluation of public health and environmental risks; or which will be referred to, as appropriate, in selecting and developing cleanup actions.[6]

This Appendix constitutes EPA's and MDEQ's formal identification and detailed description of ARARs for the implementation of the remedial action at the Anaconda Smelter NPL Site, Anaconda Regional Water, Waste & Soils Operable Unit. Final ARARs will be set forth as performance standards for any and all remedial design or remedial action work plans.

I. CONTAMINANT SPECIFIC ARARs

A. Federal and State Groundwater ARARs.

Groundwater ARARs are must be met throughout the ARWW&S OU. Compliance with groundwater ARARs in waste management areas will generally be measured at the edge of each area.

i. State of Montana requirements.

a. ARM § 17.30.1002 and -1003 (all applicable).

ARM § 17.30.1002 provides that groundwater is classified I through IV based on its present and future most beneficial uses, and states that groundwater is to be classified according to actual quality or use, whichever places the groundwater in a higher class. Class I is the highest quality class; class IV the lowest. Based upon its specific conductance, groundwater throughout the entire ARWW&S OU is considered Class I groundwater.

ARM § 17.30.1003 sets the standards for the different classes of groundwater. Concentrations of dissolved substances in Class I or II groundwater may not exceed the human health standards listed in department Circular WQB-7.[7] These levels are listed below for the primary contaminants of concern. Levels that are more stringent than the MCL or MCLG identified in the federal portion of the ARARs are set out in boldface type.

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[6] 40 CFR Section 300.400(g)(3); 40 CFR Section 300.415(i); Preamble to the NCP, 55 Fed. Reg. 8744-8746 (March 8, 1990).

[7] Montana Department of Environmental Quality, Water Quality Division, Circular WQB-7, Montana Numeric Water Quality Standards (December 3, 1995).

Contaminant	**WQB-7 Standard***
Arsenic	**18 µg/L**
Beryllium	4 µg/L
Cadmium	5 µg/L
Copper	**1,000 µg/L**
Lead	15 µg/L
Zinc	5,000 µg/L

*WQB-7 standards for metals and arsenic in ground water are based on the dissolved portion of the sample.

ARM § 17.30.1003 requires that concentrations of other dissolved or suspended substances must not exceed levels that render the waters harmful, detrimental or injurious to public health. Maximum allowable concentrations of these substances also must not exceed acute or chronic problem levels that would adversely affect existing or designated beneficial uses of groundwater of that classification.

b. ARM § 17.30.1011 (applicable).

This section provides that any groundwater whose existing quality is higher than the standard for its classification must be maintained at that high quality in accordance with MCA § 75-5-303.

An additional concern with respect to ARARs for groundwater is the impact of groundwater upon surface water. If significant loadings of contaminants from groundwater sources to Warm Springs Creek, Mill Creek and Willow Creek contribute to the inability of the stream to meet B-1 class standards, then alternatives to alleviate such groundwater loading must be evaluated and, if appropriate, implemented. Groundwater in certain areas may have to be remediated to levels more stringent than the groundwater classification standards in order to achieve the standards for affected surface water. See Compliance with Federal Water Quality Criteria, OSWER Publication 9234.2-09/FS (June 1990) ("Where the ground water flows naturally into the surface water, the ground-water remediation should be designed so that the receiving surface-water body will be able to meet any ambient water-quality standards (such as State WQSs or FWQC) that may be ARARs for the surface water.")

ii. Federal requirements.

Safe Drinking Water Act, 42 U.S.C. § 300f, et seq., National Primary and Secondary Drinking Water Regulations, 40 CFR Parts 141 and 142 (relevant and appropriate). The National Primary and Secondary Drinking Water Regulations (40 CFR Parts 141 and 143) establish maximum contaminant levels (MCLs) for chemicals in drinking water distributed in public water systems. These are enforceable in Montana under the Public Water Safety Act, MCA § 75-6-101, et seq., and ARM § 17.30.204. Safe Drinking Water Act MCLs are not applicable to the ARWW&S remedial action because the contaminated portions of the aquifers found within the ARWW&S OU are currently not a source for public water supplies. There is no known public use of groundwater underlying or coming into contact with contaminants from the

ARWW&S OU. These standards may be applicable in the future should EPA detect an exceedance at a public water outlet.

These drinking water standards are relevant and appropriate, however, because groundwater in the area is a potential source of drinking water. Since Warm Springs Creek, Mill Creek and Willow Creek are potential sources of drinking water, these standards are relevant and appropriate for these surface waters as well.

The determination that the drinking water standards are relevant and appropriate for portions of the ARWW&S OU remedial action is fully supported by the regulations and guidance. The Preamble to the NCP clearly states that the MCLs are relevant and appropriate for groundwater that is a current or potential source of drinking water. See 55 Fed. Reg. 8750, March 8, 1990, and 40 CFR § 300.430(e)(2)(i)(B). MCLs developed under the Safe Drinking Water Act generally are ARARs for current or potential drinking water sources. See, EPA Guidance On Remedial Action For Contaminated Groundwater at Superfund Sites, OSWER Dir. #9283.1-2, December 1988.

In addition, maximum contaminant level goals (MCLGs) may also be relevant and appropriate in certain site-specific situations. See 55 Fed. Reg. 8750-8752. MCLGs are health-based goals which are established at levels at which no known or anticipated adverse effects on the health of persons occur and which allow an adequate margin of safety. According to the NCP, MCLGs that are set at levels above zero must be attained by remedial actions for ground or surface waters that are current or potential sources of drinking water, where the MCLGs are relevant and appropriate under the circumstances of the release. Where the MCLG for a contaminant has been set at a level of zero, the MCL promulgated for that contaminant must be attained by the remedial actions.

The MCLGs and MCLs for contaminants of concern are:

Contaminant	**MCL (mg/L)**	**MCLG (mg/L)**
Arsenic	0.05*	none
Beryllium	none**	.004***
Cadmium	.005*	.005***
Copper	1.3***	1.3***
Lead	.015****	0***

* 40 CFR § 141.62(b)
** 40 CFR § 141.51(c) no MCL, does specify BAT to be applied
*** 40 CFR § 141.51(b)
****40 CFR § 141.80(b)-this is an action level, not a true MCL

B. Federal and State Surface Water ARARs.

1. State of Montana Surface Water Quality Requirements, Montana Water Quality Act, MCA § 75-5-101, et seq., and implementing regulations (applicable). General. The Clean Water Act, 33 U.S.C. § 1251, et seq., provides the authority for each state to adopt water quality standards (40 CFR Part 131) designed to protect beneficial uses of each water body and requires each state to designate uses for each water body. The Montana Water Quality Act, MCA § 75-5-101, et seq., establishes requirements for restoring and maintaining the quality of surface and groundwaters. The State has the authority to adopt water quality standards designed to protect beneficial uses of each water body and to designate uses for each water body. Montana's regulations classify State waters according to quality, place restrictions on the discharge of pollutants to State waters, and prohibit degradation of State waters. Pursuant to this authority and the criteria established by Montana surface water quality regulations, ARM § 17.30.601, et seq., Montana has established the Water-Use Classification system. Under ARM § 17.30.607, tributaries to Clark Fork River, including Warms Springs Creek, Mill Creek, Willow Creek, Lost Creek, and the Mill Willow Bypass have been classified "B-1." Ditches and certain other bodies of surface water must also meet these requirements.[8] Certain of the B-1 standards, codified at ARM § 17.30.623, as well as Montana's nondegradation requirements, are presented below.

a. ARM § 17.30.623 (applicable). Waters classified B-1 are, after conventional treatment, suitable for drinking, culinary and food processing purposes. These waters are also suitable for bathing, swimming and recreation, growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers, and use for agricultural and industrial purposes. This section provides also that concentrations of carcinogenic, bioconcentrating, toxic or harmful parameters which would remain in water after conventional water treatment may not exceed standards set forth in department circular WQB-7. WQB-7 provides that "whenever both Aquatic Life Standards and Human Health Standards exist for the same analyte, the more restrictive of these values will be used as the numeric Surface Water Quality Standard." For the primary Contaminants of Concern the Circular WQB-7 standards are listed below.

[8] As provided under ARM § 17.30.602(25), "'surface waters' means any waters on the earth's surface, including but not limited to, streams, lakes, ponds, and reservoirs; and irrigation and drainage systems discharging directly into a stream, lake, pond, reservoir or other surface water. Water bodies used solely for treating, transporting or impounding pollutants shall not be considered surface water."

Contaminant	WQB-7 Standard
Arsenic	18 µg/L
Cadmium	1.1 µg/L*
Copper	12 µg/L*
Iron	300 µg/L
Lead	3.2 µg/L*
Zinc	110 µg/L*

*Chronic Aquatic Life Standard based on 100 mg/L hardness.

The B-1 classification standards at ARM § 17.30.623 also include the following criteria: 1) dissolved oxygen concentration must not be reduced below the levels given in department circular WQB-7; 2) hydrogen ion concentration (pH) must be maintained within the range of 6.5 to 8.5; 3) the maximum allowable increase above naturally occurring turbidity is 5 nephelometric turbidity units; 4) temperature increases must be kept within prescribed limits; 5) no increases above naturally occurring concentrations of sediment, settleable solids, oils, floating solids, which will or are likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish or other wildlife are allowed; 5) True color must be kept within specified limits.

b. **ARM § 17.30.637 (applicable).** Provides that surface waters must be free of substances attributable to industrial practices or other discharges that will: (a) settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines; (b) create floating debris, scum, a visible oil film (or be present in concentrations at or in excess of 10 milligrams per liter) or globules of grease or other floating materials; (c) produce odors, colors or other conditions which create a nuisance or render undesirable tastes to fish flesh or make fish inedible; (d) create concentrations or combinations of materials which are toxic or harmful to human, animal, plant or aquatic life; (e) create conditions which produce undesirable aquatic life.

ARM § 17.30.637 also states that no waste may be discharged and no activities conducted which, either along or in combination with other waste activities, will cause violation of surface water quality standards; provided a short term exemption from a surface water quality standard may be authorized by the department under certain conditions.

c. **ARM § 17.30.705 (applicable).** Existing and anticipated uses of surface water and water quality necessary to support those uses must be maintained and protected.

2. **Federal Surface Water Quality Requirements, Clean Water Act, 33 U.S.C. §§ 1251, et seq. (applicable).** As provided under Section 303 of the Clean Water Act, 33 U.S.C. § 1313, the State of Montana has promulgated water quality standards. See the discussion above under State surface water quality requirements.

C. Federal and State Air Quality ARARs.

1. National Ambient Air Quality Standards, 40 CFR § 50.6 (PM-10); 40 CFR § 50.12 (lead) (applicable). These provisions establish standards for PM-10 and lead emissions to air. (Corresponding state standards are found at ARM § 17.8.222 (lead) and ARM § 17.8.223 (PM-10).)

2. Montana Ambient Air Quality Regulations, ARM §§ 17.8.206, -.222, -.220, and -.223 (applicable).

a. ARM § 17.8.206. This provision establishes sampling, data collection and analytical requirements to ensure compliance with ambient air quality standards.

b. ARM § 17.8.222. Lead emissions to ambient air shall not exceed a ninety (90) day average of 1.5 micrograms per cubic liter of air.

c. ARM § 17.8.220. Settled particulate matter shall not exceed a thirty (30) day average of 10 grams per square meter.

d. ARM § 17.8.223. PM-10 concentrations in ambient air shall not exceed a 24 hour average of 150 micrograms per cubic meter of air and an annual average of 50 micrograms per cubic meter of air.

II. LOCATION SPECIFIC REQUIREMENTS

The statutes and regulations set forth below relate to solid waste, floodplains, floodways, streambeds, and the preservation of certain cultural, historic, natural or other national resources located in certain areas which may be adversely affected by the ARWW&S OU remedial action.

A. National Historic Preservation Act, 16 U.S.C. § 470, 40 CFR § 6.301(b), 36 CFR Part 800 (NHPA) (applicable). This statute and implementing regulations require Federal agencies to take into account the effect of this response action upon any district, site, building, structure, or object that is included in or eligible for the Register of Historic Places. Compliance with NHPA requirements will be attained through the Regional Historic Preservation Plan as implemented pursuant to agreements entered into with EPA and Anaconda/Deer Lodge.

B. Archaeological and Historic Preservation Act, 16 U.S.C. § 469, 40 CFR 6.301(c) (applicable). This statute and implementing regulations establish requirements for the evaluation and preservation of historical and archaeological data, which may be destroyed through alteration of terrain as a result of a Federal construction project or a federally licensed activity or program. This requires EPA or the PRP to survey the site for covered scientific, prehistorical or archaeological artifacts. The results of this survey will be reflected in the Administrative Record. Preservation of appropriate data concerning the artifacts is hereby identified as an ARAR requirement, to be completed during the implementation of the remedial action.

C. Historic Sites, Buildings and Antiquities Act, 16 U.S.C. § 461, et seq., 40 CFR § 6.310(a) (applicable). This statute and implementing regulations require federal agencies to consider the existence and location of land marks on the National Registry of National Landmarks and to avoid undesirable impacts on such landmarks.

D. Fish and Wildlife Coordination Act, 16 U.S.C. §§ 1531, et seq., 40 CFR § 6.302(g) (applicable). This statute and implementing regulations require that Federal agencies or federally funded projects ensure that any modification of any stream or other water body affected by any action authorized or funded by the Federal agency provides for adequate protection of fish and wildlife resources. Compliance with this ARAR requires EPA to consult with the U.S. Fish and Wildlife Service and the Montana Department of Fish, Wildlife, and Parks. Further consultation will occur during remedial design and remedial action.

E. Endangered Species Act, 16 U.S.C. § 1531, 40 CFR § 6.302(h), 50 CFR Parts 17 and 402 (applicable). This statute and implementing regulations provide that federal activities not jeopardize the continued existence of any threatened or endangered species. As part of on-going site investigations, ARCO completed a report, **Wetlands and Threatened/Endangered Species Inventory with Determination of Effective Wetland Area (May 1994),** which noted that the following threatened or endangered animal species are present in the Anaconda area: bald eagles and peregrine falcons. Additionally, the Montana Natural Heritage Program data base indicates that Preble's shrew has been observed on site. The remedy selection process, including the Feasibility Study, should identify whether the proposed remedial actions will impact threatened and/or endangered species and/or their habitat, and what avoidance or mitigative measures are necessary in Section 1.0, Statutory Determinations, of the Decision Summary of the ROD.

F. Floodplain Management, 40 CFR § 6.302(b), and Executive Order No. 11988 (applicable). These require that actions be taken to avoid, to the extent possible, adverse effects associated with direct or indirect development of a floodplain, or to minimize adverse impacts if no practicable alternative exists.

G. Protection of Wetlands, 40 CFR Part 6, Appendix A, Executive Order No. 11990 (applicable). This ARAR requires Federal agencies and the PRP to avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands if a practicable alternative exists. Wetlands are defined as those areas that are inundated or saturated by groundwater or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Compliance with this ARAR will be achieved through consultation with the U.S. Fish and Wildlife Service and the U.S. Corp of Engineers, to determine the existence and category of wetlands present at the site, and any avoidance or mitigation and replacement which may be necessary. As part of on-going site investigations, ARCO completed a report, **Wetlands and Threatened/Endangered Species Inventory with Determination of Effective Wetland Area (May 1994).** A total of 10,714 acres were positively identified as jurisdictional wetlands and 164 acres of aquatic habitat were identified. .

H. Montana Floodplain and Floodway Management Act and Regulations, MCA § 76-5-401, et seq., ARM § 36.15.601, et seq. (applicable). The Floodplain and Floodway

Management Act and regulations specify types of uses and structures that are allowed or prohibited in the designated 100-year floodway[9] and floodplain.[10] Since the ARWW&S OU lies partially within the 100-year floodplain of Warm Springs Creek, these standards are applicable to all actions within this floodplain area.

i) Allowed uses

The law recognizes certain uses as allowable in the floodway and a broader range of uses as allowed in the floodplain. Residential use is among the possible allowed uses expressly recognized in both the floodway and floodplain. "Residential uses such as lawns, gardens, parking areas, and play areas," as well as certain agricultural, industrial-commercial, recreational and other uses are permissible within the designated floodway, provided they do not require structures other than portable structures, fill or permanent storage of materials or equipment. MCA § 76-5-401; ARM § 36.15.601 (Applicable). In addition, in the flood fringe (i.e., within the floodplain but outside the floodway), residential, commercial, industrial, and other structures may be permitted subject to certain conditions relating to placement of fill, roads, floodproofing, etc. MCA § 76-5-402; ARM § 36.15.701 (Applicable). Domestic water supply wells may be permitted, even within the floodway, provided the well casing is watertight to a depth of 25 feet and the well meets certain conditions for floodproofing, sealing, and positive drainage away from the well head. ARM § 36.15.602(6).

ii) Prohibited uses

Uses prohibited anywhere in either the floodway or the floodplain are:

1. solid and hazardous waste disposal; and
2. storage of toxic, flammable, hazardous, or explosive materials.

ARM §§ 36.15.605(2) and 36.15.703 (Applicable); see also ARM § 36.15.602(5)(b) (Applicable).

In the floodway, additional prohibitions apply, including prohibition of:

1. a building for living purposes or place of assembly or permanent use by human beings;

[9] The "floodway" is the channel of a watercourse or drainway and those portions of the floodplain adjoining the channel which are reasonably required to carry and discharge the floodwater of the watercourse or drainway. ARM § 36.15.101(13).

[10] The "floodplain" is the area adjoining the watercourse or drainway which would be covered by the floodwater of a base (100-year) flood except for sheetflood areas that receive less than one foot of water per occurrence. The floodplain consists of the floodway and flood fringe.

2. any structure or excavation that will cause water to be diverted from the established floodway, cause erosion, obstruct the natural flow of water, or reduce the carrying capacity of the floodway; and

3. the construction or permanent storage of an object subject to flotation or movement during flood level periods.

MCA § 76-5-402 (Applicable).

iii) Applicable considerations in use of floodplain or floodway

Applicable regulations also specify factors that must be considered in allowing diversions of the stream, changes in place of diversion of the stream, flood control works, new construction or alteration of artificial obstructions, or any other nonconforming use within the floodplain or floodway. Many of these requirements are set forth as factors that must be considered in determining whether a permit can be issued for certain obstructions or uses. While permit requirements are not directly applicable to remedial actions conducted entirely on site, the substantive criteria used to determine whether a proposed obstruction or use is permissible within the floodway or floodplain are applicable standards. Factors which must be considered in addressing any obstruction or use within the floodway or floodplain include:

1. the danger to life and property from backwater or diverted flow caused by the obstruction or use;

2. the danger that the obstruction or use will be swept downstream to the injury of others;

3. the availability of alternate locations;

4. the construction or alteration of the obstruction or use in such a manner as to lessen the danger;

5. the permanence of the obstruction or use; and

6. the anticipated development in the foreseeable future of the area which may be affected by the obstruction or use.

See MCA § 76-5-406; ARM § 36.15.216 (Applicable, substantive provisions only). Conditions or restrictions that generally apply to specific activities within the floodway or floodplain are:

1. the proposed activity, construction, or use cannot increase the upstream elevation of the 100-year flood a significant amount (½ foot or as otherwise determined by the permit issuing authority) or significantly increase flood velocities, ARM § 36.15.604 (Applicable, substantive provisions only); and

2. the proposed activity, construction, or use must be designed and constructed to minimize potential erosion.

For the substantive conditions and restrictions applicable to specific obstructions or uses, see the following applicable regulations:

Excavation of material from pits or pools - ARM § 36.15.602(1).

Water diversions or changes in place of diversion - ARM § 36.15.603.

Flood control works (levees, floodwalls, and riprap must comply with specified safety standards) - ARM § 36.15.606.

Roads, streets, highways and rail lines (must be designed to minimize increases in flood heights) - ARM § 36.15.701(3)(c).

Structures and facilities for liquid or solid waste treatment and disposal (must be floodproofed to ensure that no pollutants enter flood waters and may be allowed and approved only in accordance with MDEQ regulations, which include certain additional prohibitions on such disposal) - ARM § 36.15.701(3)(d).

Residential structures -ARM § 36.15.702(1).

Commercial or industrial structures - ARM § 36.15.702(2).

I. Montana Natural Streambed and Land Preservation Act and Regulations, MCA § 75-7-101 and ARM §§ 36.2.404, 405, and 406 (applicable). Applicable if this remedial action alters or affects a streambed or its banks. The adverse effects of any such action must be minimized.

MCA §§ 87-5-502 and 504 (Applicable -- substantive provisions only) provide that a state agency or subdivision shall not construct, modify, operate, maintain or fail to maintain any construction project or hydraulic project which may or will obstruct, damage, diminish, destroy, change, modify, or vary the natural existing shape and form of any stream or its banks or tributaries in a manner that will adversely affect any fish or game habitat. The requirement that any such project must eliminate or diminish any adverse effect on fish or game habitat is applicable to the state in approving remedial actions to be conducted. The Natural Streambed and Land Preservation Act of 1975, MCA § 75-7-101, et seq., (Applicable -- substantive provisions only) includes similar requirements and is applicable to private parties as well as government agencies.

ARM § 36.2.404 (Applicable) establishes minimum standards which would be applicable if a remedial action alters or affects a streambed, including any channel change, new diversion, riprap or other stream bank protection project, jetty, new dam or reservoir or other commercial, industrial or residential development. No such project may be approved unless reasonable efforts will be made consistent with the purpose of the project to minimize the amount of stream channel alteration, insure that the project will be as permanent a solution as possible and will create a reasonably permanent and stable situation, insure that the project will pass anticipated water flows without creating harmful erosion upstream or downstream, minimize turbidity, effects on fish and aquatic habitat, and adverse effects on the natural beauty of the area and insure that streambed gravels will not be used in the project unless there is no reasonable

alternative. Soils erosion and sedimentation must be kept to a minimum. Such projects must also protect the use of water for any useful or beneficial purpose. See MCA § 75-7-102.

While the administrative/procedural requirements, including the consent and approval requirements, set forth in these statutes and regulations are not ARARs, the party designing and implementing the remedial action for the ARWW&S OU is encouraged to continue to consult with the Montana Department of Fish, Wildlife and Parks, and any conservation district or board of county commissioners (or consolidated city/county government) as provided in the referenced statutes, to assist in the evaluation of factors discussed above.

J. Migratory Bird Treaty Act, 16 U.S.C. §§ 703, et seq. (applicable). This requirement establishes a federal responsibility for the protection of the international migratory bird resource and requires continued consultation with the USFWS during remedial design and remedial construction to ensure that the cleanup of the site does not unnecessarily impact migratory birds. Specific mitigative measures may be identified for compliance with this requirement.

K. Bald Eagle Protection Act, 16 U.S.C. §§ 668, et seq. (applicable). This requirement establishes a federal responsibility for protection of bald and golden eagles, and requires continued consultation with the USFWS during remedial design and remedial construction to ensure that any cleanup of the site does not unnecessarily adversely affect the bald and golden eagles. Specific mitigative measures may be identified for compliance with this requirement.

L. Resource Conservation and Recovery Act and regulations, 40 CFR § 264.18 (a) and (b) (relevant and appropriate). Regulations promulgated under the Solid Waste Management, MCA § 75-10-201, et seq., specify requirements that apply to the location of any solid waste management facility.

M. Montana Solid Waste Management Act and regulations, MCA § 75-10-201, et seq., ARM § 17.50.505 (applicable) . Sets forth requirements applying to the location of any solid waste management facility. Among other things, the location must have sufficient acreage, must not be within a 100-year floodplain, must be located so as to prevent pollution of ground, surface, and private and public water supply systems, and must allow for reclamation of the land.

N. American Indian Religious Freedom Act, 42 U.S.C. § 1996, et seq. (applicable). This Act establishes a federal responsibility to protect and preserve the inherent right of American Indians to believe, express and exercise the traditional religions of American Indians. This right includes, but is not limited to, access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites. The Act requires Federal agencies to protect Indian religious freedom by refraining from interfering with access, possession and use of religious objects, and by consulting with Indian organizations regarding proposed actions affecting their religious freedom.

O. Native American Graves and Repatration Act, 25 U.S.C. § 3001, et seq. (applicable). The Act prioritizes ownership or control over Native American cultural items, including human remains, funerary objects and sacred objects, excavated or discovered on Federal or tribal lands. Federal agencies and museums that have possession or control over Native American human remains and associated funerary objects are required under the Act to compile an inventory of such items and, to the extent possible, identify their geographical and cultural affiliation. Once

the cultural affiliation of such objects is established, the Federal agency or museum must expeditiously return such items, upon request by a lineal descendent of the individual Native American or tribe identified**.**

III. ACTION SPECIFIC REQUIREMENTS

A. Federal and State Water Requirements.

1. Clean Water Act Point Source Discharges requirements, 33 U.S.C. § 1342 (applicable). Section 402 of the Clean Water Act, 33 U.S.C. § 1342, et seq., authorizes the issuance of permits for the "discharge" of any "pollutant." This includes storm water discharges associated with "industrial activity." See, 40 CFR § 122.1(b)(2)(iv). "Industrial activity includes inactive mining operations that discharge storm water contaminated by contact with or that has come into contact with any overburden, raw material, intermediate products, finished products, byproducts or waste products located on the site of such operations, see, 40 CFR § 122.26(b)(14)(iii); landfills, land application sites, and open dumps that receive or have received any industrial wastes including those subject to regulation under RCRA subtitle D, see, 40 CFR § 122.26(b)(14)(v); and construction activity including clearing, grading, and excavation activities, see, 40 CFR § 122.26(b)(14)(x). Because the State of Montana has been delegated the authority to implement the Clean Water Act, these requirements are enforced in Montana through the Montana Pollutant Discharge Elimination System (MPDES). The MPDES requirements are set forth below.

a. Substantive MPDES Permit Requirements, ARM §§ 17.30.1342-1344 (applicable). These set forth the substantive requirements applicable to all MPDES and NPDES permits. The substantive requirements, including the requirement to properly operate and maintain all facilities and systems of treatment and control are applicable requirements.

b. Technology-Based Treatment, ARM §§ 17.30.1203 and 1344 (applicable). Provisions of 40 CFR Part 125 for criteria and standards for the imposition of technology-based treatment requirements are adopted and incorporated in MDEQ permits. Although the permit requirement would not apply to on-site discharges, the substantive requirements of Part 125 are applicable, i.e., for toxic and nonconventional pollutants treatment must apply the best available technology economically achievable (BAT); for conventional pollutants, application of the best conventional pollutant control technology (BCT) is required. Where effluent limitations are not specified for the particular industry or industrial category at issue, BCT/BAT technology-based treatment requirements are determined on a case by case basis using best professional judgment (BPJ). See CERCLA Compliance with Other Laws Manual, Vol. I, August 1988, p. 3-4 and 3-7.

2. Additional State of Montana requirements.

a. Water Quality Statute and Regulations (all applicable).

i. Causing of Pollution, MCA § 75-5-605. This section of the Montana Water Quality Act prohibits the causing of pollution of any state waters. Pollution is defined as contamination or other alteration of physical, chemical, or biological properties of state waters which exceeds that permitted by the water quality standards. Also, it is unlawful to place or caused to be placed any wastes where they will cause pollution of any state waters. Any permitted placement of waste is

not placement if the agency's permitting authority contains provisions for review of the placement of materials to ensure it will not cause pollution to state waters.

ii. Nondegradation, MCA § 75-5-303. This provision states that existing uses of state waters and the level of water quality necessary to protect the uses must be maintained and protected. Under MCA § 75-5-317, changes in existing water quality resulting from an emergency or remedial activity that is designed to protect the public health or the environment and is approved, authorized, or required by the department are considered nonsignificant activities, and are not subject to the nondegradation rules promulgated pursuant to MCA § 75-5-303.

(a). ARM § 17.30.705. This provides that for any surface water, existing and anticipated uses and the water quality necessary to protect these uses must be maintained and protected unless degradation is allowed under the nondegradation rules at ARM § 17.30.708.

(b). ARM § 17.30.1011. This provides that any groundwater whose existing quality is higher than the standard for its classification must be maintained at that high quality unless degradation may be allowed under the principles established in MCA § 75-5-303, and the nondegradation rules at ARM § 17.30.701, et seq.

iv. Stormwater Runoff.

(a). ARM § 17.24.633. All surface drainage from a disturbed area must be treated by the best technology currently available.

(b). General Permits. Under ARM § 17.30.601, et seq., and ARM § 17.30.1301, et seq., including ARM § 17.30.1332, the Water Quality Division has issued general storm water permits for certain activities. The substantive requirements of the following permits are applicable for the following activities: (a) for construction activities: General Discharge Permit for Storm Water Associated with Construction Activity, Permit No. MTR100000 (May 19, 1997); (b) for mining activities: General Discharge Permit for Storm Water Associated with Mining and with Oil and Gas Activities, Permit No. MTR300000 (September 10, 1997).[11] (c) for industrial activities: General Discharge Permit for Storm Water Associated with Industrial Activity, Permit No. MTR000000 (October 26, 1994).[12]

Generally, the permits require the permittee to implement Best Management Practices (BMP) and to take all reasonable steps to minimize or prevent any discharge which has a reasonable likelihood of adversely affecting human health or the environment. However, if there is evidence indicating potential or realized impacts on water quality due to any storm water discharge associated with the activity, an individual MPDES permit or alternative general permit may be required.

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[11] This permit covers point source discharges of storm water from mining and milling activities (including active, inactive, and abandoned mine and mill sites) including activities with Standard Industrial Code 14 (metal mining).

[12] Industrial activities are defined as all industries defined in 40 CFR §§ 122, 123, and 124, excluding construction, mining, oil & gas extraction activities and storm water discharges subject to effluent limitations guidelines. This includes wood treatment operations, as well as the production of slag.

v. Surface Water, ARM § 17.30.637. Prohibits discharges containing substances that will: (a) settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines; (b) create floating debris, scum, a visible oil film (or be present in concentrations at or in excess of 10 milligrams per liter) or globules of grease or other floating materials; (c) produce odors, colors or other conditions which create a nuisance or render undesirable tastes to fish flesh or make fish inedible; (d) create concentrations or combinations of materials which are toxic or harmful to human, animal, plant or aquatic life; or (e) create conditions which produce undesirable aquatic life.

B. Federal and State RCRA Subtitle C Requirements, 42 U.S.C. Section 6921, et seq. (relevant and appropriate for solid wastes, applicable for hazardous wastes). The presentation of RCRA Subtitle C requirements in this section assumes that there will be many solid wastes at the ARWW&S OU, and that some of these may be left in place in "waste management areas" as a result of this remedial action. Because of the similarity of these waste management areas to the RCRA "waste management unit," certain discrete portions of the RCRA Subtitle C implementing regulations will be relevant and appropriate for the ARWW&S remedial action. Also, although it is unlikely that hazardous wastes still exist at the ARWW&S OU (these should have been addressed the Arbiter/Beryllium removal and Flue Dust remedial actions) this possibility has not yet been eliminated. Therefore, RCRA Subtitle C and implementing regulations are hereby designated as applicable for any hazardous wastes that are actively "managed" as part of the ARWW&S OU remedial action or that were "placed" or "disposed" after 1980. These RCRA C requirements are also applicable for continued operation and maintenance of the Arbiter/Beryllium waste repository. Also, should hazardous wastes be discovered as part of any remedial design or remedial action activity taken in connection with this ROD, EPA reserves the right to identify RCRA Subtitle C requirements in more detail at a later date. All federal RCRA Subtitle C requirements set forth below are incorporated by reference as State of Montana requirements as provided for under ARM § 17.54.112(6) unless mentioned otherwise below.

1. 40 CFR Part 264 Subpart F. General Facility Standards. This is potentially relevant and appropriate for solid wastes at this OU. Any waste management unit or similar area would be required to comply with the following requirements. These are not final cleanup standards for the ARWW&S OU.

a. 40 CFR § 264.92, .93. and .94. Prescribes groundwater protection standards.

b. 40 CFR § 264.97. Prescribes general groundwater monitoring requirements.

e. 40 CFR § 264.98. Prescribes requirements for monitoring and detecting indicator parameters.

2. Closure requirements.

a. 40 CFR § 264.111. This provides that the owner or operator of a hazardous waste management facility must close the facility in a way that minimizes the need for further maintenance, and controls or eliminates the leaching or escape of hazardous waste or its constituents, leachate, or runoff to the extent necessary to protect human health and the environment.

b. **40 CFR § 264.117.** This provision incorporates monitoring requirements in Part 264, including those mentioned at Part 264.97 and Part 264.303. It governs the length of the post-closure care period, permits a lengthened security period, and prohibits any use of the property which would disturb the integrity of the management facility.

c. **40 CFR § 264.310.** This specifies requirements for caps, maintenance, and monitoring after closure.

3. **40 CFR § 264.301.** Prescribes design and operating requirements for landfills.

a. **40 CFR § 264.301(a).** This provides for a single liner and leachate collection and removal system.

b. **40 CFR § 264.301(f).** This requires a run-on control system.

c. **40 CFR § 264.301(g).** This requires a run-off management system.

d. **40 CFR § 264.301(h).** This requires prudent management of facilities for collection and holding of run-on and run-off.

e. **40 CFR § 264.301(i).** This requires that wind dispersal of particulate matter be controlled.

C. **Federal and State RCRA Subtitle D and Solid Waste Requirements (applicable).** 40 CFR Part 257 establishes criteria under Subtitle D of the Resource Conservation and Recovery Act for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health or the environment. See 40 CFR § 257.1(a). This part comes into play whenever there is a "disposal" of any solid or hazardous waste from a "facility." "Disposal" is defined as "the discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground waters." See 40 CFR § 257.2. "Facility" means "any land and appurtenances thereto used for the disposal of solid wastes." Solid waste requirements are listed herein because the there may be disposal of solid wastes as a result of this remedial action.

1. **Federal Requirements - 40 CFR § 257.** Criteria for Classification of Solid Waste Disposal Facilities and Practices. The activities to be performed for the ARWW&S OU remedial action are expected to comply with the following requirements.

a. **40 CFR § 257.3-1.** Washout of solid waste in facilities in a floodplain posing a hazard to human life, wildlife, or land or water resources shall not occur.

b. **40 CFR § 257.3-2.** Facilities shall not contribute to the taking of endangered species or the endangering of critical habitat of endangered species.

c. **40 CFR § 257.3-3.** A facility shall not cause a discharge of pollutants, dredged or fill material, into waters of the United States in violation of sections 402 and 404 of the Clean Water Act, as amended, and shall not cause non-point source pollution, in violation of applicable legal requirements implementing an area wide or statewide water quality management plan that has been approved by the Administrator under Section 208 of the Clean Water Act, as amended.

d. **40 CFR § 257.3-4.** A facility shall not contaminate an underground source of drinking water beyond the solid waste boundary or beyond an alternative boundary specified in accordance with this section.

e. **40 CFR § 257.3-8(d).** Access to a facility shall be controlled so as to prevent exposure of the public to potential health and safety hazards at the site.

2. State of Montana Solid Waste Requirements (applicable).

a. **ARM § 17.50.505(1) and (2).** Sets forth standards that all solid waste disposal sites must meet, including the requirements that (1) Class II landfills must confine solid waste and leachate to the disposal facility. If there is the potential for leachate migration, it must be demonstrated that leachate will only migrate to underlying formations which have no hydraulic continuity with any state waters; (2) adequate separation of group II wastes from underlying or adjacent water must be provided; and (3) no new disposal units or lateral expansions may be located in wetlands. ARM § 17.50.505 also specifies general soil and hydrogeological requirements pertaining to the location of any solid waste management facility.

b. **ARM § 17.50.506.** Specifies design requirements for landfills. Landfills must either be designed to ensure that MCLs are not exceeded or the landfill must contain a composite liner and leachate collection system which comply with specified criteria.

c. **ARM § 17.50.510.** Sets forth general operational and maintenance and design requirements for solid waste facilities using land filling methods. Specific operational and maintenance requirements specified in ARM § 17.50.510 that are applicable are run-on and run-off control systems requirements, requirements that sites be fenced to prevent unauthorized access, and prohibitions of point source and nonpoint source discharges which would violate Clean Water Act requirements.

d. **MCA § 75-10-121 and ARM § 17.50.523.** For solid wastes, MCA § 75-10-212 prohibits dumping or leaving any debris or refuse upon or within 200 yards of any highway, road, street, or alley of the State or other public property, or on privately owned property where hunting, fishing, or other recreation is permitted. ARM § 17.50.523 specifies that solid waste must be transported in such a manner as to prevent its discharge, dumping, spilling or leaking from the transport vehicle.

e. **MCA § 75-10-206.** Provides for a variance from solid waste requirements where such variance would not result in a danger to public health or safety. EPA invokes the variance with respect to some or all of the solid waste provisions listed above and finds that variance from these requirements will not result in danger to public health or safety**.**

f. **ARM § 17.50.530.** Sets forth the closure requirements for landfills. Class II landfills must meet the following criteria: (1) install a final cover that is designed to minimize infiltration and erosion; (2) design and construct the final cover system to minimize infiltration through the closed unit by the use of an infiltration layer that contains a minimum 18 inches of earthen material and has a permeability less than or equal to the permeability of any bottom liner, barrier layer, or natural subsoils or a permeability no greater than 1 X 10-5 cm/sec, whichever is less; (3) minimize erosion of the final cover by the use of a seed bed layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth and protecting the infiltration layer from frost effects and rooting damage; (4) revegetate the final cover with native plant growth within one year of placement of the final cover.

g. **ARM § 17.50.531**. Sets forth post closure care requirements for Class II landfills. Post closure care must be conducted for a period sufficient to protect human health and the environment. Post closure care requires maintenance of the integrity of the integrity and effectiveness of any final cover, including making repairs to the cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding or otherwise damaging the cover and comply with the groundwater monitoring requirements found at ARM Title 17, chapter 50, subchapter 7.

D. **Surface Mining Control and Reclamation Act, 30 U.S.C. §§ 1201-1326 (relevant and appropriate).** This Act and implementing regulations found at 30 CFR Parts 784 and 816 establish provisions designed to protect the environment from the effects of surface coal mining operations, and to a lesser extent non-coal mining. These requirements are relevant and appropriate to the covering of discrete areas of contamination. The regulations require that revegetation be used to stabilize soil covers over reclaimed areas. They also require that revegetation be done according to a plan which specifies schedules, species which are diverse and effective, planting methods, mulching techniques, irrigation if appropriate, and appropriate soil testing. Reclamation performance standards are currently relevant and appropriate to mining waste sites.

E. **Montana Strip and Underground Mine Reclamation Act, MCA § 82-4-201, et seq., (all relevant and appropriate) and Montana Metal Mining Reclamation Act, MCA § 82-4-301, et seq., (relevant and appropriate).** Certain discrete portions of the following statutory or regulatory provisions are relevant and appropriate requirements.

1. **MCA § 82-4-231.** Requires operators to reclaim and revegetate affected lands using most modern technology available. Operators must grade, backfill, topsoil, reduce high walls, stabilize subsidence, control water, minimize erosion, subsidence, land slides, and water pollution.

2. **MCA § 82-4-233.** Operators must plant vegetation that will yield a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the area and capable of self-regeneration.

3. **MCA § 82-4-336 (Montana Metal Mine Reclamation Act).** Disturbed areas must be reclaimed to utility and stability comparable to areas adjacent.

4. **ARM § 17.24.501(3)(a) and (d) and (4).** Backfill must be placed so as to minimize sedimentation, erosion, and leaching of acid or toxic materials into waters, unless otherwise approved.

5. **ARM § 17.24.501(A)(1)a and (2).** Final graded slopes will be 5:1 unless otherwise approved. If steeper, slopes must have a long term static safety factor of 1:3, not to exceed the angle of repose unless the existing grade of the area is steeper, in which case the existing grade meets this requirement. Disturbed areas must be blended with undisturbed ground to provide a smooth transition in topography.

6. **ARM § 17.24.514.** Final grading will be done along the existing contour in order to minimize subsequent erosion and instability, unless otherwise approved.

7. **ARM § 17.24.519.** Pertinent areas of the ARWW&S OU where excavation will occur will be regraded to minimize settlement.

8. **ARM § 17.24.631(1), (2), (3)(a) and (b).** Disturbances to the prevailing hydrologic balance will be minimized. Changes in water quality and quantity, in the depth to groundwater and in the location of surface water drainage channels will be minimized, to the extent consistent with the selected remedial alternatives. Other pollution minimization devices must be used if appropriate, including stabilizing disturbed areas through land shaping, diverting runoff, planting quickly germinating and growing stands of temporary vegetation, regulating channel velocity of water, lining drainage channels with rock or vegetation, mulching, and control of acid-forming, and toxic-forming waste materials.

9. **ARM § 17.24.633.** Surface drainage from a disturbed area must be treated by the best technology currently available (BTCA). Treatment must continue until the area is stabilized.

10. **ARM § 17.24.634.** Disturbed drainages will be restored to the approximate pre-disturbance configuration, to the extent consistent with the selected remedial alternatives. Drainage design must emphasize channel and floodplain dimensions that approximate the pre-mining configuration and that will blend with the undisturbed drainage above and below the area to be reclaimed. The average stream gradient must be maintained with a concave longitudinal profile. This regulation provides specific requirements for designing the reclaimed drainage to: (1) meander naturally; (2) remain in dynamic equilibrium with the system; (3) improve unstable premining conditions; (4) provide for floods; and (5) establish a premining diversity of aquatic habitats and riparian vegetation.

11. **ARM §§ 17.24.635 through 17.24.637.** Set forth requirements for temporary and permanent diversions.

12. **ARM § 17.24.638.** Sediment control measures must be implemented during operations.

13. **ARM § 17.24.639.** Sets forth requirements for construction and maintenance of sedimentation ponds.

14. **ARM § 17.24.640.** Discharges from sedimentation ponds, permanent and temporary impoundments, must be controlled to reduce erosion and enlargement of stream channels, and to minimize disturbance of the hydrologic balance.

15. **ARM § 17.24.641.** Practices to prevent drainage from acid or toxic forming spoil material into ground and surface water will be employed.

16. **ARM §§ 17.24.643 through 17.24.646.** Provisions for groundwater protection, groundwater recharge protection, and groundwater and surface water monitoring.

17. **ARM §§ 17.24.701 and 702.** Requirements for redistributing and stockpiling of soil for reclamation. Also, outline practices to prevent compaction, slippage, erosion, and deterioration of biological properties of soil will be employed.

18. **ARM § 17.24.703.** When using materials other than, or along with, soil for final surfacing in reclamation, the operator must demonstrate that the material (1) is at least as capable as the soil of supporting the approved vegetation and subsequent land use, and (2) the medium must be the best available in the area to support vegetation. Such substitutes must be used in a manner consistent with the requirements for redistribution of soil in ARM § 17.24.701 and 702.

19. **ARM § 17.24.711.** Requires that a diverse, effective and permanent vegetative cover of the same seasonal variety and utility as the vegetation native to the area of land to be affected must be established. This provision would not be relevant and appropriate in certain instances, for example, where there is dedicated development.

20. **ARM § 17.24.713.** Seeding and planting of disturbed areas must be conducted during the first appropriate period for favorable planting after final seedbed preparation but may not be more than 90 days after soil has been replaced.

21. **ARM § 17.24.714.** Mulch or cover crop or both must be used until adequate permanent cover can be established.

22. **ARM § 17.24.716.** Establishes method of revegetation.

23. **ARM § 17.24.718.** Requires soil amendments, irrigation, management, fencing, or other measures, if necessary to establish a diverse and permanent vegetative cover.

24. **ARM § 17.24.721.** Specifies that rills or gullies deeper than nine inches must be stabilized. In some instances shallower rills and gullies must be stabilized.

25. **ARM § 17.24.723.** States that operators shall conduct approved periodic measurements of vegetation, soils, water, and wildlife during the period of liability.

26. **ARM § 17.24.724.** Specifies that revegetation success must be measured by approved unmined reference areas. There shall be at least one reference area for each plant community type. Required management for these reference areas is set forth.

27. **ARM § 17.24.726.** Sets the required methods for measuring productivity.

28. **ARM § 17.24.728.** Sets requirements for measurements of the permanence of vegetation on reclaimed areas.

29. **ARM §§ 17.24.730 and 17.24.731.** Provide that the revegetated area must furnish palatable forage in comparable quantity and quality during the same grazing period as the reference area. If toxicity to plants or animals is suspected, comparative chemical analyses may be required.

30. **ARM § 17.24.733.** Provides additional requirements and measurement standards for trees, shrubs and half-shrubs.

31. **ARM § 17.24.751.** Measures to prevent degradation of fish and wildlife habitat will be employed.

32. **ARM § 17.24.761.** This specifies fugitive dust control measures which will be employed during excavation and construction activities to minimize the emission of fugitive dust in the ARWW&S OU. These provisions are addressed below in Section III.C.

33. **ARM § 17.24.824.** Post-mining land use must be judged on the highest and best use that can be achieved and is compatible with surrounding areas.

F. **Air Requirements (all applicable).**

1. **ARM § 17.8.308(2), (3), and (4).** Airborne particulate matter. There shall be no production, handling, transportation, or storage of any material, use of any street, road, or parking lot, or operation of a construction site or demolition project unless reasonable precautions are taken to control emissions of airborne particles. Emissions shall not exhibit an opacity exceeding 20% or greater averaged over 6 consecutive minutes.

2. **ARM § 17.8.304(2).** Visible Air Contaminants. Emissions into the outdoor atmosphere shall not exhibit an opacity of 20% or greater averaged over 6 consecutive minutes.

3. **ARM § 17.8.315(1).** Nuisance or odor bearing gases. Gases, vapors and dusts will be controlled such that no public nuisance is caused within the ARWW&S OU.

4. **ARM § 17.24.761(2)(a), (e), (h), (j), and (k).** Fugitive dust control measures such as 1) watering, stabilization, or paving of roads, 2) vehicle speed restrictions, 3) stabilization of surface areas adjoining roads, 4) restriction of travel on other than authorized roads, 5) enclosing, covering, watering, or otherwise treating loaded haul truck, 6) minimizing area of disturbed land, and 7) revegetation, must be planned and implemented, if any such measure or measures are appropriate for this remedial action.

G. **Air Quality Requirements (applicable).**

Remedial activities will comply with the following requirements to ensure that existing air quality will not be adversely affected by the ARWW&S OU remedial action.

1. **ARM § 17.8.222.** The concentration of lead in ambient air shall not exceed a 90 day average of 1.5 micrograms per cubic meter of air.

2. **ARM § 17.8.220.** Settled particulate matter shall not exceed a 30 day average of 10 grams per square meter.

3. **ARM § 17.8.823.** The concentration of PM-10 in ambient air shall not exceed a 24 hour average of 150 micrograms per cubic meter of air and an annual average of 50 micrograms per cubic meter of air.

H. **Noxious Weeds, MCA § 7-22-2101(7)(a) and ARM § 4.5.201, et seq.** MCA § 7-22-2101(7)(a) defines "noxious weeds" as any exotic plant species established or that may be introduced in the state which may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses or that may harm native plant communities and that is designated: (i) as a statewide noxious weed by rule of the department; or (ii) as a district noxious weed by a board, following public notice of intent and a public hearing. Designated noxious weeds are listed in ARM § 4.5.201 through 4.5.204 and must be managed consistent with weed management criteria developed under MCA § 7-22-2109(2)(b).

IV. TO BE CONSIDERED DOCUMENTS (TBCs).

The use of documents identified as TBCs is addressed in the Introduction, above. A list of TBC documents is included in the Preamble to the NCP, 55 Fed. Reg. 8765 (March 8, 1990). Those documents, plus any additional similar or related documents issued since that time, will be considered by EPA and MDEQ during the conduct of the RI/FS, during remedy selection, and during remedy implementation.

V. OTHER LAWS (NON-EXCLUSIVE LIST).

CERCLA defines as ARARs only federal environmental and state environmental and siting laws. Remedial design, implementation, and operation and maintenance must nevertheless comply with all other applicable laws, both state and federal, if the remediation work is done by parties other than the federal government or its contractors.

The following “other laws” are included here to provide a reminder of other legally applicable requirements for actions being conducted at the reservoir sediments operable unit. They do not purport to be an exhaustive list of such legal requirements, but are included because they set out related concerns that must be addressed and, in some cases, may require some advance planning. They are not included as ARARs because they are not “environmental or facility siting laws.” As applicable laws other than ARARs, they are not subject to ARAR waiver provisions.

Section 121(e) of CERCLA exempts removal or remedial actions conducted entirely on-site from federal, state, or local permits. This exemption is not limited to environmental or facility siting laws, but applies to other permit requirements as well.

a) Other Federal Laws.

1. Occupational Safety and Health Regulations. The federal Occupational Safety and Health Act regulations found at 29 CFR § 1910 are applicable to worker protection during conduct of RI/FS or remedial activities.

b) Other State Laws.

1. Groundwater Act. MCA § 85-2-505, precludes the wasting of groundwater. Any well producing waters that contaminate other waters must be plugged or capped, and wells must be constructed and maintained so as to prevent waste, contamination, or pollution of groundwater.

2. Public Water Supply Regulations. If remedial action at the site requires any reconstruction or modification of any public water supply line or sewer line, the construction standards specified in ARM § 17.38.101(3) must be observed.

3. Groundwater Act. MCA § 85-2-516 states that within 60 days after any well is completed a well log report must be filed by the driller with the DNRC and the appropriate county clerk and recorder.

4. Water Rights. MCA § 85-2-101 declares that all waters within the state are the state's property, and may be appropriated for beneficial uses. The wise use of water resources is encouraged for the maximum benefit to the people and with minimum degradation of natural aquatic ecosystems.

Parts 3 and 4 of Title 85, MCA, set out requirements for obtaining water rights and appropriating and utilizing water. All requirements of these parts are laws which must be complied with in any action using or affecting waters of the state. Some of the specific requirements are set forth below.

MCA § 85-2-301 provides that a person may only appropriate water for a beneficial use.

MCA § 85-2-302 specifies that a person may not appropriate water or commence construction of diversion, impoundment, withdrawal or distribution works therefor except by applying for and receiving a permit from the Montana Department of Natural Resources and Conservation. While the permit itself may not be required under federal law, appropriate notification and submission of an application should be performed and a permit should be applied for in order to establish a priority date in the prior appropriation system. A 1991 amendment imposes a fee of $1.00 per acre foot for appropriations of ground water, effective until July 1, 1993.

MCA § 85-2-306 specifies the conditions on which groundwater may be appropriated, and, at a minimum, requires notice of completion and appropriation within 60 days of well completion.

MCA § 85-2-311 specifies the criteria which must be met in order to appropriate water and includes requirements that:

1. there are unappropriated waters in the source of supply;

2. the proposed use of water is a beneficial use; and

3. the proposed use will not interfere unreasonably with other planned uses or developments.

MCA § 85-2-402 specifies that an appropriator may not change an appropriated right except as provided in this section with the approval of the DNRC.

MCA § 85-2-412 provides that where a person has diverted all of the water of a stream by virtue of prior appropriation and there is a surplus of water, over and above what is actually and necessarily used, such surplus must be returned to the stream.

5. Occupational Health Act, MCA § 50-70-101, et seq. ARM § 17.74.101 addresses occupational noise. In accordance with this section, no worker shall be exposed to noise levels in excess of the levels specified in this regulation. This regulation is applicable only to limited categories of workers and for most workers the similar federal standard in 29 CFR § 1910.95 applies.

ARM § 17.74.102 addresses occupational air contaminants. The purpose of this rule is to establish maximum threshold limit values for air contaminants under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects. In accordance with this rule, no worker shall be exposed to air contaminant levels in excess of the threshold limit values listed in the regulation.

This regulation is applicable only to limited categories of workers and for most workers the similar federal standard in 29 CFR § 1910.1000 applies.

6. Montana Safety Act. MCA §§ 50-71-201, 202 and 203 state that every employer must provide and maintain a safe place of employment, provide and require use of safety devices and safeguards, and ensure that operations and processes are reasonably adequate to render the place of employment safe. The employer must also do every other thing reasonably necessary to protect the life and safety of its employees. Employees are prohibited from refusing to use or interfering with the use of safety devices.

7. Employee and Community Hazardous Chemical Information Act. MCA §§ 50-78-201, 202, and 204 state that each employer must post notice of employee rights, maintain at the work place a list of chemical names of each chemical in the work place, and indicate the work area where the chemical is stored or used. Employees must be informed of the chemicals at the work place and trained in the proper handling of the chemicals.

APPENDIX A, Part 2

Update of Identification and Description of Applicable or Relevant and Appropriate Requirements for Record of Decision, Anaconda Smelter Superfund Site, Regional Water, Waste, and Soils Operable Unit, September 1998

I. CONTAMINANT SPECIFIC ARARs

Changes to federal and State contaminant specific surface and ground water ARARs are summarized in Table 3-1, produced at Section 3 of the ROD, and reproduced below. This table supersedes the tables presented at pages A-4, A-5, and A-7 of the Identification of ARARs, Appendix A, to the 1998 ROD.

Table 3-1. Revised RAG/Performance Standards for Water Quality. Anaconda Regional Water, Waste & Soils OU. ROD Amendment, September 2011

	Surface Water			Groundwater	
	State[(1)]			State[(1)]	Federal [(2)]
Compound	Aquatic Life - Acute (µg/L)	Aquatic Life - Chronic (µg/L)	Human Health Standard (µg/L)	Human Health Standard (µg/L)	MCL, MCLG, or Action Level (µg/L)
Arsenic	340	150	10[a]	10[a]	10[a]
Beryllium	None	None	4	4	4
Cadmium	2.13	0.27	5	5	5
Copper	14	9.33	1,000	1,000	1300[b]
Iron	None	1,000	300	N/A	N/A
Lead	81.65	3.18	15	15	15[b]
Zinc	120	110	2000	2000	N/A

Shaded cells indicate standards changed from the 1998 ROD. See discussion in Appendix A, Introduction.

Note: Hardness-dependent values (cadmium, copper, lead, and zinc) are adjusted for a hardness of 100 mg/L as $CaCO^3$.
a - This standard is waived for surface water and ground water within TI Zones as identified in this ROD Amendment. The Aquatic Life - Acute standard and the Aquatic Life - Chronic standard remain ARARs and performance standards for surface water TI reaches.

b - Indicates value is an action level as defined under the copper and lead rule.
1. Revised standards from Montana Numeric Water Quality Standards - Circular DEQ-7. August 2010. http://deq.mt.gov/wqinfo/Standards/default.mcpx Remaining standards from Montana Numeric Water Quality Standards - Circular WQB-7. December 1995.
2. National Primary Drinking Water Regulations; U.S. Environmental Protection Agency; http://www.epa.gov/safewater/contaminants/index.html; for maximum concentration limit (MCLs), see 40 C.F.R. Parts 141 and 142.

A. Revisions to Federal and State Groundwater ARARs.

i. State of Montana requirements.

a. ARM § 17.30.1002 and -1003 (all applicable).

The Montana Water Quality Act, MCA § 75-5-101, et seq., and its implementing regulations establish requirements for restoring and maintaining the quality of surface and ground waters. Both the statute and its implementing regulations have had revisions since 1998, including the groundwater standards described here.

ARM 17.30.1002 and17.30.1003 have been repealed and replaced by ARM 17.30.1005 and ARM 17.30.1006, set forth below. In addition, all State ground and surface water quality regulations now reference DEQ-7, rather than WQB-7 as set forth in the 1998 ROD. DEQ-7 was last updated in August 2010. Like ARM 17.30.1002 and17.30.1003, ARM 17.30.1005 and ARM 17.30.1006 require that concentrations of dissolved substances in Class I or II groundwater not exceed the human health standards listed in DEQ-7. State standards for ground water are set forth in Table 3-1, above.

> ARM 17.30.1005 explains the applicability and basis for the groundwater standards in ARM 17.30.1006, which establish the maximum allowable changes in groundwater quality and may limit discharges to groundwater.
>
> ARM 17.30.1006 provides that groundwater is classified into Classes I through IV based on its specific conductance and establishes the applicable ground water quality standards with respect to each groundwater classification.
>
> Concentrations of dissolved substances in Class I or II groundwater may not exceed the human health standards listed in department Circular DEQ-7.[13] These levels are listed for the primary contaminants of concern in Table 4-1 of the Decision Summary.
>
> Response actions must meet the DEQ-7 standards for all contaminants at the site. In addition, for Class I and Class II ground water, no increase of a parameter may cause a violation of MCA § 75-5-303 (nondegradation).
>
> ARM 17.30.1006 requires that concentrations of other dissolved or suspended substances must not exceed levels that render the waters harmful, detrimental or injurious to public health. Maximum allowable concentrations of these substances also must not exceed acute or chronic problem levels that would adversely affect existing or designated beneficial uses of groundwater of that classification.

[13] Montana Department of Environmental Quality, Water Quality Division, Circular DEQ-7, Montana Numeric Water Quality Standards (August 2010).

ii. Federal Requirements (relevant and appropriate).

The Safe Drinking Water Act, 42 U.S.C. § 300f, et seq., and National Primary and Secondary Drinking Water Regulations, 40 CFR Parts 141 and 142 set forth maximum contaminant levels for drinking water. These have been revised and are set forth in the column for federal MCLs in the groundwater section of Table 3-1, above. These standards would be relevant and appropriate or potentially applicable as described at page A-4 of Appendix A to the original ROD, were it not for the State standards, which control..

B. Revisions to Federal and State Surface Water ARARs.

1. State of Montana Surface Water Quality Requirements, Montana Water Quality Act, MCA § 75-5-101, et seq., and implementing regulations (applicable).

The Montana Water Quality Act and its implementing regulations have been revised since 1998, including the surface water standards described here. ARM 17.30.623 has been revised, one change being the elimination of the language "after conventional water treatment" which previously qualified "concentrations of carcinogenic, bioconcentrating, toxic, radioactive, nutrient, or harmful parameters may not exceed the applicable standards set forth in department Circular DEQ-7." ARM 17.30.637 has also been revised, one change being the elimination of language allowing for short term exemptions. ARM 17.30.705 has also been revised, however the regulation continues to require that existing and anticipated uses of surface water and water quality necessary to support those uses be maintained and protected.

2. Federal Surface Water Quality Requirements, Clean Water Act, 33 U.S.C. §§ 1251, et seq. (applicable). As provided under Section 303 of the Clean Water Act, 33 U.S.C. § 1313, the State of Montana has promulgated water quality standards. See the discussion above under State surface water quality requirements. Federal water quality criteria have changed since 1998, as shown in the columns in Table 3-1 for Federal Criteria Maximum Concentrations, and Criterion Continuous Concentrations, but these have been adopted by the State.

C. Revisions to F**ederal and State Air Standards**.

1. National Ambient Air Quality Standards, 40 CFR § 50.6 (PM-10); 40 CFR § 50.12 (lead) (applicable). These provisions establish standards for PM-10 and lead emissions to air. (Corresponding state standards are found at ARM § 17.8.222 (lead) and ARM § 17.8.223 (PM-10).) The federal lead standard has been revised and is now set at 0.15 ug/m^3.

2. The State air standards are unchanged.

II. LOCATION SPECIFIC REQUIREMENTS

1**. Federal location specific requirements (all applicable).** All federal location specific requirements at pages A-8 through A-9 and A-13 through A-14 are unchanged. Implementing regulations at 36 C.F.R. Part 800 which implement the National Historic Preservation Act, 16

U.S.C. § 470, and at 50 C.F.R. Parts 17 and 402, which implement the Endangered Species Act, 16 U.S.C. § 1531, have been revised. These revisions do not significantly change the application of these requirements. A number of the federal location specific requirements reference 40 C.F.R. Part 6. This has been significantly revised but the application of the provisions for which it has been referenced have not been significantly changed.

2. Montana Natural Streambed and Land Preservation Act and Regulations, MCA § 75-7-101 and ARM §§ 36.2.404, 405, and 406 (applicable). The Montana Natural Streambed and Land Preservation Act and regulations are applicable to remedial action that alters or affects a streambed or its banks. ARM 36.2.404 was repealed and replaced with ARM 36.2.410, with similar requirements.

ARM 36.2.410 establishes minimum standards which would be applicable if a response action alters or affects a streambed, including any channel change, new diversion, riprap or other streambank protection project, jetty, new dam or reservoir or other commercial, industrial or residential development. Projects must be designed and constructed using methods that minimize adverse impacts to the stream (both upstream and downstream) and future disturbances to the stream. All disturbed areas must be managed during construction and reclaimed after construction to minimize erosion. Temporary structures used during construction must be designed to handle high flows reasonably anticipated during the construction period. Temporary structures must be completely removed from the stream channel at the conclusion of construction, and the area must be restored to a natural or stable condition. Channel alterations must be designed to retain original stream length or otherwise provide hydrologic stability. Streambank vegetation must be protected except where removal of such vegetation is necessary for the completion of the project. When removal of vegetation is necessary, it must be kept to a minimum. Riprap, rock, and other material used in a project must be of adequate size, shape, and density and must be properly placed to protect the streambank from erosion. The placement of road fill material in a stream, the placement of debris or other materials in a stream where it can erode or float into the stream, projects that permanently prevent fish migration, operation of construction equipment in a stream, and excavation of streambed gravels are prohibited unless specifically authorized by the district. Such projects must also protect the use of water for any useful or beneficial purpose. See MCA § 75-7-102.

3. Montana Solid Waste Management Act and regulations, MCA § 75-10-201, et seq., ARM § 17.50.505 (applicable). The Montana Solid Waste Management Act and regulations set forth requirements applying to any solid waste management facility. Both the statute and its implementing regulations have had revisions since 1998, with significant repeals, revisions, and replacements of the solid waste regulations. ARM 17.50.505, now repealed, contained landfill location requirements; these are now found in Chapter 50, Subchapter 10.[14] Certain of the location specific requirements are set forth below.

[14] Consult the Montana Administrative Register for a discussion of the repeals, revisions and replacements of the solid waste regulations. 2009 MAR pp. 164, 244-245 (February 26, 2009), 2010 MAR p. 317 (February 11, 2010).

ARM 17.50.1004, Floodplains. A facility located within the 100-year floodplain may not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste that poses a hazard to human health or the environment.

ARM 17.50.1005, Wetlands. A facility may not be located in a wetland, unless there is an adequate demonstration of no practicable alternative and that the location will not cause an environmental impact.

ARM 17.50.1006, Fault Areas. A facility cannot be located within 200 feet (60 meters) of a fault that has had displacement in Holocene time without an adequate demonstration of the structural integrity and protection of human health and the environment.

ARM 17.50.1007 and ARM 17.50.1008, Seismic Areas and Unstable Areas. A facility may not be located in a seismic impact zone or an unstable area without an adequate demonstration by a Montana licensed engineer.

ARM 17.50.1009, Location Restrictions. Sets forth requirements applying to the location of any solid waste facility. Among other things, the location must have sufficient a amount of land, including adequate separation of wastes from underlying groundwater or adjacent surface water; be located in a manner that does not allow the discharge of pollutants in excess of state standards; and be located to allow for closure, post-closure care, and planned uses. The location may not cause or contribute to the taking of any endangered or threatened species of plants, fish, or wildlife, or result in the destruction or adverse modification of the critical habitat of endangered or threatened species. A Class III landfill may not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste so as to pose a hazard to human health, wildlife, or land or water resources.

III. ACTION SPECIFIC REQUIREMENTS

A. Federal and State Water Requirements.

1. Clean Water Act Point Source Discharges requirements, 33 U.S.C. § 1342 (applicable).

Because the State of Montana has been delegated authority to implement the Clean Water Act, these requirements are enforced in Montana through the Montana Pollutant Discharge Elimination System (MPDES). Revisions to the MPDES requirements are set forth below.

2. Additional State of Montana requirements.

a. Water Quality Statute and Regulations (all applicable).

The Montana Water Quality Act has had revisions since 1998, including the surface water requirements described here. MCA § 75-5-605 has changed, as the definition of pollution in the

act, incorporated into MCA § 75-5-605, expanded to also include the discharge, seepage, drainage of any substance into state waters that will likely create a nuisance or render the waters harmful, detrimental or injurious to public health, recreation, safety, welfare, livestock or wild animals.

b. Stormwater Runoff.

General Permits. Each of the general stormwater permits have been revised since the issuance of 1998 ROD. For construction activities: General Discharge Permit for Storm Water Associated with Construction Activity, Permit No. MTR100000 (April 16, 2007) for mining activities: General Discharge Permit for Storm Water Associated with Mining and with Oil and Gas Activities, Permit No. MTR300000 (January 1, 2008) for industrial activities: General Discharge Permit for Storm Water Associated with Industrial Activity, Permit No. MTR000000 (October 1, 2006).

B. Federal and State RCRA Subtitle C Requirements, 42 U.S.C. Section 6921, et seq. (applicable through the authorized State RCRA program for hazardous wastes, relevant and approprate for solid wastes).

Since the issuance of the 1998 ROD, the State hazardous waste regulations have moved from ARM title 54 to ARM title 53. The State regulation which incorporates the federal RCRA Subtitle C requirements by reference is now ARM 17.53.105. Both federal and State regulations have had minor revisions since 1998 which do not significantly affect their application here.

C. Federal and State RCRA Subtitle D and Solid Waste Requirements (all applicable).

1. Federal Solid Waste Requirements. These requirements, set forth at RCRA Subpart D, 42 U.S.C. Subchapter IV, and 40 CFR Part 257, have not been significantly changed since 1998 in any way that would affect the remedy.

2. State of Montana Solid Waste Requirements.

As discussed above in the location specific solid waste ARARs, there have been significant repeals, revisions, and replacements of the solid waste regulations within the past year. ARM 17.50.505, now repealed, contained landfill location requirements; these are now found in Chapter 50, Subchapter 10, ARM 17.50.1002 - ARM 17.50.1009. ARM 17.50.506, now repealed, contained requirements for landfill design criteria; these are now found in Subchapter 12, ARM 17.50.1202 - ARM 17.50.1205. ARM 17.50.510, now repealed, contained requirements for landfill operating criteria; these are now found in Subchapter 11, ARM 17.50.1102, ARM 17.50.1105, ARM 17.50.1107, and ARM 17.50.1108. ARM 17.50.530 and ARM 17.50.531, now repealed, contained requirements for closure and post-closure care; these are now found in Subchapter 14, ARM 17.50.1402 - ARM 17.50.1404. Subchapter 13 contains requirements for ground water monitoring and corrective action. ARM 17.50.523, pertaining to transportation of solid waste, remains. Certain of the action specific requirements are set forth below.

ARM 17.50.1009, Location Restrictions. Requires that facilities not discharge pollutants in excess of state standards; requires drainage structures be installed to control surface water run-off from waste management areas and prevent surface water run-on into waste management areas; and management activities may not cause or contribute to the taking of any endangered or threatened species of plants, fish, or wildlife, or result in the destruction or adverse modification of the critical habitat of endangered or threatened species.

ARM 17.50.1104, Cover Material. Requires that a facility provide temporary cover.

ARM 17.50.1108, Access Requirements. Requires the control of public access as appropriate to protect human health and the environment.

ARM 17.50.1109, Run-On and Run-Off Control Systems. Requires the design, construction, and maintenance of a run-on control system to prevent flow onto the active portion of the solid waste facility during the peak discharge from a 25-year storm and a run-off control system from the active portion of the facility to collect and control at least the water volume result from a 24-hour, 25-year storm.

ARM 17.50.1110, Surface Water Requirements,. Prohibits any discharge of a pollutant from a facility to state waters, including wetlands, and prohibits any discharge from a facility of a nonpoint source of pollution to waters, including wetlands..

ARM 17.50.1111 Liquid Restrictions. Prohibits the placement of liquid waste.

ARM 17.50.1116, Operating Criteria. Requires that management of the facility be confined to areas that can be effectively maintained and operated.

ARM 17.50.1204, Design Requirements. Specifies design requirements for facilities. Facilities must be designed to ensure that standards are not exceeded in the uppermost aquifer.

17.50.1403, Closure Criteria. Requires (a) design and installation of a final cover system that is designed to minimize infiltration and erosion and have a permeability no greater than to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1×10^{-5} cm/sec, whichever is less; (b) minimization of infiltration by the use of an infiltration layer that contains at least 18 inches of earthen material; and (c) minimization of erosion of the final cover by the use of an erosion layer that contains at least six inches of earthen material that is capable of sustaining native plant growth.

ARM 17.50.1404, Post-Closure Criteria. Sets forth post closure care requirements for facilities. Post closure care must be conducted for a period necessary to protect human health and the environment. Post closure care requires maintenance of the integrity and effectiveness of any final cover, including making repairs to the cover as necessary to correct the effects of settlement, subsidence, erosion, or other events; preventing run-on

and run-off from eroding or otherwise damaging the cover; complying with groundwater monitoring requirements; and any other post-closure care requirements necessary to protect human health or the environment. During the post-closure care period adequate vegetative cover must be maintained, and the facility must be annually inspected.

D. Montana Strip and Underground Mine Reclamation Act, MCA § 82-4-201, et seq., (all relevant and appropriate) and Montana Metal Mining Reclamation Act, MCA § 82-4-301, et seq., (relevant and appropriate). The Montana Strip and Underground Mine Reclamation Act and Montana Metal Mining Reclamation Act sets forth requirements for mining in Montana. Both of the statutes have had revisions since 1998, including those described here.

MCA § 82-4-231 added a requirement for designing and constructing reclaimed channels of intermittent and perennial streams to ensure long-term stability.

MCA § 82-4-233, which requires operators to plant vegetation that will yield a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the area and capable of self-regeneration, has been revised to provide more detail to the revegetation requirements.

MCA § 82-4-336 now specifies that reclamation plans need not require the removal of mine-related facilities which are valuable for postmining use. However, the postmining use of the mine-related facilities must be an approved use.

The implementing regulations have also had revisions since 1998, including those described here. Several of the reclamation regulations have been repealed since the issuance of the 1998 ROD. These include ARM 17.24.501A, ARM 17.24.514, ARM 17.24.728, ARM 17.24.730, ARM 17.24.733, and ARM 17.24.824. Yet upon their repeal, the Board of Environmental Review "disagree[d] that the proposed amendments do not provide sufficient standards with which to judge the success of reclamation. The amended rules would continue to provide standards for backfilling and grading (ARM 17.24.501), highwall reduction (ARM 17.24.515), drainage basins (ARM 17.24.634), soils (ARM 17.24.701 and 17.24.702), vegetation (ARM 17.24.711, 17.24.716, 17.24.717, 17.24.724 and 17.24.726) and wildlife (ARM 17.24.751)."[15] Certain reclamation regulations, including some of the regulations cited by the Board of Environmental Review, were promulgated or modified after issuance of the 1998 ROD.

ARM 17.24.634 has been modified to require disturbed drainages be restored to the approximate pre-disturbance configuration. Drainage design must emphasize channel and floodplain dimensions that approximate the pre-mining configuration and that will blend with the undisturbed drainage above and below the area to be reclaimed. The average stream gradient must be maintained with a concave longitudinal profile. This regulation provides specific requirements for designing the reclaimed drainage to: (1) approximate an appropriate geomorphic habit or characteristic pattern; (2) remain in dynamic equilibrium with the system without the use of artificial structural controls; (3) improve unstable premining conditions; (4) provide for floods and for the long-term stability of the landscape; and (5) establish a premining diversity of aquatic habitats and riparian vegetation.

[15] 2004 MAR p. 2577 (October 21, 2004).

ARM 17.24.711 requires that a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the area of land to be affected shall be established except on road surfaces and below the low-water line of permanent impoundments. See also MCA § 82-4-233, MCA (relevant and appropriate). Vegetative cover is considered of the same seasonal variety if it consists of a mixture of species of equal or superior utility when compared with the natural vegetation during each season of the year. This requirement may not be appropriate where other cover is more suitable for the particular land use or another cover is requested by the landowner.

ARM 17.24.717 relates to the planting of trees and other woody species if necessary, as provided in MCA § 82-4-233, to establish a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the affected area and capable of self-regeneration and plant succession at least equal to the natural vegetation of the area, except that introduced species may be used in the revegetation process where desirable and necessary to achieve the approved land use plan.

ARM 17.24.718 requires that soil amendments be used as necessary to supplement the soil and to aid in the establishment of a permanent vegetative cover, only normal husbandry practices may be used to ensure the establishment of vegetation consistent with the approved plan, and reclamation land use practices including, but not limited to, grazing, haying, or chemical applications, may not be conducted in a manner or at a time that interferes with establishment and/or persistence of seeded and planted grasses, forbs, shrubs, and trees or with other reclamation requirements.

ARM 17.24.724 specifies that revegetation success must be measured against approved technical standards or unmined reference areas. Reference areas and standards must be representative of vegetation and related site characteristics occurring on lands exhibiting good ecological integrity. Required management for these reference areas is set forth.

ARM 17.24.726 requires standard and consistent field and laboratory methods to obtain and evaluate revegetated area data with reference area data and/or technical standards, and sets out the required methods for measuring productivity.

The following reclamation regulations have also been modified since issuance of the 1998 ROD: ARM 17.24.635 through 17.24.637, which sets forth requirements for temporary and permanent diversions; ARM 17.24.639, which sets forth requirements for construction and maintenance of sedimentation ponds; ARM 17.24.645 and ARM 17.24.646 which sets forth requirements for groundwater and surface water monitoring; ARM 17.24.701 and 702, which sets forth requirements for removal, redistributing, and stockpiling of soil for reclamation; ARM 17.24.714, which requires soil stabilizing practices; ARM 17.24.716, which establishes methods of revegetation; ARM 17.24.751 which establishes protection and enhancement of fish, wildlife, and related environmental values; and ARM 17.24.761 which sets forth fugitive dust control measures.

E. Air Requirements (all applicable).

ARM 17.8.315, pertaining to nuisance and odor bearing gases, has been repealed.

F. Noxious Weeds, MCA § 7-22-2101(7)(a) and ARM § 4.5.201, et seq.

ARM 4.5.201, et seq., has been revised and updated, including listed noxious weeds species.

Appendix B
Montana DEQ Concurrence Letter

Montana Department of
ENVIRONMENTAL QUALITY
Brian Schweitzer, Governor
P.O. Box 200901 • Helena, MT 59620-0901 • (406) 444-2544 • www.deq.mt.gov

September 16, 2011

Ms. Carol L. Campbell
Assistance Regional Administrator
Ecosystems Protection and Remediation
U.S. Environmental Protection Agency, Region 8

Re: Anaconda Regional Water, Waste and Soils Operable Unit Record of Decision Amendment, September 2011

Dear Ms. Campbell:

This letter provides DEQ's concurrence with the ARWW&S Record of Decision Amendment.

DEQ concurred in the 1998 ARWW&S ROD. In its concurrence letter and related letter from DEQ counsel, DEQ cited its concern with EPA's decision to designate waste management areas without also subjecting its groundwater decision to the technical impracticability process. DEQ's concern remains. Nevertheless, DEQ concurs in this ARWW&S Record of Decision Amendment for the following site-specific reasons. First, DEQ believes the groundwater beneath the designated waste management areas would have been subject to technical impracticability waivers had the technical impracticability process also been followed, and second, EPA's specific designations of waste management areas were subject to public comment through the record of decision process.

EPA's regulatory expectation is that when restoration of ground water is not practicable, EPA will prevent further migration of the plume. The State remains concerned that at the Smelter Hill/Opportunity Ponds and Old Works WMAs, that these wastes will continue to oxidize and that over time, waste sources could have a significantly greater effect on ground water quality than was anticipated at the time of the ROD. If in the future, wells interior to the waste management areas show a significantly excessive increasing trend in contaminants of concern in ground water, there should be additional evaluations, and if needed additional remedial action taken, to assure ground water quality standards are not exceeded at the point of compliance.

Thank you again for review of the ARWW&S ROD Amendment. DEQ sincerely appreciates the active consultation role afforded DEQ in the process.

Sincerely,

Richard H. Opper
Director

Appendix C
Summary of TI Evaluation Cost Estimate

Appendix C
Summary of TI Evaluation Cost Estimates

	North Opportunity		South Opportunity								Spring- Fed Tributaries							
	Base year 2008, 30 year, 7% Discount[1]		Base year 2009, 50 year, 7% Discount[1]								Base year 2009, 50 year, 7% Discount[1]							
	Dutchman/Lost Creek WTP (32 mgd)	Notes	*Contaminated Soil Removal*[8]	Notes	*In-situ GW treatment/ PRB*	Notes	*Upper Willow Creek WTP*[12] *(8 cfs)*	Notes	*Lower Willow Creek WTP*[13] *(5cfs)*	Notes	*Mill Creek WTP*[14] *(3.1 cfs)*	Notes	*Upper Willow Creek WTP*[15] *(5.9 cfs)*	Notes	*Modesty Creek WTP*[15] *(4.2 cfs)*	Notes	*California Creek WTP*[15] *(6.4 cfs)*	Notes
Total Capital Costs	*$45-65 Million*	3,4	*$ 189,354,000*	7	*$ 47,758,000*	9,10	*$ 24,750,000*	3	*$ 14,850,000*	3	*$ 10,110,000*	3	*$ 18,924,000*	2	*$ 13,446,000*	3	*$ 20,417,000*	3
Annual O&M Costs																		
Annual O&M Costs Total	*$ 9,180,000*	5,6	*$ 39,000*		-	*17*	*$ 5,699,000*	5	*$ 4,591,000*	5	*$ 4,035,000*	5	*$ 5,099,000*	5	*$ 4,451,000*	5	*$ 5,294,000*	5
Net Present Value O&M Cost	*$ 113,912,000*		*$ 538,000*		-		*$ 78,648,000*		*$ 63,357,000*		*$ 55,684,000*		*$ 70,368,000*		*$ 61,425,000*		*$ 73,059,000*	
Periodic Costs																		
5-Year Reviews	-	17	*$ 78,000*		*$ 75,000*		*$ 75,000*		*$ 75,000*		*$ 75,000*		*$ 75,000*		*$ 75,000*		*$ 75,000*	
Other Periodic Costs	-	17	-	17	*$ 10,900,000*	*11*	*$ 24,750,000*	*16*	*$ 14,850,000*	*16*	*$ 10,110,000*	*16*	*$ 18,924,000*	*16*	*$ 13,446,000*	*16*	*$ 20,417,000*	*16*
Net Present Value Periodic Cost	-		*$ 187,000*		*$ 11,021,000*		*$ 1,019,000*		*$ 683,000*		*$ 523,000*		*$ 822,000*		*$ 636,000*		*$ 872,000*	
PRESENT VALUE COST[2]	*$159-178 Million*		*$ 190,079,000*		*$ 58,779,000*		*$ 104,417,000*		*$ 78,891,000*		*$ 66,000,000*		*$ 90,000,000*		*$ 76,000,000*		*$ 94,000,000*	

Notes:

1 Costs compiled from cost estimate summaries attached to Technical Impractibility (TI) reports. Time frame and discount rate used per EPA cost estimation guidance.
2 Present Value cost is a sum of Total Capital, Periodic and O&M costs.
3 Capital costs estimated from costing data from EPA Guidance on arsenic treatment, based on 1 mgd (Table 3.4 in EPA 2002)
4 High value is calculated based on direct scale up from price for 1 mgd facility. Low value is calculated based on 70% cost scale up.
5 Costs are based on CDM project specific experience managing the Summitville water treatment plant (1,100 gpm, 7 months/year, 2006 dollars)
6 Dutchman and Lost Creek Annual O&M values increased based on calculated Summitville WTP Annual O&M values.
7 Includes Project and Construction Management, Remedial Design and Technical Support.
8 Removal of approximately 4,100,000 BCY (bank cubic yards) of contaminated material from an area of 3,015 acres and backfill with 4,600,000 LCY (loose cubic yards) of borrow material.
9 Dimensions of PRB: Length - 15,000 linear feet, Depth - 10 feet, Thickness - 3 feet.
10 PRB composition: 50/50 mixture of zero valent iron and sand.
11 Periodic maintenance cost at 25% capital cost every 10 years.
12 Flow rate determined slightly higher than average annual discharge.
13 Flow rate to account for groundwater gain between Upper and Lower Willow Creek.
14 Flow rate determined based on average annual discharge of creek.
15 Flow rate was estimated as proportional to Upper Willow Creek based on watershed area.
16 Complete WTP replacement in year 50
17 If cell is blank, no information was provided in TI reports or cost estimate summaries for this category.

Appendix D
Physical and Chemical Characterization of the 1998 Subareas in the ARWW&S OU

Appendix D

Physical and Chemical Characterization of the 1998 Subareas in the ARWW&S OU

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TABLE D-1

Surface Water Exceedance Summary µg/l
ARWW&S OU

Analyte	Standard	Number of Exceedances/Number of Samples							
		Lost Creek		Warm Springs Creek		Mill Creek		Willow Creek	
		Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
Total Arsenic	Montana: 18 µg/l	3/14	4/12	0/51	1/42	12/15	21/21	10/10	24/25
Dissolved Arsenic	Montana: 18 µg/l	1/14	3/12	0/51	0/42	9/15	21/21	9/10	25/29
Total Arsenic	MCL: 50 µg/l	0/14	0/11	0/51	0/42	2/15	7/21	0/9	19/26
Dissolved Arsenic	MCL: 50 µg/l	0/14	0/11	0/51	0/42	1/15	6/21	0/9	18/28
Total Cadmium	AQWC[1]: Acute	0/12	0/11	0/51	0/42	2/15	0/31	1/9	3/25
Dissolved Cadmium	AQWC[1]: Acute	0/12	0/11	0/51	0/42	1/15	0/31	1/9	3/29
Total Cadmium	AQWC[1]: Chronic	0/12	0/11	0/51	0/42	2/15	1/31	2/9	5/25
Dissolved Cadmium	AQWC[1]: Chronic	0/12	0/11	0/51	1/42	1/15	1/31	1/9	6/29
Total Copper	AQWC[1]: Acute	2/12	0/11	5/51	6/42	3/15	6/31	2/9	8/25
Dissolved Copper	AQWC[1]: Acute	0/12	0/11	0/51	2/42	2/15	5/31	3/9	8/29
Total Copper	AQWC[1]: Chronic	2/12	0/11	6/51	8/42	6/15	11/31	4/9	12/25
Dissolved Copper	AQWC[1]: Chronic	0/12	0/11	1/51	2/42	2/15	8/31	2/9	12/29
Total Lead	AQWC[1]: Acute	0/12	0/11	0/51	0/42	0/15	0/31	0/9	0/25
Dissolved Lead	AQWC[1]: Acute	0/12	0/11	0/51	0/41	0/15	0/31	0/9	0/29
Total Lead	AQWC[1]: Chronic	0/12	0/11	9/51	8/42	4/15	11/31	5/9	4/25
Dissolved Lead	AQWC[1]: Chronic	0/12	0/11	1/51	0/41	1/15	6/31	2/9	2/29
Total Zinc	AQWC[1]: Acute	0/12	0/11	0/51	0/42	0/15	0/31	0/9	0/25
Dissolved Zinc	AQWC[1]: Acute	0/12	0/11	0/51	0/41	0/15	0/31	0/9	0/29
Total Zinc	AQWC[1]: Chronic	0/12	0/11	0/51	1/42	0/15	0/31	0/9	0/25
Dissolved Zinc	AQWC[1]: Chronic	0/12	0/11	0/51	0/41	0/15	0/31	0/9	0/29

Source: ESE 1996

Reach delineations:
Upper Lost Creek: LC-1, LC-2, LC-3
Lower Lost Creek: LC-4, LC-5, LC-6
Upper Warm Springs Creek: WS-1, WS-2, WS-3
Lower Warm Springs Creek: WS-4, WS-5, WS-6
Upper Mill Creek: MC-7, MC7a
Lower Mill Creek: MC-8, MC-10a
Lower Willow Creek: WC-13
Lower Willow Creek: WC-12, WC-14, WC-15

Note: Concentrations of constituents in surface water that are greater than the chronic AQWC and SSWQC are not necessarily exceedances. Samples cited are instantaneous, not for a continuous 96-hour period.

TABLE D-2

Summary of Areas of Concern in the ARWW&S OU

Subarea	Area of Concern	Area (acres)	Volume
Opportunity Ponds	Opportunity Ponds	3,600[b] *	129,300,000 cy[b]
	Toe Area Wastes	26	60,000 cy[b]
	S. Lime Ditch	490[b] *	1,700,000 cy[b]
	Triangle Wastes	300[b] *	1,400,000 cy[b]
	Contaminated Soils/Barren or Poor Vegetation Condition	1,095[a] **	NR
	Groundwater Contamination (alluvial aquifer)	2,275[c] B	4,550 to 11,375 ac-ft
North Opportunity	Contaminated Soils/Barren or Poor Vegetation Condition	1,105[a] **	NR
	Streamside Tailings - Warm Springs Creek	0.4 *	1116 cy[b]
South Opportunity	Contaminated Soils/Barren or Poor Vegetation Condition	500[a] **	NR
	Streamside Tailings - Willow Creek	65[b] *	157,000 cy[b]
	Yellow Ditch	9[b] *	120,000 cy[b]
	Blue Lagoon (including RR grade and contaminated Blue Lagoon sediment)	NR	71,000 cy[b]
	Groundwater Contamination (alluvial aquifer)	1,200[c] B	2,400 to 7,200 ac-ft
Old Works/ Stucky Ridge	Contaminated Soils/Barren or Poor Vegetation Condition	6,625 **	NR
	Groundwater Contamination (alluvial aquifer)	320[c] B	640 ac-ft
	Groundwater Contamination (bedrock aquifer)	4,771[d] BB	9,542 to 54,867 ac-ft
Smelter Hill	Proposed Waste Left in Place Areas (Disturbed Area, Main Slag Pits, Anaconda Ponds)	1,492 *	124,900,000 cy
	West Stack Slag	5.2 *	56,000 cy
	Contaminated Soils/Barren or Poor Vegetation Condition (includes Nazer Gulch debris)	3,700[a] **	NR
	East Anaconda Yard Wastes	171 *	480,000 cy
	Cabbage Gulch Surface Water Contamination	NR	NR
	Groundwater Contamination (alluvial aquifer)	990 B	1,980 to 3,960 ac-ft
	Groundwater Contamination (bedrock aquifer)	23,830[d] BB	47,660 to 274,045 ac-ft

[a]CDM Federal, 1996
* wastes cy = cubic yards
[b]ARCO, 1996a
** soils
ac-ft = acre-feet
[c]ARCO, 1996b
B alluvial ground water
NR = Not Reported
[d]TI Addendum (Appendix D)
BB bedrock ground water

TABLE D-3

Physical Composition of Tailings in Opportunity Ponds
ARWW&S OU

Parameter	Tailings Thickness (feet)	Grain Size Distribution (%)			
		Gravel	Sand	Silt	Clay
Maximum	48.3	59.5	91.2	88.2	55
Minimum	15	0.0	0.1	1.7	2.1
Arithmetic Mean	28.5	2.2	37.7	44.2	16.7
Standard Deviation	11	8.7	26.6	20.4	11
Geometric Mean	26.7	NR	26.1	36.7	13.3
Number of Samples	16	136	136	136	136

NR = not reported
Source: ESE 1996

TABLE D-4

Statistical Comparison of Chemical Analyses for Opportunity Ponds Tailings and Alluvium
ARWW&S OU

	Statistical Parameter	Slurry pH (S.U.)	Total Sulfur (%)	Pyritic Sulfur (%)	Leachable Sulfur (%)	Carbonate (%)	Arsenic (mg/kg)	Cadmium (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Lead (mg/kg)	Manganese (mg/kg)	Zinc (mg/kg)
Top of Tailings (0-3 feet)	# of Samples	19	9	9	9	19	19	19	19	19	19	19	19
	Maximum	7.45	5.09	4	1.37	2.26	505	9.7	3,130	58,100	1,730	2,600	1,230
	Minimum	2	0.9	0.01	0.04	0.01	35	2	164	12,500	20	105	60
	Arithmetic Mean	4.57	2.02	0.77	0.67	0.33	193	3.7	897	32,086	627	779	448
	Standard Deviation	2.08	1.29	1.47	0.52	0.57	113	2	794	10,454	411	778	316
	Geometric Mean	4.1	1.75	0.06	0.44	0.15	161	3.3	659	30,410	462	455	350
Base of Tailings (interval from 0-3 inches above the tailings/alluvium interface and represents the lowermost tailings sample collected in each borehole)	# of Samples	16	6	6	6	16	16	16	16	16	16	16	16
	Maximum	7.4	10.23	4.43	0.26	7.27	860	13	5,920	71,500	888	9,020	2,740
	Minimum	4.4	0.5	0.01	0.01	0.06	71	2	1,010	9,440	39	315	125
	Arithmetic Mean	5.8	4.44	1.43	0.12	0.8	338	7.1	2,531	37,346	367	3,106	1,417
	Standard Deviation	0.9	3.58	1.99	0.09	1.77	215	3.3	1,128	19,766	231	2,595	725
	Geometric Mean	5.73	2.87	0.21	0.08	0.31	277	6.2	2,336	31,468	296	2,165	1,166
Top of Alluvium (represents the uppermost alluvial core sample and the top 1-3 feet of alluvial material)	# of Samples	16	6	6	6	16	16	16	16	16	16	16	16
	Maximum	7.3	3.4	2.23	0.38	35.2	1,600	30	6,830	78,100	658	3,610	7,730
	Minimum	3.5	0.14	0.01	0.01	0.01	23	2	128	3,850	16	314	44
	Arithmetic Mean	6.18	1.53	0.41	0.11	8.07	508	10.3	2,453	28,959	235	1,433	2,242
	Standard Deviation	0.96	1.22	0.89	0.14	10.74	504	8.9	2,156	23,153	200	1,156	2,148
	Geometric Mean	6.1	0.97	0.06	0.06	1.43	280	6.8	1,430	21,334	151	1,048	1,149
Alluvium Beneath Tailings/Alluvium Interface (represents all alluvial samples collected from 3-21 feet below the tailings/alluvium interface)	# of Samples	39	17	17	18	36	36	36	36	36	36	36	36
	Maximum	8.3	1.57	1.08	0.1	32.6	370	7.7	1,420	60,300	300	2,270	4,260
	Minimum	4.9	0.1	0.01	0.01	0.15	2	0.4	5	7,726	2	154	19
	Arithmetic Mean	7.34	0.38	0.11	0.03	7.19	57	2	267	14,578	50	560	381
	Standard Deviation	0.74	0.49	0.26	0.03	7.5	83	1.6	345	10,412	66	563	719
	Geometric Mean	7.3	0.21	0.04	0.02	3.79	27	1.5	123	12,871	26	397	167
Alluvium Downgradient of the Tailings	# of Samples	122	22	22	22	22	22	22	22	22	22	22	22
	Maximum	8.6	0.1	0.13	0.23	32.1	20	1	38	26,300	31	3,334	85
	Minimum	6.6	0.1	0.01	0.01	0.15	2	0.4	6	3,255	2	32	17
	Arithmetic Mean	7.78	0.1	0.05	0.02	4.2	6	0.4	22	11,966	12	569	40
	Standard Deviation	0.32	0	0.04	0.05	7.18	4	0.1	9	5,382	8	714	21
	Geometric Mean	7.77	0.1	0.04	0.02	0.98	5	0.4	20	10,884	10	318	36

mg/kg = milligrams per kilogram
S.U. = Standard Units

TABLE D-5

Geochemical Zones as Determined from Lithologic Color Descriptions and Chemical Analyses for Borehole 88 in Cell C-1 of Opportunity Ponds ARWW&S OU

Sample Number	Depth Interval (feet)	Description	Color	Slurry pH (S.U.)	Carbonate (%)	Arsenic (mg/kg)	Cadmium (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Lead (mg/kg)	Manganese (mg/kg)	Zinc (mg/kg)	Geo-chemical Zone
TL- 146	0-3	Tailings	white and yellow	5.35	0.26	160	2.5	513	32,600	812	2,040	592	oxidized
TL- 149	4-7	Tailings	yellow, brown, olive, and gray	4.75	0.42	310	7.0	2,720	61,400	498	3,480	2,390	transition
TL-151	7-10	Tailings	gray and brown	5.90	0.79	170	3.9	1,900	66,000	335	3,960	2,320	reduced
TL-153	10-13	Tailings	gray and brown	6.70	0.73	160	3.7	1,610	63,000	294	3,680	1,610	reduced
TL-155	16-19	Tailings	gray and brown	7.20	0.29	200	2.2	1,560	65,900	214	2,200	420	reduced
TL-157	16-19	Tailings	gray and brown	6.80	0.57	250	4.8	2,810	52,400	303	3,930	1,310	reduced
TL-159	19.3-20.5	Tailings	gray and black	7.05	27.50	540	19.0	6,830	16,400	127	3,240	2,910	---
TL- 161	21-22.5	Tailings	gray and black	7.10	20.10	91	<2.0	273	11,900	105	1,760	860	---

mg/kg = milligrams per kilogram
S.U. = Standard Units
Source: ESE 1996

TABLE D-6

Summary of Lysimeter Data for Opportunity Ponds
ARWW&S OU

Lysimeter	Date	Depth (feet)	pH (S.U.)	Slurry pH (S.U.)	Dissolved Oxygen (mg/L)	Eh (mV)	As (µg/l)	Cd (µg/l)	Cu (µg/l)	Fe (µg/l)	Mn (µg/l)	Pb (µg/l)	Zn (µg/l)	Sulfate (mg/L)
Summary of Tetra Tech (1985) Lysimeter Data														
A Cell (near well 95) Shallow	6/12/85	5	---	3-7.5	---	---	49.0	680	58,000	4,600	32,000	50.0	49,000	1,640
	8/8/85	5	4.6	3.4	5.1	+350	9.0	810	120,000	2,100	40,000	80.0	65,000	---
	9/19/85	5	3.4	---	5.5	+450	24.0	1,600	339,000	1,400	64,000	76.0	94,000	---
	10/19/85	5	3.2	---	4.5	---	14.0	820	195,000	1,600	33,000	98.0	51,000	3,330
A Cell (near well 95) Deep	6/12/85	9	---	7.5-10.5	---	---	26.0	1,000	58,000	200	143,000	80.0	192,000	2,260
	8/8/85	9	5.8	5.1	4	+350	17.0	990	51,000	140	149,000	70.0	201,000	---
	9/19/85	9	5	---	6.4	+310	---	---	---	---	---	---	---	---
	10/19/85	9	5.1	---	3.2	---	8.0	640	24,500	24.5	96,000	60.0	109,000	2,320
C2 Cell (near well 85) Deep	6/12/85	4.8	---	(	---	---	31.0	130	1,700	1,000	111,000	50.0	16,000	---
	8/8/85	4.8	---	---	---	---	---	---	---	---	---	---	---	---
	9/19/85	---	---	---	3.8	+250	20.0	190	1,900	1,300	200,000	15.0	26,000	---
	10/19/85	4.8	6	---	6	---	---	---	---	---	---	---	---	---
C2 Cell (near well 85)	6/12/85	7.5	---	(	---	---	34.0	110	1,300	200	144,000	50.0	12,000	---
	8/8/85	7.5	---	---	---	---	---	---	---	---	---	---	---	---
	9/19/85	7.5	6.5	---	2.6	+230	28.0	100	890	1,200	127,000	15.0	13,000	---
	10/19/85	7.5	6.6	---	3.4	+260	15.0	60.0	400	100	64,000	54.0	6,500	---

TABLE D-6 (continued)

Summary of Lysimeter Data for Opportunity Ponds
ARWW&S OU

Summary of ESE (1993) Lysimeter Data														
D2 Cell (near well 84)														
R4 No.3	9/3/93	2.5	---	---	---	---	---	---	---	---	---	---	---	---
	9/23/93	2.5	1.16	---	---	---	---	---	---	---	---	---	---	---
R4 No.7	9/3/93	6	3.66	---	---	---	9,470	801	2,390,000	309,000	2,940,000	4,070	419,000	26,300
	9/23/93	6	2.74	---	---	---	133	813	1,670,000	3,150,000	2,320,000	40.1	392,000	19,840
R4 No.6	9/3/93	10	5.19	---	---	---	917	64.0	8,580	205,000	300,000	344	49,000	3,280
	9/23/93	10	3.97	---	---	---	3.8	38.0	2,780	721,000	259,000	26.3	35,000	2,500
C2 Cell (near well 89)														
R5 No.2	9/3/93	2	2.26	---	---	---	2,010	109	64,000	11,300,000	25,800	89,800	78,700	52,700
	9/23/93	2	1.77	---	---	---	11,500	25.7	57,100	12,100,000	182,000	754	87,800	---
R5 No.5	9/3/93	5	3.25	---	---	---	---	---	---	---	---	---	---	---
	9/23/93	5	2.71	---	---	---	---	---	---	---	---	---	---	---

--- = insufficient sample quality for chemical analysis
S.U. = Standard Units
µg/l = micrograms per liter

(= ground water monitoring well MW-86 had a pH ranging from 3.1 to 4.6 during 1985
mV = millivolts
mg/L = milligrams per liter

TABLE D-7

Concentrations of Arsenic and Metals in Sediments from Triangle Waste Area ARWW&S OU

Analyte	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Geometric Mean Concentration (mg/kg)
Arsenic	<5.8	3,370	160
Cadmium	<3.8	78.6	5.5
Copper	17	49,800	779
Manganese	145	3,250	382
Zinc	43	19,100	612

< = less than detection limit
mg/kg = milligrams per kilogram
Source: ESE 1996

TABLE D-8

Concentrations of Arsenic and Metals in Soils of the South Lime Ditch Area
ARWW&S OU

Analyte	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Geometric Mean Concentration (mg/kg)
Arsenic	<5.8	2,190	39
Cadmium	<3.8	35.7	4.3
Copper	<13.4	25,800	167
Manganese	103	28,200	409
Zinc	22.2	7,690	167.2

< = less than detection limit
Source: ESE 1996

TABLE D-9

**Summary Statistics for Network Wells in Opportunity Ponds Subarea
During the Anaconda Regional Water and Waste Remedial Investigation
ARWW&S OU**

Well Number	Analyte	Maximum	Minimum	Mean	Standard Deviation	Median	Geometric Mean	Number of Samples
MW-76	Arsenic	3.20	0.50	1.61	0.98	1.28	1.30	8
	Cadmium	2.50	0.11	1.37	0.66	1.40	1.07	8
MW-78	Arsenic	4.00	0.50	1.64	1.28	1.25	1.19	8
	Cadmium	1.95	0.11	1.26	0.52	1.40	1.02	8
MW-78	Arsenic	4.10	0.50	1.71	1.26	1.43	1.29	8
	Cadmium	**5.30**	0.11	1.74	1.44	1.40	1.19	8
MW-81	Arsenic	3.20	0.50	1.35	1.08	0.75	1.00	8
	Cadmium	3.90	0.11	1.51	1.01	1.40	1.11	8
MW-90	Arsenic	**302**	**254**	**280**	15.9	**285**	**279**	8
	Cadmium	4.00	0.10	1.48	1.20	1.30	0.85	8
MW-212	Arsenic	1.90	0.65	1.36	0.44	1.30	1.28	6
	Cadmium	1.95	0.11	1.27	0.58	1.40	0.96	6
MW-214	Arsenic	2.70	0.65	1.53	0.69	1.50	1.37	6
	Cadmium	3.50	0.17	1.61	1.01	1.48	1.18	6
MW-215	Arsenic	**22.3**	2.60	12.62	6.08	13.70	10.53	6
	Cadmium	**12.5**	0.11	3.66	4.23	1.63	1.64	6
MW-216	Arsenic	13.20	1.70	6.02	3.94	5.70	4.83	5
	Cadmium	2.00	1.10	1.57	0.35	1.50	1.53	5
MW-217 D	Arsenic	1.50	0.50	1.00	0.41	1.00	0.91	6
	Cadmium	2.50	0.04	1.40	0.76	1.40	0.86	6
MW-217 S	Arsenic	**352**	**228**	**282**	**48**	**274**	**278**	6
	Cadmium	3.00	0.11	1.49	0.87	1.40	1.06	6
MW-219	Arsenic	3.10	0.50	2.02	0.89	1.95	1.74	6
	Cadmium	2.00	0.12	1.28	0.59	1.40	0.97	6
MW-221	Arsenic	14.40	4.10	8.83	3.34	8.90	8.16	6
	Cadmium	1.95	0.04	1.26	0.61	1.40	0.81	6
MW-222	Arsenic	3.30	0.49	1.81	1.14	1.83	1.37	6
	Cadmium	4.00	0.05	1.60	1.19	1.40	0.94	6
MW-223	Arsenic	4.80	1.75	3.21	1.03	3.40	3.03	6
	Cadmium	1.95	0.08	1.26	0.59	1.40	0.91	6
MW-224	Arsenic	1.90	0.50	1.18	0.53	1.20	1.04	6
	Cadmium	1.95	0.04	1.26	0.61	1.40	0.81	6
MW-230	Arsenic	2.40	0.65	1.49	0.64	1.40	1.34	5
	Cadmium	1.95	0.05	1.21	0.65	1.30	0.75	5
MW-234 D	Arsenic	2.70	0.85	1.75	0.64	1.70	1.62	5
	Cadmium	1.95	0.04	1.21	0.65	1.30	0.71	5
WSP1D	Arsenic	5.40	1.00	3.07	1.20	3.15	2.79	8
	Cadmium	2.60	0.04	1.42	0.78	1.58	0.93	8
WSP6S	Arsenic	5.80	2.10	3.69	1.01	3.70	3.55	8
	Cadmium	2.00	0.11	1.26	0.63	1.40	0.97	8
WSP9	Arsenic	9.30	3.80	6.66	1.94	6.50	6.35	8
	Cadmium	4.00	0.04	1.44	1.10	1.40	0.89	8

All units in micrograms per liter (µg/l).
For values reported at less than instrument detection limit, one-half the reported value was used in statistical evaluations.
Exceedances of the State of Montana Ground Water Quality Standard for arsenic (18µg/l) and cadmium (5µg/l) are shown in bold.
Source: ESE 1996

TABLE D-10

Analytical Results for Non-Network Wells and Well Points in Opportunity Ponds Subarea ARWW&S OU

Location	Well ID	Sample Date	Arsenic (µg/l)	Cadmium (µg/l)
Triangle Waste	10	2Q=95	<1	<0.1
	69	2Q=95	<1	<0.1
	212	3Q=95	2.0	<0.1
	243	4Q=95	<1	<0.1
Opportunity Ponds	26s	3Q=95	<1	<0.1
	26m	3Q=95	<1	<0.1
	28s	3Q=95	4.0	<0.1
	28m	3Q=95	<1	<0.1
	31s	3Q=95	<1	<0.1
	31m	3Q=95	3.0	<0.1
	76	3Q=93	<2	<2.6
	77	2Q=93	4.4	<0.1
	78	3Q=93	<1.7	<2.6
	79	3Q=93	<3.5	<2.6
	81	3Q=93	<1.7	<2.6
	90	3Q=93	**284.0**	<0.2
	214	3Q=93	<1.7	<2.6
	215	3Q=93	13.3	<2.6
	219	3Q=93	<6	<2.6
	230	3Q=93	1.0	<2.6
	GPB	4Q=94	**427.0**	0.1
	GPC	4Q=94	2.0	<0.1
	GPD	4Q=94	3.0	0.1
	GPE	4Q=94	6.0	0.1
Anaconda Ponds	36S	4Q=95	<1	<0.1
	36D	4Q=95	<1	0.3
	75	2Q=93	<0.98	**7.9**
	218d	3Q=93	<6.4	<2.6
	218s	3Q=93	**38.5**	<9.9
Old Works	207	3Q=93	<1	<0.1
	208	3Q=93	<1	<1
	209	3Q=93	<1	**5.9**
	240	4Q=95	---	0.2
	242	4Q=95	---	0.3
South Lime Ditch	216	3Q=93	13.2	<2.6
	217d	3Q=93	<2.7	<2.6
	217s	3Q=93	**339.0**	<2.6
	HP-6	4Q=95	6.0	1.2
	HP-7	4Q=95	<1	0.2
	HP-8	4Q=95	2.0	**9.0**
Warm Springs Ponds	221	3Q=93	5.9	<2.6
	222	3Q=93	<1	<2.6
	223	3Q=93	3.8	<2.6
	234D	3Q=93	<1.7	<2.6
	CFR-3	3Q=93	<1.6	<2.6
Airport	224	3Q=93	<1.7	<2.6
Silver Bow Creek	WSP-1D	3Q=93	2.3	2.6
	WSP-6S	3Q=93	5.8	<2.6
	WSP-9	3Q=93	6.0	<2.6
East of Opportunity Ponds	GPA	4Q=94	2.0	<0.1

< = less than detection limit

Exceedances of the State of Montana Ground Water Quality Standard for arsenic (18µg/l) and cadmium (5µg/l) are shown in bold. Source: ESE 1996

TABLE D-11

Summary of Soil and Sediment Sampling Results from Yellow Ditch
ARWW&S OU

Solid Matrix Screening Study (CDM 1987)						
Station	**Depth Interval (inches)**	**Arsenic (mg/kg)**	**Cadmium (mg/kg)**	**Copper (mg/kg)**	**Lead mg/kg)**	**Zinc (mg/kg)**
SS-002 sediment in ditch	0-3	<75	---	576	722	827
	3-6	<75	---	1,170	1,130	1,340
	6-12	<75	---	1,020	947	1,190
	12-20	<75	---	725	964	1,190
SS-003 berm material	0-3	<75	---	678	1,030	1,180
	3-6	<75	---	985	985	647
	6-12	<75	---	430	569	660
	12-20	<75	---	1,240	213	394

Phase I and II Anaconda Soils Investigation Along Yellow Ditch (PTI 1992, 1993b)						
Analyte	**Depth Interval (inches)**	**Number of Samples**	**Minimum (mg/kg)**	**Maximum (mg/kg)**	**Mean (mg/kg)**	**Geometric Mean (mg/kg)**
Arsenic	0-2	28	<29	846.0	215.7	158.5
Cadmium	0-2	28	0.8	9.4	3.5	2.5
Copper	0-2	28	37.0	1,490	462.2	316.2
Lead	0-2	28	<23	829.0	212.9	125.9
Zinc	0-2	28	61.0	560.0	445.0	316.2
Arsenic	2-10	28	<29	1,170.0	174.7	100.0
Cadmium	2-10	28	0.2	10.8	1.9	1.0
Copper	2-10	28	27.0	7,240.0	610.8	154.9
Lead	2-10	28	23.0	641.0	141.8	70.8
Zinc	2-10	28	34.0	2,210.0	381.8	177.8

ARWW 3rd Quarter 1993 Waste Characterization (ESE 1994)						
Station	**Depth Interval (feet)**	**Arsenic (mg/kg)**	**Cadmium (mg/kg)**	**Copper (mg/kg)**	**Lead mg/kg)**	**Zinc (mg/kg)**
SBL-3 sediment in ditch	0-2	115.0	<3.8	577.0	91.3	295.0
	2-4	93.8	<3.8	137.0	187.0	212.0
	4-6	305.0	<3.8	257.0	116.0	197.0
	6-8	9.6	12.6	2,190.0	29.4	2,990.0

Phase I and II ARWW&S OU Feasibility Study Soil Sample Results Along Yellow Ditch (ARCO 1996c)						
Berm Material (Depth Interval)	**Number of Samples**	**Arsenic (mg/kg)**	**Cadmium (mg/kg)**	**Copper (mg/kg)**	**Lead mg/kg)**	**Zinc (mg/kg)**
Red (0-2 inches)	3	184-255	2.27-3.02	406-645	172-237	361-572
Red (2-10 inches)	2	21.9-273	0.98-3.96	105-496	26.8-201	155-511
Red (10-24 inches)	2	<5.68-202	1.52-5.79	58.1-756	25.7-174	73.6-1,010
Yellow (0-2 inches)	2	153-349	1.68-5.85	254-640	106-206	108-218
Yellow (2-10 inches)	2	46-125	1.66-2.73	103-1,520	19.7-116	83.8-233
Yellow (10-24 inches)	2	63.7-224	1.75-4.68	77.7-2,410	19.7-120	95.9-352
Native (0-2 inches)	3	38-83.7	1.68-3.95	75.4-114	28-36.3	91.1-158
Native (2-10 inches)	2	35.8-54.7	<0.59	14.8-23	8.58-10.4	29.3-35.8
Native (10-24 inches)	2	18.5-38.7	<0.6	11.7-98	9.24-24.6	25.8-94.2

Anaconda Soils Investigation, Phase I, South Opportunity Area (PTI 1992)						
Analyte	**Depth Interval (inches)**	**Number of Samples**	**Minimum (mg/kg)**	**Maximum (mg/kg)**	**Mean (mg/kg)**	**Geometric Mean (mg/kg)**
Arsenic	0-2	14	55.0	488	201.9	163.8
Cadmium	0-2	14	1.8	48.0	9.1	6.3
Copper	0-2	14	114	1,880	573.9	411.8
Lead	0-2	14	66.0	769	191.7	151.5
Zinc	0-2	14	149.0	1,650	509.6	374.5

--- = not analyzed
< = less than detection limit
mg/kg = milligrams per kilogram

TABLE D-12

Summary of Arsenic and Metals Concentrations in Soil and Waste Samples in the Vicinity of the Blue Lagoon ARWW&S OU

Sample ID	Number of Samples	Location	Depth Interval (feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Copper (mg/kg)	Lead mg/kg)	Zinc (mg/kg)	Reference
SS-002	4	Yellow Ditch sediments	0-1.6	<75	---	576-1,170	722-1,130	827-1,340	CDM 1987
SBL-3	4	Yellow Ditch sediments	0-8	9.6-305	<3.8-12.6	137-2,190	29.4-187	197-2,990	ESE 1994
SS-003	4	Yellow Ditch berm material	0-1.6	<75	---	430-1,240	213-1,030	394-1,180	CDM 1987
RTYD5	4	Yellow Ditch berm material	0-0.83	<29-266	<0.2-4.8	32-440	<23-89	80-203	ESE 1994
SL-001	1	Near railroad bed	0-0.25	<75	---	44	242	642	CDM 1987
SBL-5	2	Near railroad bed	0-6	38.1-346	<3.8-4.2	850-1,200	16.8-222	1,080-1,680	ESE 1994
YD-RR-01	1	Railroad bed	0-0.17	391	8.27	4,170	360	4,700	ARCO 1996c
YD-RR-02	1	Railroad bed	0.17-0.83	353	3.3	3,310	327	2,410	ARCO 1996c
YD-RR-03	1	Railroad bed	0.83-2	36.4	2.51	9,090	34.7	1,620	ARCO 1996c
YD-RR-04	1	Railroad bed	0-0.17	305	6.07	5,660	264	2,970	ARCO 1996c
YD-RR-05	1	Railroad bed	0.17-0.83	297	3.91	3,370	244	1,190	ARCO 1996c
YD-RR-06	1	Railroad bed	0.83-2	26.5	0.685	2,540	18.8	1,200	ARCO 1996c
RTYD5	1	Area of reported spill	0-0.17	237	2.6	88,700	---	2,010	PTI 1992, 1993
YD5	10	Area of reported spill	0-3.0	52-448	---	142-139,000	---	347-3,290	PTI 1992, 1993
SBL-1	6	Outside outwash area	0-8	<5.8-89.9	<3.8	13.4-111	9.4-17.1	88.3-339	ESE 1994
SBL-6	3	Outside outwash area	0-10	9.3-84.5	<3.8	24.7-1,930	<8.3-44.1	72.7-1,220	ESE 1994
SBL-7	3	Outside outwash area	0-7	<5.8-39.7	<3.8	<13.4-57.9	<8.3-23.6	76.2-98.9	ESE 1994
SBL-2	6	Outwash area	0-7.5	10.6-113	<3.8-9	1,830-11,300	<8.3-57.9	797-3,850	ESE 1994
SBL-4	4	Outwash area	0-12	<5.8-118	<3.8-10	32.6-2,030	11.5-69.7	358-2,970	ESE 1994
SBL-8	3	Outwash area	0-8	<5.8-39.7	<3.8	16.1-699	11-26.1	1,490-1,890	ESE 1994
MW-235	3	Outwash area	0-6	8.4-56.8	3.9-10.6	2,200-3,430	10.9-30.7	1,490-1,890	ESE 1994
SL-005	1	Outwash area	0-0.25	<75	---	>3,000	272	1,190	CDM 1987

C = not analyzed
< = less than detection limit
mg/kg = milligrams per kilogram

TABLE D-13

Summary of Arsenic and Metals Concentrations in Soils and Tailings in the MW-225 Area
ARWW&S OU

Sample Location	Sample Number	Depth (feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Copper (mg/kg)	Lead mg/kg)	Zinc (mg/kg)
Within defined area of tailings	SBW-2	0.0-0.4	614	13.2	3,210	1,200	4,000
		0.0-2.5	29.3	<3.8	98.3	42.5	193
	SBW-3	0.0-1.0	539	3.8	5,020	267	2,410
	SBW-5	0.0-1.5	746	10.2	2,110	1,680	4,680
	SBW-6	0.0-0.75	725	13.1	2,610	1,550	4,430
		0.75-2.0	53.5	25.7	1,340	71.8	5,330
	SBW-7	0.0-1.0	615	10	2,080	1,340	2,790
		1.0-2.0	93.9	13.6	1,850	942	3,380
		2.0-2.5	23	<3.8	264	111	912
Outside defined area of tailings	SBW-1	0.0-3.0	166	<3.8	566	169	560
	SBW-4	0.0-3.0	35.8	<3.8	100	36.9	137
	SBW-8	0.0-2.0	78.9	<3.8	152	45.3	143
	SBW-9	0.0-2.5	109	<3.8	96.7	30.8	114
	SBW-10	0.0-2.0	35.5	<3.8	182	24.9	143

< = less than detection limit
mg/kg = milligrams per kilogram
Source: ESE 1996

TABLE D-14

Arsenic Concentrations in Ground Water in the South Opportunity Subarea ARWW&S OU

Sample Number	Sample Date	Arsenic (µg/l)
Springs/Seeps		
SS-T1	August 1995	5.0
SS-T2	August 1995	**78.0**
SS-T17	October 1995	**80.0**
SS-T18	October 1995	**23.0**
Hydro-Punch		
HP-1	September 1995	7.0
HP-2	September 1995	**24.0**
HP-4	October 1995	5.0
HP-5	October 1995	2.0
HP-9	October 1995	10.0
HP-11	October 1995	**249.0**
ARWW Wells		
MW-225	July 1995	10.0
MW-231	July 1995	4.0
MW-232	July 1995	**120.0**
MW-235	July 1995	<1
Rural Wells		
DW-SO2	August 1995	2.0
DW-SO16	August 1995	3.0
GW-SO46	August 1995	**29.0**
GW-SO57	August 1995	<1
DW-SO58	August 1995	4.0

µg/l = micrograms per liter
< = less than instrument detection limit
Exceedances of the State of Montana Ground Water Quality Standard for arsenic (18 µg/l) are shown in bold.
Source: ESE 1996

TABLE D-15

Arsenic Concentrations in Ground Water in the MW-232 Area
ARWW&S OU

Sample Location	Sample Date	Arsenic (µg/l)
MW-232	3Q=93	**262**
Domestic wells at Willow Glen Ranch		
R1107	3Q=93	1
R1108	3Q=93	<1
R1110	3Q=93	7.9
Well Points		
SA-1	3Q=93	**24**
SA-2	3Q=93	13
SA-3	3Q=93	7
SA-4	3Q=93	7.4
SA-5	3Q=93	**245**
SA-6	3Q=93	**80.1**
SA-7	3Q=93	**84.6**

µg/l - micrograms per liter
Exceedances of the State of Montana Ground Water Quality Standard for arsenic (18 µg/l) are shown in bold.
Source: ESE 1996

TABLE D-16

Cadmium, Copper, and Zinc Concentrations in Ground Water of the Blue Lagoon Area ARWW&S OU

Sample Location	Sample Date	Cadmium (µg/l)	Copper (µg/l)	Zinc (µg/l)
MW-235	3Q=93	---	**3,550**	**15,800**
SBL-2	3Q=93	**14**	459	**9,120**
SBL-5	3Q=93	**51.9**	**108,000**	**46,400**

Exceedances of the Preliminary Remedial Action Goals for cadmium (5µg/l), copper (1,000 µg/l), and zinc (5,000 Φ/L) are shown in bold.
--- = no analysis
Source: ESE 1996

TABLE D-17

Physical Characteristics of Waste and Solids in the Old Works/Stucky Ridge Subarea
ARWW&S OU

Disposal Area	Type	Area (acres)	Thickness (feet)	Volume (cubic yards)	Material Classification	Geometric Mean Concentration of Metals (mg/kg)				
						Arsenic	Cadmium	Copper	Lead	Zinc
Upper Works Structural Areas	Demolition and flue debris	3.94	2-14	32,000	Variable	508	5.6	4,540	189	889
Lower Works Structural Area	Demolition and flue debris	0.19	2-14	4,000	Variable	773	5.6	3,570	299	614
Railroad Beds	Waste aggregate	---	---	---	---	1,060	3.4	4,150	392	645
AHeap Roast@ Slag Piles	Slag	22	2-14	298,000	Coarse sand	578	2	4,720	354	5,170
Warm Springs Creek Floodplain Area	Jig tailings and other debris	78	1-6	300,000	Clay, silt, sand, debris	1,010	5.7	1,480	328	441
Red Sands	Jig tailings	120	2-40	606,000	Sand and silt	1,200	2.1	2,920	437	3,640
Miscellaneous Waste Piles 1-8	Miscellaneous debris and waste	4.1	---	32,000	Variable	934	1.9	6,250	209	517

mg/kg = milligrams per kilogram
--- = data not available
Source: ESE 1996

TABLE D-18

Summary of Springs and Seep Sample Results for Stucky Ridge Subarea ARWW&S OU

Station	Date	Basis	Arsenic (µg/l)	Q
SP97-1	16-May-97	DIS	40.7	
SP97-2	16-May-97	DIS	42.9	
SP97-3	16-May-97	DIS	13.4	
SP97-4	19-May-97	DIS	17.3	
SP97-5	19-May-97	DIS	18.2	
SP97-6	19-May-97	DIS	2.5	
SP97-7	20-May-97	DIS	8.7	
SP97-8	20-May-97	DIS	19.6	
SP97-20	9-Jun-97	DIS	95.4	
SP-1	Jul-91	DIS	10.6	
SP-2	Jul-91	DIS	63.9	
SP-3	Jul-91	DIS	88	
OWS-1	29-Oct-92	DIS	16.2	
OWS-2	29-Oct-92	DIS	40.5	
OWS-4	29-Oct-92	DIS	12.2	
SS-T-03	2-Aug-95	WET	4	
SS-T-04	16-Aug-95	WET	7	
SS-T-14	16-Aug-95	WET	104	
SS-T-15	16-Aug-95	WET	25	
SS-T-16	19-Sep-95	WET	39	
SS-T-28	9-Oct-96	DIS	1	U
Areawide Statistics				
Number of Samples			21	
Number of Detects			20	
Geometric Mean of All at SQL (µg/l)*			18.5	
Geometric Mean of detects (µg/l)			21.4	
Maximum Detect (µg/l)			104	
Minimum Detect (µg/l)			2.5	
ARAR (µg/l)			18	
Samples exceeding ARAR			11	
Percent of Samples Exceeding ARAR			52	

* Includes nondetects converted to sample quantitation limit (SQL)
ARAR = Applicable or Relevant and Appropriate Requirement
U = nondetect
µg/L = micrograms per lite

TABLE D-19

Lysimeter Data for Red Sands and Old Works Tailings
ARWW&S OU

Location	Sample Depth (feet)	Date	Concentration of Metals (µg/l)				
			Arsenic	Cadmium	Copper	Lead	Zinc
Red Sands (RSLY)	7[1]	6/26/92	5.3	28.5	5,300	<1.0	12,100
		9/4/92	6	75.8	39,800	3	35,100
		11/18/92	8.5	322	267,000	1.1	180,000
Old Works Tailings Ponds (TPLY)	4.5[2]	6/26/92	54.8	67.8	82,900	<1.0	19,000
		9/4/92	21.6	58.5	58,500	<1.0	17,100

[1]RSLY was installed 7 feet below ground surface and 2 feet below the waste/soil interface
[2]TPLY was installed 4.5 feet below ground surface and 3 feet below the waste/soil interface
µg/l = micrograms per liter
< = less than detection limit
Source: ESE 1996

TABLE D-20

Summary of Cadmium, Copper, and Zinc Concentrations in Ground Water in the Old Works/Red Sands Area ARWW&S OU

Well I.D.	Geometric Mean*			Percent of Samples Exceeding ARAR		
	Cadmium	Copper	Zinc	Cadmium	Copper	Zinc
MW-72	3.3	126.2	534.2	13	0	0
MW-200	1.5	2.4	3.5	0	0	0
MW-202	1.8	132.4	216.7	0	0	0
MW-203	10.2	641.6	4075.8	100	22	33
MW-204	2.2	297.0	518.9	25	0	0
MW-205	2.3	21.0	94.2	11	0	0
MW-206	18.6	176.7	2128.2	100	0	0
MW-207	0.9	2.9	4.6	0	0	0
MW-208	1.2	3.0	5.7	0	0	0
MW-209	5.7	3.2	571.3	63	0	0
MW-213	7.1	869.5	2542.6	67	33	33
MW-240	0.1	4.2	11.6	0	0	0
MW-241	1.2	30.9	313.1	0	0	0
MW-242	2.6	26.0	387.8	50	0	0
LF-4	3.0	37.8	292.8	13	0	0
T1A	2.5	365.1	200.5	13	0	0
T1D	1.1	3.0	4.6	0	0	0
T2B	1.8	43.0	36.9	13	0	0
T2D	1.2	20.6	83.1	14	0	0
Area-Wide Statistics				Cadmium	Copper	Zinc
Number of Samples				137	137	137
Number of Detects				63	94	108
Geometric Mean of All at SQL (µg/l)*				2.62	46.29	148.54
Geometric Mean of detects (µg/l)				2.99	123.24	304.12
Maximum Detect (µg/l)				66.6	17300	33200
Minimum Detect (µg/l)				0.1	2	3.4
ARAR (µg/l)				5	1000	5000
Samples exceeding ARAR				36	4	5
Percent of Samples Exceeding ARAR				26	3	4
Number of Wells				19	19	19
Wells exceeding ARAR				12	2	2
Percent of Wells Exceeding ARAR				63	11	11

* Includes nondetects converted to sample quantitation limit (SQL)
ARAR = Applicable or Relevant and Appropriate Requirement
µg/l = micrograms per liter

TABLE D-21

Statistical Summary of Arsenic and Metals Concentrations in Soil Samples from the Undisturbed Area of the Smelter Hill Subarea ARWW&S OU

	Depth Interval	Number of Samples	Minimum	Maximum	Arithmetic Mean	Standard Deviation	Median	Geometric Mean
Arsenic	0-2 inches	126	43.6	**27,200**	**1,390**	2,460	976	870
Cadmium		85	1.1	964	53.2	107	29.9	29.5
Copper		126	47.3	72,400	3,230	6,760	1,870	1,820
Lead		126	26.3	6,430	755	861	535	460
Zinc		126	82.7	30,400	1,760	3,210	981	1,030
Conductivity		126	11.9	2,700	203	293	130	135
pH		126	3.8	8.2	6.0	1.1	6.2	
Arsenic	2-10 inches	125	26.2	**2,440**	476	408	384	342
Cadmium		84	0.2	126	13.0	17.2	8.5	6.0
Copper		125	6.2	5,100	620	888	270	252
Lead		125	6.0	1,550	153	241	57	67
Zinc		125	35.1	3,500	588	510	453	431
Conductivity		125	7.5	2,280	139	227	93.7	94.3
pH		125	4.0	8.2	6.2	1.0	6.1	
Arsenic	10-24 inches	107	0.6	**1,250**	216	219	150	121
Cadmium		106	0.2	32.0	2.1	5.8	0.3	0.5
Copper		107	3.5	4,150	153	542	18.6	27.8
Lead		107	3.8	587	38.3	96.3	13.8	16.5
Zinc		107	18.4	1,600	147	264	56.3	74.3
Conductivity		84	23.2	2,020	140	292	72.5	82.5
pH		107	5.4	10.3	7.2	1.0	7.0	
Arsenic	24-48 inches	23	0.6	780	129	173	110	51.0
Cadmium		23	0.2	17.5	1.1	3.6	0.3	0.4
Copper		23	3.5	808	53.2	165	15.7	18.6
Lead		23	5.5	305	25.5	61.1	13.2	13.7
Zinc		23	18.4	700	80.3	138	45.7	53.1
Conductivity		23	40.2	2,260	197	453	96.0	106
pH		23	5.9	10.3	7.4	1.2	7.0	

Values greater than or equal to 10 are reported in 3 significant figures, and values less than 10 are reported in 2 significant figures.
All concentrations are reported in mg/kg (milligrams per kilogram), except for pH, which is in Standard Units.
Exceedances of the Preliminary Remedial Action Goal for recreational use (1,000 parts per million arsenic) are shown in bold.
Source: ESE 1996

TABLE D-22

Volumes of Soil with Arsenic Concentrations Greater than 1,000 mg/kg in the Smelter Hill Subarea ARWW&S OU

Area	Total Volume (cubic yards)	Volume of Waste		
		Arsenic >1,000 mg/kg but #5,000 mg/kg (cubic yards)	Arsenic >5,000 mg/kg but #10,000 mg/kg (cubic yards)	Arsenic >10,000 mg/kg (cubic yards)
Reclaimed disturbed	280,864	217,593 (18%)	1,543 (0.1%)	61,728 (5%)
Non-reclaimed disturbed	393,162	340,100 (14%)	16,373 (1%)	36,698 (2%)
Reclaimed HPS	58,665	54,105 (34%)	2,353 (2%)	2,207 (1%)
Non-reclaimed HPS	62,916	55,748 (26%)	3,102 (2%)	4,066 (2%)
Stack	23,942	12,523 (24%)	3,387 (6%)	8,032 (15%)

Values in parentheses are the percentage of the total volume that is waste.
mg/kg = milligrams per kilogram
Source: ESE 1996

TABLE D-23

Results of Chemical Analysis for Slag Samples
ARWW&S OU

Parameter[1]	Detection Limit[2]	Main Slag Pile[3]	SPT-1[4]	SPT-2	SPT-3	SPT-4	SPT-5	SPS-1[5]	SPS-2	SPS-3	SPS-4	SPS-5	Maximum	Minimum	Arithmetic Mean	Geometric Mean	Standard Deviation
Aluminum			21,000	21,000	21,800	17,500	20,200	20,500	22,600	24,400	30,700	17,100	30,700	17,100	21,690	21,413	3,639
Antimony			67	162	115	57	129	219	129	98	42	96	219	42	111.4	100	50
Arsenic		2,690	1,470	3,070	1,690	1,340	2,270	3,190	2,170	2,160	498	1,920	3,190	498	1,978	1,787	759
Barium			1,170	1,340	463	1,690	1,450	3,190	980	266	485	766	3,190	266	1,180	942	803
Beryllium	2.5		2.5	2.7	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.7	2.5	2.5	2.5	0.1
Boron	8		17	170	27	15	22	9.7	22	8	27	14	170	8	33.17	21	46
Cadmium		23.3	21	29	26	11	25	44	30	19	4.4	19	44	4.4	22.8	19.8	10.3
Chromium			354	115	436	297	342	217	323	205	45	278	436	45	261	224	111
Cobalt			90	82	517	118	73	42	267	99	28	101	517	28	141.7	100	139
Copper		5,550	5,590	4,740	9,760	6,680	6,760	5,210	7,710	5,660	3,140	7,460	9,760	3,140	6,271	6,017	1,737
Iron			300,000	316,000	334,000	341,000	288,000	325,000	320,000	377,000	188,000	326,000	377,000	188,000	311,500	307,146	46,998
Lead		2,730	954	2,590	4,190	1,000	926	4,310	2,830	2,200	364	1,080	4,310	364	2,044	1,587	1,340
Manganese			832	8,280	864	710	961	1,470	1,750	17,200	754	908	17,200	710	3,373	1,618	5,100
Mercury	0.04		0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.08	0.08	0.04	0.04	0.04	0.01
Molybdenum	3		57	82	670	67	57	3.2	485	14	3	74	670	3	151.22	47	219
Nickel	20		40	22	291	54	23	20	129	36	20	73	291	20	70.8	46	80
Selenium	50		50	50	50	50	50	50	50	85	50	50	85	50	53.5	53	11
Silver	5		5	7.8	5.8	5.8	5.4	9.5	6.1	88	17	9	88	5	15.94	9	24
Tin	20		41	20	220	99	126	67	118	129	20	172	220	20	101	78	62
Vanadium			118	229	213	93	190	192	184	127	83	132	229	83	156.1	148	49
Zinc		23,300	38,800	25,800	36,300	21,200	34,700	23,400	29,900	23,800	8,380	23,700	38,800	8,380	26,598	24,811	8,412
Total Sulfur[6]			1.36	0.95	0.95	1.29	1.15	0.99	1.36	1.16	0.51	1.28	1.36	0.51	1.1	1.06	0.25
Pyritic Sulfur[6]	0.01		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0
Slurry pH[7]			6.6	7.5	7.0	6.4	6.8	7.2	6.9	8.9	6.5	7.1	8.9	6.4	7.1	7.1	0.7

[1]Acid extractable metals (mg/kg dry weight basis)
[2]Instrument detection limit reported for undetected values and used in the statistical calculations at the detection limits
[3]Composite slag samples collected from the main slag pile during 3rd Quarter 1993 (ESE)
[4]SPT indicates sample collected from top of slag pile
[5]SPS indicates sample collected from side slope of slag pile
[6]Percent sulfur on a dry weight basis
[7]1:1 slurry mix
All units are in µg/l (micrograms per liter), except for pH, which is in Standard Units. Source: ESE 1996

TABLE D-24

XRF-Metals Data Obtained from Slag Piles: Landfill, West Stack, and Main Granulated Slag Piles
ARWW&S OU

Location	Arsenic	Cadmium	Copper	Lead	Iron[1]	Manganese	Mercury	Selenium	Silver	Zinc
Landfill	337	<4.0	5,418	681	22.2	565	<8.0	17.4	9.9	10,100
West Stack[2]	1,870	39.6	21,600	1,470	8.99	484	<8.0	11.8	28.1	19,400
West Stack[3]	5,500	52.9	11,600	3,250	27.8	1,310	<8.0	<10.0	15.5	68,000

[1]Iron is measured on a percentage basis. All other units are in mg/kg (milligrams per kilogram).
[2]coarse slag from 1 inch to 3 feet in diameter
[3]composited from two piles, less coarse 2 to 1 inch in diameter
Source: ESE 1996

TABLE D-25

Statistical Summary of Metals Concentrations in Non-Reclaimed Soil Samples in the Disturbed Area of the Smelter Hill Subarea ARWW&S OU

	Depth Interval	Number of Samples	Minimum	Maximum	Arithmetic Mean	Standard Deviation	Median	Geometric Mean
Arsenic	0-2 inches	56	20.6	29,300	2,260	4,160	1,220	830
Cadmium		56	0.6	482	48.6	96.6	9.9	18.6
Copper		56	42.3	160,000	9,070	22,500	2,180	2,130
Lead		56	8.2	16,400	1,500	2,620	546	428
Zinc		56	42.6	61,600	6,740	10,600	2,410	2,220
Conductivity		56	69	11,500	1,230	1,930	457	614
pH		56	2.3	8.3	6.5	1.2	7.0	
Arsenic	2-10 inches	53	12.8	21,900	1,060	3,030	362	385
Cadmium		53	0.6	584	24.8	82.8	4.4	7.5
Copper		53	10.3	122,000	4,080	1,700	618	556
Lead		53	3.1	12,100	535	1,703	115	115
Zinc		53	16.3	16,500	2,070	3,450	725	715
Conductivity		53	57.6	5,940	869	1,120	470	498
pH		53	2.3	8.3	6.6	1.2	6.9	
Arsenic	10-24 inches	53	8.9	8,700	798	1,700	174	214
Cadmium		53	0.6	494	21.2	77.8	1.0	3.7
Copper		53	7.3	39,800	2,660	7,290	177	253
Lead		53	2.8	5,940	366	940	46.3	64.1
Zinc		53	13.8	64,900	2,560	9,240	269	323
Conductivity		53	72.3	22,100	1,500	3,130	780	745
pH		53	2.3	59.4	7.6	7.4	7.0	
Arsenic	24-48 inches	38	4.6	25,600	1,400	4,660	109	126
Cadmium		38	0.6	187	8.7	30.7	1.0	1.9
Copper		38	5.9	29,500	2,110	6,220	152	174
Lead		38	1.1	2,890	270	622	29.7	38.4
Zinc		38	6.9	17,900	1,960	4,580	223	212
Conductivity		38	95.3	5,780	1,100	1,200	769	705
pH		38	2.0	7.1	5.1	1.2	4.9	
Arsenic	Greater than 48 inches	31	4.9	28,300	1,400	5,210	68	105
Cadmium		31	0.6	95	5.0	17.6	0.6	1.2
Copper		31	3.3	65,700	4,190	13,700	31.9	90.3
Lead		31	2.4	2,950	319	779	9.6	24.9
Zinc		31	8.3	16,600	1,700	4,370	59	124
Conductivity		31	193	7,980	1,090	1,430	659	729
pH		31	3.6	9.5	7.1	1.1	7.2	

Values greater than or equal to 10 are reported in 3 significant figures, and values less than 10 are reported in 2 significant figures.
All concentrations are reported in mg/kg (milligrams per kilogram), except for pH, which is in Standard Units.
Source: ESE 1996

XRF-Metals Data Obtained from Slag Piles: Landfill, West Stack, and Main Granulated Slag Piles
ARWW&S OU

Location	Arsenic	Cadmium	Copper	Lead	Iron[1]	Manganese	Mercury	Selenium	Silver	Zinc
Landfill	337	<4.0	5,418	681	22.2	565	<8.0	17.4	9.9	10,100
West Stack[2]	1,870	39.6	21,600	1,470	8.99	484	<8.0	11.8	28.1	19,400
West Stack[3]	5,500	52.9	11,600	3,250	27.8	1,310	<8.0	<10.0	15.5	68,000

[1]Iron is measured on a percentage basis. All other units are in mg/kg (milligrams per kilogram).
[2]coarse slag from 1 inch to 3 feet in diameter
[3]composited from two piles, less coarse 2 to 1 inch in diameter
Source: ESE 1996

TABLE D-26

Statistical Summary of Physical Parameters for Tailings in the Anaconda Ponds
ARWW&S OU

Parameter	Tailings Thickness (feet)	Moisture (%)	Grain Size Distribution (%)			
			Gravel	Sand	Silt	Clay
Number of Samples	2	27	27	27	27	27
Maximum	90.0	25.9	17.6	89.2	60.1	57.0
Minimum	89.0	0.0	0.0	2.9	8.6	2.1
Arithmetic Mean	89.5	6.8	1.99	56.53	28.50	13.44
Standard Deviation	0.5	9.3	4.43	28.58	16.57	15.62
Geometric Mean	89.5	NA	NA	43.64	23.27	7.99

NA = not available
Source: ESE 1996

TABLE D-27

Statistical Summary of Chemical Parameters for Tailings in Anaconda Ponds
ARWW&S OU

Parameter	Slurry pH (S.U.)	Total Sulfur (%)	Pyritic Sulfur (%)	Leachable Sulfate (%)	Carbonate (%)	Arsenic (mg/kg)	Cadmium (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Lead (mg/kg)	Manganese (mg/kg)	Zinc (mg/kg)
Number of Samples	27	27	27	27	27	27	27	27	27	27	27	27
Maximum	7.40	7.13	6.67	0.86	12.80	367	42.0	4,770	74,800	1,190	17,000	12,400
Minimum	2.40	0.86	0.36	0.01	0.01	71	2.0	1,030	8,340	59	128	201
Arithmetic Mean	6.00	4.22	3.46	0.23	1.80	152	7.6	2,186	42,790	418	2,243	2,131
Standard Deviation	1.50	1.81	1.82	0.20	3.35	76	10.1	964	17,571	347	3,509	3,055
Geometric Mean	5.70	3.74	2.86	0.16	0.52	137	4.4	2,005	38,437	293	1,057	1,096

S.U. = Standard Units
mg/kg = milligrams per kilogram
Source: ESE 1996

TABLE D-28

Statistical Summary of Metals Concentrations in Soil Samples from the HPS Area of East Anaconda Yard ARWW&S OU

	Depth Interval	Number of Samples	Minimum	Maximum	Arithmetic Mean	Standard Deviation	Geometric Mean
Arsenic	0-2 inches	56	43.0	190	105.6	45.3	94.0
Copper		56	46.5	286	101.6	65.1	84.2
Lead		56	61.0	61	61.0	0.0	61.0
Zinc		56	323.5	958	402.3	183.8	374.8
pH		56	5.0	8.2	7.2	0.6	
Arsenic	2-10 inches	50	43.0	305	111.2	64.7	92.2
Copper		50	46.5	4,110	194.2	573.0	86.8
Lead		50	61.0	455	68.9	55.2	63.5
Zinc		50	323.5	1,520	429.7	273.9	383.8
pH		50	5.8	8.3	7.4	0.5	
Arsenic	10-24 inches	77	43.0	4,480	425.0	699.3	209.1
Copper		77	46.5	50,300	2,450.1	6,330.4	635.6
Lead		77	61.0	12,200	1,231.7	2,270.0	265.9
Zinc		77	242.0	4,500	1,053.2	956.7	717.6
pH		77	5.6	8.5	7.2	0.6	
Arsenic	24-48 inches	107	43.0	6,460	921.8	1,252.3	393.6
Copper		107	46.5	65,900	4,612.2	9,908.6	1,242.4
Lead		107	61.0	60,000	2,273.0	6,085.3	627.1
Zinc		107	242.0	16,400	2,522.8	3,609.5	1,228.2
pH		107	5.7	8.8	7.1	0.6	
Arsenic	Greater than 48 inches	32	43.0	6,260	1,147.5	1,587.1	360.8
Copper		32	86.0	6,810	1,756.1	2,031.8	879.4
Lead		32	61.0	30,200	2,785.4	6,902.3	538.1
Zinc		32	242.0	18,300	3,766.3	5,660.9	1,334.1
pH		31	3.7	8.0	7.0	0.8	
Arsenic	All data	322	43.0	6,460	557.6	1,019.2	208.7
Copper		322	46.5	65,900	2,340.9	6,782.9	423.7
Lead		322	61.0	60,000	1,348.0	4,394.0	236.8
Zinc		322	242.0	18,300	1,601.2	3,005.6	739.6
pH		321	3.7	8.8	7.2	0.6	

Values greater than or equal to 10 are reported in 3 significant figures, and values less than 10 are reported in 2 significant figures.
All concentrations are reported in mg/kg (milligrams per kilogram), except for pH, which is in Standard Units.
Source: ESE 1996

TABLE D-29

Statistical Summary of Metals Concentrations in Soil Samples from the Disturbed Area of East Anaconda Yard ARWW&S OU

	Depth Interval	Number of Samples	Minimum	Maximum	Arithmetic Mean	Standard Deviation	Geometric Mean
Arsenic	0-2 inches	33	19	2,090	124	363	45
Cadmium		33	0.4	126.0	6.9	21.7	1.6
Copper		33	34	16,100	864	2,910	127
Lead		33	11	1,590	93	278	30
Arsenic	2-10 inches	33	11	1,510	124	291	43
Cadmium		33	0.4	148.0	6.6	25.3	1.2
Copper		33	9	8,660	458	1,538	62
Lead		33	9	4,400	217	789	26
Arsenic	10-24 inches	42	7	2,150	480	653	167
Cadmium		42	0.6	66.2	8.6	12.4	3.9
Copper		42	16	91,600	3,668	13,910	497
Lead		42	9	22,400	822	3,406	95
Arsenic	24-48 inches	11	10	1,770	531	594	185
Cadmium		11	1.3	37.9	11.5	10.6	7.9
Copper		11	29	4,710	1,205	1,327	535
Lead		11	7	1,220	311	417	92
Arsenic	Greater than 48 inches	13	11	9,480	1,182	2,497	248
Cadmium		13	0.7	181.0	29.1	48.1	9.0
Copper		13	34	7,800	1,754	2,062	740
Lead		13	7	3,030	407	804	97
Arsenic	All data	132	7.4	9,480	376	966	90
Cadmium		132	0.4	181.0	9.9	24.6	2.7
Copper		132	8.7	91,600	1,771	8,164	219
Lead		132	6.7	22,400	405	2,008	51

Values greater than or equal to 10 are reported in 3 significant figures, and values less than 10 are reported in 2 significant figures.
All concentrations are reported in mg/kg (milligrams per kilogram).
Source: ESE 1996

TABLE D-30

Statistical Summary of Metals Concentrations in Non-Reclaimed Soil Samples in the Primary HPS Area of the Smelter Hill Subarea ARWW&S OU

	Depth Interval	Number of Samples	Minimum	Maximum	Arithmetic Mean	Standard Deviation	Median	Geometric Mean
Arsenic	0-2 inches	333	16	25,600	1,714	2,458	950	815
Copper		333	44	138,000	7,295	12,763	3,693	2,913
Lead		333	17	8,580	946	1,206	524	445
Zinc		333	99	36,900	6,441	7,893	3,320	2,877
Conductivity		333	0.34	4,100	982	864	690	572
pH		333	2.8	9.8	7.3	0.9	7.4	
Arsenic	2-10 inches	376	13	65,300	2,072	5,053	752	640
Copper		376	18	130,000	8,732	14,528	3,845	2,399
Lead		376	9.5	12,100	843	1,247	384	308
Zinc		376	28	60,900	5,307	8,587	2,155	1,634
Conductivity		395	1.8	7,400	1,077	1,048	720	626
pH		395	2.1	12.8	7.4	1.3	7.4	
Arsenic	10-24 inches	71	13	11,300	1,125	1,664	463	434
Copper		71	18	21,200	4,243	4,530	2,590	1,603
Lead		71	9.5	8,230	560	1,066	239	216
Zinc		71	28	65,800	4,696	9,841	1,410	1,199
Conductivity		459	0	8,980	1,214	988	1,020	798
pH		459	2.3	12.5	7.2	1.2	7.3	
Arsenic	24-48 inches	195	4	33,000	1,552	3,705	455	350
Copper		195	21	90,900	7,981	15,074	2,380	1,674
Lead		195	13	8,010	584	1,113	185	179
Zinc		195	18	44,100	3,909	7,359	1,180	1,049
Conductivity		539	14	7,300	1,224	990	891	830
pH		539	2.3	12.5	7.2	1.3	7.3	
Arsenic	Greater than 48 inches	178	16	12,200	691	1,685	38	90
Copper		178	21	70,600	3,348	9,274	280	343
Lead		178	13	28,900	520	2,293	27	67
Zinc		178	31	50,300	2,871	7,607	207	361
Conductivity		306	10	6,583	1,024	1,010	550	656
pH		306	1.6	12.5	7.3	1.4	7.4	

Values greater than or equal to 10 are reported in 3 significant figures, and values less than 10 are reported in 2 significant figures.
All concentrations are reported in mg/kg (milligrams per kilogram), except for pH, which is Standard Units..
Source: ESE 1996

TABLE D-31

Statistical Summary of Metals Concentrations in Soil Samples in the Stack Area of the Smelter Hill Subarea ARWW&S OU

	Depth Interval	Number of Samples	Minimum	Maximum	Arithmetic Mean	Standard Deviation	Median	Geometric Mean
Arsenic	0-2 inches	115	16	31,600	2,995	5,918	772	728
Copper		115	21	15,600	1,448	2,785	417	441
Lead		115	14	4,040	447	808	144	163
Zinc		115	39	5,030	933	1,104	502	486
Conductivity		115	27	7,060	705	1,033	217	308
pH		115	4.4	12.6	6.8	1.2	6.9	
Arsenic	2-10 inches	127	16	52,200	5,165	9,531	866	939
Copper		127	21	25,600	2,429	4,321	448	502
Lead		127	13	8,460	870	1,657	122	181
Zinc		127	22	10,000	1,536	2,145	472	571
Conductivity		127	30	4,230	831	984	233	343
pH		127	2.9	11.2	6.5	1.3	6.6	
Arsenic	10-24 inches	74	16	143,000	8,995	19,967	2,045	1,245
Copper		74	21	31,100	3,885	6,198	1,445	680
Lead		74	16	29,000	1,867	4,666	241	219
Zinc		74	24	13,700	2,238	2,630	1,085	715
Conductivity		148	33	11,700	1,152	1,452	488	517
pH		148	1.6	9.4	6.3	1.5	6.5	
Arsenic	24-48 inches	55	16	25,000	4,060	6,266	634	829
Copper		55	21	12,900	2,252	3,529	404	487
Lead		55	14	4,180	554	1,047	66	116
Zinc		55	26	9,420	1,666	2,452	407	512
Conductivity		121	51	8,960	1,135	1,367	492	599
pH		121	1.6	9.4	6.2	1.5	6.4	
Arsenic	Greater than 48 inches	53	16	44,800	4,013	9,356	200	336
Copper		53	21	14,200	1,866	3,800	74	177
Lead		53	13	8,970	780	1,939	25	60
Zinc		53	23	15,500	1,558	3,083	113	261
Conductivity		92	81	11,200	893	1,450	421	521
pH		92	3.2	10.8	6.7	1.4	6.8	

Values greater than or equal to 10 are reported in 3 significant figures, and values less than 10 are reported in 2 significant figures.
All concentrations are reported in mg/kg (milligrams per kilogram), except for pH, which is Standard Units..
Source: ESE 1996

TABLE D-32

Statistical Summary and Metals Concentrations in Soil Samples in the Loop Track Railroad Beds of the Smelter Hill Subarea ARWW&S OU

	Depth Interval	Number of Samples	Minimum	Maximum	Arithmetic Mean	Standard Deviation	Median	Geometric Mean
Arsenic	0-2 inches	10	770	7,489	3,700	1,885	3,812	3,131
Copper		10	3,939	9,880	6,212	1,685	6,324	6,021
Lead		10	1,056	2,389	1,522	362	1,412	1,488
Zinc		10	3,329	8,064	5,242	1,490	5,041	5,059
Conductivity		20	253	2,928	1,124	814	893	849
pH		20	4.3	7.6	6.4	1.0	6.6	
Arsenic	2-10 inches	3	6,720	13,100	10640	3,431	12,100	10,209
Copper		3	8,410	11,100	9,970	1,396	10,400	9,897
Lead		3	2,240	3,260	2,867	549	3,100	2,830
Zinc		3	5,510	8,350	7,280	1,544	7,980	7,158
Conductivity		6	627	1,770	1,107	389	1,105	1,052
pH		6	4.2	6.5	5.3	0.87	5.4	
Arsenic	10-24 inches	4	502	4,660	2048	1,834	1,515	1,495
Copper		4	802	14,100	7,698	6,408	7,945	4,774
Lead		4	128	1,770	842	707	735	577
Zinc		4	596	13,700	7,359	5,571	7,570	4,578
Conductivity		8	169	2,060	952	648	849	740
pH		8	4.4	7.6	5.9	1.2	6.1	

Values greater than or equal to 10 are reported in 3 significant figures, and values less than 10 are reported in 2 significant figures.
All concentrations are reported in mg/kg (milligrams per kilogram), except for pH, which is Standard Units..
Source: ESE 1996

TABLE D-33

Statistical Summary of Metals Concentrations in Reclaimed Soil Samples in the Disturbed Area of the Smelter Hill Subarea ARWW&S OU

	Depth Interval	Number of Samples	Minimum	Maximum	Arithmetic Mean	Standard Deviation	Median	Geometric Mean
Arsenic	0-2 inches	28	19.0	3,960	235	735	61.2	82.7
Cadmium		28	0.6	234	11.6	44.0	1.7	2.5
Copper		28	22.2	14,800	733	2,770	131	165
Lead		28	10.7	2,580	147	482	37.8	46.0
Zinc		28	52.1	26,300	1,300	4,910	242	308
Conductivity		28	130	3,020	470	674	228	295
pH		28	5.3	12.5	7.5	1.2	7.6	
Arsenic	2-10 inches	28	4.8	524	78.0	101	46.5	50.1
Cadmium		28	0.6	21.0	2.4	4.3	0.8	1.4
Copper		28	14.5	1,100	129	205	82.7	81.9
Lead		28	9.9	248	38.3	46.7	26.0	27.8
Zinc		28	36.6	1,940	292	383	167	184
Conductivity		28	90.0	2,460	494	557	292	336
pH		28	4.0	8.7	7.5	1.0	7.8	
Arsenic	10-24 inches	28	21.9	2,410	635	739	299	264
Cadmium		28	0.6	230	18.7	44.0	5.4	6.2
Copper		28	45.5	7,370	1,850	2,090	997	652
Lead		28	11.8	1,790	453	552	246	169
Zinc		28	89.5	18,200	4,080	5,950	841	120
Conductivity		28	0.0	2,580	1,020	822	860	703
pH		28	5.0	16.7	8.0	2.4	7.5	
Arsenic	24-48 inches	11	8.4	3,640	778	1,300	193	190
Cadmium		11	0.6	133	22.4	43.8	3.9	5.3
Copper		11	20.9	24,200	3,560	7,330	451	470
Lead		11	7.9	2,890	449	833	233	121
Zinc		11	33.8	19,400	2,570	5,720	623	505
Conductivity		11	300	5,100	1,860	1,400	1,480	1,400
pH		11	2.5	6.6	5.2	1.5	5.5	
Arsenic	Greater than 48 inches	10	15.5	19,000	2,440	5,860	308	377
Cadmium		10	0.6	208	32.9	63.4	9.9	9.6
Copper		10	23.6	31,000	4,230	9,540	693	811
Lead		10	5.1	2,000	554	611	374	236
Zinc		10	33.3	10,100	3,400	3,790	2,010	1,130
Conductivity		10	186	9,280	2,200	3,650	1,620	1,300
pH		10	2.7	8.5	5.6	2.0	5.8	

Values greater than or equal to 10 are reported in 3 significant figures, and values less than 10 are reported in 2 significant figures.
All concentrations are reported in mg/kg (milligrams per kilogram), except for pH, which is in Standard Units.
Source: ESE 1996

TABLE D-34

Statistical Summary of Metals Concentrations in Reclaimed Soil Samples in the Primary HPS Area of the Smelter Hill Subarea ARWW&S OU

	Depth Interval	Number of Samples	Minimum	Maximum	Arithmetic Mean	Standard Deviation	Median	Geometric Mean
Arsenic	0-2 inches	245	16	8,180	518	1,031	162	186
Copper		245	34	49,100	1,539	4,356	189	314
Lead		245	13	4,790	312	675	49	85
Zinc		245	36	37,000	2,950	6,901	382	592
Conductivity		252	10	18,200	586	1,620	240	264
pH		252	3.2	10.5	7.5	1.0	7.5	
Arsenic	2-10 inches	249	16	11,700	434	1,093	119	129
Copper		249	21	24,700	1,550	3,784	94	190
Lead		249	13	4,900	237	606	29	54
Zinc		249	31	41,600	1,910	5,368	175	322
Conductivity		284	10	10,600	620	906	275	338
pH		284	2.3	10.5	7.4	1.1	7.4	
Arsenic	10-24 inches	19	16	6,490	1,715	1,825	986	735
Copper		19	18	54,900	8,993	14,237	4,140	2,375
Lead		19	18	3,150	1,036	1,003	774	419
Zinc		19	56	36,533	8,719	11,056	4,240	2,408
Conductivity		366	20	11,000	1,251	1,177	830	726
pH		366	2.2	12.7	7.2	1.4	7.1	
Arsenic	24-48 inches	104	4	140,000	3,312	14,267	672	388
Copper		104	21	173,000	7,349	18,498	3,525	1,482
Lead		104	10	16,800	1,169	2,109	312	262
Zinc		104	37	60,500	8,411	12,816	2,235	1,626
Conductivity		403	20	8,800	1,450	1,310	1,190	888
pH		404	1.4	12.7	7.1	1.7	7.0	
Arsenic	Greater than 48 inches	163	3	567,000	5,654	44,656	297	269
Copper		163	13	67,800	4,599	10,181	1,120	815
Lead		163	10	35,100	1,056	3,459	132	167
Zinc		163	37	39,200	6,187	10,245	1,340	1,321
Conductivity		314	10	8,113	1,241	1,238	801	734
pH		314	2.6	12.5	7.3	1.8	7.2	

Values greater than or equal to 10 are reported in 3 significant figures, and values less than 10 are reported in 2 significant figures.
All concentrations are reported in mg/kg (milligrams per kilogram), except for pH, which is Standard Units.
Source: ESE 1996

TABLE D-35

Lysimeter Results for the Smelter Hill Subarea
ARWW&S OU

Location	Sample	Date	Depth	Arsenic	Cadmium	Copper	Lead	Iron	Zinc	SO_4	Conductivity	pH
R6 Anaconda Ponds		9/2/93	4	---	---	---	---	---	---	---	---	---
		9/22/93	4	---	---	---	---	---	---	---	---	2.24
		9/2/93	8.5	---	---	---	---	---	---	---	---	---
		9/22/93	8.5	---	---	---	---	---	---	---	---	---
		9/2/93	12.5	---	---	---	---	---	---	---	---	---
	PW016	9/22/93	12.5	2.2	0.62	55	0.7	50,400	30	1,420	3.1	5.71
R7 Smelter Hill Stack Area		9/2/93	2.5	---	---	---	---	---	---	---	3.02	5.05
		9/22/93	2.5	---	---	---	---	---	---	---	---	---
	PW001	9/2/93	6.5	1,120	44,100	149,000	5.5	39	787,000	4,410	4.68	5.33
	PW011	9/22/93	6.5	901	38,200	256,000	3.6	142	864,000	3,870	4.9	4.67
		9/2/93	10.5	---	---	---	---	---	---	---	---	6.35
		9/22/93	10.5	---	---	---	---	---	---	---	2.56	6.31
		9/2/93	14.5	---	---	---	---	---	---	---	3.27	7.75
	PW013	9/22/93	14.5	10,400	139	100	1	42.1	872	2,080	3.41	6.58
R8 Smelter Hill Iron Pond	PW002	9/2/93	2.5	2.6	95.9	3,270	5.5	381	15,800	1,970	2.85	4.99
	PW015	9/22/93	2.5	2.3	123	5,470	1.6	1,070	22,200	1,740	2.98	3.67
		9/2/93	6.5	---	---	---	---	---	---	---	---	---
		9/22/93	6.5	---	---	---	---	---	---	---	---	---
		9/2/93	11	---	---	---	---	---	---	---	---	---
		9/22/93	11	---	---	---	---	---	---	---	---	---
	PW004	9/2/93	15.5	39.5	1.3	2.9	5.5	3.9	5.7	1,550	2.63	6.65
	PW014	9/22/93	15.5	50.2	1.7	14.6	1.6	26.9	52.1	1,320	2.4	6.4
R9 Reposi-tory Bench		9/2/93	3	---	---	---	---	---	---	---	---	---
	PW019	9/22/93	3	10,400	2	31.9	1.9	319	24	2,710	4.93	6.97
		9/2/93	7	---	---	---	---	---	---	---	2.96	3.59
	PW018	9/22/93	7	159	1.5	10.7	1.6	21.5	32.1	1,500	2.72	7.02
		9/2/93	11	---	---	---	---	---	---	---	---	---
		9/22/93	11	---	---	---	---	---	---	---	2.59	7.27
		9/2/93	15	---	---	---	---	---	---	---	3.06	4.34
	PW017	9/22/93	15	131	2.2	15.4	1.6	21.5	46.9	1,490	2.87	6.82

Concentrations are in µg/l (micrograms per liter) except sulfate, which is in mg/L (milligrams per liter).
Conductivity in millimhos per centimeter (mmhos/cm).
pH in Standard Units.
C = no sample analyzed
Source: ESE 1996

TABLE D-36

Summary of Analytical Results for Lysimeters in the Main Slag Pile
ARWW&S OU

Lysimeter	Date/Time	Depth (feet)	pH (S.U.)	Arsenic (µg/l)	Cadmium (µg/l)	Sulfate (mg/L)
SLAG-LY-1[1]	7/24/95 16:31	78'6" - 78'8"	6.4	12	87.6	1,620
SLAG-LY-1	7/25/95 11:30	78'6" - 78'8"	---	11	90.1	1,700
SLAG-LY-2D[2]	7/24/95 17:14	97'5.4" - 97'7.4"	7.53	80	0.9	2,020
SLAG-LY-2D	7/25/95 12:19	97'5.4" - 97'7.4"	---	80	0.9	2,070
SLAG-LY-2S[3]	8/16/95 14:12	74' - 74'2"	---	15	<0.1	503
SLAG-LY-2S	8/17/95 16:28	74' - 74'2"	---	18	0.2	659

[1]located in the black slag immediately above the slag/alluvium interface
[2]located beneath the slag at the slag/alluvium interface
[3]shallow lysimeter placed in the SLAG-LY-2 boring
--- = no analysis
S.U. = Standard Units
µg/l = micrograms per liter
mg/L = milligrams per liter

TABLE D-37

Statistical Summary of Sample Results from Network Wells in the Smelter Hill Subarea During the Anaconda Regional Water and Waste Remedial Investigation ARWW&S OU

Well ID	Location	Zone Monitored	Analyte	Number of Samples	Maximum	Minimum	Mean	Standard Deviation	Median	Geometric Mean
A1BR2	Stack Area	Bedrock	Arsenic	8	**8,470**	**2,510**	**5,337.5**	1,669.9	**5,080.0**	**5,064.0**
			Cadmium	8	**5.8**	0.2	1.6	1.7	1.2	1.0
A1BR3	Stack Area	Bedrock	Arsenic	6	**33.4**	7.8	**19.0**	8.1	16.9	17.2
			Cadmium	6	2.0	0.1	1.0	0.6	1.2	0.7
A2BR	East Anaconda Yard	Bedrock	Arsenic	8	**2,410**	**843**	**1,225.8**	475.1	**1,090.0**	**1,158.1**
			Cadmium	8	2.0	0.1	1.0	0.7	1.3	0.6
B4BR	Primary HPS Area	Bedrock	Arsenic	8	**1,660**	**1,120**	**1,272.5**	163.1	**1,215.0**	**1,263.1**
			Cadmium	8	**56.3**	**38.0**	**45.4**	5.6	**44.9**	**45.1**
C2AL	Iron Ponds	Bedrock	Arsenic	8	**2,450**	**2,010**	**2,306.3**	155.2	**2,375.0**	**2,300.8**
			Cadmium	8	**6.2**	0.3	2.2	2.3	1.3	1.3
C2BR	Iron Ponds	Bedrock	Arsenic	6	**1,240**	**979**	**1,134.8**	107.3	**1,175.0**	**1,129.6**
			Cadmium	6	2.0	0.1	1.0	0.7	1.2	0.6
F2BR	South Mill Creek	Bedrock	Arsenic	8	14.6	0.5	3.1	4.4	1.4	1.7
			Cadmium	8	2.0	0.0	1.1	0.6	1.2	0.7
D3AL1	Northeast Smelter Hill	Alluvium	Arsenic	8	**101**	**38.4**	**62.5**	17.7	**63.7**	**60.1**
			Cadmium	8	**5.1**	0.1	1.9	1.7	1.2	1.0
E2AL1	Mill Creek	Alluvium	Arsenic	8	5.3	0.5	1.9	1.7	1.3	1.3
			Cadmium	8	2.0	0.0	1.0	0.6	1.1	0.6
MW-207	Old Works	Alluvium	Arsenic	9	2.6	0.5	1.2	0.7	1.0	1.0
			Cadmium	9	2.0	0.0	1.2	0.7	1.5	0.6
MW-210	East Anaconda Yard	Alluvium	Arsenic	6	**102**	**47.0**	**81.6**	18.1	**88.2**	**79.2**
			Cadmium	6	2.2	0.2	1.3	0.7	1.4	1.0
MW-211	Anaconda Ponds	Alluvium	Arsenic	6	**61.6**	**40.9**	**49.8**	8.5	**47.6**	**49.1**
			Cadmium	5	2.0	1.1	1.5	0.3	1.5	1.5
MW-218D	Anaconda Ponds	Alluvium	Arsenic	6	3.2	0.5	1.6	0.9	1.6	1.4
			Cadmium	6	2.0	0.6	1.2	0.5	1.2	1.1
MW-218S	Anaconda Ponds	Alluvium	Arsenic	6	**45.8**	**31.6**	**38.8**	4.8	**37.6**	**38.5**
			Cadmium	6	**9.0**	5.0	**6.7**	1.5	**6.9**	**6.6**
MW-219	Anaconda Ponds	Alluvium	Arsenic	6	3.1	0.5	2.0	0.9	2.0	1.7
			Cadmium	6	2.0	0.1	1.3	0.6	1.4	1.0
MW-220	Anaconda Ponds	Alluvium	Arsenic	6	3.0	0.9	1.9	0.7	2.0	1.7
			Cadmium	6	2.0	0.0	1.3	0.6	1.4	0.8
MW-227	East Anaconda Yard	Alluvium	Arsenic	5	**125**	**47.3**	**64.6**	30.2	**49.3**	**59.6**
			Cadmium	5	2.0	0.1	0.7	0.7	0.2	0.3
MW-233	Mill Creek	Alluvium	Arsenic	5	3.6	1.4	2.5	0.9	2.1	2.3
			Cadmium	5	2.0	0.0	0.9	0.7	1.1	0.5

All units in µg/l (micrograms per liter).
For values reported at less than the instrument detection limit, one-half of the reported value was used in the statistical evaluations.
Exceedances of the Preliminary Remedial Action Goals for arsenic (18µg/l) and cadmium (5µg/l) are shown in bold.
Source: ESE 1996

TABLE D-38

Average Sample Results from Non-Network Wells in the Smelter Hill Subarea
ARWW&S OU

Well I.D.	Location	Zone Monitored	Number of Samples	Arithmetic Average	
				Arsenic (µg/l) Dissolved	Cadmium (µg/l) Dissolved
D2-BR	Repository Area	Alluvium	2	41.7	2.1
MW-244	East Anaconda Yard	Alluvium	1	7	<.01
MW-35	Anaconda Ponds	Alluvium	3	41	<2
MW-36d	Anaconda Ponds	Alluvium	1	<1	0.3
MW-36s	Anaconda Ponds	Alluvium	3	20	<4
MW-37	Anaconda Ponds	Alluvium	3	<3	<2
MW-38	Anaconda Ponds	Alluvium	1	<5	<5
MW-39	Anaconda Ponds	Alluvium	3	<3	<2
MW-55	Iron Ponds Area	Alluvium	165	5123	16 t
MW-56	Iron Ponds Area	Alluvium	168	26901	10206 t
MW-57	Iron Ponds Area	Alluvium	169	1873	12 t
MW-58	Iron Ponds Area	Alluvium	168	62t	11 t
MW-63	Repository Area	Alluvium	22	7	1
MW-64	Repository Area	Alluvium	22	3	2
MW-65	Repository Area	Alluvium	23	5.4	1
MW-75	Anaconda Ponds	Alluvium	3	3.4	25.9
MW-3	Repository Area	Alluvium?	2	13	5
MW-4	Repository Area	Alluvium?	2	2	5
MW-66	Lower Mill Creek	Alluvium?	1	5	5
MW-66A	Lower Mill Creek	Alluvium?	6	2	0.1
MW-67	Repository Area	Alluvium?	21	10	1
MW-68	Repository Area	Alluvium?	23	5.9	1.3
MW-245s	Smelter Hill	Bedrock	1	1170	---
MW-247	East Anaconda Yard	Bedrock	1	<1.1	---
MW-53	Iron Ponds Area	Bedrock	150	3486	11 t
MW-54	Iron Ponds Area	Bedrock	165	1868	39 t
MW-96	Stack Area	Bedrock	3	2840	11.3
MW-97	Stack Area	Bedrock	2	230	87.5
MW-97R	Stack Area	Bedrock	1	3300	29
MW-98	Stack Area	Bedrock	2	480	461
NGP-1	Smelter Hill	Bedrock	2	171.5	0.06
WGP-2	Smelter Hill	Bedrock	1	3.3	---
MW-43	Anaconda Ponds	Tailings	40	3489	27 t
MW-73	Anaconda Ponds	Tailings	2	1455	13.6

t = total metals analysis for arsenic and cadmium
--- = not analyzed
< = less than instrument detection limit
ID = identification
µg/l = micrograms per liter

TABLE D-39

Seep and Spring Sample Results for the Smelter Hill Subarea
ARWW&S OU

Station	Location	Date Sampled	Dissolved Arsenic (µg/l)	
SH-1	Walker Gulch	4Q'92	394.0	
SH-2	Walker Gulch	4Q'92	917.0	
SH-3	Walker Gulch	4Q'92	39.3	
SH-4	South Side of Smelter Hill	4Q'92	1450.0	
SH-5	Southeast side of Smelter Hill	4Q'92	15.2	
SHSN-1	Northeast Side of Smelter Hill	4Q'92	5.1	
SHSS-1	Northeast Side of Smelter Hill	4Q'92	4.3	
SP97-10	Aspen Hills	2Q'97	277.0	
SP97-11	Aspen Hills	2Q'97	608.0	
SP97-12	Aspen Hills	2Q'97	482.0	
SP97-13	Aspen Hills	2Q'97	37.4	
SP97-14	Clear Creek	2Q'97	3.6	
SP97-15	Clear Creek	2Q'97	5.7	
SP97-16	Clear Creek	2Q'97	1.1	
SP97-17	Upper Mill Creek	2Q'97	112.0	
SP97-18	Upper Mill Creek	2Q'97	87.4	
SP97-19	West of Naser Gulch	2Q'97	2.5	
SP97-21	Clear Creek	2Q'97	147.0	
SP97-22	Cabbage Gulch	2Q'97	223.0	
SP97-23	Cabbage Gulch	2Q'97	42.3	
SP97-24	Aspen Hills	2Q'97	269.0	
SP97-25	Aspen Hills	2Q'97	710.0	
SP97-26	Upper Willow Creek	2Q'97	60.4	
SP97-27	Upper Willow Creek	2Q'97	34.8	
SP97-28	Upper Willow Creek	2Q'97	50.9	
SP97-29	Upper Willow Creek	2Q'97	260.0	
SP97-30	Upper Willow Creek	2Q'97	33.8	
SP97-31	Upper Willow Creek	2Q'97	74.8	
SP97-32	Mount Haggin	2Q'97	73.1	
SP97-33	Mount Haggin	3Q'97	189.0	
SP97-34	Mount Haggin	3Q'97	42.9	
SP97-35	Mount Haggin	3Q'97	29.3	
SP97-36	Mount Haggin	3Q'97	32.3	
SP97-37	Mount Haggin	3Q'97	17.4	
SP97-38	Mount Haggin	3Q'97	42.7	
SP97-39	Upper Mill Creek	3Q'97	45.9	
SP97-40	Upper Mill Creek	3Q'97	20.1	
SP97-9	South Side of Smelter Hill	2Q'97	1990.0	
SS-T-07	Aspen Hills	3Q'95	172.0	t
SS-T-08	Clear Creek	3Q'95	22.0	t
SS-T-09	Clear Creek	3Q'95	23.0	t
SS-T-10	Clear Creek	3Q'95	5.0	t

Station	Location	Date Sampled	Dissolved Arsenic (µg/l)	
SS-T-13	Cabbage Gulch	3Q'95	129.0	t
SS-T-19	Cabbage Gulch	4Q'96	57.0	
SS-T-20	Cabbage Gulch	4Q'96	94.0	
SS-T-21	Cabbage Gulch	4Q'96	61.0	
SS-T-22	Cabbage Gulch	4Q'96	52.0	
SS-T-23	Cabbage Gulch	4Q'96	54.0	
SS-T-24	Cabbage Gulch	4Q'96	46.0	
SS-T-25	Cabbage Gulch	4Q'96	210.0	
SS-T-26	Cabbage Gulch	4Q'96	36.0	
SS-T-27	Cabbage Gulch	4Q'96	76.0	
SS-T-30	Naser Gulch	2Q'97	245.0	
SS-T-31	Naser Gulch	2Q'97	324.0	
SS-T-32	Southest of Naser Gulch	2Q'97	146.0	
SS-T-33	South of Stack	2Q'97	708.0	
SS-T-34	South of Stack	2Q'97	777.0	

t = total metals analysis
µg/l = micrograms per liter

TABLE D-40

Statistical Summary of Metals in Regional Surface and Subsurface Soil
ARWW&S OU

	Depth Interval	Number of Samples	Maximum	Minimum	Arithmetic Mean	Geometric Mean
Arsenic	0-2 inches	791	3,960	16	457	234
Cadmium		581	85.9	0.2	9.7	5.2
Copper		508	10,185	29	1308	632
Lead		707	1,910	9	252	137
Zinc		510	6,890	32	721	425
Arsenic	2-10 inches	388	2,440	2.3	237	122
Cadmium		325	126	0.2	4.9	2.4
Copper		354	18,133	6.2	509	156
Lead		370	1,550	6	88	40
Zinc		354	3,500	28	339	200
Arsenic	Greater than 10 inches	189	1,250	0.6	145	56
Cadmium		175	32	0.2	2.4	0.8
Copper		186	7,590	3.5	299	44
Lead		184	587	3.8	32	16
Zinc		186	3,850	18.4	242	92

Source: ESE 1996

Record of Decision Amendment
Anaconda Regional Water, Waste and Soils Operable Unit
Anaconda Smelter NPL Site

U.S. Environmental Protection Agency

Montana Department of Environmental Quality

September 2011

Part 3: Responsiveness Summary

Responsiveness Summary

Responsiveness Summary

Written comments to the Anaconda Regional Water, Waste and Soils (ARWW&S) Operable Unit (OU) Record of Decision (ROD) Amendment Proposed Plan were received from Anaconda – Deer Lodge County (ADLC), the Clark Fork River Technical Assistance Committee (CFRTAC), the Clark Fork Coalition (CFC), the Arrowhead Foundation, Anaconda Local Development Corporation (ALDC), Atlantic Richfield Company (Atlantic Richfield), and one individual from the general public. These comments are provided in Appendix A. Each of these comments is addressed below by the U.S. Environmental Protection Agency (EPA) and the Montana Department of Environmental Quality (DEQ) in the following subsections. The format used is that a synopsis of the comment is provided, followed by EPA and DEQ's response in italic font. Complete comments as received by EPA are attached to this Responsiveness Summary as Appendix A.

Several of the comments received addressed issues that were not included in the Proposed Plan. The ARWW&S OU ROD Amendment (and this Responsiveness Summary) only addresses changes to the 1998 ARWW&S OU ROD. EPA anticipates completing a proposed plan addressing possible changes to the 1996 Community Soils OU ROD in fall of 2011, which will address residential soils and dust, and commercial/industrial properties within the community of Anaconda.

1.0 Comments from ADLC

A. ***Institutional Controls:*** ADLC believes that the Proposed Plan does not adequately address institutional controls for the site, in particular several controls being developed by ADLC including the Development Permit System, Interim Institutional Controls Program, and Interim Community Protective Measures Program.

EPA and DEQ Response: *Institutional controls were described in detail in the 1998 ARWW&S OU ROD, see ROD page DS-89 through DS-91, and include the provisions identified by ADL. Therefore, no significant changes to the Selected Remedy addressing these institutional controls presented in the ROD are set forth in this ROD Amendment.*

B. ***Domestic Well Permit:*** ADLC has enacted a well permit program as part of its Development Permit System, and would like to participate with DEQ and Montana Department of Natural Resources and Conservation (DNRC) in the proposed Controlled Ground Water Area in the coordination, notification, and enforcement of these two program requirements.

EPA and DEQ Response: *The Agencies agree with this comment. Through the establishment of the anticipated Controlled Groundwater Area (CGWA), notification of well drilling permit applications received by DNRC will be forwarded to ADLC, and coordination of sampling and any other requirements will be conducted under the*

Domestic Well Management and Replacement Plan. EPA will coordinate the development of the Controlled Ground Water Area with DEQ.

C. ***Dutchman Creek Wildlife Management Area:*** ADLC has concerns that the proposed Dutchman Creek Wildlife Management Area lacks adequate controls to manage high arsenic soils if a road or parking lot is constructed.

EPA and DEQ Response: *Several other commenters also questioned the potential for off-site transport of high arsenic soils through the development and operations of the Wildlife Management Area. To address this concern, EPA and DEQ will require through the land management plan roads and/or parking lots constructed within the HAA to either remove or cover contaminated soils in accordance with approved Superfund designs should the Dutchman area become a wildlife management area.*

D. ***Additional Characterization:*** ADLC comments that additional source (at the Opportunity and Anaconda Ponds and at the Dutchman High Arsenic Area) and hydrological characterization should be conducted and suggests that interim decisions concerning technical impracticability be considered pending additional characterization. ADLC further comments that the proposed monitoring program can be characterized as reactive and questions if the Opportunity tile drain collapses if there is a significant risk of contamination of the aquifer used for human health by the community of Opportunity.

EPA and DEQ Response: *As discussed in the TI evaluation reports, several soils, ground water and surface water investigations have been conducted since the 1998 ARWW&S OU ROD was issued. These investigations are listed in the reports. EPA and DEQ believe that sufficient data has been collected to support the TI evaluations and decision to grant waivers of the arsenic human health standards at the four areas addressed in the reports.*

Note that the TI decisions will be reviewed every five years. If the alternate remedial strategies provided in the ROD amendment are determined to be unprotective of human health and/or the environment, the decisions will be revisited.

Concerning the risk to the alluvial aquifer beneath the community of Opportunity in the event of a tile drain failure, a monitoring well network has been included to test the uppermost portion of the aquifer upgradient from the community, where contaminant migration would first be anticipated. If arsenic contamination were detected in those points of compliance wells, actions would be triggered that may include additional characterization, design and construction of permanent Superfund source control measures, and increased monitoring of domestic wells under the Domestic Well Monitoring and Replacement Plan.

E. ***Opportunity Tile Drain System:*** ADLC has several comments concerning the community of Opportunity's tile drain system. ADLC seeks clarification from EPA whether discharges from the tile drains north of Highway 1 are included in the South Opportunity surface water/alluvial aquifer technical impracticability (TI) zone and whether they require Montana Pollutant Discharge Elimination

System (MPDES) permits. ADLC also requests that Atlantic Richfield be directed to sample the tile drain discharges for water quality. ADLC requests that the tile drains south of Highway 1 be recognized as a barrier to the migration of contaminated ground water into the community of Opportunity, and that they be maintained under Superfund.

EPA and DEQ Response: *The tile drain discharges at Opportunity are not considered to be Superfund remedial discharges, and EPA and DEQ do not consider the tile drain system to be part of remedy. Whether the tile drains require MPDES permits is not a Superfund issue. The current monitoring plans for ground water and surface water quality are adequate to monitor potential changes in the ground water and receiving streams. EPA and DEQ do not believe collection of additional tile drain monitoring data is necessary at this time. The Agencies recognize that the tile drains have an anthropogenic effect on water quality and flow in the Opportunity area and currently appear to be capturing arsenic-impacted shallow ground water and discharging that water into Willow Creek. Whether the tile drains continue to perform this function will be monitored indirectly through the ground water and surface water monitoring programs including one of the tile drains south of Highway 1 (WCT-27).*

F. ***Recreational Use in High Arsenic Areas (HAA):*** ADLC is concerned about the safety and health of recreational users in HAA, specifically: (1) consumption of fish and wildlife taken by fisherman and hunters at the proposed Dutchman Creek Wildlife Management Area; and (2) exposure of children and pets to high arsenic soils. ADLC recommends that a public education program be implemented with information distributed at points of entry, and a biomonitoring program be implemented to evaluate fish and wildlife that may be taken from HAA and consumed by humans, including a testing program of species taken by sportsmen upon request.

EPA and DEQ Response: *The risk analysis presented in the human health risk assessment addendum attached to the Dutchman final design report concludes that creation of a wildlife management area in the Dutchman High Arsenic Area poses no unacceptable risk to human health. A wildlife biomonitoring investigation by Texas Tech University in cooperation with EPA and the U.S. Fish and Wildlife Service (USF&WS) was conducted in 1999 and 2000 to assess actual health effects endpoints in wildlife inhabiting the area. The Wildlife Biomonitoring Report (Hooper et al 2002) concluded that arsenic and metals are not accumulating to detrimental levels in upper trophic level receptors such as the American kestrel, and that metal bioavailability to small mammals in aerial deposition areas such as the Dutchman wetlands is low.*

Based on the results of this study, EPA and DEQ conclude that there is no substantive reason to require biomonitoring at the proposed Dutchman Wildlife Management Area and that hunting dogs or other pets are not at risk. The Montana Department of Fish, Wildlife and Parks (FWP) has indicated that they may conduct biomonitoring as part of their management of the wildlife management area should the Dutchman area become a wildlife management area. If, in the future, FWP biomonitoring results indicate a potential for risk to the public, EPA may revise the Superfund Operations &Maintenance (O&M)

requirements for the Dutchman High Arsenic Area, for example under the five year review protectiveness evaluation.

Because surface water quality in the Dutchman area meets aquatic life standards, the Agencies believe that the potential for bioaccumulations of contaminants of concern in fish that may be harmful to humans consuming these fish over a long period of time is low. FWP may conduct fish tissue biomonitoring to confirm this assumption.

Entry points to the Dutchman area currently have signs indicating that the area is within a Superfund area and that users should take appropriate precautions. It is anticipated that this part of the Superfund education program will be maintained by FWP in the future should the Dutchman area become a wildlife management area.

G. ***Wildlife Enhancement near ADLC-Owned Facilities:*** ADLC believes that the establishment of a Wildlife Management Area near county-owned facilities (i.e., the airport and wastewater treatment discharge ponds) may result in increased encounters with wildlife that may result in vehicle and equipment accidents and injuries. ADLC requests that FWP and Natural Resource Damage program (NRD) consider funding a wildlife-proof fence around these facilities.

EPA and DEQ Response: *FWP and Montana Department of Justice –NRD funding of a wildlife-proof fence is not a Superfund concern and is outside of the scope of this ROD amendment.*

H. ***Inadequacy of FWP funding:*** ADLC is concerned that the $1 million account proposed for FWP to perform long-term Superfund O&M required under the proposed Dutchman Creek High Arsenic Area remedy may be inadequate, particularly in light of any new requirements that may be mandated under the final remedy.

EPA and DEQ Response: *The proposed $1 million account would be for FWP to manage the wildlife management area, and FWP believes the proposed amount is adequate for that purpose. There is some overlap between that management and Superfund requirements. FWP, with input from NRD, has reviewed the Dutchman Final Design Report, which identifies Superfund long-term monitoring and management requirements, and believes certain of the components can be accomplished better as part of its management. However, Atlantic Richfield would maintain responsibility for Superfund components other than institutional controls, such as long-term inspection and maintenance requirements.*

2.0 Comments from the Clark Fork River Technical Assistance Committee

Two sets of comments were received from the CFRTAC (Kuipers and Associates and Darrel Barton).

A. ***Inadequate Characterization of the Dutchman area***: CFRTAC believes that given the high levels of arsenic contamination that will remain in place at the Dutchman area, further investigations are needed to characterize the depth of contamination, concentrations of contaminations at various depths, and their impacts.

EPA and DEQ Response: *ADLC shared a similar concern. Please refer to the response to 1.D. EPA and DEQ believe that the current understanding of the site based on available data provides a sufficient basis for the decisions documented in this ROD amendment. EPA and DEQ do not believe additional subsurface characterization is necessary, or would change the decisions set forth in this ROD amendment.*

B. ***Continued Source of Loading to the Clark Fork River***: CFRTAC states that without removal of contaminants in the Dutchman High Arsenic Area, this area will continue to be a source of arsenic loading to the Clark Fork River.

EPA and DEQ Response: *EPA and DEQ acknowledge that the Dutchman area will continue to be a source of arsenic loading to the Clark Fork River. However, removal of the arsenic-contaminated soils, with significant impact to the existing wetlands, would still not lead to the arsenic concentrations in the Clark Fork River meeting standard.*

C. ***Limited Public Outreach***: CFRTAC notes that there was limited public attendance at recent public meetings, and offers their help in getting increased public involvement.

EPA and DEQ Response: *Several notices seeking public input were provided in local newspapers and mailings. Additional meetings were also provided to solicit input. EPA and DEQ appreciate CFRTAC's offer of future assistance.*

D. ***Inadequate Characterization of Opportunity Ponds and Anaconda Ponds tailings impoundments***: CFRTAC believes that the long-term characterization of the two tailing impoundments is inadequate, particularly if the acid-generation potential of the impoundments exceeds the neutralizing potential of the underlying aquifers in the future. CFRTAC asks whether an interim decision is more appropriate for the site, pending additional data collection. CFRTAC asks what financial assurance mechanisms are in place in the event that future releases of contamination occur.

EPA and DEQ Response: *Please refer to the response to 1.D. The remedy for the Opportunity Ponds and the Anaconda Ponds have not been changed since the 1998 ROD, and consequently are not included in the scope of this ROD amendment. The 1998 Selected Remedy remains the same for Waste Management Areas, so there is no need for interim decisions.*

As part of the design of the Opportunity Ponds remedy, Atlantic Richfield is constructing a ground water/surface water management system to capture acid-generating water at a portion of the toe of the ponds. A long-term O&M plan will be required after this system has been installed. Additionally, ground water points of compliance will be monitored on

a semi-annual basis indefinitely. Violations of these points of compliance would trigger additional work.

EPA evaluates corporate financial tests and guarantees for the Atlantic Richfield routinely as part of its oversight of settlements, unilateral orders, and administrative orders on consent. The issue of financial assurance is an enforcement issue. As such, it is not a remedy issue addressed by the ROD or modifications to the ROD. Nevertheless, the legal instrument which requires that Atlantic Richfield perform remedial action at the Opportunity Ponds does require adequate financial assurance. Atlantic Richfield generally satisfies this requirement by providing information to EPA that it is capable of performing all work on the basis of its financial position as indicated in its balance sheets.

E. ***Opportunity Tile Drain System***: CFRTAC does not believe that the role that the Opportunity tile drain system plays in protecting the community of Opportunity's ground water has been adequately characterized. CFRTAC believes that the drain tile system presents an environmental and economical risk to the residents of Opportunity if not adequately maintained. CFRTAC also recommends that EPA evaluate the current agreement between Atlantic Richfield and the Opportunity Drain Tile Association with respect to points of discharge and environmental liability, O&M, and financial adequacy, and explain what role if any EPA would expect to play in the event the association failed to conduct the necessary O&M or funding was no longer available to conduct such activities on its portion of the system, and for the same activities on the south portion of the system, or on the portion of the system owned by the Anaconda Country Club?

EPA and DEQ Response: *Please refer to our response to 1.E. Because EPA and DEQ do not considered the drain tiles to be Superfund remedial components and because agencies do not generally interfere in agreements between private parties, the Agencies see no need to review the agreement between Atlantic Richfield and the Opportunity Drain Tile Association. The monitoring programs presented in the ROD amendment should be adequate to detect any migration of arsenic contaminant plumes towards domestic well points of use, and additional work will be required if ground water points of compliance at Opportunity are exceeded.*

F. ***Recreational Use in HAA***: CFRTAC has the same concerns as ADLC regarding recreational use in the proposed Dutchman Wildlife Management Area.

EPA and DEQ Response: *Please refer to our response to Comment 1.F.*

G. ***Inadequacy of FWP funding***: CFRTAC has the same concerns as ADLC regarding adequacy of the proposed FWP trust fund to manage the Dutchman Wildlife Management Area.

EPA and DEQ Response: *Please refer to our response to Comment 1.G.*

H. ***Concerns over the Efficacy of the LRES***: CFRTAC postulates that the Land Reclamation Evaluation System (LRES) may not be the most appropriate tool to

evaluate the Dutchman wetland complex. CFRTAC also requests an economic and environmental evaluation of the potential for vegetation failure in the Dutchman area and its consequences.

EPA and DEQ Response: *The LRES was indeed designed for use in upland areas and EPA acknowledges that it may not be the most appropriate tool to measure ecological functionality in a subirrigated/wetlands environment such as the Dutchman wetlands complex. However, like any site evaluation tool, the LRES does provide basic metrics to measure vegetation performance in terms of maintaining a minimum vegetative cover to prevent wind and water erosion of soils. Given the flat, subirrigated morphology of the Dutchman wetland complex, there is very little or no potential for vegetation failure other than through overgrazing (which will not be allowed for a minimum of five years under the land management plan), or if the natural subirrigated condition was somehow lessened. The latter is viewed as very remote, given that the Dutchman Creek wetland complex has existed as it does today throughout recorded history. Consequently, the economic risk of using the LRES to evaluate vegetation suitability as part of EPA's 5 year review is also low.*

3.0 Comments from the CFC

A. ***TI Waivers are premature:*** The CFC questions the decision to grant a TI waiver for the arsenic human health standard before all of the remedies of the 1998 ARWW&S OU ROD have been completed.

EPA and DEQ Response: *Prior to the lowering of the human health standard from 18 to 10 micrograms per liter (µg/L), the Agencies might have concurred with this comment. Mass loading analyses completed in the Mill Creek drainage in 1999 indicated that there was some potential to lower arsenic concentrations in the mainstem of Mill Creek to below18 µg/L. However, our analyses now indicates that there is little chance that arsenic loading to Mill Creek can be lowered below 10 µg/L.*

This does not change the remedial decisions addressing source control measures that were determined before the arsenic human health performance standard was lowered. The ARWW&S OU remedy remains unchanged in specifying soil treatment and revegetation, waste removals and consolidation within designated waste management areas, and monitoring and maintenance. As identified in the Proposed Plan and this ROD amendment, considerably more removals and soil remediation have been identified for the ARWW&S OU presently compared to the 1998 ROD through the completion of additional design data collection and characterization.

B. ***No data is available to indicate that stopping flood irrigation won't reduce arsenic below standards:*** CFC disagrees with the conclusions presented in the Proposed Plan drawn from the South Opportunity TI Evaluation that a cessation of flood irrigation practices in the South Opportunity area will not eventually lower arsenic concentrations in ground water. CFC cites the data from monitoring wells MW-232 as inconclusive due to its location downgradient from an irrigation that conveys arsenic-impacted surface water, and MW-225 as evidence that

ceasing flood irrigation does improve water quality (noting that the TI Evaluation uses a single data point as evidence that the arsenic concentration decrease began before flood irrigation cessation). CFC requests that EPA encourage area landowners to convert to more efficient irrigation practices such as pivots to see if arsenic concentrations in the underlying aquifer cannot be reduced to below the human health standard. If such measures are successful, then the area determined to be TI for arsenic can be reduced, and landowners should be compensated for the increased costs of more modern irrigation practices compared to flood irrigation.

EPA and DEQ Response: *EPA and DEQ agree with CFC that the data are inconclusive regarding the efficacy of irrigation reduction on reduction of arsenic concentration in ground water. It cannot be clearly concluded that cessation of irrigation changed the extent or magnitude of arsenic concentration as measured at a single well. However, for the Area of Concern as a whole, we observed a reduction in irrigated acreage by approximately 25 percent since 1996, but the sampling conducted after 1996 shows that arsenic contamination remains widespread and is not currently trending higher or lower. This suggests that this scale of change in irrigation was not effective at inducing a significant change in ground water contamination and it may require a major change in irrigation practices to result in an observable response in water quality. Additionally, the major source of contamination is the soil, and the major transport mechanism is seasonal saturation of the soil. In order to significantly reduce loading to ground water, the source, the transport mechanism, or both need to be altered. Large scale source removal was deemed impracticable. A large portion of the valley is jurisdictional wetlands and it hasn't been determined if these are irrigation-induced or naturally occurring. If they are irrigation-induced, a Superfund-imposed major change in irrigation would result in a loss of wetlands and would require mitigation by replacement elsewhere, which is beyond the scope of the ROD modification. If they are naturally-occurring, the transport mechanism would remain and little to no change in ground water contamination would be expected in these areas.*

The surface water and spring sampling conducted in 2008 identified several areas that contributed arsenic to surface water. Ground water investigations conducted in 1992 to 1995 and 2002 indicated widespread arsenic contamination. The body of data is sufficient to conclude that ground water contamination occurs in wetlands and non-wetlands supporting the theory that arsenic is mobilized by seasonal saturation caused by irrigation, wetlands, or both.

Modernizing historic irrigation practices to limit the amount of irrigation water that percolates into the shallow aquifer is a worthy goal that EPA and DEQ fully support, both from contaminant loading reduction and water conservation perspectives. Early on in the ARWW&S OU design process, the Agencies had discussions with Atlantic Richfield, area landowners and local government in expanding conservation easements to limit flood irrigation with some measure of compensation to upgrade irrigation equipment.

The Agencies do support programs to reduce historic flood irrigation practices in the South Opportunity area as a means to further reduce arsenic loading to ground water. EPA and

DEQ believe that this may be best implemented through landowner management plans and other mechanisms, rather than through remedy. Towards this end, EPA and DEQ intend to work with ADLC, local landowners, NRD, and Atlantic Richfield in developing partnerships to allow local landowners to voluntarily modernize their irrigation practices.

C. ***Partial soil removal options should be further explored:*** CFC believes that a partial soil removal alternative of removing arsenic-contaminated soil in wetland areas (as opposed to soil removal over the entire South Opportunity area) should be further evaluated, as these saturated soils are likely the greatest contributor to arsenic loading in ground water. CFC notes that one to two million cubic yards of soil could be removed from these areas, and used as cover material for the Opportunity Ponds, which would result in a substantial cost savings over the amounts estimated in the TI evaluation.

EPA and DEQ Response: *EPA and DEQ considered soil removal in wetlands areas at both South Opportunity and the Dutchman areas during the design/TI evaluation process. EPA and DEQ could not find a correlation between areas of high soil arsenic concentrations and elevated ground water concentrations or loading to surface water and concluded that partial soil removal would not result in a measurable effect on ground water and surface water. These areas of high soil arsenic concentrations do not pose an unacceptable risk to human health and the environment due to their well-vegetated nature; and unlike waste deposition areas such as those at the Clark Fork River, Silver Bow Creek, Warm Springs and Willow Creeks, and Milltown reservoir, the North Opportunity and South Opportunity OU wetlands are undisturbed areas that are ecologically functional and are valued as wildlife habitat.*

D. ***Arsenic waiver for Willow Creek is premature:*** CFC feels that other alternatives instead of the waiver for the arsenic human health standard be explored for Willow Creek, such as a permeable reactive barrier using zero valent iron to remove arsenic from shallow ground water discharging in the stream (a permeable reactive barrier (PRB) was analyzed in the TI evaluation, but CFC believes a shallower, less expensive alternative should be considered). CFC states that an arsenic waiver for Willow Creek should be deferred until: (1) flood irrigation practices are terminated and modern, less water wasteful and ground saturation irrigation methods are implemented; (2) partial soil removal in wetlands is implemented; and (3) a final remedy for the Warm Springs Ponds OU is determined.

EPA and DEQ Response: *These measures may lead to lower arsenic concentrations in lower Willow Creek and the Clark Fork River; however, upper Willow Creek is primarily fed by ground water discharges from the bedrock aquifer TI zone, so upstream waters would still likely exceed the arsenic human health standard. Discharge from the bedrock aquifer into the shallow alluvial aquifer in the South Opportunity area is also suspected to be a source of additional arsenic loading. EPA and DEQ have determined that even with the first two measures, Willow Creek would still not attain the 10 µg/L arsenic standard. The third measure, delaying waiver until the final remedy is selected for Warm Springs*

Ponds, would not affect the technical impracticability evaluation, as Warm Springs Ponds is part of another Superfund site and downstream of Willow Creek.

E. ***Domestic Well Area of Concern:*** CFC asks who is responsible for drilling new or deeper domestic wells in the event that arsenic contamination is detected in a landowner's well, and requests that stock wells be included in the program.

EPA and DEQ Response: *The cost of replacing new or existing domestic wells where arsenic concentrations are above the performance standard through the Domestic Well Monitoring and Replacement Program would be funded by Atlantic Richfield. Under the program, EPA and DEQ may elect to sample stock wells, but such wells will not be eligible for replacement because stock wells with exceedances would not present a risk to human health or the environment. Note that the University of Wyoming conducted a literature review of the risk to livestock and wildlife from consumption of water impacted by arsenic, and recommended that such waters be limited to no more than 1,000 µg/L arsenic (Raisbeck et al 2008). Ground water and surface water arsenic concentrations with the ARWW&S OU are much lower than that.*

F. ***Additional recommendations for the proposed Dutchman wildlife management area:*** CFC concurs with the proposed decision for the Dutchman wetland (TI waiver and establishment of a wildlife management area), but asks for additional measures to be implemented as safeguards to prevent human exposure to toxic contaminants. Specifically, CFC requests: (1) biomonitoring should include analyses of fish and game that people are likely to hunt and eat from the site; (2) additional analysis should be done to ensure that the area is safe for children and pets; (3)a boot wash area should be provided to keep contaminated soil within the site, preventing spread of arsenic to residences; (4) warnings and explanations should be clearly posted; (5) roads and parking areas should be paved to prevent dust and exposure to bare soil; (6) a wildlife fence should be placed around the airport; and (7) an adequate trust fund must be established for continuing monitoring and maintenance.

EPA and DEQ Response: *The Agencies appreciate that the CFC agrees that it is undesirable to disturb a large intact wetland area such as the Dutchman. As previously discussed above, we concur that additional safeguards should be included for the Wildlife Management Area as part of a long-term Superfund O&M Plan to minimize human exposure to the high arsenic soils in the Dutchman area. To answer CFCs points specifically: (1 and 2) As discussed above, previous wildlife biomonitoring studies did not identify any terrestrial wildlife risks from exposure to soil arsenic. However, FWP indicates that it intends to initiate its own biomonitoring program(s) should the Dutchman area become a wildlife management area. Additional biomonitoring may be conducted at the request of the USF&WS; however, these studies will not be part of the Superfund O&M Plan for the Dutchman area. The Superfund O&M Plan would be reviewed every five years by EPA, and if biomonitoring results indicate potential risk, the Superfund O&M Plan will be modified. (3) The Agencies do not believe that significant (i.e., harmful) arsenic levels would be transported off-site via muddy boots; however, this may be assessed by the additional studies. (4) Warnings are posted at entry points and this*

practice is expected to continue. (5) Roads and parking areas would be constructed to minimize human health risk through approved designs. (6) This is not a Superfund issue. (7) According to the FWP, adequate funding for management of the wildlife management area would be provided.

G. ***Expansion of Bedrock TI Zone should wait until remedy is implemented:*** CFC suggests that expansion of the Bedrock Aquifer TI zone should wait until more of the remedy is implemented.

EPA and DEQ Response: *Based on Final Design Reports approved by the Agencies, remedial actions are expected to address erosion, but will not have appreciable effects on ground water quality for the reasons stated in the Bedrock Aquifer TI prepared in 1996 and addenda prepared in 1998 and 2009.*

4.0 Comments from the Arrowhead Foundation

A. ***Treat the water emanating from the Dutchman Wetland to remove arsenic prior to discharge into the Clark Fork River:*** Arrowhead asks if constructing a water treatment plant to remove arsenic from lower Lost Creek prior to discharge into the Clark Fork River is a potential solution.

EPA and DEQ Response: *The North Opportunity TI Evaluation analyzed the feasibility of constructing a water treatment plant to remove arsenic from Lost Creek and Dutchman Creek prior to discharge into the Clark Fork River. Because of the significant flow of arsenic-impacted surface and ground water (estimated 50 cubic feet per second), the capital costs to build such a plant are estimated to range from $45 to 65 million dollars and annual O&M costs were estimated at nearly $9 million dollars.*

B. ***Offsite transport of arsenic from the Dutchman area:*** Arrrowhead asks how the vegetative cover at the proposed Dutchman wildlife management area will be maintained, and what guarantees that users will clean contaminated soil from clothing, equipment, and vehicles prior to leaving the wildlife management area.

EPA and DEQ Response: *Atlantic Richfield will be responsible to conduct inspection and maintenance at a minimum of once every five years. Additionally, FWP would implement a management plan that would provide improvement of existing vegetation. Every year, FWP would complete a self-audit of vegetation under their management plan, and would report the results to EPA and DEQ. Every five years, Atlantic Richfield or its designated representative will conduct an independent verification of the vegetative cover to ensure that it continues to meet Superfund performance standards under the long-term Superfund O&M plan. The results of Atlantic Richfield's assessment will be summarized in a report to EPA and DEQ, which will be submitted prior to the five-year review. It should be noted that, based on the risk assessment conducted for the Anaconda Smelter site, soil arsenic levels in the Dutchman Creek area do not present a health risk to hunters and other recreational users of the area. Therefore, additional measures are unnecessary to "ensure" that hunters and other recreational users follow guidelines for cleaning their gear and clothing.*

C. ***Risk to Dutchman wildlife management area users:*** Arrrowhead asks if the human health risk assessment addendum for the Dutchman area presented in the Dutchman final design report can be reconciled with the ROD amendment, and if it can be guaranteed that wild game meat taken from the Dutchman area be safe for human consumption.

EPA and DEQ Response: *The risk analysis presented in the human health risk assessment addendum attached to the Dutchman final design report concludes that creation of a wildlife management area in the Dutchman High Arsenic Area poses no unacceptable risk to human health. As noted earlier, a wildlife biomonitoring study conducted by Texas Tech University for USF&WS) concluded that the potential for arsenic accumulation in wildlife at the Anaconda site is minimal.*

5.0 Comments from the Atlantic Richfield Company

A. ***Naturally occurring arsenic should be acknowledged in the ROD amendment:*** Atlantic Richfield notes that arsenic occurs naturally above the 10 µg/L human health standard at many locations in Montana, including portions of the ARWW&S OU, and asks that the ROD amendment mention it in the discussion.

EPA and DEQ Response: *EPA and DEQ agree that arsenic occurs naturally in waters of the state at certain locations above the 10 µg/L standard, particularly in geothermal and mineralized areas. Text has been added to the ROD amendment document.*

B. ***Revisions to the Bedrock Aquifer TI Zone boundary:*** Atlantic Richfield requests that the TI Zone boundary be expanded to include well WV-04, where sampling results indicate the presence of arsenic above the 10 µg/L human health standard. Atlantic Richfield also asks that the results of the 2009 sampling conducted by the Montana Bureau of Mines and Geology be reviewed to determine if further adjustments of the boundary is warranted.

EPA and DEQ Response: *DW-WV-04 was included in the analysis and is shown on Figure 5-3 of the Bedrock TI Evaluation Addendum. This well lies within the expanded TI Zone. All of the available MBMG spring and well sampling data from 2009 were reviewed and no changes to the expanded Bedrock TI Zone boundary are necessary.*

C. ***Depth of the Alluvial Aquifer TI Zone:*** Atlantic Richfield comments that restricting the alluvial aquifer to the top few feet of the aquifer may not be valid and some areas, and suggests using "the upper zone of the aquifer" as alternative language.

EPA and DEQ Response: *Hydrogeological evaluations conducted to date have not defined any distinct aquifer zones in the alluvial aquifer.*

D. ***Extent of the Alluvial Aquifer TI Zone:*** Atlantic Richfield notes that since the conceptual site model states that arsenic concentrations may exceed the human health standard wherever shallow ground water is in contact with arsenic-

contaminated soils, the North and South Opportunity Alluvial Aquifer TI Zones should be merged into one larger TI zone, and notes that such a boundary would be more administratively simpler for establishing a controlled ground water area.

EPA and DEQ Response: *Although the conceptual site model does predict arsenic exceedances where shallow ground water is in contacted with arsenic contaminated soils, there is no analytical data to support expanding the horizontal boundaries of the TI Zones. If additional data in the future indicate that alluvial aquifer arsenic contamination extends past the current boundaries (or conversely, is clean within the TI zone boundary), EPA will evaluate revision of the TI Zone boundaries during the five-year review. TI zone boundaries do not have to coincide with controlled ground water area boundaries.*

E. ***North Opportunity Alluvial Aquifer TI Zone:*** Atlantic Richfield requests that, at a minimum, the RDU 10 portion of Warm Springs Creek be included in the North Opportunity TI Zone.

EPA and DEQ Response: *Those wetland areas within RDU 10 with characteristics similar to the Dutchman area are included in the North Opportunity TI Zone.*

F. ***Scope of Ground Water Remediation:*** Atlantic Richfield requests for clarification that the ROD amendment text be clarified to state that ground water remediation is not required for the town of Warm Springs (a known geothermal area) and Section 32/33 (where no data exists to indicate that arsenic contamination in ground water is present).

EPA and DEQ Response: *EPA and DEQ agree with this clarification and have added text to the ROD amendment.*

G. ***Scope of Spring-fed Tributaries to TI Waiver:*** While Atlantic Richfield concurs with the arsenic human health standard waiver; they request that the waiver be expanded to include the State of Montana's total recoverable aquatic life standards for all contaminants of concern, deferring to the federal aquatic life standards which are based on dissolved arsenic and metals. Atlantic Richfield states that the existing data demonstrates that the streams cannot be in compliance with DEQ-7 standards at all times.

EPA and DEQ Response: *While there are occasional exceedances of DEQ-7 standards for cadmium, copper, lead and zinc in all four perennial streams, these exceedances are limited to high flow or storm events. Remedial action construction of the uplands remedies and streamside tailings removals along Warm Springs and Willow Creeks have yet to be implemented. These actions are expected to greatly reduce the amount of contaminated runoff that causes exceedances of total recoverable metals standards. Those actions are expected to bring the creeks into compliance so it is premature to consider waiving standards until these actions have been completed. EPA and DEQ will review monitoring data as remedies are completed to determine if additional work or TI evaluations are necessary as part of the five-year review. If TI evaluations indicate that it is warranted, alternative surface water quality performance standards may be considered at that time.*

H. ***Scope of Domestic Well Area of Concern:*** Atlantic Richfield states that the proposed Domestic Well Area of Concern extends beyond locations where arsenic concentrations are greater than 10 µg/L, and such areas may have elevated arsenic concentrations due to natural conditions. Atlantic Richfield is presently conducting evaluations of the extent of naturally occurring arsenic within the ARWW&S OU.

EPA and DEQ Response: *EPA and DEQ will require a process in the Domestic Well Monitoring and Replacement Plan that includes an evaluation of source of arsenic exceedances in a domestic well (i.e., mining-related or naturally occurring). The Domestic Well Area of Concern has been intentionally located beyond the TI zones as a conservative measure to ensure that all potential areas where mining or smelting-related arsenic contamination in ground water could occur are included in this program. Other areas where little or no data are available will be further investigated to determine whether they should be included in the Domestic Well Area of Concern and/or controlled ground water area after this ROD amendment.*

I. ***Ground Water Points of Compliance:*** Atlantic Richfield concurs that no ground water point of compliance is required at the north toe of the Anaconda Ponds, and that new monitoring wells proposed as ground water points of compliance must be below standards for 4 consecutive sampling events before they officially become points of compliance.

EPA and DEQ Response: *The selection of future points of compliance is beyond the scope of this ROD amendment.*

J. ***Dutchman High Arsenic Area:*** Atlantic Richfield notes that portions of the Dutchman High Arsenic Area as shown in Figure 5 of the proposed plan include the ADLC Airport, portions of which will be remediated under RDU 7 North Opportunity Uplands. Consequently, these areas should be removed from the High Arsenic Area. Atlantic Richfield supports the inclusion of wetland areas east of the east-west runway into the High Arsenic Area, and notes that the State of Montana and ADLC will be responsible for enforcing access restrictions on their property.

EPA and DEQ Response: *The Dutchman High Arsenic Area boundary has been revised to exclude all property owned by ADLC. The Agencies agree that state and local governments are responsible for enforcing property restrictions, but note that Atlantic Richfield would be responsible for conducting an independent assessment of the efficacy of these restrictions under the long-term Superfund O&M plan for the Dutchman High Arsenic Area. The results of Atlantic Richfield's assessment will be provided to the Agencies in a report prior to the five-year review.*

K. ***Remedial Action Objectives:*** Atlantic Richfield requests that the Federal ambient water quality standards be used as interim surface water quality performance standards in lieu of State of Montana DEQ-7 standards, and that "in the event future surface water monitoring shows compliance with the interim federal

standards cannot be achieved through completion of reclamation and the other elements of the ARWW&S Remedy, the modified ROD should acknowledge that alternative permanent standards for surface water quality may be developed in conjunction with the future monitoring program to ensure that a practical system of compliance is in place long-term that protects both human health and the environment".

EPA and DEQ Response: *Please refer to our response to 5 (G).*

6.0 Comments from Penny Ryan

A. ***Objections to waiving the arsenic human health standard:*** Ms. Ryan states that the costs of cleanup should never supersede the public's health issues.

EPA and DEQ Response: *Cost is only considered in a waiver if the agencies determine a standard is technically impracticable due to inordinate cost, a very high bar. Even with a waiver, the remedy must remain protective of human health and the environment. The alternative remedial plan, detailed in the Proposed Plan and ROD amendment, ensures that the public will be protected through monitoring, institutional controls, including a controlled ground water area, and well replacement, if necessary...*

B. ***Communicating risk to the public:*** Ms. Ryan believes that the public should have been made aware of the risks from gardening and soil contamination.

EPA and DEQ Response: *Communication of risk from gardening and exposure to potentially contaminated soils will be addressed in the Community Protective Measures Program administered by ADLC. This topic will be discussed in the forthcoming proposed plan for the Community Soils OU (anticipated to be completed in the fall of 2011), and is out of scope of this ARWW&S ROD amendment.*

C. ***Residential soils arsenic cleanup standard:*** Ms. Ryan objects to the soil cleanup standard for residential areas of 250 mg/kg.

EPA and DEQ Response: *Cleanup of residential soils is being conducted under the Community Soils OU. As such, revisiting the cleanup level for residential soils is beyond the scope of this ARWW&S OU ROD amendment. Nevertheless, EPA's risk assessment concluded that soil arsenic concentrations less than 250 mg/kg do not present a risk to residents. The Anaconda soil arsenic level was based on site-specific toxicological testing and is applicable only to the Anaconda Site while many other sites rely on textbook or guideline values.*

D. ***Medical Monitoring:*** Ms. Ryan believes that with ongoing soil excavation and placement, the public should be afforded medical monitoring to verify that exposure to contaminants is not occurring.

EPA and DEQ Response: *Medical monitoring is beyond the scope of this ARWW&S OU ROD amendment. It is within the scope of the Community Protective Measures Program, and may be addressed in the forthcoming ROD amendment to the Community*

Soils OU. EPA notes that ambient air monitoring conducted by both ADLC and Atlantic Richfield around the perimeter of the Opportunity Ponds Waste Management Area during remedial action construction has not identified any exceedances of state and federal air quality standards.

E. ***Frequency of domestic well testing:*** Ms. Ryan objects to domestic wells being tested only 3 times in 10 years for arsenic, stating that individuals could potential consume contaminated water for several years in between tests.

EPA and DEQ Response: *This was also a concern of ADLC. In 2006, the county initiated monthly testing of domestic wells in the community of Opportunity. The results of this testing confirmed the results of ongoing ground water monitoring being conducted at the ARWW&S OU – that ground water concentrations are slow to change given the rates of ground water movement at the site and therefore the less frequent monitoring was appropriate.*

7.0 Comments from Anaconda Local Development Corporation

A. ***Objections to extending the Old Works Waste Management Area***. ALDC objects to incorporating an additional 13 acres of the KANA parcel within the Old Works WMA.

EPA and DEQ Response: *The portion of the Old Works WMA boundary in this area will be revised to remove this additional portion of the KANA parcel (i.e., the Old Works WMA boundary will be restored to the original boundary shown in the 1998 ARWW&S OU ROD for this 13 acre area).*

8.0 References Cited

Hooper, M.J., Cobb, G.P. and S.T. McMurray. 2002. Final Report: Wildlife Biomonitoring at the Anaconda Smelter Site, Deer Lodge County, Montana, Inst. of Env. and Human Health, Texas Tech Univ.

Raisbeck, M.F., Riker, S.L., Tate, C.M., Jackson, R., Smith, M.A., Reddy, K.J., and Zygmunt, J.R. 2008. Water Quality for Wyoming Livestock & Wildlife: A Review of the Literature Pertaining to Health Effects of Inorganic Contaminants. University of Wyoming College of Agricultural Bulletin 1183.

Appendix A
Comments

Anaconda-Deer Lodge County Comments on the Proposed Plan for Modifications to the Remedy Anaconda Regional Water, Waste and Soils Anaconda Smelter Superfund Site

By
Kuipers and Associates
January 29, 2010

The following comments on the Environmental Protection Agency's (EPA's) Proposed Plan for Modifications to the Remedy Anaconda Regional Water, Waste and Soils (ARWWS) Anaconda Smelter Superfund Site (the Plan) have been developed by Kuipers & Associates based on input from the Anaconda-Deer Lodge County's (ADLC's) Chief Executive, County Commissioners, county Planning Department and Public Health Department staff and local citizens.

General

The opportunity for a technical meeting to clarify and discuss the Plan with EPA and DEQ, their consultants, and other agency staff (Montana Fish Wildlife and Parks and Montana Natural Resource Damage Program) was sincerely appreciated. Together with the extension of the comment period this allowed for meaningful consideration and comment by the county, and EPA and the other agencies are commended for their consideration with respect to public and local government involvement on this proposal.

As the county's government and citizens have increased their knowledge and involvement in Superfund and related matters it has become evident that the decisions contained in the Plan and other related actions have a significant impact on their economic and environmental well-being. It is the county's intent to become and remain involved in these decisions so as to best serve it and its citizens' interests. In that regard it is the county's goal to establish a mutually cooperative relationship with its fellow and various state and federal agencies in the immediate and long-term management of all areas of the county including those particularly referenced in the Plan.

Institutional Controls

As EPA is aware, the county has made significant strides with respect to its involvement in Institutional Controls (ICs) at the Anaconda Smelter Superfund Site. The Plan does not provide information on ICs applicable to the site. The county believes that the Proposed Plan, or at least the Record of Decision (ROD) modification, should provide more details on the existing and future ICs envisioned for the site. This should include recognition of the ICs programs including the Development Permit System (DPS), Interim Institutional Controls Program (IICP) and Interim Community Protective Measures Plan (ICPMP) currently being utilized by ADLC pending a final ICs plan being developed with EPA and Atlantic Richfield. Those programs would provide provisions that would restrict land or resource use at the site, control development activities, and provide community health information as well as respond to concerns raised by local residents or business owners.

ADLC has enacted a well permit requirement which in concert with its Development Permit System would require notification and direction of future groundwater development activities including domestic wells. The county through its Public Health Department would desire to participate with the Montana Department of Environmental Quality (DEQ) and Montana Department of Natural Resources and Conservation (DNRC) in the establishment and enforcement of the controlled groundwater areas and coordination of our various permitting and notification requirements.

ADLC is interested in determining how ICs will be developed and enforced for those areas of the site owned by the State of Montana. For example, in the event of parking lot construction or modifications, who will ensure that any soils are properly removed and deposited in an authorized repository and ensure that any caps are maintained? The county would be interested in working with the State to use the county's ICs program to ensure such activities are controlled and do not compromise the existing remedy.

ADLC recommends that EPA provide additional ICs information in the modified ROD. ADLC also recommends that any final decisions on the ICs program and Controlled Groundwater Area be delayed pending further discussions with the county on its related programs.

Technical Impracticability Zones and Controlled Groundwater Areas

ADLC appreciates the effort that EPA has undertaken to monitor groundwater and determine areas of concern within the Anaconda Smelter Superfund Site. However, without increased characterization of various sources of contamination, the monitoring program is largely reactive to future conditions and implementation of adaptive management techniques to future situations may be problematic. For example, if the drain tile system south of Hwy 1 failed, could a simple fix be employed or would it be likely that the entire Opportunity domestic well area might be at least temporarily threatened?

ADLC recommends that additional source (e.g. Anaconda and Opportunity Tailings, Dutchman soils) characterization together with hydrological characterization be conducted for the ARWWS. ADLC also recommends that the agency consider whether an interim decision pending additional characterization and monitoring might be more appropriate for this site. Finally, ADLC recommends that additional evaluation be done of the impacts of waste in place and potential long-term impacts on local surface water and in the Clark Fork River.

Drain Tile System

As the EPA is aware, in the early 1900's, the Anaconda Company installed a system of subterranean drain tiles in and around the community of Opportunity. These tiles are between four and six feet deep and drain from the ground any subsurface water that rises above the elevation of the tiles. Installation of the drain system was necessary to make what became Opportunity habitable. The County understands that there are at least two drain tiles south of Highway 1 and at least 7 drain tiles north of Highway 1. The County understands that each of these tile drains constitutes a discharge point.

The Proposed Plan references tile drains in only one place, which is found on page 4 in its description of the South Opportunity Alluvial Aquifer. There, the EPA states that the South Opportunity Alluvial TI Zone "would include surface water, particularly in lower Willow Creek and the Opportunity tile drains, which receive ground water discharge from this area. Based on discussions that occurred with the EPA and its consultants, the County understands that discharge from all known tile drains was tested and that only discharge from the two drains located south of Highway 1 showed arsenic contamination above applicable water quality standards. Discharge from the rest of the drain tiles tested "clean." The remaining tile drains are all north of Highway 1. It is unclear how this "clean" discharge is treated in the Proposed Plan.

ADLC recommends that EPA clarify how the discharge from the drain tiles located north of Highway 1 should be viewed. For example, it appears that these clean discharges are encompassed within the South Opportunity Alluvial TI Zone. Also, these drain tiles discharges may represent discharges into Willow Creek (the drain tiles north of Highway 1 do not appear to be part of the Bedrock Aquifer Area). For example, do the discharges from these drain tiles fall under the proposed waiver of water quality standards for arsenic because, even though clean, these discharges appear to be located within areas that are proposed for the T1 waivers, namely the South Opportunity Alluvia T1 Zone and the Surface Water T1 Zone? Were this the case, the County understands that it may never matter if, for whatever reason, discharge from these drain tiles begins to show elevated arsenic concentrations. Or, are these discharges excluded from the proposed T1 waiver zones and will be sampled periodically to assure that they remain clean and do begin to contribute to arsenic concentrations in either ground water or surface water? The County prefers this option and believes that EPA should require ARCO to sample the drain tile discharges periodically.

Also, the County recommends that EPA require ARCO to determine whether MPDES discharge permits are required for the drain tiles north of Highway 1. This is important because under the terms of a settlement between Atlantic Richfield and the Opportunity Drainage District, ARCO bears the liability for any costs associated with an MPDES Permit and treatment of the discharged water for CERCLA reasons. The Opportunity Drainage District owns six (6) of the seven (7) tiles north of the highway; the 7th drain tile appears to be owned by the Anaconda County Club. Will there be any requirement to sample these discharges periodically?

The County also recommends that the EPA expressly recognize that at least the two drain tiles south of the highway represent a barrier to the existing contaminated ground water plume, and to the extent it can, require that this barrier be maintained. If a party other than ARCO owns these drain tiles, then that party needs to be aware of the importance of this barrier in the selected remedy. While the EPA has stated that these two drain tiles will be designated as points of compliance, the county hopes that the EPA can take a more proactive and preventative approach to assure the integrity of these barriers. Such measures would be more cost effective and protective in the long run, than having to address an expansion of a contaminated ground water plume.

<u>Recreational Uses in High Arsenic Areas</u>

The county is concerned that recreational use in high arsenic areas presents a potential threat to human safety. It was extremely helpful to learn that the Dutchman area recreational use acceptability was

based on recreational usage as represented by golf usage at the Old Works Golf Course. However, given that recreational use includes the taking and ingestion of game species including fish, waterfowl and upland birds, and big game (deer and elk) from the area, which most likely was not considered in the previous human health risk assessments, ADLC is concerned that unsuspecting users might be exposed to a significant human health risk. ADLC is also particularly concerned for children who might use the area and be more highly vulnerable, and for hunting dogs which may be more highly exposed.

ADLC recommends that further evaluation be done of potential human health impacts due to the particular types of recreational use likely for the Dutchman and surrounding areas in the ARWWS OU. ADLC also recommends that a public education program be undertaken with appropriate information distributed on a regular basis to the local public as well as posted at all public points of entry. ADLC also recommends that a bio-monitoring program be conducted for those species most likely to inhabit and to be utilized by humans. The bio-monitoring program should at a minimum be conducted as part of the five-year review process and offered to the public at large to test game species on a voluntary basis.

Airport and Wastewater Treatment Discharge Ponds and Wildlife

ADLC continues to be concerned with wildlife related issues and operation of the airport and wastewater treatment discharge ponds. While ADLC recognizes that wildlife are a natural part of the area, and the county supports setting aside areas for wildlife and public recreational usage, this results in additional governmental burden on the county to provide support to management of wildlife. The county has received no additional funding for such efforts while losing tax revenue as lands are transferred to the State from private ownership.

ADLC requests that FWPs and the NRD program consider funding all or part of the cost of installing a wildlife proof fence along the perimeter of the county's wastewater treatment discharge ponds. ADLC also understands that FWPs staff have met with and assisted with airport related matters, and requests that FWP involve and coordinate such communications with ADLC's planning department (Paula Arneson, 563-4010), which assists the Airport Authority Board in the operation of the airport. ADLC would cordially request the opportunity to work more closely with FWPs to jointly manage wildlife and public recreation issues in those areas where they jointly impact both the county and state.

Adequacy of FWPs Trust Fund

As discussed with EPA and the other agencies, ADLC is concerned with the adequacy of the $1 million trust fund established to conduct operation and maintenance and any Superfund associated activities in the Dutchman area. It is recognized that it is very difficult to estimate future costs with a high level of confidence and ADLC believes the responsible parties did their best in establishing the fund amount. However, it has been the county's experience that the extent and cost of operation and maintenance together with institutional controls, monitoring (including bio-monitoring), and other regulatory requirements, is easily and typically underestimated. ADLC is particularly concerned that additional costs are now being proposed as a result of various recommendations, or as a result of future reassessment of site conditions (e.g. vegetative success), which would render the trust fund inadequate over the long-term.

ADLC recommends that FWP conduct a formal cost estimate for activities related to the Dutchman area to determine the adequacy of the existing funds, determine what management constraints might exist because of such funds, and determine what additional funds might be necessary as a contingency to reasonably probable events. This information should be made public and utilized to communicate FWP goals and progress with respect to long term management of the Dutchman area.

Clark Fork River Technical Assistance Committee Comments on the Proposed Plan for Modifications to the Remedy Anaconda Regional Water, Waste and Soils Anaconda Smelter Superfund Site

By
Kuipers and Associates
January 29, 2010

The following comments on the Environmental Protection Agency's (EPA's) Proposed Plan for Modifications to the Remedy Anaconda Regional Water, Waste and Soils (ARWWS) Anaconda Smelter Superfund Site (the Plan) have been developed by Kuipers & Associates based on input from the Clark Fork River Technical Assistance Committee (CFRTAC) board and members, and local citizens.

General

The opportunity for a technical meeting to clarify and discuss the Plan with EPA and DEQ, their consultants, and other agency staff (Montana Fish Wildlife and Parks and Montana Natural Resource Damage Program) was sincerely appreciated. Together with the extension of the comment period this allowed for meaningful consideration and comment by CFRTAC, and EPA and the other agencies are commended for their consideration with respect to public and local government involvement on this proposal.

Technical Impracticability Zones and Controlled Groundwater Areas

CFRTAC recognizes that EPA has required Atlantic Richfield to monitor groundwater and determine areas of concern within the Anaconda Smelter Superfund Site. However, it is unclear whether adequate characterization has been performed to determine if existing conditions will reflect future conditions. Many tailings deposits that are currently non-acid generating or acid generating to a limited extent are predicted to change characterization and reach levels of significant acid drainage in from 50 years (e.g. Phoenix, NV) to 350 years (Tyrone, NM). The limited characterization that has been performed to date on the Opportunity Ponds, and by assumption on the Anaconda Ponds, suggests the approximately 625 million tons of tailings stored within the ARWWS either are, or will be, acid generating, and the existing and proposed remedy assumes the present condition will continue in the future. However, what if the tailings become more acid generating in the future? Will the existing dilution and possible groundwater attenuation capacity be adequate to result in future loads of contamination from the Anaconda and Opportunity Ponds to not result in significant impacts to surface water, including the Clark Fork River? Without additional characterization of the sources of contamination and further knowledge as to the fate and transport or those contaminants future predictions are not possible. Please explain what risks, from both an environmental and financial assurance standpoint, will exist in the event future conditions at the site change so as to require not only additional monitoring, but also potential capture and treatment of acid drainage associated contamination from the Anaconda and Opportunity Ponds?

CFRTAC recommends that additional source (e.g. Anaconda and Opportunity Tailings, Dutchman soils) characterization together with hydrological characterization be conducted for the ARWWS. CFRTAC also recommends that the agency consider whether an interim decision pending additional characterization and monitoring might be more appropriate for this site. Finally, CFRTAC recommends that additional evaluation be done of the impacts of waste in place and potential long-term impacts on local surface water and in the Clark Fork River.

Tile Drain System

CFRTAC together with the Opportunity Community Protective Association are concerned that the tile drain system is poorly understood and presents a potential environmental, if not economical, risk to the community of Opportunity and to the proposed remedial action. At the very least the EPA should ensure that the tile drain system has been completely characterized and its role in maintaining the present protective situation with respect to domestic well water in the Opportunity area is understood. Opportunity citizens are extremely concerned that should the tile drain system fail to operate, in part or in full, that domestic water will be impacted and that property values will otherwise be affected.

CFRTAC recommends additional effort be undertaken to educate Opportunity citizens as to the role the tile drain system plays in local hydrology and with respect to potential for migration of Superfund related contamination into the Opportunity groundwater area and into domestic wells. CFRTAC also recommends that EPA evaluate the current agreement between Atlantic Richfield and the Opportunity Drain Tile Association with respect to points of discharge and environmental liability, operation and maintenance, and financial adequacy. Please explain what role if any EPA would expect to play in the event the association failed to conduct the necessary operation and maintenance or funding was no longer available to conduct such activities on its portion of the system, and for the same activities on the south portion of the system, or on the portion of the system owned by the Anaconda Country Club?

Recreational Uses in High Arsenic Areas

CFRTAC is concerned that recreational use in high arsenic areas presents a potential threat to human safety. It was extremely helpful to learn that the Dutchman area recreational use acceptability was based on recreational usage as represented by golf usage at the Old Works Golf Course. However, given that recreational use includes the taking and ingestion of game species including fish, waterfowl and upland birds, and big game (deer and elk) from the area, which most likely was not considered in the previous human health risk assessments, CFRTAC is concerned that unsuspecting users might be exposed to a significant human health risk. CFRTAC is also particularly concerned for children who might use the area and be more highly vulnerable, and for hunting dogs which may be more highly exposed.

CFRTAC recommends that further evaluation be done of potential human health impacts due to the particular types of recreational use likely for the Dutchman and surrounding areas in the ARWWS OU. CFRTAC recommends that an additional evaluation of site-specific data be performed and additional soils and other data collected as required to better characterize ecological and human health risks in this area. CFRTAC also recommends that a public education program be undertaken with appropriate information distributed on a regular basis to the local public as well as posted at all public points of entry. CFRTAC also recommends that a bio-monitoring program be conducted for those species most

likely to inhabit and to be utilized by humans. The bio-monitoring program should at a minimum be conducted as part of the five-year review process and offered to the public at large to test game species on a voluntary basis.

Adequacy of FWPs Trust Fund

As discussed with EPA and the other agencies, CFRTAC is concerned with the adequacy of the $1 million trust fund established to conduct operation and maintenance and any Superfund associated activities in the Dutchman area. It is recognized that it is very difficult to estimate future costs with a high level of confidence and CFRTAC believes the responsible parties did their best in establishing the fund amount. However, CFRTAC is concerned that a variety of demands will be presented for those funds and they will prove inadequate to meet agency and public expectations.

CFRTAC is particularly concerned that the LRES classification system used to support this decision in part or whole may prove problematic in the future. As EPA is aware, the RIPES system used to establish cleanup priorities on the Clark Fork River Operable Unit of the Milltown Reservoir site has come into question and additional evaluations by DEQ are raising the possibility of additional cleanup requirements. Please explain and evaluate the risks that could result, from both an environmental and economic basis, if the assumption in the ROD MOD that high arsenic soils in the Dutchman area support adequate vegetation changes in the future as a result of additional evaluation or long-term evidence otherwise so indicates less than suitable results?

Charlie Coleman, Project Manager
U.S. Environmental Protection Agency (EPA)
10 West 15th Street, Suite 3200
Helena, MT 59626

CFRTAC
CLARK FORK RIVER
Technical Assistance Committee

January 29, 2009

Dear Mr. Coleman:

The Clark Fork River Technical Assistance Committee (CFRTAC) appreciates this opportunity to comment on the proposed plan for modifications to the Record of Decision (ROD) for the Anaconda Regional Water, Waste and Soils Operable Unit of the Anaconda Smelter Superfund site. CFRTAC is a nonprofit citizens' group that works to inform and engage the public in the Superfund cleanup, restoration and redevelopment of the upper Clark Fork River. CFRTAC is comprised of people with diverse backgrounds: landowners along the river, business owners, scientists, fishermen, engineers, journalists, outfitters and ranchers. We live and work along the Clark Fork and enjoy its splendor. We are also a part of the watershed's continued improvement. We know the importance of the decisions that impact its future and appreciate the work you do to help form these decisions.

CFRTAC board and staff met to discuss the plan to modify the ROD. These are significant changes to an important decision. We feel that such modifications should not be made without adequate time and energy to engage the people that this impacts the most: those of us who live and work here.

I respectfully comment to EPA:

1. Such a decision to leave such high levels of contamination in place in the Dutchman area should be studied further. Questions regarding depth of contamination, concentrations of contaminants at various depths and their impact on groundwater and surface water in the area seem to be unanswered.
2. The Dutchman area is contributing to contamination of the Clark Fork River and looks as though it will continue for many years to come. Justification offered by EPA contracted staff points to many other sources of contamination to the Clark Fork River like the Warm Springs Ponds, Silver Bow, Mill and Willow Creeks. However, work will continue on these sites to reduce contamination. If the decision to leave the Dutchman contaminants in place becomes final no work will ever be done to reduce this source of contamination. Contamination from other sources should not justify this source.
3. Public outreach regarding these important decisions should be much more extensive. Public meetings were held with very little attendance from residents of the areas affected. CFRTAC is available and willing to help in this process. Groups like ours were created through Superfund law to help involve the people who live in communities affected by Superfund sites.

Thank you again for this opportunity to comment. Public process is vital. CFRTAC believes an engaged citizenry ensures that good decisions are made about what happens to public resources.

Sincerely,

Darryl Barton
Darryl Barton
CFRTAC

CLARK FORK COALITION P.O. Box 7539, Missoula, MT 59807 ph. 406.542.0539

Charlie Coleman
U.S. Environmental Protection Agency
10 West 15th St., Suite 3200
Helena, MT 59626

January 29, 2010

RE: Comments on the Proposed Plan for Modifications to the Remedy for Anaconda Regional Water, Waste and Soils, Anaconda Smelter Superfund Site.

Dear Charlie,

On behalf of our 1,500 members—scientists, business people, and river recreationists who are dedicated to protecting clean water—the Clark Fork Coalition presents these comments on the proposed technical impracticability waivers for the bedrock aquifer, the alluvial aquifer in north and south Opportunity, and the surface water arsenic waivers that are under consideration as amendments to the 1998 Record of Decision for the Anaconda Regional Water, Waste and Soils operable unit of the Anaconda Smelter Superfund site.

In general, we understand that complete removal of all contaminated material is likely impossible within the ARWWS operable unit. As with other sites in the Clark Fork Superfund complex, including Milltown, it is inevitable that some waste will remain in place. While there is no doubt that the magnitude of contamination at ARWWS is daunting, we feel strongly that the proposed TI waivers are premature. Much of the proposed remedy from the ROD in 1998 has not yet been implemented in these areas, and before TI waivers are granted the PRPs should (1) carry out more of the proposed remedy so that its efficacy can be reliably assessed, and (2) conduct additional investigation on several fronts before a decision to waive standards can be made. More specific comments on each of the areas are detailed below.

South Opportunity TI Evaluation

The conceptual model describes the pathway of arsenic contamination between soil and groundwater as occurring where flood irrigation and/or a high water table mobilize arsenic from soil to groundwater. This is a reasonable assumption. Apparently a portion of this area was taken out of irrigated agriculture in 1997, and evidence from monitoring well MW-232, which is located in an area that has been taken out of flood irrigation, is used to suggest that further irrigation reductions may not help achieve compliance with the drinking water standard for arsenic (p. 4-7). Yet, the report also states that evidence from this well is "inconclusive regarding the performance of the selected remedy, and cessation of irrigation was only partially implemented" (p. 4-7). Given the well's location "directly downgradient of an irrigation ditch

still in use" that conveys arsenic-contaminated water, and that "the area upgradient of the ditch is flood-irrigated and data from domestic wells have been shown to be contaminated in this area," it isn't at all surprising that MW-232 continues to show no trend in arsenic concentration over the past 10 years or more.

The record from monitoring well MW-225 is also offered as an example of declining arsenic concentrations in an area where irrigation ceased. In this case, the concentration decreased below the drinking water standard and can now be considered clean. However, the report states that "since the decline started before alteration of irrigation practices," the improvement in water quality may not be the result of changing irrigation practices. Yet an examination of Figure 4-2 (the hydrograph for MW-225) shows there was only a single year of data (with significant seasonal variation) in 1992-3, followed by a two year gap, a single data point in 1995, and another five year gap up to the year 2000. The report's assertion that the decline in arsenic occurred before the cessation of irrigation is based on the single data point in 1995, and is simply not a well-supported conclusion. Indeed, the report itself states that "There are no monitoring wells which evaluate ground water quality in an area where irrigation was completely ceased."

Yet the inconclusive data from these wells is presented as a justification for the claim that change in irrigation practices has been unsuccessful in improving groundwater quality and that the effectiveness of dewatering trenches or an irrigation ban is highly uncertain. There is not enough information at this point to know whether this is true.

We've spoken with representatives of Anaconda-Deerlodge County government and we understand that the county is not interested in an outright irrigation ban in South Opportunity. This is understandable given that the land is privately held and has been in agricultural production since the mid-1800s. We are opposed to any takings of water rights, but curious to know whether EPA has explored the potential for irrigation efficiencies with landowners in this area. How much of the land is flood irrigated? Has EPA spoken with landowners or the county about this since 1997? Would landowners consider switching to an irrigation method (such as pivot) that would result in less soil saturation and therefore less transport of arsenic to groundwater? If water is carefully applied at the agronomic rate, it should be wholly used by the crop with minimal percolation to groundwater. Before a TI waiver is declared for South Opportunity groundwater and Willow Creek, this option should be explored. A carefully chosen pilot study with a willing landowner would demonstrate whether this approach has potential for success. If irrigation efficiencies can be demonstrated as effective for improving groundwater quality, landowners should be compensated through remedy for the cost of conversion from flood irrigation to other methods.

Along with irrigation efficiencies, the CFC believes that the option of partial soil removal in South Opportunity deserves further investigation and analysis. We agree that soil contamination is widespread, and that there may be no "hot spot" areas of high concentration, but further investigation may be needed to determine if there are areas of higher loading. In particular, it's not clear whether the monitoring network is designed to identify areas of potentially higher loading from wetlands. As the report states in several places, it's reasonable to assume that arsenic is mobilized from soils to groundwater during episodes of soil saturation, either from flood irrigation or, perhaps more importantly, in wetland areas where reducing conditions are

prevalent. Roughly one third of the South Opportunity area is jurisdictional wetland. Is the monitoring network sufficient to determine whether these areas are primary sources of arsenic loading to the aquifer?

The cost estimate for soil removal (p. 6-2) is based on removing the top 10 inches over the entire extent of the groundwater arsenic plume. But areas that are well above the water table would not necessarily need to be removed. If removal is limited to areas of high groundwater, the cost could be cut substantially, possibly by as much as two thirds to three quarters. The resulting removal volume of 1-2 million cubic yards is reasonable, especially since the Opportunity waste management area is nearby. Although contaminated with arsenic, the high organic content of these soils could be used to help facilitate revegetation of the waste management area. Does the cost estimate for soil removal factor in the cost savings that would be realized by using this material as cover soil in the waste management area? Although removal of well-vegetated wetlands is difficult for a number of reasons, it isn't impossible, and wetlands can be restored with time. The temporary loss of wetlands must be weighed against the potential for permanent gains in groundwater (and ultimately surface water) quality. We believe that this option should be further investigated before considering a TI waiver.

Finally, we feel that it is premature to issue a TI waiver for arsenic in Willow Creek, given that it is the second or third highest source of arsenic to the Clark Fork River. The option of a permeable reactive barrier using zero-valent iron shouldn't be ruled out at this point, especially since groundwater is shallow and it seems likely that the reactive wall could be much shorter than shown in this report. The previously mentioned cleanup strategies for groundwater should be pursued first, and even if after further investigation they are not deemed effective, a TI waiver on Willow Creek should wait until the final disposition of the Warm Springs Ponds is determined. Although the headwaters of the Clark Fork happen to be in different operable units, the problem of arsenic loading to the main stem of the river should be considered as a whole.

Domestic Well Area of Concern

The Domestic Well Monitoring and Replacement Program is a positive step in the right direction and we commend EPA and ARCO for establishing this program. It remains unclear, however, who will pay the additional cost for new wells in the Controlled Groundwater Area that must be drilled deeper because of arsenic contamination in the upper part of the aquifer. The landowner should not have to bear this cost. For new wells (not replacement wells), the landowner could pay for drilling to a depth ten feet below the first water of desired quantity, and if this is contaminated, ARCO should bear the cost of drilling deeper.

Currently, we understand that stock wells will not be tested. We believe that they should be included under this program.

North Opportunity TI Evaluation

We agree that soils in the Dutchman Creek area would be difficult to remediate because the contamination is so widespread and because the area encompasses a very large intact wetland, making it undesirable to rip it all up. If this property is transferred to the State of Montana and made into a Wildlife Management Area, a number of safeguards should be implemented to prevent toxic exposure to humans:

- Biomonitoring should include analyses of fish and game that people are likely to hunt and eat from the site.
- Additional analysis should be done to ensure that the area is safe for children and pets.
- A boot wash area should be provided to keep contaminated soil within the site, preventing spread of arsenic to residences.
- Warnings and explanations should be clearly posted.
- Roads and parking areas should be paved to prevent dust and exposure to bare soil.
- A wildlife fence should be placed around the airport.
- An adequate trust fund must be established for continuing monitoring and maintenance.

Bedrock Aquifer TI Evaluation

We agree that it may be impossible to meet ARARs for groundwater in the bedrock aquifer. It appears, however, as if very little of the proposed remedy has been accomplished so far, and where work has been done, it's had a positive effect on water quality in the aquifer. Perhaps the remedy should be fully implemented before an expansion of the TI waiver is considered.

Finally, thank you for extending the period for public comment and for arranging an additional technical meeting with CFRTAC, the County, CFC and State agencies. This was very helpful in understanding the many complex issues at the site. And thank you for considering these comments - I'd be glad to discuss any of these issues further.

Sincerely,

Christine Brick
Science Director
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To Whom It My Concern:

The following are questions that Arrowhead has received from multiple community members, its board, and advisors. The attached materials include references to parts of the current ROD and intended ROD to emphasize the questions that have been asked by the above parties. These questions have been put into more specific site relevant versions below.

1) Being that the Dutchman HAA is the site of numerous springs and 3 perennial streams: Warm Spring Creek, Lost Creek and Dutchman Creek all of which are documented for elevated arsenic levels and eventually make their way into the Clark Fork River thus becoming a source of contamination for the river would a treatment plant be able to remove the contaminants present or would this concern not require a revision of the proposed remediation solutions?

2) Taken into consideration the specific physical characteristics of the Dutchman HAA how would the proposed increase and maintenance of the vegetative cover be a guarantee to sufficiently mitigate the COC's (contaminates of concern) in particular arsenic? Repeated expressed concern was voiced regarding the contaminants transported on hunter's clothing etc once they have concluded their hunting activities on the proposed Wildlife Management Area. Can the ROD modifications honestly ensure that hunters and other recreational users will always follow the proposed guidelines regarding "cleaning" their gear and clothing before exiting the area?

3) How can the human risk assessment of Appendix B of the CDM FINAL DESIGN REPORT (September 2008) be reconciled with the proposed changes in the ROD? Is it possible to guarantee that the wild game meat hunted on the proposed Wildlife Management Area will be safe for human consumption especially children?

Referencing the
Dutchman Creek High Arsenic Area Final Design Report – ARWW&S OU – September 2008

Document prepared by

Katherine Basirico: Arrowhead Research Assistant / Superfund Library Coordinator (Biology B.A.)
Adam Vauthier: Arrowhead Outreach Coordinator

Atlantic Richfield Company

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January 29, 2010

Via E-mail (coleman.charles@epa.gov) ***and Regular Mail***

Mr. Charlie Coleman, Project Manager
U.S. Environmental Protection Agency
10 West 15th Street, Suite 3200
Helena, Montana, 59626

Re: Proposed Plan for Modifications to the Remedy; Anaconda Regional Water, Waste, and Soils: Atlantic Richfield Company's Comments

Dear Charlie:

This letter and the enclosed written comments are submitted on behalf of the Atlantic Richfield Company ("Atlantic Richfield") in review of the Environmental Protection Agency's ("EPA") Proposed Plan for Modifications to the Remedy for the Anaconda Regional Water, Waste, and Soils Operable Unit ("ARWW&S OU") of the Anaconda Smelter Superfund Site. The Proposed Plan was released for public comment in November 2009, and the public comment period was extended through January 2010.

Thank you for your careful consideration of Atlantic Richfield's comments on the Proposed Plan.

Sincerely,

Robin Bullock
Portfolio Manager E&P, OB&C and Decommissioning

Enclosures

cc: Ron Halsey
Jean Martin, Esq.
John Brown, DEQ

Atlantic Richfield Company's Comments to the *Proposed Plan for Modifications to the Remedy Anaconda Regional Water, Waste and Soils Operable Unit (ARWW&S OU)*

Prepared by EPA, November 2009

General Support for Proposed Plan

Atlantic Richfield Company ("Atlantic Richfield) generally agrees with and is supportive of many of the remedy modifications identified in the Proposed Plan to modify the September 1998 Record of Decision. More specifically, Atlantic Richfield supports EPA's recognition that it is technically impracticable for response actions to achieve certain of the Record of Decision Remedial Action Objectives for groundwater and surface water. The proposed expansion of the bedrock Technical Impracticability ("TI") zone, the addition of new alluvial aquifer TI zones, the addition of the arsenic surface water TI zone all are appropriate modifications to the 1998 Record of Decision. Atlantic Richfield also supports EPA's proposed changes to the Waste Management Area ("WMA") boundaries and the designation of Dutchman and Smelter Hill high arsenic areas. These proposed modifications to the remedy and others Atlantic Richfield proposes below support the success of the on-going work to complete the ARWW&S remedy selected in the 1998 Record of Decision.

Atlantic Richfield's comments on the specific proposals outlined in the Proposed Plan follow. These comments focus primarily on the boundaries of proposed the TI zones and EPA's suggested limitations on waiver of the performance standard for arsenic. Atlantic Richfield requests EPA's and DEQ's consideration and incorporation of Atlantic Richfield's comments in EPA's final decision document that modifies the 1998 Record of Decision.

Specific Comments on Proposed Plan

Revised Performance Standard for Arsenic

In 2001, EPA adopted 10 ug/l as the Safe Drinking Water Act Maximum Contaminant Level ("MCL") for arsenic. The State of Montana has adopted this regulatory standard as well as a human health standard for surface water and groundwater. Thus, the rationale for revision of the Remedy to adopt the revised standard is understood. For the Anaconda area generally and the ARWW&S Remedial Action, Atlantic Richfield agrees with EPA that it is technically impracticable for response actions to reduce arsenic concentrations in groundwater and surface water to achieve compliance with the revised MCL. In part, waiver of the MCL as a performance standard for the Remedy is appropriate because arsenic concentrations found in groundwater and surface water in the Anaconda area reflect the contribution of naturally-occurring sources of arsenic. Specific to the point, Atlantic Richfield offers the following comments:

1. Page 1, Introduction second paragraph. Atlantic Richfield recommends that discussion be added to this paragraph clarifying that concentrations of arsenic in groundwater resources in many areas of the state, including areas within the

ARWW&S operable unit, do not meet the new arsenic standard due to natural sources.

2. Page 1, Introduction fourth paragraph. Atlantic Richfield recommends that discussion be added to this paragraph to acknowledge the presence of geothermal sources that contribute arsenic and metals to groundwater and surface water in, and adjacent to, the ARWW&S OU. These naturally-occurring sources in areas of the site explain the presence of arsenic levels above the new MCL-based standard.

Bedrock Aquifer TI Zone

Given the documented contribution of naturally-occurring arsenic and other metals to the bedrock aquifer, AR supports expansion of the boundaries of the Bedrock Aquifer TI Zone established in the 1998 ARWW&S ROD. The expanded boundaries reflect the results of the investigations and monitoring accomplished since 1998 which provide a better understanding of groundwater chemistry and the distribution of arsenic in the bedrock aquifer. Specific to this point:

1. Page 4, Bedrock Aquifer. The boundary of the Bedrock Aquifer TI Zone was based upon the original ARWW&S OU Bedrock Aquifer TI Investigation and subsequent 1998 Addendum. Groundwater and surface water data generated since 1998 should be utilized to define the new TI Zone boundary, and Atlantic Richfield supports EPA's proposal with the following caveats: a) EPA should verify that the boundary west of Anaconda includes Well WV-04 where an arsenic reading above 10 ug/l was observed in previous sampling; and b) when available, data from the Montana Bureau of Mines and Geology's 2009 sampling of groundwater monitoring wells, domestic wells, and surface expressions of groundwater should be reviewed to confirm the revised TI zone boundaries encompass the entire geographic area overlying the bedrock aquifer where an exceedance of the arsenic standard has been documented.

North and South Alluvial Groundwater / Surface Water TI Zones

Atlantic Richfield agrees with EPA's proposal that the North and South Alluvial Groundwater TI Zones (or single, TI Zone that joins the separate North and South TI Zones as Atlantic Richfield proposes) be limited in depth, but limiting to the upper "few feet" of the alluvial aquifer may be too restrictive in some areas. Thus, Atlantic Richfield suggests describing the TI Zone to include the upper zone of the alluvial aquifer. Because State law requires the sealing of any new water well to a minimum depth of 18 feet[1] below ground surface, designation of the TI Zones within the upper zone of the aquifer will not unnecessarily restrict potential development of deeper alluvial groundwater for water supply. Specific to this point:

1. Page 4, South Opportunity Alluvial Aquifer. Atlantic Richfield believes the data support and Atlantic Richfield recommends that EPA establish a single, larger TI waiver zone that encompasses the proposed North and South Opportunity alluvial

[1] *See* Section 36.21.654(3), Administrative Rules of Montana

aquifers along with the areas in between where the human health arsenic standard is not already waived in ground and surface water (*i.e.*, outside the Bedrock Aquifer TI zone and the Waste Management Areas). The conceptual model for the alluvial aquifer forecasts that the presence of contaminated soil in combination with saturated conditions can result in arsenic concentrations above 10 ug/l in both shallow groundwater and surface water. These conditions are present in areas between the North and South "areas of concern" that EPA has identified. Thus, Atlantic Richfield believes it is both prudent and appropriate to define a single, larger arsenic TI zone that encompasses all the shallow ground and surface water between the AOCs that is not within the Old Works or Opportunity Ponds/Smelter Hill Waste Management Areas ("WMA"). Defining a single zone in this fashion would also be administratively simpler and more appropriate, for example, for purposes of obtaining a controlled groundwater control area.

2. Page 4, North Opportunity Alluvial Aquifer. Atlantic Richfield concurs with EPA's proposal to grant a TI Waiver for surface and groundwater in the North Opportunity area. As noted above, we believe it would be prudent to establish a single larger TI waiver zone that encompasses the proposed North and South Opportunity AOCs along with the areas in between where the human health arsenic standard is not already waived in ground and surface water (*i.e.*, outside the Bedrock Aquifer TI zone and the WMAs).

3. In the alternative, if the larger single TI zone described above is not established, then Atlantic Richfield recommends and the data and conceptual model support, *at a minimum*, that the North Opportunity area TI boundary be modified on the southern side to include the RDU 10 portion of Warm Springs Creek.

4. For purposes of clarity, Atlantic Richfield requests that EPA revise the text discussion to acknowledge that groundwater remediation is not required as part of remedial action for the ARWW&S OU for the adjacent Town of Warm Springs thermal area or within Sections 32 and 33.

Spring-Fed Surface Water

1. Page 7, Spring Fed Surface Water. Atlantic Richfield agrees that a TI waiver of the arsenic human health standard for surface water is necessary for the spring-fed tributaries and mainstem segments of several streams within the ARWW&S OU. Including surface water within the scope of the TI waiver acknowledges the impact of groundwater inflow from springs, seeps, and gaining reaches upon surface water quality.

2. Atlantic Richfield also believes the investigations, cleanup and monitoring actions performed to date support waiver of the DEQ-7 aquatic life standards (total recoverable) for arsenic, cadmium, copper, lead and zinc as performance standards for surface water. Notwithstanding the demonstrated success of reclamation actions, monitoring data shows it is technically impracticable to

achieve consistent compliance with the DEQ aquatic life standards (measured as total recoverable) under all conditions. Further comments on this point follow under the heading "Remedial Action Objectives."

Domestic Well Area of Concern

1. Page 7, Domestic Well Area of Concern and Figure 3. Atlantic Richfield concurs with modification of the ARWW&S Remedy to formally include domestic well monitoring and replacement as part of long-term groundwater management for the site. However, the extent of the monitoring and the proposed Area of Concern shown on Figure 3 is larger than the geographic area where monitoring data show mining-related exceedances of the arsenic human health standard (10 ug/l). Should EPA pursue monitoring of domestic wells over this larger area, EPA's monitoring plan approach must provide a mechanism for review and exclusion of domestic wells impacted by naturally-occurring or other sources of arsenic in groundwater that are not related to mining. Moreover, the ROD modification text should also recognize that the geographic boundary of EPA's Area of Concern will be reduced over time where new data confirms mining-related arsenic exceedances are not found within the AOC boundary that EPA adopts.

   Atlantic Richfield's review of the influence of naturally-occurring geothermal fluids on the occurrence of arsenic and other COCs in the groundwater is ongoing. Atlantic Richfield anticipates supplementing its comments on this topic following the close of the public comment period on EPA's Proposed Plan.

Groundwater Points of Compliance

1. Page 10, Groundwater Points of Compliance. With combination of the Smelter Hill and Opportunity Ponds areas into a single WMA, Atlantic Richfield concurs that a point of compliance well at the north toe of the Anaconda Ponds is not required.

2. Specific to new Point of Compliance wells, Atlantic Richfield notes that a new well installed as a potential POC well must show no exceedance of a standard for at least 4 consecutive sampling events before that well may be identified to serve as a groundwater point of compliance. This protocol has been accepted by EPA to date, and Atlantic Richfield requests that EPA acknowledge this same protocol will be followed going forward.

   At present, four (4) wells installed along the boundary of the proposed South Opportunity TI zone north of Highway 1 (Well ID#'s: LTW-1-SOs, LTW-1-SOd, LTW-3-SOs, LTW-3-SOd) have not yet been sampled 4 times. As well, one (1) well installed near the Anaconda Ponds east toe (Well ID#: NW-6s) has not yet been sampled 4 times. In addition, EPA presently proposes eight (8) new wells that would be installed at the toe of Opportunity Ponds (Well ID#'s: NW-1-OPs, NW-1-OPd, NW-2-OPs, NW-2-OPd, NW-3-OPs, NW-3-OPd, NW-4-OPs, NW-4-OPd). Prior to identification of any of these wells as a POC well, as EPA presently proposes, each

well location must be sampled a minimum of four times and the above-stated criteria satisfied.

Establishment of High Arsenic Areas

1. Page 12, High Arsenic Areas and Figure 5. The area between the County airport runways is shown as being included in the proposed Dutchman High Arsenic Area. However, portions of the area are presently included in the proposed remediation polygons designed to reduce soil arsenic concentrations below 1,000 ppm. If remediated to reduce soil arsenic concentrations, the remediated areas should be excluded from the Dutchman High Arsenic Area. Atlantic Richfield supports inclusion of the area due east of the east / west runway in the Dutchman High Arsenic Area to protect wetland resources that would potentially be disturbed by response actions to reduce soil arsenic concentrations.

2. Page 12, High Arsenic Areas. Atlantic Richfield notes that the State of Montana and ADLC are responsible for enforcing these restrictions on properties under their respective ownership.

Remedial Action Objectives

1. Page 14, Remedial Action Objectives, Paragraph 5. In addition to the arsenic human health standard, the available data documenting site conditions indicate response actions will not achieve compliance with DEQ-7 aquatic life performance standards measured as total recoverable metals for other contaminants of concern found in ARWW&S OU surface waters. Given this reality, Atlantic Richfield requests that EPA recognize the federal ambient water quality standards for protection of aquatic life (measured as dissolved) as interim replacement standards for all metals of concern in ARWW&S OU surface waters.

   Atlantic Richfield believes it is appropriate to recognize the federal aquatic life standards as interim replacement standards (for the DEQ-7 standards) to provide a more applicable metric for assessment of remedy success and protectiveness. The replacement federal standards should also include the potential for site-specific adjustments using EPA's bio-ligand model, water effects ratios, or other scientifically supported methods, as appropriate. In the event future surface water monitoring shows compliance with the interim federal standards cannot be achieved through completion of reclamation and the other elements of the ARWW&S Remedy, the modified Record of Decision should acknowledge that alternative permanent standards for surface water quality may be developed in conjunction with the future monitoring program to ensure that a practical system of compliance is in place long-term that protects both human health and the environment.

January 28, 2010

ENVIRONMENTAL PROTECTION AGENCY
FEB 01 2010
MONTANA OFFICE

US Environmental Protection Agency
10 West 15th Street, Suite 3200
Helena, MT 59626

ATTENTION; Charlie Coleman

RE; "Proposed Plan For Modifications To Remedy".

I have objections to waving the environmental standard, 10 ug/L for arsenic in ground and surface water levels. The concerns of costs to clean up should never supersede the public' s health issues.

In this Superfund Site, I believe that the public should have been and should be made aware of the dangers in gardening and the soil contamination.

In this Superfund Site the arsenic levels for soil contamination are set at 250 ppm. I find this unacceptable as the research I have done, other states acceptable levels for arsenic have been set at less than 1/10 of those contamination numbers.

This Superfund Site was set up to address public health issues yet there is no medical monitoring put in place. With contaminated soil being dug up, it is now again being redistributed into the air, giving local citizens more reasons for health concerns and making medical monitoring a reasonable request.

I object to water wells for drinking being tested only 3 times in 10 years. This action can cause many people to be unknowingly contaminated for years in between testing. This is not a decision made in the best interest of this community..

I am requesting this letter be part of the record.

Thank-You,

Penny Ryan

Penny Ryan
302 Stewart Street
Anaconda, MT 59711

Phone # (406) 797-8886

APPENDIX D

ARWW&S OU ROD AMENDMENT
(June 12, 2020)

2020 PARTIAL CONSENT DECREE
for the
ANACONDA SMELTER NPL SITE
Anaconda Deer Lodge County, Montana

Record of Decision Amendment for the Anaconda Regional Water, Waste & Soils Operable Unit

Anaconda Smelter National Priorities List Site

Anaconda – Deer Lodge County, Montana

June 2020

U.S. Environmental Protection Agency
Montana Department of Environmental Quality

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Part 1 – Declaration

Site Name and Location

Anaconda Smelter National Priorities List (NPL) Site, Anaconda Regional Water, Waste & Soils (ARWW&S) Operable Unit (OU), OU 4, CERCLIS ID Number: MTD093291656, SSID: 0818. The ARWW&S OU is located within the southern Deer Lodge valley and surrounding uplands and surrounds the communities of Anaconda and Opportunity.

Statement of Basis and Purpose of this Amendment

This document amends the 1998 Record of Decision (ROD) (1998 ARWW&S OU ROD) (EPA 1998), as amended by the 2011 ARWW&S OU ROD Amendment. The amended remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended, 42 U.S.C. Section 9601 et seq. and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Section 300.400 et seq. This document is issued by United States Environmental Protection Agency (EPA), the lead agency, with the concurrence of the Montana Department of Environmental Quality (DEQ), the supporting agency.

The selected remedy is based on the administrative record for the 2020 ARWW&S OU ROD Amendment and will become part of that administrative record per the NCP, 40 CFR Section 300.825(a)(2). The administrative record (on electronic disk) and copies of key documents are available for public review at the joint Deer Lodge County/Arrowhead Foundation Superfund Document Repository at 118 East Seventh Street in Anaconda. The administrative record also is maintained at the EPA – Montana Office at 10 West 15th Street, Suite 3200, in Helena, Montana and can be viewed during normal business hours by appointment.

Assessment of the ARWW&S OU

As documented in the administrative record, many exposure pathways at the ARWW&S OU create unacceptable risks to human health and the environment. The remedial actions selected in the 1998 ROD were modified by the 2011 Amendment (EPA 2011). The ROD, together with the 2011 Amendment, is hereinafter referred to as the Original, or the 1998/2011 ROD. Those actions, as modified by this ROD Amendment, are necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment at the ARWW&S OU.

Description of the ROD Amendment

This ROD amendment provides for several changes to the Original ROD.

1. First, this ROD amendment provides for a fundamental change to the Original ROD consisting of an expansion of the amount of work to be completed in the upland areas north, west, and south of Anaconda; a period of monitoring of surface water in that area after completion of the additional work; and waiver of certain state of Montana total recoverable surface water standards if those standards are not met after the technically

practicable additional work is completed.

2. Second, this ROD amendment provides for a significant change to the Original ROD consisting of an alternative institutional control (IC) program to support the remedy if Anaconda – Deer Lodge County is unable to perform its IC program.

3. Finally, this ROD amendment includes four minor modifications that clarify components of the Original ROD (Appendix A). As required by the NCP, the changes to the Original ROD are documented in this ROD amendment.

Statutory Determinations

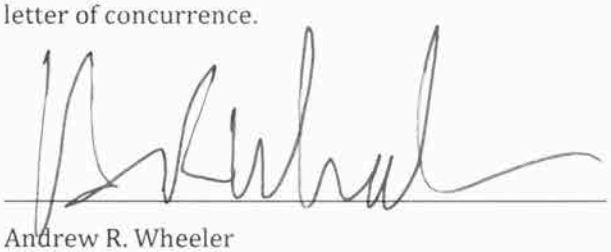
The Original ROD, as amended, meets the mandates of CERCLA Section 121 and the NCP. It is protective of human health and the environment, complies with all federal and state requirements that are applicable or relevant and appropriate to the remedial action or appropriately waives these requirements, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the technically practicable additional response actions.

This decision does not satisfy the statutory preference for treatment as a principal element of the remedy. Active treatment of mining waste would be significantly more expensive because of the large quantities of materials impacted. Although they are present in large volumes, the solid materials within the ARWW&S OU are generally low in toxicity and can be reliably removed or contained.

Because the selected remedy, as amended, will continue to result in mining contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, statutory 5-year reviews have been initiated at the ARWW&S OU and will continue to ensure that remedies remain protective of human health and the environment. The 5-year reviews will continue to focus on areas where waste has been left in place or where remaining concentrations of site-related contamination do not allow for unlimited use of the property.

Authorizing Signature

This 2020 ARWW&S OU ROD Amendment, along with unaltered portions of the 1998/2011 ROD, documents the selected remedy for OU 4, the Anaconda Regional Water, Waste & Soils Operable Unit of the Anaconda Smelter National Priorities List Site. This remedy was selected by EPA with the concurrence of the State of Montana, as authorized by the EPA signatory below and the DEQ letter of concurrence.



6-12-2020

Andrew R. Wheeler
Administrator
United States Environmental Protection Agency

Date

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Part 3 Responsiveness Summary

List of Acronyms

ADLC	Anaconda-Deer Lodge County
agencies	EPA and DEQ
ARAR	applicable or relevant and appropriate requirement
ARWW&S OU	Anaconda Regional Water, Waste & Soils Operable Unit Atlantic Richfield Atlantic Richfield Company
BLM	Biotic Ligand Model
BMP	best management practice
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act, as amended
CFR	Code of Federal Regulations
COC	contaminant of concern
CPMP	Community Protective Measures Program
CS OU	Community Soils Operable Unit
DEQ	Montana Department of Environmental Quality
DPS	Development Permit System
Circular DEQ-7	State of Montana's water quality standards
EPA	United States Environmental Protection Agency
IC	institutional control
LRES	Land Reclamation Evaluation System
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
NRD	natural resource damages
O&M	operations and maintenance
OM&M	operations, monitoring and maintenance
OW/EADA OU	Old Works/East Anaconda Development Area Operable Unit
ROD	Record of Decision
SWMP	surface water management plan
TI	technical impracticability
U.S.C.	United States Code
USGS	United States Geological Survey

Section 1
Introduction and Statement of Purpose

1.1 Site Name and Location

Site Name: Anaconda Smelter Site

CERCLIS ID Number: MTD093291656

Operable Unit: Anaconda Regional Water, Waste & Soils Operable Unit (OU) (ARWW&S), OU4

Original ROD: September 29, 1998 (EPA 1998)

ROD Amendment: September 29, 2011 (EPA 2011)

1.2 Purpose for the Amendment

Since the 1998 ROD (EPA 1998) and 2011 ROD amendment (EPA 2011) were issued, the principal responsible party, the Atlantic Richfield Company (Atlantic Richfield), has implemented significant portions of the ARWW&S OU remedy. In order to complete the remaining work at the Site, EPA, DEQ, and Atlantic Richfield identified technical issues and conducted evaluations necessary for completing this work.

Over 20,000 acres have been remediated to date, yet certain streams still do not meet several State of Montana acute and chronic aquatic life standards (Circular DEQ-7) (DEQ 2019) for surface water at certain times of the year. Anticipating this, the 1998/2011 ROD identified contingency actions for surface water if it was determined—after completion of remedial actions—that applicable water quality standards could not be achieved.

The contingency actions for this circumstance were identified as:

1. Analysis of the technical impracticability (TI) of achieving further contaminant reduction and the potential waiver of the water quality standard
2. Reevaluation of remedial technologies for treatment of surface water
3. Consideration of additional best management practices (BMPs)

With this in mind, EPA and DEQ directed Atlantic Richfield to complete a TI evaluation to determine if the acute and chronic standards could be achieved with additional remedial work. That evaluation resulted in the *ARWW&S OU Surface Water Technical Impracticability Evaluation Report* (Atlantic Richfield 2017). The report concluded that achieving the standards may be difficult or impossible, even with the implementation of all additional, technically practicable remediation.

The possibility of surface water treatment had been assessed in previous surface water TI evaluations (summarized in the 2011 ROD amendment) and was determined to be impracticable because of cost and high environmental impacts (construction of water treatment plants, conveyance channels, and large holding ponds). Thus, surface water treatment alternatives were again dismissed from further consideration. Additional large-scale removal of contaminated soil was ruled out based on the results of the 2017 TI evaluation and visual inspections of the Site by EPA and DEQ. Such aggressive actions to address what are low-level contaminated soils would destroy extensive stands of mature vegetation, causing unnecessary and potentially irreparable harm to the environment for relatively low benefit.

With active water treatment and large-scale removal or treatment of soils ruled out, the 2017 TI evaluation focused on additional engineered controls, stormwater BMPs, and steep slope reclamation. Additions to existing steep slope reclamation remedies include aerial application of seed or fertilizer or both to improve vegetation cover on moderately vegetated to barren steep slopes. (Note: steep slopes as defined under this ROD amendment are steeper than 3 horizontal run to 1 vertical rise (3H:1V) where conventional agricultural tillage equipment can be operated safely).

Based on the results of the TI evaluation and the mutual desire of stakeholders to expeditiously complete the remaining remedial actions at the Site, EPA, DEQ, and Atlantic Richfield initiated development of a surface water management plan (SWMP) that sets forth steps to expand the existing remedy, complete remaining remedial actions, monitor surface water quality, and determine remedy compliance. If the SWMP monitoring process indicates that compliance with certain Circular DEQ-7 standards for specific contaminants of concern (COCs) in a receiving stream cannot be achieved, then this ROD amendment provides that the standard will be waived. Under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended, applicable or relevant and appropriate requirement (ARAR) standards that initially apply to cleanup can be waived and, if necessary, replaced by other protective standards, where appropriate, if it is technically impracticable from an engineering perspective to meet the initial standards[1]. This potential waiver of standard(s) is a fundamental change to the 1998/2011 ROD and necessitates this ROD amendment.

This ROD amendment presents a brief overview of the ARWW&S OU and prior enforcement activities for implementation of ARWW&S OU response actions. It also includes the basis for and specific components of the amendment based on new information, evaluation of alternatives, description of the selected remedy, and statutory determinations. The 1998/2011 ROD remedial components that are not specifically removed or modified in this document remain in effect.

EPA is the lead agency and DEQ is the support agency. EPA is issuing this ROD amendment as part of its responsibilities under of Section 117 of CERCLA as amended and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) at 40 CFR Section 300.435 (c)(2)(ii).

1.3 Administrative Record

This ROD amendment is part of the administrative record for the Site, along with significant documents prepared since the 1998/2011 ROD that contributed to the modification of the original surface water remedy. The complete administrative record for the 2020 ARWW&S OU ROD

[1] See Section 121(e) of CERCLA, 42 U.S.C. Section 9621(e) and 40 CFR Section 300.430(f)(ii)(C)(3).

Amendment is housed at the Deer Lodge County/Arrowhead Foundation Superfund Document Repository at 118 East Seventh Street in Anaconda. The administrative record also is maintained at EPA's Montana Office at 10 West 15th Street, Suite 3200, in Helena, Montana and can be viewed there by appointment.

The following key documents are among the documents available in the administrative record, and their contents support the need for this amendment and the conclusions presented herein:

- *EPA Superfund Record of Decision: Anaconda Company Smelter (ARWW&S) OU, Anaconda, MT, 9/29/1998*. PB98-964406. November 1998. (EPA 1998)
- *Record of Decision Amendment, Anaconda Regional Water Waste and Soils Operable Unit, Anaconda Smelter National Priorities List Site, Anaconda-Deer Lodge County, Montana.* September 2011. 1211311-R8 SDMS (EPA 2011)
- *ARWW&S OU Surface Water Technical Impracticability Evaluation Report*. April 2017. (Atlantic Richfield 2017)
- *Proposed Plan for Modifications to the Remedy, Anaconda Regional Water Waste and Soils, Anaconda Smelter Superfund Site*, June 2017 (EPA 2017)
- *Proposed Plan to Amend the 1998/2011 Record of Decision, Anaconda Regional Water Waste and Soils Operable Unit, Anaconda Smelter NPL Site*, September 2019, 1917242-R8 SDMS (EPA 2019)

1.4 Terms Important to Understanding the ROD Amendment

Certain terms are useful for understanding the changes made to the 1998/2011 ROD in this ROD amendment. Terms described below are used in a manner that is consistent with Superfund activities throughout the nation.

- **Dissolved metals analysis**. Analysis of water after it has been filtered (typically a 0.45-micron filter). The filtered (dissolved) concentration is always less than or equal to the unfiltered (total) concentration described below. Most federal water quality criteria are based on dissolved metals analysis because, in EPA's view, a dissolved metal is more bioavailable to aquatic life. Dissolved metals analysis is considered protective of surface water when there are no contaminated sediments present in a surface water body.
- **Total recoverable metals (or total metals)**. Analysis of an unfiltered water sample, including any solid undissolved sediments, visible or microscopic. Montana bases its numeric standards on the federal water quality criteria but applies them to a total recoverable sample instead of a filtered sample, thus making the state standards more conservative than the federal criteria. The State of Montana applies these total recoverable metals results to surface water to incorporate the uncertainty of risk to aquatic environments in water bodies that also have contaminated sediments that currently do not have state or federal protectiveness standards. There are also minor correction factors and other nuances between the state and federal standards.

- **Base flow.** Base flow is defined as times when groundwater inflow comprises the greatest percentage of flow within surface water. Both surface water and groundwater vary seasonally, but base flow generally occurs in late summer and winter when surface water conditions are fairly stable (i.e., not rising or falling and stormwater or snowmelt runoff is not occurring). For compliance evaluations, chronic aquatic life and human health water quality standards apply to base flow conditions.

- **Normal high flow.** Normal high flow is defined as normal flow that increases above base flow when the regional winter mountain snowpack melts and there is no local wet weather event. In general, the highest concentrations of contaminants are associated with normal high flows and wet weather event flows. For compliance evaluations, metals concentrations at normal high flow are compared to chronic aquatic life and human health performance standards.

- **Storm event flow.** Storm event flow is defined as flow that increases for a short period of time above base flow due to a local wet weather event. For compliance evaluations, metals concentrations during storm event flow are compared to acute aquatic life performance standards.

- **Watershed**. A geographic area that includes all land and water in a particular drainage system, including the mainstem stream and all permanent and ephemeral tributaries flowing into the mainstem stream(s) that drain(s) that area.

Section 2
History, Contamination, and the 1998/2011 Remedy

Per EPA ROD guidance (EPA 1999), the introductory sections of the previous ROD and amendment are addressed only briefly in this ROD amendment. A more detailed summary of previous investigations, site conditions, and unacceptable risks is presented in the 1998/2011 ARWW&S OU ROD. The following focuses on site background relevant to the ARWW&S OU surface water remedy modified by this ROD amendment.

2.1 Site Description

The Anaconda Smelter Site (the Site) represents one of four contiguous Superfund sites on EPA's National Priorities List (NPL) in the upper Clark Fork River Basin (Figure 2-1). The other Clark Fork River Basin Superfund Sites are the Silver Bow Creek/Butte Area Site, Clark Fork River/Milltown Reservoir Site, and Montana Pole Site. The footprint of the four sites extends 140 miles from an area north of Butte to the Milltown Reservoir near Missoula, Montana.

The Site is in the Deer Lodge Valley in southwestern Montana, in and around the city of Anaconda (population 8,487). For nearly a century The Anaconda Company and its predecessors conducted milling and smelting activities at the Anaconda Site. Milling and smelting activities began in 1884 and ended in 1980, when the smelter closed. The facilities were dismantled by Atlantic Richfield, the successor by merger to The Anaconda Company and its predecessors. The nearly 100 years of mining and smelting activity in the area resulted in the contamination of soils, surface water, and ground water, primarily through airborne emissions and disposal practices from smelting. The primary COCs are arsenic, cadmium, copper, lead, and zinc.

The Site was added to the NPL in 1983, with Atlantic Richfield identified as the primary potentially responsible party. Since then, Atlantic Richfield has been actively involved in the investigation and cleanup under the direction and authority of EPA and Montana DEQ. The Site consists of five OUs, listed below by the date of their ROD. They are in various stages of remedial action.

- **Mill Creek OU (1987 ROD).** Cleanup involved relocating residents from Mill Creek and stabilizing soils.
- **Flue Dust OU (1991 ROD).** Cleanup addressed flue dust on Smelter Hill through removal, treatment, and containment. At the same time, Arbiter and beryllium wastes were similarly addressed through removal, treatment and/or containment. Wastes are contained within the Smelter Hill Repository Complex.
- **Old Works/East Anaconda Development Area OU (1994 ROD).** Cleanup addressed waste sources within the Old Works smelter facility.
- **Community Soils OU (1996 ROD, 2013 ROD amendment**). Ongoing cleanup addresses residential and commercial soils contaminated with arsenic and lead in Anaconda, Opportunity, and the surrounding area.

- **ARWW&S OU (1998 ROD, 2011 ROD amendment).** Provides for cleanup of all remaining contamination, including large volumes of wastes, slag, tailings, debris, and contaminated soil, ground water, and surface water spread over 170 square miles of agricultural, pasture, rangeland, forests, and riparian and wetland areas in nine subareas.

This ROD amendment focuses exclusively on the ARWW&S OU.

2.2 Nature and Extent of Contamination at ARWW&S OU

The 1998 ROD separated the ARWW&S OU into five subareas (Figure 2-2) to facilitate the screening of potential remedial technologies and the evaluation of alternatives. These subareas are Opportunity Ponds, North Opportunity, South Opportunity, Old Works/Stucky Ridge, and Smelter Hill. The 1998 ROD also identified cleanup requirements for Mill, Willow, and Warm Springs Creeks and the 2011 ROD amendment added cleanup requirements for Lost Creek and California Creek.

Figure 2-3 shows these streams and their drainages and identifies the TI evaluation area, which is approximately 170 square miles.

Surface water monitoring has been conducted since the early 1990s, resulting in a database of nearly 2,000 samples that have been analyzed for metals. Under the TI evaluation, high-flow, storm-flow, and sediment sampling was conducted in 2013. In 2014, additional soil sampling based on vegetation condition was performed to better understand the source of metals loading to streams during runoff events.

State of Montana water quality standards—which are based on total recoverable analysis—have been and continue to be occasionally exceeded in all streams and tributaries during high-flow and storm events. Standards exceeded are copper, lead, and (to a lesser extent) cadmium. Tributaries generally have higher exceedance rates than main streams and, under base flow conditions, copper only periodically exceeds the state standard.

A conceptual site model was developed under the TI evaluation to help understand how and why water quality varies across seasonal flow patterns in the streams. The model indicates that:

- Surficial soils are contaminated with metals from aerial deposition of past smelter emissions.
- Runoff from the uplands is contaminated with these metals during spring snowmelt and periodic storm events, resulting in higher concentrations of suspended sediment and total recoverable metals (copper, lead, and [less often] cadmium).
- Water hardness decreases during wet weather events and, because both state and federal water quality standards are hardness-based, this results in lower calculated standards and more frequent exceedances.
- Exceedances are less frequent during base flow when ground water recharge supplies most surface water flow.

The model also suggests that sediment runoff is the most important pathway of metals to surface water. That runoff occurs during base flow and normal high flow (see Section 1.4 for definitions of flow regimes).

2.3 Summary of ARWW&S OU Risks

The COCs identified in the 1998/2011 ROD are arsenic, lead, cadmium, copper, and zinc. Human health risk from exposure to impacted surface water is minimal because concentrations of cadmium, copper, lead, and zinc are below human health standards in area streams. Although arsenic concentrations in surface water exceed the drinking water standard, the standard was waived in the 2011 ROD amendment and these streams are not used for drinking water. The arsenic aquatic life standards remain applicable.

The 1998/2011 ARWW&S OU ROD identified potential ecological risks to aquatic receptors based on contaminant concentrations and exposure criteria. Acute and chronic ambient water quality criteria for both total recoverable and dissolved metals were evaluated in surface water. These criteria provide the range of acceptable risk from metals in surface water, with total recoverable metals being more conservative than dissolved. The primary ecological risk to surface water and sediment at the Site is the periodic exceedance of acute and chronic ambient water quality criteria.

2.4 Previous ARWW&S OU Cleanup Activities

Atlantic Richfield has completed or is completing remedial designs and implementing remedial actions throughout the nearly 170 square miles of land impacted by smelter emissions and milling and smelting waste deposition in the ARWW&S OU. Remedial actions to address contaminants have been implemented on more than 21,000 acres. Sparsely vegetated soils and mining wastes have been treated or covered and revegetated, and controls to manage stormwater runoff have been constructed. Remedial actions have been completed in the most contaminated areas of the ARWW&S OU (waste management areas and surrounding valley lowlands) and where heavy equipment can be readily used. Remedial actions are still required in the lesser-contaminated upland areas where steep slopes will limit the use of heavy equipment for construction.

2.5 ARWW&S OU Acreage Remediated since the 2011 ROD Amendment

Since 2011, over 21,000 acres of contaminated land at the ARWW&S OU have been remediated. The acreage per reclamation design unit is shown in Table 2.1. This work was done under several CERCLA Section 106 unilateral administrative orders issued by EPA. These orders left the full implementation of the surface water component of the remedy open, pending further evaluation of Site conditions and additional analysis.

Table 2-1. Summary of Remedial Action Complete Acres at ARWW&S OU

Remedial Design Unit (RDU)		Remedial Action Completed Acres		Remedial Design Unit (RDU)		Remedial Action Completed Acres
1	Stucky Ridge	1,037		9	Fluvial Tailings	1,455
2	Lost Creek	121		10	Warm Springs Creek	98
3	Smelter Hill Uplands	271		11	Cashman Pile	1
4	Anaconda Ponds	678		12	Slag	0
5	Blue Lagoon/Active RR	135		13	Old Works WMA	1,266
6	South Opportunity Upland	367		14	Smelter Hill Facilities	1,367
7	North Opportunity Upland	807		15	Mt. Haggin	0
8	Opportunity Ponds	7,422			West Galen Expansion	6,389

2.6 Surface Water Remedial Action Objectives and Remedial Goals

Remedial action objectives presented in the 1998/2011 ROD for contaminated surface water remain generally unchanged for this ROD amendment, except for the need to waive certain Circular DEQ-7 standards (DEQ 2019), which will be replaced by federal water quality criteria.

The remedial action objectives are:

- Minimize source contamination to surface waters that would result in exceedances of State of Montana water quality standards. This remedial action objective is modified to recognize the ARAR waivers and replacement standards in Section 4.
- Return surface water to its beneficial use by reducing loading sources of COCs.

2.7 Summary of the Original Remedy for Surface Water

Major components of the current remedy for surface water identified in the 1998/2011 ROD are as follows:

- Reclamation of contaminated soils and engineered stormwater 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 placed in a designated waste management area.

These requirements led to the development of specific remedial technologies for the ARWW&S OU:

- Soil removal
- Soil remediation (in situ treatment and revegetation)
- Steep slope reclamation (revegetation and on-slope BMPs)

- Stormwater BMPs (check dams and erosion controls in drainages)
- Engineered stormwater controls (retention/detention basins)

There are several in-stream ARARs related to surface water and storm water control for the ARWW&S OU. A main remedial goal in the 1998/2011 ROD is that water quality in surface water complies with Circular DEQ-7[2] and a main remedial action objective is for sources of contaminants to surface water to be controlled. Circular DEQ-7 standards are as stringent as, or more stringent than, the corresponding federal water quality criteria enacted by EPA and therefore were selected as the surface water quality performance standard in the 1998/2011 ROD. When determining compliance with the chronic performance standards, the most stringent of the human health or aquatic water quality criterion is applied. Acute performance standards for storm event flow and wet weather conditions are based on acute aquatic water quality criteria.

[2] ARARs referenced in the 1998/2011 ROD are from Circular WQB-7, which was the predecessor to Circular DEQ-7. For clarity, this ROD amendment refers to Circular DEQ-7 (June 2019).

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Section 3
Basis for Revisions to the 1998/2011 ROD Remedy

The basis for revising the 1998/2011 ROD is twofold:

1. Despite ongoing remedial action construction, analysis of surface water quality monitoring data indicates that compliance with State of Montana acute and chronic aquatic life standards (Circular DEQ-7) for copper, cadmium, lead, and zinc that have been adopted as surface water performance standards may not be achievable for certain parameters in specific stream reaches.

2. EPA's community interviews of local government and the general public revealed that people desire an expeditious end to remedial actions that will bring the Site to closure and eventual delisting. EPA also prioritized the Site in 2017 for immediate and intense attention.

3.1 Impracticability of Meeting Some Surface Water Standards

As discussed in Section 2, Atlantic Richfield has been completing remedial designs and implementing remedial actions throughout the ARWW&S OU since 2000 under the direction and authority of EPA and Montana DEQ. The OU footprint covers an area of nearly 200 square miles of land impacted by smelter emissions and milling and smelting waste deposition. Surface water monitoring is also being conducted by the United States Geological Survey (USGS) at two locations on each of the four major streams that drain the Site (Mill Creek, Lost Creek, Willow Creek, and Warm Springs Creek). The USGS began monitoring Warm Springs Creek at the lower and upper stations in 1989 and 1997, respectively. Three other stream-monitoring locations were established in the early 2000s as part of the ARWW&S OU surface water remedy.

To date, remedial actions to address contaminants have been implemented on more than 20,000 acres. Barren/denuded and sparsely vegetated soils and milling/smelting wastes have been treated or covered and revegetated and BMPs and engineered controls to manage storm water runoff have been constructed. Despite this work, sporadic exceedances of State of Montana acute and chronic aquatic life standards (Circular DEQ-7) for copper, cadmium, lead, and zinc in surface water are detected during monitoring events conducted by the USGS at eight stations along the four streams of concern. Additional exceedances have been documented in California Creek.

Additional TI evaluations were conducted to evaluate meeting the human health drinking water standard for arsenic in groundwater and surface water, which led to the 2011 ROD amendment that waived the human health arsenic standard for significant portions of the Site. In 2012, Atlantic Richfield informed EPA and DEQ that planned remedial actions identified in approved remedial action work plans were not expected to result in compliance with the Circular DEQ-7 aquatic life standards for all streams at all times. EPA and DEQ then directed Atlantic Richfield to complete a TI evaluation to determine if those standards could be achieved with additional work utilizing technically practicable cleanup measures.

A technical work group was established that included EPA, DEQ, the Montana Department of Justice

– Natural Resource Damage (NRD) Program, Atlantic Richfield, and their contractors. The work group began meeting in late 2012 to scope the TI evaluation. Existing data were compiled, and a data gaps assessment was performed.

The first data gap that the technical work group identified was the lack of existing data concerning surface water quality in tributaries, and in main stems of streams during storm events. In 2002, Atlantic Richfield had attempted to collect storm water data; however, 2002 was a drought year and too few summer/fall storm events occurred. Atlantic Richfield developed a sampling and analysis plan to collect additional storm water samples during the 2013 field season, and that sampling event confirmed and improved the previous site characterization. Analysis of the 2013 data also showed a correlation between COC concentrations in storm water samples and seasonally high-flow events. This is further discussed in Section 4.

Following this data analysis, the technical work group decided to implement further soils and stream corridor sediment sampling in 2014 in tributary drainages that were determined by the previous data to be the most significant sources of COC loading to the mainstem of streams, most specifically to upper Mill Creek. Data analysis of these headwaters resulted in the classification of the drainage basin into polygons that were designated as "well-vegetated, moderately vegetated, or poorly vegetated." Rock outcrops were also identified and eliminated from further analysis during this evaluation.

The analysis of the newly acquired data, coupled with the older data, indicated the following:

- Metals loading to Mill Creek, Lost Creek, and Warm Springs Creek was occurring in areas beyond the surface water TI evaluation area of concern (although all exceedances were within the area of concern). Willow Creek's headwaters are totally within the area of concern. Areas upstream of the area of concern are generally described as pristine and are on national forest lands or other protected areas.
- The highest concentrations of contaminants in soils in the tributary watersheds targeted as high COC loaders were found in well-vegetated areas. The lowest concentrations were found in the barren steep slopes. This is likely caused by the fact that surficial smelter emission deposits on barren slopes have been transported through storm water and snow melt runoff for years.
- A statistical comparison of the concentration of COCs between the storm water and the high flow water quality sampling data showed a high correlation. The highest concentrations of COCs occur when flow rates are highest for both storm water and normal high-flow scenarios.

The work group determined that these additional data provided sufficient reason to proceed with developing alternatives for a TI evaluation. As required under the 1998/2011 ROD, the evaluation was to include additional technologies that could be used in each creek watershed to improve water quality as one component of the potential additional remedy. Additional technologies included those that may have emerged since the 1998/2011 ROD (such as active water treatment), enhancements to existing approved designs (such as new approaches to steep slope reclamation), and remediation applied in new locations outside of the approved work plan remedy areas.

The active water treatment options were reviewed by the work group, with a focus on new technologies other than those analyzed during the arsenic TI evaluations and summarized in the2011 ROD amendment. None of the new technologies were determined to be practicable for the Anaconda uplands for the same reasons identified in the previous TI evaluations.

Those reasons are:

- Exceedances occur during high-flow and storm events. This would require capture of large flow rates for storage in suitable sized large storage ponds for treatment.
- As a result of water storage and treatment, the treated water would have a warmer temperature and an altered chemistry, potentially impacting aquatic life, including threatened bull trout in the Clark Fork River.
- The process of capturing and retaining water for treatment during spring and early summer when high flows occur also would potentially impact water rights of downstream users.

The TI evaluation identified additional remedial action beyond the current approved remedy, including aerial fertilization and seeding. Additional new storm water BMPs based on lessons learned during previous work were selected, and the previous steep slope reclamation toolbox was updated to include different technologies. Storm water engineered controls also were identified in selected drainages where there was adequate space to construct such features.

The cumulative results of work group discussions and data evaluation resulted in the *ARWW&S OU Surface Water Technical Impracticability Evaluation Report* (Atlantic Richfield 2017), completed in April 2017. Modeling results in that report show that achieving some acute and chronic surface water standards would likely be impracticable from an engineering perspective. At the same time, the TI evaluation identified additional remedial measures that could be implemented to reduce metals loading to receiving streams. Figure 3-1 shows the surface water TI evaluation area, existing work identified by the previous remedial design unit land reclamation evaluation system, and new remedy work areas delineated by the TI evaluation.

3.2 Public Participation in the CERCLA Process

Based on the analysis of the surface water TI evaluation, EPA issued a proposed plan for a ROD amendment in June 2017 (EPA 2017). The proposed plan included additional work to address contaminant runoff and proposed waiving the Circular DEQ-7 surface water standards in limited tributaries of upper Mill Creek and upper Willow Creek. The proposed plan included certain up-front waivers for standards that would be granted before any of the additional work would be completed, as well as a waiver if the Circular DEQ-7 standard was not met after this additional work was complete.

Most public comments on the June 2017 Proposed Plan were against these limited upfront waivers. Commenters generally believed the technically practicable work should be completed before any waivers were granted. EPA's response to the public comments to the 2017 proposed plan is provided in the attached responsiveness summary. Based on that response, the proposed plan was reevaluated.

In December 2017, the Site was placed on the Administrator's Emphasis List, a list of Superfund sites targeted by EPA for immediate and intense action. The EPA Region 8 Regional Administrator began regular visits to the Site to conduct listening sessions with local government, the community, and other stakeholders. Local government and community advocates asked EPA to expeditiously complete the Superfund work in the community. Based on this input and after discussions with DEQ, an aggressive schedule to complete the majority of the work at the Site by 2025 has been identified as a goal of all major stakeholders. The contingency approach, as identified in the 1998/2011 ROD, does not meet this desired outcome. While the original surface water remedy stated in the 1998 ARWW&S OU ROD is a valid approach for an extremely large site, all parties (EPA, DEQ, and Atlantic Richfield) have agreed on a new approach to complete the technically practicable remediation now, as opposed to waiting years for monitoring data to suggest locations for additional remediation. The proposed plan (EPA 2019) was revised and released to the public in September 2019 without the up-front waivers of ARARs. The specifics of the revised proposed plan are addressed in Section 4.

Section 4
Description of the Fundamental Change to the Remedy

The 2017 ARWW&S OU TI evaluation report identified a process for completion of the surface water remedy that may result in future waivers of existing State of Montana water quality standards for specific COCs for specific streams. This is the sole fundamental change for this ROD amendment.

The change includes three primary components:

- Expand the remedy to complete the technically practicable work in the uplands of the Lost Creek, Mill Creek, and Warm Springs Creek drainages. This work is described in Section 4.1 and outlined in Table 4.1 below. Completion of this work is described in Section 4.2.
- Once the technically practical uplands work is complete, a six-year sampling period will begin. This is described in Section 4.3, below. Downstream compliance locations in each mainstem stream in each watershed will be sampled for COCs, including arsenic, lead, cadmium, copper, and zinc, as will be provided for in the SWMP. Under the SWMP, these sampling results will be compiled and compared to Circular DEQ-7 acute and chronic ambient water quality criteria. The SWMP will specify monitoring requirements and define exceedances.
- If certain Circular DEQ-7 standards are not met, as defined by and evaluated under the SWMP, then this ROD amendment provides that those standards are waived on the basis that it is technically impracticable to meet them. Where a standard is waived, federal water quality criteria will be applied.

Each component of the fundamental change to the 1998/2011 ROD amendment is discussed below.

4.1 Expand Existing Remedy to Technically Practicable Remedy

The 2017 ARWW&S OU TI evaluation report analyzed additional reclamation technologies beyond the existing remedy in the uplands, as well as expanding the remedy to new areas of concern identified from surface water and soil sampling. The evaluation considered additional storm water engineered controls and focused on enhancing the current steep slope reclamation techniques that were identified in previously approved remedial design unit (RDU) remedial action work plans. The surface water TI evaluation report identified an alternative remedial strategy that included these new technologies and enhancements, new sediment ponds in tributary drainages, and additional steep slope reclamation and BMPs in new areas where moderate or sparsely vegetated conditions were identified.

A TI evaluation identifies a feasibility study level of remedial alternative assessment. Consequently, the alternative remedial strategy presented in the 2017 TI evaluation report represents a

conceptual level design. Since the 2017 report was approved, Atlantic Richfield and the State of Montana have been conducting additional design evaluations to further define the remaining remedial requirements, under the direction of EPA and DEQ. The following additional work reflects these design evaluations.

Additional work for the Lost Creek, Warm Springs Creek, and northwestern Mill Creek drainages is summarized in Figures 4-1, 4-2 and 4-3, respectively. The work identified in these figures includes up to six sediment ponds within the Lost Creek and Warm Springs Creek drainages, and slope reclamation in the Mill Creek, Lost Creek and Warm Springs Creek drainages. The 2017 TI evaluation report identified barren vegetated and moderately vegetated slopes in these drainages for additional erosion controls to reduce the transport of sediment and COCs. Table 4-1 summarizes the remedial work selected in this ROD amendment for the drainages.

Table 4-1. Existing Conditions and Selected Actions by Watershed

	Unit	Specific Creek				
		Lost	Mill	Warm Springs	Willow	California
Existing Conditions						
Undisturbed	Acres	16,918	13,558	16,268	15,608	8,175
Remediation Areas	Acres	8,905	5,202	8,089	2,724	0
Stormwater Retention	Acres	0	1,236	9,985	0	0
Stormwater Detention	Acres	1,798	4,391	1,184	0	0
Proposed Action[6]						
Steep Slope Reclamation	Acres	143	781	0	141	149
Stormwater BMPs:						
Rock Grade Controls	Each	6	4	3	NA	NA
Riprap outlet protection structures	Each	0	6	0	NA	NA
Stone check dams	Each	142	32	148	NA	NA
Log check dams	Each	73	840	227	NA	NA
Geo-bag check dams	Each	135	295	935	NA	NA
Rill treatment	Acres	NA	73	NA	36	44
Hand-installed BMPs	Feet	NA	38,179	NA	10,066	18,329
Mechanized BMPs	Acres	NA	71	NA	6	3
Stormwater Detention	Each	3	0	3	0	0

Notes
1. Watershed acreage is that identified as the Surface Water Area of Concern under the 2017 Surface Water Technical Impracticability Evaluation.
2. Undisturbed acreage includes moderate to well vegetated areas, rock outcrops, facilities such as gravel pits and irrigated cropland, and other areas not identified for remediation.
3. Remediation areas are those areas targeted for remediation under the original remedial design units of the ARWW&S OU.
4. Stormwater retention areas are designed to retain the 24-hour, 25-year storm event and are primarily limited to the Old Works and Smelter Hill/Opportunity Ponds Waste Management Areas.
5. Steep slope reclamation includes aerial seeding and fertilization.
6. All Proposed Action quantities shown are approximate. Quantities for Warm Springs Creek, Willow Creek, and California Creek include work to be performed by the State (as discussed in Section 4.1 above, and as outlined in the Clark Fork CD and the State-AR 2008 CD). Some features may be substituted or replaced with those of like kind based on design refinements and field conditions (e.g. rock check dams replaced with geo-bag check dams).

Additional work for California Creek, southeastern Mill Creek and its tributaries (Cabbage, Muddy, and Joiner Gulches), and Willow Creek drainages is summarized in Figures 4-4 through 4-13. Table 4-2 provides a summary of the categories and subtypes of steep slope reclamation selected in this ROD amendment for the California Creek, Mill Creek and its tributaries (Cabbage, Muddy, and Joiner Gulches), and Willow Creek drainages.

Table 4-2. Types of Steep Slope Reclamation[1]

Type	Title	Description
SSR-1a	Broadcast seeding	Typically broadcast by ground crews.
SSR-1b	Broadcast seeding with fertilization	Fertilization can be slow-release organic or Nitrogen-Phosphorous-Potassium, typically helicopter applied over large area.
SSR-1c	Soil scarification/trenching	Hand-dug trenches and broadcast application of seed, fertilizer, and other amendment and a coir blanket.
SSR-1d	Woody plant establishment	Can include live willow stakes and/or container plants.
SSR-1e	Other soil amendment	Lime, compost, and other soil amendments.
SSR-2a	Slope stabilization	Stabilize bare slopes and form rills. Can include coffee bags, slash, coir/straw wattles, and downed logs.
SSR-2b	In-stream check structures	Brush and straw bales to slow water, capture sediment, and enhance wetlands.
SSR-2c	Gully slash filters	Available conifer material used to fill gully bottom.
SSR-2d	Gully check dams	Keyed-in structures made of rock, log, geobag, and/or coir fabric.
SSR-2e	Anchored brush bundles/boxes	Bundles of slash anchored to ground or gully side slope to capture sediment.
SSR-3a	Slope pitting and roughing	Can include dozer pits, “rough and loose” surfacing, and addition of woody debris.
SSR-3b	Earthen sediment retention	Large berms constructed to divert and/or capture sediment flow. Can include native sod and shrug transplants.
SSR-3c	Gully grading and filling	Can include clearing/grubbing, filling of gullies, and channel construction.
SSR-3d	Engineered rock check dams	Lined earth berms topped with boulders
SSR-3e	Hydroseeding	Limited roadside polygons. Can include amendments, seed, fertilizer.
SSR-4a	Slope grading	Land-forming to control runoff.
SSR-4b	Compost tillage	Slope grading plus incorporation of compost to soil.
SSR-4c	Lime tillage	Slope grading plus incorporation of compost and lime to soil.
SSR-4d	Sediment detention pond	Lined catchment basin with outlet.
SSR-4e	Soil and earth removal	Remove soil from location.

Notes

1. Remedy designations (Type and Title) are specific to work that will be performed by the State pursuant to the Clark Fork CD and the State-AR 2008 CD.

For slope reclamation work associated with the expanded surface water remedy, an erosion control scoring system introduced by the Bureau of Land Management in U.S. Department of the Interior - Bureau of Land Management. Erosion Condition Classification System, Ronnie Clark. October 1980 (Clark 1980) shall be used as a landscape stability performance standard. A Bureau of Land Management erosion score less than or equal to 45 is required for reclaimed slope areas to meet performance standards.

For the slope reclamation work specifically included within the expanded surface water remedy and addressed in this ROD amendment, the landscape stability performance standard is modified from

the 1998/2011 ROD in this ROD amendment to allow areas to pass to completion if the standard cannot be achieved after three attempts to construct and maintain the remedy. This modification is based on a consideration of several factors, including remote locations and highly erosive parent geology.

Certain tributaries to the Clark Fork River and the mainstem of the Clark Fork River have been identified as critical bull trout habitat. EPA has consulted with the United States Fish & Wildlife Service to address any potential adverse effects that would result from the modified remedy and will continue to consult with the service when considering the waiving of standards.

4.2 Development of a Surface Water Management Plan for the Anaconda Smelter Site

After the 1998 ROD was issued, the agencies and Atlantic Richfield agreed that a pathway to implement the surface water remedy and meet remedial action objectives and performance standards would best be achieved through development of a SWMP. In the early 2000s, Atlantic Richfield prepared and submitted several drainage-specific, draft SWMPs before determining that one sitewide plan would be more suitable. It was determined by EPA that it was necessary to complete the surface water TI evaluation before the development of a SWMP. The TI evaluation was completed and approved by EPA and DEQ in 2017.

The objectives of the SWMP are:

- Establish the surface water monitoring network, monitoring schedules, and sampling and analytical parameters and procedures for surface water quality monitoring;
- Identify the surface water performance standards and methodology for verifying compliance or modifying compliance targets;
- Assess the effectiveness and protectiveness of the remedial actions (RAs);
- Establish the process for a waiver to federal water quality standards ifcurrent standards cannot be met after completion of the RA;
- Identify contingent remedial measures relative to long-term monitoring results

Each of these objectives, and how the SWMP will meet them, is described below.

4.2.1 Surface Water Monitoring Plan

The 1998/2011 ROD required development of a long-term surface water quality monitoring plan that would be consistent with the *Upper Clark Fork Basin Long-Term Monitoring Plan*, currently implemented by the USGS. The SWMP will meet this requirement by continuing sampling at USGS stations established in Lost, Mill, Warm Springs, and Willow Creeks (Figure 4-14). An additional sampling station has been established by the Montana Department of Justice – NRD program in California Creek.

Each of the four tributaries of the Clark Fork River has two monitoring stations: an upper station where the stream exits the uplands into the southern Deer Lodge valley and a lower station at the

end of the operable unit before the stream flows into the Clark Fork River. Upper stations are designated as performance monitoring stations, while lower stations are compliance monitoring stations.

Samples will be collected at each station eight times per year and will be analyzed for the five Site COCs, arsenic, lead, cadmium, copper, and zinc, common cations and anions, hardness, and other parameters. Sampling at the upper Clark Fork River tributaries will continue until determined unnecessary under the SWMP. Further details on sampling and analysis will be provided in the SWMP.

4.2.2 Performance Standards and Contingent Replacement Standards

The current surface water performance standards were established in the 2011 ROD amendment and are shown in Table 4-3 along with the contingent replacement standards that are based on the current federal dissolved standards adopted under this ROD amendment.

Whether these standards have been met will be evaluated under the SWMP. The SWMP will follow current DEQ guidance (June 2019) for allowable exceedances. One exceedance is allowed for every three years, so one exceedance is allowed every 24 sampling events (8 samples collected every year) without triggering the contingent replacement performance standard for a given contaminant of concern. If a particular standard for a particular watershed has not been met in samples collected from the downstream compliance point, then this ROD amendment provides that the particular standard for the particular watershed is waived on the basis that it is technically impracticable to meet that standard in that watershed. The SWMP will define a six-year window to determine if a compliance location is meeting the criteria. This window begins after all remedial action work (excluding operations and maintenance (O&M)) within the particular watershed has been completed and the applicable performance requirements have been met. More than two exceedances in the six-year monitoring period will trigger the contingent replacement performance standard for a given contaminant of concern.

Where a standard is waived, except for copper, the waived to standard will be the federal standard in place at the time of this ROD amendment (see footnote 2 in Table 4-3 below). The waived to standard for copper will be the Biotic Ligand Model (BLM) in place at the time of the compliance determination (i.e. at the time the waiver is granted). The hardness adjusted aquatic life standards for cadmium, copper, lead, and zinc are calculated from the water hardness concentration measured in each discrete surface water sample. Table 4-4 summarizes the current equations and parameters for the hardness dependent aquatic life standards.

Table 4-3. Performance Standards for Surface Water Compliance in ARWW&S OU Streams

COC	Performance Standard[1]		Contingent Replacement Standard[2]	
	Fraction	Chronic Standard	Fraction	Chronic Standard
Arsenic	Total Recoverable	150 µg/L	Dissolved	None – achieving compliance
Cadmium		0.26 µg/L		0.25 µg/L
Copper		2.85 µg/L		BLM
Lead		0.545 µg/L		0.541 µg/L
Zinc		37 µg/L		36.5 µg/L

Notes:

Compliance standards are Circular DEQ-7 (June 2019) Total Recoverable Chronic Aquatic Life Standards. If compliance standards are not met at a point-of-compliance during the compliance monitoring period, the compliance standard will be waived to the contingent replacement standard through the process established in this ARWW&S OU ROD amendment and the SWMP.

Except for copper, contingent replacement standards are based on current (i.e., 2020) published federal water quality criteria issued pursuant to Section 403(a) of the Federal Clean Water Act, 33.U.S.C. Section 1314(a). See footnote 6 for further discussion of contingent replacement standard for copper. https://www.epa.gov/wqc/national-recommended-water- quality-criteria-aquatic-life-criteria-table.

Performance standards for cadmium, copper, lead, and zinc are hardness dependent. Values shown are calculated at a hardness of 25 mg/L.

The arsenic compliance standard in lower Warm Springs Creek (at compliance station 12323770) is the arsenic human health criterion (10 µg/L).

The performance standard for cadmium is updated to reflect the June 2019 DEQ-7 standard. The contingent replacement standard for cadmium is the federal ambient water quality criteria updated March 2016.

Biotic Ligand Model in place at the time of the waiver. For every sample collected, the water quality parameters for BLM calculation will be input into the BLM to generate an Instantaneous Water Quality Criterion (IWQC) for compliance comparisons.

Table 4-4. Parameters for Calculating Hardness Dependent Chronic Aquatic Life Standards

COC	Total Recoverable Chronic Standard (µg/L)[1] = exp.{mc[ln(hardness)]+bc}		Dissolved Conversion Factor[2]
	mC	bC	
Cadmium	0.7977	–3.909	1.101672– [(lnhardness)(0.041838)]
Lead	1.273	–4.705	1.46203– [(lnhardness)(0.145712)]
Copper	0.8545	1.702	N/A
Zinc	0.8473	0.884	0.986

Notes:

Equations for chronic standards are from Circular DEQ-7 (August 2010) Total Recoverable Chronic Aquatic Life Standards except cadmium which is revised to the June 2019 version of DEQ-7.

Dissolved conversion factors are from https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life- criteria-table. Dissolved replacement standards are calculated by multiplying the total recoverable standard by the dissolved conversion factor.

Dissolved copper replacement standard is based on BLM adjustment in place at the time of the waiver, so the dissolved conversion factor is not applicable.

4.2.3 Contingency Measures

Compliance monitoring shall begin at the four compliance monitoring locations (Figure 4-12) after either of the following occurs:

- All remedial areas within a watershed have met vegetation and landscape stability performance standards.
- Landscape stability performance standards have been waived after a maximum of three remedial action attempts in expanded remedy areas.

The waiver process from state to federal standards is discussed in Section 4.3. If compliance monitoring results show that the waived-to federal standards are exceeded, the SWMP will identify a process to be followed to identify and implement contingency remedial measures. These include data analysis, review of operations, monitoring, and maintenance records, and potential diagnostic monitoring of surface water quality. Based on these analyses, corrective actions, as defined in the SWMP, may be identified and implemented.[3] If the specified corrective actions fail to achieve the replacement standards, a new TI evaluation may be requested to assess any additional waivers. Any waivers of federal replacement standards are not addressed in this ROD amendment.

4.3 Future Waivers to Contingency Replacement Standards

A report summarizing ongoing surface water monitoring results shall be prepared annually. Once the compliance monitoring period is initiated, up to two exceedances of chronic or acute Circular DEQ-7 aquatic life standards—based on a total recoverable (unfiltered) sample— may occur in a particular watershed in a six-year period. If the report documents more than two exceedances of a Circular DEQ-7 parameter in a six-year period, this ROD amendment provides that the standard is waived, and replaced with the federal acute aquatic life standard based on a dissolved (filtered) sample as shown in Table 4-2, which becomes the new standard. The waiver occurs when the report is approved by EPA in consultation with DEQ.[4]

If EPA, in consultation with DEQ, approves the report and the waiver becomes active, that decision will be documented for the record. The waiver will apply only to the watershed where the documented exceedances occurred, and only for the parameters that have been exceeded.

[3] The process will be further described in Section 8 of the SWMP.
[4] This process will be further described in Section 6 of the SWMP

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Section 5
Evaluation of Modification

CERCLA requires that any fundamental change to a ROD be evaluated using the nine criteria specified in the NCP and used for all remedial decisions under the Superfund program. The evaluation ensures the remedy can meet EPA's mission of protecting human health and the environment. Accordingly, the ROD amendment's selected remedy for surface water remediation was first evaluated against the two threshold criteria, which must be met for an alternative to move forward. The five primary balancing criteria were then used to compare the 1998/2011 ROD remedy to the modified selected remedy. Evaluation against the two modifying criteria was made after the public comment period ended. Results of the evaluation are presented below.

5.1 Threshold Criteria

5.1.1 Overall Protection of Human Health and the Environment

This criterion assesses the ability of the modified remedy to protect human health and the environment, in both the short- and long- term. Protection is from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the Site by eliminating, reducing, or controlling exposures to levels established during development of remediation goals consistent with 40 CFR Section 300.430(e)(2)(i).

The 1998/2011 ROD and the modified remedy are both protective of human health and the environment. Both will continue to meet federal or state standards for surface water (based on total recoverable or dissolved). The modified remedy will increase overall protection of the environment through expansion and enhancement of the current remedy. The modified remedy will include biological monitoring to assess the protectiveness of the remedy to the environment.

Implementing the technically practicable remedy as a first step, rather than as an iterative process, speeds up the remedial process without impacting overall protectiveness. If anything, it has the potential to provide more protection, as incremental remedies are not tried before proceeding to the technically practicable remedy. Should waivers be necessary, federal replacement standards are based on the dissolved (filtered) sample fraction and are national surface water quality criteria promulgated by EPA pursuant to the Clean Water Act. While not as conservative as Montana standards, they are protective of aquatic life. The potential replacement aquatic standards are also more stringent than the human health standards.

5.1.2 Compliance with ARARs

This criterion assesses the ability of the modified remedy to comply with ARARs or provide grounds for invoking one of the waivers under paragraph 40 CFR Section 300.430 (f)(1)(ii)(C). The potential waiver of certain in-stream surface water standards and use of federal replacement standards is compliant with the CERCLA statute and its waiver provisions. The CERCLA statute allows ARARs to be waived based on an evaluation that they are technically impracticable from an engineering perspective.

The modified remedy will ultimately comply with ARARs (either state or federal chronic/acute surface water standards). Through the SWMP, the modified remedy includes a process to evaluate TI waivers for the State of Montana water quality standards (Montana Numeric Water Quality Standards, DEQ-7, total recoverable fraction) for cadmium, copper, lead, and zinc. For a potential waiver, compliance with ARARs would mean compliance with the federal surface water standards. Replacement performance standards are based on the dissolved (filtered) sample fraction and are national surface water quality criteria enacted by EPA pursuant to the Clean Water Act and are protective of aquatic life. Because in-stream human health standards must also be met, and the replacement standards are more stringent than the human health standards, human health is protected.

5.2 Primary Balancing Criteria

5.2.1 Long-term Effectiveness and Permanence

This criterion assesses the long-term effectiveness and permanence and certainty that the alternative will prove successful. Surface water waivers do not impact remedy performance.

The modified remedy will provide greater long-term effectiveness through implementation of enhanced stormwater controls and greater permanence through the implementation of enhanced soil treatment and vegetation techniques. Vegetative growth from the current remedy indicates that the vast majority (over 90 percent) of remediated soils support adequate vegetation and have been doing so for up to 20 years in some locations. Thus, it is expected that the revegetation of the preferred alternative will also be permanent in the long-term and effective in reducing loading to area streams. The engineered controls inspection and maintenance plan will ensure that storm water engineered controls continue to be effective.

Remedial technologies used to date at the ARWW&S OU are: soil removal, soil remediation (in-situ treatment and revegetation), steep slope reclamation (revegetation and on-slope BMPs), stormwater BMPs (check dams and erosion controls in drainages), and engineered stormwater controls (retention/ detention basins). As with the protectiveness criterion, implementing the technically practicable remedy using these proven techniques, rather than taking an iterative approach, may also increase long-term effectiveness and permanence and reduce long-term O&M. The remedial technologies used were thoroughly evaluated for the 1998/2011 ARWW&S OU ROD and were found to be effective and permanent and data gathered since further supports that conclusion.

5.2.2 Reduction of Toxicity, Mobility, or Volume

This criterion assesses the degree to which the modification uses recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the Site. There is no significant difference in reduction of toxicity, mobility, or volume of solid wastes between the interactive approach to cleanup as stated in the 1998/2011 ARWW&S OU ROD and the technically practicable approach of the 2020 amended remedy. Neither the original nor the amended remedy satisfy the statutory preference for treatment as a principal element of the remedy. Active treatment of mining waste would be significantly more expensive because of the large quantities of materials impacted. Although they are present in large volumes, the solid materials within the ARWW&S OU are generally low in toxicity and can be reliably removed or contained.

5.2.3 Short-term Effectiveness

This criterion assesses short-term impacts of the selected remedy during implementation, including potential risks to the community, impacts on workers, environmental impacts, and time until protection is achieved. The most significant difference in short-term effectiveness between the 1998/2011 ARWW&S OU ROD remedy and the selected modified remedy is that the disturbance to the area will occur over a shorter period. The modified remedy would essentially speed up that process by implementing contingency actions concurrent with the remedy.

Construction activities will use standard equipment, such as excavators and trucks. This type and scale of construction is common locally and poses low risks to workers and the community. Other risks, such as those from dust and storm water runoff during construction, can be mitigated.

5.2.4 Implementability

This criterion assesses the ease or difficulty of implementation, including technical and administrative feasibility and availability of services and materials. Implementability of the ROD amendment's selected remedy is not significantly different than the existing remedy under the 1998/2011 ARWW&S OU ROD. The remedial technologies are the same, with some notable improvements, although the schedule has been accelerated. Materials and services needed are readily available nearby and construction techniques are the same as those currently used at the Site and at other Superfund sites in the area.

5.2.5 Cost

The suite of activities to be conducted under the ROD amendment's selected remedy are within the scope of those detailed in the 1998/2011 ROD. An accelerated implementation schedule is anticipated to reduce future costs and to offset the increase in costs presented by expansion and enhancement of the current remedy.

Preliminary estimates of capital and operations, maintenance, and management costs (OM&M) for the remedy were provided by Atlantic Richfield. These include capital costs for remedial work yet to be done, and then maintained into the future, as well as OM&M costs. These totals, however, do not include the cost of actions to be completed that are within the scope of the original 1998/2011ROD. EPA estimates that the modified remedy (including work to be completed by Atlantic Richfield and the State) is anticipated to cost approximately $20 million over 50 years and is within the acceptable cost range (-30 percent to +50 percent) of cost estimated in the original 1998/2011 ROD. The 1998/2011 ROD estimated the cost of the entire remedy to range from $89,973,000 to $162,555,000 and addressed nearly 25,000 acres of reclamation in the four watersheds (including work conducted under the OW/EADA OU). The supplemental work in this ROD amendment adds an additional 124 acres of steep slope reclamation, as well as additional stormwater BMPs, sediment ponds, and enhanced reclamation in the existing 1998/2011 ROD remedy areas.

5.3 Modifying Criteria

5.3.1 State Acceptance

This criterion discusses the State's position and key concerns related to the modification to the original remedy provided for in the ROD amendment. The State of Montana, acting through DEQ,

agrees with the process for the surface water TI waiver provided that the technically practicable measures are implemented. The State of Montana further agrees that the 1998/2011 ROD should be modified to include these technically practicable measures as elements of the remedy.

5.3.2 Community Acceptance

Community acceptance was assessed based on comments received on the 2019 proposed plan. These limited comments were generally supportive of the proposed plan. Many of the comments received identify issues that can be addressed during the remedial design. Community comments on both the 2017 and 2019 proposed plans were carefully considered by the agencies and specific responses to comments are provided and addressed in Part 3, the Responsiveness Summary.

Section 6
Statutory Determinations

The types of actions to be completed under the selected remedy presented in this ROD amendment are essentially the same as the remedy presented in the 1998/2011 ROD. The time frame for implementation of the amended remedy is compressed to meet a completion goal of 2025 and the extent or scale of action is somewhat larger and is enhanced, but the applicability to statutory determination is unchanged. Therefore, the statutory determination section presented in the 1998/2011 ARWW&S OU ROD is still accurate. The following summarizes those determinations.

The selected remedy presented in this ROD amendment for the ARWW&S OU satisfies CERCLA Section 121 requirements, as it is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and uses permanent solutions and alternative treatment technologies to the maximum extent possible.

As is true at most large Superfund sites contaminated with vast amounts of mining, milling, or smelting waste, the selected remedy does not satisfy the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment). Surface water treatment alternatives are considered technically impracticable.

Because the remedy results in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action and every five years thereafter to ensure that the remedy is, or will be, protective of human health and the environment.

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Section 7
Description of the Significant Change to the Remedy

The 1998/2011 ROD provided for several different institutional control (IC) elements. Anaconda Deer-Lodge County (ADLC), under agreements with the responsible party, has been and is implementing these requirements. If this implementation stops or becomes ineffective, this ROD amendment establishes an alternate IC program to support the remedy.

7.1 Current IC Requirements

ICs in the 1998 ROD and 2011 ROD amendment include the following goals:

- Assure that future land use at the Site is consistent with EPA's determination of health and environmental risk posed by contaminants at the Site.
- Provide for the preservation and maintenance of Superfund remedial structures on the Site, including but not limited to caps, berms, waste repositories and vegetated areas.
- Require that future development at the Site employ construction practices that are consistent with the protection of public health and the environment, as determined by Superfund remedial actions.
- As end land use development occurs at the Site, soil arsenic (and lead) concentrations to levels appropriate for the intended use, as determined by Superfund remedial actions, shall be obtained through further remedial action.
- Provide for implementation of other laws applicable to development, such as subdivision and floodplain requirements.
- Take "additional measures" if the ADLC ICs program is not fully effective in monitoring and protecting the implemented remedy.

The ROD, as amended, identified various IC programs to achieve these requirements: Development Permit System (DPS) and Community Protective Measures Program (CPMP) which have been and will be implemented by ADLC.

7.2 Implementation of ICs By Parties Other Than ADLC

Although the 1998 ROD identified the potential for contingency measures if IC programs fail to achieve the above requirements, it did not recognize that alternative ICs could be implemented by parties other than ADLC. This significant change identifies the following alternate ICs to be implemented by parties other than ADLC as the "additional measures" required pursuant to the ROD in the event that ADLC fails or ceases to perform the DPS and other primary ICs programs:

- Materials Handling Program. This would allow for continued delivery of the services provided under the DPS for identifying, tracking, and assisting with certain development projects within the Superfund Overlay. These would include: education and outreach;

monitoring of a public notification process for development projects (such as 811 "call-before-you-dig"); an element in the geographic information system (GIS) mentioned below for tracking development projects; pre-development and post-development sampling; instruction on appropriate measures for soil removal, treatment, or covering; and protection or replacement of existing protective covers and storm water controls within a proposed development area.

- Domestic Well Program. This program would identify, track, and assist with the drilling and use of new domestic wells and the replacement or conversion of existing wells for drinking water use within the Superfund Domestic Well Overlay. Eligible wells would be identified through education of well drillers, 811 "call-before-you-dig" services, and public education. Eligible wells would be sampled in accordance with the Domestic Well Monitoring Plan. Sampling results would be used to determine what additional remedial action should be done, as specified in the Domestic Well Monitoring Plan. Designation and enforcement of a Controlled Groundwater Area by the Montana Department of Natural Resources and Conservation (under Mont. Code Ann. Section 85-2-501 et seq.) could be used instead of or in addition to the domestic well program described above.

- Interior Dust Program. This program would include education; cleaning, hygiene, and diet guidance; HEPA Vacuum Cleaner Loaner Program and renovation starter kits; and home inspections.

- Community Protective Measures Program. This would provide for a health education program to inform residents within the Superfund Overlay of the potential risks from arsenic and lead and recommendations for reducing exposure to lead; track information and data on arsenic and lead concentrations/locations in the ADLC database/GIS for public access to be used by regulators, prospective home buyers, lenders, contractors, and others; and prior to soil remediation, coordinate with landowners so they have the opportunity to address deteriorating exterior lead paint from homes/garages/fences that may have the potential to re-contaminate remediated soil areas.

    - Soil Swap Program. An element of the CPMP, this would provide for removing soil from certain vegetable gardens, designated play areas, or excavation areas, and replacing it with clean soil.

EPA will allow the performing entity(ies) a reasonable period of time to implement the alternate ICs and demonstrate that they effectively protect the remedy. No other ICs or additional measures will be required beyond the alternate ICs described above unless EPA, in consultation with DEQ, determines the alternate ICs are not protective. Nothing in this ROD amendment alters EPA's authority under the 1998 ROD to require additional contingency remedial measures if initial and alternate ICs (implemented by ADLC and/or other parties) fail to protect an engineered remedy or human health or the environment.

Section 8
Description of the Minor Changes to the Remedy

Four minor modifications to the original remedy for the ARWW&S OU are presented below for the purpose of documenting them in the administrative record.

8.1 Partially Cover the Main Granulated Slag Pile

The 1998 ARWW&S OU ROD allowed the Main Granulated Slag Pile to be developed as a resource and included specific remedial requirements that included preventing off-site migration of the slag material through implementation of BMPs. Since 1998, only limited development of the slag has occurred. While wind and water erosion BMPs have been implemented, off-site wind erosion of the slag pile continues to occur as evidenced by photographs of dust-blown slag in the annual reports (Atlantic Richfield 2020).

Based on these concerns, a partial soil cover over the north and west facing slopes of the Main Granulated Slag Pile shall be required. The slag pile will be graded on those slopes to 3.5:1 ratio of horizontal to vertical to allow the placement of a 12-inch thick soil cover. The soil cover will be seeded with a grass mix. Development of the slag as a resource will be allowed to continue provided it does not result in an unacceptable human health risk. All the remedial requirements identified in Section 9.3.1 of the 1998 ARWW&S OU ROD for the Main Granulated Slag Pile, including the requirement for full closure of the Main Granulated Slag Pile following resource development, shall remain in effect.

8.2 Allow Continued Waste Consolidation into the Opportunity Ponds Waste Management Area

The 1998/2011 ROD allows fluvially deposited mining waste and contaminated soil from the adjacent Silver Bow Creek/Butte Area and Milltown Reservoir/Clark Fork River NPL Sites to be disposed of in the Opportunity Ponds Waste Management Area. Additional waste and impacted soil materials from both the Clark Fork River OU and Silver Bow Creek (Rocker and Ramsay areas) which are removed from those sites shall be allowed to be disposed into the waste management area. Ongoing construction activities will continue to meet transportation safety and dust control requirements as identified in the remedial action work plans that have been or will be approved by EPA in consultation with DEQ as part of ongoing remedial actions at those NPL sites. Final closure of these waste disposal areas at the Opportunity Ponds Waste Management Area will meet the requirements established for waste management areas set forth in Section 9.1 of the 1998 ARWW&S OU ROD.

8.3 Clarify Stormwater Monitoring Requirements

The 1998 ARWW&S OU ROD required that a stormwater performance monitoring program be established as part of the site wide surface water remedial actions. As stated in Section 9.6.3 of that document:

- *Establish a storm water management performance monitoring program. The ability of revegetation and engineering controls to improve and protect surface water quality will be evaluated by a storm water performance monitoring program. The performance monitoring program will specify location, frequency, and type of samples and measurements necessary to evaluate remedy performance. Performance monitoring will continue as long as contamination remains above required cleanup levels.*

  Prior to construction of the remedies, a mass balance waste load analysis will be conducted within each of the watersheds to assess storm water contaminant contribution to receiving water bodies. An initial three-year monitoring program will begin at construction completion with sample measurements taken at the final downgradient discharge point and within receiving water bodies. An evaluation of the performance of the remedy will be provided during each of the five-year Site reviews.

Mass balance load analyses for low flow and high flow events were conducted in both Mill and Willow Creeks shortly after the 1998 ROD was issued. In 2002, Atlantic Richfield conducted storm water sampling in the uplands to evaluate potential stormwater loading contributions from tributary streams. Atlantic Richfield and the Montana Bureau of Mines and Geology conducted additional storm water sampling in 2012, 2013, and 2014 as part of the 2017 TI evaluation report.

The sitewide storm water sampling events provided incomplete data in the efforts to quantify storm water loading sources. The TI evaluation area is approximately 140 square miles. Storms that pass through the area often had highly variable precipitation amounts. Antecedent conditions significantly affected the volume of storm water runoff. EPA and Atlantic Richfield scientists compared the storm water quality data to the high and low flow data collected at the USGS monitoring locations. Data analysis in the TI evaluation report showed that the highest concentrations of metals in surface water occurred at the highest flow rates for both storm water and high flow data. Based on this correlation, EPA and DEQ have determined that the water quality data from the high flow surface water sampling provides a reasonable surrogate for storm water monitoring sampling data, and the three-year storm water performance monitoring post-remedial action identified in the 1998 ARWW&S OU ROD will no longer be required.

8.4 Determination of Final Remedial Action Completion for OUs 9, 11, and 12

Early in the remedial investigation screening process that began shortly after the Anaconda Smelter NPL Site was listed in 1983, several principal threat waste sources were identified at the Site. These were identified as Arbiter OU 12, Beryllium OU 9, and Flue Dust OU 11. In 1991, EPA issued a ROD for the Flue Dust OU. In 1991, EPA issued an Action Memorandum for the Arbiter and Beryllium OUs using CERCLA's removal authority.

The Flue Dust OU remedial action and the Arbiter and Beryllium OUs removal actions both required removal and placement of waste materials into an engineered repository complex located on Smelter Hill. The Arbiter wastes were located at the former Arbiter Plant. The beryllium wastes were located at two disposal locations: a cell within the Opportunity Ponds tailings impoundment; and a concrete bunker located at Weather Hill. The flue dust was stored at nine piles on Smelter Hill. The locations of the former principal threat wastes and the engineered repository complex are

shown on Figure 8-1.

The flue dust materials were treated with a cement/silicate-based additive to pass the toxicity characteristic leaching procedure criteria for non-hazardous waste. Each repository was lined with impermeable membrane liners and contained a leachate collection system.

Most of the requirements identified in the Flue Dust OU ROD and the Arbiter and Beryllium OUs Action Memorandum were completed years ago. However, the final long-term O&M requirements for these actions was deferred to the ARWW&S OU (OU 4). These three repositories were grouped together as the Smelter Hill Repository Complex. The complex has been operating under interim O&M plans, the most recent having been completed in 2004 (Atlantic Richfield 2004). Prior to the remediation of RDU 8 Opportunity Ponds and RDU 14 Smelter Hill Facilities, leachate from the repository complex would be land-applied for evaporation onto the contaminated soils of the waste management area.

With the completion of the remedial actions, land application was no longer an option. Complicating the completion of a final long-term O&M plan has been the unexpected generation of leachate from the flue dust repository, and to a lesser degree from the Arbiter repository. After several Site investigations and actions designed to minimize leachate production, a leachate management work plan was completed in 2017 (Atlantic Richfield 2017). The work included in this plan included pumping of the leachate to an enhanced evaporation area, leachate treatment, and fencing to keep wildlife out. A long-term Smelter Hill Repository Complex O&M Plan reflecting these actions shall be developed, approved and implemented. Until that plan is approved, current operations, monitoring and maintenance will continue under the EPA-approved 2004 O&M Plan.

With the completion and implementation of a long-term O&M Plan, these three OUs will achieve all the remedial requirements for the ARWW&S OU. Specifically, the removal actions for the Arbiter and Beryllium OUs are now considered final remedial actions consistent with the ARWW&S OU remedy.

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Section 9
Public Participation

Under CERCLA Section 117(c), 42 U.S.C. Section 9617(c), and the NCP, 40 CFR Section 300.435(c)(2)(ii), EPA must publish proposed changes to existing remedies that fundamentally alter the basic features of a selected remedy with respect to scope, performance, or cost and provide the public an opportunity for comment on the proposed changes. Changes proposed for the ARWW&S OU fundamentally alter the basic features of the 1998/2011 remedy, prompting the issuance of a proposed plan for ROD amendment.

As documented below, the public participation requirements set out in the NCP have been met through the proposed plan and public comment process:

- EPA issued a proposed plan that highlighted proposed changes to the original surface water remedy on June 21, 2017.
- A public notice regarding issuance of the plan, start of the public comment period, and information about the public meeting was placed in the *Anaconda Leader* (June 21and 23 and July 14 and 19, 2017) and also ran in the *Montana Standard* (in Butte) (June 25 and 28 and July 16 and 19, 2017) .
- A 45-day public comment period ran from June 21 to August 4, 2017.
- EPA hosted a public meeting at the Metcalf Senior Center in Anaconda from 6:00– 8:00 p.m. on July 20, 2017. Copies of the proposed plan and a fact sheet were provided at the meetings.
- A 30-day extension to the comment period was requested, and it was extended through September 4, 2017. Public notice of the extension was published in the *Anaconda Leader* (August 2, 2017) and the *Montana Standard* (August 6, 2017).
- EPA issued a revised proposed plan that highlighted proposed changes to the original surface water remedy on September 4, 2019.
- A public notice regarding issuance of the plan, start of the public comment period, and information about the public meeting was placed in the *Anaconda Leader* (September 4 and 13, 2019) and the *Montana Standard* (September 1 and 16, 2019).
- A 30-day public comment period ran from September 4, 2019 to October 4, 2019.
- EPA hosted a public meeting at the Metcalf Senior Center in Anaconda from 6:00– 8:00 p.m. on September 17, 2019. Copies of the proposed plan, a proposed plan fact sheet, and a surface water TI fact sheet were provided at the meetings and made available on the EPA website.
- In both 2017 and 2019, the proposed plan and the supporting administrative record were available throughout that period on the EPA website and at the joint Deer Lodge

County/Arrowhead Foundation Superfund Document Repository at 118 East Seventh Street in Anaconda. The administrative record is also maintained at the EPA - Montana Office at 10 West 15th Street, Suite 3200, in Helena, Montana.

- Public comment was received and evaluated prior to finalization of the ROD amendment.
- EPA received comments from 32 separate comment submissions in total on both versions of the proposed plan during the two public comment periods, 26 in 2017 and 6 in 2019. A responsiveness summary, which includes each comment, criticism, or new relevant information submitted, followed by a response to each, is included as Part 3 of this ROD amendment.
- EPA will publish a notice of the availability of the amended ROD in the *Anaconda Leader*.
- This ROD amendment is a part of the administrative record for the ARWW&S OU ROD amendment and the administrative record and this ROD amendment are available at the information repository for public review prior to the commencement of the remedial action described herein. A list of the most relevant documents to this amendment is provided in Section 1.3.

Section 10
References

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EPA 1999. *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Documents*. U.S. Environmental Protection Agency, July, EPA 540-R-98-031, OSWER 9200.1-23P.

EPA 2011. *Record of Decision Amendment, Anaconda Regional Water Waste and Soils Operable Unit, Anaconda Smelter National Priorities List Site, Anaconda-Deer Lodge County, Montana.* September 2011. 1211311-R8 SDMS.

EPA 2017. *Proposed Plan for Modifications to the Remedy, Anaconda Regional Water Waste and Soils, Anaconda Smelter Superfund Site, June 2017.*

EPA 2019. *Proposed Plan to Amend the 1998/2011 Record of Decision, Anaconda Regional Water Waste and Soils Operable Unit, Anaconda Smelter NPL Site*, September 2019, 1917242-R8 SDMS.

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Figures

Figure 2-1 Clark Fork River Basin Superfund Sites
Figure 2-2 Five Subareas within the ARWW&S OU
Figure 2-3 Stream Reaches That Have Exceeded Water Quality Standards One or More Times
Figure 3-1 Surface Water Technical Impracticability Area
Figure 4-1 Lost Creek South Proposed Remedial Summary
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Figure 4-4 California Creek Proposed Treatment Summary
Figure 4-5 Mill Creek 1 Proposed Treatment Summary
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Figure 4-8 Cabbage Gulch Proposed Treatment Summary
Figure 4-9 Muddy Gulch Proposed Treatment Summary
Figure 4-10 Joiner Gulch Proposed Treatment Summary
Figure 4-11 Lost Creek South Proposed Treatment Summary
Figure 4-12 Surface Water Monitoring Stations
Figure 8-1 Arbiter, Beryllium and Flue Dust Operable Units

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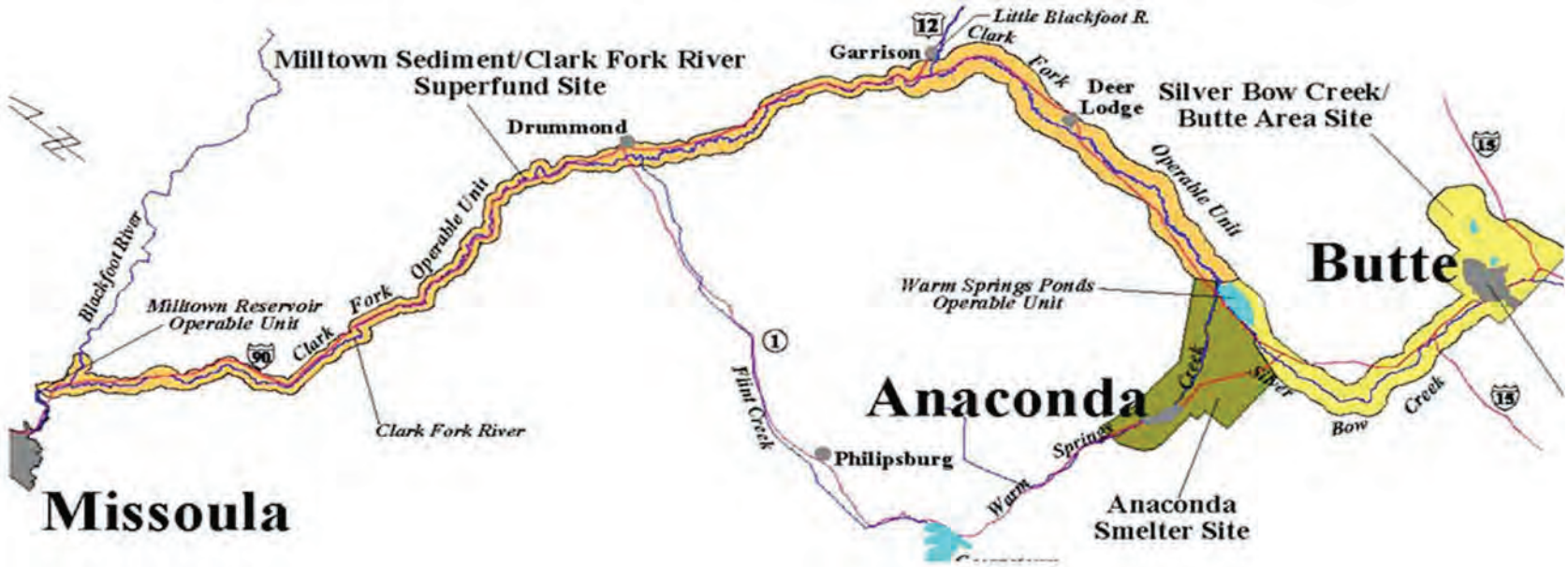

Figure 2-1. Clark Fork River Basin Superfund Sites
Anaconda Regional Water, Waste, and Soils OU
Anaconda Smelter NPL Site, Montana

Montana Department of Environmental Quality

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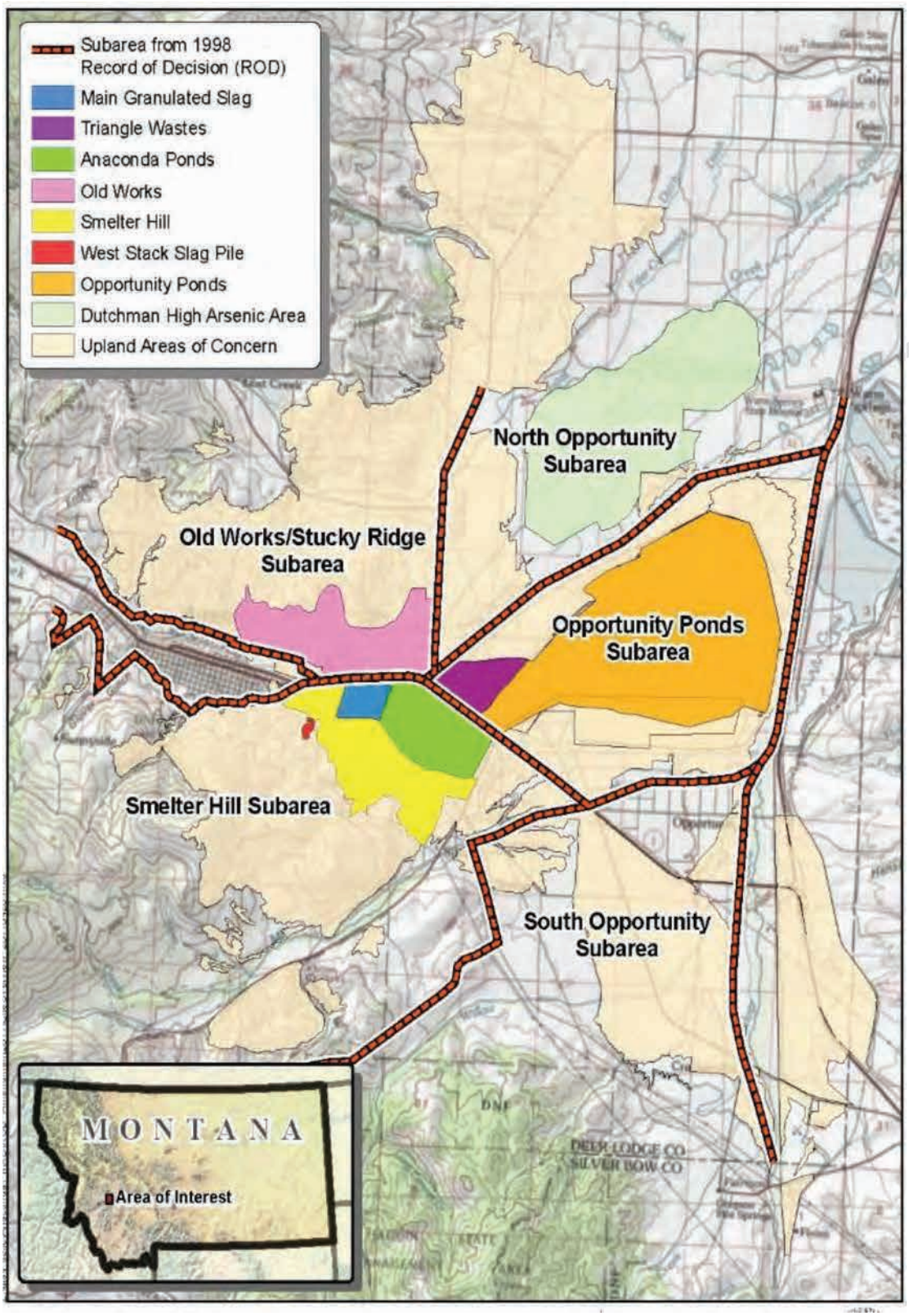

Figure 2-2. Five Subareas within the ARWW&S OU
Anaconda Regional Water, Waste, and Soils OU
Anaconda Smelter NPL Site, Montana

Montana Department of Environmental Quality

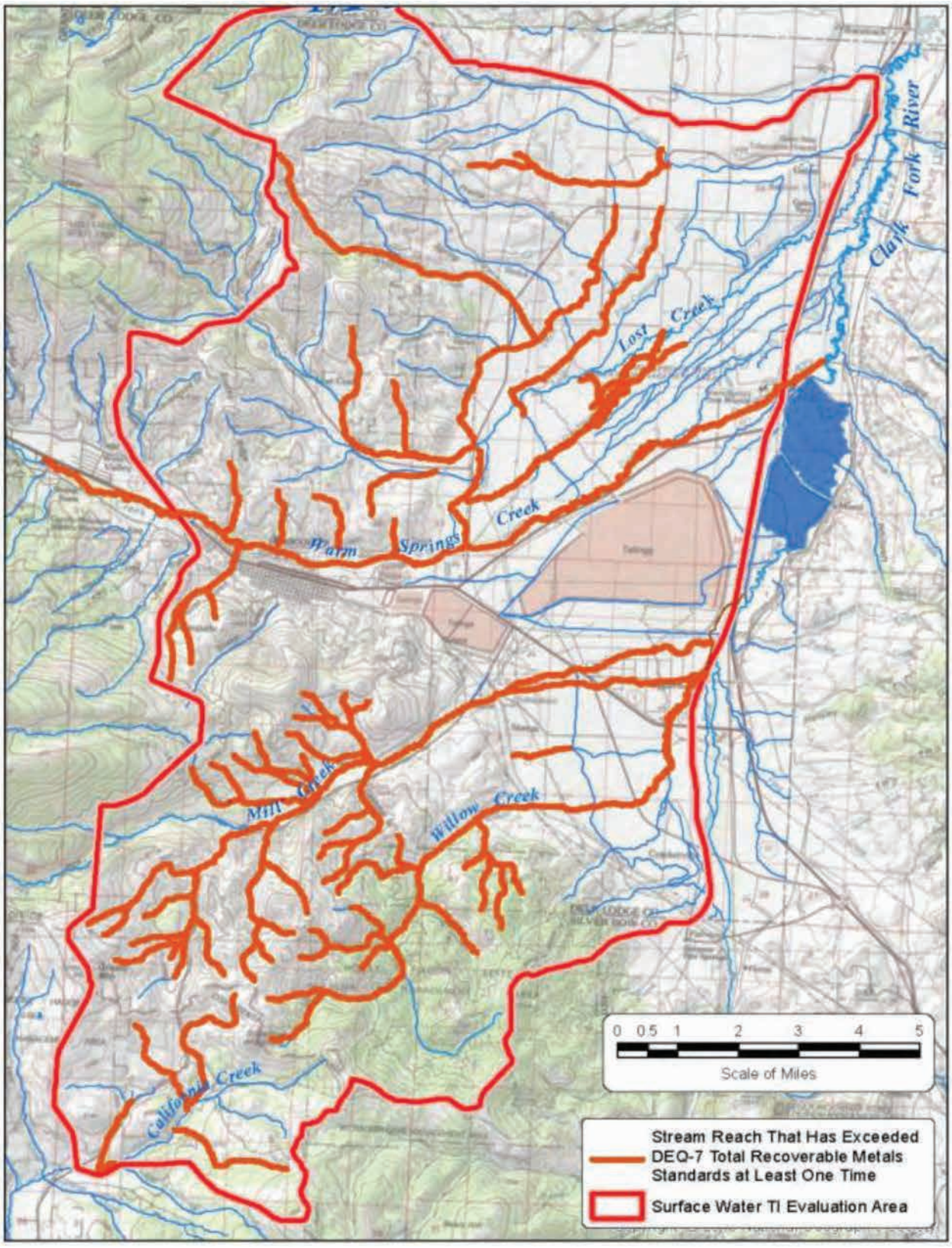

Figure 2-3. Stream Reaches That Have Exceeded Water Quality Standards One or More Times
Anaconda Regional Water, Waste, and Soils OU
Anaconda Smelter NPL Site, Montana

Montana Department of Environmental Quality

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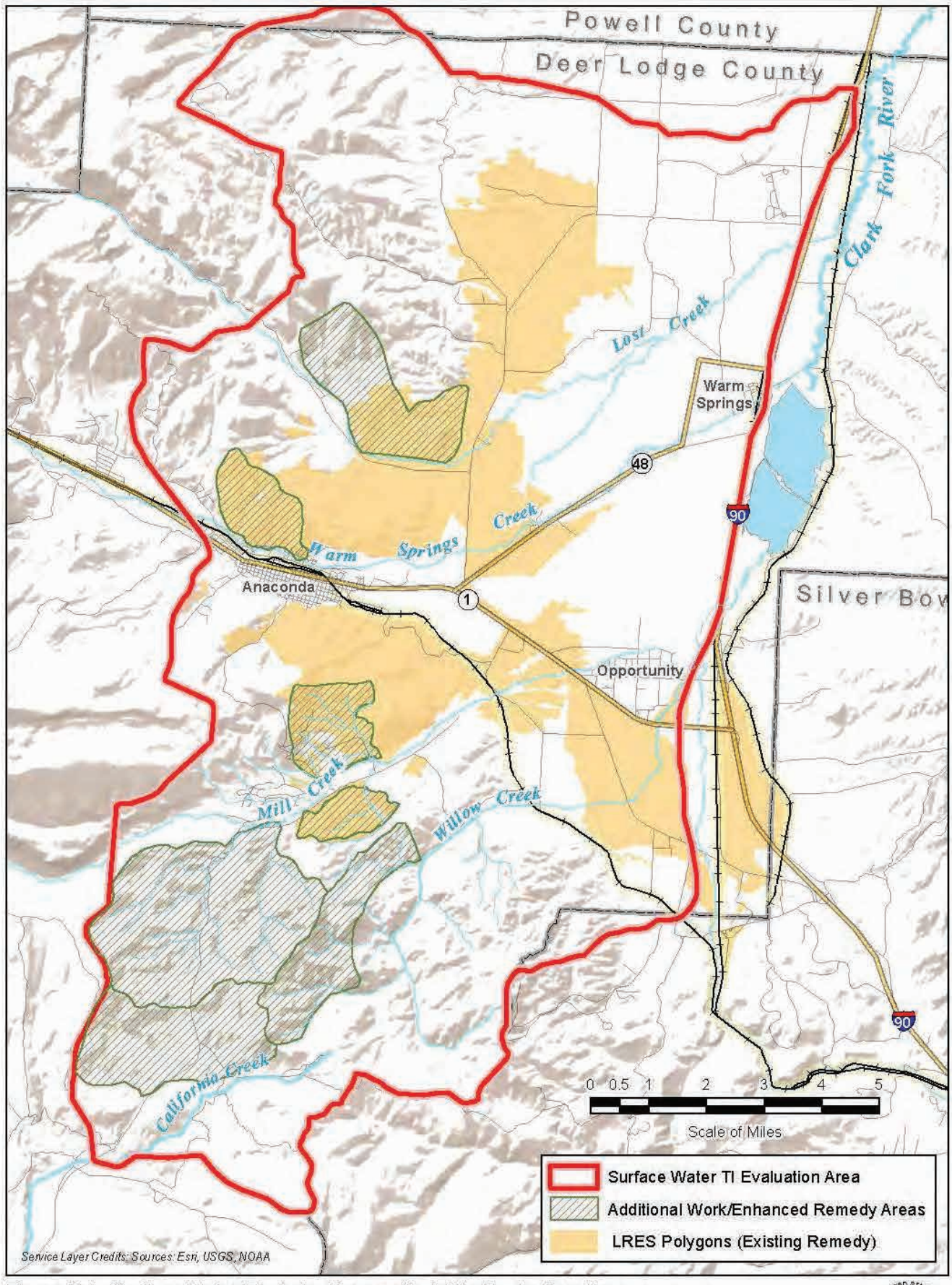

Figure 3-1. Surface Water Technical Impracticability Evaluation Area
Anaconda Regional Water, Waste, & Soils OU
Anaconda Smelter NPL Site, Montana

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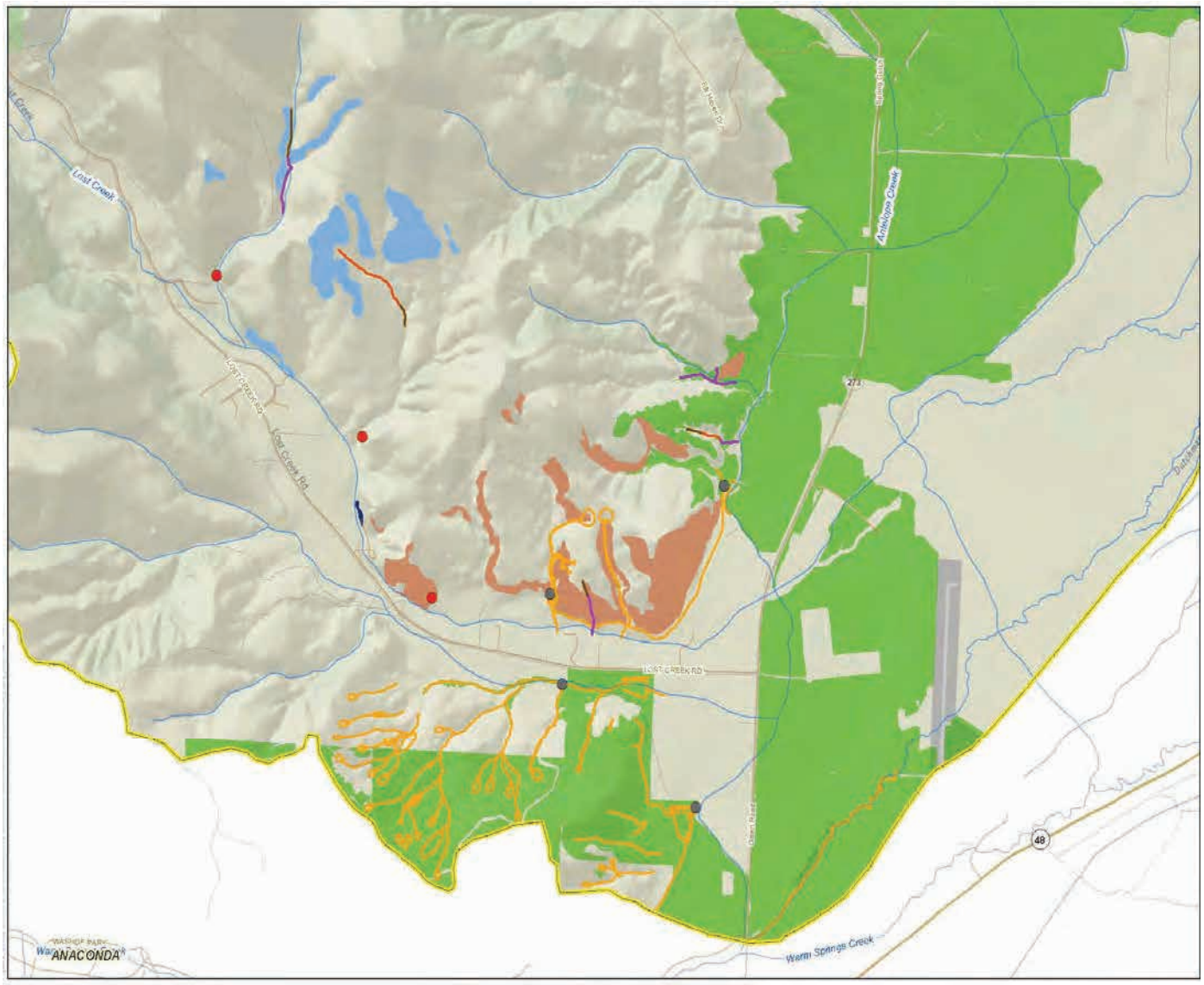
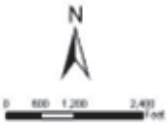
Montana Department of Environmental Quality



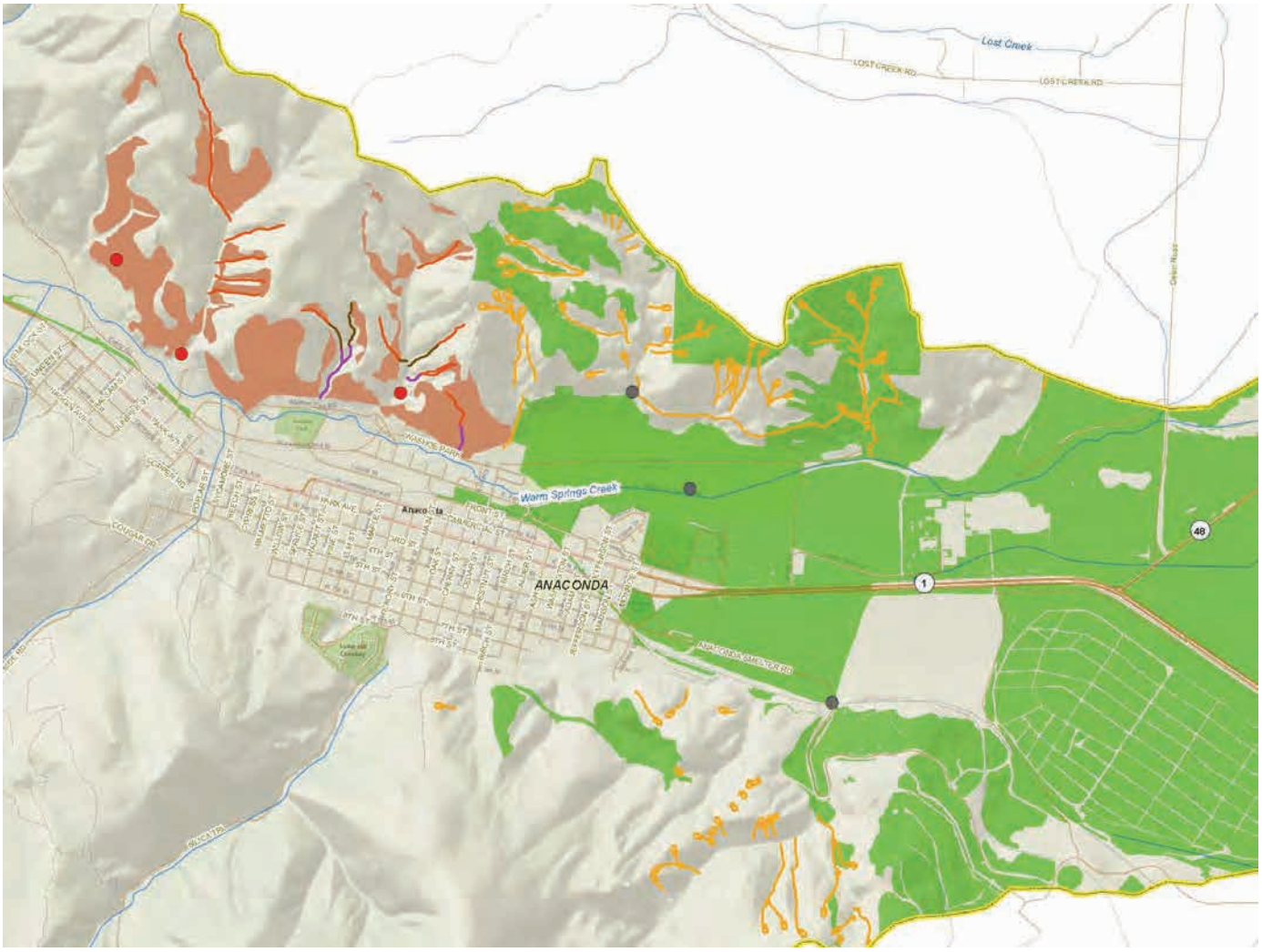


Legend

- Lost Creek Drainage Basin
- Remediated Areas
- Barren Areas
- Moderately Vegetated Areas (MV)
- Steep Slope Areas Investigated for Enhancement
- Proposed Sediment Ponds
- Proposed Log Check Dams
- Proposed Soil-Filled Geobag Check Dams
- Proposed Stone Check Dams
- Designed Channel BMP's
- Designed Engineered Controls

Figure 4-1. Lost Creek South Proposed Remedial Summary
Anaconda Regional Water, Waste, and Soils OU
Anaconda Smelter NPL Site, Montana

Montana Department of Environmental Quality



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Legend

- Warm Springs Creek Drainage Basin
- Remediated Areas
- Barren Areas
- Moderately Vegetated Areas (MV)
- Steep Slope Areas Investigated for Enhancement
- Proposed Sediment Ponds
- Proposed Log Check Dams
- Proposed Soil-Filled Geobag Check Dams
- Proposed Stone Check Dams
- Designed Channel BMP's
- Designed Engineered Controls

Figure 4-2. Warm Springs Creek Proposed Remedial Summary
Anaconda Regional Water, Waste, and Soils OU
Anaconda Smelter NPL Site, Montana

Montana Department of Environmental Quality

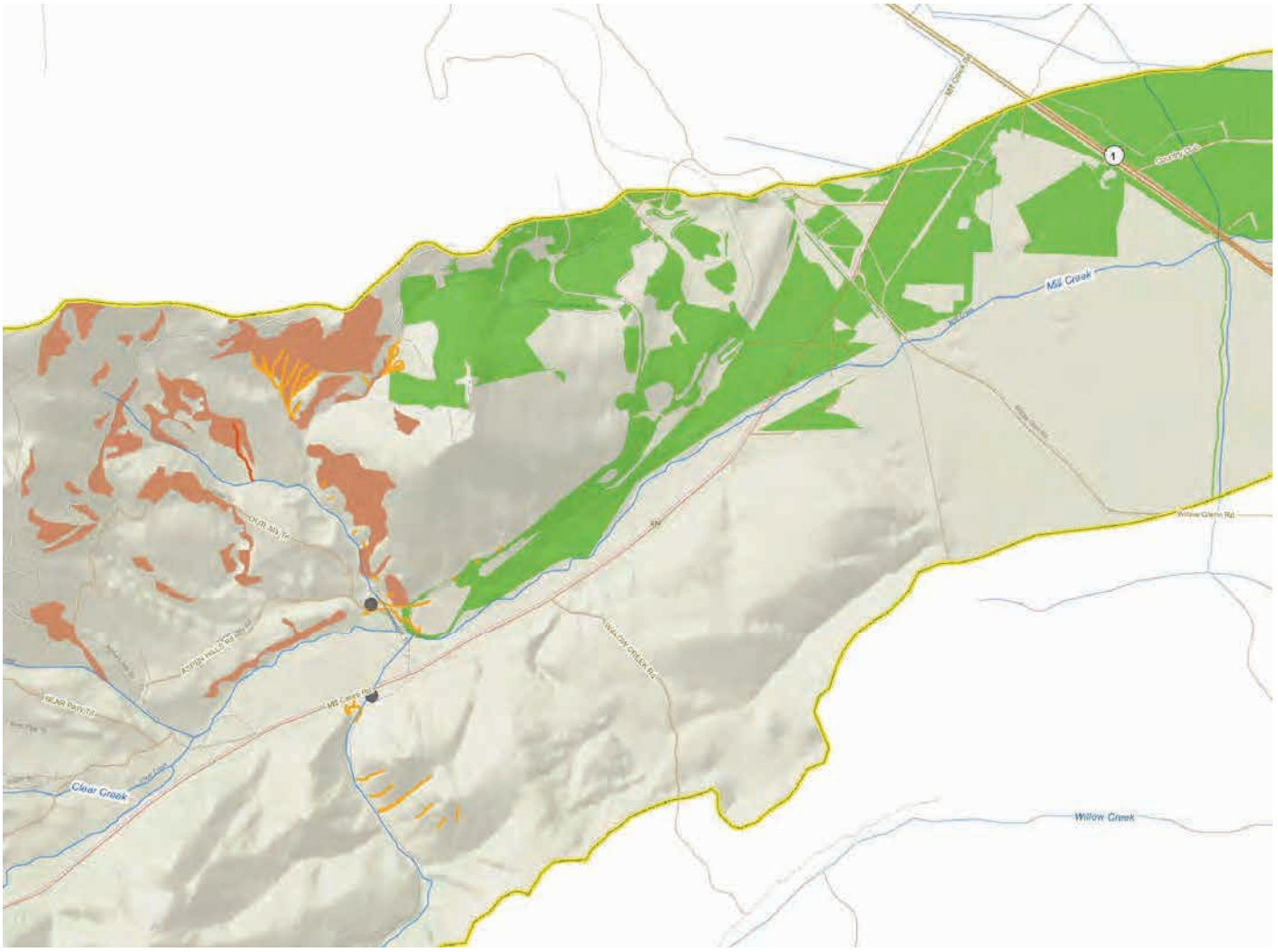


Figure 4-3. Mill Creek East Proposed Remedial Summary
Anaconda Regional Water, Waste, and Soils OU
Anaconda Smelter NPL Site, Montana

Montana Department of Environmental Quality

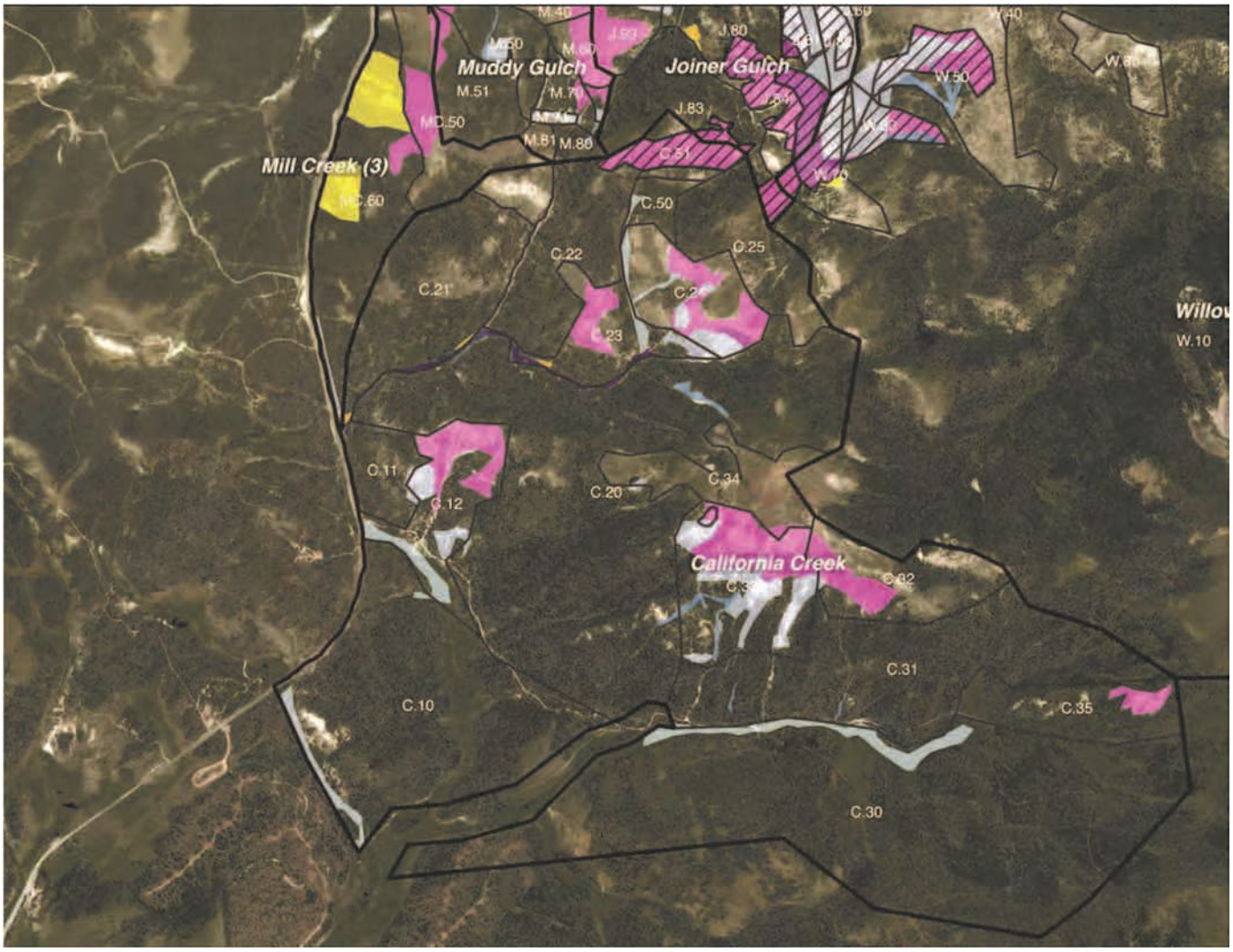


Figure 4-4. California Creek Proposed Treatment Summary
Anaconda Regional Water, Waste, and Soils OU
Anaconda Smelter NPL Site, Montana

Montana Department of Environmental Quality

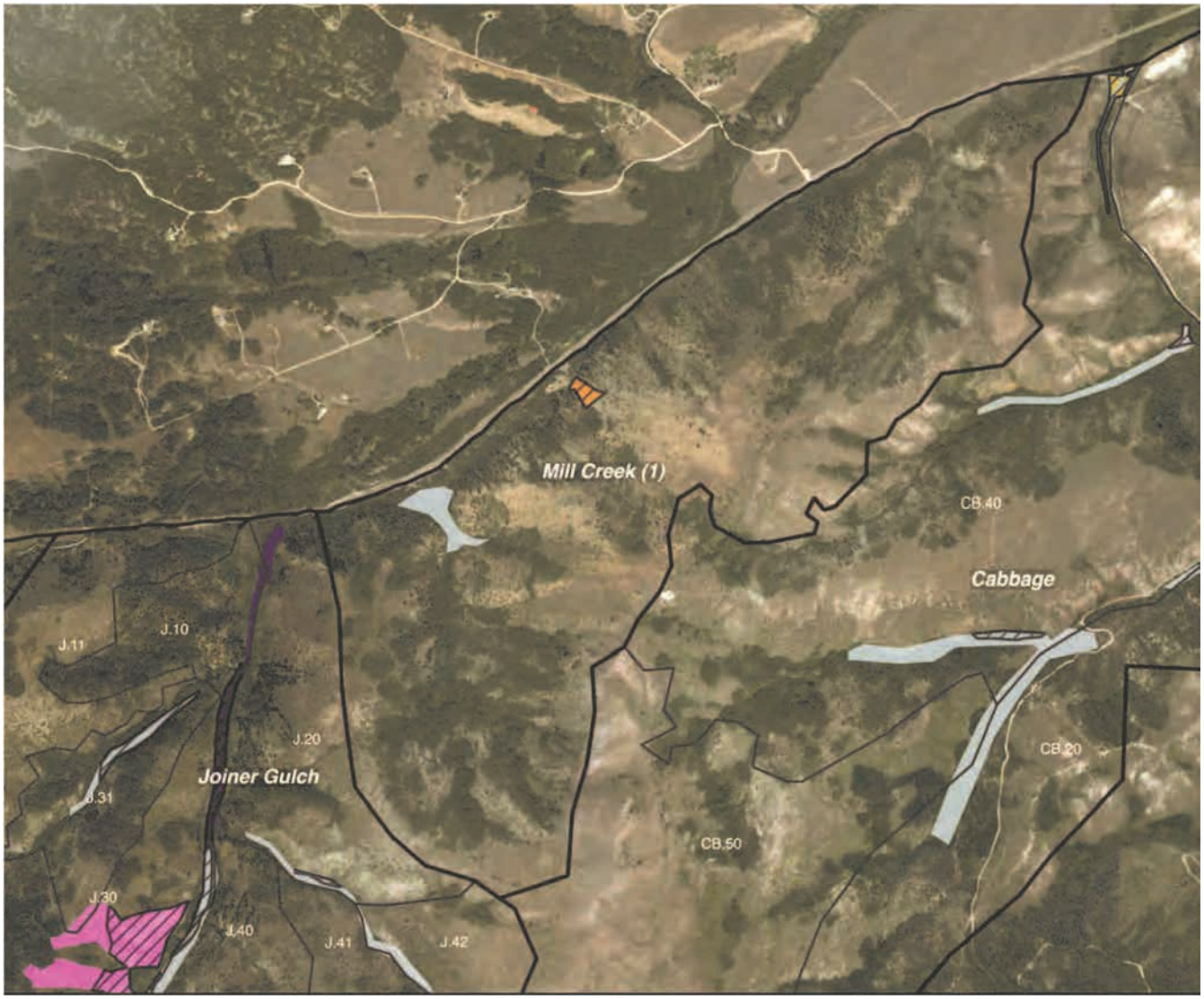


Figure 4-5. Mill Creek 1 Proposed Treatment Summary
Anaconda Regional Water, Waste, and Soils OU
Anaconda Smelter NPL Site, Montana

Montana Department of Environmental Quality

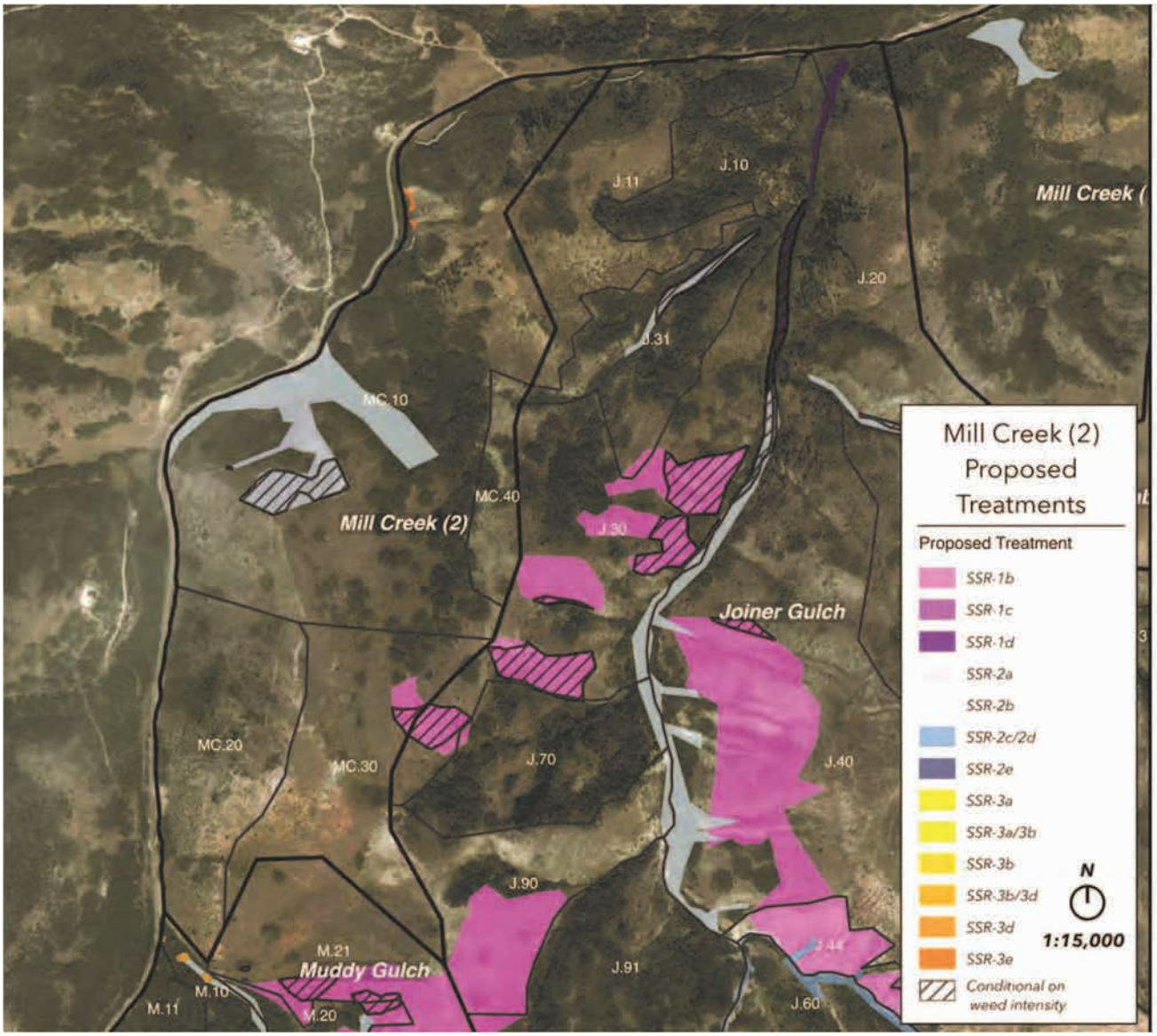


Figure 4-6. Mill Creek 2 Proposed Treatment Summary
Anaconda Regional Water, Waste, and Soils OU
Anaconda Smelter NPL Site, Montana

Montana Department of Environmental Quality

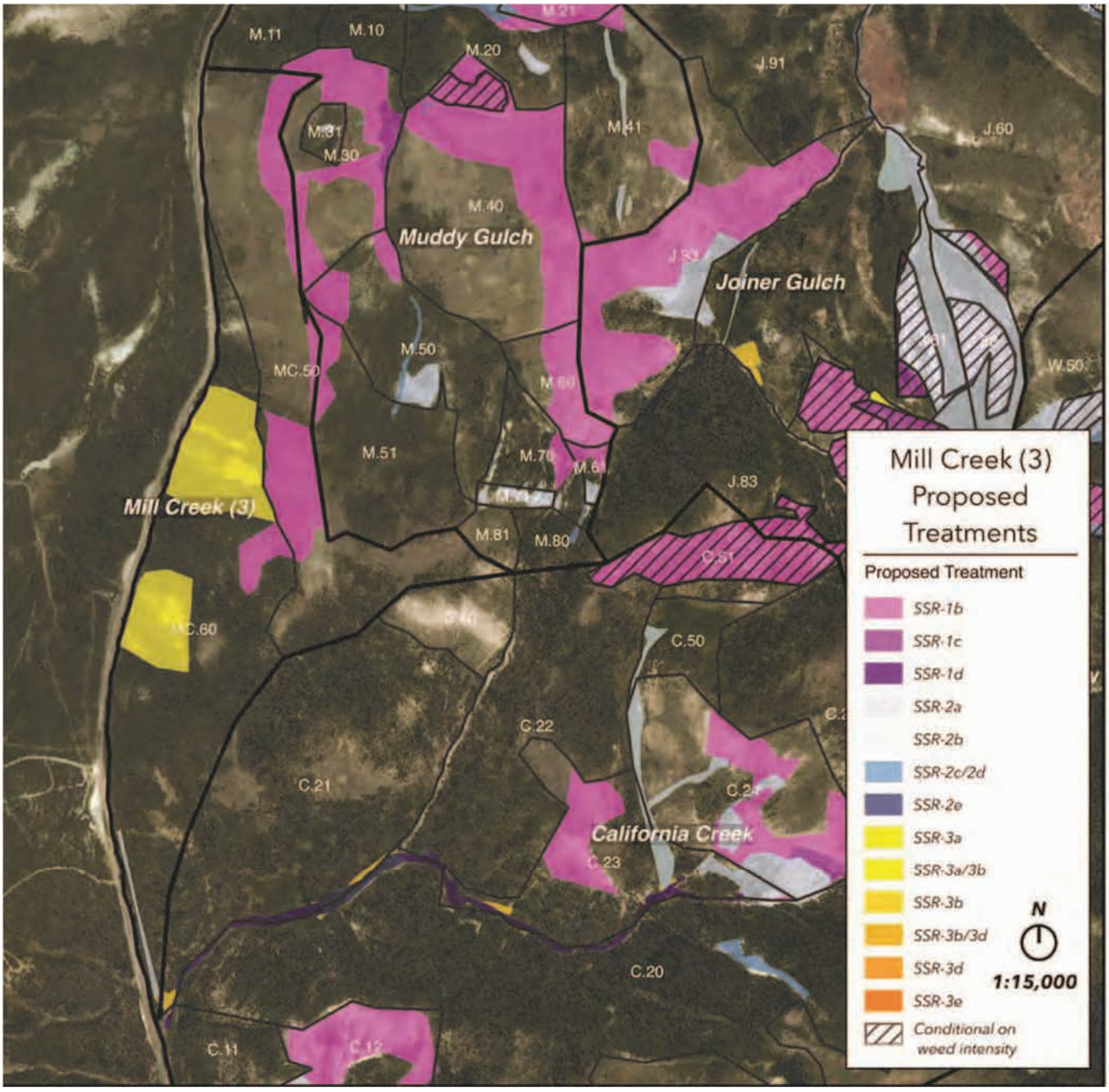


Figure 4-7. Mill Creek 3 Proposed Treatment Summary
Anaconda Regional Water, Waste, and Soils OU
Anaconda Smelter NPL Site, Montana

Montana Department of Environmental Quality

Figure 4-8. Cabbage Gulch Proposed Treatment Summary
Anaconda Regional Water, Waste, and Soils OU
Anaconda Smelter NPL Site, Montana

Montana Department of Environmental Quality

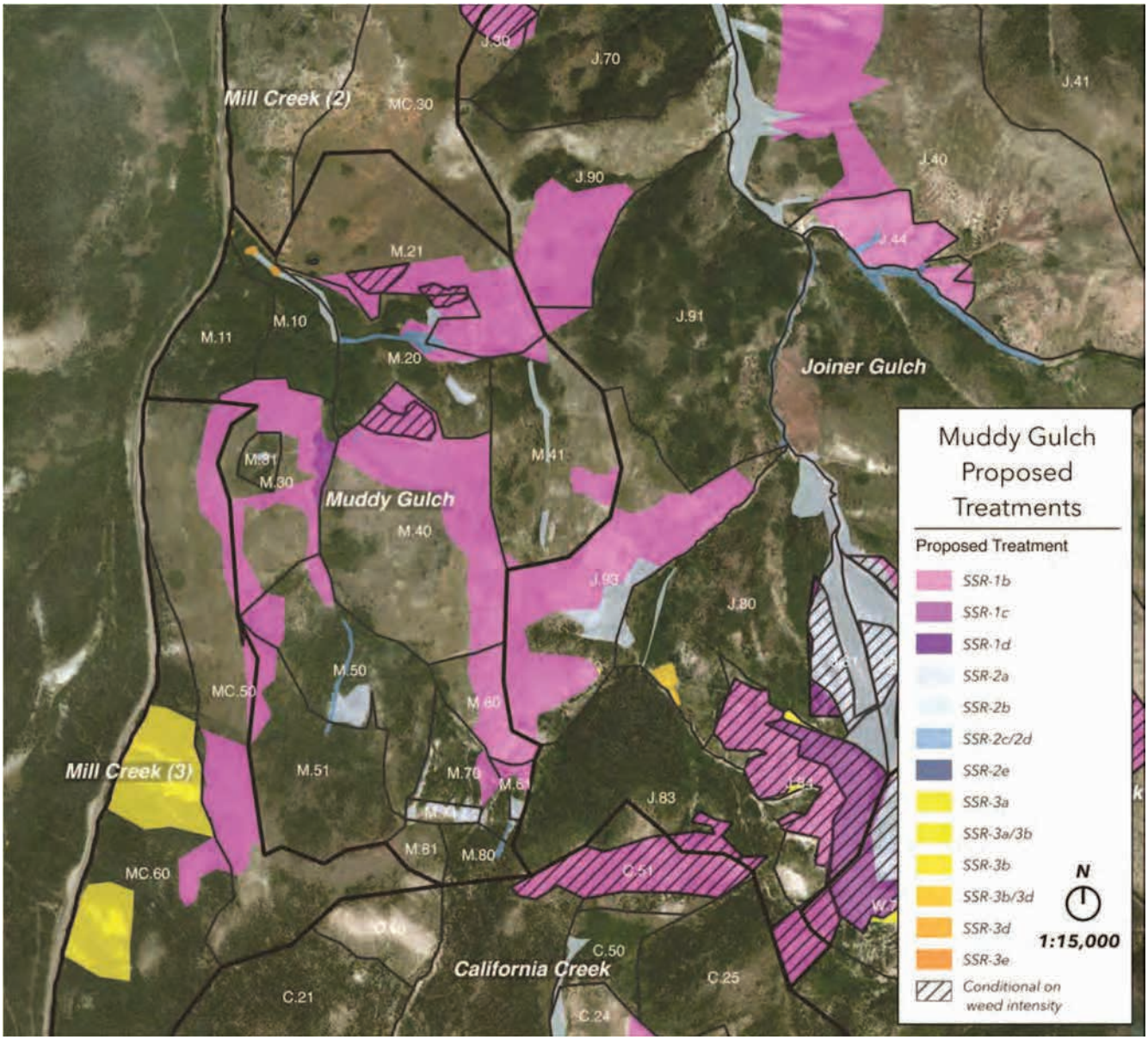


Figure 4-9. Muddy Gulch Proposed Treatment Summary
Anaconda Regional Water, Waste, and Soils OU
Anaconda Smelter NPL Site, Montana

Montana Department of Environmental Quality

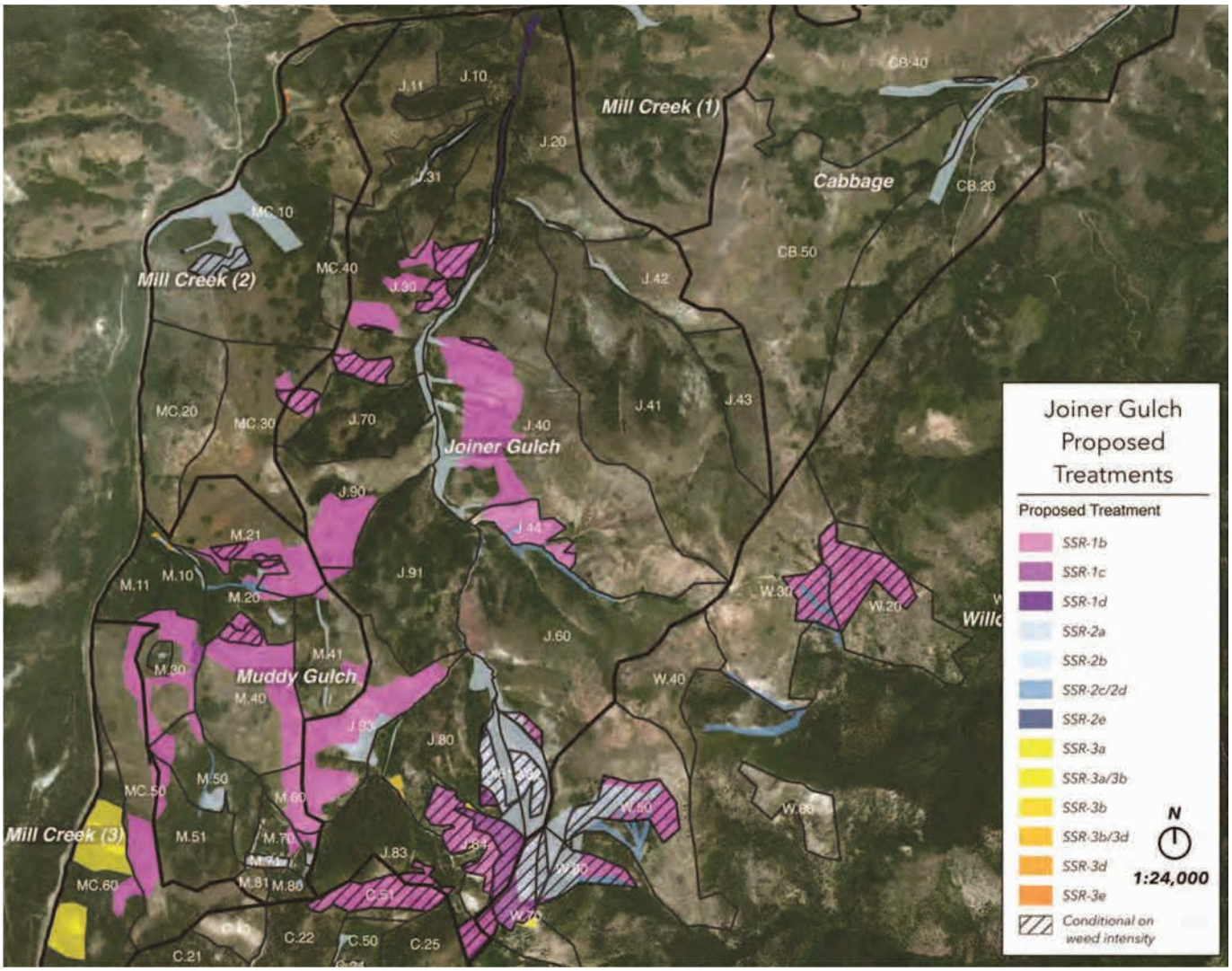


Figure 4-10. Joiner Gulch Proposed Treatment Summary
Anaconda Regional Water, Waste, and Soils OU
Anaconda Smelter NPL Site, Montana

Montana Department of Environmental Quality

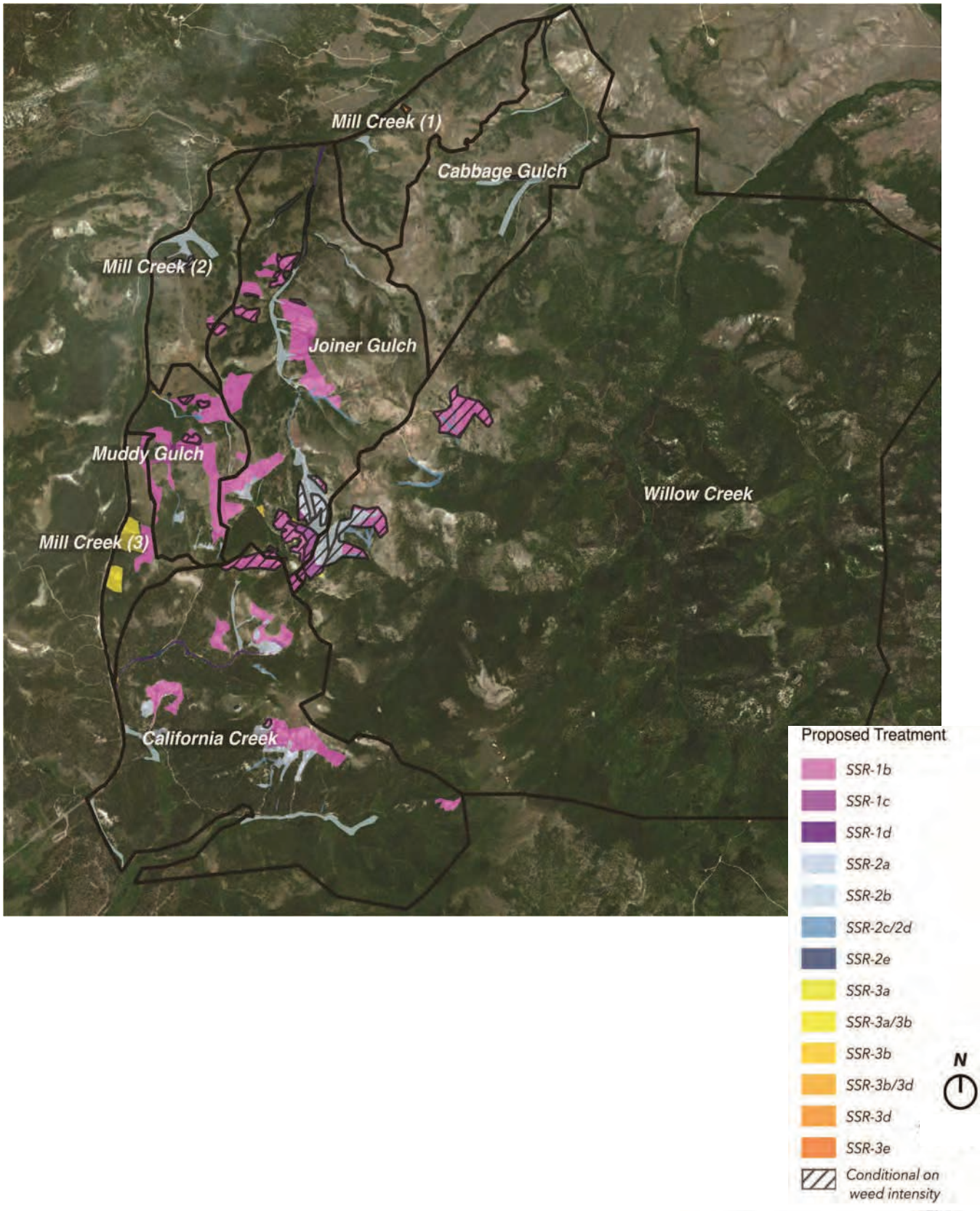


Figure 4-11. Willow Creek Proposed Treatment Summary
Anaconda Regional Water, Waste, and Soils OU
Anaconda Smelter NPL Site, Montana

Montana Department of Environmental Quality

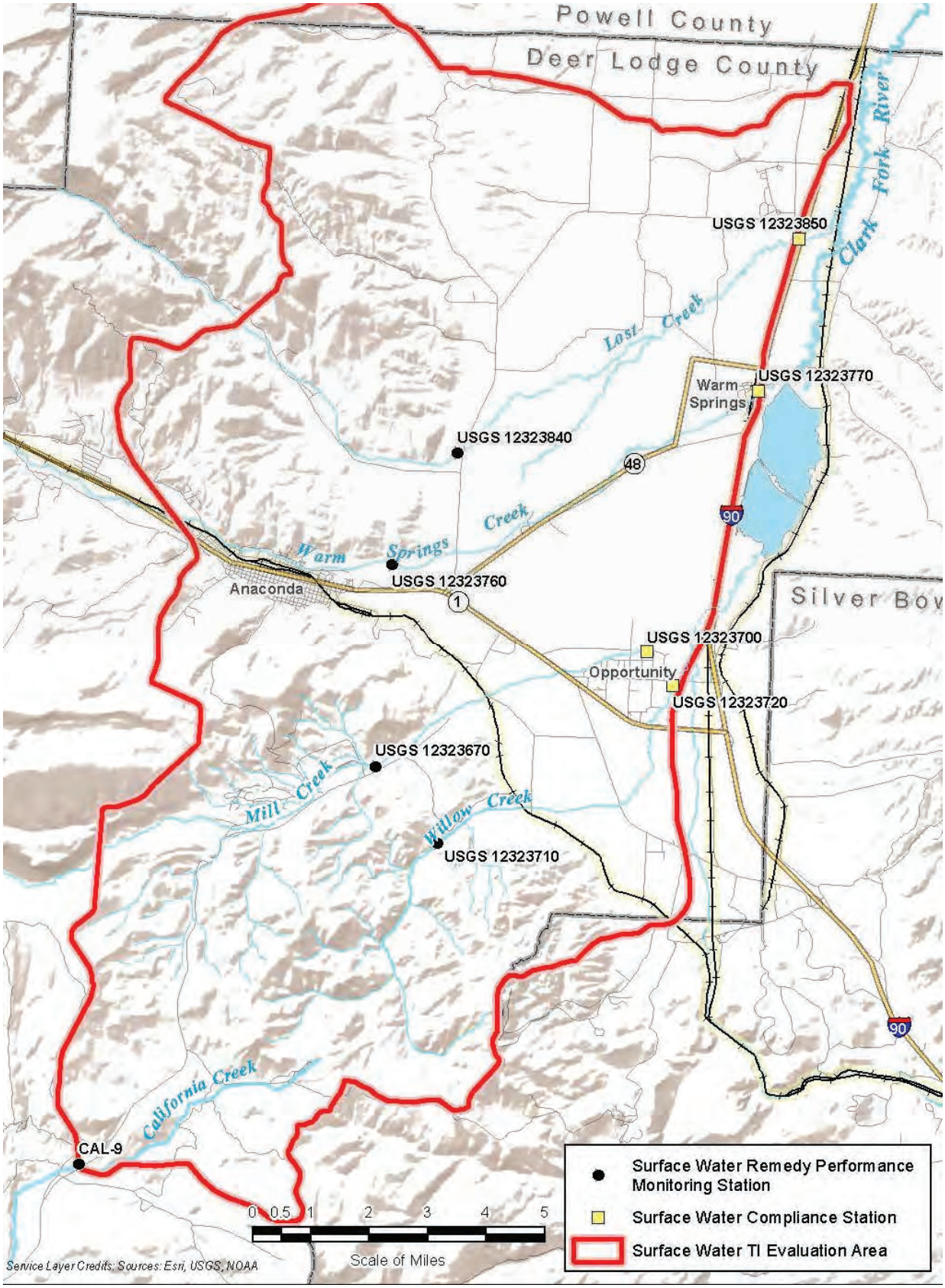
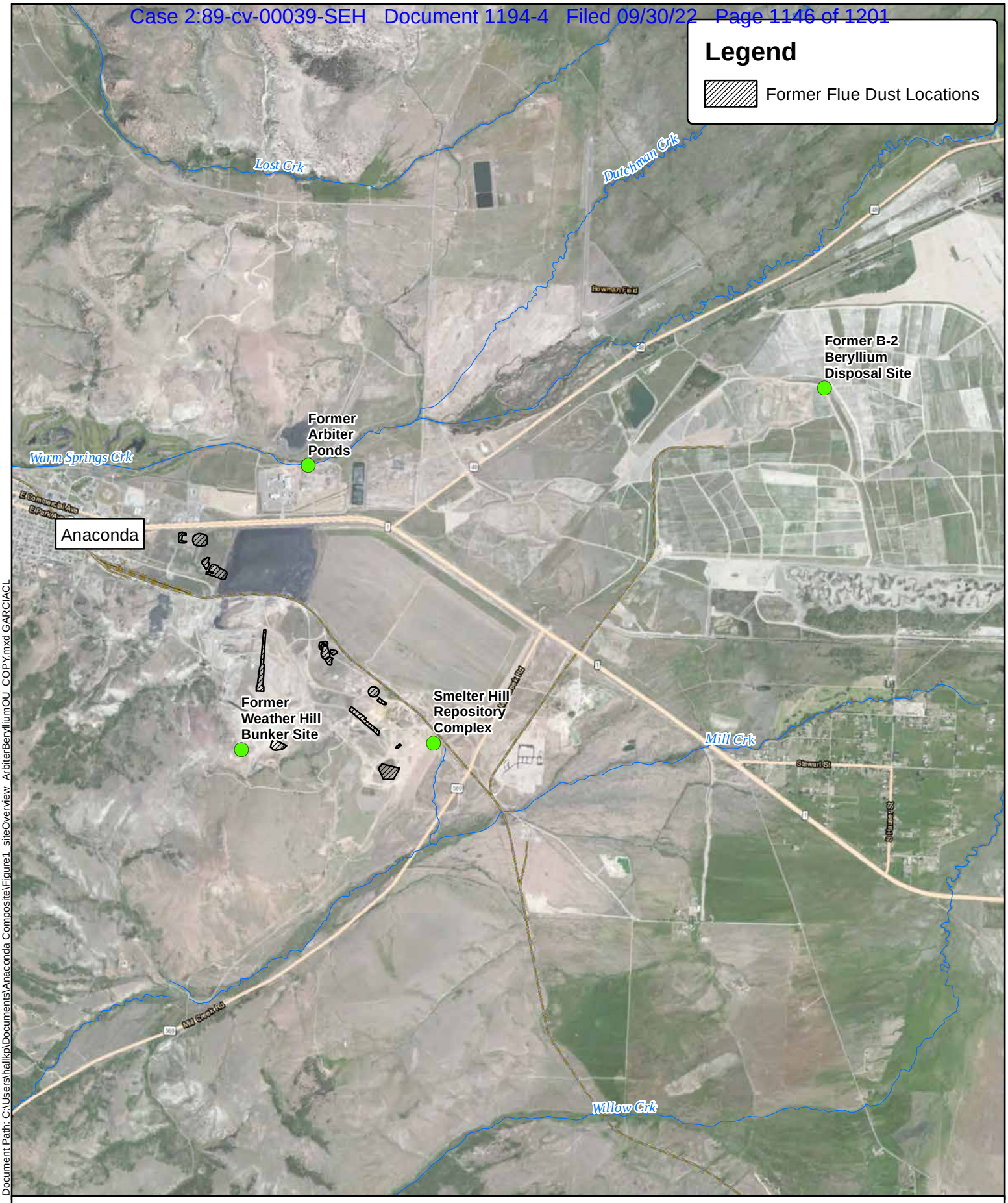


Figure 4-12. Surface Water Monitoring Stations
Anaconda Regional Water, Waste, and Soils OU
Anaconda Smelter NPL Site, Montana

Montana Department of Environmental Quality



Document Path: C:\Users\hallkp\Documents\Anaconda Composite\Figure1_siteOverview_ArbiterBerylliumOU_COPY.mxd GARCIACL

Figure 8-1.
Arbiter, Beryllium and Flue Dust Operable Units
Anaconda Smelter NPL Site

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Part 3 – Responsiveness Summary

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Appendix A Technical Note

Acronyms

ADLC	Anaconda Deer Lodge County
ARARs	applicable relevant and appropriate requirements
ARWW&S	Anaconda Regional Water Waste and Soils
AWQC	Ambient Water Quality Criteria
BMPs	best management practices
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CH	critical habitat
DEQ	Montana Department of Environmental Quality
EPA	U.S. Environmental Protection Agency
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NRD	Natural Resource Damage Program
OU	operable unit
OU4	Operable Unit 4
RD/RA	remedial design/remedial action
ROD	record of decision
RUSLE	Revised Universal Soil Loss Equation
SSR	steep slope reclamation
SWMP	surface water management plan
TI	technical impracticability
USLE	Universal Soil Loss Equation
WEPP	Water Erosion Prediction Project

Section 1
Introduction

1.1 Process Overview

In June 2017, the U.S. Environmental Protection Agency (EPA) released the *Proposed Plan for the Anaconda Regional Water, Waste and Soils Operable Unit (OU4) of the Anaconda Smelter Superfund Site* (EPA 2017). The plan outlined proposed modifications to the remedy for the *Anaconda Regional Water, Waste and Soils Operable Unit (ARWW&S OU)* that had been selected by EPA in a 1998 record of decision (ROD) (EPA 1998) and modified in a 2011 ROD amendment (EPA 2011). A ROD amendment is required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) at 40 Code of Federal Regulation (CFR) § 300.430(f)(3)(F) when fundamental changes to an approved ROD are made by EPA.

The main components of the 2017 proposed plan were:

- Waive the State of Montana's acute and aquatic life surface water criteria for cadmium, copper, lead and zinc for upper Willow Creek and its tributaries and the tributaries of upper Mill Creek
- Maintain federal water quality criteria as the applicable surface water standard
- Expand and enhance the current upland remedies to minimize source contamination to surface waters that would result in exceedances of water quality standards

The proposed plan release marked the start of a public comment period that ran from June 21 to August 4, 2017. EPA presented the proposed plan at a public meeting on July 20, 2017. Based on comment received during the comment period, EPA, in consultation with the Montana Department of Environmental Quality (DEQ), decided to pull the proposed plan and reconsider the up-front waiver of surface water standards. After careful deliberation, the decision was made to remove the up-front waiver of standards. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) ROD guidance would have allowed EPA to proceed directly to a ROD amendment at that point. However, in the interest of full transparency, EPA chose to issue a revised proposed plan for public comment.

EPA issued the *Proposed Plan to Amend the 1998/2011 Record of Decision, Anaconda Regional Water, Waste and Soils Operable Unit Anaconda Smelter Superfund Site, Anaconda, MT* (EPA 2019) in September 2019. The public comment period ran from September 4 to October 4, 2019 and a public meeting was held on September 17, 2019.

In the 2019 proposed plan, EPA did not immediately waive state total recoverable metals standards on certain stream segments. Instead, the remaining remedial action work, and additional work identified under the *ARWW&S OU Surface Water Technical Impracticability Evaluation Report* (Atlantic Richfield 2017), must be completed before potential waivers will be considered through a process that will be documented in the forthcoming surface water management plan (SWMP). The SWMP will identify performance and compliance monitoring locations, frequency of monitoring, process to certify compliance determination with water quality performance standards, and consideration of waivers of standards if all work that is technically practicable has been completed under the 2020 ARWW&S ROD Amendment.

As required by the NCP, the responsiveness summary (this document) provides a summary of the public comments submitted to EPA regarding the proposed plan. EPA's responses to those comments are also provided. The document is organized as follows:

- Section 1 – Introduction
- Section 2 – Public Comments and Responses
- Section 3 – References Cited

1.2 Public Comment Received

EPA has worked closely with community members and other stakeholders throughout the Superfund process at the ARWW&S. That cooperation continued into the ROD amendment process. Community participation played an essential role in the development of the proposed plan and the ROD amendment.

EPA received 26 comments in 2017 and 6 in 2019. Comments were in the form of testimony at the July 20, 2017 and September 17, 2019 public hearings and as written comments, emails, and telephone calls. Most commenters were residents of Anaconda or Butte. Comments were also received from Atlantic Richfield, Alliance for the Wild Rockies, Clark Fork Coalition, Mom's Clean Air Force, and Anaconda Deer Lodge County (ADLC).

Each submission was given a sequential individual comment identification number. For each number assigned, basic identification information (date received, commenter name, and comment method) was tracked on a master spreadsheet using identification numbers for the submission and its subcomments (e.g., 5.1, 5.2, 5.3, etc.). Names of individuals who submitted comments were recorded and tracked but are not available to the public due to EPA's Privacy Policy and commitment to protect personally identifiable information.

The comments are addressed in the following subsections by EPA in consultation with DEQ. A synopsis of the comments on a topic is provided, followed by EPA's response.

Opposition to the 2017 proposed plan centered around the proposal to waive the state total recoverable metals standards in Upper Willow Creek and its tributaries and the Upper Mill Creek tributaries. In contrast, there were only six comments on the 2019 proposed plan and the centered mainly on technical details or were not relevant to the proposed plan itself.

Section 2
Comments and Responses

Public comments are presented below by topic (arranged alphabetically) (Table 2-1) along with EPA's response.

Table 2-1. Public Comment Organized by Topic

Section Number and Topic	
2.1 Adaptive Management	2.12 Jobs Program
2.2 Additional Monitoring	2.13 Modification of the ROD
2.3 Aquatic Biological Effects	2.14 Removals from Well-Vegetated Areas
2.4 Barren Slopes	2.15 Soil Removal
2.5 Beaver Ponds and Sediment Basins	2.16 Surface Water Standards
2.6 Best Management Practices	2.17 Text Changes Relevant to the 2020 ROD Amendment
2.7 Bull Trout	2.18 TI Report
2.8 Environmental Impact Statement	2.19 TI Waiver
2.9 Fire Potential	2.20 Total Metals Versus Dissolved Metals
2.10 Flue Dust	2.21 Water Treatment
2.11 Irrigation Impacts	2.22 Watershed Functionality

2.1 Adaptive Management

2.1.1 Comment Summary

Four commenters advocated for an adaptive management approach that completes remedial actions, monitoring, and completing additional work based on knowledge gained from experience on what works and what doesn't. The approach would adopt new technologies, as needed.

- **Comment 1.2 (2019).** "The steep slope areas eligible for additional BMPs are difficult to access by machinery and existing conditions often make vegetation establishment difficult. These on-the-ground conditions are consistent with those faced by the NRDP and MFWP in the Injured Areas of RDU 15, just across the Mill Creek highway. We have demonstrated techniques that effectively achieve the goals of the additional proposed BMPs, namely, the sequestration of sediment on the landscape to prevent the mobilization of metals-contaminated sediments into waterways. Operating in these difficult conditions requires a project design that blends ecology and engineering in order to kickstart natural recovery processes that become self-sustaining and increase in resilience over time. As natural recovery improves, long-term maintenance needs decrease. In our collective experience, "one and done" approaches are insufficient for true remedy of these lands. The following recommendations were developed over 7 years of trial and error and should be adhered to in the implementation of the proposed BMPs, particularly in the Mill Creek watershed, where we have substantial experience

to offer in this process. Efforts that fall short of these recommended minimum standards are not likely to achieve sufficient results.

"Mechanized access to steep slopes is possible, however care should be taken to minimize impacts to established riparian and wetland areas in developing access roads. The implementation of the proposed BMPs often requires hand labor crews with some knowledge of ecological restoration, working in concert with mechanized equipment. In our experience, mechanical efforts accompanied by hand-labor have produced some of the best outcomes on the landscape."

- **Comment 18.1 (2017).** EPA should not stop encouraging the development and deployment of BMPs to improve the capture of these metals under storm and a full range of conditions. Storm water flow treatment is in its infancy of development. The state standards should remain in place as a continued encouragement to do more and continually seek better and more protective metal capture/removal options and best management practices (BMPs). Technical impracticability (TI) is presented in the PowerPoint. What is technically impracticable for a county or local government is much different than for a premier energy company with a large and high quality staff of engineers and scientists who are, over a broad geographic area, solving similar challenges. The experience gained by the company across the globe should continue to be applied for the benefit of the Anaconda Regional Water, Wastes and Soils Operating Unit. Please do not lower the bar for water quality improvement in the suggested watershed areas of Anaconda/Deer Lodge County. After all, we are talking about impacts for hundreds and hundreds of years in the future. These impacts just don't go away on their own, they have to be continually and actively worked and will benefit from technology yet to be developed."

- **Comment 27.2 (2017).** "I just have three or four points. I'll try to get to them quickly. As a starting point, we feel that all work outlined in the Record of Decision should be accomplished before a TI waiver is granted in this case. Given the nature of the contamination here, there needs to be a combined process of reclamation and monitoring over time until it can be conclusively demonstrated that no further progress toward meeting Montana's water quality standards are possible. In our view, granting a TI waiver in advance, based on modeling, is premature until we have more of a concrete sense of how often these standards will be exceeded.

  Lastly, here, because I'm running out of time, we've already proposed waived standards. We've always believed, along with the State of Montana, that our more-protective water quality standards for aquatic life are best for our state precisely because of the nature of the contamination in the Clark Fork's Superfund complex, where toxic metals are bound to sediment, as was raised by this gentleman. Again, it's been demonstrated that aquatic life in the Clark Fork suffers from this sediment-bound metal. Finally, I'd just like to point out that federal law and policy dictate a forward-thinking approach to water protection where, as technology gets better and changes, so does our ability to effectively eliminate water pollution. For all these reasons, the coalition would advocate for clear timelines for the agencies and the potentially responsible parties to reevaluate remedial technology and best management practices as it applies to contamination."

- **Comment 32 (2017)**. "Steep Slope Reclamation (SSR). The TI evaluation recognized the importance of expanding and enhancing the existing remedy for steep slope

reclamation as these often barren, or sparsely vegetated areas are recognized as the main source of sediment and total recoverable COCs to Anaconda's streams. The connections between stable vegetation cover, erosion and stream sediment are intuitive. The connection between barren, steep slopes and exceedance of water quality standards during storm and snow-melt conditions is well documented and to some degree quantified in the TI evaluation.

"However, reclaiming vast acreage of barren and poorly vegetated steep slopes, often in areas that are hard to access, has long been and remains a bugaboo at the Smelter Site. At this time there is a paucity of proven techniques. The exception is dozer basins, but those cannot be applied to very steep slopes. The reclamation techniques established at ARWW&S for non-steep slopes rely on heavy equipment for tilling, fertilizing and seeding – those techniques have limited application or completely untenable on steep slopes.

"The final Vegetation Management Plan (AR, 2013) defines a reclamation management program for non-steep slope reclamation that is founded on years of successful re-vegetation. It includes performance standards as defined by the Land Reclamation Evaluation System (LRES), a 10-year period of performance, long-term inspection and maintenance and a contingency of adding six inches of topsoil if performance standards have not been met after 10 years. The VMP does not define vegetation performance standards for SSR and the contingency for non-steep slope reclamation does not apply to SSR. Instead of a vegetation performance standard, the VMP established a landscape stability (erodibility) performance standard based on the Bureau of Land Management Erosion Condition Classification System (Clark, 1980).

"Specifically, the standard requires "a stability of less than or equal to 45." Additionally, areas where there is evidence of soil movement –solid deposition greater than 3 inches over more than 10% of the area, require maintenance. Areas exhibiting greater than 25% coarse fragment movement over more than 10% of the area require maintenance. Areas exhibiting rills greater than 2 inches deep and at intervals of 10 feet or less within the inspection area require maintenance. All active gullies require maintenance. But maintenance is not practical in most steep slope areas because they are remote and have limited access.

"It will be hard to get all stakeholders to agree to a program based on uncertain techniques, have an unspecified period of performance and may require long-term annual inspection and maintenance. The SSR program inferred by the Preferred Alternative and only partially defined by the VMP may prove to be impracticable. I recommend a program based on adaptive management, a standard approach to environmental management where outcomes are uncertain. It's an iterative approach consisting of applying remedy, monitoring and evaluating outcomes, then applying effective remedy measures in the next iteration. The program I suggest consists of testing SSR techniques annually on demonstration areas. The amount of work required each year could be set by acreage or cost. Three years after a demonstration area is completed it should be evaluated for effectiveness.

"At each five-year review, the SSR program should be evaluated and revised as necessary. With a better understanding effective SSR and its limitation, the revisions might include revised performance standards and contingencies. With a better

understanding of what is achievable on steep slopes, it may be more effective to establish a vegetation performance standard and discard the slope stability standard. A greater than or equal to 20% vegetative coverage has been suggested elsewhere.

"The final remedial design/remedial action work plan, which will be attached to the consent decree for the site, will need a specific plan and program for SSR including a performance schedule. The period of performance should be specified by a number of three year cycles and an evaluation of the effectiveness of continuing or terminating the program. The RD/RA work plan or CD will likely include language allowing the PRPs to request management mediation to determine if the polygon(s) in question can be moved beyond the active stage without meeting performance standards.

"The Montana Natural Resource Damage Program has conducted several steep slope reclamation and erosion BMPs demonstrations in Cabbage Gulch and California Creek drainages. Those demonstrations have included some heavy equipment work where it was feasible, but have also demonstrated hand work. Assessing the effectiveness of those demonstration should be the first step in a long-term program.

"As required by the VMP, SSR designs, monitoring and evaluations must be overseen and performed by qualified ecologists or reclamation scientists. To the extent practicable, the vegetation should consist of local native species, including grasses, shrubs and trees to conform to the ROD ARARs and to a strategy to establish self-sustaining vegetative cover."

2.1.2 EPA Response

An adaptive management strategy was adopted in the 1998 ARWW&S OU ROD (EPA 1998) as the Selected Remedy for surface water. That strategy is acceptable but would take decades to implement. The community of Anaconda and local government has requested that EPA make it a priority to complete remedial actions and move the site towards completion. That was the intent of the 2017 and 2019 proposed plans and is the intent of this 2020 ARWW&S OU ROD Amendment.

The proposed waiver was limited to a very small area where access to equipment is limited. However, EPA acknowledges that there is a significant amount of variability in estimates of sediment reductions and consequential metals reduction loading in the modeling conducted to support the technical impracticability evaluation. Given public concern over modeling and the wish that work be implemented before standards are waived, EPA is electing not to waive standards at this time, but rather, outline a process through which the standards will be waived. The Selected Remedy for surface water set forth in the 1998 ARWW&S OU Record of Decision, as modified by the 2011 ARWW&S OU ROD Amendment (EPA 2011), remains unchanged.

The supplemental work to be conducted by Atlantic Richfield requires a minimum of three attempts over at least five years to meet erosion control performance standards. This approach does allow some flexibility in applying successful reclamation techniques as the site moves towards completion.

2.2 Additional Monitoring

2.2.1 Comment Summary

Three comments were received that requested additional monitoring be conducted to support the effectiveness of the ROD modification.

- **Comment 7.2 (2017).** "Will the EPA test fish to see how the new cleanup plan would be affecting the aquatic life in the creeks? How will the new cleanup plan affect wildlife? ... We request a careful analysis of the impacts to fisheries and water quality, including considerations of sedimentation, increases in peak flow, channel stability, risk of rain-on-snow events, and increases in stream water temperature. Please disclose the locations of seeps, springs, bogs and other sensitive wet areas, and the effects on these areas of the project activities. Where livestock are permitted to graze, we ask that you assess the present condition and continue to monitor the impacts of grazing activities upon vegetation diversity, soil compaction, stream bank stability and subsequent sedimentation. Livestock grazing occurs in the Project area and causes sediment impacts, trampled or destabilized banks, increased nutrient loads in streams, and decreased density, diversity, and function of riparian vegetation that may lead to increased stream temperatures and further detrimental impacts to water quality."

- **Comment 30.1 (2017)**. "I've been involved in Anaconda surface water and ground water since 1990. And I was involved as a DEQ employee in this TI. And I've been involved in other TIs in this area. And this was fairly conservatively done. And it's not a matter of is it hard. It gets back to is it a matter -- it's a matter of is it practicable. And the reason I say it was conservatively done is it started out with just the tributaries, and it required a certain amount of work to be done. We won't exactly know what that requirement is until there's a Statement of Work of what that's going to require. But I would also -- I'd like to add in that I noticed that there was a -- in the TI itself called for, now, additional biomonitoring. And I'd like to add to that. I think more than just macro invertebrate population biodiversity studies, I think there's a couple of other studies that should be added in. One would be Michelle Hornberger with the USGS has, for a long time, studied metal body burden on certain cattle fly. I think that would be a great addition to the biomonitoring. And, additionally, I think Fish, Wildlife and Parks actually do a fish count and possibly cage fish studies."

- **Comment 32.5 (2017).** "Waiving DEQ-7 Standard – Need for Additional Monitoring. The TI clearly defined the need to waive aquatic life standards. Montana's DEQ-7 hardness based standard for the metals, which uses the total recoverable fraction, will be replaced with the less protective Federal hardness based standard, which uses the "dissolved" fraction. The specific waive-to standard for copper is vague and warrants additional discussion below. Montana's standards are being waived under federal CERCLA jurisdiction, with Montana DEQ consent. It is a site-specific waiver that only applies to the four ARWW&S streams.

  "Throughout Montana, under state jurisdiction, DEQ-7 still applies. Montana has a well-founded rationale for maintaining the more protective total recoverable standard. The total recoverable fraction consists of both metals attached to suspended sediment and dissolved metals. EPA has been unable to develop water quality criteria for contaminated sediments and has made little progress since publishing the draft

Developing Water Quality Criteria for Suspended and Bedded Sediments (SABS) – Potential Approaches (EPA, August 2003).

"The state still recognizes that contaminated sediment likely affects aquatic life through diet and the food chain. Waiving the total recoverable fraction leaves Montana without the tools to regulate contaminated sediment and raises the need to expand the current USGS water quality monitoring program to include both bed sediment biological monitoring.

"Silver Bow Creek and the Clark Fork have long-term biomonitoring and bed sediment monitoring programs in place that should be incorporated into the long-term monitoring plan for ARWW&S. The programs consist of the following monitoring elements:

- Aquatic insect diversity coupled with biotic indices conducted by consultants (Rhithron, Dan McGuire)
- Aquatic insect metal body burden targeting hydropsyche conducted by USGS (Michele Hornberger)
- Fish population surveys conducted by FWP
- Caged fish studies conducted by FWP
- Fish tissue studies conducted by FWP
- Bed sediment conducted by USGS and consultants (Respec)

"In addition to these suggested monitoring components, synoptic water quality monitoring events should be included in the program in preparation for the five-year reviews. Synoptic monitoring, conducted during spring runoff, should be used to gauge the effectiveness of remedy.

"The Proposed Plan infers that copper standards will be a special case. According to Exhibit 4 of the Proposed Plan – the waived-to standard will be determined under the forthcoming Surface Water Management Plan. Apparently the Agencies are considering two options. As with the other COCs, they may require a hardness based standard, using the dissolved fraction. But they are likely also considering the Biotic Ligand Model (BLM). The EPA recognizes the BLM based standard for copper and only copper. It has not been adopted by any state, but is used selectively in some states on a site-specific basis. The BLM is an empirically based model used to examine the bioavailability of copper in the aquatic environment and the affinity of copper to accumulate on gill surfaces of organisms that at some concentration has a toxic effect. The model uses the specific stream chemistry at the time a sample is collected to derive both chronic and acute standards. There is some uncertainty that the acute BLM standard is protective. The acute standard is applied to storm events, when aquatic life can endure higher concentrations for a short interval. It would be prudent for the Agencies to take a cautious approach to selecting the copper standard and require the hardness and dissolved based standard be written into the forthcoming Surface Water Management Plan. They should hold out the BLM until it is further validated with a well-established biomonitoring dataset."

2.2.2 EPA Response

A biomonitoring program will be developed for future monitoring under the forthcoming SWMP. This will likely consist of benthic macroinvertebrate monitoring, as biologists are largely in agreement that these organisms provide excellent indicators of localized stream impairment.

2.3 Aquatic Biological Effects

2.3.1 Comment Summary

- **Comment 21.3 (2017)**. "3. Executive Summary Page xxi of xxii addresses Remedy Enhancements and Long Term Monitoring that are planned as a result of this Tl evaluation. Comment: ADLC's position on this matter is that it is conspicuously evident that aquatic biological effects have received little to no focus in the TI evaluation. No remedy enhancements address the aquatic ecosystem and only annual benthic invertebrate monitoring is touched on in the long term monitoring proposed. Have any aquatic bioassay/bioconcentration/bioaccumulation studies been performed to date on fish and benthic invertebrates in the watersheds addressed in this study? Will relaxation of water quality standards result in restrictions on fish consumption from these watersheds?"

2.3.2 EPA Response

The *1996 Baseline Ecological Risk Assessment* (EPA 1996b) addressed ecological risks to aquatic life, which was summarized in the 1998 ARWW&S OU ROD. The Selected Remedy for surface water in the 1998 ROD set goals to meet Montana's total recoverable standards which are protective of aquatic life. Those goals remain in effect.

Macroinvertebrate monitoring has been conducted sporadically at the site since the mid-1980s. A 2012 biomonitoring study provided biointegrity scores that indicated that the Anaconda tributaries to the Clark Fork River were classified as either non-impaired or slightly impaired. Montana Fish, Wildlife, and Parks (FWP) conducted copper and zinc analysis of fish tissue (brown trout) from several sites in the Clark Fork River basin in 2013 and 2014, including Warm Springs Creek and the Mill-Willow Bypass. To date, FWP has not issued any warnings about consumption of fish from Anaconda streams.

2.4 Barren Slopes

2.4.1 Comment Summary

- **Comment 24.6 (2017). "**BARREN SLOPES**.** I can guarantee that fiddling with barren slopes will have no measurable effect for two major reasons:

  1. Only a very tiny fraction of dissolved metals originate there, with a tinier fraction entering surface water.

  2. Lacking is the sort of database, preferably a century or more, linking TDM to flows. Even if it existed, it would not be static but show continual improvement. In comparison, even the most optimistic hopes for "remedy" would be undetected or inconsequential.

  "The predominantly barren slopes are usually the cleanest and often unconnected to flowing water, so erosional deposition ends up relatively isolated. I am fairly certain

that working on relatively barren slopes will have no measurable effect on exceedances because they are not an important source, much less the root cause. This is an idiosyncratic remedy, meaning that other persons with the same information would have selected something else. Someone obviously likes it. Maybe they hope it will bolster their career, but it's unrelated to TDMs."

2.4.2 EPA Response

Data collected and analyzed during the TI evaluation demonstrated that although barren slopes do have the least amount of metals concentrations compared to moderately and well-vegetated areas, they remain a significant loading source of total recoverable metals to streams due to their high degree of erosion. That noted, little on-slope work is proposed for barren slopes due to concerns over exacerbating erosion. Most of the proposed work for these slopes consists of aerial applications of seed and fertilizer.

2.5 Beaver Ponds and Sediment Basins

2.5.1 Comment Summary

Four comments were received that requested that the use of beaver dams be considered in the proposed plan. One of the commenters believed that sediment basins on steep slopes were inherently unstable and likely to fail.

- **Comment 1.10 (2019).** "Existing wetlands and beaver ponds should be considered assets to the proposed remedy as sediment catchment areas and should be protected and enhanced where possible. In-stream woody structures (beaver mimicry) should be implemented to promote overbank deposition of sediments during high flows, particularly in incised stream reaches."

- **Comment 7.3 (2017)**. "Please consider an alternative which would ensure that there are stable beaver populations. They do a better job of capturing sediment than any engineer."

- **Comment 24.5 (2017)**. "FLUVIAL WORKS and the NATURE OF FLOODS. Those who watched the floods in Norway last week, or the California dam overflow, which required evacuation last spring, or those who have seen the photos/movies of the 1964 floods in northwest Montana, take a dim view of channel obstructions. On Sun River, Gibson Dam was breached in June 1964. "Flood waters inundated areas far beyond the Flathead River channel near Kalispell. Similar broad swaths of flood waters also inundated parts of the Blackfeet Indian Reservation, Great Falls, Choteau, and St. Mary. The 1964 floods on the Flathead, Sun, Teton, and Marias Rivers are the largest in recorded history. Floods bigger than the "100-year" event have occurred, and likely will occur again." (See https://wy-mt. water.usgs.gov/floodwatch/floods1964jun.html.) Thirty people died, and many bridges were swept away. Good stuff to remember when prescribing sediment basins to protect the Clark Fork.

  "Nor do I have much faith in small-scale stream work, from mountainous check dams to so-called "beaver mimicry." This fails to take the long view, and the long view assuredly involves gully-washers. I have watched beavers build a series of dams along stretches of High Rye Creek (east of Willow Creek), and several years later they washed out with most of the sediment moving on. And those were real beaver dams that held some volume of both water and sediment. If copying beavers where beavers won't build, yes,

there may be a lack of woody plants, but also topography is wrong. Do not expect this work to have any enduring benefit.

"The only reasonable way to view sediment basins and small ponds, especially in steep terrain, is temporary. A gully-washer, they're gone. The narrower the drainage, the steeper the side slope, and the greater the stream gradient, the more assured the future transport of sediments. Beavers have dammed the best sites – the ones likely to retain sediment when breached. It's important to recognize this. Now a treatment facility has limitations too, and it won't treat a 100-year flood, but I want to point out that most proposed stream work is short-term, enough to probably escape with your career intact. But not a solution."

- **Comment 30.2 (2017)**. "The other thing I would just add in is part of the remedy looks at retention and detention ponds. In some of those cases, we're talking about tributaries that are on wildlands and truly wildlands. And it may be better to try and ensure that there are stable beaver populations which can probably do a better job than any engineer of capturing sediments and restoring it."

2.5.2 EPA Response

EPA agrees that beaver dam complexes are effective in reducing sediment transport from the tributaries to the mainstems of the creeks. The additional design conducted in the *Supplemental Surface Water Controls RD/RA Report* (Atlantic Richfield 2020) has less engineered sediment ponds than the alternative strategy presented in the 2017 TI evaluation report, as further analysis determined that many of the areas targeted for ponds were unsuitable for a variety of factors.

The Natural Resource Damage (NRD) Program recently submitted a Request for Change to eliminate the need for engineered sediment basins in the Cabbage, Joiner and Muddy Gulch drainages, providing the rationale that their on-slope and in-channel revegetation and BMP efforts effectively captured a similar amount of sediment.

Beaver dams play a significant role in capturing metals-laden sediment in the Anaconda uplands and EPA believes they should be encouraged to supplement current and future work. However, EPA cannot dictate how Montana FWP manages local beaver populations. Further, EPA cannot require Atlantic Richfield or private landowners to manage beavers under Superfund, as this exceeds EPA's CERCLA authority.

2.6 Best Management Practices

2.6.1 Comment Summary

Three comments were received regarding best management practices (BMPs). The first outlines recommended design specifications. The remaining comments request independent evaluation of the effectiveness of storm water BMPs to supplement modeling and analytical data collected to date.

- **Comment 1.1 (2019).** "We support the additional BMPs proposed in the plan to amend the 1998/2011 Record of Decision. We have developed the restoration and remedy techniques highlighted in the example documents provided by EPA, and collectively have substantial knowledge of and experience with the restoration and remediation of degraded ecosystems under Superfund, particularly on steep slopes. By adhering to these minimum design standards, we are confident that ARCO/BP and the EPA will be

able to achieve substantial remedy of the degraded uplands in the Mill Creek watershed and other areas in this plan and leave the landscape in a better condition to recover to fully functioning conditions.

- "Organic fertilizer products outperform inorganic fertilizers in promoting vegetation growth on bare slopes and should be used exclusively in the first few years of revegetation on bare and mostly-bare slopes. These products applied at high rates without the addition of seed activates the native seed bank and have shown increases in vegetation cover of up to 40% over 3 years.

- "Inorganic, NPK {agricultural) fertilizers, lack micronutrients typically missing from the barest slopes and should not be used until 40-60% vegetation cover has been achieved. Organic fertilizer products, if used, should be applied at the high recommended rates. {1500-2000 lbs/acre). We found that organic fertilizer products applied at high rates with the addition of a native, locally adapted seed mixes, produce up to 60% vegetation cover increases in 3 years.

- "Due to high winds and adverse climatic conditions, the highest, most bare slopes should be treated with mechanized slope roughening where possible prior to addition of seed and fertilizer. Where not possible, these slopes should be treated by hand with trenches filled with organic fertilizer and a native seed mix, and covered with fully bio-degradable erosion control blankets. This technique has produced vegetation cover of 100% within the trenches."

- **Comment 6.1 (2019). "**ADLC seeks to independently evaluate the effectiveness of storm water best management practices implemented in this watershed and understand how the determination of "Technical infeasibility" was made by developing an understanding of how modeling work associated with this decision was conducted and validated in the field. It is my professional opinion that relaxing water quality standards applicable to these watersheds without first fully validating model assumptions and results is premature. ADLC is opposed to such action."

- **Comment 21.1 (2017)**. "1. Executive Summary Page xv of xxii states that "To date, the remedy has been partially constructed, primarily in lowlands and waste management areas (WMAs) where heavy equipment can be readily used." Comment: ADLC's position on this matter is that credible efforts to implement appropriate storm water best management practices (BMPs) are needed before a decision is made that it is technically infeasible to address contaminant source term areas in the upper reaches of the watersheds evaluated in the TI report (i.e., Mill Creek, Willow Creek, California Creek, Warm Springs Creek and Lost Creek). Modeling and data analysis of low lying areas and WMAs alone form an insufficient basis to address whether mountainous terrain BMPs will be successful at reducing contaminant mobilization. Have any test plots been installed and evaluated in the upper watershed areas to implement mountainous terrain BMPs, and has any attempt been made to validate the results of modeling efforts performed to date?

  "2. Executive Summary Page xix of xxii under Water Quality Improvement Predictions states that "...implementation of all of the additional work would result in a 16% to 46% reduction in metals concentrations in various Anaconda streams." Comment: ADLC's position on this matter is that with proper design, implementation, monitoring and

maintenance of mountainous terrain BMPs, significant reductions in contaminant loading to the watersheds evaluated is possible. While it may be difficult to implement, it is premature to relax water quality standards until modeling performed in the evaluation is validated by demonstrating that water quality improvement cannot be achieved by direct examination of BMP effectiveness.""

2.6.2 EPA Response

Storm water BMPs and revegetation are part of both currently approved work plans and supplemental work being developed by both Atlantic Richfield and the Montana Department of Justice – NRD Program. Storm water BMPs and revegetation demonstration plots and remediation have been constructed at the site for more than 20 years. These efforts include Atlantic Richfield and NRD work on Stucky Ridge, Atlantic Richfield work on Smelter Hill, and NRD work in Cabbage Gulch, Muddy Creek, and California Creek.

2.7 Bull Trout

2.7.1 Comment Summary

One comment was received that cited concerns regarding the impact of the 2017 proposed plan on bull trout and bull trout habitat. It requested that a formal consultation be made with the U.S. Fish and Wildlife Service.

- **Comment 7 (2017).** "How will the proposed changes affect bull trout and bull trout critical habitat? Please formally consult with the U.S. Fish and Wildlife Service on how the proposed changes will impact bull trout and bull trout critical habitat. ... On July 10, 1998 bull trout (*Salvelinus confluentus*) were listed as a Threatened Species, within the Columbia River Basin, by the United States Fish and Wildlife Service (USFWS). Section 7(a) (2) of the Endangered Species Act (ESA) of 1973 as amended requires all federal agencies to review actions authorized, funded, or carried out by them to ensure such actions do not jeopardize the continued existence of listed species. Bull trout were listed under ESA primarily due to habitat threats. Habitat conditions are important in the recovery and conservation of bull trout. Spawning usually occurs in third and fourth order streams, in low gradient areas (less than 2 percent) with gravel cobble substrate. Proximity of cover for the adult fish before and during spawning is an important habitat component. Successful incubation of bull trout embryos requires water temperatures below 8o C, spawning gravels with low amounts of fine sediment and high gravel permeability. Mortality of eggs or fry can be caused by scouring during high flows, freezing during low flows, or deposition of fine sediments.

  "On September 30, 2010, the U.S. Fish and Wildlife Service designated critical habitat (CH) for bull trout throughout their U.S. range. Critical habitat includes those areas occupied by the species, on which are found physical and biological features that are essential for conservation of an ESA listed species and which may require special management considerations or protection. The proposed changes to the Anaconda cleanup plan do not recover bull trout. It is an extinction plan, not a plan that will contribute to bull trout recovery. Please see the attached comments by Christopher A. Frissell, Ph.D on The 2014 Draft Recovery Plan. He said the recovery plan for bull trout for bull trout implies (and in a backhanded way specifies) that the USFWS assumes there is flexibility to make management choices deliberately allowing some core area populations of bull trout to go into decline or extinction, on the expectation others will appear from scratch, or disperse from severely depressed relict populations elsewhere

in the Recovery Unit to arise in new locations. However this Draft Plan, the previous listing and recovery planning record, and the published literature present virtually no evidence to substantiate that new populations of bull trout have established in contemporary times, either at the Core Area scale or the next smaller scale of breeding populations. In this regard bull trout are the biological polar opposite of vagile species like wolves, which are demonstrated to be amenable to reintroduction and are proficient colonizers of new territory at the regional scale. On the other hand, we do have evidence that even small, so- called "relict" bull trout populations can rapidly re-establish migratory life histories, or expand extant spawning areas when changing habitat conditions allow it. But we do not know that they can establish new populations in previously unoccupied streams or watersheds under contemporary prevailing conditions. Hence from a scientific perspective, existing populations of bull trout, no matter how small and far-flung, must be viewed as the sole seed sources for future recovery."

"Please formally consult with the USFWS on the impacts of this project on candidate, threatened, or endangered species and plants. Please disclose whether you have conducted surveys in the Project area for bull trout and westslope cutthroat trout. Would the habitat be better for bull trout and bull trout critical habitat if the cleanup plan is changed? Will all WQLS streams in the project area have completed TMDLs before a decision is signed? Does the proposed cleanup plan comply with the TMDLs? Would it be better for bull trout and bull trout critical habitat if state water quality regulations and laws are followed?"

2.7.2 EPA Response

EPA disagrees that the proposed changes to the remedy "is an extinction plan." EPA believes that the modified remedy will have no negative impacts on bull trout or bull trout habitat. In fact, modeling conducted under the TI evaluation (Atlantic Richfield 2017) suggests that area streams may see a 16 to 46 percent reduction in metals concentrations, which would also decrease metal concentrations in the Clark Fork River (where bull trout live). Remedial alternatives that would potentially be harmful to bull trout—such as construction and operation of water treatment plants which would increase stream water temperatures—were screened out of consideration in remedy modification. Overall, EPA sees the proposed changes as beneficial to bull trout critical habitat identified by U.S. Fish & Wildlife Service (Warm Springs Creek and the Clark Fork River).

EPA has previously formally consulted with U.S. Fish & Wildlife Service on remedial design/remedial actions being conducted on Warm Springs Creek, which is identified as bull trout critical habitat. EPA has initiated informal consultation for non-critical habitat streams (Lost Creek, Mill Creek and Willow Creek) with U.S. Fish & Wildlife Service as these streams are tributaries to the Clark Fork River. Formal consultation is not required as no waivers are proposed at this time. On April 8, 2020, EPA received a letter from U.S Fish & Wildlife Service that concurs with EPA's determination that the proposed surface water remedies identified in the proposed plan may affect but not likely to adversely affect bull trout or its designated critical habitat.

Under its CERCLA authority, EPA must identify remedies that protects human health and the environment from releases of hazardous substances. Studies and plans to recover bull trout are beyond EPA's CERCLA authority.

2.8 Environmental Impact Statement

2.8.1 Comment Summary

One comment was received that stated that an environmental impact statement was required for the work proposed.

- **Comment 7 (2017)**. "We believe that the National Environmental Policy Act requires that you write an Environmental Impact Statement for the EPA's proposed changes to Anaconda's cleanup."

2.8.2 EPA Response

EPA disagrees. Case law has established that the CERCLA decision making process is sufficiently protective of the environment and functionally equivalent to the National Environmental Policy Act decision making process. Thus, an environmental impact statement is not required for the 2020 ARWW&S ROD Amendment.

2.9 Fire Potential

2.9.1 Comment Summary

Two comments were received regarding the potential for fire to destroy vegetation in well-vegetated areas resulting in erosion and transport of contaminated soils.

- **Comment 15.1 (2017).** "I request that the deficiencies and biases in the report be addressed. Given the likelihood of a forest fire that will result in increased sediment releases, the idea of sediment basins cannot be dismissed. Active measures must be constructed to allow this greater sediment load to the controlled to some degree."

- **Comment 22.1 (2017).** "The report is grossly incomplete for not addressing increased erosion rates from currently "stable" areas once the vegetative cover is burned away from a forest fire. The report notes the elevated contamination in the vegetative areas, and seems to suggest that this is a sign that the contamination poses no harm to the environment. There is a significant risk that a forest fire will occur in the areas of concern within the next 50 – 100 years. The loss of vegetation will change the stable nature of the slope and an increase in erosion can be expected. Given this likely occurrence, the idea that filtration basins are not warranted, whatever their size, is a fatal oversight. The expected release of contaminants from such an event cannot be allowed to occur. It is astonishing that ARCO would produce and the EPA would accept a proposal dealing with stream sediment that does not once mention the risk of a forest fire and its effect on contaminant release from a denuded environment."

2.9.2 EPA Response

Since 2011, EPA has required evaluation of the effects of climate change on Superfund remedies as part of the remedial decision-making process and subsequent remedy reviews. After consideration of this comment, the consent decree will include a step for re-opening the remedy if waived-to standards cannot be achieved if catastrophic events such as forest fires or massive flooding occur at the site. Engineering design criteria places limits on the types of events that can be designed for. However, the Anaconda uplands are a natural open space environment, and most public comment as well as land management trustees comment indicate that they would like to keep the uplands as wild land, not a controlled engineered

environment which would be required to construct the stormwater control systems that the commenter requested.

2.10 Flue Dust

2.10.1 Comment Summary

One oral comment was received at the 2019 public meeting regarding flue dust.

- **Comment 3.1 (2019).** "I guess my issue is over this soot, all this... And so I do want it in the record that we have not been notified of all the flue dust that's been in the homes in Anaconda over the last 125 years. A lot of these homes have zero insulation in them, and the insulation that's been put in them, some of it was Zonolite, which is a contaminated substance. So, if that's in your attic space, you need to get ahold of the EPA and the Atlantic Richfield Company to deal with these kinds of things. And the reason why I'm here is because I live here, I've been raised here, and this is my family. And I honestly want -- and I don't know of any homes, except maybe in the west end of town, they call it --but, anyway, in the west end of town. But if they were cleaning up lawns at the Dwyer School, that means those houses that were built in the 50s probably have it, too.

  "So, I think it's advantageous for all of us to get a note out, whatever it takes, to get somebody in there to take a look at it. I understand we've got a system in Anaconda, and if I wanted to vacuum my mother-in-law's house out I would be welcome to the system. I didn't put the stuff there. I'm not taking it out. I worked on that smelter. I'm not going to do it again. So, my thinking is, if you guys are from Anaconda, take hold, it's your house, it's your family, make sure you get it cleaned up."

2.10.2 EPA Response

This issue is not relevant to the ARWW&S OU. It is addressed elsewhere as part of the Community Soils Operable Unit.

2.11 Irrigation Impacts

2.11.1 Comment Summary

Three comments touched on concerns with use of contaminated surface or groundwater for irrigation and the resultant potential to impact human health through uptake of metals by garden produce and other vegetation. An independent study of potential impacts was requested. The comments were part of larger comments expressing opposition to up-front waivers (Section 2.2.2)

- **Comments 16.1and 20.1 (2017).** "Irrigators and ranchers use water during non-baseflow conditions when limits are not being meet, allowing the Cu, Cd, and Pb to enter our food supply. Children play in the creeks as well and the sediment is allowed to accumulate along creek banks, irrigation ditches, fields and yards. The EPA's core mission is to protect human health and the environment, increasing the limits because they are not being meet is not protective."

- **Comment 19.1 (2017). "**The tributaries of concern, along with the toxic heavy metals they carry, are known to travel through a community where this exact water is regularly used for irrigation of agricultural lands and residential yards, and will seep into wells contaminating drinking water. Cutting these toxins off at the source in OU4 by

removing them from the environment would prevent the widespread contamination of local and distant communities from these heavy metals. Furthermore, Opportunity was intentionally designed to be an agricultural community from its inception. Many residents still depend on the income of their livestock or other crops for their livelihood. We would like to see the EPA, DEQ, and ARCO spearhead a study from an independent researcher to examine the effects of these mobile heavy metal toxins on livestock and food plants in this area, which can directly be impacting human health and the environment."

2.11.2 EPA Response

While the concentrations of copper in Mill Creek and Willow Creek are cause for concern for aquatic life, the concentrations (which are measured in parts per billion) have no discernable impact on livestock or food crops, as reported by the Montana State University Extension Water Quality Program (see http://waterquality.montana.edu/well-ed/files-images/Livestock_Suitability.pdf).

As for the need for an independent study to be conducted, results from review of scientific literature and a wildlife biomonitoring study conducted by Texas Tech University for the U.S. Fish and Wildlife Service previously concluded that there is minimal risk to terrestrial animals from arsenic and metals present in the concentrations found at the Anaconda smelter site (see https://www.fws.gov/montanafieldoffice/Environmental_Contaminants/ABR/ABR_Final_Report.pdf). Thorough washing of garden produce also minimizes the potential for metals ingestion. In 2018 EPA conducted a study of garden produce in the Anaconda area. EPA is presently summarizing the results of previous ecological assessments and conducting literature reviews to complete fact sheets to advise the public on risk to wildlife and livestock.

2.12 Jobs Program

2.12.1 Comment Summary

- **Comment 31 (2017).** "Historically, the "A" and "C" hills of Anaconda were not only contaminated from smelter operations, but were denuded of vegetation. While the "technical infeasibility" addressed in the proposed plan speaks to difficulty in getting heavy equipment to work on steep slopes, these hills were successfully revegetated using on-the-ground manpower. The same efforts need to be made in the watersheds covered in the proposed plan. The remedy designed for these watersheds needs to be fully implemented. A "jobs program" (tree planting) was instituted to accomplish revegetation of the "A" and "C" hills years ago, creating much needed jobs in addition to restoring these lands. The same conditions apply today. Without fully implementing the remedy designed for these watersheds and seeing the results of such efforts makes relaxing water quality standards premature. We oppose such action."

2.12.2 EPA Response

The Montana NRD program has been contracting with the Montana Conservation Corps to conduct steep slope reclamation, including tree planting, for the past several years in the Mount Haggin Wildlife Management Area. Other than to ensure protectiveness, CERCLA does not provide the agencies with the authority to dictate hiring practices to parties performing work.

2.13 Modification of the ROD

2.13.1 Comment Summary

Comments were received from two individuals that were against the modification of the ROD as described in the 2017 proposed plan.

- **Comment 12.1 (2017).** "Dear Sir, I would like to add my voice to Bill Everett and others who oppose the lowering of standards for the State of Montana's water criteria for heavy metals in the upper Willow Creek, Mill Creek and tributaries. Once again the citizen and the environment become the losers in this. I lived away from Montana for 15 years. I came back home to Anaconda thinking that the EPA had our back and was making sure things were being cleaned up and made livable and productive. Only to find that things have not been cleaned up but only covered up. All of the contaminants are still there but buried. We can't get new businesses to town because any land available for new construction is in the east valley which means any buyer of that property assumes the liability of what is underneath it. Who would want to assume such liability? Not ShopCo. New homes can't be built on that area because of the buried contamination. I am disheartened to see that the EPA has not had our back and has instead protected ARCO more than the environment they are commissioned to protect. Now our water quality is targeted to be compromised. How does this protect the environment? The standards for cleanup of Anaconda were set pretty low and now the EPA wants to further lower them so ARCO can get away with even less responsibility. Anaconda is being left with no chance of ever recovering our economy. With no ability to grow or attract bigger business', our surrounding environment is all we have left to attract dollars to help our distressed economy. Why would we ever agree to allow our environment to be further compromised so that ARCO can be let off the hook. The fact that this "clean up" has been going on for over 30 years and is little more than a band aid is a travesty in itself. We deserve and demand real solutions. Let's start with not lowering the water standards for the benefit of ARCO."

- **Comment 24.1 (2017).** "Have you even noticed how the big issues are glossed over as we quickly settle on minutia? You see it all the time. As soon as EPA found "surface water treatment to be impracticable due to cost and inordinate impact to the environment (construction of water treatment plants, conveyance channels, and large holding ponds). Treatment alternatives were considered to be technically impracticable," an AWQC waiver became a foregone conclusion. ARCO needn't have spent all that money showing how little could be accomplished because the most promising solution was ruled out a priori. With its focus on procedure and history, the remedy is hardly sketched in the 10-page https://semspub.epa.gov/work/08/1818033.pdf, although EPA found room for a photo of the remediated upper Clark Fork of all things, where someone just last week complained to me that the fishing in the Upper Clark Fork had been ruined, in his experience. I have no time to look at an 825-page ROD, nor I suppose does anyone else unpaid.

  "What I see as failures or inadequacies include:

  - The waiver replaced incentive to effectively reduce exceedances with procedure. ARCO's mission and incentive was to prove "impractability." To no one's surprise, they did.

- Vegetating barren slopes is a valid restoration goal but will have no measurable effect on TDMs in streams. Not just no effect on exceedances, no measurable effect whatever.

- Any actions damming streams are likely to be impermanent. Sooner or later, trapped contaminants will race downstream in a debris torrent. Permanent maintenance is a fiction.

- No mention of weeds and weed control or the role of natural recovery. Big omissions.

"I take issue with characterizing twice the proposed actions as "minimizing" exceedances. "Hopefully reducing but unmeasurably" would be more accurate. Maybe you need some fresh eyes to look at this? Thanks for considering my views. My comments are confined to Mill Creek, the only area I know."

2.13.2. EPA Response

The 2017 public comments have been largely addressed in the revised 2019 proposed plan through withdrawal of the upfront-front waiver proposal. No sediment basins are proposed in the Mill Creek drainage under this 2020 ROD Amendment. Vegetation performance standards include limitations on the percentage of noxious weeds; consequently, weed control is required. EPA acknowledges that natural recovery processes have been ongoing in the uplands for many decades. However, surface water quality standards are still exceeded in area streams, and an accelerated cleanup remedy is warranted.

2.14 Removals from Well-Vegetated Areas

2.14.1 Comment Summary

One comment was received that indicated that smelter-related metals should be removed from all areas, regardless of vegetative cover.

- **Comment 19.1 (2017).** The EPA proposed at the public meeting on July 20, 2017 that the terrain and vegetation in parts of OU4 are well vegetated and undisturbed, and therefore shouldn't be remediated, at the risk that remediation could cause even more contamination of the environment. However, the environment and terrain are already disturbed by the presence of toxic heavy metals that are contaminating our waters and our families. And even the well-vegetated areas have been established as leaching toxins into the water. Science supports the common-sense idea that we need to remove these toxins from the environment - even if it's challenging - in order to protect our families, aquatic life, and the environment.

2.14.2 EPA Response

The Agencies believe that the harm that would be caused to the environment though wide-scale removal actions in the uplands far outweighs the benefits from removing the metals. This is demonstrated in the TI evaluation report (Atlantic Richfield 2017).

2.15 Soil Removal

2.15.1 Comment Summary

- **Comment 27.3 (2017).** "Just as a note, the coalition recognizes that removal of all surface soil is impractical. In this case, it appears that, based on the record, additional

targeted removals could potentially be considered for removal. It is unclear whether additional targeted removals of contaminant soils has been considered."

2.15.2 EPA Response

Under the 2011 ARWW&S OU ROD Amendment, which waived the arsenic human health drinking water standard for certain ground water and surface water resources, point source waste and soil/waste mixtures in areas outside of waste management areas originally identified in the 1998 ROD and later characterized through remedial design, were targeted for removal. Most of this work has been completed. Under the 2017 TI evaluation report, additional source areas for removal were evaluated. The evaluation did not identify any specific loading sources to area streams. Instead, the evaluation presented and confirmed a conceptual site model of widespread low levels of metals from past smelter emission fallout. The more highly contaminated areas were also the most well vegetated.

2.16 Surface Water Standards

2.16.1 Comment Summary

One comment was submitted in 2019 regarding the use of Montana surface water quality standards as applicable or relevant and appropriate regulations (ARARs). An additional comment was submitted in 2017 regarding Atlantic Richfield's right to comment should EPA propose a different waived-to standard.

- **Comment 2.6 (2019). "**5. Surface Water ARARs & RAOs: The Proposed Plan calls for expansion and enhancement of remediation to reduce source contamination to surface water, including vegetation efforts, slope grading, and on-slope and drainage channel BMPs, among other things. Atlantic Richfield would be willing to complete these surface water remedial actions pursuant to mutually acceptable terms embodied in a CD, including the in-stream compliance framework set forth in the SWMP, and on that basis generally supports these elements of the Proposed Plan. However, Atlantic Richfield maintains that Montana DEQ-7 numeric surface water standards are not the applicable or relevant and appropriate requirements (ARARs) for the selected remedial action.

  "Under CERCLA and the NCP, EPA has authority to identify and require remedial action to the extent necessary to meet RAOs for surface water. See, e.g., 40 C.F.R. §300.430(e)(2)(i), (e)(9)(iii); Preamble to the National Oil and Hazardous Substances Pollution Contingency Plan, 53 FR 51394, 51426-27 (Dec. 21, 1988); EPA, Guidance for Conducting RI/FS Under CERCLA, §§ 4.2, 4.3.1.1 (Oct. 1988). The applicable RAO from the 1998 ROD is to "minimize source contamination to surface waters that would result in exceedances of State of Montana water quality standards" (except for the arsenic waiver granted in the 2011 ROD Amendment), which the Proposed Plan leaves unchanged. See Proposed Plan at 5. AR does not agree that State surface water quality standards are proper ARARs for surface water here because of the non-point source nature of stormwater impacts. Therefore, compliance with such standards is not a proper RAO for the surface water remedy."

- **Comment 26.4 (2017).** "3. Copper Standard: The Proposed Plan notes that the replacement standard for copper is "to be determined" under the forthcoming Surface Water Management Plan (SWMP). The appropriate replacement standard for copper should be EPA's Ambient Water Quality Criteria ("AWQC"), which is based on the biotic ligand model (BLM) and incorporates the latest scientific knowledge on metals

speciation and bioavailability. If EPA proposes a different replacement standard, then Atlantic Richfield reserves the right to comment on whether the waived-to standard identified in the SWMP is appropriate and consistent with the findings of the TI Evaluation."

2.16.2 EPA Response

EPA disagrees that state surface water quality standards do not apply to the ARWW&S OU because of the non-point source nature of stormwater impacts. Circular DEQ-7 does not identify such an exception. However, measurement of compliance with surface water quality standards will be conducted under the SWMP.

2.17 Text Changes Relevant to the 2020 ROD Amendment

2.17.1 Comment Summary and Embedded EPA Response

Atlantic Richfield submitted a number of editorial changes to the 2017 and 2019 proposed plans. As those plans are final and will not be reissued, only the comments relative to the text, tables, or figures for the 2020 ARWW&S ROD Amendment are shown and addressed below.

- **Comment 2.8 (2019)**.

  "1. Page 4, Exhibit 4 – Consistent with the TI Evaluation and Page 3, Paragraph 2 of the Proposed Plan, the "storm flow" regime (i.e., "wet weather" events) should be added to Exhibit 4 to define all flow regimes at the site, particularly since this is when total recoverable metals standards are routinely exceeded in the Anaconda mainstem streams and tributaries. Per the SWMP, these events represent acute conditions and should be excluded from compliance determinations for chronic standards.

  EPA Response: Exhibit 4 refers to the proposed plan. The suggested revisions were carried forward in the ROD amendment.

  "2. Page 5, "Why Modification is Needed," third paragraph, last sentence – This sentence states that the 2017 TI Evaluation report concluded that "it may be difficult to achieve these standards, even with additional remediation." This is an incorrect characterization. The TI Evaluation concluded that achieving standards was technically impracticable. This language should be revised in the ROD Amendment to state that the TI Evaluation concluded it would be technically impracticable to meet the standards, and therefore waivers are justified in this instance.

  EPA Response: EPA disagree with this assertion. While the modeling conducted under the TI evaluation indicates that compliance with state surface water quality standards is impracticable, the error bars surrounding these estimates suggest that compliance in the streams may be achievable after remedies have been implemented.

  "3. Page 6, "Why Modification Is Needed," last sentence of last paragraph – Enhancements to existing steep slope remedies can include additional treatments beyond aerial application of seed and/or fertilizer. For example, BMPs in eroded gullies are also proposed for enhancement areas, and additional treatments may be selected from the Slope Reclamation Toolbox, as outlined in the RD/RA Report. Atlantic Richfield requests that EPA include this clarification in the ROD Amendment.

  EPA Response: EPA concurs.

"4. Page 6, "EPA's Proposed Modification for Surface Water Remedy," box 2 of Exhibit 8 – Additional work and enhancements to existing work, as identified in the RD/RA Report, are held only to erosion standards (specifically, BLM) because these have the most bearing and control on surface water quality. Although vegetation is a contributing factor to meeting erosion standards, there are no stand-alone vegetation standards (such as LRES Scoring) that apply to slope reclamation work outlined in the RD/RA Report. See also Detailed Comment No. 9, below.

EPA Response: EPA concurs.

"5. Page 6, "Expand Remedy," first sentence of first paragraph; see also page 8, Exhibit 10 – The agency-approved TI Evaluation states that a "reasonable maximum level of practicable additional response actions" would be performed, not the "maximum extent practicable." See TI Evaluation, § 9.1. An element of reasonableness should be built into this standard. Atlantic Richfield requests that EPA include language in the ROD Amendment that is consistent with the TI Evaluation, replacing the phrase "maximum extent practicable" with "reasonable maximum level of practicable additional response actions."

EPA Response: This is addressed in the ROD Amendment.

"Page 6, "Expand Remedy," second sentence of first paragraph – The actual area of the existing remedy proposed for enhancement and the expanded area, as outlined in he RD/RA Report, are significantly smaller than the quantities listed here (23,852 and 12,417 acres, respectively), as also reflected in the Supplemental Surface Water Remediation Workplans Fact Sheet. EPA should clarify that only portions of the identified acreages will be remediated under the expanded remedy.

EPA Response: This is addressed in the ROD Amendment.

"7. Page 6, "Expand Remedy," second paragraph – The definition of "steep slopes" is not clear. Atlantic Richfield requests that EPA include language that clarifies this definition. In addition, "horizontal rise" should be replaced with "horizontal run."

EPA Response: This is addressed in the ROD Amendment.

"8. Page 7, "Expand Remedy," fourth bullet – The term "Slope grading" may be misleading as there is no major grading in the scope of work. Grading is limited to minor regrading to address rills and gullies, with no major recontouring. Atlantic Richfield requests that EPA qualify this language in the ROD Amendment consistent with this comment.

EPA Response: Atlantic Richfield has misinterpreted the term "slope grading." A discussion of steep slope reclamation categories has been included in this ROD amendment.

"9. Page 7, "Achieve Vegetation and Erosion Standards," first sentence – Consistent with the Vegetation Monitoring Plan and RD/RA Report, this section should explain the process for compliance with BLM standards. Although the goal of the Remedies in expanded areas includes increasing vegetation, especially on steep rocky slopes, success is not measured by the type or density of the vegetation established here. Success ultimately is measured by whether the remedy achieves erosion objectives.

Accordingly, the ROD Amendment should clarify that Remedies for slope work will be evaluated based on BLM erosion criteria only. Per the SWMP, if the BLM erosion criteria are not met after three attempts of remedial action, no additional remedial action will be required, and the remedy will be considered complete. The Proposed Plan and ROD Amendment should not suggest that specific "vegetation standards" will be applied.

EPA Response: The ROD amendment includes a discussion of the performance standards including the three attempts limitation.

"10. Page 7, "Determine Remedial Action Compliance" – This section addresses surface water compliance and would be more appropriately titled "Determine Compliance with Surface Water Standards." Atlantic Richfield requests that EPA make this change in the ROD Amendment.

EPA Response: The ROD amendment discusses vegetation, erosion, and surface water performance standards.

"11. Page 7, "Determine Remedial Action Compliance," first sentence of first paragraph –Per the SWMP Compliance Flowchart, the determination of whether remedial action is complete is made at the end of the Remedy Construction Monitoring Period. This determination does not necessarily occur after 6 years. Atlantic Richfield requests that EPA make this clarification in the ROD Amendment. More generally, Atlantic Richfield also requests that the ROD Amendment include a more detailed description of the SWMP and the agreed upon compliance framework.

EPA Response: Section 4 of the ROD amendment includes a detailed description of the SWMP.

"12. Page 7, "Determine Remedial Action Compliance," second sentence of first paragraph – The SWMP will determine "compliance with surface water standards" for each creek and watershed, not "remedy compliance." Atlantic Richfield requests that EPA make this change in the ROD Amendment.

EPA Response: The ROD amendment provides this clarification.

"13. Page 7, "Determine Remedial Action Compliance," sentence 3 of paragraph 1 – California Creek should be added to the list of creeks as the Proposed Plan is not limited to Atlantic Richfield's obligations. California Creek was included in the TI Evaluation, and the State's remedial obligations are summarized in the Supplemental Surface Water Remediation Workplans Fact Sheet. Atlantic Richfield requests that EPA include California Creek in the ROD Amendment.

EPA Response: California Creek is included in the ROD amendment.

"14. Page 7, "Determine Remedial Action Compliance," first paragraph – Per the SWMP and consistent with Atlantic Richfield's General Comments above, if the State standards are not met after the compliance monitoring period, the State standards will be automatically waived at that time to 2019 Federal AWQC (biotic ligand model criteria for copper), as documented in and approved through a SMP annual report. Post-construction waivers will not require any subsequent TI evaluation, ROD

amendment, or other formal decision-making process. As requested above, AR requests that EPA make this clear in the ROD Amendment.

EPA Response: The ROD amendment clarifies the process to future waivers. Note that any future waivers will not be considered "automatic" – the ROD Amendment provides a process to adopt and document potential waivers of State standards. This process will not require that EPA issue another decision document.

"15. Page 9, "Compliance with ARARs," second sentence of first paragraph – The Proposed Plan states that "the modified remedy, through the surface water management plan, includes a process to evaluate technical impracticability waivers …" (emphasis added). This is not correct. TI waivers will not be "evaluated" at that point. Rather, State surface water standards will be automatically waived to current (i.e. 2019) Federal AWQC without any subsequent TI evaluation, based on documentation provided in the SMP annual report.

EPA Response: Refer to the previous comment response.

"16. Page 9, "Compliance with ARARs," last sentence of second paragraph – Upon issuance of the 2019 ROD Amendment, concurrence from U.S. Fish and Wildlife Service would not be required for granting post-construction TI waivers. Atlantic Richfield requests that EPA change "… and will continue to consult when considering the waiver of standards…" to "…and will continue to consult with US Fish & Wildlife Service as needed to inform the Service of any post-construction TI waivers…" in the ROD Amendment.

EPA Response: The ROD amendment includes Atlantic Richfield's requested language concerning continued consultation with the U.S. Fish & Wildlife Service.

"17. Page 10, "Short-Term Effectiveness," final sentence – While construction completion may be anticipated by 2025, the actual amount of time required for completion is and uncertain and could be affected by a variety of factors and unanticipated contingencies. It is also unclear if "cleanup," as used in this sentence of the Proposed Plan, is limited to remedial action construction or is meant to include compliance with performance standards. Atlantic Richfield requests that EPA omit this language from the ROD Amendment.

"18. Page 10, "Cost" – A cost of $20 Million is not reflective of proposed remedy modifications or the currently approved remedy plus proposed modifications. Atlantic Richfield requests that EPA reevaluate remedy costs in the ROD Amendment.

EPA Response: The estimate of $20 million is based on the $17,167,000 estimate provided by Atlantic Richfield in the TI Evaluation Report (Atlantic Richfield 2017). The short-term effectiveness language has been modified to indicate a construction completion goal of 2025.

"19. Page 10, "Modifying Criteria," "State Acceptance" – This section fails to acknowledge that the TI Evaluation has been approved by EPA in consultation with the State. The State has been closely involved with the surface water compliance process for the ARWW&S OU, including support and development of the SWMP, which sets forth a direct pathway for waiver to federal standards through the 2019 Proposed

Plan and ROD Amendment. The ROD Amendment should identify the State's prior involvement in the TI Evaluation and waiver process.

EPA Response: State acceptance is included in the ROD amendment. State acceptance of the waivers outlined in this ROD Amendment is predicated on AR constructing and completing the technically practicable remedy elements outlined in the ROD Amendment.

"20. Page 10, "Non-Significant or Minor Modifications," bullet #2 – The heading should be changed to "Opportunity Ponds Waste Management Area," to be consistent with past regulatory documents and the 1998/2011 ROD. The reference to "BP" should be removed, since BP does not own the property."

EPA Response: BP is the parent company of Atlantic Richfield, which owns the property.

- **Comment 26.5 (2017).** "Specific Comments on ARWW&S Proposed Plan text

  "3. Page 4, Site Characterization, bullet list – Given current standards are hardness dependent, Atlantic Richfield requests that the text include discussion of the impact of changes in hardness on the expected frequency of exceedances during wet weather. During storm events and sustained high flows that occur during spring snowmelt events, water hardness decreases. This change in water hardness results in lower calculated numeric values for the hardness-dependent standards (i.e. cadmium, copper, lead, and zinc). The reality that exceedances could occur as hardness decreases without metals concentrations increasing should be recognized and explained. (See language in TI Executive Summary, Conceptual Site Model).

  EPA Response: The requested discussion has been included in the ROD Amendment.

  "4. Page 4, "What's the Difference between Total Recoverable and Total Dissolved Metals Box – Please revise the text to include the phrase "in the particulates of the water" after "metals present "in the first sentence. This will clarify that total recoverable metals concentrations are based on analysis of an unfiltered water sample following a "total recoverable" digestion process and therefore include both the dissolved fraction and the metals in the particulate (i.e., sediment) suspended in the water.

  EPA Response: The requested text additions were included in the 2019 Proposed Plan and the 2020 ROD Amendment.

  "5. Page 4, "What's the Difference between Total Recoverable and Total Dissolved Metals" Box, third sentence – text should be clarified to identify that the total recoverable digestion process results in an analysis of metals that are not available to aquatic life. This revision to the Proposed Plan and ROD Amendment text is required because total recoverable standards are not more protective. The application of total recoverable methods for laboratory analysis generates laboratory results that simply are more stringent (i.e., a higher concentration) than measurement of the dissolved fraction of metal(s) in the water column without providing measurable benefit in terms of protecting aquatic life in surface waters.

EPA and DEQ Response: The requested text modification was addressed in the 2019 Proposed Plan and the 2020 ROD Amendment. DEQ disagrees with the statement that "total recoverable standards are not more protective."

"6. Page 7, Preferred Alternative, bullet #4 – consistent with General Comment #2, Atlantic Richfield requests that EPA revise the text supporting the Preferred Alternative to acknowledge the response work to be completed will benefit drainages beyond those within the geographic area where EPA proposes to waive DEQ-7 standards. If the present waiver described in the ROD Amendment is not co-extensive with the geographic scope of the additional response work proposed in the planned ROD Amendment, then the ROD Amendment text must acknowledge that replacement standards, the same as those presently approved, will be adopted for those other surface waters if standards are not met post-construction. Also the Preferred Alternative description, as carried forward in the ROD Amendment, should recognize the limitations on the scope of the additional response work that are described in the Supplemental Surface Water Controls Remedial Design/Remedial Action Report and the Supplemental Surface Water Controls Slope/BMPs Tech Memo. Specifically, the text must clarify that additional response work is not required where compliance with DEQ-7 standards is demonstrated through monitoring conducted during the implementation period.

EPA and DEQ Response: EPA and DEQ have not concurred in any waivers beyond those outlined in the proposed plan and ROD Amendment. Any further waivers, in terms of the geographic scope of the waivers or further waiver of the federal waived to standards must be included in a petition for further waivers. EPA and DEQ will evaluate such request at that time.

2.18 TI Report

2.18.1 Comment Summary

One commenter provided extensive comments on the *Anaconda Smelter NPL Site, Anaconda Regional Water, Waste & Soils Operable Unit, Final Surface Water Technical Impracticability (TI) Evaluation Report* (Atlantic Richfield 2017) that was released to the public shortly before the 2017 proposed plan. The comment is excerpted here to include only the major technical points that may be relevant to the 2020 ARWW&S ROD amendment.

- **Comment 22 (2017)**. "The report may be acceptable for industry or a fully technical audience, but if the intent is really to facilitate public review and elicit public comments, additional effort must be made. The report should be modified and resubmitted to the public for comment, in tandem with additional public meetings. As it stands now, this report seems designed to be an incomprehensible tome, made to stymie public understanding and comment."

  "The hydrology model assumes that no beaver ponds are present and that differential timing of runoff does not occur (PDF page 761 of 914). The report does not discuss that this produces a biased result against the idea of filtration basins. Both assumptions will produce a greater and sooner peak flow, which will make a basin look more inefficient than in reality.

  "The report uses the Universal Soil Loss Equation (USLE). It does not use the more recent Revised Universal Soil Loss Equation (RUSLE) or the Water Erosion Prediction

Project (WEPP) model. From WEPP"s Wikipedia page: The model was developed by an interagency team of scientists to replace the Universal Soil Loss Equation (USLE) and has been widely used in the United States and the world. The WEPP model has been improved continuously since its public delivery in 1995, and is applicable for a variety of areas (e.g., cropland, rangeland, forestry, fisheries, and surface coal mining). WEPP is a very capable model that seems ideally suited to the area in question. The report should justify the use of USLE, and discuss why it was chosen over WEPP. WEPP should at least be used as a check, with a more detailed assessment of beaver ponds and differential runoff to see if WEPP provides similar results.

"PDF page 838 and 839 of 914 discuss that the filtration basin is assumed to have only a 24 hour holding time, and that based on an external reference for sediment removal, that 24 hours only provide 18% efficiency for silt/clay. It is therefore clear that this assumption, buried in the 914 page report, will provide results that appear inefficient or make a filtration basin remedy appear technically infeasible. The report does not show technical infeasibility. It shows relatively low efficiency from filtration basins based on a biased 24 hour standard, and using a biased assumption of no beaver ponds or differential runoff. The cost of a filtration basin remedy (at that low efficiency) is not exorbitant, and designs and cost estimates should be made that will provide greater efficiency and protection following a forest fire."

2.18.2 EPA Response

The final and approved TI evaluation report (Atlantic Richfield 2017) was provided for members of the general public to learn more about the scientific and engineering evaluation that was conducted to give the background for the proposed plan. EPA agrees that it is a complex technical document, and therefore created a fact sheet summarizing the findings of the TI report, which was made available on the EPA website with the release of the 2019 proposed plan.

The mountainous topography of the Anaconda uplands precludes construction of sediment ponds with capacities greater than the 24-hour storm event. Beaver ponds were excluded from the watershed runoff model as they are not engineered structures and are constantly evolving.

The commenter correctly identified the availability of public domain erosion estimation software products Revised Universal Soil Loss Equation and the Water Erosion Prediction Project model. These products are ever evolving and improving yet were not selected for use in the TI analysis as noted. The central reason for use of Universal Soil Loss Equation was to simplify the already complicated soil metal transport analysis by providing order of magnitude erosion predictions for TI evaluation areas as a basis for developing ballpark erosion rates and contrasting between pre-treatment/post-treatment erosion conditions resulting from remediation. Validation of the Universal Soil Loss Equation estimated erosion rates was made using literature references. Complicating the accurate prediction of erosion is the unique site-specific characteristic of the TI areas where: 1) erosion is accentuated compared to an agricultural or rangeland setting due to soil phytotoxicity and 2) extensive areas of highly erosive ephemeral gullies that are not well modeled by software. Furthermore, the erosion of contaminants may occur at a different rate than erosion of the bulk soil. Most of the TI areas were affected by smelter fallout of very small particles typically in the ~10 micron size fraction. The cumulative uncertainty of the erosion rates is unquantified, but

efforts were made to perform sensitivity analyses using a range of erosion rates estimated by Universal Soil Loss Equation to develop a best estimate in support of related TI analyses.

2.19 TI Waiver

2.19.1 Supports Up-Front Waiver

2.19.1.1 Comment Summary

- **Comment 2.2 (2019).** "Unfortunately, the Proposed Plan equivocates regarding the TI waiver process, stating that "waiver[s] and any necessary evaluations will be documented in a subsequent modification of this Record of Decision." Consistent with the *2017 Surface Water Technical Impracticability Evaluation Report* (TI Evaluation) and the ARWW&S SWMP, the ROD Amendment should clearly state that post-construction waivers will not require any subsequent TI evaluation, ROD amendment, or other formal decision-making process. o this point, EPA's presentation materials for the September 17, 2019 public meeting (Slide 22) stated: "If Montana acute and chronic aquatic life standards are still not consistently met after cleanup and monitoring, a TI waiver of state standards will be granted for identified contaminants and stream reaches, and replaced with aquatic life criteria" (emphasis added). EPA's materials did not suggest that further evaluation, decision-making, or administrative documentation would be required. Similar language should be included in the ROD Amendment.

  "2. Up-Front TI Waivers: Atlantic Richfield's support in these comments for future TI waivers depends on there being a clear and non-discretionary process articulated in the ROD Amendment for granting metals-specific and stream-specific waivers if post-construction monitoring shows that State standards are not being met. Atlantic Richfield continues to believe, however, that sufficient justification exists already, as documented in the TI Evaluation, to support up-front waivers for all ARWW&S surface waters that do not presently meet the DEQ-7 standards for cadmium, copper, lead and zinc. See TI Evaluation Figures 9-4 through 9-8 (identifying the streams where waivers of the standards are supported).

- **Comment 26.1 (2017).** "With this letter I am providing Atlantic Richfield Company's (Atlantic Richfield) comments on the Proposed Plan for Amendment of the Anaconda Regional Water, Waste and Soils (ARWW&S) Record of Decision (ROD Amendment) released by EPA in June 2017. Atlantic Richfield supports the EPA's proposed waiver of state acute and chronic aquatic life standards to federal Ambient Water Quality Criteria (AWQC) for upper Willow Creek and its tributaries and the tributaries of upper Mill Creek. The proposed waiver of state standards is fully supported by the approved Technical Impracticability Report (TI Evaluation) and monitoring of remedy actions that have already been implemented to date by Atlantic Richfield. In fact, those same analyses and lines of evidence support the waiver of state aquatic life standards for arsenic, cadmium, copper, lead and zinc over a broader geographic area where exceedances of state standards are recorded, and are expected to continue to occur after implementation of all practicable response work. Because the administrative record fully supports the waiver of state aquatic life standards to federal AWQC for surface waters within this broader geographic area, Atlantic Richfield requests that EPA revise the Preferred Alternative in in the ROD Amendment to expand the geographic area in which state aquatic life water quality standards are waived. This will make the ROD Amendment consistent with the TI Evaluation. If the proposed expanded waiver of additional elements over the broader geographic area is not implemented at this time,

then the Record of Decision Amendment should contain a clear process defining how and when these additional TI waivers will be adopted in the future, after all practicable response work has been implemented. The EPA should make a clear decision based on the available science in the TI evaluation now to allow the site to progress toward completion. The General Comments listed below describe the geographic scope of the waiver that is supported by site-specific studies in the record. We have also provided comments on specific sections of Proposed Plan text in the Specific Comments (below).

"1. Acute Water Standards: The available data and TI Evaluation both support waiver of acute state water quality standards (measured as total recoverable metals) for all ARWW&S surface waters that do not presently meet the DEQ-7 acute standards for arsenic, cadmium, copper, lead and/or zinc. Please refer to TI Figures 9-4 through 9-8 for the stream reaches where waiver of the acute standard is supported. At the July 20, 2017 public meeting, EPA commented that "modelling uncertainty" supported deferring a decision to waive state standards for these same metals outside of upper Willow Creek, its tributaries, and the tributaries of upper Mill Creek. EPA further commented that waiver of DEQ-7 standards for other surface waters would be considered after all remedy work is complete. It is unreasonable to defer the waiver decision based on concerns with the adequacy of EPA's modeling analysis. The TI Evaluation and monitoring of best management practices (BMP) technologies in place today has shown that compliance with the state's total recoverable standards is technically impracticable from an engineering perspective because compliance cannot be achieved through application of effective BMPs during wet weather events. The waiver of acute standards could also be accomplished by changing the manner in which storm water is monitored to be consistent with how storm water is typically regulated in the country and within Montana. Typically acute standards are applied to point sources rather than non-point sources at the base of watersheds. EPA could acknowledge that there is no legal requirement to apply acute aquatic life standards to non-point sources, and no practical way to achieve acute standards in a watershed where point sources are controlled, and the remaining impacts are from non-point sources.

"2. Chronic Water Standards: The TI Evaluation also supports a waiver of the DEQ-7 chronic standards (for arsenic, cadmium, copper, lead and zinc) for all ARWW&S surface waters that exceed state chronic standards after the completion of the planned additional actions described in the TI Evaluation (hereinafter "additional actions"). If General Comment #1 is not accepted, the TI Evaluation also supports a waiver of acute standards at that time. The TI Waiver of chronic standards for other surface waters should be anticipated and described in the ROD Amendment, including: (a) the approved replacement standards for such surface waters; and (b) the administrative steps EPA would complete to adopt those replacement standards if monitoring shows that total recoverable standards are exceeded after the "additional actions" are complete. The ROD Amendment issued by EPA should describe this process and acknowledge that replacement standards will be confirmed for areas where surface water quality exceeds DEQ-7 standards after "additional actions" are complete. Atlantic Richfield and Agency representatives have discussed an efficient process to review post-construction monitoring data and confirm replacement standards. Following Agency approval of the construction completion report(s) for the "additional actions", annual monitoring reports would

be prepared and submitted that: a) present the surface water monitoring test results for the year; and b) identify those surface waters that exceed DEQ-7 standards. Such reports would provide the technical basis for confirmation of replacement standards (i.e., AWQC) that are approved in the ROD Amendment for other, specific surface waters. There is no need for EPA to prepare more TI Evaluations and/or further ROD Amendments to implement the above process. The "additional actions" described in the TI Evaluation and detailed in future remedial design documents define the scope of technically practicable BMPs. The ROD Amendment should acknowledge this, and include a well-defined process for confirming the adoption of replacement standards in areas where they are supported by post-construction monitoring. This would benefit all parties by reducing resource demands and costs, and it should be described in the ROD Amendment, and should not require additional ROD modifications.

- **Comment 32.2 (2017).** "A TI evaluation and the subsequent decision to waive water quality standards is a complex, highly technical process that is often a necessary component of Superfund. The process requires finding pragmatic balance between protecting the environment, legally defined by meeting water quality standards, and determining the limits of what is truly achievable in an environmental cleanup. There are real limits to what can be achieved and in many cases proposed remedy measures can be counterproductive, causing "unnecessary and potential irreparable harm to the environment for relatively low benefit." Foremost among counterproductive potential remedy elements in this TI are the proposed retention/detention basins that would replace highly functional riparian reaches where numerous beaver ponds are already reducing metal concentrations. In the Proposed Plan, EPA and DEQ are proposing a cautious, step-wise approach toward waiving aquatic life standards. Cautious, because the proposed waivers are applied to a limited portion of the affected streams – only tributaries of upper Mill Creek and only upper Willow Creek. The waivers would not apply to mainstem Mill Creek, lower Willow Creek, California Creek, Warm Springs Creek or Lost Creek.

  "Step-wise because additional waivers are contingent on additional work – an "expanded and enhanced" remedy largely based on additional steep slope reclamation (SSR), storm water best management practices (BMPs) and constructing engineered retention/detention basins.

  "Although the Proposed Plan limits waivers at this time to Mill Creek tributaries and to upper Willow Creek, the TI Evaluation defined potential additional work elements in the remaining drainages and the Preferred Alternative holds out the requirement and promise that in the future, based on monitoring results "additional work and additional waivers will be considered."

  "The Proposed Plan and TI are a working framework for a rational path forward. However, detailed Remedial Design/Remedial Action (RDRA) work plans are not part of the Proposed Plan – those will be finalized in confidential consent decree negotiations. My overriding concern – the success of SSR is speculative; the techniques and SSR program are poorly defined. The Proposed Plan defines a contingent remedy founded on a wait and see what works strategy. The TI clearly defined the need to replace Montana's DEQ-7 standard for aquatic life, which is based on the total recoverable fraction, with the less protective Federal standard, which is based on the "dissolved"

fraction. But the success of the Preferred Alternative rests on the Agencies and the Settling Defendants negotiating a balance between protecting the environment and defining what is technically practicable.

"My comments and discussion focus on three major concerns with the Proposed Plan:

1. Beaver pond complexes versus engineered storm water ponds.

2. Steep slope reclamation.

3. Waiving standards – the need for biomonitoring."

2.19.1.2 EPA Response

The Commenter's preference and argument for the upfront waivers is noted.

Regarding Comment 26.1, the uncertainties in the modeling suggest that State of Montana total recoverable standards could be met in Mill Creek after additional actions are implemented. There is no compelling reason to grant waivers at this time. Acute standards apply to all State waters. Water quality monitoring will be determined under the surface water management plan. Additionally, the Agencies have no plans for future TI evaluations to further address surface water. The 2020 ARWW&S ROD Amendment will outline the general approach to certifying that the work that is technically practicable to complete has been completed, and, based on the monitoring data, will determine where waivers are necessary. The detailed approach will be provided in the surface water management plan. As changing surface water quality performance standards. EPA, in consultation with DEQ, will determine the necessity of a ROD modification if the monitoring data collected and analyzed under the surface water management plan indicates that waiver should be granted at that time.

Comment 32.2 is noted.

2.19.2 Against Up-Front Waiver

2.19.2.1 Comment Summary

Most comments received in 2017 opposed waiver of the state standards. Many commenters stated that it was premature to grant such waivers based on the results of modelling alone before the required remedial work had been completed. Several pointed out that Montana had adopted the more stringent total recoverable standard because EPA had not adopted cleanup criteria for sediment in streams. Two comments opposing a potential future waiver of state standards were received in 2019.

- **Comment 4.1 (2019).** "My complaint is to drop the state -- to drop the state standards to go to the federal, to me, is a big mistake. The federal standards, to me, are not adequate. We've got a thing around here, even in our pollution standards, that one -- 250 parts per million. Right? There's no place else, I think, in the country that has that. That's ridiculous. One time I asked Mr. Brockman from the EPA, "Why 250 parts per million?" And this was my answer in my kitchen, with the city manager standing there, he said, "I pulled that out of my butt." The EPA backs ARCO, not us. Sorry, Charlie, that's how it is."

- **Comment 5.1 (2019)**. "My question will be: If we're going to accept federal standards instead of state standards, what happens if the federal standards change, which could

happen under different administrations. Would that mean that we would have to change to the new federal standards, which could be even lower?"

- **Comment 8.1 (2017)**. "As a former Anaconda native, I and many people of opportunity, Anaconda and the state oppose this proposal to waive water standards. The EPA already gave Arco the gift it didn't deserve by granting them grossly higher cleanup standards for soil of 250ppm when it should have been 20 as in other cleanup sites across the nation. Water interception walls, or a treatment plant is called for here. Not the lessening of our states water quality standards."

- **Comment 9.1 (2017).** "I would like current state restrictions on mineral levels in the creeks near Anaconda to be kept AS IS. Federal standards are not strict enough."

- **Comment 10.1 (2017)**. "I am personally and professionally against the EPA's recommendation to waive the water quality standards. I live in Anaconda-Deer Lodge County and we favor outdoor recreation such as hunting and fishing and we value our water resources. We are tied to one of the largest Superfund Sites and the negative effects of contamination hits our community on a daily basis. Our community needs help in establishing remedies to restore and improve our water resources ... not waiving water quality standards. I respectfully ask that you take all comments from the citizens of Anaconda-Deer Lodge County into consideration. Thank you."

- **Comment 11.1 (2017)**. "Received phone message, on August 31, 2017, from Terry Galle indicating that he was not in favor of the proposed waiver of state standards."

- **Comment 13.1 (2017)**. "I do NOT want any reduction in the Montana state criteria for cadmium, copper, lead & zinc in Upper Willow Creek, Warm Springs Creek, Lost Creek, Mill Creek & their tributaries. Me & mine have hunted, fished, picnicked & played in that area for 100 years. Any relaxation of standards affects not only local recreation & commerce but the entire Columbia River drainage."

- **Comment 14.1 (2017).** "Dear Mr. Coleman: I am against the EPA's recommendation to waive the water quality standards. I live in Anaconda-Deer Lodge County and we favor outdoor recreation such as hunting and fishing and we value our water resources. We are tied to one of the largest Superfund Sites and the negative effects of contamination hits our community on a daily basis. Our community needs help in establishing remedies to restore and improve our water resources ... not waiving water quality standards. I respectfully ask that you take all comments from the citizens of Anaconda-Deer Lodge County into consideration."

- **Comment 15.1 (2017).** "I do not support the EPA or the State of Montana providing ARCO with an alternate water quality standard. I urge the EPA and DEQ to not provide a waiver of water quality standards."

- **Comment 16**.1 **(2017).** "I ... a resident of Opportunity Montana, strongly oppose waiving DEQ-7 surface water quality standards for upper Mill Creek and upper Willow Creek. Montana created the standard for Montana based on our unique geology and they should be used in the state. The change in standards to federal guidelines, would ignore the large amount of sediment that will be deposited downstream. Irrigators and ranchers use water during non-baseflow conditions when limits are not being meet, allowing the Cu, Cd, and Pb to enter our food supply. Children play in the creeks as well

and the sediment is allowed to accumulate along creek banks, irrigation ditches, fields and yards. The EPA's core mission is to protect human health and the environment, increasing the limits because they are not being meet is not protective. As technology improves the ability to clean the soils will as well and work should continue to meet the Montana surface water quality standards."

- **Comment 17.1 (2017)**. "I do not support the waiving of the State of Montana acute and aquatic life surface water criteria for cadmium, copper, lead and zinc for upper Willow Creek and its tributaries and the tributaries of upper Mill Creek. I believe it is premature to waive these standards at this time. It would seem that waiving these standards would eliminate any meaningful future clean-up. I recognize the problems that exist in a mountainous terrain and the difficulty of eliminating the contamination is this area. However, we will never be rid of the airborne emissions if we do not step back and reconsider the situation. I do not believe the Federal water quality standards will protect the population of Anaconda-Deer Lodge County. I look forward to continued efforts and information regarding this issue."

- **Comment 18.1 (2017)**. "Dear Mr. Coleman, These comments refer to the Proposed ROD Amendment for the Anaconda Regional Water, Wastes and Soils; more particularly waiver of the State of Montana Acute and Chronic Water Quality Standards for Copper, Cadmium, Lead and Zinc (and other contaminants as they apply, such as arsenic) in favor of Federal Water Quality Standards. Federal Water Quality Standards are developed with a nationwide perspective and under the knowledge that state standards will be developed that are more specific to local conditions, weather, soils, ground and surface water protection, plant and animal protection, use of open land and resources by the public, maintenance of historic background water quality and both rural or urban development. After much consideration State Standards, such as Montana's, are adopted. The effort to establish these standards has been greater and more wide spread (especially with diverse public input) than what has been presented here to set them aside. These standards should not be easily or cavalierly set aside due to cost or difficulty in meeting the standards. To do so suggests to the public that the state standards established are not important and even more serious, that the reduction in required standards means the public is safe to use fish and animals for personal consumption and to freely recreate in these waters and watersheds without fear of health impacts. In the PowerPoint presentation it is indicated that the listed heavy metals are mobilized by storm flows in the affected basins and streams. EPA should not stop encouraging the development and deployment of BMPs to improve the capture of these metals under storm and a full range of conditions. Storm water flow treatment is in its infancy of development. The state standards should remain in place as a continued encouragement to do more and continually seek better and more protective metal capture/removal options and best management practices (BMPs). Technical impracticability (TI) is presented in the PowerPoint. What is technically impracticable for a county or local government is much different than for a premier energy company with a large and high quality staff of engineers and scientists who are, over a broad geographic area, solving similar challenges. The experience gained by the company across the globe should continue to be applied for the benefit of the Anaconda Regional Water, Wastes and Soils Operating Unit. Please do not lower the bar for water quality improvement in the suggested watershed areas of Anaconda/Deer Lodge County. After all, we are talking about impacts for hundreds and hundreds of years in the future.

These impacts just don't go away on their own, they have to be continually and actively worked and will benefit from technology yet to be developed."

- **Comment 19.1 (2017)**. "On behalf of Moms Clean Air Force, a network of more than one million moms united against air pollution, we are writing to express our concern and opposition to the alternate proposed plan offered for the surface water remedy at the Anaconda Co. Smelter Superfund Site, Anaconda Regional Water, Waste and Soils Operable Unit (OU4). The Environmental Protection Agency (EPA) has a core mission to protect human health and the environment. Weakening the water quality by waiving Montana standards in favor of federal standards does not make these toxic waters safer for people and the environment. The EPA proposed at the public meeting on July 20, 2017 that the terrain and vegetation in parts of OU4 are well vegetated and undisturbed, and therefore shouldn't be remediated, at the risk that remediation could cause even more contamination of the environment. However, the environment and terrain are already disturbed by the presence of toxic heavy metals that are contaminating our waters and our families. And even the well-vegetated areas have been established as leaching toxins into the water. Science supports the common sense idea that we need to remove these toxins from the environment - even if it's challenging - in order to protect our families, aquatic life, and the environment.

  "The smelter is no longer active, but the waters that connect Western Montana still are, flowing downstream connecting OU4 via Mill Creek and Willow Creek - through many communities - to the rest of Western Montana. Heavy metals have been known to travel to as near as Opportunity to far as downstream as Milltown spreading contaminated and undrinkable drinking water for communities across the Clark Fork River. The tributaries of concern, along with the toxic heavy metals they carry, are known to travel through a community where this exact water is regularly used for irrigation of agricultural lands and residential yards, and will seep into wells contaminating drinking water. Cutting these toxins off at the source in OU4 by removing them from the environment would prevent the widespread contamination of local and distant communities from these heavy metals. Furthermore, Opportunity was intentionally designed to be an agricultural community from its inception. Many residents still depend on the income of their livestock or other crops for their livelihood. We would like to see the EPA, DEQ, and ARCO spearhead a study from an independent researcher to examine the effects of these mobile heavy metal toxins on livestock and food plants in this area, which can directly be impacting human health and the environment."

- **Comment 20.1 (2017)**. "I ... a resident of Opportunity Montana, strongly oppose waiving DEQ-7 surface water quality standards for upper Mill Creek and upper Willow Creek. Montana created the standard for Montana based on our unique geology and they should be used in the state. The change in standards to federal guidelines, would ignore the large amount of sediment that will be deposited downstream. Irrigators and ranchers use water during non-base-flow conditions when limits are not being meet, allowing the Cu, Cd, and Pb to enter our food supply. Children play in the creeks as well and the sediment is allowed to accumulate along creek banks, irrigation ditches, fields and yards. The EPA's core mission is to protect human health and the environment, increasing the limits because they are not being meet is not protective. As technology improves the ability to clean the soils will as well and work should continue to meet the Montana surface water quality standards."

- **Comment 22.1 (2017)**. "I ... disagree with the EPA proposal to waive State of Montana water standards and aquatic sampling methodology in leu of the less stringent federal water quality criteria (filtered sampling methodology). I attended the public meeting on Thursday July 20th at the Metcalf Senior Center in Anaconda. I came eager to learn about the topic and appreciate the time spent by the presenters. As a mother of two young boys I often look at the world with concern. I often wonder how we can make this world better for my boys, their wonderful friends, and all the children who will grow up with the weight of trying to care for our earth after we have damaged it so extensively on their shoulders. Keeping our world healthy and safe should be a priority to our community and government. Unfortunately, in today's busy world, health and safety are too often placed on the back burner with the idea that we as individuals, communities, government agencies or businesses will get to it later. Later often comes when there is an accident, health disparity, or tragedy.

  "My disagreement to waive the current State of Montana water standard stems not only from my concern for the health and safety of my community and family but for all communities and families downstream of these contaminated waters. The public meeting left me with more questions than answers. While I am not a hydrologist, geologist, or any other "ologist" I do have a Bachelor of Science and have attended many seminars, meetings, conferences and research presentation in my field. Maybe I am naïve but I expected the public meeting to include at least a small amount of information and comparison data between the two sampling methods. What I heard at the meeting was a presentation, that seemed like a sales pitch, addressing why we could not meet the current State of Montana water standards despite the fact that it hasn't been tried. I was left wondering, "Why not try?"

  "The people of Montana deserve the highest standards of water quality. I urge you to continue with current State of Montana Water Standards. Instead of looking at technical impracticality evaluations that state why cleanup is not practical from an engineering standpoint I urge you to continue to strive to meet State of Montana water quality standards. Imagine finishing this project in the distant future and looking back with pride, despite the difficult task at hand, and being able to say "I did it"."

- **Comment 23.1 (2017).** "Thank you for your prompt response and for forwarding the OU information that you sent (my originals on file). I am responding once again within the response date period to express my opinion on changing current Montana standards for five listed HEAVY METALS to a lower National standard that I believe does not apply in our Great State of MT, but especially out in my subdivision on the Mill Creek drainage. I staunchly will oppose these changes at several levels, and will arrange Council, if necessary. Because of biopractices such as ground filter and more importantly BIOMAGNIFICATION higher levels of specific metals will affect larger mammals who depend on that drainage for H2O, including Man. There is already a significant health risk because of the smelter and no one is more prepared, , qualified, and capable to put up significant resistance than I. I believe a quieter professional agreement can be reached, however and look forward to meeting with you to discuss options."

- **Comment 24.7 (2017)**. "SUMMING UP. When I read that, "EPA and DEQ directed Atlantic Richfield to complete a technical impracticability evaluation to determine if those standards could be achieved with additional work," I do not expect the next

sentence to begin, "But no: ARCO said that if a few hundred Spaniards in two year could conquer one of the great civilizations of the world, whose monumental architecture was accomplished without even the wheel or beasts of burden, then we can do much more than the faint-hearted think." More like: It's even worse than you thought. Give us a pass and we'll all pretend to do something, but not too expensively please. Incentive to do much is gone with the waiver. Stream work is impermanent. Barren slopes are neither the problem nor the solution. Two hundred conquistadors could surely overcome water treatment challenges – and they loved challenges. I have never seen such magnificent natural recovery as in the Mill Creek drainage. I first saw this area about 1970 driving to the Big Hole Valley. My mouth fell open. "What happened here?" I gasped. "The smelter," my Anaconda hosts replied. I grew up in the Anthracite coal region where streams in my youth ran orange from acid-mine drainage, but Montana, I thought, was pristine. The improvement since is breathtaking. Even in the 10 years or so I have worked in Mill Creek, natural recovery is ascendant. I witnessed some transplanting there that was utterly ineffective, but there was the natural recovery process operating at a far grander scale. Exceedances will diminish, but not because due to beefing up the remedy."

- **Comment 27.2 (2017)**. "As an advocate and stakeholder in this process, the coalition has consistently pushed for use of stricter state water quality standards based on total recoverable concentrations for two main reasons. We know, first of all, that the metals of concern are pervasive in sediments that are located in the beds and banks of the streams. And, secondly, we know that these streams continue to show biological harm even though they meet federal water quality standards. With respect to the proposed TI waiver at issue today, the coalition's position is that the waiver is inappropriate at the stage -- or at this stage of the process. Excuse me. Federal guidance makes it clear that these so-called front-end, or sort of decision-first, evaluations must be adequately supported by detailed site characterization and data analysis that is focused on the most critical limitations to restoration."

- **Comment 28.1 (2017)**. "I'm just representing myself as a native of Anaconda and a property owner. I strongly disagree with the proposed -- the proposal to raise the standards to raise limits for the contaminants. I don't believe that will help us, and it would end up permanently allowing Arco to violate with absolution, excused by the Montana and federal governments. The reason that it's too hard is not sufficient to support the excuse of Arco from complying with the surface water standards and, instead, raising them. They already enjoy relaxed standards for solids contamination.

  "It's hard to do work, but does that mean you don't have to do your job or uphold your responsibilities? It's hard because it is work. We've worked hard to prove it's impractical. I did not hear all of the methods that were tried, but I don't know if it included alter filtration, reverse osmosis, working on water softening or other methods of your treatment of partial portions of the stream which can be mixed back in and then allow them to meet these standards. I don't think that people in this area are necessarily in the same protection of our health by environmental standards as the rest of the United States. We don't even have the EPA stepping in for us to fight for stronger protection, but, instead, trying to just allow this to come to a conclusion. We should not be downgraded and we should not be less human than the rest of the country. I think that we should impose fines for the violation and that the water -- that the money brought in from this should be brought in to this area to provide additional motivation

to work on additional remedies for the problems, and those provide some compensation to the Anaconda area for deterioration of the environmental quality and health for the improved increase and exposure to population."

Comment 29.1 (2017). "I'm a property owner and water right owner along Willow. I just have two quick comments. And how Anaconda is such an extreme Superfund site, how can we -- how do we need to -- how can our Superfund site go under the federal, and how did their guidelines start? And do they start with our major Superfund site, or where do their guidelines start from? Because we are such a massive Superfund site. And, also, I'd like the community to be able to request a second opinion on all of the studies and testing that have been done."

Comment 31.1(2017). "1. Some of the cleanest water in the nation finds its origin in the Pintler Mountains, Anaconda-Pintler Wilderness Area. We view it as our responsibility to the citizens of Anaconda-Deer Lodge County, the State of Montana and the citizens of the United States to protect this water and provide this high quality resource for all to enjoy and benefit from in perpetuity. Relaxing water quality standards in these watersheds is NOT the answer. We adamantly oppose the Proposed Plan to do so."

2.19.2.2 EPA Response

Based on the comment received, in 2019, EPA removed upfront waivers of water quality standards from the revised proposed plan. EPA notes that the ROD amendment sets forth replacement standards that are the current 2020 federal standards for cadmium, lead and zinc, and the federal biotic ligand model standard for copper that is in effect at the time of the petition for a waiver.

2.19.3 Other

2.19.3.1 Comment Summary

- **Comment 6.1 (2017).** "In response to the Public Notice dated 6/21/17 regarding solicitation of public comments on the plan (by 9/5/17) to modify the remedy for OU4 by: Waiving the State of Montana's acute and aquatic life surface water criteria for cadmium, copper, lead and zinc for upper Willow Creek and its tributaries and the tributaries of upper Mill Creek; Maintaining federal water quality criteria as the applicable surface water standard; and Expanding and enhancing the current upland remedies to minimize source contamination to surface waters that would result in exceedances of water quality standards. I respectfully request that Anaconda-Deer Lodge County (ADLC) be provided an on-the-ground tour of and detailed technical presentation on the remedy that has been put in place to-date pertaining to this proposed plan. On behalf of ADLC I am requesting the opportunity to examine and provide professional input on the remedy that has been only partially implemented for this watershed.

- **Comment 21.4 (2017).** "4. General Comment: ADLC 's economy in large part relies on recreational opportunities tied to fishing and hunting, among other outdoor activities. We value our water and land resources and strive to maintain the highest beneficial use of these assets through sound environmental management. The environmental degradation effects of contamination from historic smelter operations are widely evident as are the negative effects to ADLC's economy from the smelter's closure. ADLC

is limited in what it can do alone to remedy the ills of the past, and must therefore rely on State and Federal regulatory agencies to assist ADLC in restoring, protecting and improving our resources and economy. Until sufficient effort is made to adjust, enhance and exhaust potential remedies for restoration of the watersheds addressed in the subject Tl evaluation, we view it as premature to relax any water quality standards."

- **Comment 21.5 (2017).** "5. General Comment: ADLC concurs with comments on the Tl evaluation provided by the Clark Fork Coalition, and reiterates their concerns regarding completing all work outlined in the Record of Decision (ROD), the appropriate timing to consider issuance of a Tl waiver based on Federal guidance, and advocating for clear timelines for the agencies and the Potentially Responsible Party (ARCO) to fully re-evaluate remedial technologies and BMPs applicable to the contaminants of concern in these watersheds."

2.19.3.2 EPA Response

ADLC has participated in the development of the surface water management plan and the supplemental surface water remedy, and has provided comment.

2.20 Total Metals Versus Dissolved Water Quality Standards

2.20.1 Comment Summary

One comment was given orally at the 2017 public meeting regarding the lack of information about the differences in total and dissolved water quality standards.

- **Comment 22.2 (2017).** "I really wanted, and expected, to hear and explanation of how these two water quality standards differ. Not just how the sampling methods differed, but more importantly how the results differed. There was one slide during the presentation that gave data on the Water Quality Criteria. Based on this one slide, it seems that comparing the state and federal numbers is like comparing apples and oranges. When I asked for further explanation in order to better understand this data the answer given was vague and confirmed my initial belief that comparing the state and federal water quality criteria is indeed like comparing apples and oranges (excluding the levels of arsenic). I would have appreciated data and statistics explaining how to interpret these comparisons. I found it bewildering that this was not included. This information, even presented at a lay person's level, would have given me something tangible in my mind and help me make a more educated opinion on this topic."

  Comment 27.1 (2017). "As an advocate and stakeholder in this process, the coalition has consistently pushed for use of stricter state water quality standards based on total recoverable concentrations for two main reasons. We know, first of all, that the metals of concern are pervasive in sediments that are located in the beds and banks of the streams. And, secondly, we know that these streams continue to show biological harm even though they meet federal water quality standards. With respect to the proposed TI waiver at issue today, the coalition's position is that the waiver is inappropriate at the stage -- or at this stage of the process. Excuse me. Federal guidance makes it clear that these so-called front-end, or sort of decision-first, evaluations must be adequately supported by detailed site characterization and data analysis that is focused on the most critical limitations to restoration."

2.20.2 EPA Response

Additional text was provided in the 2019 Proposed Plan and the ARWW&S ROD amendment that explains the difference between the two standards. A technical note explaining Montana's DEQ-7 aquatic life surface water criteria and federal ambient water quality criteria is provided in Appendix A.

DEQ agrees that Montana's total recoverable metals standards are more appropriate for the Clark Fork River Superfund Site Complex because metals are bound in the sediment. The technical note in Appendix A also explains DEQ's position on total recoverable metals. EPA notes that the ROD amendment does not contain upfront waivers, and the waiver to the federal dissolved will only occur after the technically practicable work has been completed and a compliance determination period shows that the total recoverable standard cannot be met.

2.21 Water Treatment

2.21.1 Comment Summary

Two commenters believed that water treatment was not adequately evaluated in the *Surface Water TI Evaluation Report.* One stated that there was ample room to construct a water treatment plant east of the Dave Gates power plant to treat Mill Creek water.

- **Comment 8.1 (2017). "**Water interception walls, or a treatment plant is called for here. Not the lessening of our states water quality standards."

- **Comment 24 (2017).** "No place for a water-treatment facility? Too much conveyance channel? Come now. One could be built in Sections 16-17, T4N, R10W, east of the gas-fired power plant. That area currently awaits remediation and Mill Creek as a ditch runs right by it. I lack the knowledge to comment on the other three streams. I have been told by someone who operates a water-treatment facility that it can sit idle and self-actuate when a certain flow is exceeded. There are challenges to be sure, but I doubt the proposed plan will accomplish much other than waiving standards."

  "WATER TREATMENT. In the big picture, almost the entire Mill Creek watershed has been contaminated with As and heavy metals from smelter emissions, not to mention acidity. The issue before us is mainly dissolved copper originating throughout the watershed and transporting to the Clark Fork River. Through SO2 fumigation, vegetation loss, and soil erosion (up to two feet), barren slopes consisting of rhyolitic tuff are among the cleanest, whereas some well-vegetated slopes harbor more contaminants. The natural recovery process has been nothing short of phenomenal. Never lose sight of this: natural recovery dwarfs any proposed remedial action. Let's see, we have diffuse contamination that concentrates in Lower Mill Creek before damaging an iconic Montana river, the Clark Fork of the Columbia. The solution is obvious: treat the water before it enters the river. But this, I have heard, was ruled out almost at the onset. Admittedly, there are problems with treatment of very high flows. There is little chance that remedial actions, as proposed and I have no doubt adopted, will reduce Cu delivery significantly, much less to Montana water standards. Moreover, there are problems and limitations with the proposed remedy surpassing those associated with treatment.

"Because of the continuing role of natural recovery, completely overshadowing assisted recovery, water treatment would not have to be "in perpetuity," to use the fanciful but clearly imaginary plan for the Berkeley Pit, Golden Sunlight pit, etc. Exceedances will continue to reduce, as they have for many decades."

2.21.2 EPA Response

Water treatment was extensively evaluated as part of the 2011 ARWW&S OU ROD Amendment for arsenic. That analysis determined that if less than 10 percent of the total flow of the tributary flow (tributaries that contributed the highest arsenic loading to Mill Creek) were diverted to a treatment plant, it would require a peak storage capacity of about 1,000 acre-feet. Since that evaluation was to treat dissolved arsenic, and the 2017 TI evaluation required treatment of much greater flows during wet weather for suspended metals, the required storage capacity would be much greater than 1,000 acre-feet. Moreover, different technologies would be needed to remove suspended metals as opposed to treating dissolved metals. As explained in the 2017 TI Evaluation Report, filtration technologies are not suitable for the high flow rates and high total suspend solids concentration that the area streams experience during annual spring runoff.

2.22 Watershed Functionality

2.22.1 Comment Summary

One comment was received that addressed the functionality of the watersheds in the project area.

- **Comment 7.5 (2017).** "Are the watersheds in the project area functioning at risk, functioning at unacceptable risk, or in a properly functioning condition? Are there any WQLS streams in the project area and if so are the TMDLs completed and are you complying with them?"

2.22.2 EPA Response

The CERCLA remedy will address metals loading to area streams within the Superfund site. Within the Surface Water Area of Concern, five water bodies were on the 2008 Clean Water Act Section 303(d) list as being impaired by metals: Modesty Creek, Lost Creek, Warm Springs Creek, Mill Creek, and Willow Creek. A metals Total Maximum Daily Load (TMDL) and Framework for Water Quality Restoration report was prepared by DEQ for these streams as part of the Upper Clark Fork River Tributaries TMDL. The streams remain on the 2016 303(d) list.

Section 3
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Appendix A

Technical Note

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Technical Discussion
Federal Dissolved Aquatic Life Ambient Water Quality Criteria
Compared to Montana Numeric Water Quality Standards
As Applied to Technical Impracticability Evaluations
Of Achieving Metals Standards at the Anaconda Smelter NPL Site

The surface water quality performance standards applied in the Anaconda Smelter Site Technical Impracticability (TI) waiver are for certain metals in surface water based on aquatic life. **Human health standards were not involved in this TI evaluation**. The metals of interest are generally insoluble in metallic form, but soluble in an oxidized state. They are referred to in this form as *divalent* metals. It is the divalent metals that can have toxic effects on aquatic life at elevated concentrations. Under the Clean Water Act, recommended criteria for divalent metals are prepared by the U.S. Environmental Protection Agency (EPA) and published as Section 304(a) of the Clean Water Act. These are the criteria that are proposed as the replacement standards in the proposed plan.

The 304(a) criteria are derived by a specific method in EPA's "*Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and their Uses*". This method uses toxicological testing results and statistical methodology to derive recommended criteria. EPA occasionally updates criteria using these guidelines when new toxicological test results become available. For example, the 1980 fresh water acute standard for cadmium was developed using 29 species while the 2016 revised standard used significantly more (101 species).

The toxicological data on which the criteria are based come from numerous sources including academia, industry, and government. When reviewing criteria, EPA evaluates the toxicological data for applicability and consistency using criteria in the guidelines. Most testing is conducted using established methodology such the "*Standard Guide for Conducting Acute Toxicity Tests on Test Materials with Fishes, Macroinvertebrates, and Amphibians*" (ASTM Designation E729-96). In this test, the metal is dissolved into specially-formulated water and the organisms are exposed to the water for specific periods of time under controlled conditions. Results are used to develop criteria by following the guidelines described above.

Toxicological effects to aquatic biota are thought to occur because divalent metals have the same ionic charge as calcium and the metals can interfere with biological processes involving calcium. Interferences can also occur with other divalent ions such as magnesium. The oxidized form of calcium, magnesium, and divalent metals occur in the dissolved state and the processes occur under aqueous conditions. This is considered to be the bioavailable form of the metals – those that are available for uptake by aquatic organisms. Exposure to metals via diet is not measured by these tests. This route uses a different test and is reported as a bioconcentration factor. Since the criteria are for contaminants in water, not in food sources, the recommended criteria focus on exposure to water.

Early EPA-recommended criteria such as those contained in the *Red Book* (1976) and the *Gold Book* (1986) were published prior to the implementation of the guidelines and the ASTM standard. These were based on the unfiltered metals concentrations reported with the toxicological test results. **Toxicological research since that time has developed better models of exposure routes and toxic mechanisms generally determining the important**

toxicological effects occur as described above. As a result, EPA changed its recommended criteria in 1993 to use a dissolved metals concentration as being the bioavailable form.

Montana retains the use of unfiltered metals concentrations for its standards. In a response to a comment on the dissolved standard in the 2016 triennial review of water quality standards under the Clean Water Act Section 303(c) by EPA, Montana responded:

> *On October 1, 1993, the U.S. Environmental Protection Agency (EPA), Office of Water recommended dissolved metals criteria to be adopted instead of total recoverable criteria as the State Water Quality Standard for metals to protect aquatic life. In the same memorandum, EPA maintained its position that the total recoverable fraction (TR) published under the 304(a) of the Clean Water Act is scientifically defensible and specified that it will approve individual state's risk management decisions to keep the total recoverable fraction as the water quality standard. The State of Montana adopted the total recoverable fraction as the water quality standard to protect aquatic life and human health, with the exception of aluminum which is expressed as the dissolved fraction (MT DEQ, 2012). In 2007, EPA issued a revised national recommendation for copper aquatic life criteria using the copper biotic ligand model (BLM) for those who wanted to use this approach (EPA 2007).*
>
> *For the BLM, ten characteristics of the receiving water are necessary as inputs to the model (temperature, pH, dissolved organic carbon (DOC), major cations (Ca, Mg, Na, & K), major anions (SO4 & Cl), alkalinity, and sulfide). Whereas for the dissolved metal fraction, only two factors are necessary to implement the water quality standard: Factor one relates to the fact that the EPA's section 304(a) criteria for metals are expressed as total recoverable (TR) metal fraction, not as dissolved requiring a conversion factor (EPA 1996) to express the total recoverable fraction as a dissolved fraction; Factor two relates to Federal regulation 40CFR 122.45(c), which requires metal permit discharges to be expressed as total recoverable, not dissolved making, a translator factor necessary to determine the dissolved fraction of the total recoverable fraction in the fully mixed receiving water. This translator factor can be greatly influenced by temperature, pH, hardness, total suspended solids (TSS), particulate organic carbon (POC), dissolved organic carbon (DOC), acid volatile sulfides (AVS) as well as concentrations of other metals and organic compounds. A test of the parameters per site that influence the translation factor and development of the correspondent regressions to calculate the translator is the best approach. Other approaches have been used as interim measures in the absence of site specific information and conservative assumptions can be made. These approaches can be found in the EPA guidance document on how to develop a translator factor (EPA, 1996).*
>
> *Although the dissolved fraction is more bioavailable to aquatic life, aquatic organisms are subjected to metals contamination from factors other than water. Dissolved fractions move with surface water and groundwater flows, interact with other compounds (ligands) to form complexes that reduce the apparent toxicity of the dissolved metal and adsorbed to sediment particles. Both the BLM and the dissolved fraction provide only estimates of water column toxicity. Ingestion of contaminated sediment is a pathway for aquatic organisms, therefore the use of sediment metals standards when using the BLM model or the dissolved metal fraction as water quality standard (WQS) is recommended (EPA, 1993). At present, there are not sediment standards, only guidance values. The total recoverable fraction is a more conservative approach but includes the particulates, which minimizes the need for a complementary sediment standard.*
>
> *DEQ is currently in the process of evaluating data gaps, research needs, complexities and implications of the BLM and the dissolved fraction as a water quality standard. Stakeholder input will be incorporated to this process when the time arrives to present the findings. In the absence of these findings, the Board is not adopting use of the BLM in Montana and is not adopting the footnote suggested by the commenter. However, under Montana Code Annotated §75-5- 310, a permit applicant, permittee, or person potentially liable under any state or federal environmental remediation statute may petition the Board of Environmental Review to adopt site-specific standards of water quality for acute and chronic life. The board's decision to adopt site-specific standards must be based on sound scientific, technical, and available site-specific evidence.*

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Based on the above response by the Montana Department of Environmental Quality, the state is attempting to be conservative by including the ingestion pathway as measured in the total recoverable (unfiltered) form of metals. The EPA guidelines for developing criteria specifically exclude toxicological tests where the organisms were fed. This limits the tests to include only those that evaluate the toxicological effects of the water column. **Since the ambient water quality criteria are applicable to water and not food sources to aquatic life, the criteria based on dissolved metals are appropriate for that purpose.**

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