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Clark Fork River Operable Unit

of the Milltown Reservoir/Clark Fork River Superfund Site

Record of Decision

Part 3: Responsiveness Summary

U.S. Environmental Protection Agency
Region 8

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1 Overview of Process, Responders, and Stakeholder Comments

This *Responsiveness Summary* is Part 3 of the *Record of Decision* for the Clark Fork River Operable Unit (OU). The purpose of the *Responsiveness Summary* is to present the U.S. Environmental Protection Agency's (EPA's) response to significant stakeholder and potentially responsible party (PRP) comments on the *Proposed Plan* in accordance with 40 CFR 300.430(f)(3)(F) and Section 117(a) and (b) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The public outreach process used to encourage comment and participation on this decision is presented in this *Record of Decision* at Part 2, *Decision Summary*, Section 3.

This *Responsiveness Summary*, which is Part 3 of the *Record of Decision* for the Clark Fork River OU, consists of four sections. First, this section (Section 1) provides an overview of the comments received from various stakeholder groups. Section 2, *Stakeholder Issues and Lead Agency Responses*, summarizes with more detail the specific, significant comments received from all stakeholders (page 3-11). Responses to those comments are provided by the lead agency: Region 8 of the EPA, after consultation with the Montana Department of Environmental Quality (DEQ). Section 3, *PRP Comments and Lead Agency Responses*, summarizes significant *Proposed Plan* comments from the PRP—the Atlantic Richfield Company—and lead agency responses to those comments (page 3-81). Section 4, *Stakeholder and PRP Categorized Comments* (page 3-137), provides the original text of the comments from the stakeholders and the PRP as Adobe Acrobat Reader (PDF) files on an enclosed CD-ROM.

1.1 Number of Comments Received and Types of Stakeholders Submitting Comments

A total of **1,978 people submitted comments**, excluding the Atlantic Richfield Company (their comments and responses are summarized in Section 3, *PRP Issues and Lead Agency Responses*). Many people submitted more than one comment document. Therefore, the total number of comment documents submitted was higher, at 2,109, excluding Atlantic Richfield Company.

The statistics in this summary **are based on comment documents**—not people. Two basic types of comment documents are recognized:

- **Personal Comment Documents**, such as letters, e-mails, telephone messages, or postcards with additional comments written on them. EPA received a total of **330 unique comment documents**.
- **Form Letters/Public Meeting Testimony,** which include such documents as postcards, form e-mails, and testimony (comments) presented at public meetings. EPA received a total of **1,779 form letters and made transcripts of two public meetings**.

To identify the range of the public represented by the comment documents, this section contains a description of the kinds of form letters and public testimony received. Later, this section contains a description of the comment documents by commenter type.

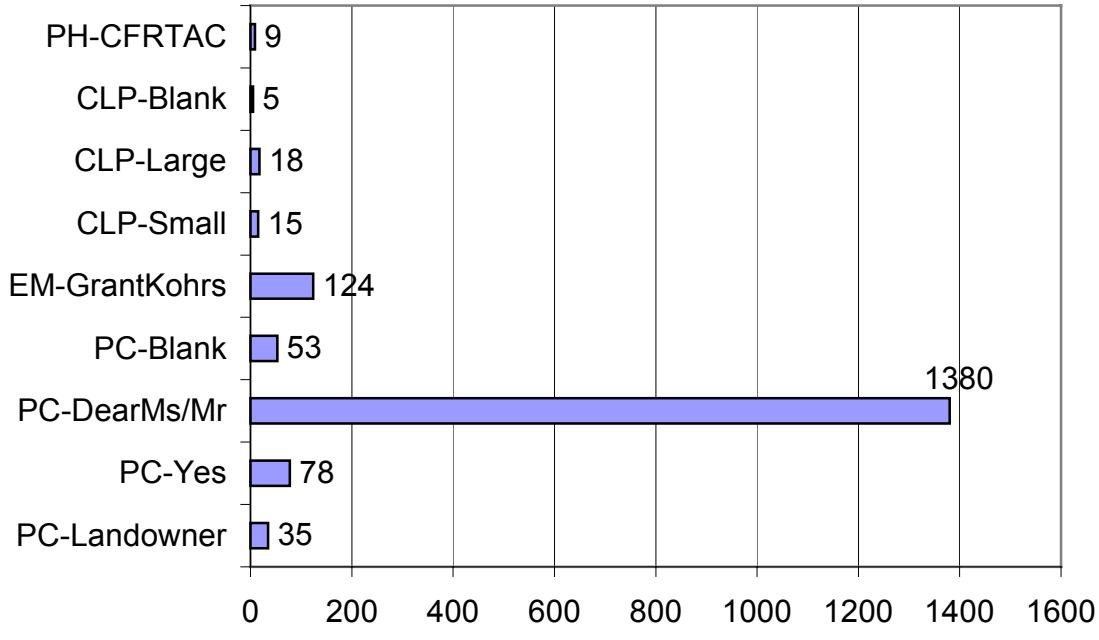
1.1.1 Form Letters and Public Testimony (Comments) Received

The form letters were grouped by the content of the postcard or e-mail, as shown below:

- CLP-Blank: Blank, lined newspaper clipping that contains handwriting
- CLP-Large: Large newspaper clipping from (Clark Fork River Technical Advisory Committee (CFRTAC) advertisement
- CLP-Small: Small newspaper clipping from CFRTAC advertisement
- EM-GrantKohrs: Form e-mail that focuses on the Grant-Kohrs Ranch
- PC-Blank: Blank, lined postcards with handwritten comments
- PC-DearMs/Mr: Postcards beginning with an address to "Dear Ms. Thomi and Mr. Brown"
- PC-Landowner: Postcards sent by landowners
- PC-Yes: Postcards beginning with "YES" and a checkbox
- PH-CFRTAC: Phone message left on the CFRTAC public recording

If someone submitted two different kinds of form letters, for example, a Landowner postcard and a "DearMs/Mr" postcard, each postcard was counted. That is, each postcard is counted in its group as two separate comment documents, rather than just one for the person. Exhibit 3-1 shows the number of comment documents received for each of these types.

Exhibit 3-1: Number of Form Letters Submitted (1,717) by Type



Public testimony was heard at two meetings: one in Deer Lodge on September 17, 2002, and one in Missoula on September 19, 2002. At the Deer Lodge meeting, 29 people provided comments. At the Missoula meeting, 33 people provided comments.

1.1.2 Comment Documents by Commenter Type

The authors of comment letters were organized into the following commenter types:

- **ATSDR:** Agency for Toxic Substances and Disease Registry
- **CFB Residents:** Clark Fork Basin Residents—anyone in Butte, Anaconda, Deer Lodge, Garrison, Missoula, Drummond, Clinton, Milltown, and smaller communities
- **Group:** Citizen groups and organizations
- **Local Government:** City and County officials, Conservation District Board
- **Meeting:** Oral comments provided to EPA at meeting or hearing
- **Natural Resources Trustees:** Federal, Tribal, and State Trustees
- **No Address:** People who did not supply an address
- **Others:** All other individuals

Each comment document was tagged with a commenter type, and form letters were counted in the total. Therefore, the total count for each type of document received includes form letters. Exhibit 3-2 presents the numbers of each commenter type by "unique comment document" and by "form letter."

EXHIBIT 3-2
Number of Comment Documents Received by Commenter Type

Commenter Type	Unique Comment Documents	Form Letters	Total Comment Documents
CFB Residents	183	1,317	**1,500**
Others	81	388	**469**
No Address	33	64	**97**
Group	17	4	**21**
Local Government	9	6	**15**
Meeting	3	0	**3**
Natural Resources Trustees	3	0	**3**
ATSDR	1	0	**1**
TOTAL	**330**	**1,779**	**2,109**
Percent of Total	**15.6%**	**84.4%**	**100%**

Exhibits 3-3 through 3-5 display the table information graphically.

Exhibit 3-3: Unique Comment Documents (330) by Commentor Type

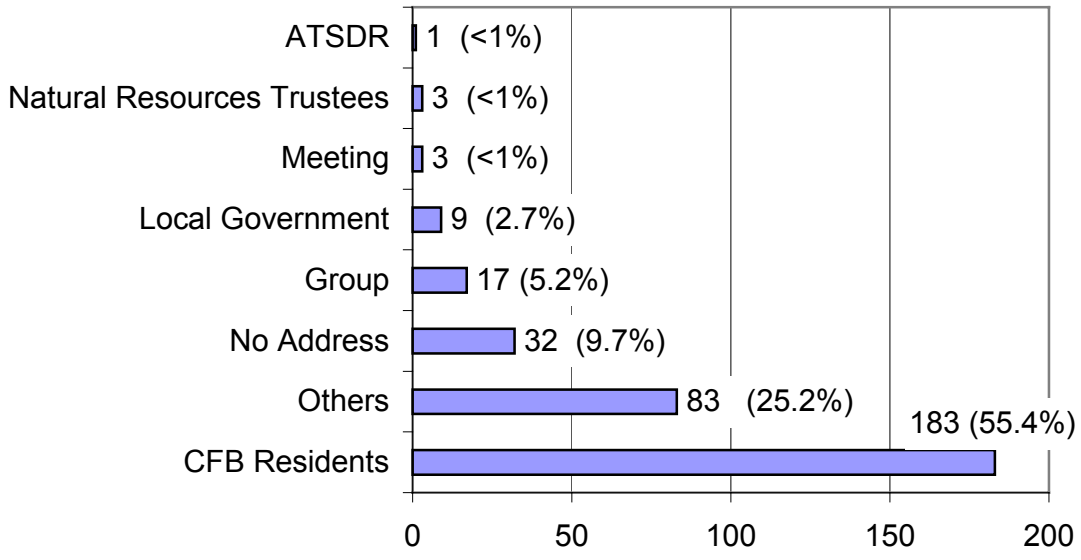


Exhibit 3-4: Number of Form Letters and Public Meeting Participants (1,779) by Commentor Type

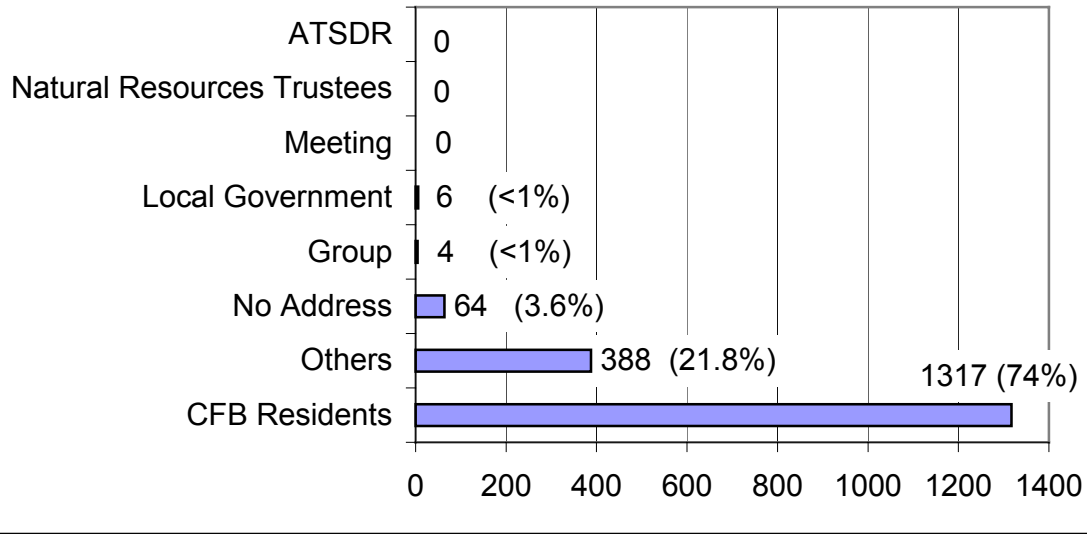
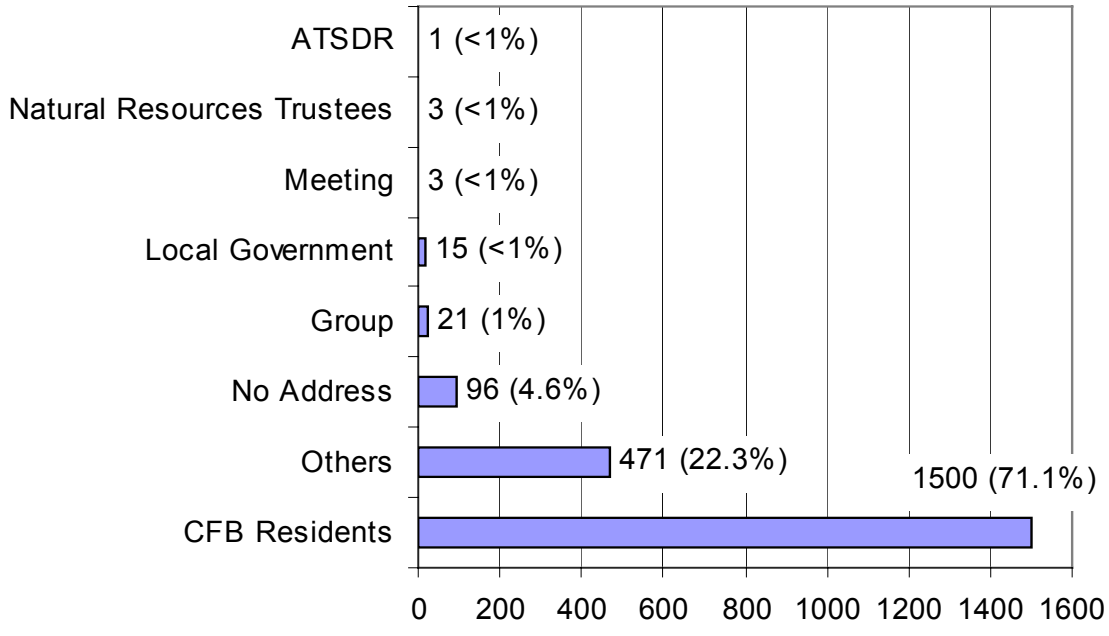


Exhibit 3-5: Total Comment Documents (2,109) by Commentor Type



1.2 Types of Comments Received

All non-PRP comments received during the comment period were categorized as shown in Exhibit 3-6, *Categories and Subcategories Applied to Stakeholder Comments*. Comments within each comment document were numbered and marked for placement with an appropriate category and subcategory, whether it was an e-mail, letter, fax, phone message, or public meeting transcript. These comment documents, with comment number and categorization indicated, are available for viewing in Section 4, *Stakeholder and PRP Categorized Comments*. The table also indicates the number of comments received for each category.

Notable in this analysis of the comments are the 1,629 comments that support the *Proposed Plan* as well balanced and sufficiently protective. Another 161 comments conditionally supported the plan. Thirty-four commenters directly opposed the plan.

EXHIBIT 3-6
Categories and Subcategories Applied to Stakeholder Comments (Excluding the PRP)

Categories	Subcategories	Description	Number of Comments
Technical Categories			
Air Quality	Air quality	Comments about air quality	2
Bank Stabilization/Buffer Zone	General comments	General comments on streambank stabilization and riparian buffer	206
	Remedies	What would happen at banks and in near-channel corridor	133
	Protection of vegetation	Limit use in areas of riparian woody vegetation for protection	4
	Buffer zone too narrow	Width of the buffer zone is too narrow	1,556
	Buffer zone too wide	Width of the buffer zone is too wide	6
	Concern about erosion	Comments about erosion	11
Best Management Practice (BMPs)	Grazing	BMPs for grazing	29
	Other land use management issues	Other BMPs	155
Costs	Cost of remedy	Cost of remedy	8
Ecological Health Risks	Terrestrial vegetation	Risks to terrestrial vegetation	2
	Livestock and wildlife	Risks to livestock and wildlife	3
	Soil organisms	Risks to soil organisms	1
	Fish/aquatic life	Risks to fish and other aquatic life	13
	Threatened and endangered species	Risks to threatened and endangered species	1
Floodplain Stability	Fluvial geomorphology issues	Floodplain stability and fluvial geomorphology issues	2
Groundwater Quality	Copper and other metals	Impact of copper and other metals on groundwater quality	3
	Arsenic	Impact of arsenic on groundwater quality	2
	Other constituents	Other constituents that affect groundwater quality	1
Human Health Risks	Residential	Residential risks	13
	Rancher and farmer	Agricultural rancher/farmer risks	1
	Recreational and Tribal	Recreational risks and risks to Tribal members in traditional cultural practices	5
Impacts During and After Remedy	Human safety and health	Traffic and dust affecting residents and construction workers	143
	Roads	Impact of roads on the environment	7

EXHIBIT 3-6
Categories and Subcategories Applied to Stakeholder Comments (Excluding the PRP)

Categories	Subcategories	Description	Number of Comments
	Ecological health	Impacts of implementation on ecological health	4
	Sequencing of construction activity	How construction will proceed	3
	Time required for construction	Length of construction period	16
	Construction monitoring	How construction will be monitored	3
	Post-construction monitoring	Post-construction monitoring and maturation of vegetation	151
	Operations and maintenance (O&M)	Ongoing O&M of remedy	1
In-situ Treatment/Phytostabilization	Extent	Extent of application of in-situ treatment and phytostabilization	3
	Vegetation success	Willows and other vegetation	18
	Re-entrainment	Re-entrainment of treated contaminants	1
	Arsenic mobilization	What happens to arsenic if in-situ treatment is applied	1
	Effectiveness	Effectiveness of in-situ treatment	29
Institutional Controls (ICs)	ICs for land use management	Comments about ICs	14
Natural Recovery/Natural Healing	Natural recovery effectiveness	Comments about natural recovery and healing	11
Non-Floodplain Lands	Historically irrigated fields	Irrigated fields outside of the floodplain	3
Noxious Weeds	Noxious weeds/invasive plant species	Concerns about these plants	186
Permanence	Long-term permanence	Permanence of remedy	15
Reaches B and C and Tributaries	Reaches B and C and Tributaries	Comments about reaches B and C and tributaries	25
Removal/Excavation	Effectiveness	Effectiveness of Removal	11
	Extent	Extent of removal	175
	With backfill	How much backfill is used	3
	Without backfill	No backfill used	1
Riparian Evaluation System (RipES)	Further development	How CFR RipES is developed	1,556
	Application in the field	How CFR RipES is implemented	3

EXHIBIT 3-6
Categories and Subcategories Applied to Stakeholder Comments (Excluding the PRP)

Categories	Subcategories	Description	Number of Comments
Surface Water Quality	Copper and other metals	Impact of copper and heavy metals on water quality	3
	Arsenic	Impact of arsenic on surface water quality	1
	Other constituents	Other constituents that affect surface water quality	2
Non-Technical Categories			
Access	Access to land by landowners	Access during and after remedy implementation for owners	3
	Recreation access and use river	Access during and after remedy implementation for recreation	3
ARARs	Compliance	ARARs compliance	4
	Waivers	ARARs waivers	10
	Park Service Organic Act	Relationship of ARARs to Park Service Organic Act	126
General Comments	General comments	No technical response needed because comment is an opinion	141
Consistency with Guidance	Consistency w/ NCP guidance	Consistency with NCP guidance	38
Economic Development	Effects on local economy	How remedy will affect economic development of area	19
Enforcement of BMPs	BMP enforcement on private land	How enforcement of BMPs will work	3
Landowner Compensation	Compensation for lost use of land	Landowner compensation for lost use of land	306
Landowner Involvement	Mandatory cleanup	Cleanup should be mandatory regardless of landowner desires	18
	Optional cleanup	Cleanup should be optional, allowing landowner choice	1
	Property rights	What rights landowners have	17
	Design/Land Use	Landowner/EPA negotiations	1,649
Opinion of Plan	Fully support plan	Commenter fully supports plan	1,629
	Conditionally support plan	Commenter conditionally supports plan	161
	Needs more information	Commenter needs more information to support/oppose plan	17
	Oppose plan	Commenter opposes plan	34

EXHIBIT 3-6
Categories and Subcategories Applied to Stakeholder Comments (Excluding the PRP)

Categories	Subcategories	Description	Number of Comments
Proposed Plan Remedy	Differences RRB vs. Plan	Differences between the Remedy Review Board (RRB) and Proposed Plan Remedies	1
	Additional study requests and Feasibility Study issues	Why the preferred remedy was selected	5
	Needs more investigation	Remedy needs further study or evaluation	3
Restoration	Restoration vs. remediation	Remediation is under Superfund; restoration is State and Federal Natural Resource Damages Program	6
State and Local Acceptance	Degree of State and local acceptance	Comments about State and local acceptance	3
Unrelated Comment	Out of scope; no response required	Comment was on an unrelated topic – no response needed	18
Water Rights	Transfer/use	Obtaining water rights for project	3

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2 Stakeholder Issues and Lead Agency Responses

The analysis method used by EPA provided a means of categorizing (and thereby separating) comments into common topics, then grouping similar comments together so that stakeholder's comments could be thoroughly and efficiently examined. To accomplish this, EPA analyzed and responded to comments using a four-step process:

- First, EPA identified technical and non-technical comment categories and subcategories after reviewing comment documents.
- Second, EPA assigned individual comments within each piece of correspondence a comment number, category, and subcategory (see Exhibit 3-6, page 3-6, for a list of categories and subcategories). A total of 8,764 separate comments were identified in the 2,109 pieces of correspondence received (not including the PRP).
- Third, EPA viewed the comments for each subcategory as a group and summarized the range of issues represented by the comments.
- Finally, EPA, in consultation with DEQ, wrote a response for each subcategory of comments.

This section is organized alphabetically by category. The subcategories are listed under each category. Within each subcategory, a summary of the comments is provided, along with the lead agency's response. The original comment documents, with comments marked and category indicated, are provided in Section 4, *Stakeholder and PRP Categorized Comments* (page 3-137).

2.1 Technical Categories

2.1.1 Air Quality

2.1.1.1 Air Quality

Summary of Comments

Of the comments received in this category, one individual felt that air quality risks from construction and implementation were negligible and could easily be mitigated by water trucks, and that the overall goal of restoring water quality is more important. Another commenter believed that construction would create huge dust clouds, contaminated with metals and arsenic, and would pose significant human health risks that should be analyzed more thoroughly before proceeding.

Response

The Selected Remedy for the Clark Fork River will be applied in a progressive manner throughout the Deer Lodge Valley. As with any construction project, it is anticipated that

localized dust will be generated, particularly during the drier periods of the year. Most of the excavation work will be near the river, within the 100-year floodplain, and away from local structures and residents. Precautions to reduce dust levels, such as keeping roads moist, will be implemented as part of the site activities. The likelihood of fugitive dust and air impacts is unlikely. Construction Best Management Practices (BMPs) will be used throughout the remedial work to assure that the generation of contaminated dust and inhalation exposure is minimized.

Additionally, EPA believes the risks posed by construction dust are not significant. The *Baseline Human Health Risk Assessment* (EPA 1998) performed an evaluation of farming and ranching field activities (such as plowing and tilling) that generate substantial levels of soil and dust and could lead to inhalation exposure. It was concluded that the inhalation risk (for arsenic) was small when compared to the risk posed by ingestion, and that the exposure pathway did not warrant quantification.

2.1.2 Bank Stabilization/Buffer Zone

2.1.2.1 General Comments

Summary of Comments

Comments within the bank stabilization/buffer zone general comments category were quite diverse. Most commenters in this subcategory assumed that a buffer zone of some sort will be a remedy component. One person asked if EPA could provide an example of another river system with similar problems that were solved in the same way as proposed through a 50-foot buffer zone. Many commenters felt that implementation of the zone would be key to success of the remedy.

Several commenters questioned the size of the zone. Specific comments about the width of the zone are addressed in later sub-categories within this category. In the general comments, some commenters questioned how EPA determined the proposed width. Two people said that the 50-foot width is arbitrary and should be flexible for site-specific conditions. These commenters believe that a one-size-fits-all approach would be inappropriate. One commenter asked that the final buffer zone selected be based on science and account for stream hydrology and avoidance of contaminated areas in the future.

Many commenters want to make sure the remedy results in a healthy riparian plant community that can be protected for long-term stability. Most of these commenters indicated that using plants to stabilize the bank and reduce erosion would be the preferred approach, and asked that EPA use as little rock rip-rap as possible. One commenter agreed that mature willows, planted 3 feet deep, would be a good strategy for streambank stabilization, but wanted assurance that funding would be available if the first planting failed and additional plantings were needed. In addition, the commenter requested a contingency plan for the possibility of large flood events during the implementation of the remedy, and for some specified period of time after planting—at least 10 years.

Some commenters questioned the need for a riparian buffer zone and bank stabilization and asked for a detailed description and rationale for this component.

A few commenters were concerned about the use of willow plantings for a number of reasons. Such reasons included concerns that willow plantings would change the course of the river, willows would not be compatible with current land use practices, willows would

not survive far from the river, or willows would use too much water from the Clark Fork River and contribute to dewatering the river.

One commenter specifically mentioned the work of Dr. Jim Smith of the U.S. Geological Survey (USGS). This commenter asked that EPA's plan be combined with Dr. Smith's research and consultation, which differs from the approach at the Atlantic Richfield Company's demonstration areas.

Another specific request was that for areas where meander bends are close to natural avulsions, bank stabilization techniques should be used to reduce the chance of streambank erosion and re-entrainment of contaminated soils from the floodplain. The commenter also asked EPA to consider establishing woody vegetation strips perpendicular to the slope of the meander belt in order to trap sediment and limit avulsion. The commenter suggested that these could potentially be associated with off-channel sediment detention ponds.

Individuals who commented on land use in the buffer zone ranged from asking that all grazing be excluded and no development allowed, to asking that no land uses be excluded and landowners should use the land in the riparian zone as they choose. Some commenters suggested riparian exclosure fencing. Others felt that a landowner compensation component would be needed if land uses are excluded. A few commenters suggested that conservation easements or outright purchase of the riparian buffer zone would be the best approach.

Response

During the *Remedial Investigation/Feasibility Study* (RI/FS), the USGS and the Fluvial Geomorphology Committee prepared several reports for EPA stating that there is clear evidence of floodplain instability on the Clark Fork River because of the release of hazardous material on the floodplain from mining activities. This is demonstrated primarily by available data that shows high erosion rates and frequent meander and tab changes and washouts. The primary cause of this excessive erosion is the lack of vegetation along the streambank, which in turn is caused, primarily, by the phytotoxic effects of mine contamination on vegetation (Atlantic Richfield Company 1998, *Final Draft Remedial Investigation Report;* EPA 1999, *Ecological Risk Assessment for the Clark Fork River;* Atlantic Richfield Company 2002, *Feasibility Study Report;* EPA 2002, *Proposed Plan*). Therefore, accelerated erosion of streambanks poses a threat to the environment, and this condition is primarily the result of a lack of adequate vegetation.

Excessive streambank erosion releases substantial quantities of copper and other metals and arsenic into the river, which causes violations of the State of Montana water quality standards. During normal hydrologic events, approximately 60 percent of the copper loading to the river is from streambank erosion (see Exhibit 3-7, *Sources of Copper in Surface Water [at Turah, 1998]*). The erosion also causes the loss of productive land to private and public landowners along the river.

These high levels cause exceedances of State of Montana water quality standards and are a significant concern. The proposed remedy must address this issue according to the CERCLA law, which requires Applicable or Relevant and Appropriate Requirements (ARARs) to be met by remedy implementation. Streambank erosion is also a major source of copper in the river that causes an unacceptable chronic risk to the aquatic environment and fish as described in the *Proposed Plan* (EPA 2002) and *Ecological Risk Assessment* (EPA 1999).

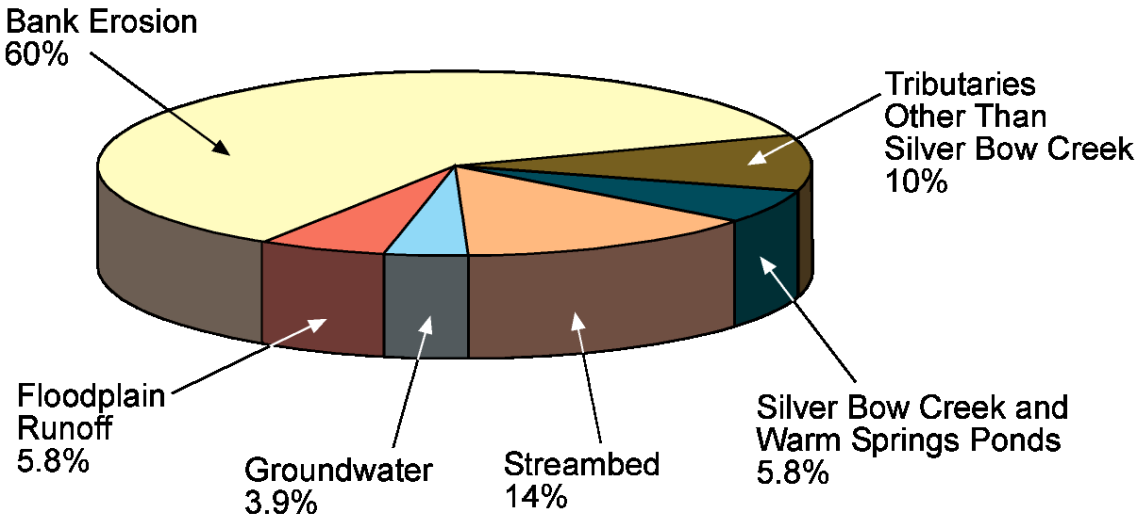

EXHIBIT 3-7
Sources of Copper in Surface Water (at Turah, 1998)

EPA's remedy includes an approximate 50-foot streambank stabilization component designed to develop a properly functioning, healthy riparian zone in response to this concern. The approximate 50-foot streambank stabilization component developed for the Clark Fork River by EPA is judged to be crucial for addressing overall protection of the environment. It addresses sediment copper loading, erosion risks, and exposure pathways. The approximate 50-foot width of the buffer zone is an ecologically based compromise. See further discussion of this issue in Section 2.1.2.4, page 3-20.

In general, healthy riparian areas provide for at least eight key ecological functions (Hansen et al. 1995, Hansen et al. 2000, Adams and Fitch 1998, Fitch and Ambrose 2003):

1. Trap and store sediments
    a) Sediment adds to and builds soil in riparian areas.
    b) Sediment aids in the ability of soils to hold and store moisture.
    c) Sediment can carry contaminants and nutrients—trapping it improves water quality.
    d) Excess sediment can harm aquatic animals like fish and insects.

2. Build and maintain streambanks
    a) Erosion is balanced with streambank building—the effects of erosion are reduced by adding streambanks elsewhere.
    b) Increase stability, resilience, and recovery.
    c) Maintain or restore profile of channel—extends width of riparian area through higher water tables.

3. Store water and energy
    a) Watershed safety valve—storage of high water on the floodplain during floods.
    b) Reduce flood damage by slowing water and reducing erosion.
    c) Slow floodwater allowing absorption and storage in underground aquifer.

4. Recharge aquifers
    a) Store, hold, and slowly release water.
    b) Maintain surface flows in rivers, streams, and wetlands through storage and slow release.
    c) Maintain high water table and extend width of productive riparian area.

5. Filter and buffer water
    a) Reduce amount of contaminants, nutrients, and pathogens reaching the water.
    b) Uptake and absorption of nutrients by riparian plants.
    c) Trap sediment, reduce water quality issues, and enhance amount of vegetation to perform filtering and buffering function.

6. Reduce and dissipate energy
    a) Reduce water velocity, which slows erosion and sediment transport.
    b) Resist erosion and slow channel movement.
    c) Aid in sediment capture.

7. Maintain biodiversity
    a) Create and maintain habitats for fish, wildlife, invertebrates, and plants.
    b) Connect other habitats to allow corridors for movement and dispersal.
    c) Maintain a high number of individuals and species.

8. Create primary productivity
    a) Vegetation diversity and age-class structure creates links to other riparian functions.
    b) Provide shelter and forage values.
    c) Enhance soil development.
    d) Capture and recycle nutrients.

Geomorphic stability is characterized by a dynamically stable floodplain that allows for lateral adjustment through normal streambank erosion and bar building. A necessary component of an equilibrium channel and floodplain are mobile channel boundaries that reflect a balance between the basin hydrology, geology, and climate. Typically, in alluvial geomorphic equilibrium systems, the streambank stability is provided by well-vegetated streambanks that are characterized by the presence of a deep, binding rootmass. Therefore, the long-term goal of the streambank stabilization component is to achieve well-vegetated streambanks with deep, binding rootmass that allow for gradual streambank change over time.

Peak flow data from the gage at Deer Lodge indicate that geomorphic and hydrologic conditions in the Upper Clark Fork Basin are now such that a bankfull flow recurs approximately every 7 years in the Deer Lodge Valley. This is the stage of flow that is most formative in establishing channel size and shape; that is, this stage has the greatest power to erode the streambanks. Broad, non-entrenched valleys such as this greatly dissipate the fluvial energy of flood flows that surpass the bankfull stage because the volume and energy of overbank flooding spreads out over a wide area, instead of increasing depth and velocity.

Most, but not all, riparian areas support woody vegetation (trees and shrubs). Trees and shrubs have an important and key role in riparian health. Their root systems generally are excellent streambank stabilizers and play a key role in the uptake of nutrients that could

otherwise degrade water quality. The canopies formed by trees and shrubs protect soil from erosion, provide shelter to livestock and wildlife, and modify the riparian environment. Even when dead, the trunks of woody vegetation provide erosion protection and structural complexity, which plays a role in stabilizing floodplains. A good indicator of the ecological stability of a riparian reach is the presence of woody vegetation in all age classes, especially young age classes. Without signs of regeneration of preferred woody vegetation (those species that contribute most to riparian condition and stability), the long-term stability of the stream reach is compromised.

Currently, Reach A of the Upper Clark Fork River is characterized as a shrub-dominated system with trees playing a limited role. During the *Remedial Investigation* (Atlantic Richfield Company 1998) and the *Feasibility Study* (Atlantic Richfield Company 2002), it was determined that prior to European settlers, the Upper Clark Fork River Valley was a beaver-influenced system dominated by numerous beaver ponds and dams. The river corridor was dominated by shrubs such as willows (*Salix* species), water birch (*Betula occidentalis*), mountain alder (*Alnus incana*), red-osier dogwood (*Cornus stolonifera*), common chokecherry (*Prunus virginiana*), and western serviceberry (*Amelanchier alnifolia*). Trees, such as black cottonwood (*Populus trichocarpa*) and quaking aspen (*Populus tremuloides*) were limited in extent, mostly associated with the higher gradient tributaries of the Upper Clark Fork River. These species will be replanted in the streambank stabilization zone.

EPA's approximate 50-foot streambank stability component relies on extensive use of shrub planting to stabilize streambanks, which will slow the rate of erosion to more natural levels. It is important to remember that the woody vegetation is the glue that holds the streambanks together. With this in mind, all streambanks will need to have deep, binding, woody vegetation along them. One must think of the upper Clark Fork River floodplain as one unit. The river and its floodplain are inseparable. The natural movement of a river is to move back and forth across its floodplain over time. This means that through time, meanders are naturally cut off. However, the wide-spread presence of mine contaminants has accelerated this rate of movement above the natural background levels for the upper Clark Fork River and its floodplain. Therefore, it is critical to both establish and maintain woody vegetation throughout much of the meander tabs and not just along the outside of current meander bends. The woody vegetation on meander tabs will also reduce overland erosion and help stabilize the tabs so that meander cutoffs do not occur at an accelerated rate. This is critical for establishing both short- and long-term geomorphic stability along the upper Clark Fork River.

Temporary irrigation water to ensure survival of the revegetation efforts will be obtained. Plantings of willows and other species will be to a depth that reaches groundwater during sufficient periods during the growing season. EPA believes additional water demand placed on the river system by enhanced vegetation, such as willows, can be achieved with no harmful effects on existing water users.

Phytotoxic soils within the streambank stabilization component will be either removed and replaced with appropriate soil or treated in-place. (The Selected Remedy is described in Part 2, *Decision Summary*, Sections 13.2 and 13.3.) There is a strong desire to leave existing woody vegetation undisturbed and to improve poorly vegetated streambank areas because of the importance of vegetation in preventing erosion, channel migration, and floodplain

destabilization. All construction activities will apply construction BMPs to protect healthy vegetation and the river.

The use of rock toes or rip-rap (large rock) will be minimized. In a stable natural system, the rate of lateral migration is typically low. A rip-rapped bank is static and cannot move with the river as it migrates naturally across its floodplain. Using rip-rap extensively would forever change the upper Clark Fork River Valley. The goal is to develop a self-maintaining, self-regulating floodplain by establishing a riparian buffer zone of woody vegetation. During the remedial design phase, certain areas may be identified by the design professional that require a more rigorous defense than vegetation alone is capable of providing. Examples would include protection of public infrastructure or streambanks subject to high stress where little or no riparian vegetation exists. In these areas, limited, targeted use of rock in conjunction with vegetation elements of the riparian buffer zone may be appropriate.

All remediated lands will be protected in such a fashion to allow adequate establishment and growth of new vegetation. Once the required amount and type of vegetation has become established, the land will be brought back into normal land use activities as described by a management plan written with landowner participation for each property. The land will be monitored to ensure adequate growth and establishment of the vegetation, especially the woody vegetation along the streambank. The use of grazing BMPs is discussed in Part 2, *Decision Summary*, Section 13.9. Performance standards must be met 10 years after remedial treatment and at interim intervals before that to ensure the site is on a revegetation trajectory to reach compliance (see Part 2, *Decision Summary*, Section 13.11.1).

Riparian pastures will be established throughout the floodplain. A riparian pasture can allow for forage use by livestock while reducing impacts to woody vegetation. Once the remediation and revegetation has been implemented, the riparian zone is expected to produce a much greater amount of forage than it currently produces. A riparian pasture with an appropriate level of use can provide the best of both worlds—herbaceous forage production for the landowner and maximum growth of woody vegetation to protect against erosion, soil loss, and floodplain instability. The appropriate livestock use levels will be determined and will follow those outlined in the documents by Hansen 1993, Hansen 1994, Ehrhart and Hansen 1997, and Ehrhart and Hansen 1998. Additional information on grazing in riparian zones can be found in articles by Hansen et al. 1995, Hansen et al. 2000, Adams and Fitch 1998, Fitch and Ambrose 2003, and by the Montana Department of Natural Resources Conservation (DNRC) 1995, 1999, and 2001. For bank stabilization, the key to success will be to base management responses on monitored levels of woody vegetation use, not on use levels of herbaceous vegetation.

During the design phase of the remedial action, a construction sequencing plan will be prepared. The priority of activities that will be enacted within a specific parcel of property as described in Part 2, *Decision Summary*, Section 12.2. The sequence of properties to be remediated throughout the Deer Lodge reach will be carefully planned and prepared. Properties will be engaged in a discontinuous manner to prevent jeopardizing the integrity of the floodplain, should a flood event greater than the annual flood occur during the 10-season remedial action period. Regarding high water events, the construction activities will be planned and conducted to the extent practical in concert with continuing awareness and

evaluation of anticipated hydrologic changes (particularly high runoff that could cause overbank flows).

The approximate 50-foot streambank stabilization component developed by EPA is judged to be crucial for addressing overall protection of the environment. EPA believes the streambank revegetation component of the remedy will reduce erosional rates to levels that will address the potential for environmental risk in the river from flood events and mine contaminants that may be left in place in the remedy, and lessen the loss of land to normal erosional ranges experienced by other Montana landowners. It will also reduce the impact of very large flood events such that these events will not produce widespread floodplain destabilization. EPA also believes that a greatly expanded woody riparian corridor would be less implementable, as it would cause more disruption with landowners current operations. For a discussion of the issues regarding the proposed width of the buffer zone, please see Section 2.1.2.4, page 3-20.

Streamside buffers are widely used to reduce sedimentation and erosion problems along streams. Therefore, EPA believes the approximate 50-foot streambank stabilization component of the proposed remedy is implementable, protective, and practical. EPA's normal CERCLA authorities allow EPA to direct additional remediation if events occur, such as flooding, that exacerbate the release of hazardous substances. Because of these authorities, EPA does not see a need to include contingency components for bank stabilization if flooding occurs.

2.1.2.2 Remedies

Summary of Comments

While a few commenters advocated the use of large rock rip-rap to stabilize the streambank, many felt that a more natural remedy involving native vegetation would be more appropriate. One commenter felt that any revegetation approach to streambank stabilization needs to be accompanied by removal of tailings, significant re-shaping of banks, and heavy use of erosion control matting. Another was concerned about how the bank stabilization material would be transported along both banks of the river for up to 50 miles. A common theme in the comments was the desire for all landowners to participate to stabilize streambanks to ensure that future contamination would not be a problem.

Response

See previous response in Section 2.1.2.1, page 3-12, for a more detailed discussion. In general, most, but not all, riparian areas support woody vegetation (trees and shrubs). Trees and shrubs have an important and key role in riparian health. Their root systems generally are excellent streambank stabilizers and play a key role in the uptake of nutrients that could otherwise degrade water quality. The canopies formed by trees and shrubs protect soil from erosion, provide shelter to livestock and wildlife, and modify the riparian environment. Even when dead, the trunks of woody vegetation provide erosion protection and structural complexity, which plays a role in stabilizing floodplains.

EPA's approximate 50-foot streambank stability component relies on extensive use of shrub planting to stabilize streambanks that will slow the rate of erosion to more natural levels. It is important to remember that the woody vegetation is the glue that holds the streambanks together. With this in mind, all streambanks will need to have deep, binding, woody

vegetation along them. It is critical to both establish and maintain woody vegetation throughout much of the meander tabs and not just along the outside of current meander bends. The woody vegetation on meander tabs will also reduce overland erosion and help stabilize the tabs so that meander cutoffs do not occur at an accelerated rate. This is critical for establishing both short- and long-term geomorphic stability along the upper Clark Fork River. Phytotoxic soils within the streambank stabilization component will be either removed and replaced with appropriate soil or treated in-place. There is a strong desire to leave existing woody vegetation undisturbed and to improve poorly vegetated streambank areas because of the importance of such vegetation in preventing erosion, channel migration, and floodplain destabilization. All construction activities will use construction BMPs to protect healthy vegetation and the river. BMPs will be done in close consultation with landowners. They will specifically be carefully applied in designing, constructing, and reclaiming roads on private lands that are needed to access areas of contaminated land and streambanks.

The use of rock toes or rip-rap (large rock) will be minimized. The goal is to develop a self-maintaining, self-regulating floodplain by establishing a riparian buffer zone of woody vegetation (see Response in Section 2.1.2.1, page 3-12).

2.1.2.3 Protection of Vegetation

Summary of Comments

Commenters had varied opinions about how the buffer zone should be used to protect riparian vegetation. While one commenter supported the idea that the riparian buffer zone still allows for grazing and weed control, another wanted all grazing uses removed and a fund established to maintain riparian fences in perpetuity. Another simply asked EPA for more detail about how grazing would be controlled until the vegetation is established. Another commenter asked that the remedy focus on restoring soil health so that vegetation could be supported.

Response

See response in Section 2.1.2.1, page 3-12, for a more detailed discussion. All remediated lands will be protected in such a fashion to allow adequate establishment and growth of new vegetation. The land will be monitored to ensure adequate growth and establishment of the vegetation, especially the woody vegetation along the streambank. Once this re-vegetation has met all applicable performance standards, the land will be brought back into the normal land use activities in accordance with management plans written for each property. Part 2, *Decision Summary*, Section 13.11, describes specific requirements and limitations for vegetation and grazing. Section 13.9.3, also in Part 2, *Decision Summary*, describes fencing maintenance and fencing requirements.

Once the remediation and revegetation has taken place, the riparian zone is expected to produce a much greater amount of forage than it currently produces. A properly managed riparian pasture can provide both herbaceous forage production for the landowner and maximum growth of woody vegetation to protect against erosion, soil loss, and floodplain instability. Appropriate livestock use levels will be determined and will follow those outlined in the documents by Hansen 1993, Hansen 1994, Ehrhart and Hansen 1997, and Ehrhart and Hansen 1998. Additional information on grazing in riparian zones can be found in articles by Hansen et al. 1995, Hansen et al. 2000, Adams and Fitch 1998, Fitch and

Ambrose 2003, and in DNRC 1995, 1999, and 2001. For bank stabilization, the key to success will be to monitor the use levels of the woody vegetation and not the use levels on the herbaceous vegetation. See Section 2.1.3.1, page 3-23, for more discussion about grazing issues. For a more detailed discussion, see Part 2, *Decision Summary*, Section 13.9.1.

Control of invasive plants will be an integral and critical component of remediation. An aggressive campaign to control weeds already on a site will be undertaken concurrently with any other remedial work being performed. For a more detailed discussion, see Part 2, *Decision Summary*, Section 13.10.

Native species or carefully chosen non-invasive introduced species will be used so that "vacant" or bare ground is quickly occupied by desirable plants. All sites will be monitored and treated for 5 years for weed infestations, as part of the post-construction monitoring process.

2.1.2.4 Buffer Zone Too Narrow

Summary of Comments

The approximate 50-foot buffer zone was considered either barely adequate or too narrow by most commenters. Many suggested expanding the zone to adequately stabilize the river, and their suggestions ranged widely, from 75 feet, 80 feet, 100 feet, 150 feet, 300 feet, 400 feet, and up to 600 feet. Other specific suggestions included increasing the riparian buffer zone to 400 feet upstream of Deer Lodge and to 300 feet downstream of Deer Lodge. Some suggested that the buffer should include as much of the floodplain as possible.

Some commenters argued that the riparian buffer zone width should be flexible. According to these commenters, the width should be determined by stream channel characteristics such as sinuosity, floodplain width, and channel slope that follows the natural contours of the landscape as it relates to the shape and natural meander of the river.

Response

The width of the streambank stabilization component (that is, the streambank and riparian corridor buffer) was based upon both the ecology of riparian plant species and the work of Dr. Jim Smith of the USGS. According to Griffin and Smith (2001), the Clark Fork River is vulnerable to high rates of streambank erosion as a result of extreme thinning of woody vegetation. They also stated that the presence of dense, woody vegetation on streambanks can decrease erosion substantially both by reducing the shear stress along the bases of the streambanks and by reinforcing the cohesion of the soil that forms the streambanks.

In a streambank stabilization demonstration project, Dr. Smith suggested that a series of rows of woody vegetation are needed to protect the streambank from excessive erosion rates. If the buffer zone is too small (for example, one or two rows of woody vegetation), the streambank is vulnerable to excessive erosion rates and is not protected by multiple rows of woody vegetation. Dr. Smith suggests that a minimum of four to five rows of woody vegetation will provide sufficient protection to effectively reduce the susceptibility of the streambank to excessive erosion rates.

Griffin and Smith (2001 and 2002), and Smith and Griffin (2002) stress the need for overlapping canopies of woody vegetation to have a density of plants great enough to effectively reduce excessive erosion rates. With this in mind, EPA developed the streambank

stabilization component based on a buffer zone of approximately 50 feet that would have at least 10 to 12 rows of various woody vegetation (for example, clonal and multiple-stemmed shrubs) providing streambank stabilization.

Dr. Smith, in his November 2001 letter, criticized EPA's streambank stabilization component as insufficient to address the postulated unraveling event. Dr. Smith's concern was that the zone only addressed streambanks and not the floodplain, therefore, he proposes additional woody vegetation and land use restriction over a broader area than is contained in EPA's remedy.

EPA acknowledges this concern and acknowledges that the remedy does not fully address Dr. Smith's postulated unraveling event. However, EPA strongly disagrees that the remedy will not address the demonstrated erosional problems along the Clark Fork River. (See response under Section 2.1.2.1, page 3-12, for a more detailed discussion.) The approximate 50-foot streambank stabilization component developed by EPA is judged to be crucial for addressing overall protection of the environment. EPA believes the streambank revegetation component of the remedy will reduce erosional rates to levels that will address the potential for environmental risk in the river from flood events and mine contaminants that may be left in place in the remedy, and lessen the loss of land to landowners to normal erosional ranges experienced by other Montana landowners. It will also positively influence the very large flood events such that these events will not produce widespread floodplain destabilization (that is, floodplain unraveling). EPA also believes that an expanded woody riparian corridor would be less implementable, as it would cause greater disruption of some landowners' current operations.

Finally, many landowners stated that the riparian buffer zone should be flexible to address site specific conditions. EPA agrees with the commenters that specific landowner needs or land conditions may require flexibility in the approach. Accordingly, the *Record of Decision* notes that the approximate 50-foot streambank stabilization buffer zone component is approximate, and can be varied on a property-by-property basis. Therefore, EPA believes the approximate 50-foot streambank stabilization component of the proposed remedy is implementable, protective, and practical, given the requirement by EPA to select implementable remedies under the Superfund program.

2.1.2.5 Buffer Zone Too Wide

Summary of Comments

Comparatively few commenters indicated that the approximate 50-foot riparian buffer zone was too wide, as compared to those who felt it was too narrow. Those commenters favoring a more narrow zone felt that a 50-foot buffer would adversely affect normal ranching operations. One commenter stated that there are many places where the river has recovered on its own without a 50-foot wide buffer of willows.

Response

See previous responses in Section 2.1.2.1, page 3-12, and Section 2.1.2.4, page 3-20, for additional related discussion.

As noted in the previous response, EPA agrees that some flexibility is appropriate for the buffer zone, and will work with landowners on a site-by-site basis to determine the exact

width of the buffer zone. Therefore, EPA believes the approximate 50-foot streambank stabilization component of the proposed remedy is implementable, protective, and practical.

2.1.2.6 Concern About Erosion

Summary of Comments

Most commenters in this subcategory were concerned about the erosion of contaminated materials into the river, especially during remediation work on the streambanks. They wanted measures taken to reduce the possibility of erosion during the streambank work and for up to 10 years after the streambank work or until the vegetation is well established. One commenter did not feel that the use of willows will stop the river from meandering. Another commenter did not want a lot of willows along the river, as it will reduce the ability to see the river.

Response

See response in Section 2.1.2.1, page 3-12, for additional related discussion.

Geomorphic stability is characterized by a dynamically stable floodplain that allows for lateral adjustment through normal streambank erosion and bar building. Typically, in alluvial geomorphic equilibrium systems, the streambank stability is provided by well-vegetated streambanks that are characterized by the presence of a deep, binding rootmass. Therefore, the long-term goal of the streambank stabilization component is to achieve well-vegetated streambanks with deep, binding rootmass that allow for gradual streambank change over time.

EPA's approximate 50-foot streambank stability component relies on extensive use of shrub planting to stabilize streambanks that will slow the rate of erosion to more natural levels. It is important to remember that the woody vegetation is the glue that holds the streambanks together. With this in mind, all streambanks will need to have deep, binding, woody vegetation along them.

EPA is acutely aware of the need to prevent the re-introduction of sediment from streambanks during remedial activities and the streambank stabilization process. Construction practices that incorporate safeguards and BMPs (such as the use of silt curtains, sediment barriers, etc.) will be implemented. EPA will coordinate these activities with the U.S. Fish and Wildlife Service (FWS). Construction activities will be closely monitored by EPA as will downstream water quality.

During remedial design, a construction sequencing plan will be prepared. The priority of activities that will be enacted within a specific parcel of property is described in Part 2, *Decision Summary*, Section 12.2. The sequence of properties to be remediated throughout the Deer Lodge reach will be carefully planned and prepared. Properties will be engaged in a discontinuous manner to prevent jeopardizing the integrity of the floodplain, should a flood event greater than the annual flood occur during the 10-season remedial action period.

A willow-lined river corridor that provides a stable floodplain will unavoidably impair the view of the river in some locations. However, the structural diversity provided by a combination of pastures and shrubs favors species diversity and increases wildlife values, further adding to the attractiveness of the landscape.

2.1.3 Best Management Practice (BMPs)

2.1.3.1 Grazing

Summary of Comments

Most commenters in this subcategory favored allowing some limited, careful livestock usage of the remediated areas under BMP guidelines with monitoring and enforcement provisions made. Some preferred that all livestock use be excluded from the streamside riparian buffer zone, but agreed reluctantly that BMPs are necessary if the streamside riparian buffer zone must be grazed. Some who favor BMP employment spelled out more specific suggestions and concerns. A common suggestion was that all grazing be excluded from the riparian buffer zone until woody vegetation is well established.

Some commenters did not favor employment of BMPs, favoring instead total exclusion of all grazing from the streamside riparian buffer zone. A few expressed doubt that BMPs can work because typical Montana riparian grazing practices are far too intense for this project.

Two commenters preferred that their grazing access to the floodplain not be limited. Without referring specifically to BMPs one way or the other, they took issue with fencing, fence maintenance, and the long time period required for woody vegetation to reach an effective growth stage.

Other specific comments and suggestions from those in favor of BMP employment included creating land use restrictions based on conditions at certain streambank areas, excluding livestock permanently from some areas, and including Reaches B and C (in addition to Reach A) in these considerations. One commenter was concerned that unrealistic expectations are being created by overstating the ability of the treated areas to tolerate grazing use, and that grazing levels will need to be much lower than they have been historically on many properties. A couple of commenters asked that landowners be compensated for lost uses and for fencing maintenance, while another said that conservation easements from willing landowners would be a good long-term solution. One commenter asked what kind of fence might be installed that would exclude livestock, but allow passage of wildlife.

Response

The development of proper grazing strategies and BMPs is critical to the success of EPA's remedy for the Clark Fork River. These management plans will be landowner-specific, and ensure that revegetated areas—whether the subject of removal of contaminants, in-situ treatment of contaminants, or contaminants left in place—are appropriately managed so that operation and maintenance (O&M) of these areas can occur. This approach will protect important revegetation efforts, minimize risks to the environment, achieve compliance with ARARs, and sustain remedial actions over time. The plans also ensure continued access, at appropriate times, by agency and Atlantic Richfield Company personnel to monitor and maintain the remedy. BMPs for removed areas would likely be less extensive and continue for a lesser period of time. EPA believes it essential that these efforts are implemented on a wide scale within the Clark Fork River OU, and funded by Atlantic Richfield Company in cooperation with the Department of Agriculture and local conservation boards. These efforts do not replace O&M or future work activities that remain the responsibility of the PRP.

In Section 13.9 of Part 2, *Decision Summary*, EPA discusses grazing strategies, BMPs, and the process involved in developing grazing management plans for various landowners along the Clark Fork River. Some things to consider in designing BMPs and in writing a riparian grazing management plan are presented in more detail in Appendix C of the *Record of Decision*. Plans for individual ranch management of grazing in the Clark Fork River riparian zone will be written based on the process described in Appendix C.

All remediated lands will be protected in such a fashion to allow adequate establishment and growth of new vegetation. Within the approximate 50-foot streambank riparian buffer zone, grazing will be excluded for 5 years following remedial treatment. After that period, grazing may be re-introduced as interim performance standards are met (see Part 2, *Decision Summary,* Section 13.11.1). Once this time has occurred, the land will be brought back into the normal land use activities as outlined in land use management plans written for each property in cooperation with the landowners. The land will be monitored to ensure adequate growth and establishment of the vegetation, especially the woody vegetation along the streambank.

On grazing lands, riparian pastures will be established in the Clark Fork River OU. A riparian pasture can allow for forage use by livestock while reducing any impacts to woody vegetation. Once the remediation and revegetation has taken place, the riparian zone is expected to produce a much greater amount of forage than it produces today.

Grazing is a complex issue that does not lend itself to a simple, "one size fits all" answer. The development for each property of BMPs and a comprehensive management plan that promotes woody vegetation and minimizes streambank impacts is essential for the success of these remedial actions on the Clark Fork River floodplain (see Part 2, *Decision Summary,* Section 13.9.1). Each landowner will be consulted to learn their vision for their piece of land. Once this is done, reasonable and attainable goals and objectives will be developed for their land. In some cases, no fences will be needed because the piece of land is being used for hay production or a crop. In other situations, an existing large pasture may be cross-fenced to allow for a rotational grazing system to reduce browsing of woody vegetation and reduced streambank trampling in the riparian zone and to provide periods of rest that will promote a healthy riparian zone. In still other cases, a fence running a couple hundred feet back from the stream, but parallel to the stream, will allow for the development of a riparian pasture. Riparian pastures are one of the most successful options for the following reasons:

1. When land is fenced "like-with-like" (in homogeneous units), land managers can more easily control livestock distribution.

2. Animal distribution is improved in both uplands and riparian areas when these areas are managed as separate units, which will often allow the land managers to increase sustainable carrying capacity.

3. Providing effective control over livestock grazing during the high risk periods immediately following construction allows for the most rapid recovery of riparian area health and productivity.

4. As a component of a land manager's riparian area management options, a riparian pasture will provide the flexibility to help restore and maintain woody vegetation.

Finally, and only as a last resort, would fencing of a narrow riparian corridor (for example, the approximate 50-foot riparian buffer corridor) be attempted. These narrow corridors are too small to effectively manage except as an exclusion zone from livestock grazing. Corridor fencing may be done for those situations where the landscape and property ownership boundaries preclude the other options. In other words, corridor fencing will be considered for those riparian areas where all other management options would fail. Fencing is to be maintained by the PRP as part of the remedy as provided in the *Record of Decision* (see Part 2, *Decision Summary*, Section 13.9.3).

Livestock grazing and proper riparian management are not incompatible goals. There are examples of working ranches with healthy riparian systems throughout North America that did not eliminate grazing from the riparian zone. Improper grazing was eliminated, not grazing altogether.

Having written a set of BMPs does not mean a landowner will have a functioning and healthy riparian zone. Usually, the step that is missed is the development of a ranch management plan that takes the generalized ideas of a BMP and develops reasonable and attainable objectives specific to each piece of ground. The BMPs are really the overall goals for a piece of land, while the objectives contain the specifics of how those goals are going to be met. For example, a goal (BMP) may be to reduce browse levels on woody vegetation to allow for the growth and maintenance of a shrubby corridor near the river. Another goal (BMP) may be to reduce streambank trampling and shearing. These goals do not tell a land manager how to accomplish them. That is where a riparian management plan comes into play. This is where the goals are made specific for a piece of land.

To assure compliance and performance, a comprehensive monitoring plan will be written for implementation along with each ranch management plan. Funding for the monitoring and enforcement will be provided.

Institutional controls (ICs) necessary for the Selected Remedy are identified in Part 2, *Decision Summary*, Section 13.4. In addition, conservation easements or deed restrictions may be useful for lands addressed by the remedy. EPA will continue to explore these types of ICs during the remedial design process.

Compensation to landowners is an issue that the agencies will continue to explore. See Part 2, *Decision Summary*, Section 13.6.5, for further discussion of this issue.

Appendix C, *Clark Fork River OU BMPs and Riparian Management Plan Considerations*, contains a list of key ideas to keep in mind when developing BMPs (goals) and a riparian management plan.

2.1.3.2 Other Land Use Management Issues

Summary of Comments

Of the many commenters in this category of general land use BMPs, several expressed outright preference for application of BMPs, while none expressed opposition to them. The most frequent comment was a request for definition of the BMPs. One stipulated that the Atlantic Richfield Company not be allowed to write them. Two asked that they be based in "good science." Commenters asked for clarification on such matters as where and how BMPs would be applied.

Some concern was expressed about enforcement of the BMPs and ICs. One person stated that the ICs and BMPs are not enforceable and not credible as written. A few asked who would enforce BMPs, who would pay for enforcement, and whether independent staff would be hired and funded for the purpose. A few others disliked the suggestion in the *Proposed Plan* that the Natural Resources Conservation Service (NRCS) or the local counties be charged with the task, because these agencies are already overworked and their staff members are vulnerable to local pressures. A few other commenters pointed out that success of BMPs depends on close monitoring, with two stating that water quality, as well as vegetation, should be monitored.

Some commenters suggested purchasing floodplain properties from willing sellers, with one suggesting that title to such lands could be placed with Montana Fish, Wildlife, and Parks (MFWP). A couple of commenters suggested that the use of conservation easements with willing sellers as a good way to gain better control of management within the critical riparian buffer.

Other comments included a request that the Atlantic Richfield Company pay for fencing maintenance, unless the landowner wishes to assume maintenance; that agricultural uses be given consideration to minimize disruption as much as possible; that some term other than ICs be used; and that cleanup should not depend on BMPs in locations where contaminants are left in place. Finally, the Deer Lodge Valley Conservation District requested continued, long-term involvement with the BMP program.

Response

EPA has responded to these comments by providing detail about BMPs and BMP enforcement in this *Record of Decision*. See response above in Section 2.1.3.1, page 3-23, for a more detailed discussion on grazing BMPs.

The role of ICs, BMPs, and land use plans are described in detail in Part 2, *Decision Summary*, Section 13.9, and BMP enforcement is addressed in Part 2, *Decision Summary,* Section 13.6.5. Additional detail is also found in Appendix C of this *Record of Decision*.

2.1.4 Costs

2.1.4.1 Cost of Remedy

Summary of Comments

Of the commenters in this subcategory, most indicated that the Atlantic Richfield Company should pay, one indicated the need for adequate funding, and one asked how the balancing criteria of cost was used in defining the remedy called for in the *Proposed Plan*.

Response

EPA, as mandated by CERCLA, has the authority to require the PRP, in this case the Atlantic Richfield Company, to perform or be financially responsible for the costs of remedial actions and associated monitoring costs as defined in Part 2, *Decision Summary*, Section 13.3. As was the case with previously completed records of decision such as for the Warm Springs Ponds and Rocker OUs, the Atlantic Richfield Company was deemed financially responsible for all remedial actions and funded and completed remedial actions as mandated in those respective records of decision.

As a balancing criteria, Capital and Operating and Maintenance Costs, in a present worth form, were compared for each alternative as proposed. Cost effectiveness was then considered, as described in NCP section 300.430(f)(ii)(D). Of the alternatives considered, EPA believes that the overall effectiveness of Alternative 5 best meets the cost effectiveness criteria. EPA believes the Selected Remedy is cost effective and will achieve benefits and effectiveness proportional to the expected costs (see Part 2, *Decision Summary*, Section 14.3).

2.1.5 Ecological Health Risks

2.1.5.1 Terrestrial Vegetation

Summary of Comments

The commenter stated that there are no numeric goals for terrestrial vegetation.

Response

Performance of vegetation will be integrated into specific remedial designs based primarily on end land use; thus, each land unit may have site-specific vegetation performance standards. The use of native species for revegetation will be stressed for some open space areas, while appropriate agronomic species may be used in other areas. Detailed numerical performance standards for vegetation based on post-remedial land use are presented in Part 2, *Decision Summary,* Section 13.11.1. For streambank riparian buffer zone polygons, numerical values for survival of planted woody species and for canopy cover of perennial vegetation are provided (see Exhibit 2-26 in Section 13.11.1), and relate to the length of time after remedation is completed. Numerical performance standards are also provided in Section 13.11.1, Exhibit 2-27 for canopy cover of perennial vegetation outside the riparian buffer zone, and for cover and species richness for non-riparian vegetation (Exhibit 2-28).

2.1.5.2 Livestock and Wildlife

Summary of Comments

The commenter stated that good water quality would be a plus for livestock and wildlife.

Response

EPA agrees. *The Ecological Risk Assessment* (EPA 2001) predicted that the overall hazard to range cattle to be moderate, with the primary source of the risk from ingestion of copper from soil, not from normal drinking water sources.

Surface water runoff from barren slickens or ponded water on barren slickens can contain very high concentrations of contaminants. Maximum concentrations in runoff water from barren slickens were reported to be 7,380 mg/L copper, 2,350 mg/L zinc, and 23 mg/L arsenic (Atlantic Richfield Company 1997). Because of the high level of contaminants in runoff from bare slickens, EPA made screening level calculations of acute risk to wildlife (birds and mammals, including cattle) from ingestion of surface runoff water. Results presented in the *Ecological Risk Assessment* (EPA 2001) indicated that under these maximum concentration conditions of contaminants in surface runoff waters, ingested doses might be of acute concern to birds and even large mammals. Removal of barren slickens areas as part of the Selected Remedy will eliminate this potential acute risk.

2.1.5.3 Soil Organisms

Summary of Comments

Commenter indicated that levels of contaminants of concern (COCs) were negatively correlated with microbial respiration in the contaminated soils. Microbial community structure was also negatively impacted by COCs.

Response

EPA agrees with the comment that soil organisms are impacted by contamination. The *Ecological Risk Assessment* reported that available data and information on the effect of soil contamination with elevated metals and/or low pH to soil organisms are limited, but the weight of evidence is strong that hazard does exist to soil organisms (worms, microbes), at least in slickens areas and in soils adjacent to slickens areas. It is also likely that metals in non-slickens soils within the riparian and upland areas may also be toxic to some soil organisms.

2.1.5.4 Fish and Aquatic Life

Summary of Comments

Of the comments in this category, most commenters were generally supportive of the proposed cleanup plan, but expressed some concern that EPA may have underestimated ecological risks. A few commenters questioned the need for cleanup, saying that fishing was already great near the Warm Springs Ponds, and that there was insufficient risk to justify the proposed cleanup plan.

Response

EPA recognizes that both acute and chronic aquatic risks must be considered in selecting a final remedy. EPA's Selected Remedy identified removal of slickens and in-situ treatment of less impacted contaminated areas, along with significant bank stabilization, as an appropriate and balanced means to address all risks identified in the administrative record for this site.

Acute Risks

The Ecological Risk Assessment (EPA 2001) reported that acute toxicity studies done using Clark Fork River water indicate acute lethality does not occur at dissolved copper concentrations lower than about 30 to 40 µg/L (depending on hardness). This finding is generally supported by laboratory studies that use water similar to that from the Clark Fork River (hardness = 100 to 300 mg/L). Between 1991 and 1997, concentrations of dissolved copper in the Clark Fork River measured under "typical" (non-storm event) conditions have mainly ranged from 2 to 20 µg/L, with 2 out of 232 samples falling above a concentration where some lethality might be expected. This low frequency of concentrations above the lethal effect level indicates that typical concentrations of copper in the river pose low risk of acute mortality to trout, even to the most sensitive life stage (which occurs at a body weight of about 0.4 grams).

Historically, there has been a clear association between storm events and the occurrence of fish kills in the Clark Fork River. This is thought to be due to surface water run-off from exposed tailings areas, since these surface flows generally contain high concentrations of copper and other metals, and are also acidic. Maximum concentrations in runoff water from barren slickens were reported to be 7,380 mg/L copper, 2,350 mg/L zinc, and 23 mg/L

arsenic (Atlantic Richfield Company 1997). In this regard, it is important to note that not all storms cause acute lethality. Rather, a key factor appears to be the formation of a salt crust on the tailings, which in turn requires an appropriate set of meteorological conditions to form initially. In a review of a major fish kill in 1989, EPA postulated that concentrations of metals in these salts, in readily soluble form, were responsible for rapid increases in river water metal levels, and subsequently the lethal concentrations of metals, especially copper, in fish tissues (Munshower et al. 1997). In recent years (1992 to 1997), no storm-related fish kill events have been reported within the OU; however, berms were constructed in 1989 and 1990 to limit runoff from slickens areas and no data have been obtained to document the occurrence of acutely lethal concentrations of metals in the Clark Fork River, either during routine sampling or during detailed monitoring of storm events. However, absence of observed fish kills is not proof that fish kills are no longer occurring, and available monitoring data are not adequate to establish that short-term pulse events are not occurring. Because the basic source material remains in place (barren slickens and reoccurring metal salts), and because run-off waters from exposed tailings are known to contain very high levels of metals and are acidic, it is concluded that the risk of acutely lethal pulses remains.

Removal of barren slickens areas, which produce these soluble metal salts that can then be washed into the river during storm events, as part of the Selected Remedy described in this *Record of Decision* document will eliminate this potential acute risk to aquatic receptors.

Chronic Risks

In the *Ecological Risk Assessment* (EPA 2001) several factors and investigation results relating to chronic risks to Clark Fork River fish were evaluated. These included chronic exposure to contaminated surface waters, site-specific fish survival tests, avoidance studies, exposure to contaminants from diet and from sediments, and comparative fish density studies. In a recent fish feeding study (Stratus 2002), juvenile rainbow trout were fed live diets exclusively of *Lumbriculus variegatus* (common names include California blackworm, blackworm, mudworm). The *Lumbriculus* were cultured in metal- and arsenic-contaminated sediments collected from Silver Bow Creek and the Clark Fork River. Significant growth inhibition was reported for fish fed the contaminated diets during the 67 day trial period. Growth inhibition was statistically related to metals and arsenic in the diets and to levels found in fish tissues. The best statistical correlations were reported for arsenic. The study suggests that *Lumbriculus variegatus* grown in metal- and arsenic-contaminated sediments can pose a risk to juvenile rainbow trout through an exclusive dietary exposure pathway.

Taken together, the data from these studies are consistent with the hypothesis that copper (and possibly arsenic and other metals) in the aquatic environment (surface water and diet, which presumes intake from contaminated sediments) impose low-level chronic stress on aquatic macroinvertebrates, trout, and other fish. The *Ecological Risk Assessment* and EPA's unacceptable risk findings are carefully and accurately stated in this *Record of Decision* and the *Proposed Plan,* and are well supported by the record.

EPA's broad unacceptable risk finding also accounts for the State's concern about chronic risks to aquatic organisms. The State also maintains as its ARAR for the Clark Fork River a total recoverable standard for metals and arsenic, and this chronic standard is routinely violated in the upper reaches of the Clark Fork River by releases of metals from sources such as bank erosion and runoff. The State emphasizes the chronic risks presented at the site.

EPA's proposed remedy is an appropriate response to these unacceptable acute and chronic risks to Clark Fork River fish as well as to other risks identified in the Clark Fork River OU administrative record (see Part 2, *Decision Summary*, Section 7, for a thorough discussion of site risks and the relationship of risks to the Response Action). The removal of barren slickens areas addresses the principal waste and acute risk in a permanent manner without residual risk. The in-situ treatment component addresses other impacted soils and vegetation and related terrestrial risk found at the site. The bank stabilization component addresses the erosion, stream stability, and chronic aquatic risks found at the site.

2.1.5.5 Threatened and Endangered Species

Summary of Comments

One commenter stated that bull trout recovery required removal of toxic metals.

Response

Bull trout are listed as a threatened species under the Endangered Species Act (ESA), and EPA has a responsibility under the National Contingency Plan (NCP) to ensure that such species are sufficiently protected through remedy selection and implementation. The remedy will remove the most toxic metal located in barren slickens areas, treat other impacted areas, and stabilize the streambanks. These actions will all help in recovery of bull trout. EPA has performed consultation under the ESA with the FWS and produced a Biological Assessment as part of the RI/FS process for the Clark Fork River OU. EPA will continue to consult with the FWS as described in the Biological Opinion for this project as remedial design goes forward.

2.1.6 Floodplain Stability

2.1.6.1 Fluvial Geomorphology Issues

Summary of Comments

One commenter was not convinced that the *Proposed Plan* contains the proper strategy to address the next 100-year flood. This individual predicted the unraveling of the floodplain, conversion to a braided system, and subsequent release of the same toxic contaminants downriver over the floodplain that this *Proposed Plan* is attempting to contain and control. Another commenter was concerned that the removal of 167 acres of tailings will cause the channel to unravel.

Response

The USGS and the Fluvial Geomorphology Committee prepared several reports for EPA as part of the RI/FS and site study process. Those reports stated two essential points about floodplain stability on the Clark Fork River.

There is clear evidence of floodplain instability on the Clark Fork River because of the release of mine contaminants upon the floodplain. This is demonstrated primarily by available data that shows high erosion rates and frequent meander and tab changes and washouts. This erosion is caused by impacts to the terrestrial environment (vegetation) resulting primarily from mine wastes at the site. This, in turn, causes the Clark Fork River to have less streambank stability than it should. The erosion releases substantial quantities of copper and other metals into the river, which causes violations of the State of Montana

water quality standards. The erosion also causes the loss of productive land to private and public landowners along the river.

Dr. Jim Smith, a USGS scientist, has postulated that the present floodplain instability is so great as to present a risk of further severe floodplain instability and land loss (the unraveling theory) in very high flood events because of the lack of vegetation.

EPA acknowledges uncertainty associated with the modeling of Dr. Smith and with the developing science used for modeling and predicting these effects. (See the following reports prepared by Atlantic Richfield Consultants Parker, Gary—St. Anthony Falls Laboratory, University of Minnesota—*Draft Technical Review of Smith, J. Dungan on Quantifying the Effects of Riparian Vegetation on Stabilizing Single Threaded Streams*, 7th Federal Interagency Sedimentation Conference, Reno, Nevada, April 26, 2001; R2 Consultants Inc.—*Technical Review of Smith, J. Dungan on Quantifying the Effects of Riparian Vegetation on Stabilizing Single Threaded Streams*, 7th Federal Interagency Sedimentation Conference, Reno, Nevada, September, 2001; and R2 Consultants Inc.—*Assessment of Geomorphic Stability During Historical Floods of Silver Bow Creek, Little Blackfoot River and Big Hole River, Montana,* September 2001).

EPA notes that Dr. Smith's work was peer reviewed by other USGS scientists prior to publication. EPA must address this possibility and risk despite its uncertainty. EPA also notes that Dr. Parker's comments as well as other Atlantic Richfield Company citations have not been peer reviewed. In fact, Dr. Parker states, "The reach of the Clark Fork in question is **moderately affected** by tailings from the Anaconda copper mine, which were deposited in a major flood in 1908." He further states, "It does not suggest that the basis for the analysis by Smith is fundamentally wrong." Thus, Atlantic Richfield Company's own retained expert finds some validity in Dr. Smith's modeling work.

In partial response to this geomorphic stability concern, EPA's remedy includes a streambank stabilization component. It is not a component supported by Dr. Smith and, in his view, does not fully address the problem. Dr. Smith, in his November 2001 letter to EPA, proposes additional woody vegetation and land use restrictions over a broader area than is contained in EPA's proposed remedy.

EPA believes that the streambank stabilization component is a protective measure given the uncertainty associated with the modeling effort, and will continue to monitor the remedy after implementation to see if sufficient vegetation is present to prevent the risk of unraveling.

The Selected Remedy*'s* streambank stabilization component is not based solely on the risk of catastrophic unraveling. The streambank component also addresses two other elements of risk presented by mine contaminants deposited along Reach A of the Clark Fork River:

- Excessive erosion of valuable agricultural, recreational, and important habitat land is documented by other USGS studies in which Atlantic Richfield Company experts participated. The primary cause of this excessive erosion is the lack of vegetation along the streambank, which in turn is caused, primarily, by the phytotoxic effects of mine contaminants on vegetation (see the *Remedial Investigation*, *Ecological Risk Assessment for the Clark Fork River, Feasibility Study*, and *Proposed Plan*). The streambank stabilization component will slow the rate of erosion to more natural levels.

- The streambanks release large quantities of copper and other metals during erosion into the Clark Fork River (See Exhibit 3-7, page 3-14). During normal hydrologic events, approximately 60 percent of the copper loading to the river is by streambank erosion. These levels cause exceedances of State of Montana water quality standards and are a significant concern. The proposed remedy must address this issue according to the CERCLA law, which requires ARARs to be met by remedy implementation. Streambank erosion is also a major source of copper in the river that causes an unacceptable chronic risk to the aquatic environment and fish as described in the *Proposed Plan* and the *Ecological Risk Assessment.* During high bank flows, invertebrate levels may become significantly reduced.

EPA acknowledges that the remedy does not fully address Dr. Smith's postulated unraveling event. However, EPA strongly disagrees that the proposed remedy will not address the demonstrated erosional problems for the Clark Fork River. EPA believes the streambank revegetation component of the remedy will reduce erosional rates to acceptable levels. This reduction will address the potential for environmental risk in the river from flood events and contaminants that may be left in place in the remedy, and will lessen the loss of land to landowners to normal erosional ranges experienced by other Montana landowners. It will also reduce the impact of the very large flood events so that these events will not produce widespread floodplain destabilization. EPA also believes the woody riparian corridor plan advocated by Dr. Smith may not be implementable, as it would disrupt the use of riparian pastures by certain landowners.

Therefore, EPA believes the streambank stabilization component of the proposed remedy is implementable, protective, and practical.

2.1.7 Groundwater Quality

2.1.7.1 Copper and Other Metals

Summary of Comments

All commenters in this subcategory believed that contamination would leach into the groundwater, and/or that contaminated groundwater would leach into the Clark Fork River.

Response

In a 1998 report, the USGS conducted a study to determine sources of contaminants to the Clark Fork River. They found that the mass load contribution of contaminants, using copper as an indicator, was as follows (see Exhibit 3-7, page 3-14):

- From the shallow groundwater system into the Clark Fork River: 3.9 percent
- From floodplain runoff into the Clark Fork River: 5.8 percent
- From upstream sources (Silver Bow Creek and Warm Springs Ponds) into the Clark Fork River: 5.8 percent
- From tributaries into the Clark Fork River: 10 percent
- From the streambed into the Clark Fork River: 14 percent

- From the streambanks into the Clark Fork River: 60 percent

The *Remedial Investigation* (Atlantic Richfield Company 1998) found groundwater is contaminated only to shallow depths of approximately 10 feet or less and the plumes are associated with overbank tailings locations. The migration pathway of contaminants from this shallow system into the Clark Fork River is the pathway of least concern in terms of loading to the river. Concentrations of copper in groundwater ranged from the detection limit of 0.5 µg/L to 413 µg/L, while zinc levels ranged from the detection limit of 0.5 µg/L to 60,000 µg/L. Of the 381 samples tested, none were found to exceed the State of Montana water quality standard for copper of 1,000 µg/L, while two of the samples exceeded the standard for zinc of 5,000 µg/L. Arsenic concentrations in 385 samples ranged from below the detection limit (0.1 µg/L) to 170 µg/L. Thirty-four samples from 18 wells had levels above the Montana standard of 18 µg/L. All of these concentrations, except one, were found in samples within 8 feet of the ground surface. Five percent of the groundwater samples exceeded Montana standards for cadmium and for lead. Potable wells were found to be generally uncontaminated. Data from the Clark Fork River Site Screening Study (CH2M HILL et al. 1991) indicate one domestic well, of the 77 tested, had an exceedance of existing Montana standards for cadmium. Arsenic levels in all but four domestic wells are below the State and Federal drinking water standards of 10 µg/L. The wells were completed in the shallow water table, and were sampled in June 1987. The wells were located in Deer Lodge, Montana, and are to be re-sampled as part of the Selected Remedy.

The removal of slickens and in-situ remediation of impacted soils and vegetation as described in the *Record of Decision* will reduce the rate of future groundwater contamination for copper, cadmium and other metals and shallow groundwater quality is expected to improve over time. In addition, a domestic well sampling program will be instituted to ensure groundwater wells are safe for human consumption. For a discussion of arsenic, see Section 2.1.7.2, *Arsenic*, below.

2.1.7.2 Arsenic

Summary of Comments

The sole commenter in this subcategory said that there are no groundwater protection measures in the *Proposed Plan*, and such measures should be added.

Response

The Selected Remedy described in this *Record of Decision*, when implemented, will improve groundwater quality over time. The removal of slickens and in-situ remediation of impacted soils and vegetation as described in the *Record of Decision* will reduce the rate of future groundwater contamination for copper, cadmium, and other metals. In the case of arsenic, removal of slickens will eliminate this arsenic from the system. For in-situ treatment, the addition of lime to impacted soils will raise the pH of the soils into the neutral or basic range (approximately pH range of 7.5 to 8.5). Such a pH change can theoretically mobilize arsenic ions from the soils and/or substrate and allow them to move to shallow groundwater and into the Clark Fork River. Additional amendments to fix arsenic and inhibit its mobility are suggested for impacted soils and vegetation areas slated for in-situ treatment when the arsenic concentration exceeds 1,000 mg/kg (refer to Part 2, *Decision Summary*, Section 13.5.4). Arsenic is also bound to soils and substrate by other mechanisms that may not be sensitive to the aforementioned pH changes, thus not releasing arsenic ions. Additionally, increased

vegetation may reduce arsenic mobilization and input to groundwater. In any case, the arsenic concentrations are relatively low in the soils and substrate and, if released, the arsenic would have no detectable measurable concentration changes in the river. This conclusion is also supported by the fact that only 3.9 percent of the total contamination is estimated to come from the groundwater, as mentioned earlier. This *Record of Decision* also specifies performance standards to minimize the transport of COCs into groundwater. These are presented in Part 2, *Decision Summary*, Section 13.11.2. Public health issues with groundwater can be managed through the use of monitoring and well surveys as described in Part 2, *Decision Summary*.

2.1.7.3 Other Constituents

Summary of Comments

The only commenter in this category said that there is a risk of radionuclides in groundwater that is not addressed.

Response

During the initial investigations conducted during the *Remedial Investigation* for this site, numerous water and contaminated soils samples were tested for various radionuclides. Based upon those initial analytical results, it was concluded that radioactivity from radionuclides and radionuclide concentrations were not above screening levels at this OU. Therefore, these contaminants were not identified as COCs.

2.1.8 Human Health Risks

2.1.8.1 Residential

Summary of Comments

Most commenters in this category asked for continued evaluation and assessment of health risks from all COCs, including arsenic, copper, zinc, lead, cadmium, and mercury. One commenter asked that these assessments focus on risks to children and other high-risk populations. Along with this, some commenters noted that recreational areas, which attract children, are being constructed on what they believed to be contaminated ground. A couple of commenters cited Arrowstone Park as an example, and requested that these types of areas be cleaned up along with the rest of the floodplain, and that complete removal would be the only way to assure a safe environment.

Some commenters felt that the *Human Health Risk Assessment* was inadequate and left many questions unanswered. One commenter said that additional questions have been raised about exposure levels for arsenic and COCs since the publication of the *Human Health Risk Assessment*, so additional review of acceptable levels is warranted. Another commenter asked whether tributaries were included in the remedy because of human health risks.

Other commenters asked if cancer rates in Deer Lodge are abnormal, and if there is a connection between an apparent increase in Wegener's disease in the Deer Lodge Valley and the contamination in the river. A few other commenters asked if the 10^{-4} excess cancer risk level would be applied in the Clark Fork River OU, and why the EPA did not use a 10^{-5} or 10^{-6} standard for residential, recreational, or agricultural uses.

In contrast to these comments, a few commenters felt that the minimal human health risks described in the *Human Health Risk Assessment* and the *Proposed Plan* would not warrant a cleanup on the scale proposed. Because the *Proposed Plan* stated that human health risks are within the normally acceptable range, the *Record of Decision* should simply address other risks (such as living in a historically irrigated field, using a shallow well, ingesting contaminated soil, or engaging in Tribal traditional cultural activities) through educational programs. Another commenter felt that implementation of the remedy would cause more human health risk problems that it would solve by disturbing the area.

Finally, the ATSDR provided some specific recommendations for addressing human health risks. While they acknowledged that EPA has already analyzed risks for specific exposure scenarios, they felt that future development of recreational or residential areas may require further risk evaluation. Although they believed land use restrictions in the *Proposed Plan* would protect human health in most situations, ATSDR stated that they would be available to assist in evaluating special situations that may arise. ATSDR also recommended that exposed tailings be addressed at the area of the old trestle site in Deer Lodge.

Response

A summary of human health risks is provided in Part 2, *Decision Summary*, Section 7.1. How the Selected Remedy will mitigate these human health risks is explained in Part 2, *Decision Summary*, Section 13.4. In the recent past under its removal authority, EPA has actively addressed human health risks resulting from arsenic exposure in residential areas near Deer Lodge, including playgrounds and parks, and some residential areas along the East Side Road. This *Record of Decision* specifies that any similar exposures would also have to be addressed to ensure that human health is protected. This *Record of Decision* also specifically identifies that ICs, such as limiting residential use of the floodplain and potable water wells in the floodplain, will be implemented to ensure public health protection. Groundwater well surveys and monitoring are also required. Seven specific actions to reduce risks to human health are presented in Part 2, *Decision Summary*, Section 13.4.

EPA's *Human Health Risk Assessment* (EPA 1998) and its Addendum (EPA 2001) evaluated the most likely scenarios for human exposure to COCs in the Clark Fork River OU. Risk managers have made decisions establishing specific action levels for cleanup of wastes containing arsenic, which is the contaminant associated with unacceptable risk. These levels vary depending on the reasonably anticipated land use for a given area. Human health risk based concentrations (RBCs) of antimony, arsenic, beryllium, cadmium, copper, iron, manganese, mercury, and zinc for soils/tailings, river water, pooled water, groundwater, and for foods were established in the *Human Health Risk Assessment* (EPA 1998). In addition, risks were calculated for humans exposed by multiple pathways.

EPA has used the 10^{-4} risk level as a basis to require remediation to protect human health at the Clark Fork River OU. This is consistent with other EPA superfund cleanups in the basin where risks less than 10^{-4} (such as 10^{-5} or 10^{-6}) have not been addressed by remedial action and are considered acceptable. The 10^{-4} risk level is within EPA's acceptable risk range as provided for in the NCP at 40 CFR 300.430(e)(2)(i)(A)(2).

The *Human Health Risk Assessment* provided text to help interpret the RBC and states, "RBC values should be interpreted by comparison to concentration values which represent the arithmetic mean and/or UCL (upper confidence level) of the mean of a chemical averaged

over an appropriate exposure unit and should not be interpreted as a 'not–to-be-exceeded' value on a sample-by-sample basis." The document also states, "noncancer and cancer risks from exposure to soil and tailings are dominated by arsenic, and no other chemical poses risks in a range of concern."

The *Record of Decision* document specifies actions required to address human health considerations. The Selected Remedy sets action levels for arsenic in soils within the Clark Fork River OU as follows:

- Residential – 150 ppm
- Rancher/Farmer – 620 ppm
- Recreational – 680 ppm for children at Arrowstone Park and other recreational scenarios
- Fishermen, swimmers, and tubers along the river only – 1,600 ppm

The trestle area in Deer Lodge was identified by ATSDR as an area where current data indicates an exceedance of the recreational level established above. Early sampling of this area shall be undertaken as needed to supplement existing data. If levels are exceeded, contaminated soils will be removed and replaced with appropriate backfill, and revegetation shall be implemented. Disposal of excavated materials will be in Opportunity Ponds. Other known recreational areas will be evaluated, using existing data where possible, to determine if they exceed the recreational level. If exceedances are found, they will be dealt with in a similar manner.

Some residences are identified under the Deer Lodge Valley Historically Irrigated Lands time-critical removal action (TCRA) as exceeding the action level for arsenic in residential areas and were not addressed under the TCRA. These areas will be revisited and remediated consistent with that action. Other follow-up operation and maintenance activities from this action will be implemented.

EPA does not believe that other historically irrigated lands within the Clark Fork River OU exceed EPA's action level for reasonably anticipated land use for those lands. This shall be confirmed via sampling of these lands if necessary and confirmation that residential development is not planned for these areas. As noted in later portions of this section, confirmation sampling for in-situ treated areas is also required to ensure that these areas are below action levels for current and reasonably anticipated uses (which is likely to be agricultural for most lands) after treatment.

The Clark Fork River *Human Health Risk Assessment* (EPA 1998) and the *Human Health Risk Assessment Addendum for Recreational Visitors at Arrowstone Park* (EPA and ATSDR 2001) evaluated the human health risks arising from exposures to heavy metals and arsenic within tailings deposits, soils, and groundwater along the river. The studies concluded that, based upon the understanding that no residential development exists within the floodplain, and that exposures are limited to ranch (or farm) workers and recreators (fishermen, tubers, and children at parks), the human health risks are generally acceptable. On historically irrigated lands, however, where residential development has occurred or where it may occur in the future, the risk assessment concludes that risks may be unacceptable. National Park Service (NPS) conducted a human health risk assessment for the Grant-Kohrs Ranch National Historic Site (NPS 2003) and found potential risks to workers from contaminated sediments in irrigation ditches that may be unacceptable.

EPA is unaware if cancer rates in Deer Lodge are abnormal. As previously stated, EPA considers acceptable exposure levels to be concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} (1 in 10,000 probability) to 10^{-6} (1 in 1,000,000 probability), with 10^{-6} as the point of departure. EPA is also unaware if there is a connection between exposure to metals and Wegener's disease. Health experts do not know what causes Wegener's granulomatosis. Wegener's granulomatosis is an uncommon disease, in which the blood vessels are inflamed (vasculitis). This inflammation damages important organs of the body by limiting blood flow to those organs and destroying normal tissue. Although the disease can involve any organ system, Wegener's granulomatosis mainly affects the respiratory tract (sinuses, nose, trachea [windpipe], and lungs) and the kidneys. This disorder can affect people at any age and strikes men and women equally. It is rare in African Americans compared to Caucasians.

EPA will respond to any new information it may become aware of during remedy implementation to be sure that public health protection is achieved.

Three ICs will be implemented (refer to Part 2, *Decision Summary*, Section 13.4, for detailed description of these ICs) to further protect human health. The ICs are summarized below:

- Continued implementation, including funding, will be provided for Powell County's and Deer Lodge County's zoning ordinances, which prohibit building a permanent residence within the floodplain of the Clark Fork River in those counties.
- Permanent deed restrictions and use funding are required for Arrowstone Park near Deer Lodge, to ensure that this area is maintained and dedicated to use as a recreational area.
- All previously sampled domestic wells that exceeded MCLs will be resampled, as well as any new private domestic well located in or near the floodplain. Appropriate ICs to address groundwater use in the shallow aquifer shall be implemented and funded. A survey of well use in the floodplain of Reach A is necessary. Domestic wells that are near contamination sources will be sampled, and appropriate action to ensure safe water supplies for domestic users will be taken if exceedances of groundwater performance standards are found. Additional ICs beyond existing State statutory protections can range from groundwater control areas to ordinances or deed restrictions.

Educational efforts for recreational users within the river corridor area concerning the need to prevent soil intake by children and maintain other health practices to prevent unnecessary exposure to soils shall be undertaken, in cooperation with local and State health authorities. These also must be funded.

2.1.8.2 Rancher and Farmer

Summary of Comments

The Department of the Interior expressed concerns relative to workers exposed to soils historically irrigated with Clark Fork River water on the Grant-Kohrs Ranch National Historic Site.

Response

The NPS provided data indicating potential risks to workers from arsenic contaminated irrigation ditches at the Grant-Kohrs National Historic Site. A baseline human health risk assessment for the Grant-Kohrs Ranch National Historic Site (Foster Wheeler 2003) indicated that a full time seasonal irrigator working at the ranch had a cancer risk estimate greater than 1×10^{-4}, (arsenic and cadmium) and a hazard quotient greater than 1.0 (arsenic). Additional sampling will be performed in coordination with the NPS to determine if unacceptable risks are present for the Grant-Kohrs Ranch National Historic Site and other similar irrigators, and, if so, contamination will be remediated.

2.1.8.3 Recreational and Tribal

Summary of Comments

Commenters in this category felt that recreational human health risks had not been adequately assessed. In particular, the commenters felt that children involved in recreational activities would be especially vulnerable to contamination along the river. One commenter asked EPA to explicitly prohibit, or at least limit, recreational access to known contaminated areas.

Another commenter was concerned about risks to Tribal members in their traditional cultural practices. The key concerns expressed include the following:

- The Clark Fork River OU is contained wholly within the aboriginal territory in which Tribes retain Treaty rights. The *Proposed Plan* points out that the exercise of those rights and participation in traditional cultural practices may result in additional exposures to Tribal members above and beyond those expected from general recreational and agricultural activities.
- The risks to Tribal members from these activities has not been assessed.
- The *Proposed Plan* would reduce soil arsenic concentrations based on land use criteria (for example, different levels based on agricultural, recreational, or residential uses and sites). It is not clear if these reductions would reduce additional exposures for traditional cultural practitioners. The *Record of Decision* should recognize this.

Response

Since the *Human Health Risk Assessment* was released, a local public park (Arrowstone Park) was developed in Deer Lodge. This park has different use patterns than those evaluated in the *Human Health Risk Assessment.* As a consequence, EPA prepared an addendum to the *Human Health Risk Assessment* that focused on characterizing chronic arsenic exposure to children aged 1 to 10 years old visiting Arrowstone Park no more than 48 times per year (Syracuse 2001). The chronic risk-based concentration of 680 mg/kg (ppm) for children recreational users was determined. Concurrently, the ATSDR concluded that the existing data for the park did not adequately characterize park conditions and recommended further sampling and analysis of soils for arsenic concentrations. A team from ATSDR collected soil samples from several areas within the park that represented different exposure units in 2001. Conclusions of this work (ATSDR 2001) are provided in Part 2, *Decision Summary*, Section 7.1. In summary, EPA and ATSDR both believe that the 680 ppm level is appropriate, and that unacceptable risks are not present at Arrowstone Park.

Although human RBCs for arsenic did not specifically address Tribal traditional cultural practitioners, the *Baseline Human Health Risk Assessment* quantitatively considered risks to humans from subsistence hunting, subsistence fishing, and ingestion of native plants. Evaluations of these specific exposure routes cover some of the pathways that may be of concern to Native Americans. Other cultural practices, not known by EPA, which may lead to exposure of Native Americans by other pathways, were not considered. However, EPA expects that these unidentified cultural activities may not differ greatly from the recreational use scenario considered in the *Human Health Risk Assessment Addendum.* One scenario assumed 48 days of use each year for a combined age of 40 years (10 years child and 30 years adult). The most stringent RBC for such chronic exposure to arsenic is 745 ppm. EPA believes the remedy of removal of slickens and treatment of impacted areas will reduce the arsenic exposures in the floodplain to values that would not pose unacceptable risk to traditional Tribal practitioners.

2.1.9 Impacts During and After Remedy

2.1.9.1 Human Safety and Health

Summary of Comments

Many commenters expressed concern about the human safety risks associated with the large volume of truck traffic that would accompany implementation of the *Proposed Plan*. Stated concerns about risks included accidents with other vehicles, bicycles, horse riders, and pedestrians. The second most frequent concern was directed at human health issues that could be generated by the creation and exposure to dust and noise. Impacts on local roads and the disruption of culture and serenity of the small town of Deer Lodge were also voiced as concerns. Suggestions for limiting human health risks included the use of ICs where applicable and sampling and maintenance activities.

Response

As previously stated, the proposed remedy for the Clark Fork River will be applied in a progressive manner throughout the Deer Lodge Valley, that is, not all at one time. The *Record of Decision* requires the removal and backfill of approximately 430,000 cubic yards of tailings from slickens areas and treatment of approximately 700 acres of contaminated soils. This work will be staged at different times and locations and will create an increase in truck traffic within the valley. The safety risk posed to the public is directly related to many things, including the route driven, condition of the existing road infrastructure, and the volume of traffic using it. As with other large construction projects, preparing truck and equipment travel routes, times, and frequency are essential to an efficient and safe plan of operations. EPA anticipates that truck and local traffic planning will be coordinated through local County and City officials before being implemented to help minimize impacts to local residents. Travel routes will be publicized ahead of time to notify the community of travel corridors that will be affected. Through this careful planning process, construction risks can be managed to avoid injury. EPA has overseen other large construction projects like this, with satisfactory health and safety results.

Precautions to reduce dust levels, such as keeping roads moist and covering haul loads, will be implemented as part of the site activities. As explained in Part 2, *Decision Summary,* Section 13.11.5, and Section 2.1.1 of this *Responsiveness Summary* (page 3-11), the likelihood

of fugitive dust and air impacts is unlikely. Construction BMPs will be used throughout the remedial work to assure that the generation of contaminated dust and inhalation exposure is minimized. The *Baseline Human Health Risk Assessment* (EPA 1998) concluded after examining dust generating activities (such as soil tilling) that the inhalation risk (of arsenic) was small when compared to the risk posed by ingestion, and that this exposure pathway did not warrant quantification.

Prior to implementation of the remedy, road and bridge designs along proposed corridors of travel for trucks and equipment will be evaluated for structural integrity. Results of these assessments will dictate the required changes to the infrastructure to promote a safe and efficient travel plan for the remedial activities.

2.1.9.2 Roads

Summary of Comments

A handful of comments were specific to the impacts on local roads caused by heavy truck traffic from the proposed cleanup. Commenters' concerns ranged from wanting East Side Road paved, to making sure all roads and bridges used for the cleanup were properly upgraded and maintained, to asking that all new access roads would be reclaimed at no cost to the County. Two commenters indicated they had no problem with the likely increased traffic.

Response

Implementation of the Selected Remedy, as described in this *Record of Decision*, will result in an increase of truck and equipment traffic on many local roads and a portion of the interstate corridor during the planned 10-year construction phase. The remedial design phase will be performed on a landowner-by-landowner basis. During design, slickens areas designated for removal and disposal at the Opportunity Ponds will be delineated, and the actual volume of these materials to be excavated will be calculated. The excavation volumes will determine the number of truck cycles that will be required. The design will also define transportation corridors across the property that will subsequently connect with County, City, State, and the interstate road systems to transport the wastes to the Opportunity Ponds repository. It is likely the same route will accommodate a return trip with the required backfill soils and other remedy defined supplies and amendments to the same property. Traffic safety plans for those corridors will be prepared and coordinated with appropriate City, County, and State agencies as described in Part 2, *Decision Summary*, Section 13.11.5. The existing connecting roads will then be evaluated based upon the additional haul traffic and will be upgraded as necessary to safely handle the additional traffic. All other roads and bridges will be evaluated and upgraded on an as-needed basis. The cost of the upgrades and maintenance are the responsibility of the PRP. It is anticipated that temporary haul roads on private property will be constructed in consultation with landowners, as will the reclamation of those roads.

2.1.9.3 Ecological Health

Summary of Comments

A few comments specifically stated concerns for the resident wildlife and disruption of their habitat by the remedial action. Other commenters suggested that the final water quality and health of the wildlife populations be used to help gage the success of the cleanup.

Response

Implementation of the remedy will be conducted in a manner that minimizes impacts to areas not specifically targeted for remedial action. BMPs will be employed to avoid contributing additional sediment to the river or increasing the risks to aquatic life. Sensitive wildlife habitat will be noted during design and pre-construction reconnaissance of areas. Remedial designs will reflect the sensitive nature of these areas. However, it is anticipated that some habitat will be impacted because of the scale of the remedial action being proposed. The agencies will strive to minimize impacts as the remedy progresses through the Deer Lodge Valley. Water quality monitoring in the Clark Fork River will be implemented during the construction activities to assess impacts to the aquatic environment.

2.1.9.4 Sequencing of Construction Activity

Summary of Comments

A few commenters recommended that cleanup begin on the most contaminated areas first. Another suggested that, before work begins, a logical plan for sequencing the work throughout the Deer Lodge Valley be prepared and implemented.

Response

During the design phase of the remedial action, a construction sequencing plan will be prepared. Since the majority of Clark Fork River to be remedied is on private property (71 percent), it is important that the remedy be implemented on a property owner by property owner basis. It will be appropriate to first schedule and coordinate design and construction work with willing landowners who control large sections of the river since necessary construction impacts will affect these people the most. Willing property owners with lesser amounts of property may be scheduled if sequencing a number of properties in a row will be advantageous. Until such contacts are made with all property owners, a final sequencing plan cannot be completed.

The final sequencing of properties to be remediated throughout the Deer Lodge reach will be planned as carefully as possible. Progress is heavily dependent upon the cooperation of willing landowners.

2.1.9.5 Time Required for Construction

Summary of Comments

Several commenters spoke to the necessity of starting the cleanup as soon as possible. Other commenters focused on the duration of the cleanup. Many commenters asserted that the cleanup should and would take more than the 10 years projected in the *Proposed Plan*. Limiting cleanup operations to 18 months on any one property was suggested, as was remaining flexible with the duration of the property operation and the importance of working with the landowner. One comment suggested that a realistic schedule should be presented in the *Record of Decision*.

Response

A general schedule for remedial action on the Clark Fork River is described in the *Record of Decision*. The anticipated duration, as discussed in the *Record of Decision*, is ten field construction seasons. EPA believes this is a reasonable period of time for implementation of the remedy, if the work is well planned and organized. Within that period, it is assumed

that several construction crews will be working on several properties concurrently. At this time, a 2-year implementation target per property appears reasonable. However, the first step of implementation involves a detailed reconnaissance of the subject property, which includes a Clark Fork River Riparian Evaluation System (CFR RipES) assessment and discussions with the landowner. These activities form the cornerstone of the level of effort to be applied to the property. The site specific design then dictates the construction timetable for that portion of the project. As the remedy progresses and knowledge is gained, there may need to be adjustments in this anticipated schedule.

2.1.9.6 Construction Monitoring

Summary of Comments

Commenters in this subcategory emphasized the importance of oversight during cleanup, hiring competent contractors, conducting adequate planning and monitoring of increased truck traffic, and monitoring of the duration of operations on each property with emphasis on successful re-vegetation.

Response

The remedy will be implemented with agency (EPA/DEQ) oversight over the length of the planned 10-year remedial construction period. It is currently assumed that the Atlantic Richfield Company will implement the remedy as they have done on the majority of other Clark Fork Basin OUs. If that is the case, the agencies performing oversight will review and approve all final designs. In addition, they will review and approve all contractors selected for work on each property.

During construction, EPA/State representatives will provide field oversight to assure that all work is being conducted appropriately and in conformance with the design developed for that property. They will verify removal depths, backfill quality and placement, and in-situ methods and depths to determine that adequate mixing is achieved and that health based criteria for arsenic at the surface are met when mixing is complete. They will verify that streambank remediation is conducted per the design. All revegetation efforts will be monitored to assess their conformance with performance standards and the design specifications.

2.1.9.7 Post-Construction Monitoring

Summary of Comments

Post-construction monitoring of the proposed cleanup activities was suggested by many commenters. Performance standards for cleanup that could be readily monitored in a post-construction activity were suggested. Providing adequate funds to promote the long-term monitoring and re-planting, if necessary, was important to commenters. It was also suggested that remedies not requiring monitoring in perpetuity be considered. In several comments, the question was posed about a comparison between long-term impacts of the proposed remedy versus that of no action. The final suggestion raised the concern of high water events and whether that possibility had been considered.

Response

Post-construction monitoring of the remedial action is an integral part of the remedy. Adequate funding will be provided for monitoring activities. The *Record of Decision* discusses various post-construction monitoring programs that will be implemented, such as

operational and functional monitoring, and short term and long term monitoring. Five-year reviews will assess the progress of the remedial action, allow comparison of specific remedial attributes with performance standards outlined in the *Record of Decision*, and dictate follow-up action, if warranted. Refer to Part 2, *Decision Summary*, Section 13.9, Section 13.10, and Section 13.11, for detailed discussions. The application of nutrients and water to the re-vegetation effort should promote a quicker, more robust, growth response. EPA and DEQ will coordinate with local land management agencies (such as the NRCS) regarding the monitoring and assessment of post-construction response. Sufficient funding will be provided to ensure that the necessary monitoring will be conducted by a qualified party. Post-construction monitoring will continue until EPA and DEQ determine that the remedy is functioning properly and performing as designed, as directed by regulations in 40 CFR 300.435(f)(1). Regarding high water events, the construction activities will be planned and conducted to the extent practical in concert with continuing awareness and evaluation of anticipated hydrologic changes (particularly high runoff that could cause overbank flows).

2.1.9.8 Operations and Maintenance (O&M)

Summary of Comments

The commenter requested a better definition for the term O&M, and also asked what organization or agency would be responsible for O&M.

Response

O&M activities will be employed as part of the remedy to protect the integrity of the Selected Remedy for the Clark Fork River. The O&M measures are initiated after the remedy has become functional after the completion of construction as outlined in the *Record of Decision*, and the constructed remedy is determined to be complete based on State and Federal acceptance. Once the O&M period begins after the completion of construction for a specific property, the PRP has continuing responsibility for maintaining the effectiveness of the remedy. Monitoring and maintenance activities are specified in Part 2, *Decision Summary*, Section 13.11.4.

2.1.10 In-situ Treatment/Phytostabilization

2.1.10.1 Extent

Summary of Comments

The comments received in this subcategory are polarized. While some individuals desire more extensive use of in-situ treatment—even of slickens areas—others said that impacted areas should be removed rather than treated. One commenter asked that conditions for removal and in-situ treatment be stated in the *Record of Decision*.

Response

Decision criteria and definition for removal areas, in-situ treatment areas, and no treatment are fully presented in this *Record of Decision* (see Part 2, *Decision Summary*, Section 13.6). CFR RipES is a remedial design tool that allows the *Record of Decision* requirements to be implemented on a site-specific, refined, and definitive basis. The purpose is to provide a data predicated decision tool to identify and categorize polygons based on landscape stability, plant community attributes, and contamination severity within the OU.

EPA carefully considered the comments advocating more treatment and those advocating more removal. EPA believes that the combination of these techniques—removal of most slickens and in-situ treatment of most impacted areas—reflects the best balance among trade-offs when considering the NCP required balancing criteria and modifying criteria. Further explanation regarding EPA's decision making is contained in Part 2, *Decision Summary,* Sections 10 through 13, and in the August 2003 EPA memorandum (regarding: Preparation of the *Record of Decision* for the Clark Fork River OU), which responded to concerns from four employees, and is incorporated herein by reference.

2.1.10.2 Vegetation Success

Summary of Comments

Commenters had a range of opinions about how to achieve vegetative success. Some asked that willows and other woody species only be planted in areas that provide the highest vegetation success rate, and that native species (local origin) of grasses, trees, and shrubs be established in the riparian corridor. Some commenters identified the individual species to be used. A few asserted that the remedy, whether it involves removal and replacement or in-situ treatment, should focus on restoring soil conditions that support grasses and woody species to ensure streambank stability. Some commenters were concerned about the effects of metals and arsenic on the vegetation community after in-situ treatment, and wondered if willows could only be established in limited areas in tailing-impacted sites. One commenter stated that slickens areas could be developed into a good alfalfa field, as demonstrated by Lampert's field.

Response

As discussed in this *Record of Decision*, removal with replacement and in-situ treatment represent the primary tools for addressing exposed tailings and impacted soils and vegetation areas, respectively. These remedial tools will be used to create a remedial environment that will promote and sustain a robust vegetative community within the floodplain.

In a recent investigation, the effect of depth of incorporation of soil amendments (lime and organic matter) on growth of Geyer willow planted in fluvial mine tailings was reported by scientists at Colorado State University (Fisher et al. 2000). Willows grown in tailings treated to a depth of 60 cm produced eight times more biomass than willows planted in non-amended (pH 4.0) tailing materials, and 36 percent more than willow planted in tailings amended to a depth of 20 cm. Chemical analyses of the growth media indicated the lime amendment increased pH of the mine tailings (pH near 7.3) such that metals were made less bioavailable and therefore, not phytotoxic. This study suggests that increased depth of incorporation of soil amendments into mine tailings can significantly enhance production of willow cuttings. Depth of incorporation of amendments for phytostabilized areas and depth of excavation for removal areas are major remedial design issues for the application of the remedy for the Clark Fork River. Treatment of the entire contaminated zone for phytostabilization and excavation of all contaminated materials during removal are key design criteria. In practice, willows will be planted in or near the static water table, ensuring the best possible potential for successful establishment and growth. Appendix B of this *Record of Decision* document provides streambank stabilization design considerations and examples.

Objectives for the reclaimed plant community cross many disciplines, including geomorphology, agriculture, wildlife, fisheries, hydrology, risk assessment, and others. The plant community within the OU is expected to serve as a biological soil anchor during flood events, as forage and habitat for wildlife and cattle, as an evapotranspiration system to prevent the recharge of COCs into groundwater, as a deterrent to surface water runoff, and as an aesthetic component of the agricultural landscape. Characteristics of the plant community that are important in the remedy include plant production, forage quality, species diversity, and structural diversity. The relative importance of a characteristic is driven by the land management objectives. Agricultural production objectives would favor high forage value and high production with limited emphasis placed on species and structural diversity. By contrast, wildlife and habitat values increase with structurally complex vegetation and species diversity. The degree to which remedy is able to satisfy the objectives of the landowner is dependent on the management objectives for a specific land area. Native vegetation—such as grasses, shrubs, and trees—will be stressed for many areas that will receive remedial actions. For other areas, the vegetation community to be established will depend on current and future land uses. Remediated areas that are to be used for intense agricultural production—for example, irrigated alfalfa—will be seeded with appropriate agronomic species. In areas that may be subject to flooding during high spring runoff, extra caution will be needed to ensure that farming techniques do not leave bare ground in sensitive areas exposed for significant periods of time.

2.1.10.3 Re-Entrainment

Summary of Comments

This commenter desired removal of toxins as protection of human health. The commenter felt that in-situ treatment is doomed to failure because of the relentless power of the river over time.

Response

Human health RBCs for antimony, arsenic, beryllium, cadmium, copper, iron, manganese, mercury, and zinc for soils/tailings, river water, pooled water, groundwater, and for foods were established in the *Human Health Risk Assessment* (EPA 1998) and its addendum. In addition, risks were calculated for humans exposed by multiple pathways. Arsenic was determined to be the primary COC for human health. Refer to Part 2, *Decision Summary*, Section 13.4, for a discussion of how the Selected Remedy will reduce the risk (from arsenic) to humans.

The Clark Fork River will meander within its existing channel, and re-entrain treated or phytostabilized tailing materials as well as untreated materials and soils that are imported after removal actions. No remedy, including removal or in-place treatment of mine tailings, will stop stream processes such as erosion. The extensive streambank stabilization planned as part of the remedial action, including the 50-foot buffer zone, is intended to slow the rate of meandering and erosion to normal levels, thereby reducing the release of contaminants to concentrations that achieve State of Montana water quality standards or replacement standards when combined with the other remedial action components.

2.1.10.4 Arsenic Mobilization

Summary of Comments

Commenter believed that in-situ treatment of contaminated soils will likely make arsenic more soluble. The commenter added that even if it were granted that STARS (in-situ treatment) approach does result in overall decrease in solubility of arsenic, low mobility does not mean that arsenic present in contaminated soils is not a significant risk as it will continue to enter the environment slowly and that risk will continue over a long time period. EPA should not downplay the public's concern over arsenic mobility and in-situ treatment, but should take a reasonably precautionary approach.

Response

The mobility of arsenic, differentiated from its solubility, in a phytostabilized environment is dependent on several interrelated chemical, physical, biological, and climatic factors. In laboratory column experiments (Jones et al. 1997), arsenic concentrations in the effluent were increased by a factor of 400 when the pH of smelter tailings was raised from 4.5 to very high pH levels between 9 and 10. Adding lime to reprocessed smelter tailings raised the pH from 3.5 to about 8. Under these pH conditions, the arsenic concentrations in the laboratory column effluent increased from about 0.74 to about 7.4 µg/L (Jones et al 1997). Speciation of arsenic was not attempted in these laboratory tests. Extensive site-specific field data from the Governor's Project and from other sites within the Clark Fork River basin were well summarized in the phytostabilization document (CH2M HILL 2001). At the Anaconda Revegation Treatibility Studies (ARTS) phytostabilization experimental field sites near Anaconda (RRU 1997), concentrations of water soluble arsenic within the rootzone of the amended wastes varied among the sites and by oxidation state of arsenic. Little difference exists between the soluble arsenic (V) levels as a result of increasing the pH of the materials. Levels of water soluble arsenic (III) were increased by a factor of two upon liming of the heavily contaminated soils on Anaconda's Smelter Hill. Adding lime to the smelter wastes in the Opportunity Ponds **reduced** the soluble arsenic (III) by a factor of 250.

In *Arsenic in the Environment*, Mok and Wai (1994) state the following: "The observation of enhanced arsenic solubilization at low and high pH as well as under reducing conditions is significant… Therefore, when planning disposal of arsenic-containing wastes or when dealing with long-term stability of mine wastes with respect to arsenic, consideration should be given to maintaining high-redox and near-neutral [pH] conditions for minimum arsenic solubility and mobilization." Mobility of arsenic can be controlled by careful liming practices, by increasing the arsenic oxidation state, by adding amendments that precipitate arsenic (ferrous sulfate), and by adding phosphorus to decrease arsenic bioavailability. The bottom line is that between a pH of 6.5 to 8.0, arsenic solubility appears to be well controlled. This is the long-term target pH range for phytostabilization techniques that are to be applied to impacted soil and vegetation areas as part of the Selected Remedy.

2.1.10.5 Effectiveness

Summary of Comments

Comments received regarding the effectiveness of phytostabilization or in-situ treatment were variable, ranging from "in-situ treatment within the floodplain is not acceptable," to "in-situ is a proven remedial technology being used for 15 years throughout the U.S. and should be used here." In general, however, most of the comments questioned the

effectiveness and permanence of in-situ treatment, and the potential effects of not being able to establish appropriate plant communities, bioaccumulation, re-entrainment, and increases in contamination volume. A much smaller number of comments suggested that there is no scientific evidence that removal is preferable to in-situ treatment and that in-situ treatment is a sound scientific approach. A third set of comments suggested that results of in-situ treatment were variable: some phytostabilized areas have improved substantially while others have not responded. Some suggested that in-situ treated sites could be used in areas that are contaminated, but only where vegetation is present. Others said that long-term monitoring and maintenance and ICs on land use would be required for treated areas in which contaminated materials are to be left in place.

A series of comments were received that questioned all aspects of in-situ treatment. People were concerned about creating an inappropriate pH for native plants, grazing their animals in metals-contaminated soils, accumulating contaminants in the food chain, increasing the mobility of metals, and creating solidification and encapsulation problems. People questioned whether the mixing would be effective, if this treatment is only effective for a shallow depth of contamination, and what would happen if drought or floods destroyed plants. This series of comments concluded that phytoremediation is too new to be approved by regulatory agencies, does not meet goals of Superfund, and that it is not an effective long-term remedy for hazardous waste problems.

Another set of comments stated that metals and arsenic remaining in the treated soils after phytostabilization continue to be phytotoxic, reducing productivity and altering the plant community composition from its potential natural community. There is uncertainty concerning the effectiveness and permanence of establishing woody vegetation, as contaminants will continue to impact riparian plant communities. People are also concerned that treated soils might re-acidify.

One commenter suggested that EPA should proceed cautiously in applying in-situ treatment to large areas, and questioned how EPA would react if phytostabilization caused more problems than cures.

Only one commenter mentioned human health in relation to phytostabilization, and stated that if in-situ treatment could reduce soil arsenic levels below applicable human RBCs, as proven by post-treatment sampling, the proposed cleanup would be protective of human health.

Response

There is some risk that any vegetation-based technology, phytostabilization or others, will fail to achieve objectives in the future. Many possible circumstances could lead to a partial or complete failure. Possible problems include weed infestation, excessive metal accumulation impacting wildlife or livestock, changes in the plant community, over-grazing, phytotoxicity, excessive channel migration, contaminant leaching to groundwater, soil erosion by wind or water, failure to achieve agricultural productivity goals, failure to provide adequate fish habitat, and failure to allow reestablishment of wetlands. Some of these potential failures are relevant only to phytostabilization and can be related directly to the continued presence of contaminants in the soil. Risks not related to COCs can be attributed equally to any vegetation based remedial action. Central issues for phytostabilization technologies are toxicity to plants, livestock exposure from forage,

incidental ingestion by livestock, vegetation response to grazing phytostabilized land, COC caused phytotoxicity, plant communities and phytostabilization, and long-term permanence of phytostabilization. Each of these issues is addressed below. In conclusion, EPA believes that the lengthy development and examination of in-situ treatment done for the Clark Fork River OU makes it an appropriate technology for use at this site in combination with the streambank stabilization and removal components.

Toxicity to Plants

Based on a review of the scientific literature, ranges of elemental levels for mature leaf tissue have been presented by Kabata-Pendias and Pendias (1992). The authors provide elemental levels for generalized plant species into ranges representing deficient, sufficient or normal, excessive or toxic, and tolerable in agronomic crops.

Vegetation samples collected from the Governor's Demonstration area in 1996 revealed that most plant loadings were within the normal or sufficient range, with a few arsenic concentrations in the excessive range. It is believed that the plant species growing in phytostabilized areas of the Governor's Demonstration are tolerant of metal and acid. For example, redtop (*Agrostis* spp.) is known to be able to evolve metal-resistance (Shaw 1990), and basin wildrye has invaded the upper portions of Smelter Hill in Anaconda, which has soils with extremely elevated metal and arsenic concentration (RRU 1993). EPA believes that restricting the in-situ treatment to non-slicken areas where metals are generally lower, pH is higher, and there is more organic material will help reduce potential toxicity to plants.

Contaminant Exposure from Forage

Cattle grazing is a major agricultural land use in the Clark Fork River Basin. The protection and enhancement of this resource is a significant consideration in remedial design for land near the river. One of the principles of phytostabilization is to select plant species that are poor translocators of contaminants (metals and arsenic) into the above ground portions of the plant. In 1999, a summary of metal and arsenic concentrations in and on plants growing in reclaimed areas in the vicinity of Silver Bow Creek, Anaconda, and along the Clark Fork River was prepared (CDM and RRU 1999). These metal loads (concentration on (as topical dusts) and in the plant tissue) were compared to maximum tolerable levels of dietary minerals for domestic animals (NRC 1980). The maximum tolerable dietary levels for cattle and horses are as follows:

- arsenic = 50 mg/kg
- cadmium = 0.5 mg/kg
- lead = 30 mg/kg
- zinc = 500 mg/kg
- copper = 100 mg/kg (cattle) or 800 mg/kg (horses)

Most of the plant species growing in the Governor's Demonstration revealed metal and arsenic concentration below the maximum dietary tolerance levels for cattle and horses. It is expected that by removing slickens and treating less impacted areas, the overall less-metal tolerant vegetation that will be established and may be grazed would not be a concern for excessive metal ingestion.

Incidental Ingestion by Livestock

Because in-situ treatment does not remove contaminants from the soil, there is a residual risk of exposure to cattle from the incidental ingestion of soil during grazing. Ingestion of soil along with forage can be a source of additional elements for grazing cattle. Mayland et al. (1975), Healy (1974), and Thornton (1974) reported similar soil ingestion rates. Lead levels in blood from cattle residing near the East Helena Smelter (Neuman and Dollhopf 1992) were significantly correlated with soil concentrations of lead, as well as vegetation concentrations, and distance (negative correlation) from the lead smelter. It was postulated that soil concentrations may be more important than forage as a source of lead to the cattle in the East Helena investigation.

Edible muscle, kidney, and liver tissues from six selected cattle from the Grant-Kohrs Ranch National Historic Site were analyzed for concentrations of arsenic, cadmium, copper, lead, and zinc (DOI 1996 and revised 1997). Ninety days prior to slaughter, three of the animals were allowed to graze within contaminated riparian areas, and three others were held in less-contaminated pastures. It was reported that riparian cows had metal tissue concentration very similar to pasture cows. Elevated diagnostic levels were reported for cadmium in kidney tissue from pasture cows, copper levels in muscle tissues were elevated in four animals, and copper in liver tissue of one animal was reported at a toxic level. There are no site-specific data for metal levels in cattle grazing on in-situ treated lands within the Clark Fork River Basin. White-tailed deer and cattle were selected for quantitative evaluation in the Clark Fork River *Ecological Risk Assessment* (EPA 1999). Predictive analysis indicated little or no hazard of toxic effects to deer from metals or arsenic in the terrestrial environment. A moderate hazard to range cattle was predicted from arsenic and copper in soils. The authors stated that results should be interpreted with caution because there is little site-specific information to support the predictions.

Vegetation Response to Grazing Phytostabilized Land

As part of the Governor's Demonstration, landowners were restricted from grazing the phytostabilized land for a 3-year period after implementation of the treatment. When grazing resumed, the cattle were to be removed by the landowners when the stand of vegetation was reduced to a predetermined height of approximately 4 inches (Atlantic Richfield Company 2000a). Production and vegetation cover were measured on grazed and non-grazed pastures. During the monitoring period, forage production varied from year to year, but averaged 3,004 kilograms per hectare (kg/ha) on the ungrazed areas as compared to 2,453 kg/ha on grazed areas. Statistically, these mean production values were not different. Vegetation cover values of grazed and ungrazed were nearly identical with mean percentages of 70.1 and 70.8 percent, respectively (Atlantic Richfield Company 2000a).

The number and source of plant species on treated areas within the Governor's Demonstration Project was also summarized in the Atlantic Richfield Company's report. The study included grasses, forbs, shrubs, and rushes, and noted whether each species was seeded or if it invaded from nearby areas. This information was analyzed with respect to the initial tailings thickness (deep, moderate, shallow, or riparian), and as a function of whether the area was grazed or ungrazed by cattle. Species richness, or the number of species, was identical between areas that were grazed and those not grazed. For example, 10 species were found growing in areas with deep treated tailings that were not grazed, while 12 species were found growing in areas with deep treated tailings that were subjected to

grazing pressure. There are some, but limited, differences in the presence or absence of specific plant species when observations from grazed and ungrazed areas are compared. It should be noted that this was a short-term study. EPA believes that well-managed grazing can be compatible with a healthy riparian system that results from removal of phytotoxic conditions. This *Record of Decision* provides guidelines for allowance of grazing after appropriate vegetation levels are achieved.

COC Caused Phytotoxicity

The initial plant community, established on phytostabilized lands of the Governor's Demonstration, provided production (6-year average of 3,100 kg/ha), adequate cover (6-year average of 83.7 percent), and species richness (average of 9 species with greater than 1 percent cover) over a 10-year period (Atlantic Richfield Company 2000a and 2001). The community consisted of species obviously tolerant of the climatic and chemical environment (including metal levels measured in pore waters). A privately owned portion of the Governor's Demonstration area was subjected to multiple land uses during this time, including a hay pasture, cattle grazing, an alfalfa field, and a bull pasture. These practices resulted in different plant communities in this area. In 2000, the rancher seeded this area with barley, and in 2001 he seeded it with a mix of barley and alfalfa. The response of the barley in the first growing season was quite variable. An investigation (Neuman et al. 2002) was conducted to determine the causative factor(s) for this variable barley response. Statistical analyses of amended soils and barley plants data indicated that reduction in barley biomass, grown in materials with near neutral pH, was significantly correlated with metal levels (as a "standardized metal index") in the remediated soil. When the barley data were superimposed on EPA's Phytotoxicity Model (as was done for the *Ecological Risk Assessment* for the Clark Fork River), the results indicated that barley may be a sensitive plant species, or that the model itself becomes less accurate as it appears to flatten out at pH above about 7.5. The investigators concluded the in-situ treated areas with elevated metals may have limitations on the vegetation communities that can be established, but that healthy communities can be established. This conclusion is consistent with field observations, the theoretical phytotoxicity models, and data presented in the *Ecological Risk Assessment* for the Clark Fork River. EPA believes that in-situ treatment, carefully done in impacted areas, will produce successful plant communities.

Plant Communities and Phytostabilization

In general, diversity on reclaimed lands is less than that of undisturbed, adjacent areas. This has been observed even on areas that are not impacted by harsh chemical environments (metals and pH). It is unlikely that replacement of available soils after total removal of tailings or contaminated soils would result in communities that are exactly equivalent to the baseline or reference area. It is important to distinguish remedy—in this case, in-situ treatment, removal, or a combination of techniques—from restoration. For additional information, please see Section 3.2, items number 18 (page 3-19) and 28 (page 3-99).

Long-term Permanence of Phytostabilization

A recent paper (Munshower et al. 2003) investigated the permanence of phytostabilization, primarily in upland areas, within the upper Clark Fork Basin. The purpose of the investigation was to generate sufficient data and information from areas receiving phytostabilization treatments, varying in age from 6 to 19 years, so that the permanence and self-sufficiency of the established and reconstructed ecosystem(s) can be generally assessed.

Major conclusions of this investigation were that phytostabilization of acid mine waste is a valuable reclamation technique, calcium carbonate amendment applied as ground limestone or certain industrial wastes can be calculated and applied to produce a non-acid root zone (particularly if underlain by organic soil) that will last indefinitely, and that successional changes in vegetation are occurring over time. To ensure that phytostabilized vegetation in the floodplain is permanent, a comprehensive monitoring and operation and maintenance program must also be employed. In all, EPA finds that the in-situ treatment at impacted areas designated in this *Record of Decision* can be done with long-term effectiveness and permanence because residual risks can be effectively managed. Again, EPA believes the Selected Remedy appropriately weighs trade-offs from the balancing criteria, including long-term effectiveness and permanence, as reflected elsewhere in this *Responsiveness Summary*.

2.1.11 Institutional Controls (ICs)

2.1.11.1 ICs for Land Use Management

Summary of Comments

Most commenters were in favor of ICs, but had specific issues and questions about implementation. Five key issues were cited in the comments:

- Compensate landowners for ICs that impact their land use.
- Fund local agencies for enforcement of ICs.
- Develop a plan to ensure long-term effectiveness of ICs.
- Do not rely heavily on ICs because they are not effective.
- Use conservation easements or outright purchase to ensure long-term protection instead of ICs.

Many commenters believed that a commitment of dollars for the long term would be key to the success of ICs. One commenter said that ICs are considered "takings" of private property because some land uses could be eliminated. Many commenters who called for landowner compensation also asked that agencies be funded for enforcement. Commenters felt that agencies do not have the staff to enforce the ICs. One commenter cited an example from Butte-Silver Bow, in which there are no guarantees to manage the site in perpetuity because the agency was not funded in perpetuity.

Some commenters described specific processes and features that should be included in a long-term, comprehensive plan for ICs. The process suggested by one commenter included gathering input from the public, landowners, and local and State agencies. Others requested specific features, such as riparian zone controls and a human health and safety component.

Some commenters felt that ICs are inadequate and that the *Proposed Plan* relies too heavily on this tool. One commenter cited cases where enforcement of ICs had declined over time, and education programs were not adequately implemented. Also, the commenter felt that ICs incur high costs to landowners while providing little benefit. Future land use cannot always be anticipated, which makes ICs more difficult to implement. Some commenters

suggested using conservation easements or outright purchase to assure a long-term remedy instead of ICs.

Response

ICs are non-engineered instruments such as administrative or legal controls that minimize the potential for human exposure to contamination by limiting land or resource use. They are typically used in conjunction with engineering measures such as waste treatment or containment. They can be used during all stages of cleanup. The fact that the most heavily contaminated areas will be removed helps to reduce the potential need for long-term ICs in these areas.

ICs will be implemented as part of the proposed remedy; refer to Part 2, *Decision Summary*, Section 13.9, for a full description of the role of ICs, BMPs, and land use plans. Appendices C and D also contain pertinent information on this topic. ICs necessary for the Selected Remedy to protect human health and ecological health are provided in Part 2, *Decision Summary*, Section 13.4, and Section 13.5, respectively. Access and BMP enforcement are discussed in Part 2, *Decision Summary*, Section 13.6.5. See Sections 2.2.6 and 2.2.7 of this *Responsiveness Summary* (pages 3-70 and 3-71, respectively) for additional details on IC issues and compensation issues. Orders and decrees require PRPs to pay reasonable compensation to landowners or tenants for access. The loss of production from the land affected by implementation of the remedial actions, including remedial components such as road building and staging areas, will be an important issue that must be addressed in any access agreement. Clearly defined BMPs and the ability to ensure that BMPs are implemented is very important to the success of the remedy. As noted in Part 2, *Decision Summary,* Section 13.9.1, EPA will work with the PRP, other stakeholders, and the U.S. Department of Agriculture to develop an effective, funded, and enforceable BMP program. EPA believes that the carefully crafted ICs described in various sections of Part 2, *Decision Summary,* are appropriate for this type of a site and can be successful over the long run to protect the remedy. EPA will work with stakeholders on the exact nature of the specific ICs during remedial design.

2.1.12 Natural Recovery/Natural Healing

2.1.12.1 Natural Recovery Effectiveness

Summary of Comments

Several commenters indicated that a lot of healing has occurred naturally in the Clark Fork River floodplain. A couple of these commenters cautioned against disrupting the gains already made by the natural system and of causing even more harm. Based on long histories of living along the river, a couple other people indicated that both the vegetation and wildlife, including fish, are much more abundant and healthy than before. Other commenters said that the *Proposed Plan* failed to recognize the extent of natural healing that has occurred in the system without human intervention. Another commenter asked for a way to predict effects of remediation on levels of sediment and metals in the river. While one commenter suggested that tailings should be left alone where good vegetation is naturally establishing, another advocated a more active approach and said nature needs help to repair the damage that humans caused. Finally, one commenter said that the river

downstream from Deer Lodge already looks great with lots of fish, wildlife, and beautiful vegetation.

Response

Some natural recovery has occurred along the Clark Fork River, but EPA found widespread unacceptable risk and surface water quality problems, especially in Reach A. Barren slickens still exist along the upper 43 miles of river after nearly 100 years, with little observable healing. This *Record of Decision,* through the CFR RipES process, appropriately distinguishes between impacted soils and vegetation areas where in-situ treatment will be implemented, and areas that are only slightly impacted and require no active remediation. These areas may be said to be naturally healing. Many areas with elevated concentrations of metals in the soil profile do have pH near the neutral range and robust vegetation. The application of CFR RipES to these areas will discern between areas to remove, areas to remediate in-situ, and areas where no action will be taken (see Part 2, *Decision Summary,* Section 13.6.1). The desired option is to leave as many as possible of certain "preferred woody plant species" in place that are already growing on the floodplain within the Clark Fork River OU. This will be accomplished by working around them whenever practicable and whenever the overall goals of the project can still be achieved by doing so. Additional discussion is provided in Part 2, *Decision Summary*, Section 13.8.1.

It is not possible at this time to accurately predict the effects of remediation on specific levels of sediment and metals in the river. However, it is expected that significant reduction in erosion will occur, resulting in improved water quality. Measurement of the improvement of water quality will be ascertained through a rigorous monitoring program to be developed during remedial design.

2.1.13 Non-Floodplain Lands

2.1.13.1 Historically Irrigated Fields

Summary of Comments

Those who commented in this category feel that historically irrigated fields represent a large potential for contamination. The commenters suggested that these areas be included in the proposed remedy.

Response

Historically irrigated field are addressed in several sections of this *Record of Decision* in Part 2, *Decision Summary*. In Section 13.4 of Part 2, the following text describes how the remedy will be implemented for irrigated fields:

> Some residences are identified under the Deer Lodge Valley Historically Irrigated Lands TCRA as exceeding the action level for arsenic in residential areas and were not addressed under the TCRA. These areas will be revisited and remediated consistent with that action. Other follow-up operation and maintenance activities from this action will be implemented.

EPA does not believe that other historically irrigated lands within the Clark Fork River OU exceed EPA's action level for current and reasonably anticipated land use for those lands. This shall be confirmed via sampling of these lands if necessary and confirmation that residential development is not planned for these areas. As noted in later portions of this

section, confirmation sampling for in-situ treated areas is also required to ensure that these areas are below action levels for current and reasonably anticipated uses (which is likely to be agricultural for most lands) after treatment.

2.1.14 Noxious Weeds

2.1.14.1 Noxious Weeds/Invasive Plant Species

Summary of Comments

Many commenters stated the need for effective weed control measures to be incorporated into the cleanup work on the upper Clark Fork Basin, while most of them, as well as others, expressed a variety of concerns about details or the lack of detail in the *Proposed Plan* on this topic. A variety of adjectives were applied to the term weed control, including well-funded, comprehensive, and long term.

Stakeholder comments on this topic included issues of landowner assistance and compensation for weed control measures, minimization or avoidance of chemical herbicides—particularly near the river, and inclusion of county and local weed boards in formulating weed education, prevention, and control plans. A few commenters expressed fear that remediation work would actually spread weeds to more sites. A couple of commenters emphasized the importance of employing education and prevention methods as the primary thrust of the plan, with control of existing weeds secondary. Other commenters felt that controlling weeds at the river's edge seems minimal compared to what needs to be done, and that weed management should cover the entire 100-year floodplain. One commenter suggested that EPA adopt Roger Sheley's (MSU Extension) recommendations on how to accomplish weed control:

- Include weed reports when working with landowners.
- Plan for prevention, rather than relying on control after invasion.
- Identify and address causes of invasion in remediation areas.
- Include strategies for early detection of weed invasion.
- Rely on multiple control strategies working in tandem.
- Plant multiple species, all having ability to resist weed competition.

One commenter felt that the Atlantic Richfield Company should be responsible for weed control during the project and for 5 years after completion of the work. Another felt that the *Proposed Plan* was misleading, because burning weeds is not a control measure and bringing in new soil will introduce more weeds. Other opinions about weed control included the use of grazing as a long-term weed management tool, incorporation of weed control contracts in the remedial design, and guarantee of monitoring and weeds control throughout the Upper Clark Fork River Valley. Finally, a commenter indicated that if the agencies sincerely and substantively address landowner concerns about weeds, then landowners would be more likely to participate in the cleanup.

Response

Control of invasive plants will be an integral and critical component of remediation (see Part 2, *Decision Summary,* Section 13.10). An aggressive integrated weed management program will be implemented during the construction cycle. An integral part of the remedial plan for every site upon which remedial work is done will include a

comprehensive plan for controlling weeds. The approach taken is that all weeds on property within the Clark Fork River OU upon which remedial work is done will be controlled. This is the best way to minimize the possibility that weeds from nearby sites would invade treated areas. An aggressive campaign to control weeds already on a site will be undertaken concurrently with any other remedial work being performed.

An integrated weed management approach will be taken, and an integrated weed management program will be established as a vital component of all ranch management BMPs and ranch management plans. This program will be developed with the cooperation of the State, local weed management experts, and landowners. The program, as described in this *Record of Decision*, will emphasize up front planning, resource identification, monitoring, and corrective actions. Appendix D of this *Record of Decision* presents a detailed series of weed management options and measures specific to weed species likely to occur within the OU. Coupled with the implementation of the integrated weed management plan on each property will be a program of comprehensive monitoring and evaluation to assess which components are working and which are not, so that adjustments can be made. Invasive species will be monitored and any re-infestations will be treated for 5 years after the remedial construction and re-vegetation phase of the work is completed on each site as part of the post-construction monitoring process. Monitoring will be conducted in a timely manner, so as to promptly inform managers of the need for any adjustments of control efforts. EPA consulted with the Powell County weed board as it developed the weed control requirements and explanations found in this *Record of Decision*.

The Center for Invasive Plant Management (CIPM) at Montana State University was heavily utilized to obtain information on invasive plant control and management, as well as sources from surrounding states and Canada, including the Powell County Weed Board.

2.1.15 Permanence

2.1.15.1 Long-Term Permanence

Summary of Comments

All commenters in this subcategory desired "permanence" or a "permanent remedy," but differ widely on the definition of permanence and how that definition applies to the Selected Remedy. One individual said that "permanence," as used in Superfund law, means that the ecological or human health risks are controlled long term, which could be accomplished with in-situ treatment and ICs. Another commenter felt that nothing less than a "permanent, total cleanup" was acceptable, and advocated removal to the greatest extent possible. One commenter cited the "non-impairment clause" for the Grant-Kohrs Ranch National Historic Site to argue for a permanent solution. Many of the commenters in this subcategory felt that leaving any contaminated soil in place would not equate to a permanent solution and does not consider impacts on future generations. Others felt that if contaminated soil remained, conservation easements and restricted land use would be the only way to then assure a permanent remedy. Another commenter felt that regardless of which remedy is selected, landowners should not be held liable if the remediation fails.

Response

In the CERCLA *Feasibility Study* process, remedial alternatives are evaluated against nine criteria. Long-term effectiveness and permanence is one of the criteria and is a balancing,

not a threshold, criteria. According to EPA Guidance, a remedy is to be assessed for "magnitude of residual risks" and "adequacy and reliability of controls." Long-term effectiveness and permanence are also addressed in Part 2, *Decision Summary*, Section 10.2.3. The remedy described in this *Record of Decision* physically removes and disposes of concentrated deposits of exposed tailings or "slickens" from the floodplain and addresses other contaminated areas with vegetation impacts through blending and dilution with underlying clean soil, amendments of lime, and planting of vegetation. Although the exposed slickens represent approximately 5 percent of the mining waste contamination in the Reach A floodplain, sampling has shown that these deposits often have the lowest pH, the highest metal and arsenic concentrations, and the most potential for re-mobilization of metals through thunderstorm and flood events. They also represent phytotoxic conditions that do not support healthy vegetative cover with robust, soil-binding root structures. Their removal and replacement with clean borrow material reduces the risk of human and ecological exposure associated with this contaminated material, and does not implement in-situ treatment where there is less chance of success, and thus less chance for successful management of residual risks. In-situ treatment of the balance of contaminated soils areas immobilizes contaminants within the soil and plant complex, reduces contaminant movement to groundwater and receiving streams, and helps stabilize the landscape from wind erosion. Once implemented, EPA considers the "magnitude of residual risks" from these materials to be acceptable where done with long-term operation, maintenance, and monitoring. From the standpoint of "adequacy and reliability of controls," EPA is confident that these technologies work when properly implemented and coupled with an appropriate land use management strategy that promotes healthy vegetative cover.

O&M activities will be implemented as part of the remedy to protect the integrity of the Selected Remedy for the Clark Fork River. Performance evaluations of the Selected Remedy is discussed in Part 2, *Decision Summary*, Section 13.11, and includes methods for determining when and if the remedy is operational and functional, and provides a mandate for short-term and long-term monitoring of the remedy, as well as a maintenance program. Numerical performance standards are also specified in Section 13.11 for the rootzone, for vegetation, surface and groundwater. Finally, a review of the entire remedy is required at 5-year intervals.

2.1.16 Reaches B and C and Tributaries

2.1.16.1 Reaches B and C and Tributaries

Summary of Comments

Many commenters wanted the cleanup extended in some degree to include more of Reach B and at least some of Reach C. Of the commenters, most used the terms "cleanup," "treatment," or "remedy" in their preference for Reaches B and C. Some suggested application of BMPs, streambank stabilization and revegetation techniques, or use of rip-rap to protect the remedy if ice jams occur. A few expressed a desire for no contamination to be left in place along the entire upper Clark Fork River, and believe that more contamination will be found in Reaches B and C in the future. A few commenters asked for further investigation of possible contamination in these reaches, stating that contaminated sediments have accumulated in these reaches incrementally over time, and the *Record of Decision* should provide for future remediation if critical concentrations are ever found

there. One commenter feared that the "No Action" decision for Reaches B and C sends a message that these areas are free of contamination. At a minimum, this commenter believed that landowners should be informed of possible contamination and land use restrictions should be in place.

Response

The remedy, as described in this *Record of Decision*, will be applied at limited, localized areas within Reach B of the OU. The difficulty of applying any remedial technique in Reach C and most areas of Reach B—where waste has been thoroughly mixed with soils and where higher flows occur—lead EPA to find that a remedy is not required for lands within many areas of Reaches B and C of the OU.

Studies performed for the *Remedial Investigation* and the *Feasibility Study* have shown that a focused cleanup effort in Reach A results in the greatest reduction in contamination. Efforts in Reach B would be expected to provide limited additional benefit. Reach C has more limited risks and no clear practical clean-up alternatives because of the widespread contamination, mixing of the contamination with fluvial soils, and the lack of feasible remedial alternatives.

Based on data presented in the *Remedial Investigation* and the *Feasibility Study*, no streambank removal and reconfiguration will be necessary in Reach B. The data do not show exposed tailings or buried tailings greater than 12 inches thick in contact with the present streambank of the river. Of the 6.23 acres of visible contamination recorded on the 52.1 percent of area inventoried within Reach B (Atlantic Richfield Company 1996), about 500 linear feet of streambank are very near the surface tailings (within 10 feet). This extrapolates to about 960 total feet of streambank that may be near visible surface contamination in Reach B. No secondary channels of the Clark Fork River or its tributaries requiring remediation work were noted in Reaches B or C.

2.1.17 Removal/Excavation

2.1.17.1 Effectiveness

Summary of Comments

The removal portion of the *Proposed Plan* generated a wide variety of comments. While overall many commenters favor removal, others expressed concern about removal. Some felt that it would be best not to disturb anything through removal, because such disturbance could create a bigger risk of contaminant release to the environment. People were also concerned that importing soils from other locations would extend the disturbance issue to off-site locations and heighten the risk of importing a seed bank of invasive weed species.

Many commenters wanted to know why EPA selected removal (including off-site contaminated soil disposal and replacement with clean soils) instead of in-situ treatment. These people indicated that removal results in greater disturbance, higher cost, and equal effectiveness. They asked why EPA feels that in-place treatment is less permanent and effective, and what the measurable benefits would be of removing slickens rather than treating them in place. Many landowners who are not in favor of removal and replacement have been informed that EPA has the authority to compel access on their property to implement the remedy, which was not favored.

Finally, commenters were concerned about the ultimate fate of the removed soils. Some asked for disclosure of where removed soils will be deposited, while others suggested that nutrients within removed floodplain soils may actually benefit Opportunity Ponds as a repository site. Contrary to this, other commenters suggested that another repository site be selected because Opportunity Ponds already contains plenty of waste and has existing groundwater problems.

Response

The Selected Remedy requires removal of the most phytotoxic exposed tailings, while the lesser impacted soils and vegetated areas will be remediated using in-situ treatment with appropriate BMPs. The removal of exposed tailings is discussed in Part 2, *Decision Summary*, Section 13.6.2. Necessary temporary haul roads to provide an access corridor across a landowners' property can be designed and constructed to avoid or minimize impacts on healthy vegetation and all such roads will be reclaimed after cleanup. Excavated materials will be transported to the Opportunity Ponds Waste Management Repository, as specified in Part 2, *Decision Summary,* Section 13.6.2.

The Selected Remedy balances the desire for permanent source control with the reality that not all wastes can or need to be removed but that some must be managed in place. Removal will be done only in the most phytotoxic areas as defined in Part 2, *Decision Summary*, Section 13.6.2. The removal of approximately 430,000 cubic yards of tailings in slickens in Reach A will reduce the arsenic by approximately 750 tons and the copper by 1,900 tons.

EPA believes this approach will result in greater vegetative success than if slickens were remediated by in-situ means. This belief is supported by BRI (2002), which showed that "Lower Area One (LAO) has a significantly higher riparian functional health than the Governor's Demonstration Project as determined by the methods of this study." At LAO, tailings were removed, while at the Governor's Demonstration Project, tailings/impacted soils were treated in-situ.

As described in the CERCLA statute, EPA has the authority to compel the landowner to implement the Selected Remedy. However, EPA intends to work closely with each landowner before, during, and after implementation of the Selected Remedy on each property. Part 2, *Decision Summary*, Section 13.6.1, presents information about how landowners and the agencies will interact through the CFR RipES process in determining the level of implementation of the remedy required. Initial consultation with each landowner regarding access and implementation, as well as management plans, ICs, and BMPs, will all be part of a remedial plan specific to each landowner. Refer to Part 2, *Decision Summary,* Section 13.6.5 for a discussion of access and BMPs, to Section 13.9 for a description of BMPs, to Section 13.10 for a description of weed management, and to Section 13.12 for anticipated scheduling of the remedy.

2.1.17.2 Extent

Summary of Comments

Again, commenters expressed a variety of views relative to this issue. While some commenters asked that only the slickens be removed and the buried tailings left alone, others asked that all contamination and phytotoxic areas be removed from the floodplain and transported to Opportunity Ponds. Some said that that slickens removal was essential

to the success of this cleanup project, while others said that soils should also be tested and removed if they exhibit high concentrations of metals, arsenic, or phytotoxicity. Most commenters asked that removal be done carefully to prevent additional contamination, protect bank stability, enhance woody vegetation, and reduce the risk to the floodplain if a flood occurs during construction. One commenter suggested excavating replacement soils from elsewhere in the floodplain and making the excavations into ponds for stock watering.

Several commenters felt that no removal was necessary, the removal of 167 acres was unwarranted, and in-situ treatment should be maximized because the risks were not great enough to justify the removal strategy. Some commenters expressed concern about the uncertainty of the volume of material to be removed and the impacts on landowners. EPA was strongly encouraged to work with landowners to develop plans for their properties.

One commenter said that the *Record of Decision* should specify exactly how removal areas would be selected, and suggested that EPA treat everything in-situ except for those slickens areas that exceeded 2 feet in depth. Another commenter also wanted an exact removal specification, but suggested that all exposed tailings except those 400 square feet in size located contiguous to impacted soils with impacted vegetation be removed.

Response

Clear definitions of areas that must be removed are provided in Part 2, *Decision Summary*, Section 13.6.2. For each landowner-specific design, locations and aerial extent of exposed tailings, impacted soils and vegetation, and streambank classifications (lengths and locations of Class 1, 2, and 3 streambanks) will be clearly delineated using CFR RipES (refer to Part 2, *Decision Summary*, Section 13.6.1). This step defines what and where various types of work must be done. Following this initial step, transportation corridors can be determined to enable removal of wastes and replacement with backfill soils. Chemical amendments, plants, other supplies, and appropriate types of construction equipment will also need to get to the work. After the required remedial actions are completed for the slickens, impacted soils, and the streambanks, revegetation of the riparian corridor and other lands—suitable to previous use—can be completed. Finally, fences, gates, haul road reclamation, and other construction activities can be completed for each landowner.

EPA disagrees with comments to expand the removal. It is estimated that there are more than 9 million cubic yards of tailings and contaminated soils in the floodplain of Reach A. In the *Feasibility Study*, Alternative 8b, total removal, was evaluated and was found to cost in excess of $355 million. This alternative would take many decades to implement. EPA believes the Selected Remedy strikes a sensible balance between the use of in-situ remediation on impacted soils and vegetated areas and the use of removal and replacement techniques on the slickens areas. Also, this approach significantly reduces environmental risk, can be implemented in one decade, and is cost effective.

EPA disagrees that there should be less removal of slickens. The *Ecological Risk Assessment* established clear risks to the aquatic and terrestrial environment along Reach A of the river. Slickens generally lack vegetation, and impacted soils and vegetation areas sustain reduced terrestrial plant species and diversity. Based on the USGS copper loading model, more than 60 percent of the copper load to the river comes from eroding banks lacking deep binding root mass (see Exhibit 3-7, page 3-14). This lack of deep binding woody vegetation primarily results from the phytotoxicity typically associated with slickens. The additional copper load

to the river, and results of other studies described in Section 2.1.5.4 of this *Responsiveness Summary* (page 3-28), has led EPA to the conclusion that copper (and possibly arsenic and other metals) in the aquatic environment (surface water and diet, which presumes intake from contaminated sediments) impose low-level chronic stress on aquatic macroinvertebrates, trout, and other fish. In addition, EPA considers it likely that acute exposures to pulses of metals also contribute to reduced fish and aquatic invertebrate populations. The Clark Fork River frequently exceeds State WQB-7 water standards at certain monitoring locations. Because of the aforementioned risk issues and their causes, EPA believes that removal of the slickens, in conjunction with the implementation of the additional streambank improvements to significantly reduce erosion and improve bank stability, will provide important remedial components to the reduce the copper load to the river.

EPA believes that the Selected Remedy approach to removal will result in the best level of remediation success. This approach involves the removal of approximately 167 acres of slickens and disposal in the Opportunity Ponds. The removed areas would be backfilled with high quality, clean, amended soils and revegetated. Use of the CFR RipES tool will define the areal boundaries and thickness of slickens and impacted soils and vegetation to be addressed.

In general, slickens that are removed will be replaced with clean backfill soils to the approximate original elevation(s) so as not to change the overall floodplain characteristics and geomorphology, so that the general channel alignment will remain the same. In certain specific locations, with the concurrence of the landowner, it may be prudent to develop wetland areas, including watering ponds, in conjunction with removal efforts to establish a healthier riparian ecosystem or provide greater land use and to minimize backfill requirements for a given section of the floodplain.

In the detailed design stage for a given landowner parcel to be remediated, CFR RipES will be used to specifically designate the areal boundaries of slickens to be removed and those areas to be remediated by in-situ techniques. Maintaining existing bank stability and not impacting existing woody vegetation are important components considered in the design, particularly in the riparian buffer zone, regardless of which method is used.

2.1.17.3 With Backfill

Summary of Comments

Commenters in this subcategory focused on the quality of the soils that would replace the removed slickens. Commenters were also concerned about the source of the borrow material.

Response

After removal, and as appropriate depending on the land use (to be determined during design), an equivalent volume of clean soil backfill (considering in-situ compacted density and that has been tested and determined to be suitable as growth media for both riparian and herbaceous vegetation), will be brought to the site and placed in the excavations, leveled, and compacted for revegetation. Consideration will be given to reducing backfill needs, where possible. Borrow material source areas must be carefully planned to minimize

the amount of disturbed land, and must be adequately reclaimed. Specific backfill source areas have not yet been identified. The backfill soils must meet the following criteria:

- Match strict chemical and physical specifications (e.g. soil type, grain size, metal and arsenic concentrations, percent organic, etc.).
- Be free of weeds and weed seeds.
- Contain the required quantity of organic materials and other nutrients necessary for growth media.

Specific chemical and physical properties of the borrow soils are presented in Part 2, *Decision Summary*, Section 13.8.2.

2.1.17.4 Without Backfill

Summary of Comments
One commenter felt that removal without replacement soils is a better approach.

Response
In general, exposed tailings that are removed will be replaced with clean backfill soils to the original elevation so that the overall floodplain characteristics and geomorphology will not be changed. This will allow the general channel alignment to remain the same. In certain specific locations, it may be appropriate to develop wetland areas (including watering ponds) in conjunction with removal efforts to minimize backfill requirements for a given section of the floodplain. Site-specific remedial designs will be required for these areas.

2.1.18 Riparian Evaluation System (RipES)

2.1.18.1 Further Development

Summary of Comments
Many comments were received asking that EPA describe the decision criteria that would be used to determine where removals would be implemented and where in-situ treatment would be selected. In a related comment, it was suggested that EPA needs to clarify an apparent contradiction between pre-determined remedial actions in the *Proposed Plan* (removal of 167 acres of slickens and treatment of 700 acres using in-situ methods) and those actions determined by CFR RipES. A second set of comments recommended that CFR RipES should use river health as the ultimate measure of evaluating the recovery effort. A third set of comments suggested that "best science" be used to determine which materials should be removed and which materials should stay.

Many comments requested that CFR RipES should be described in detail in the *Record of Decision* document, that CFR RipES should be subjected to public comment, and that a field demonstration of the system should be conducted. Some individuals volunteered to help develop the system.

A few comments suggested that phytotoxicity thresholds should be considered, and additional related comments suggested that copper levels in slickens and soils (and impacts to water levels) should be part of CFR RipES. A third related comment asked if there is a water component to the system. A couple of comments were received regarding the lack of

clarity regarding streambank classification, with one suggesting that EPA err on the conservative side in classifying banks.

One comment suggested that site-specific results of CFR RipES be subject to public comment prior to design, and another objected to details of CFR RipES being negotiated with landowners at a later time. It was stated that CFR RipES was not robust enough to determine site-specific remediation. Lastly, one commenter was "insulted" that site-specific treatment is to be determined by an unspecified and underdeveloped evaluation scheme.

Response

The CFR RipES remedial design tool is described in Part 2, *Decision Summary*, Section 13.6.1. Decision criteria for selection of areas at which removals are to be implemented, areas that will be treated in place, and areas that do not require remedial action are also fully presented in Part 2, *Decision Summary*, Section 13.6.1. CFR RipES will be released by EPA at the same time as this *Record of Decision* is released and will be subject to further discussion and refinement.

Metals in soils and tailings are present at concentrations that range from benign, to slightly phytotoxic, to severely phytotoxic. In addition, metals released from tailings via overland flow of surface water runoff and from bank erosion are major contributors to loads found in the river. The concentration of copper (used as a surrogate for all the COCs) in the soil and tailings is one of the metrics scored in the CFR RipES system. Low concentrations of soil and tailings copper receive several points (maximum of 10), while elevated concentrations receive few or no points. The *Remedial Investigation* found a geometric mean value for copper in unimpacted soils of 303 mg/kg (ppm). Polygons with soils or tailings having greater than or equal to 300 mg/kg copper receive full points. A sliding scale is then used that relates copper concentration and CFR RipES points. Copper levels above 1,500 mg/kg receive zero points. The basis of the upper concentration is the *Baseline Ecological Risk Assessment for Anaconda Regional Water, Wastes, and Soils OU* (EPA 1997), which reported phytotoxic values for copper in soils ranging from 750 mg/kg (for soils with pH less than 6.5) to 1636 mg/kg (for soils with pH greater than 6.5).

A CFR RipES Data Summary Report (RRU and BRI 2003) was prepared based on data collected in the summer of 2003. This Data Summary Report describes the results of analysis of polygon vegetation data, physical attribute data, and laboratory analysis data on soils/tailings samples collected on the polygons within Reach A of the Clark Fork River OU. The purpose of this analysis was to calibrate and validate the CFR RipES remedial design tool. A field demonstration describing the development and application of the CFR RipES process was conducted in summer 2003. In short, good and thorough science has been applied in developing CFR RipES. CFR RipES, however, does not substitute for remedial decision making based on the nine criteria. That is the function of this *Record of Decision*. CFR RipES is a design tool and will be used to implement the remedy consistent with the requirements of this *Record of Decision*.

2.1.18.2 Application in the Field

Summary of Comments

A field demonstration of the application of CFR RipES to a representative area along the Clark Fork River was requested. Another commenter suggested that the human health RBCs

be used to determine where contaminants should be removed (that is, soils with levels of contamination greater than the human health RBC should be removed). It was further recommended that the *Record of Decision* document specify other action levels for aquatic and human health based on each contaminant and on other soil attributes. Finally, a commenter asked whether the plan would be altered if additional contaminated lands are found during the CFR RipES assessment so that those areas would be included in remediation.

Response

A field demonstration of CFR RipES was conducted during the summer of 2003. Several locations within Reach A of the Clark Fork River OU were visited by agency representatives, Atlantic Richfield Company representatives and contractors, citizen's groups, and other interested individuals including landowners. Polygons representing different classes of streambanks and lands with varying levels of contamination impact were identified by the CFR RipES developers. Each polygon was scored using appropriate field forms and the CFR RipES decision matrix was then used to select potential remedial actions. Modifying factors were also identified for each polygon. The CFR RipES evaluation tool is ecologically based, and does not contain a human health or an aquatic health component. The CFR RipES tool assesses the vegetation status and the contamination severity of the landscape within a defined polygon. However, for in-situ treated areas, the surface soil arsenic concentration after remediation is completed must be less than the human RBC for the current and reasonably anticipated land use. If this risk level is not achieved after one re-treatment, the contaminated soils will then be removed. According to the *Human Health Risk Assessment*, only arsenic presents a potentially unacceptable risk to the human population in some locations. Other Clark Fork River COCs (refer to Part 2, *Decision Summary*, Section 7.1) pose no unacceptable human health hazard or risk at the concentrations found within the Clark Fork River OU. If additional contaminated lands are found during the CFR RipES assessment that meet criteria for remediation, they will be included in remediation.

2.1.19 Surface Water Quality

2.1.19.1 Copper and Other Metals

Summary of Comments

Commenters in this subcategory stated that ongoing water quality monitoring should indicate reduced metals loading and serve to see if standards were met or improved.

Response

During normal flow conditions, more than 60 percent of the copper load is estimated to come from streambanks, and 6 percent of the copper load comes from overland flow (see Exhibit 3-7, page 3-14). Therefore, removal of exposed tailings (the principal source of copper from overland flow) and streambank stabilization should significantly reduce copper loads (hence total recoverable copper concentrations) in the river, particularly during ice scour events. However, even with these remedial measures, WQB-7 standards for copper would likely not be met all of the time. Extensive monitoring of surface waters of the Clark Fork River has been in place for over a decade and will continue during and after remediation. Long term water quality, as monitored throughout the years, will clearly

improve as a result of these remedial actions. Points of compliance will be established as part of a formal Monitoring and Maintenance Program. Ongoing monitoring of the remedy is discussed in Part 2, *Decision Summary*, Section 13.11.4.

2.1.19.2 Arsenic

Summary of Comments

The commenter in this category asserted that the maximum contaminant levels (MCLs) as measured in potable tap water for arsenic would not represent an appropriate standard for instream water quality. The commenter asked whether EPA agrees that post-water-treatment-based MCLs are not an appropriate standard for instream water quality.

Response

EPA agrees with this assertion, but only if the instream water quality (as a dissolved measurement) is evaluated appropriately. At Superfund sites, EPA is generally measuring and attempting to control ambient levels of contaminants, like arsenic and other inorganic metals, in surface water and groundwater. MCLs are relevant and appropriate requirements, and EPA must determine the appropriate manner in which to apply them as ambient standards. If a surface water source (such as the Clark Fork River) is used for public water supply purposes, it is required to be filtered with conventional filtration to remove particulate matter. This would reduce or eliminate particulate matter, including total metals. Therefore, EPA interprets the use of MCLs for inorganic metals for Superfund sites as appropriately measured using the dissolved method. This method filters surface water (to mimic conventional treatment) and measures metals content in the filtered sample. Thus it is appropriate for EPA to use the MCL for a human health RBC standard for this project, but with modification for application to the ambient environment. Performance standards for arsenic in surface water are discussed in Part 2, *Decision Summary*, Section 13.11.3. This human health RBC is based on the Federal drinking water MCL for dissolved arsenic. The State's WQB-7 human health standard for arsenic in surface water, 18 µg/L, is also a performance standard, and under WQB-7, is measured as total recoverable. According to the *Human Health Risk Assessment*, arsenic levels in the surface water of the Clark Fork River do not pose unacceptable health risks for people who wade or swim in the river.

2.1.19.3 Other Constituents

Summary of Comments

This commenter asked why the *Human Health Risk Assessment* did not consider the Clark Fork River to be a drinking water source. Also, the commenter asked whether the use of a mass load model was appropriate.

Response

The Clark Fork River in Reach A is not currently used as a source of drinking water. All known potable water is currently obtained from wells.

The mass load model was used during the RI to determine the relative contribution of total copper from various sources and pathways to the Clark Fork River as part of the necessary determination of nature and extent of contamination. The model was used to distinguish contamination coming from on-site sources versus that coming via upstream pathways.

2.2 Non-Technical Categories

2.2.1 Access

2.2.1.1 Access to Land by Landowners

Summary of Comments

Comments received in this category were primarily in regards to steps that would be taken in accessing landowner property, impacts on landowners' quality of life, and effects on property values. Specifically, commenters were concerned about procedures and responsibilities for opening and closing property gates, covering haul trucks to minimize emissions, accessing currently "inaccessible" sections of the riparian zone, providing liability protection for landowners, and impacts of riparian easements on property use, value, and taxes (specifically, could land with easement restrictions still be used by landowner, how would values be impacted, and who would pay property taxes).

Response

If the agencies perform the cleanup, they will strive to obtain access from landowners to conduct cleanup activities by creating a simple, understandable access agreement that clearly describes the purpose and extent of the access. If the PRP, the Atlantic Richfield Company, performs the remedy, they will be asked to obtain access. EPA's direction to Atlantic Richfield Company will be to act reasonably and responsibly to obtain this, including payment of reasonable compensation if needed. The access agreement may have two separate sections to deal with two separate purposes for needing access. The first section would be only for accessing the property to obtain soil/tailings and other samples so that a cleanup plan specific to the property could be designed. The design would be done with landowner input to attempt to address any landowner concerns. A second section of the access agreement would be signed when a specific design has been completed and the landowner understands exactly what cleanup activities will occur on the property. It is expected that this two-phase approach to obtaining access agreements will provide much more information to landowners, which will improve opportunities for access agreements to be reached. EPA can require access from landowners under the Superfund law.

2.2.1.2 Recreation Access and Use of the River

Summary of Comments

Comments received requested that more information be provided on the expected impacts of the riparian easement and remediation work on recreational uses of the river. In addition, one commenter suggested that additional public access points be constructed in coordination with the remediation work.

Response

It is not expected that the implementation of the remedy will change any new or present recreational access opportunities. Access for recreation will be controlled by the current landowner.

2.2.2 ARARs

2.2.2.1 Compliance

Summary of Comments

The comments received represented two diverse concerns. The first questioned the impacts of upstream remediation projects (for example, Silver Bow Creek) on Clark Fork River OU water quality compliance, such as eliminating the need for waivers. The second view stated concerns that the remedy should comply with the ARARs, preferably without the use of regulatory waivers.

Response

In response to the commenter who asked questions about the meaning of statements regarding upstream contamination, the *Proposed Plan* was meant to convey that upstream cleanup, when combined with the Clark Fork River OU cleanup, is expected to result in ARAR compliance (except for the waived copper standard). The same standards are used, generally, for upstream and Clark Fork River cleanups.

To the second commenter, EPA agrees that compliance with ARARs is an important requirement of section 121 of CERCLA. That same statutory section allows EPA to invoke ARAR waivers, when those waivers are justified under the criteria given there. After re-examination, EPA continues to find that the ARAR waivers discussed in the *Proposed Plan* and found in this *Record of Decision* are justified under the criteria. Further responses on ARAR waivers are provided in subsequent comment responses. EPA continues to believe that the Selected Remedy meets the entire set of criteria given in section 121 and the NCP, including the ARAR compliance or waiver requirement. EPA's waiver explanations are contained in this *Record of Decision*.

2.2.2.2 Waivers

Summary of Comments

Comments received generally opposed the use of waivers. Several comments stated that the remedy should be in compliance with ARARs without the use of waivers. Several more commenters suggested water treatment systems be installed or more extensive removal of contaminated materials should be performed to meet the ARARs.

Several commenters also requested that the waivers be temporary and subject to periodic review. Finally, a few comments questioned the need for arsenic waivers. One contends the Safe Water Drinking Act standards do not apply to surface water and the other questions the constitutionality of the waivers under the State constitution.

Response

Some ARAR waiver comments focused on the application and waiver of the arsenic standard, and the *Proposed Plan's* notation that a waiver of this standard may be required. One commenter correctly notes that the arsenic MCL is an "at the tap" standard under normal applications of the Safe Drinking Water Act and questions whether its use as an instream standard is appropriate. The Federal Drinking Water Act standard of 10 µg/L is a relevant and appropriate requirement for surface water designated for use as drinking water under CERCLA's ARAR provisions and EPA guidance, even if the standard would not be applied as an in stream standard directly under the Safe Water Drinking Act. The

remedy must either meet this standard or invoke an ARAR waiver. EPA carefully examined Atlantic Richfield Company's modeling information on arsenic, and concluded that the 10 µg/L standard for arsenic measured as a dissolved constituent is potentially achievable at the Clark Fork River OU. This is based on an examination of the current instream data from USGS, which shows that some areas of Reach A are at or near compliance with this standard during a significant part of the year. It is difficult to model or predict what will occur at the site once upstream cleanup occurs in source areas, and Clark Fork River banks are stabilized, slickens areas are removed, and impacted areas are treated and vegetation is re-established. There are too many factors involved to model resulting arsenic levels accurately. EPA believes it is more prudent to retain the instream arsenic standard of 10 µg/L dissolved as an ARAR and performance standard, as well as the State WQB-7 ambient water quality standard, 18 µg/L, measured as total recoverable. EPA recognizes the uncertainty associated with the remedy's ability to achieve these standards, and may waive one or both of these standards after remedy implementation and monitoring.

EPA agrees with the commenters who suggest that the waived copper standard for in-stream water quality should be reviewed periodically. EPA's 5-year review process is required at this site and will assess this issue. If remedy performance, and upstream cleanups, lead to compliance with the State standard, or if the waived standard does not prove to be protective of human health and the environment, the waiver can be revisited at that time. EPA will measure the copper, as well as other in-stream standards within the Clark Fork River, at appropriate monitoring locations—it does not intend to measure compliance in all tributaries or intermittent water bodies.

EPA disagrees with commenters who believe that the copper standard should not be waived. Achievement of the copper standard is unlikely for any of the examined potential remedies at the Clark Fork River OU, and the *Feasibility Study* and the *Proposed Plan* provide adequate justification for this waiver. The waivers are described in this *Record of Decision*. The State of Montana's general preference for removal does not provide a sufficient basis to alter the remedy or to require full ARAR compliance without waivers, and the State DEQ supported the *Proposed Plan* at public meetings on the *Proposed Plan*, and has now concurred in the *Record of Decision*.

With respect to the State constitutional provision requiring the State to maintain a clean and healthful environment, the State has identified as ARARs the substantive provisions of the State statutes and regulations that have been promulgated by the legislature and authorized administrative agencies. These substantive requirements establish, for example, cleanup levels that must be met by the remedial action and represent at least one available criteria for determining what is "clean and healthful." The cleanup is expected to attain these standards except to the extent that certain ARARs are waived under the Federal CERCLA law. The State believes that the remedy is a necessary step in attaining a clean and healthful environment and DEQ concurs in the remedy for that purpose. When combined with possible natural resource damage restoration actions that the State hopes to implement, the State believes that it will attain a clean and healthful environment in the Clark Fork River OU to the fullest extent possible.

2.2.2.3 Park Service Organic Act

Summary of Comments

Several comments received stated that the proposed remedy would fail to meet site-specific ARARs set for the Grant-Kohrs Ranch National Historic Site by EPA in a letter from Scott Brown dated May 2000 (Brown 2000a and 2000b).

Response

Commenters on this issue included more than 120 comments from citizens and a specific comment from the U.S. Department of the Interior, which is responsible for implementation and enforcement of the Organic Act ARAR requirements in most situations. EPA agrees that the NPS Organic Act and accompanying provisions, as defined in the May 2000 letter from EPA to the Department of the Interior, and their emphasis on non-impairment, are important ARARs applied to the site cleanup at the Grant-Kohr's Ranch National Historic Site, which is within the Clark Fork River OU. The *Proposed Plan* did not clearly identify the specific requirements and modifications from the general *Proposed Plan* that would be needed to ensure compliance with this ARAR. In developing the *Record of Decision*, EPA worked closely with the NPS to clearly define these additional requirements, and they are reflected in Part 2, *Decision Summary*, Section 13.7. Some commenters wanted action taken on the streamside property owned by the Bureau of Land Management (BLM), located in Reach C of the Clark Fork River. EPA disagrees that the Organic Act requires additional remediation at areas downstream from the Grant-Kohr's Ranch National Historic Site on BLM land in Reach C, as explained elsewhere. EPA notes that BLM has found injury to natural resources at its land in Reach C, which is a different issue addressed under a different provisions of CERCLA—the natural resource damage provisions. EPA also notes that the NPS has found that residual injury to its land will continue to exist even after implementation of the remedial activities, and again notes the applicability of CERCLA's natural resource damage provisions to these findings. Further explanation of the NPS ARARs is provided in the response to PRP comments in Section 3.3, issue number 51, page 3-111.

2.2.3 General Comments

2.2.3.1 General Comments

Summary of Comments

These comments were general in nature or expressed general opinions of the respondents. Many expressed support or non-support for the decision as a whole. For example, comments such as, "Montanans deserve a good cleanup," do not bring up a specific issue for response. In some cases, substantive issues were described in the context of the general comments. Responses to those specific issues are presented below.

Response

EPA does value public input and has incorporated public input where possible and consistent with statutory and regulatory mandates and EPA guidance. This *Record of Decision* has been modified in response to comments on the *Proposed Plan*. Landowner rights are important to EPA, and EPA will try to work with landowners before seeking ordered access. The use of local work forces is something EPA has encouraged Atlantic Richfield Company itself and the State to use in past remedial implementations, and EPA will

continue to seek that if Atlantic Richfield Company or the State perform the work. Educational opportunities during design and implementation are also important side benefits from remedy implementation, which EPA encourages.

2.2.4 Consistency with Guidance

2.2.4.1 Consistency with NCP Guidance—Funding and NRD Coordination

Summary of Comments

The majority of the comments emphasized the need to secure adequate funding for the long term remedy. Several of these commenters were specific in adding that this funding needs to be provided by the Atlantic Richfield Company.

Additional comments suggested that a trust fund be established for land leases or purchases, BMP expenses, compensation, groundwater losses, contracts, and other issues. One comment stated that funding should be provided for local governments to repair and maintain roads, as well as provide for additional police services. Some commenters specifically added that this fund needs to be sufficient for a 100-year period.

Several commenters recommended that the *Record of Decision* should specify the management plans for land use restrictions, liabilities, long-term O&M, and other ongoing project features. These comments were phrased in the context of allowing better evaluation of funding issues.

A couple of commenters stated that the *Proposed Plan* appears cost effective, but that the plans should be kept flexible. One additional commenter stated that the plan would not meet the NRDP's requirements and that complete remediation must occur.

On the opposing side, one commenter stated there was no need to establish a fund for land leases or purchases, BMP expenses, or other project needs. Furthermore, this commenter asserted that remediation must take place and that the remediation should take precedence over private property rights.

Response

EPA agrees that the obligations to implement the remedy need to be clearly delineated and enforced, and that adequate funding for remedy implementation and ICs and BMP activities beyond the normal landowner responsibilities needs to be provided. The *Record of Decision* describes the necessary ICs and BMP guidelines in more detail than the *Proposed Plan*. The current cost estimate includes costs for these activities. EPA will ensure, through its enforcement mechanisms, adequate funding and/or commitments to make the requirements of this *Record of Decision* become reality.

EPA agrees that the Atlantic Richfield Company, as the primary potentially responsible party, should bear the costs for implementation of the remedy, including ICs and additional BMP activities.

Some specific comments addressed the enforceability of land use BMPs and other ICs. EPA will work with the county, the Department of Agriculture, and other interested agencies and entities during remedial design to ensure that these plans and controls are indeed implemented. These mechanisms may include easements or other government programs,

and funding for these programs also needs further definition. These issues will be further explored during remedial design.

Some specific comments focused on the need for adequate financial assurance associated with enforcement mechanisms to implement the remedy. EPA is given considerable flexibility in establishing these requirements, and EPA will pursue adequate protection for financial assurance at these sites. EPA's cost estimates for the remedial action, including long term operation and maintenance, have been calculated conservatively and will form the basis for these assurances.

Coordination with restoration activities is important to EPA. EPA believes the remedy can fit with restoration plans and will continue to work with natural resource damage trustees to ensure coordination and efficient implementation of cleanup activities at the site.

EPA notes that one commenter has concerns about the role of landowners in the cleanup decisions. EPA believes that cooperative and constructive relations with landowners during implementation is very important, and plans to implement the remedy with that in mind. EPA also recognizes the need for an adequate and protective remedy at the site, and the need for consistency and clarity during remedy implementation. EPA and the other parties involved in the implementation of the remedy will work along those lines to balance these needs.

2.2.5 Economic Development

2.2.5.1 Effects on Local Economy

Summary of Comments

The strong majority of the comments stated that the plan was a good investment in the area and expected the remediation to positively impact area jobs, recreationists, and businesses, as well as increase land values. A few commenters suggested that local residents should be hired preferentially. One commenter stated that the remediation plans should not be based solely on the potential economic boost to the area.

Response

The remedy for the Clark Fork River may have an overall cost in excess of $100 million. Previous experience with other cleanup projects in the basin indicate that much of that money will go to local contractors and businesses. As an example, approximately 95 percent of the $15 million spent on cleanup of Silver Bow Creek has been paid to Montana contractors. This will have an overall positive impact on the local economy for the project duration, which is expected to be at least 10 years.

2.2.6 Enforcement of BMPs

2.2.6.1 BMP Enforcement on Private Land

Summary of Comments

A few comments were received supporting the monitoring and enforcement of land use restrictions.

Response

It is expected that BMPs employed by the remedy would be similar to BMPs that are currently employed throughout the West where progressive riparian and range management occurs. This type of management is only successful when it is tied into a comprehensive ranch management plan. This is typically done with assistance by the local conservation district and the NRCS. The agencies expect to work closely with these agencies and landowners to provide additional resources to enable development of site specific ranch management plans that describe any necessary BMPs. Experience to date has shown that this type of up-front planning, supported by necessary resources and monitoring, can improve production from the land. As awareness of this positive impact becomes more prevalent, it is expected that voluntary compliance with management plans will become the norm (because it benefits the landowner financially). However, the agencies plan to ensure appropriate monitoring of the use and effectiveness of these BMPs so that compliance problems can be detected and corrected.

This *Record of Decision* defines what BMPs are meant to accomplish in terms of this project and provides additional detail and definition. However, BMPs need to be site specific and include flexibility to meet landowner needs. Implementation of BMPs is left for further development under this *Record of Decision*—EPA will work with other agencies and the State NRDP concerning easements and/or regulatory programs to ensure the best fit for each landowner.

2.2.7 Landowner Compensation

2.2.7.1 Compensation for Lost Use of Land

Summary of Comments

EPA received a large number of comments supporting compensation to landowners during remedy implementation. One commenter opposed compensation. Comments in favor of compensation were received from those who generally supported the proposed remedy and those who opposed it. Granite County Commissioner comments emphasized this issue and requested specific language in the *Record of Decision* to address the issue.

Most commenters focused on compensation for lost or reduced use of land during remedy implementation. Some commenters wanted clarification about fencing and responsibility for that fencing. Other commenters suggested the use of conservation easements as a means of compensation for landowners.

Response

EPA has added language to this *Record of Decision* that addresses both access and landowner compensation, and fencing responsibility. Part 2, *Decision Summary,* Section 13.6.5, addresses access and BMP plans. It notes that when PRPs perform EPA remedial action, EPA requires those parties to pay reasonable compensation to landowners for access. The section emphasizes the need to look at lost use compensation when addressing these issues.

EPA also added Section 13.9.3 to Part 2, *Decision Summary,* which addresses fencing needs and fence maintenance. It requires the remedy implementer to maintain fences as needed to protect the remedy until fences are no longer required, or if they are, they become the responsibility of the landowner or tenant.

The use of conservation easements is a possibility. Many of the commenters who discussed this issue pointed out that they are voluntary measures between willing buyers and sellers. EPA believes that conservation easements for landowners who agree to them could be a useful tool to address compensation and land use management as part of the remedy. During remedial design, EPA will explore the potential use of conservation easements, as well as funding sources for such easements, with the State of Montana and the PRP.

2.2.8 Landowner Involvement

2.2.8.1 Mandatory Cleanup

Summary of Comments

Most commenters supported requiring the landowners to cooperate with the plan. Some comments supported encouraging the landowners to cooperate. One commenter asked whether landowner participation would be required, and a few commenters stated that cleanup should be optional for landowners. One commenter suggested that those landowners who do not participate should be held liable for future impacts.

Response

The remedy will be implemented with close landowner involvement. Close interaction will occur with landowners throughout the cleanup duration but particularly during several specific activities noted below:

- Arranging access agreements.
- Developing sampling plans.
- Developing site-specific designs for improving or eliminating contaminated areas while minimizing impacts on ranch operations.
- Preparing ranch management plans.
- Defining actual construction methods, procedures, and schedules.
- Correcting any problems during construction.
- Defining future monitoring and maintenance activities.
- Implementing ranch management plans that will complement the remedy and ensure improved productivity of the resource.

Further discussion of ways to obtain cooperative involvement in the cleanup plan is provided in this *Responsiveness Summary* in Section 2.2.1, page 3-65, and Section 2.2.6, page 3-70. The CFR RipES process is described in Part 2, *Decision Summary,* Section 13.6.1. Several steps within the CFR RipES process detail landowner feedback and input into cleanup plans. These steps will provide the opportunity to achieve landowner cooperation.

EPA does have authority, given to it by Congress in the CERCLA law, to require access to land if voluntary access is not granted. See section 104(e) of CERCLA as amended, 42 U.S.C. § 9604(e). EPA intends to see the entire cleanup described in this *Record of Decision* implemented, again in accordance with the CERCLA law.

2.2.8.2 Optional Cleanup

Summary of Comments

One comment was submitted stating that landowner cooperation should be optional.

Response

See the response in Section 2.2.8.1, *Mandatory Cleanup,* above.

2.2.8.3 Property Rights

Summary of Comments

Comments varied widely in this area of interest. Several landowners stated they intend to limit access to their property unless need is clearly shown. Several landowners asked for more specific details about the cleanup plans and processes. One commenter specifically intended to use legal means to limit access. One commenter questioned the legal basis for accessing private property and restricting land use. One commenter expressed concern that land ownership will be taken away. Another landowner expressed concern that property values would decrease.

Several commenters stated that the plan be developed to meet landowner needs, with two stating that landowners should have the decision on what actions would be taken on their land. Some landowner comments stated a specific preference for in-place treatment versus removal of contaminated soils.

Response

The comments that address EPA's selection of some limited removal along with treatment are addressed in other parts of this *Responsiveness Summary*, including Section 2.1.10, page 3-43, and Section 2.1.17, page 3-57. EPA also provided a detailed explanation of its decision to use a mixture of removal and in-situ treatment in the August 2002 *Proposed Plan*, the EPA memorandum dated July 28, 2003, which was published in the Silver State Post, and in the *Record of Decision*. EPA incorporates the July 28 memorandum and its Attachment 3 into this *Responsiveness Summary* by reference. EPA has also added specific details on what areas will be removed, what areas will be treated in-situ, BMPs and long term O&M needs, and how the remedial design and CFR RipES process will work at any given property.

Property rights are important to EPA as well. That is why we are emphasizing cooperation and communication between the implementing party and the landowner as property specific cleanup plans are developed. We also have emphasized the need to consider compensation for lost use when cleanup activities are implemented. We think this, along with the direct benefits of cleanup, will lead to voluntary access for the cleanup plans. As noted above in Section 2.2.8.1, EPA does have other means available to it to legally obtain access if voluntary access is not obtained.

2.2.8.4 Design/Land Use

Summary of Comments

Many of the comments specifically stated that the plan should be developed to meet landowner needs. Several commenters said that landowners should be treated fairly, with one specifically adding that landowners should be treated equally. Many comments were received stating that landowner cooperation is critical to the success of the plan. Several

landowner commenters pointed out that landowners' expertise and knowledge about their own land needs to be carefully considered in any cleanup plan.

Several comments stated that the individual landowners should have a say on specific actions to be taken on their land. Conversely, one commenter stated that individual landowners should not have a say on the actions to be taken on their land and that EPA should do what is required to remediate the Clark Fork River. A few commenters requested that specific plan information (such as what, where, and when) be conveyed to individual landowners. In addition, several commenters suggested there be a mechanism for retaining landowner acceptance of the remediation plan.

Similarly, there were several commenters who stated agreement with the *Proposed Plan*, but that success of the plan will be dependent upon getting the majority of landowners involved. One commenter suggested that the landowners should be provided with a neutral group of technical and legal advisors to evaluate the plan. A couple of other commenters supported the use of fee titles and conservation easement purchases in negotiations with the landowners.

One comment was received stating that the river looked great as is.

Response

EPA intends to work closely with landowners, and agrees with the commenter who urged careful and respectful dialogue with landowners throughout the cleanup process. This point is emphasized in several places in this *Record of Decision*, as the specifics of weed control, BMP plans, access, and the process for land evaluation and cleanup design are described.

Prior to the release of the *Record of Decision*, EPA held a field demonstration of the CFR RipES process and evaluation issues for landowners. EPA representatives have spoken at length with landowners as the *Record of Decision* has been developed. EPA also agrees with the commenters who noted that landowners expertise and knowledge of their own land has to be a major part of the planning for cleanup at a specific site.

EPA cannot give landowners a neutral group of advisors regarding this plan. EPA does fund a Technical Assistance Grant to the CFRTAC, and one of its main jobs is to provide neutral evaluation of technical issues and to distribute that information to the affected public. We will continue to work with CFRTAC to ensure that their efforts are aimed at a broad range of affected parties.

Conservation easements are discussed in Section 2.2.7.1 in this *Responsiveness Summary* (page 3-71).

2.2.9 Opinion of Plan

2.2.9.1 Fully Support Plan

Summary of Comments

Many commenters support proceeding with the *Proposed Plan*. Several commenters specifically support the 50-foot riparian zone. Two commenters stated specific support for a remedy that combines elements of the Alternatives 5d and 6c.

Response

EPA acknowledges the support of more than 1,600 commenters for the *Proposed Plan's* recommended remedy.

2.2.9.2 Conditionally Support Plan

Summary of Comments

All comments received in this category generally support the *Proposed Plan*, and stated that it would be reasonable and workable. However, numerous commenters proposed specific actions that should be taken, including the following:

- Adding stabilization, bank cleanup, or other actions for Reaches B and C.
- Going further in protecting river and corridor, including emphasis on removal of all contaminated soils.
- Continuing evaluation of human health risks.
- Implementing an ongoing, long-term monitoring and maintenance program to evaluate remediation results and to identify contamination that may become exposed in the future.
- Specifying plan details on revegetation, livestock use, fencing, and owner compensation.
- Providing more technical data on remediation and revegetation processes.
- Adding more technical input from specialists, specifically geomorphologists.
- Requesting more details on proposed weed control plans.
- Recommending expanding the riparian buffer to accommodate flood conditions and include old river channels.
- Providing an example of CFR RipES evaluation based on an actual area.
- Modifying the plan significantly:
  - Use Alternative 7b instead.
  - Evaluate if the CFR RipES process is sufficient to determine long-term remediation needs.
  - Allow evaluation and comments on CFR RipES results before beginning remedation.
  - Develop a permanent remedy, because the commenter does not believe the *Proposed Plan* is protective of human health and the environment.

Response

EPA examined these comments and added additional detail to the *Record of Decision* to address many of these issues. Human health risks are addressed with more detail, and additional requirements for the measurement of arsenic in soils to ensure the protection of human health at irrigated soils, irrigation ditches, and in-situ treated areas are emphasized. Weed control elements of the *Record of Decision* are addressed in much greater detail. Additional specification on vegetation, grazing, fencing, old river channels, and access and

landowner compensation is now included in the *Record of Decision*. Long term monitoring is also described in more detail in the *Record of Decision*. EPA did a demonstration of the application of the CFR RipES process in August 2003.

EPA does not agree that additional work in Reaches B and C is required to meet remediation requirements, both because of the nature of the contamination in those areas and the lack of demonstrated remedial risk. The removal of all contaminated soils is not practical or cost effective under EPA's remedy selection criteria, and we believe the remedy described in this *Record of Decision* best meets the remedy selection criteria. EPA had a wide variety of technical specialists involved throughout the RI/FS process, and used those people's views and input extensively in the remedy selection process. EPA did not see a need for additional involvement of specialists beyond its contractors and in house experts during the remedy selection process.

EPA believes that the remedy does reflect the appropriate balancing of the long-term effectiveness and permanence balancing criteria with the other balancing and modifying criteria, as noted in Part 2, *Decision Summary*, Section 10. EPA believes that the detailed monitoring requirements and performance standard definitions, along with ICs, will result in the reliable management of residual risk at the site, and that additional removal is not necessary to meet remediation requirements at this site.

2.2.9.3 Needs More Information

Summary of Comments

Commenters in this category generally stated that the *Proposed Plan* was vague and that specific details were needed. Several comments stated that the *Proposed Plan* did not adequately describe land cleanup and long-term management issues. Several other commenters recommended that each landowner be informed of the specific actions planned for their land. Some of the specific information needs of these commenters include details about BMPs, land use restrictions, plan funding, and impacts of other restoration activities in the Clark Fork River Basin.

Response

Proposed plans are normally general in nature. EPA supplemented the *Proposed Plan* with specific answers to specific questions, to ensure that the public had adequate information during the public comment period. The *Record of Decision* contains detail on the issues that commenters identified as too vague in the *Proposed Plan* – definitions of slickens and impacted soils, vegetation standards, information on grazing, weed control, and BMPs.

EPA cannot provide information regarding how the remediation may affect restoration issues. Restoration issues are the responsibility of natural resource damage trustees. Those trustees may individually or collectively produce restoration plans for the Clark Fork River OU after EPA issues its remedial *Record of Decision*. EPA will continue to coordinate with the natural resource damage trustees in the post-*Record of Decision* processes.

2.2.9.4 Oppose Plan

Summary of Comments

Comments received for this category generally take two positions: either the *Proposed Plan* does not go far enough, or the *Proposed Plan* goes too far.

Approximately half of the commenters who oppose the *Proposed Plan* prefer more extensive removal and treatment, as described under Alternatives 7 and 8.

The other half of the commenters oppose the proposed extent of the cleanup plan, generally believing it is better to leave the river alone. Some of these commenters specifically requested that more in-situ treatment is preferred over removal of contaminated soils.

A couple of the other commenters generally oppose the *Proposed Plan*, believing it to be inadequate in addressing human health issues during remedial activities.

Response
EPA notes opposition on both ends of the remedy spectrum (from no action to extensive removal without in-situ treatment). EPA believes that the remedial action described in the *Record of Decision* meets the threshold criteria for remedy selection, and provides the best balance among the remaining balancing and modifying criteria. This remedy selection analysis is described in greater detail in Part 2, *Decision Summary,* Sections 10, 13.1, and 14.

2.2.10 Proposed Plan Remedy

2.2.10.1 Differences in Remedy Review Board Presentation vs. the Proposed Plan

Summary of Comments
One comment was received questioning the basis for the changes noted in the *Proposed Plan*, with the overall concern being the extent of the proposed removal activities.

Response
EPA's Clark Fork River *Proposed Plan* did differ from EPA Region 8's recommendation to the National Remedy Review Board (NRRB), primarily by including additional removal requirements for most slickens areas. EPA made this change based on additional consideration of community and State acceptance criteria—particularly State acceptance. The State of Montana has invested considerable time and effort into the study of the Clark Fork River OU and has consistently recommended that removal of slickens areas be done. These concerns emerged even more strongly in the time period following the NRRB proceedings and the issuance of the *Proposed Plan*. EPA is required under CERCLA and the NCP to give the State substantial and meaningful involvement in the remedy selection process. EPA also notes that some affected landowners and all Trustees for natural resources also strongly supported additional removal requirements.

EPA also re-examined the technical basis for use of in-situ treatment at slickens areas. This re-examination is explained in detail in the publicly distributed EPA memorandum of July 2003 (prepared by EPA in response to a memorandum by four staff level personnel who wanted EPA to use in-situ treatment in slickens areas), which is incorporated herein by reference. That analysis found that slickens areas generally presented conditions of low pH and high metals content that would make the success of in-situ treatment less certain in these areas, and also noted that the removal of slickens would help the remedy possibly achieve groundwater performance standards. The analysis also looked closely at the safety and implementability issues surrounding removal and found that careful implementation of a limited removal program could be achieved safely and in a timely manner. All of these factors led EPA to change its position in the *Proposed Plan*.

2.2.10.2 Additional Study Requests and Feasibility Study Issue

Summary of Comments

The comments in this subcategory raised specific issues regarding past investigations, feasibility study analysis, and weighting of alternatives, or suggested broad future study needs. Specific issues raised include a quantitative evaluation of long-term benefits from the recommended action, evaluation of potential impacts of flooding on pond sediments, reexamination of weighting methodology used in *Feasibility Study* comparative analysis, and inclusion of a discussion of preliminary investigation findings in the analysis.

Response

The NCP does not require EPA to do a detailed comparison study of the quantified benefits of a proposed remedial action versus the no action alternative, as one commenter suggested. This *Record of Decision* does contain a more general description of expected benefits in Part 2, *Decision Summary,* Section 13.14. The Opportunity Ponds area is not within the 100-year floodplain and will not wash out during flooding, so additional study of that area is not needed. The *Remedial Investigation* process did look closely at prior investigations and data results, and summaries of these efforts are included in the administrative record for the Clark Fork River OU and in the *Remedial Investigation*. The equal weighting given to the seven criteria in the *Feasibility Study* report is recommended in EPA guidance—the remedy selection process then appropriately weighs the different criteria according to the threshold, balancing, and modifying categories described in the NCP. The numeric scores given for the *Feasibility Study* alternatives is generally explained in the *Feasibility Study* – cost effectiveness scoring was determined by looking at past Clark Fork Basin actions and applying a general ranking for costs.

2.2.10.3 Needs More Investigation

Summary of Comments

A few comments were received proposing additional areas of investigation needed to address the *Selected Remedy*. These areas included development of a long-term monitoring and maintenance program to address new areas of contamination, additional monitoring and experimentation on plant and COC interaction, and additional studies on impact of removal and treatment processes on vegetation.

Response

The *Record of Decision* now requires detailed and systematic monitoring to ensure that impacted areas and slickens are identified and addressed within Reach A and limited areas of Reach B. If more technical studies are determined to be necessary during remedial design regarding vegetation response, EPA can require this during that process.

2.2.11 Restoration

2.2.11.1 Restoration vs. Remediation

Summary of Comments

Some commenters in this subcategory requested additional information on the proposed restoration actions, while others proposed a more extensive removal followed by or in conjunction with restoration actions. One commenter stated a desire for long-term restoration of the river versus short term fixes.

Other commenters specifically stated that the Atlantic Richfield Company should fund the restoration program in addition to the remedial action. One expressed concern that incomplete remediation actions will, in turn, deplete restoration funding.

Response

EPA cannot give additional information on what specific restoration actions will be implemented in addition to the remedial actions, as those decisions are reserved for other agencies that act as natural resource damage trustees. EPA understands that the State of Montana and the Department of Interior will present revised or initial restoration plans after EPA has issued its *Record of Decision*. EPA believes that the remedial action is a significant action that will achieve EPA's mandate to protect human health and the environment. EPA cannot consider the effects of its remedy decision making on the State's existing restoration funds in choosing a remedy, as urged by one commenter. Finally and most importantly, EPA will continue to coordinate with natural resource damage trustees at this site as required by CERCLA and the NCP.

2.2.12 State and Local Acceptance

2.2.12.1 Degree of State and Local Acceptance

Summary of Comments

Few comments were received in this category, and one stated the opinion that EPA has failed to encourage community consent and that new and better project management to bring in the State and landowners is needed. Another commenter specifically asked if the DEQ has accepted the plan, asserting that State acceptance will be needed to garner public support. One commenter questioned whether the decision on volume of material to be removed was a politically based decision designed to appease the State, versus being based on technical or cost considerations.

Response

State acceptance is shown in the concurrence letter from the State in Appendix F of this *Record of Decision*. EPA considered State acceptance as an important modifying criteria in accordance with the NCP and noted the State's clear interest in this site as reflected in the time and effort the State has put into the study of the Clark Fork River. However, EPA based its final remedial decision on the full remedy selection criteria, and did not make "political" decisions in an effort to satisfy the State. EPA agrees that bringing all stakeholders together during remedial design will be important at this site because of the high level of interest in the environmental conditions at the site. EPA will continue to pursue efforts in that regard.

2.2.13 Unrelated Comment

2.2.13.1 Out of Scope, No Response Required

Summary of Comments

These comments were deemed to be outside the scope of the plan and, therefore, no specific response is required. Virtually all the comments stated support for removal of the Milltown Dam and sediments, which does not apply to this OU.

2.2.14 Water Rights

2.2.14.1 Transfer/Use

Summary of Comments

Of the comments received, most specifically stated that the Atlantic Richfield Company's water rights in the upper basin should be used as needed for the remedy. One commenter specifically mentioned that Atlantic Richfield Company's water rights from the Silver Lake and Ueland Ranch sources should be dedicated to maintain in-stream flows versus use for agriculture. One commenter recommended calculation of the anticipated water usage by vegetation in the 50-foot riparian zone.

Response

EPA understands the importance of water rights and irrigation needs, and will work closely with State water rights authorities to ensure that existing water rights are respected and irrigation water is made available as necessary for this action. EPA notes that the Atlantic Richfield Company has obtained water rights in the nearby basin. Finally, use of water rights for in-stream flow is outside the scope of EPA's remedial requirements at this site, but may be an issue of interest to the natural resource damage trustees.

3 PRP Comments and EPA Responses

3.1 Introduction

The Atlantic Richfield Company, the PRP for the Clark Fork River OU, submitted two documents with comments on the *Proposed Plan*. The first document was a letter containing a request to extend the comment period. EPA did extend the comment period by 30 days. The second document was a cover letter and two-volume binder containing comments and supporting data. After the conclusion of the comment period, the Atlantic Richfield Company submitted a letter requesting that the comment period be reopened. EPA did not reopen the comment period.

EPA's August 2002 *Proposed Plan* invited comments on EPA's August 2002 *Proposed Plan* and the other remedial alternatives described in the Clark Fork River OU *Feasibility Study* and summarized in the *Proposed Plan*. Section 117(2) of CERCLA requires the agency to publish the *Proposed Plan* and accept comments on the *Proposed Plan* and other alternatives examined by EPA, and on proposed cleanup standards for the site. Section 400.300(f)(2) of the NCP (40 CFR § 300.430(f)(2)) states that the "purpose of the *Proposed Plan* is to supplement the RI/FS and provide the public with a reasonable opportunity to comment on the preferred alternative for remedial action, as well as alternative plans under consideration, and to participate in the selection of the remedial action at a site." After the conclusion of the public comment period, EPA must respond to "significant comments, criticisms, and new relevant information submitted during the public comment period."

Atlantic Richfield Company's two-volume, 2,000-page comment letter goes well beyond the boundaries established by law and regulation for the remedy selection and *Proposed Plan* comment period. In its comments, Atlantic Richfield Company actually develops and submits remedial design for a new alternative of its own making, and submits this information as comments. This has made response to Atlantic Richfield Company's submission difficult, as Atlantic Richfield Company's remedial design information relates primarily to a remedy that is not selected by EPA and is not consistent with the NCP. The NCP requires the lead agency, in this case EPA, to select the remedy after review of all community and State comments—see section 430(f)(4) of the NCP (40 CFR § 300.430(f)(4). According to CERCLA and the NCP, remedial design then occurs **after** selection of the remedy, and must be "in conformance with the remedy selected and set forth in the *Record of Decision* or other decision document for that site." Section 435(b)(1) of the NCP (40 CFR § 300.435(b)(1)).

Accordingly, much of Atlantic Richfield Company's comment package, especially the remedial design information for an alternative that was not selected as the appropriate remedy under CERCLA and the NCP, is outside the scope of the laws and regulations that govern the comment period and is not in accordance with the NCP. Atlantic Richfield Company does not provide a rationale or basis for this unusual submittal. Additionally, much of the Atlantic Richfield Company two volume package is repetitive and rhetorical. Much of the package explains what Atlantic Richfield Company calls the Atlantic Richfield

Preferred Remedy, which is not the remedy selected under CERCLA and described in the *Record of Decision*.

Despite the problems presented by the Atlantic Richfield Company package, EPA did examine the Atlantic Richfield Company comment package carefully and methodically, and extracted significant comments, criticism, and relevant new information from the Atlantic Richfield Company package that fit within the appropriate scope of the comment period as defined above. In accordance with the NCP, EPA responds to those comments here.

The comments that were most readily identifiable as appropriate comments were those contained in Appendix B to the Atlantic Richfield Company comment package. These comments specifically addressed the August 2002 *Proposed Plan* and EPA's rationale for selection of the Proposed Remedy. Issues 1 through 32 of Section 3.2, *Summary of Comments and Responses*, respond to those comments. Section 3.3, *Additional Comments and Responses*, contains responses to other comments beyond those in Appendix B of Atlantic Richfield Company's submission.

3.2 Summary of Comments and Responses

The text of each issue number (1 through 32) refers to the page and section of the August 2003 *Proposed Plan* that Atlantic Richfield Company targets in their comments.

1) Proposed Plan, page 4, second paragraph under "Site Characteristics"

Summary of Comments

The statement in the *Proposed Plan,* "The potential flood unraveling risk could change the Clark Fork River from a cobble-bed, single thread meandering system to a braided system with dispersed contaminants, incapable of supporting trout" is unsupported. Atlantic Richfield Company has identified flaws in the analysis: see AERL 2001, R2 Resource Consultants 2001, and G. Parker 2001. To the extent that such geomorphic instability exists, EPA has not correlated such potential instability with the presence of hazardous substances.

Response

Following the above statement quoted from the *Proposed Plan,* EPA also stated, "There is uncertainty associated with the probability and severity of this event."

EPA acknowledges uncertainty associated with the modeling of Dr. Smith of USGS. EPA notes that Dr. Smith's work was peer reviewed by other USGS scientists prior to publication. EPA must address this possibility and risk despite its uncertainty. EPA also notes that Dr. Parker's comments as well as other Atlantic Richfield Company citations have not been peer reviewed. In fact, Dr. Parker states, "The reach of the Clark Fork in question is **moderately affected** by tailings from the Anaconda copper mine, which were deposited in a major flood in 1908." He further states, "It does not suggest that the basis for the analysis by Smith is fundamentally wrong." Thus, Atlantic Richfield Company's own retained expert finds some validity in Dr. Smith's modeling work.

EPA's Selected Remedy contains a streambank stabilization component, which is not based solely on the risk of catastrophic unraveling. The streambank component also addresses two

other elements of risk presented by the mine contamination deposited along the Clark Fork River:

- Excessive erosion of valuable agricultural, recreational, and important habitat land documented by USGS studies in which Atlantic Richfield Company experts participated. The estimated annual channel meander rates for Reach A ranges from 0 to 5.8 feet per year with an average rate of 0.6 feet per year over the 43-mile reach. On unaffected streams, erosion rates are estimated to be 0.1 to 0.25 feet per year. The primary cause of this excessive erosion is the lack of vegetation along the streambank caused by the phytotoxic effects of the mine contaminants on plant growth. Implementation of EPA's streambank stabilization component will slow the rate of erosion to more acceptable levels.

- The streambanks release large quantities of copper and other metals through erosion into the river over a wide range of flow conditions. Under current conditions, the source of about 60 percent of all copper input into the river upstream of Turah Bridge originates from streambank erosion. These erosional copper loads contribute to the frequency of exceedances of State water quality standards. This is a concern to the State, and any remedy must address this issue according to the CERCLA law that requires ARARs to be met by remedy implementation. Streambank erosion is a major contributor to copper concentrations, which cause low level but still unacceptable chronic risk to the aquatic environment, as described in the *Proposed Plan* and *Ecological Risk Assessment*, and during high bank flows may cause invertebrate levels to drop considerably.

Further explanation of the need for the streambank stabilization and buffer zone component of the remedy is found in this *Responsiveness Summary* in Section 2.1.2.1, page 3-12, and in Section 2.1.6, page 3-30. In short, the statements in the *Proposed Plan* are supported and appropriately qualified, and the component of the remedy associated with the unravelling risk is necessary and appropriate.

2) Page 5, Third paragraph of "Nature and Extent of Contamination"

Summary of Comments

Atlantic Richfield Company disagrees with the statement in the *Proposed Plan* that the "entire Deer Lodge valley floodplain—some 43 miles long and generally 300 to 500 feet wide—consists today of tailings, soils and sediments that are impacted by metals, arsenic and acid-generating sulfides." Atlantic Richfield Company has suggested alternate language.

Response

EPA disagrees with Atlantic Richfield Company's suggested language. During the years that mining wastes were discharged into various Clark Fork River headwaters, they were redistributed and mixed with river sediments and were deposited over the entire historic 100-year floodplain, particularly during the 1908 flood. Every sample taken and analyzed on the floodplain contains metals concentrations that were higher than anticipated natural background levels (refer to Table 3-6 of the Clark Fork River *Remedial Investigation* [Atlantic Richfield Company 1998]). Over the years, weathering of primary minerals contained in the tailings has occurred. This has resulted in some areas that still produce acid, creating phytotoxic conditions resulting in a total lack of vegetation or moderately impacted

vegetation. Other areas have a lower pH, but no acid generating capability, and show severely to moderately impacted vegetation. Still other areas have a high concentration of residual metals but near neutral pH, and produce moderately to minimally impacted vegetation. Overall, vegetative communities range from severely affected to minimally impaired.

3) Page 6, First paragraph of "What are Primary Sources of Copper"

Summary of Comments

EPA stated that, "During non-flood conditions, the largest source of copper to surface water in Reach A of the Clark Fork River is bank erosion (see Exhibit 2)." This implies that the loading evaluation results presented in Exhibit 2 showing bank erosion contributing 60 percent of the loading was limited to non-flood conditions only. In actuality, the data collected and model developed for the copper loadings to the Clark Fork River evaluation included a range of flow conditions including high flows. The statement in this same paragraph that, "Streambed sediments make up 14 percent of the copper loading" should be qualified to note that this will not always be the case. The copper loading evaluation concluded that over time, the streambed sediments would be expected to equilibrate with surface water concentrations naturally, eliminating them as a net loading source.

Response

EPA concurs with the Atlantic Richfield Company comment that the modeling considered a range of flow conditions, including high flows. EPA has adjusted the language relating to the mass balance loading and associated charts to reflect a more accurate description of the mass balance. EPA also concurs that streambed sediments will equilibrate over time. However, EPA and USGS believe that "over time" means decades or even centuries, based on the hydrology of the basin over the last 100 years. Given this, EPA does not see a need to change any language in the *Record of Decision*.

4) Proposed Plan page 6 and Fact Sheet

Summary of Comments

Atlantic Richfield Company contends that lack of floodplain vegetation also results from historic land use/management practices including cattle grazing, rancher vegetation clearing, and other induced human actions.

Response

EPA recognizes and has concurred in the *Remedial Investigation* and in the *Feasibility Study* that historic land use/management practices have had an effect on the current conditions of the historic floodplain. However, EPA believes the main cause of vegetative impacts to the historic floodplain is the fluvially deposited mine contaminants and the resulting elevated metals and phytotoxicity in the soils of the floodplain.

5) Proposed Plan, page 10

Summary of Comments

Atlantic Richfield Company disagrees with EPA's concern regarding the Clark Fork River channel geomorphic instability. The *Ecological Risk Assessment* did not note "risks" from COCs documented to cause excessive erosion and loss of land and the hypothesized unraveling during a flood event. Nowhere in the geomorphic studies are such risks from

CERCLA COCs documented. To the extent that the *Proposed Plan* Preferred Remedy is intended to prevent undocumented geomorphologic risks, no documented unacceptable CERCLA risk from the alleged release of hazardous substances has been identified to support such a remedy. In addition, the documentation of vegetative screening risks in the *Ecological Risk Assessment* did not use specific endpoints related to key woody plant species that stabilize banks such as willows.

Response

See *Role of Geomorphic Fluvial Stability in the Clark Fork River Remedy Selection Process*, EPA, August 14, 2002. USGS and the Fluvial Geomorphology Committee prepared several reports for EPA as part of the RI/FS and site study process. Those reports stated two essential points about floodplain stability at the Clark Fork River. The text below is excerpted from that document:

A. There is clear evidence of floodplain instability at the Clark Fork River due to the release of mining waste hazardous substances upon the floodplain. This is demonstrated primarily by available data that shows high erosion rates and frequent meander and tab changes and washouts. This erosion is caused by impacts to the terrestrial environment (vegetation) present at the site, which causes the Clark Fork River to have less streambank stability than it should. The erosion process releases substantial quantities of copper and other metals into the river, which causes violations of the State of Montana water quality standards. The erosion also causes the loss of productive land to private and public landowners along the river.

B. Dr. Smith has postulated that the present floodplain instability is so great as to present a risk of further floodplain instability and land loss (the unraveling theory) in very high flood events because of the lack of vegetation. Dr. Smith's modeling efforts are not complete in this area at this time, as EPA understands it, and there is substantial uncertainty associated with the developing science used for modeling and predicting these effects (see Parker, Gary—St. Anthony Falls Laboratory, University of Minnesota—"Draft Technical Review of Smith, J. Dungan on Quantifying the Effect of Riparian Vegetation on Stabilizing Single Threaded Streams: 7th Federal Interagency Sedimentation Conference, Reno, Nevada—September, 2001", R2 Consultants Inc.—"Technical Review of Smith, J. Dungan on Quantifying the Effects of Riparian Vegetation on Stabilizing Single Threaded Streams, 7th Federal Interagency Sedimentation Conference, Reno, Nevada, September, 2001," and R2 Resource Consultants—"Assessment of Geomorphic Stability During Historical Floods of Silver Bow Creek, Little Blackfoot River and Big Hole River, Montana—September 2001."

In the same document, EPA further states:

> EPA acknowledges this concern and acknowledges that the remedy does not fully address Dr. Smith's postulated unraveling event. However, EPA strongly disagrees that the proposed remedy will not address the demonstrated erosional problems for the Clark Fork River. It has been developed by EPA advisors other than Dr. Smith who are familiar with Montana growing seasons, rainfall expectations, plants, and other land use practices. EPA believes the proposed streambank revegetation component of the remedy will reduce erosion rates to levels which will address the potential for environmental

risk in the river from flood events and waste which may be left in place in the remedy, and lessen the loss of land to landowners to normal erosion ranges experienced by other Montana landowners. It will also positively influence the very large flood events, such that these events will not produce widespread floodplain destabilization.

In short, EPA believes that the streambank component of the proposed remedy released in the *Proposed Plan* is necessary, implementable, protective, and practical. EPA also believes that the erosional and unravelling risks were sufficiently documented and quantified in the RI/FS process, such that risk managers had to recognize and address these risks. The fact that these risks were not in the *Ecological Risk Assessment* does not imply they should not be addressed. They are clearly a result of the impact of COCs in the floodplain.

6) Page 10, last paragraph of "What are the Human Health Risks?"

Summary of Comments

The *Proposed Plan* fails to note that State regulations prevent the construction of shallow wells less than 25 feet deep in the floodplain so unacceptable risks to human health resulting from arsenic do not exist.

Response

The State has classified all groundwater within and near the OU as a potential drinking water source. An examination of the RI data indicates that a total of four existing domestic wells within the OU exceed the most recent Federal drinking water standard for arsenic for human consumption (10 µg/L). These wells were completed in the shallow water table (no exceedances were found below a depth of 22 feet), and were sampled in June 1987.

State laws referred to by Atlantic Richfield Company can be changed, and are not routinely enforced. Thus, the findings of the *Proposed Plan* regarding the potential for groundwater risk are well founded. All previously sampled domestic wells that exceeded MCLs will be resampled, as well as any new private domestic well located in or near the floodplain. Appropriate ICs to address groundwater use in the shallow aquifer shall be implemented and funded. This will help ensure that State regulations preventing the construction of shallow wells less than 25 feet deep are enforced. This will also eliminate the potential that shallow groundwater contamination could be drawn deeper if groundwater development occurred and the shallow contamination was unaddressed.

7) Page 10, "What are the Ecological Risks," first paragraph

Summary of Comments

The geomorphological studies did not conclude that the Clark Fork River suffers from excessive loss of land. Atlantic Richfield Company disagrees that excessive bank erosion is due solely to the presence of historic mine wastes but rather past land management practices.

Response

EPA disagrees. See EPA response to Atlantic Richfield Company issues 4 and 5 from above.

8) Page 11, second paragraph of "What are the Ecological Risks?"

Summary of Comments

EPA's partial reference to statements made in the *Ecological Risk Assessment* is extremely misleading. Atlantic Richfield Company also disagrees with EPA's conclusion in the *Ecological Risk Assessment* that copper in diet (and other metals) impose an intermittent low level chronic stress on fish as evidenced by numerous papers cited by Atlantic Richfield Company.

Response

EPA stands by its conclusion in the *Ecological Risk Assessment* that metals are likely to contribute to the reduction in standing trout populations, to the reduction in some types of benthic macroinvertebrates, to decreased diversity and abundance of terrestrial plants in some locations, as well as potentially posing risks to several terrestrial receptors. EPA evaluated several factors and investigation results relating to chronic risks to Clark Fork River fish. These included chronic exposure to contaminated surface waters, site-specific fish survival tests, avoidance studies, exposure to contaminants from diet and from sediments, and comparative fish density studies. In a recent laboratory fish feeding study (Stratus 2002), juvenile rainbow trout were fed live diets exclusively of *Lumbriculus variegatus* (common names include California blackworm, blackworm, mudworm). The *Lumbriculus* were cultured in metal-contaminated sediments collected from Silver Bow Creek and the Clark Fork River. Significant growth inhibition was reported for fish fed the contaminated diets over the 67 day trial period. Growth inhibition was statistically related to metals and arsenic in the diets and to levels found in fish tissues. The best statistical correlations were reported for arsenic. The study suggests that *Lumbriculus variegatus* grown in metal-contaminated sediments can pose a risk to juvenile rainbow trout through an exclusive dietary exposure pathway. Taken together, EPA concluded the data from these studies are consistent with the hypothesis that copper (and possibly arsenic and other metals) in the aquatic environment (surface water, diet) impose a low-level chronic stress on aquatic macroinvertebrates, trout, and other fish. The *Ecological Risk Assessment* and EPA's unacceptable risk findings are carefully and accurately stated in *Proposed Plan* and are well supported by the record.

Atlantic Richfield Company's extensive comments on EPA's *Ecological Risk Assessment* were responded to by EPA in a lengthy written document, which is part of the administrative record and is incorporated herein by reference (May 2001, *EPA Response to Comments from AERL on the Clark Fork River Ecological Risk Assessment*).

9) Page 10, second paragraph

Summary of Comments

Atlantic Richfield Company strongly disagrees with EPA's conclusion that acute exposure during pulse events and other mining-related causes has led to decreased trout populations as evidenced by numerous papers cited by Atlantic Richfield Company.

Response

Historically, there has been a clear association between storm events and the occurrence of fish kills in the Clark Fork River. This is thought to be due to surface water run-off from contaminated soils, since these surface flows generally contain high concentrations of

copper and other metals, and are also acidic. Maximum concentrations in runoff water from barren slickens were reported to be 7,380 mg/L copper, 2,350 mg/L zinc, and 23 mg/L arsenic (Atlantic Richfield Company 1997). In this regard, it is important to note that not all storms cause acute lethality. Rather, a key factor appears to be the formation of metal salt crusts on the tailings, which in turn requires an appropriate set of meteorological conditions to form initially. In a review of a major fish kill in 1989, EPA postulated that concentrations of metals in these salts, in readily soluble form, were responsible for rapid increases in river water metal levels, and subsequently the lethal concentrations of metals, especially copper, in fish tissues (Munshower et al. 1997). EPA considers it likely that acute exposures to pulses of metals or other high-concentration events are more important than chronic stresses to both fish and other important aquatic invertebrates, since even intermittent fish kills from pulse events could lead to reductions in fish population. Such pulse events are also responsible for the intermittent fish kills that have occurred since fish populations began to re-establish in the 1950s. It is also considered likely that decreases in fish populations in the Clark Fork River may also be due in part to other (non-metal) factors, such as sedimentation caused by excessive erosion resulting from contaminated soils. Considering all the available information, EPA has concluded that the risks to the aquatic system are unacceptable, including acute risks from pulse events.

Atlantic Richfield Company's extensive comments on EPA's *Ecological Risk Assessment* were responded to by EPA in a lengthy written document, which is part of the administrative record and is incorporated herein by reference (May 2001, *EPA Response to Comments from AERL on the Clark Fork River Ecological Risk Assessment*).

10) Page 11, second paragraph of "Remedial Action Objectives"

Summary of Comments

EPA provided no explanation in the *Proposed Plan* for a change in Preliminary Remedial Action Objective (PRAO) regarding groundwater waivers. The change is inconsistent with that stated in the *Feasibility Study* which indicated no *Feasibility Study* alternatives would fully achieve groundwater standards. By eliminating the reference to the potential for waiver of groundwater standards, EPA appears to insist on achieving what is technically impractical to achieve, as acknowledged by EPA.

Response

The remedial action objective for groundwater is to return contaminated shallow groundwater to its beneficial use within a reasonable timeframe. EPA believes that the removal of slicken areas, increased vegetative cover, and decreased percolation rates, in combination with natural attenuation, will lead to groundwater compliance within a reasonable time (perhaps several decades). Therefore, EPA is not proposing a waiver of groundwater standards. EPA reached this conclusion subsequent to the completion of the *Feasibility Study*, based on a closer examination of the expected effects of robust vegetation and careful in-situ treatment. EPA also has worked with scientists from Montana State University on possible amendment additions during in-situ treatment, which may further reduce arsenic mobilization. That work also supports the *Proposed Plan* and *Record of Decision* findings in this regard.

11) Page 11, second paragraph of "Remedial Action Objectives", No. 3

Summary of Comments

Groundwater discharge to surface waters is not a significant source of metals in surface water. Under existing conditions, groundwater discharge does not cause exceedances of surface water RAOs and would not be expected to under any of the alternatives considered.

Response

EPA believes the RAOs as stated are correct. The remedial actions in the *Record of Decision*, when implemented, will collectively reduce contaminated groundwater loading to the surface waters over time. Even though the loading model indicated only 3.9 percent of total copper loading to the river came from the groundwater compared to floodplain runoff of 5.8 percent and streambank erosion of 60 percent, the remedial actions will have an effect on all three and result in the ability to meet State of Montana surface water ARARs or the copper replacement standard.

12) Page 12, middle of first column

Summary of Comments

In the *Proposed Plan,* EPA stated that the *Human Health Risk Assessment*, the *Human Health Risk Assessment Addendum* and the *Ecological Risk Assessment* provide numeric goals for the protection of human health and the environment. Atlantic Richfield Company believes the reference should be clarified to state whether EPA is referring to site-specific numeric goals, such as trout Toxicity Reference Values (TRVs) that were developed for the *Ecological Risk Assessment*, or screening values, which are not themselves indicators of risk.

Response

The Selected Remedy specifies performance standards for protection of human health and the environment. These include calculated RBCs for contaminated soil and numeric concentrations (ARARs) for surface and groundwater. In addition, performance standards for vegetation and streambank treatments are specified.

13) Page 16, first paragraph of "ARARs Waivers for Certain Metals, Surface Water Standards"

Summary of Comments

EPA's Preferred Remedy proposes a waiver of the State's WQB-7 standard for copper in surface water but states that no waiver of the arsenic standard is proposed at this time. Atlantic Richfield Company previously submitted an analysis of predicted arsenic loads to EPA, which showed that none of the *Feasibility Study* alternatives would achieve the recently promulgated Federal standard of 10 ppb for arsenic, because the majority of current arsenic loading comes from upstream. Upstream and tributary sources of arsenic by themselves are predicted to result in exceedance of the 10 ppb standard so the need for a surface water arsenic standard waiver is clear.

Response

EPA believes the *Selected Remedy* for the Clark Fork River will ultimately reduce arsenic loading to the river from adjacent floodplain surface and groundwater sources. EPA acknowledges there are other upstream sources that contribute to elevated levels of arsenic in the river at this time. However, it is anticipated that future Superfund cleanup activities at these sources will ultimately reduce loads to the river. The overall effect from these basin-

wide cleanup activities is expected to result in a positive trend toward compliance with the arsenic standard. EPA notes that some areas of Reach A are at or near compliance with the 10 µg/L dissolved arsenic standard during significant parts of the year. Therefore, EPA has elected not to waive the arsenic standard. See also Section 2.2.2.2 of this *Responsiveness Summary* (page 3-66) for further information regarding EPA's decision on the arsenic standard waiver.

14) Page 18, last paragraph

Summary of Comments

Atlantic Richfield Company believes EPA's conclusion stated in the *Proposed Plan* that "Alternative 1… does not address the unacceptable risks and pathway and is not considered further," is too general. They feel the *Ecological Risk Assessment* fails to document risks to aquatic species resulting from historic mine wastes and that in the *Feasibility Study*, through the evaluation of compliance with TRVs, the no further action alternative achieves remedial objectives for aquatic species.

Response

EPA disagrees with this comment. Based on the entire administrative record, including the *Ecological Risk Assessment* and the *Human Health Risk Assessment* and *Addendum*, and geomorphology reports and other USGS work, EPA's conclusion is that widespread unacceptable terrestrial and aquatic risk exists in Reach A and portions of Reach B of the Clark Fork River OU. Alternative 1, no further action, would fail to achieve ARARs and replacement standards, would fail to address terrestrial risks at exposed tailings areas (as well as human health risks), and would allow excessive erosion and stream instability to continue.

15) Page 19, first paragraph

Summary of Comments

Atlantic Richfield Company disagrees with EPA and believes that Alternatives 2 and 3, as demonstrated in the *Feasibility Study* and NRRB comments, are reliable and permanent. Furthermore, implementation of remedial actions such as Alternatives 2 and 3 has drawn the support of many landowners and local government, based particularly on the success of the Governor's Demonstration Project, and the ability to execute the actions with minimal disruptions to the landowners' property and operations.

Response

EPA strongly disagrees with Atlantic Richfield Company, particularly because the two alternatives do not include a streambank stabilization component, which is absolutely necessary to reduce copper loading from the eroding streambanks and to provide the necessary geomorphic stability. Reduced copper loading from eroding streambanks is necessary to move much closer to achieving State of Montana surface water standards. In addition, as noted in Exhibit 2-19 of Part 2, *Decision Summary,* Alternatives 2 and 3 scored lower in overall protectiveness, compliance with ARARs, and long-term effectiveness and permanence, compared to Alternatives 4, 5, and 6, the combination upon which the Preferred Remedy is based. EPA also notes that some landowners and the Anaconda/Deer Lodge County commissioners adamantly opposed these alternatives.

16) Page 19, last paragraph

Summary of Comments

Atlantic Richfield Company believes that Alternatives 5D and 6C will not significantly "move closer to State water quality standards" based upon *Feasibility Study* prediction comparisons to Alternative 4B4 because the model does not allow for conclusions to be made to this level of precision.

Response

EPA believes that the Selected Remedy, which removes the principal threat wastes, slickens and phytotoxic streambanks, will be a more permanent remedy. It will move closer to water quality standards because there will be less metals in the floodplain (an estimated 1,900 tons of copper and 750 tons of arsenic) to potentially be eroded back into the river as it moves across the floodplain over time. EPA did not indicate that a specific precise change in metals would occur, and EPA recognizes the model is unable to predict such changes in future metal concentrations.

17) Page 19, third paragraph

Summary of Comments

Atlantic Richfield Company believes Alternatives 5D and 6C do not "provide a greater reduction in mobility and volume" of the contaminants because the contaminants are not treated, the intent of the EPA criterion. Alternatives that include treatment (phytostabilization) actually provide greater achievement with this criterion since mobility is reduced.

Response

EPA disagrees. Alternatives 5 and 6 provide some reduction in mobility and volume by removal of the worst of the contaminants from the floodplain. Contaminants left in a floodplain are mobile. Alternative 5D addresses principal soil contaminants—slickens and phytotoxic streambanks—in a more reliable manner by removing these materials from the floodplain and thereby decreasing mobility. It also decreases toxicity of the remaining contaminants by using in-situ treatment on impacted areas. Alternative 6C, removal of exposed contaminated soils and impacted soils and vegetation, better addresses reduction of toxicity and mobility than Alternatives 4 and 5 because it reduces mobility for a large volume of contamination. Alternative 5 also relies on in-situ treatment, but in areas where organic content is present and some vegetation has established over time. EPA considers in-situ treatment in these areas to be effective in reducing toxicity in the long term, as long as it is designed, carefully implemented, and monitored over time.

18) Page 19, fourth paragraph

Summary of Comments

Atlantic Richfield Company notes that EPA, during the technical evaluation included in the *Feasibility Study*, identified, "uncertainties for implementation of in-situ in areas with low pH such as slickens." They disagree, noting that EPA's own contractors have produced numerous documents showing phytostabilization as being implementable and effective on low pH tailing areas such as slickens (see responses to issues to NRRB).

Response

At the request of the EPA NRRB, EPA conducted a review of the in-situ treatment technology, which is documented in *Responses to Issues Posed by the EPA National Remedy Review Board Regarding Phytostabilization of the Clark Fork River Operable Unit, Milltown Sediments Superfund Site* (CH2M HILL 2001). The record shows that some experts did not participate and disagree with some of the findings. However, the record also shows that the Governor's Demonstration Project and other areas treated in-situ have generally produced a return of vegetated conditions in contaminated soils when that soil is amended with appropriate chemicals (lime, organic matter, fertilizer, and other amendments) throughout the zone of contamination, and is monitored and maintained. The data and evaluations also demonstrate some problems with in-situ treated areas—less diverse vegetation, soluble arsenic in the vadoze zone of the treated area, concern about the ability to sustain woody vegetation, and a concern regarding the permanence of in-situ treatment. These issues and others were addressed in detail, using site-specific data in the responses to the EPA NRRB document. For the large acreages of impacted areas without slickens in the Clark Fork River OU, but where some vegetation and organic material exists, the in-situ technology should be implemented with a goal of returning mostly private agricultural land to productive use. For areas of exposed tailings without organic content, and with low pH and high metals content, particularly at the surface, the residual risk is greater and the removal technology is more appropriate. The slickens areas are the principal waste within the OU—remediation of these areas requires a higher level of certainty and permanence according to EPA guidance and the NCP (refer to Part 2, *Decision Summary*, Sections 11 and 13). The slickens areas have low pH and virtually no organic content. They have existed for many decades and natural healing has not led to revegetation in those areas. They generally have higher levels of arsenic and metals, and represent the principal threat waste. They produce runoff that is a clear threat to aquatic receptors (refer to Part 2, *Decision Summary*, Sections 7.2, 13.5.1, and 13.5.2). The higher metal content could also lead to more extensive re-treatment and more monitoring and land use controls on these areas, which is not beneficial to the landowners. Finally, it appears that deep rooted woody vegetation growth, which is so important to the bank and river stability, is less certain with in-situ treatment in these areas. EPA believes that the Selected Remedy is correct in addressing slickens areas with the more aggressive cleanup; that is, removal of slickens. See also the August 2003 EPA memorandum (regarding: Preparation of the *Record of Decision* for the Clark Fork River OU) for a detailed discussion of this point. That document is incorporated herein by reference.

19) Page 19, fifth paragraph

Summary of Comments

EPA proposed a combination of Alternatives 4B4, 5D, and 6C as the Preferred Remedy. Atlantic Richfield Company notes that EPA's own evaluation of alternative performance (Table 7-1 of *Feasibility Study*) scored Alternative 6C lower than 4B4 and 5D. Therefore Atlantic Richfield Company questions including any components from 6C in the preferred alternative.

Response

The *Feasibility Study* ranked alternatives by weighing each of the seven criteria equally, in accordance with EPA guidance. The remedy selection process weighs different criteria differently—threshold criteria are the most important and long-term effectiveness and

permanence, implementability, and reduction of mobility, toxicity, and volume receive added emphasis, according to the preamble to the NCP. EPA believes that this *Record of Decision* appropriately weighs and discusses these criteria (see Part 2, *Decision Summary*, Section 10), and that the Selected Remedy, including portions of Alternative 6C, is the appropriate remedy for this site.

20) Page 20, first paragraph of "General Cleanup Strategies"

Summary of Comments

EPA identified small, localized areas of Reach B that will require streambank stabilization. Atlantic Richfield Company notes that these areas were dropped from the *Feasibility Study*, and no basis was provided as to why they are now included in the Preferred Remedy.

Response

There are locations in Reach B with eroding banks containing tailings that need bank stabilization to minimize further bank erosion and land loss and to reduce copper loading to the river. These areas are partially documented in the *Remedial Investigation*. Their inclusion in the *Proposed Plan* and *Record of Decision* is appropriate.

21) Page 20, fourth paragraph of "General Cleanup Strategies"

Summary of Comments

EPA identifies the costs of the preferred remedy to be in the range of $90 to $100 million. Atlantic Richfield Company believes this cost range significantly overestimates actual costs, considering flexibility in design and implementation.

Response

The comment represents Atlantic Richfield Company's opinion. EPA has conducted further review of the estimated remedy costs, including a careful review of the cost issues presented by Atlantic Richfield Company in its comments, and believes the cost estimate presented in the *Record of Decision* is reasonable. EPA's cost estimate document, which will be available at the same time as this *Record of Decision* is released, contains specific responses to Atlantic Richfield Company's cost information.

22) Page 20, "General Cleanup Strategy," first bullet

Summary of Comments

The term "channel reconstruction" should be removed from the *Proposed Plan*.

Response

EPA agrees. Its use was in error.

23) Page 20, "General Cleanup Strategy," second bullet

Summary of Comments

EPA states that exposed tailings would be removed with limited exceptions (small areas [less that 400 square feet], less than 2 feet deep, and contiguous with impacted soils and vegetation that would be treated in place). Atlantic Richfield Company believes these exceptions are unclear as to whether the exception applies to areas with all of the described properties or to any of them. Atlantic Richfield Company believes there is no technical basis

for the exceptions given the equipment and techniques that have been demonstrated to effectively phytostabilize all of the identified areas slated for removal.

Response

EPA requires that **all** of the described properties be present in order to apply the exception for removal and has added language to the *Record of Decision* to ensure this clarity. EPA included this exception to provide certain flexibility and practicality not to adversely impact productive land with haul roads simply to access relatively small areas of tailings. This is part of the "additional design considerations" being integrated with the CFR RipES process to be used as a part of site-specific design to help meet important landowner concerns about disruption of their operations.

With regards to the last portion of the comment, see Section 2.1.10 (page 3-43), and Section 2.1.17 (page 3-57), of this *Responsiveness Summary*.

24) Page 21, "General Cleanup Strategy," first bullet

Summary of Comments

The Preferred Remedy identified that impacted soils and vegetation areas will be treated in-place unless the tailings and impacted soils extend to depths more than 2 feet or is limited to depths of 2 feet below the surface or are too wet to permit the use of in-place treatment techniques. Atlantic Richfield Company disputes the 2-foot limit and believes it has been demonstrated that methods of in-place treatment to mix soils and lime effectively to depths greater than 2 feet. In addition, existing vegetation conditions overlying buried tailings extending greater than 2 feet below ground surface may already achieve RAOs and may not warrant treatment or removal.

Response

See response to issue 18 (page 3-91). EPA has established the 2-foot depth limit for in-situ treatment based upon proven technologies capable of treating to those depths. A detailed description of the treatment of impacted soils and vegetation is provided in Part 2, *Decision Summary*, Sections 13.3 and 13.6.3. The presently accepted in-situ treatment technology, the Baker plow, has proven to be effective in mixing the soil and lime to depths of up to 30 inches based upon use of three right angle or acute angle passes. Extremely wet ground can limit the use of this technique.

With regards to the possibility of finding existing vegetation that achieves RAOs and exists over soils with tailings greater than 2 feet in depth, the use of CFR RipES to delineate impacted soils and vegetation areas versus slightly impacted soils requiring no additional treatment will be able to identify areas with sufficient vegetation such that in-situ treatment will not be required.

25) Page 21, "Preferred Remedy," second bullet

Summary of Comments

Some larger removed areas may actually require more BMPs, due to the likelihood of weed infestation, not less as indicated by EPA.

Response

Weed growth exacerbation is a historical phenomenon associated with any ground surface disturbance, whether by removal or by the use of in-place treatment. EPA believes that fewer BMPs may be associated with the removal portions of the Selected Remedy, because the replacement soils should have a much lower weed seedbank because of prior weed treatment, in contrast to the existing soils being treated by in-situ means, and because there will be less need for long-term monitoring and maintenance of these areas.

26) Page 21, "Preferred Remedy," fourth bullet

Summary of Comments

The Human Health Risk Assessment documented that there are no risks to human health outside the normally accepted range, based upon data collected during the *Remedial Investigation*. Atlantic Richfield Company believes the sole potential exception to this are certain residential areas historically irrigated with water from the Eastside Ditch, most of which have been remediated under a TRCA. Other data, such as from Arrowstone Park, have been collected since completion of the *Remedial Investigation* and confirmed there are no risks outside the normally acceptable range. Atlantic Richfield Company feels it is unnecessary to evaluate recreation and residential health risks further.

Response

A summary of human health risks is provided in Part 2, *Decision Summary*, Section 7.1. How the Selected Remedy will mitigate these human health risks is explained in Part 2, *Decision Summary*, Section 13.4. In the recent past under its removal authority, EPA has actively addressed human health risks resulting from arsenic exposure in residential areas near Deer Lodge, including playgrounds and parks, and residential areas along the East Side Road. This *Record of Decision* specifies that any similar exposures would also have to be addressed to ensure that human health is protected. The *Record of Decision* also specifically identifies that ICs, such as limiting residential use of the floodplain and potable water wells in the floodplain, will be implemented to ensure public health protection. Seven specific actions to reduce risks to human health are presented in Part 2, *Decision Summary*, Section 13.4.

EPA's *Human Health Risk Assessment* (EPA 1998) and its addendum evaluated the most likely scenarios for human exposure to the COCs for the Clark Fork River OU. Risk managers have made decisions establishing specific action levels for cleanup of arsenic contaminated soils throughout Reach A.

The *Human Health Risk Assessment* provided text to help interpret the RBC and states, "RBC values should be interpreted by comparison to concentration values which represent the arithmetic mean and/or UCL (upper confidence level) of the mean of a chemical averaged over an appropriate exposure unit and should not be interpreted as a 'not–to-be-exceeded' value on a sample-by-sample basis." The document also states, "noncancer and cancer risks from exposure to soil and tailings are dominated by arsenic, and no other chemical poses risks in a range of concern." EPA has incorporated these concepts into the *Record of Decision*.

The *Record of Decision* document specifies actions required to address human health considerations. The Selected Remedy sets action levels for arsenic in soils within the Clark Fork River OU as follows:

- Residential—150 ppm

- Rancher/Farmer—620 ppm
- Recreational—680 ppm for children at Arrowstone Park and other recreational scenarios
- Fishermen, swimmers, and tubers along the river only—1,600 ppm

ATSDR, an agency devoted to human health protection, commented on the *Proposed Plan* and stated a basis for ensuring human health risks are carefully and methodically protected as part of this remedy. The trestle area in Deer Lodge will be sampled and if risk based levels are exceeded, contamination will be removed and disposed in the Opportunity Ponds. Other known recreational areas will be evaluated and if exceedances are found, they will be dealt with in a similar manner. Some residences, identified under the Deer Lodge Valley Historically Irrigated Lands as exceeding the action level for arsenic in residential areas, were not addressed under the TCRA. These areas will be revisited and remediated consistent with that action. Other follow-up operation and maintenance activities from this action will be implemented.

EPA does not believe that other historically irrigated lands within the Clark Fork River OU do not exceed EPA's action level for reasonably anticipated land use for those lands. This will be confirmed via sampling of these lands if necessary and confirmation that residential development is not planned for these areas. As noted in Part 2, *Decision Summary*, Section 13, confirmation sampling for in-situ treated areas is also required to ensure that these areas are below action levels for the current and reasonably anticipated land use.

Additional sampling will be performed in coordination with the NPS at the Grant-Kohrs Ranch National Historic Site irrigation areas and other similar areas to determine if unacceptable risks are present, and if so, contamination will be removed.

Three ICs will be implemented (refer to Part 2, *Decision Summary*, Section 13.4 for detailed description of these ICs) to further protect human health. The ICs are summarized below:

- Continued implementation, including funding, will be provided for Powell County's and Deer Lodge County's zoning ordinances, which prohibit building a permanent residence within the floodplain of the Clark Fork River in those counties.

- Permanent deed restrictions and use funding are required for Arrowstone Park near Deer Lodge, to ensure that this area is maintained and dedicated to use as a recreational area.

- All previously sampled domestic wells that exceeded MCLs will be resampled, as well as any new private domestic well located in or near the floodplain. Appropriate ICs to address groundwater use in the shallow aquifer shall be implemented and funded. A survey of well use in the floodplain of Reach A is necessary. Additional ICs beyond existing State statutory protections can range from groundwater control areas to ordinances or deed restrictions.

Educational efforts for recreational users within the river corridor area concerning the need to prevent soil intake by children and maintain other health practices to prevent unnecessary exposure to soils shall be undertaken or funded, in cooperation with local and State health authorities.

EPA believes all of these measures are necessary and appropriate for protection of human health.

27) Page 21, second column, first full paragraph

Summary of Comments

EPA provided no basis for the "approximately 56 miles of streambank stabilization" mentioned. Atlantic Richfield Company believes that this amount of streambank stabilization is not required based upon design of RDU6 and earlier work and also believes the criteria selected by EPA, less than a 0.25 feet per year of bank erosion, may not be attainable.

Response

The approximately 56 miles of streambank stabilization referred to in the *Proposed Plan* should have been approximately 50 miles in order to correspond with the 264,000 feet of streambank stabilization included as part of the Preferred Remedy in the *Proposed Plan*. Additional information about the required amount of streambank stabilization identified in the Selected Remedy is provided below:

- **Information on the Clark Fork River in Reach A:**
  - Total streambank length in Reach A = 455,136 feet (86.2 miles of streambanks; 43.1 river miles), include:
    1. Length of streambank in Reach A considered = 436,436 feet
    2. Length of streambank in Reach A not considered = 18,700 feet, which includes:
       a. City of Deer Lodge = approximately 11,600 feet
       b. Streambank with public infrastructure currently protected by rip-rap = 5,500 feet, which include:
          i. Highway = 2,500 feet
          ii. Railroad = 1,800 feet
          iii. County roads/bridges = 300 feet
          iv. Irrigation structures = 200 feet
          v. Sewer lagoon = 700 feet
       c. Other lengths of rip-rapped streambanks of unknown origin = 1,600 feet
- **Comparison of the Feasibility Study, Atlantic Richfield Company's Evaluation of the *Proposed Plan*, and EPA's Cost Estimation of the *Proposed Plan*—**Exhibit 3-8 represents a comparison of lengths of treatments and acres for the *Feasibility Study* (Atlantic Richfield Company 2002), Atlantic Richfield Company's evaluation of the *Proposed Plan* Preferred Remedy on 2.5 miles of floodplain immediately upstream of Deer Lodge, Montana (Booth and Johnson 2003), and EPA's cost estimation of the *Proposed Plan* (2003). (The values in Exhibit 3-8 represent Atlantic Richfield Company's extrapolations to the entire Reach A.)

EXHIBIT 3-8
Comparison of Estimates of Streambank Lengths, Percent of Total Length, and Acres for the Clark Fork River in Reach A
Percent of total length is based upon a total length of Reach A = 455,136 ft.

Cost Estimate Evaluation	Linear Streambank Treatment Length (feet)	Percent of Total Length (%)	Acres
April 5, 2001, EPA Memo to Atlantic Richfield Company; EPA original streambank request (Atlantic Richfield Company 2002)[a]	385,968	85.0	443.1
April 5, 2001, EPA Memo to Atlantic Richfield Company; EPA agreed to the following streambank length (Atlantic Richfield Company 2002)[b]	298,848	65.7	343.1
Feasibility Study streambank lengths (Atlantic Richfield Company 2002)	264,000	58.0	303.0
Atlantic Richfield Company's Evaluation of the *Proposed Plan* on Forson's property (EPA 2002)	313,287	68.8	308.0
EPA's Cost Estimation of the CFR Cleanup Plan (CH2M HILL 2004)[c] (Excludes No Treatment and Currently Rip-Rapped)	411,123	90.3	501.1
EPA's Cost Estimation of the CFR Cleanup Plan (CH2M HILL 2004)[c] (Excluding No Treatment, Currently Rip-Rapped, and Treatment 1)	315,979[d]	69.4	362.8[e]

[a] This information is added to the original Table D3 based upon April 5, 2001, memo from EPA to Atlantic Richfield Company. It is found in Appendix D5-2 (page 1068 of the *Feasibility Study* CD).

[b] This information is added to the original Table D3 based upon April 5, 2001, memo from EPA to Atlantic Richfield Company. It is found in Appendix D5-2 (page 1068 of the *Feasibility Study* CD).

[c] The Cost Estimate document is to be released at the same time as the *Record of Decision.*

[d] The value is based upon the exclusion of No Treatment Necessary, Currently Rip-Rapped, and Treatment 1 (vegetation augmentation) due to the limited amount of work that needs to be done and the limited costs per linear foot of streambank vegetation augmentation treatment ($2.78 per linear foot; linear streambank length = 95,144; total cost = $264,500).

[e] The value is based upon the exclusion of No Treatment Necessary (29.1 acres) and Treatment 1 acres (109.2 acres).

In the memo dated April 5, 2001, to Scott Brown of the EPA, which included in Appendix D5-2 (page 1068 of the *Feasibility Study* CD) of the *Feasibility Study*, the technical team estimated the streambank work in Reach A to be 385,968 feet. On page 1068 of the *Feasibility Study* CD, the memo states:

> The new subalternative has been crafted in such a manner as to be consistent with the framework of the existing Alternatives and the structure of the cost estimates.

On page 1075 of the *Feasibility Study* CD, the memo states:

> EPA desires to add the streambank component described above to the range of existing alternatives. This addition facilitates a better comparison and contrast with alternatives containing different types of streambank stabilization methods. EPA's original intent was to apply the new streambank riparian buffer zone model design to **both** sides of the river channel and in all areas where deep binding root mass does not currently exist. It is assumed this would encompass approximately 85 percent of 43 river miles in Reach A or 385,968 feet of riverbank. However, to do so would require more extensive work, make this subalternative incompatible with streambank stabilization lengths of other alternatives, and require re-running the CAST Model and other Feasibility Study variables.

The memo goes on to state:

> Instead, EPA has chosen to apply it to a more limited length of streambanks (assumed to be 298,848 feet, double Atlantic Richfield Company's estimate for streambank stabilization along one bank under Alternative 4a&b Criteria 3) that is compatible with existing Alternatives. The erosion rates of the new subalternative are assumed to be comparable to Atlantic Richfield Company's most effective streambank alternatives, which achieve an erosion rate of 0.25 feet per year. This permits EPA to add this additional streambank component to Alternatives 4 (4a and 4b), 5 (5c), 6 (6c), 7 (7b), and 8 (8b) for comparative analysis.

However, the streambank length actually used in both the *Feasibility Study* and the *Proposed Plan* was changed to 264,000 feet.

In the memo from Don Booth of EMC2 (Booth and Johnson 2003), Don discusses the differences between the extrapolated streambank lengths from Forson's property (313,287 feet) and the *Feasibility Study* (264,000 feet). Booth and Johnson (2003) state:

> SRBZ bank treatment lengths based on GIS queries completed for the Feasibility Study and incorporated into the Preferred Remedy (i.e. 264,000 feet in Reach A) are considered to be the most representative, as they make the most use of available site-specific information.

In other words, even though the preliminary design work done on Richard Forson's property came up with a higher number than their numbers from the *Feasibility Study* (313,287 feet vs. 264,000 feet), they recommend using the lower number as they feel it is more representative of the entire Reach A than Forson's property by itself.

EPA did not select the criterion of 0.25 feet per year of bank erosion. It is not mentioned in the *Proposed Plan.* This was a value determined by the geomorphology subcommittee that represented an average erosion rate of a well vegetated bank. Dr. Smith, in a later USGS publication, indicated that an average erosion rate could possibly be reduced to as little as 0.1 feet per year with banks and riparian corridor stabilized with deep binding root mass that was assumed by EPA to be the ultimate minimum erosion rate achievable by the use of the riparian buffer zone concept when fully mature. Both rates were used in the *Feasibility Study* in modeling runs to see the effect of copper loading differences based upon different bank treatment methods.

28) Page 21, second column, second full paragraph

Summary of Comments

EPA states that removal focuses on specific areas where severe contamination complicates or prevents re-establishment of vegetation while treatment in-place focuses on other less contaminated areas. Atlantic Richfield Company believes that the Governor's and other demonstration areas have shown that areas of relatively greater contamination (slickens) can be effectively treated in-place and should not require differentiation for removal.

Response

EPA disagrees. Slickens areas are highly contaminated, phytotoxic, and the principal threat wastes to the environment; therefore, they must be removed (refer to Part 2, *Decision Summary*, Section 11). Leaving contaminated wastes in-place leaves the landowner with property management issues that removal of these wastes does not. There is evidence that treated wastes left in place can restrict the types of vegetation a landowner may want to grow (DOI 2002; MSU 2002). If the wastes are removed, the landowner is free to manage the property without restriction, after vegetation has been established. Moreover, removal ensures that these wastes will not be re-entrained into the river. A full description of phytostabilization methods as implemented in the Clark Fork River basin is presented in EPA's responses to issues posed by the NRRB (CH2M HILL 2001).

The results of three more recent investigations are summarized below:

- Hansen (2002) states that LAO (where tailings were removed) has a statistically-significant higher riparian functional health that the Governor's Demonstration Project (where tailings were treated in-situ). Twenty-five percent of the plant community at the Governors Demonstration Project is composed of redtop, a metal tolerant species, while it was not present at all at LAO. This contributes to the finding that the functional health rating average scores for vegetation at the Governor's Demonstration Project is 74, (Functional at Risk—Healthy, but with problems), while at LAO it is 88, (Proper Functioning Condition—Healthy). It should be noted that several variables between the two sites, such as grazing practices, weed control, and bank stabilization work, make it difficult to accurately compare the two sites, which also have different re-growth periods. Nevertheless, within the objective methodology of this study, an analysis shows statistically significant differences in vegetation functional health and overall functional health.

- An investigation by Neuman et al. (2002), at privately owned portions of the Governor's Demonstration, concluded the phytostabilized areas with elevated metals may have

limitations on the vegetation communities that can be established. This conclusion is consistent with field observations, the theoretical phytotoxicity models, and data presented in the *Ecological Risk Assessment* for the Clark Fork River. It is noted that the private landowner's field produced very good alfalfa crops in 2002 and 2003. This species is thought to be tolerant, relative to barley, of the chemical, physical, and biological attributes in the rootzone.

- A recent paper (Munshower et al. 2003) investigated the permanence of phytostabilization, primarily in upland areas, within the upper Clark Fork basin. The purpose of the investigation was to generate sufficient data and information from areas receiving phytostabilization treatments, varying in age from 6 to 19 years, so that the permanence and self-sufficiency of the established and reconstructed ecosystem(s) can be assessed. Major conclusions of this investigation were that phytostabilization of acid waste is a valuable reclamation technique, calcium carbonate amendment applied as ground limestone or certain industrial waste can be calculated to produce a non-acid root zone that will last indefinitely, and that successional changes in vegetation are occurring over time. See also EPA's August 2003 memorandum, which is incorporated herein by reference.

29) Page 21, last paragraph

Summary of Comments

The implication that some impacted soils may be too deep or too wet for in-situ treatment is not correct. Techniques can be developed for treating these soils in-place.

Response

The general clean-up strategy in Part 2, *Decision Summary*, Section 13.3, states that impacted soils and vegetation areas will be generally treated in-situ, unless certain exceptions apply. Areas of impacted soils and vegetation that have tailings and impacted soils extending deeper than 2 feet will be removed rather than treated in-situ. Such areas will also be removed if they are too wet to efficiently treat in-situ. Additional detail for treatment of impacted soils and vegetation is provided in Part 2, *Decision Summary*, Section 13.6.3, as follows: Agricultural tillage up to depths approaching 12 inches can be completed with a disc, chisel, or moldboard plow. For deeper tilling, incorporation and mixing of lime and soil has been successfully completed to depths up to 30 inches with the use of a Baker disc type plow being pulled by a large tractor or bulldozer, again using several right or acute angle passes. Other large or small rotary-type mixers have also been used to very effectively mix and incorporate amendments in dry conditions. These application techniques can be applied in areas with shallow groundwater, if the area is not too wet to permit equipment access, and if the mixer blends amendments without the formation of unmixed "balled-up" materials.

30) Page 23, first paragraph (continuation of No. 2 from page 22)

Summary of Comments

The *Human Health Risk Assessment* documented that there are no risks outside the normally accepted range in the Clark Fork River, based on data from the *Remedial Investigation*, with the exception of the Eastside Ditch historically irrigated lands. It is not necessary to continue

evaluation of other recreational and residential areas to determine if action levels are exceeded.

Response
EPA disagrees. See response to issue 26, page 3-95.

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31) Page 23, No. 4

Summary of Comments
Atlantic Richfield Company agrees that ICs will prevent groundwater use of the shallow aquifer, should be enforced by government, and should not be funded by Atlantic Richfield Company as the *Proposed Plan* implied.

Response
When costs are incurred to implement necessary institutional controls in order to protect public health from contamination, it is appropriate that those costs be borne by the responsible party, as they are response and remedial costs, as defined by CERCLA and the NCP.

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32) Page 23, Box "Impacted Soils Areas"

Summary of Comments
EPA should have qualified their assumption regarding the use of 700 acres of impacted soils and vegetation areas for some alternatives described in the *Feasibility Study*, which was based on the phytotoxicity formula included in the *Ecological Risk Assessment*. Based on the use of the buried tailings method, impacted soils could be a low as 185 acres.

Response
Comment noted. EPA has noted in the *Record of Decision* that all estimates of slickens areas and impacted areas are estimates with ranges. However, whether a site is categorized as an impacted soils and vegetation area will depend on its CFR RipES score, which is based on actual vegetation and contamination conditions on the polygon. Estimates of the area of impacted soils and vegetation areas, as reported in the *Feasibility Study*, ranged as high as 1,760 acres in Reach A. Remedial design will determine the actual areas of slickens and impacted areas.

3.3 Additional Comments and Responses

As noted previously, Atlantic Richfield Company's remaining comment package cannot be as easily examined to find comments on significant issues, criticisms, and new relevant information regarding the *Proposed Plan* or the other alternatives examined in the *Feasibility Study* and summarized in the *Proposed Plan*. The remaining text of the comment package was read and significant comments, criticism, or new relevant information were summarized and responded to as shown below. The text of each issue number (33 through 103) refers to the page number and paragraph from the Atlantic Richfield Company December 2003 comment package where the comment was found.

33) Page 1, second paragraph, and page 4, second paragraph

Summary of Comments

Include this document and the other Atlantic Richfield Company authored documents referred to in the text and listed in Appendix A of the comment package, in the Administrative Record.

Response

EPA has included the December 2003 Atlantic Richfield Company comment package in the Clark Fork River OU Administrative Record. Not all documents listed in Appendix A of the Atlantic Richfield Company package are referred to in the text of the Atlantic Richfield Company package, as asserted by Atlantic Richfield Company in this comment. Please see the response to Appendix A (issue 99, page 3-134) for a listing of which of these documents are included in the Administrative Record.

34) Page 2, paragraph 2, and page 4 second paragraph

Summary of Comments

There is no viable explanation as to why EPA's Preferred Remedy is necessary or appropriate to address ecological risks at the Clark Fork River OU.

Response

EPA's August 2002 *Proposed Plan* contains a detailed explanation of the human health and ecological risks found at the Clark Fork River OU, and the rationale for the approach contained in the *Proposed Plan*. The *Record of Decision* contains more detailed findings about the risks presented at the site and the rationale for the remedial action selected in the *Record of Decision*—see especially Part 1, *Declaration*, Sections 1.2 and 1.5; and Part 2, *Decision Summary,* Sections 5, 7, 10, 11, 13.1, and 14.

Atlantic Richfield Company is incorrect in asserting that only ecological risks exist at this site—human health risks were identified in the *Human Health Risk Assessment* and its *Addendum*, the ATSDR human health evaluations for the site, and the NPS Human Health Risk Assessment, and EPA risk managers considered these findings in describing the human health risks that exist and must be addressed in the final remedy for the site. Action levels for arsenic in soils, appropriate for the reasonably anticipated land uses, and groundwater are established in the *Proposed Plan* and *Record of Decision*. The *Record of Decision* also describes appropriate actions to ensure that the areas addressed by the Selected Remedy meet those levels to ensure protection of human health.

Prior responses to comments have further explained EPA's reasons for selection of the remedial action, and the connection of the remedy components with the ecological risks and ARAR exceedance problems presented at the site. EPA refers Atlantic Richfield Company to Section 2 of this *Responsiveness Summary* and to EPA's August 2003 Memorandum for additional explanation of EPA's remedy selection reasons.

Given the significant detail contained in the *Proposed Plan* and supporting documents, it strains credibility to state that EPA has provided no explanation why it proposed the actions it did in the August 2002 *Proposed Plan*.

35) Page 2, paragraph 2

Summary of Comments

Slickens present the only unacceptable risk at the site.

Response

EPA's August 2002 *Proposed Plan* contained a detailed explanation of the various pathways and receptors for hazardous substances at the site, and the unacceptable risks found at the site—see pages 2 through 11 of the *Proposed Plan*. EPA's *Record of Decision* contains a more detailed description of the unacceptable risks and the basis of those assessments—see Part 2, *Decision Summary*, Sections 5, 6, and 7. Atlantic Richfield Company provides no rationale for its comment beyond this statement, and no further response can be given to this general statement.

36) Page 2, paragraph 2

Summary of Comments

EPA's proposed action is arbitrary and capricious, inconsistent with the NCP, unauthorized by CERCLA, and contrary to law.

Response

Again, Atlantic Richfield Company has provided no basis for this conclusory statement, nor does it cite specific NCP provisions or CERCLA provisions that it believes have not been followed for the site or the remedy selection process or content. EPA believes the detailed Administrative Record, *Proposed Plan*, and *Record of Decision* more than adequately demonstrates that EPA's Selected Remedy is not arbitrary and capricious, and is consistent with the NCP and CERCLA. More detailed and specific Atlantic Richfield Company comments concerning the remedy selection process and content are responded to in issues 34 and 35 above and issue 37 below.

37) Page 2, paragraphs 3 and 4

Summary of Comments

Atlantic Richfield Company has developed a proposed remedy called the Atlantic Richfield Preferred Remedy that is consistent with CERCLA and the NCP and protective of human health and the environment, and costs considerably less than the EPA *Proposed Plan* remedy.

Response

EPA acknowledges that Atlantic Richfield Company's Preferred remedy costs less than EPA's selected remedy, but cost is not the only consideration in EPA's remedy selection process. EPA disagrees that Atlantic Richfield Company's Preferred Remedy is protective of human health and the environment or in compliance with ARARs for the site, and its selection would not be consistent with the NCP or CERCLA. EPA's disagreements with these assertions are more fully explained below.

38) Page 3, paragraph 5 and page 4 paragraph 1

Summary of Comments

EPA's cost estimates for its *Proposed Plan* are flawed and excessive and should be reduced substantially.

Response

EPA examined Atlantic Richfield Company's detailed cost estimates and its own cost estimates carefully, and has presented a more detailed cost estimate in a separate document titled *Cost Estimate for the U.S. Environmental Protection Agency's Cleanup plan for the Clark Fork River Operable Unit*, which will be released at the same time as this *Record of Decision*. EPA responds to Atlantic Richfield Company's cost estimate criticisms in detail in that document, which is incorporated herein by reference. The basis for EPA's cost estimate is described in detail in that document, and was prepared by experienced engineers in accordance with EPA's Superfund cost estimation guidance. That effort largely confirmed and refined EPA's initial cost estimates presented in the *Proposed Plan*. EPA disagrees with Atlantic Richfield Company's assertion that the *Proposed Plan* cost estimate was flawed, and believes the cost estimate that appears in this *Record of Decision* at Part 2, *Decision Summary*, Section 13.13, is well founded and accurate.

39) Section I, pages 1 through 3

Summary of Comments

Atlantic Richfield Company's Preferred Remedy is one in which slickens and surrounding areas where cover soils are thin and/or buried tailings are thick—areas that Atlantic Richfield Company describes as disturbed areas—would be addressed through in-situ treatment or soil cover. Atlantic Richfield Company estimates that only 420 acres would meet Atlantic Richfield Company's criteria for slickens and disturbed areas. Atlantic Richfield Company does not describe when it would apply in-situ treatment and when it would apply soil cover. Areas would be revegetated after cover or in-situ treatment. Atlantic Richfield Company would apply three types of bank stabilization—revegetation, bio-technical, and rip rap—to banks that are actively eroding and have exposed tailings. Atlantic Richfield Company estimates the streambank length covered by this part of its proposed action to be 22,400 feet within Reach A. The bio-technical bank stabilization would be done only at banks such as outer meander bends or other high shear stress areas. Atlantic Richfield Company would also implement BMPs to floodplain areas and streambanks in Reach A that contain metals-elevated soils or groundwater, which would temporarily prohibit cattle grazing in revegetated areas until vegetation was fully established and would also include fencing, off-site water provision, or grazing rotation. Atlantic Richfield Company's preferred remedy would also implement ICs that would consist of the continued land use restrictions on residential development within the Clark Fork River floodplain. Atlantic Richfield Company believes that its preferred remedy meets the threshold criteria for selection of a remedy and should be selected by EPA under CERCLA remedy decision criteria.

Response

Atlantic Richfield Company states that this remedy is similar to Alternative 4A1, which was presented in the *Feasibility Study*. EPA's rationale for not selecting Alternative 4 is explained on pages 18 through 20 of the *Proposed Plan* and in this *Record of Decision* at Part 2, *Decision Summary*, Section 10. This rationale notes that Alternative 4A does not address the copper loading found at the approximately 242,000 feet of streambanks outside of the approximately 22,000 feet of streambank addressed in Atlantic Richfield Company's Preferred Remedy—all of which are contaminated with metals and all of which erode and contribute to aquatic risks and other pathways at the site. The Atlantic Richfield Company

stabilization technique would also not address comprehensively the high erosional rates and loss of land or the unraveling risks presented at the site. EPA notes that Atlantic Richfield Company's preferred remedy would implement in-situ treatment in areas where it is not reliable and is not likely to be effective in the long term—namely in phytotoxic streambanks without vegetation and in slickens areas. It also would not address at least 582 acres of impacted soils and vegetation which, because they do not exhibit vegetation that is sufficient and have elevated metals and pH content, are impacted and exhibit environmental terrestrial risk. Atlantic Richfield Company's remedy does not address groundwater at all, and Atlantic Richfield Company admits that groundwater would not likely achieve required, protective standards under its proposal. Atlantic Richfield Company also does not propose ICs of any kind to address groundwater contamination, despite the fact that four domestic wells sampled during the RI exceeded the arsenic standard for drinking water. The Atlantic Richfield Company preferred remedy also does not address those known residential areas above risk based levels that were not addressed under the previous Deer Lodge Valley TCRA, nor does it propose anything towards surveying other areas within Reach A of the OU to ensure that they meet risk based standards for protection of health from arsenic. Thus the Atlantic Richfield Company preferred remedy would not be protective of human health or the environment, one of the main, threshold criteria for selection of a remedy under CERCLA. It would also not do enough to comply with surface water ARARs and would do nothing to attempt to comply with groundwater ARARs—another threshold criteria for remedy selection under CERCLA. More detailed evaluation of Atlantic Richfield Company's issues on these threshold criteria are addressed below in response to more specific comments from Atlantic Richfield Company. Those responses are incorporated into this response by reference.

EPA's evaluation and balancing of the other seven criteria, in relation to Alternative 4 and in relation to EPA's Selected Remedy, are further explained below and in this *Record of Decision*. Those responses and sections of the *Record of Decision* are incorporated by reference into this response.

40) Page I.3, paragraph 3

Summary of Comments

EPA's 1998 *Human Health Risk Assessment* found that current risks to humans from constituents of concern tailings deposits was within the normally acceptable range.

Response

Atlantic Richfield Company does not accurately summarize EPA's *Human Health Risk Assessment* and ignores ATSDR's human health risk concerns at the site. Atlantic Richfield Company's comment fails to even acknowledge EPA's *Human Health Risk Addendum*, which examined more closely potential risks to recreational receptors and established the basis human health action levels for recreational use for children. The true findings of the human health risk assessments and ATSDR health evaluations are found in Part 2, *Decision Summary,* Sections 7.1 and 13.4. Based on these findings, EPA's human health risk components are appropriate and necessary, and go well beyond Atlantic Richfield Company's preferred remedy.

Also see EPA's response to comments at Section 2.1.8 of this *Responsiveness Summary* (page 3-34), which is incorporated herein by reference.

41) Page I.3 and page I.4, paragraph 4, fourth paragraph

Summary of Comments

EPA's Proposed Remedy presents short term risks to workers that will lead to fatalities.

Response

The worker safety fatalities predicted by Atlantic Richfield Company are just that—predicted estimates that may or may not prove true for this specific project. EPA believes that this project can be successfully managed in a safe manner to avoid worker fatalities. Careful safety plans developed under detailed Occupational Health and Safety Act criteria have been used by Atlantic Richfield Company and other PRPs to avoid and minimize work safety at other large construction sites, and that success can be translated here to this project. For example, Atlantic Richfield Company recently completed the construction of a large treatment plant within a permitted mine site under difficult physical conditions, and did so without a single safety incident, let alone a fatality. A similar removal project going on upstream at the Silver Bow Creek site has not resulted in worker fatality or significant worker safety issues. Appropriate sequencing of the work can also be used to reduce worker safety risks. EPA's further examination of this issue is found in its July 2003 memorandum at Exhibit 3, which is incorporated herein by reference. See also EPA's response to community safety concerns in Section 2.1.9.1 of this *Responsiveness Summary* (page 3-39).

42) Page I.4, second paragraph

Summary of Comments

Atlantic Richfield Company's preferred remedy mitigates ecological risk from slickens by in-situ treatment.

Response

The use of in-situ treatment on slickens would mitigate the risk from pulse events and slickens run-off if successful. However, as explained in detail in EPA's July 2003 memorandum and in Sections 2.1.5.1 and 2.1.17 of this *Responsiveness Summary* (pages 3-27 and 3-57, respectively), EPA does not believe that the use of in-situ treatment for slickens would be successful in the long run nor would it produce appropriate vegetation for these areas.

43) Page I.4, fourth paragraph, and page I.5, paragraph 2

Summary of Comments

Atlantic Richfield Company's preferred remedy protects the terrestrial environment and the geomorphic stability of the floodplain.

Response

Atlantic Richfield Company's Proposed Remedy does not address a considerable portion of the floodplain—at least 582 acres—that EPA has identified as impacted areas subject to terrestrial risk. Addressing these areas is necessary to produce sufficient vegetation to stabilize the floodplain, to reduce impacts on ground and surface waters, and to make the lands fully usable. Atlantic Richfield Company's plan is limited to those lower vegetation areas found at fringe areas around slickens areas only. Atlantic Richfield Company's plan does not address almost 242,000 feet of streambank that EPA finds are eroding at excessive rates and contributing to geomorphic instability, land loss, and contribution of metals to in-

stream chronic aquatic risks identified in EPA's *Ecological Risk Assessment* and found unacceptable by EPA risk managers as described in the *Proposed Plan* and this *Record of Decision*. Therefore, Atlantic Richfield Company's plan would not be protective of the terrestrial environment, nor would it contribute significantly to the stabilization of the floodplain.

44) Page I.4, paragraph 3

Summary of Comments

EPA's *Proposed Plan* has similar effects on the aquatic environment as Atlantic Richfield Company's Preferred Remedy, but costs more and is more difficult to implement.

Response

EPA's *Proposed Plan* would more permanently and reliably address aquatic risks from slickens areas, and would comprehensively address the chronic risks from bank erosion—60 percent of the ongoing copper load to the stream. Atlantic Richfield Company measures protection of the aquatic environment in terms of trout TRV compliance only. EPA notes that reduction of total recoverable metals from bank stabilization and more comprehensive bank treatment to address geomorphic stability is necessary and these endpoints are not included in Atlantic Richfield Company's comparative assessment. Atlantic Richfield Company's remedy simply does not address major aquatic pathways and risk problems at the site, which the Selected Remedy does, and therefore it is not similar in protectiveness. The selected remedy will cost more and will be more difficult to implement than Atlantic Richfield Company's minimal preferred remedy, but Atlantic Richfield Company's Preferred Remedy would not be protective of the aquatic environment, and is not similar in its protectiveness of the aquatic environment to EPA's Selected Remedy. The additional components of the Selected Remedy are cost effective and necessary to fully protect the aquatic environment.

45) Page I.5, paragraph 1 and 2

Summary of Comments

EPA's *Proposed Plan* has similar effects on the terrestrial environment as Atlantic Richfield Company's Preferred Remedy, but costs more and is more difficult to implement.

Response

As noted above, Atlantic Richfield Company's preferred remedy does not address terrestrial risk at large portions of Reach A, which EPA has identified as impacted. Also, it does not fully protect terrestrial ecological health nor result in full production for landowners. Atlantic Richfield Company's Preferred Remedy also does not address the risks to the terrestrial environment from excessive erosion along Reach A of the Clark Fork River. Thus, it does not have similar effects to the Selected Remedy. The Selected Remedy does cost more than Atlantic Richfield Company's preferred remedy and would be more difficult to implement, but the additional components of the Selected Remedy are cost effective and necessary to fully protect the terrestrial environment.

46) Page I.5, paragraph 1, and page I.6, paragraph 1

Summary of Comments

Atlantic Richfield Company notes that their preferred remedy is estimated to lead to violations of the State's WQB-7 total recoverable copper standard 61 percent of the time for chronic values and 26 percent of the time for acute value at "certain locations," while EPA's remedy would lead to exceedances of 21 percent for chronic values and 9 percent of acute values at Deer Lodge. There is also a measurable difference between the two remedies in terms of exceedances when measured at the lower end of the OU at Turah. Atlantic Richfield Company argues that since a waiver of the copper standard would be required in either case, these exceedances do not relate to protectiveness in Atlantic Richfield Company's opinion. This should not be a factor in remedy selection.

Response

EPA appreciates Atlantic Richfield Company's candor in its comments, but disagrees on the significance of this fact. Congress declared that CERCLA remedies were to achieve ARARs as the assumed cleanup standard—see section 121(d)(2)(A) of CERCLA, 42 U.S.C. § 9621(d)(2)(A). This statutory requirement is independent of protectiveness or risk reduction concepts expressed elsewhere in CERCLA. EPA has an obligation to select remedies that achieve ARARs or when they can't fully achieve ARARs, come as close as possible to achieving them. EPA granted the waiver for the State's WQB-7 copper standard because **none** of the alternatives could achieve that standard fully. Still, EPA believes that the remedy should come as close as possible to the standard, while still representing the best tradeoffs among the other remedy selection criteria for the site. Atlantic Richfield Company's preferred remedy does not meet this remedy selection criteria.

Finally, EPA disagrees that reduction of total recoverable copper is unrelated to environmental risk protection. EPA's *Ecological Risk Assessment* found low level aquatic risk above EPA's Hazard Quotient Level of 1 at the site, due in large part to copper pathways from streambanks in total recoverable form. Reduction of this pathway is extremely important to protection of the aquatic environment.

47) Page I.6, paragraphs 2, 3, and 4

Summary of Comments

EPA should waive the instream standards for arsenic, based on Atlantic Richfield Company's modeling effort, which shows that no alternative could meet the standards. Atlantic Richfield Company also argues that the standard is unrelated to protectiveness of aquatic resources

Response

See EPA's response to comments at Section 2.2.2.2 of this *Responsiveness Summary* (page 3-66). EPA believes that the Selected Remedy can possibly achieve the arsenic standards for in-stream arsenic set forth in the *Record of Decision*—both the Federal 10 µg/L standard, measured as dissolved, and the State 18 µg/L standard, measured as total recoverable. EPA acknowledges that there is uncertainty with this finding and will continue to examine the possible need for an ARAR waiver of these standards, while still maintaining protectiveness, when the remedy is implemented and the effects of upstream cleanups have been ascertained.

EPA believes control of in-stream arsenic is necessary for protection of human health, and that compliance with the State's WQB-7 standards for total recoverable arsenic for aquatic protection is also necessary.

48) Page I.7, paragraph 1

Summary of Comments

Atlantic Richfield Company and EPA's preferred remedy would comply with groundwater arsenic ARARs in areas below 25 feet. Neither remedy would comply with groundwater arsenic standards in shallow aquifers, and thus both remedies are equivalent. Atlantic Richfield Company does not propose a groundwater ARAR waiver.

Response

EPA believes that the Selected Remedy will more likely achieve the arsenic groundwater standard of 10 µg/L dissolved in both aquifers than the Atlantic Richfield Company remedy, because it will eliminate the most contaminated areas from the system (the slickens areas) and will reliably place vegetation in the floodplain through the appropriate application of in-situ treatment which will reduce infiltration of contaminants into the groundwater. Elsewhere, Atlantic Richfield Company argues that the groundwater ARAR standard should somehow not apply to the shallow groundwater, but that conclusion would be contrary to the NCP. All groundwater classified by the State as usable for drinking water is subject to the groundwater ARARs, according to CERCLA and the NCP. The State has classified the shallow groundwater at the Clark Fork as potentially usable and current State standards that restrict such use may be changed in the future and are not consistently enforced. EPA believes the removal of 750 tons of arsenic from the system and its potential effect on groundwater cleanup is important and another reason to select removal of slickens areas rather than in-situ treatment of these areas.

49) Page 1.8, paragraph 2

Summary of Comments

The State's regulations addressing the management of solid waste in the floodplain are not appropriate ARARs.

Response

EPA and the State have previously addressed Atlantic Richfield Company's arguments regarding the use of the State's solid waste and floodplain protection prohibitions against the active management of waste such as the contaminated material found in the Clark Fork as ARARs, and continued to believe they are appropriate ARAR standards. See Appendix A, pages 5, 8, 16, and 19, of the *Streamside Tailings Operable Unit of the Silver Bow Creek/Butte Area NPL Site Record of Decision* (EPA and MDEQ 1995) and Appendix A, pages 9 and 13, of the *Anaconda Regional Water, Waste and Soils Record of Decision* (EPA and MDEQ 1998), which are incorporated herein by reference. EPA notes that Atlantic Richfield Company indicates that under the State's floodplain ARARs, the presence of historic mill tailings in the floodplain does not constitute management. EPA agrees with this statement—the action specific State floodplain ARARs become applicable once the agencies decide to address the waste in the floodplain. When any active management occurs, the ARARs apply.

50) Page I.7, paragraph 2

Summary of Comments

The State's floodplain standards should be waived based on equivalent level of performance, as shown in Tab 5 of the Atlantic Richfield Company package. There is precedent for this waiver in EPA actions at the Streamside Tailings OU and the Butte Property Soils OU.

Response

EPA has waived the State's floodplain management ARARs with respect to areas that are designated for treatment, because removal of all the wastes and contaminated soils in the floodplain would be technically impracticable. EPA does not find that removal of the more limited slickens areas—estimated to be around 170 acres—is technically impracticable and cannot invoke the ARAR waiver for those areas. The State of Montana, who administers these ARARs, strongly believes this limited waiver is the only appropriate one for this action.

EPA examined the equivalent level of performance standard demonstration by Atlantic Richfield Company, and does not believe it is appropriate for this site. First, as discussed elsewhere in this *Record of Decision*, EPA does not believe that implementation of in-situ treatment in slickens areas would be successful or reliable over the long term and therefore would not be equivalent to the ARAR requirement to remove the waste that would be reliable and eliminate the threat from these wastes. Secondly, EPA notes the success of in-situ treatment in appropriate areas in terms of vegetation, but notes that this level of performance, which requires long term monitoring, careful O&M, and has the potential for groundwater releases of arsenic through mobilization, is not "equivalent" to the removal of the material as required by the ARAR.

51) Page I.7, paragraph 3

Summary of Comments

The Grant-Kohrs Ranch related ARARs, identified by EPA in its ARAR attachment, are not appropriate ARARs.

Response

EPA has identified, and the remedy selected by this *Record of Decision* will attain, location-specific ARARs with respect to hazardous substance releases within or potentially affecting the Grant-Kohrs Ranch National Historic Site, which is a unit of the National Park System administered by the NPS. These ARARs are derived from the NPS Organic Act, 16 U.S.C. §§ 1 et seq. (the Organic Act), and the enabling legislation for Grant-Kohrs Ranch (Pub. L. 92-406, 86 Stat. 7632 [1972]; Grant-Kohrs Act). As described further, attainment of these ARARs requires restrictions, treatment, removal, or other measures addressing concentrations of hazardous substances to ensure that the historic ranch landscape of the late nineteenth century is reestablished, preserved, and sustained for future generations in a condition unimpaired by hazardous substances.

The Atlantic Richfield Company objected to the designation of the Organic Act and the Grant-Kohrs Act as ARARs on three grounds:

1. The Organic Act and Grant-Kohrs Act do not authorize the NPS to improve the condition of land where such land has been contaminated by mining wastes prior to the land's inclusion in the National Park System.

2. Identification of the Organic Act and Grant-Kohrs Act as sources of ARARs amounts to an impermissible attempt by EPA to require natural resource restoration rather than an appropriate use of remedial action authority.

3. The Organic Act and Grant-Kohrs Act contain only non-binding administrative and "aspirational" standards that lack the precision required by the NCP.

As explained below, EPA finds Atlantic Richfield's objections to be unpersuasive.

Application to Mining Wastes on NPS Property

Section 1 of the Organic Act directs that the NPS "shall promote and regulate the use of … national parks … by such means and measures as conform to the fundamental purpose of the said parks … which purpose is to conserve the scenery and the natural and historic objects and the wildlife therein … in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."[1] Atlantic Richfield Company suggests that this mandate for the NPS to conserve in an unimpaired condition the scenery, wildlife, and natural and historic objects of a National Park in order to achieve the fundamental purposes of the park should not be read to allow for improvement of impacted lands to a better condition than the lands were in when they were added to the National Park system.[2]

EPA disagrees with this suggestion. The Organic Act expressly directs the NPS to manage and regulate national parks to conserve the "scenery" and "wildlife" within parks and to leave them unimpaired for the enjoyment of future generations.[3] The notion that the NPS does not have authority to improve sites added to the National Parks system so as to fulfill the purposes for which the site was acquired is contradicted by clear statutory directive and established precedent.[4] In particular, with respect to National Historic Sites, the NPS is directed by statute to "restore, reconstruct, rehabilitate, preserve, and maintain historic or prehistoric sites … of national historical or archaeological significance" such as the Grant-Kohrs Ranch National Historic Site.[5] This congressional directive—*to restore, reconstruct, or rehabilitate*—clearly contemplates the improvement of National Historic Sites that have been damaged or impaired prior or subsequent to becoming National Parks.

The *Grant-Kohrs Ranch Cultural Landscape Inventory* conducted by the NPS identifies historic elements of the "Riparian/Woodland Landscape" type as those "natural landscape features that existed during the ranch's period of significance and contribute to the landscape

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[1] 16 U.S.C. §§ 1.

2 See Atlantic Richfield correspondence from Barry C. Duff to Scott Brown and D. Henry Elsen, Environmental Protection Agency, and Mary Capdeville and Kevin Kirley, Montana Department of Environmental Quality (June 8, 2000) (hereinafter "Duff correspondence).

[3] 16 U.S.C. §§ 1 et seq. The conservation of both "scenery" and "wildlife" includes conservation and rehabilitation of native vegetation. See, e.g., *Interim Final Guidance on Assessing Impacts and Impairment to Natural Resources*, pp. 11-20, NPS, Natural Resource Program Center (April, 2003).

[4] *See*, e.g., *U.S. v. Chrysler Corp.,* Partial Consent Decree (Ford Motor Co., General Motors Corp., Department of Defense) (Civ. Action No. 5:97 CV00894, N.D. Ohio April 22, 2002) (Court Order approving remedy selected by the NPS that mandated removal of hazardous substances from Krejci Dump site, resulting in conditions better than those that existed when the site was added to the Cuyahoga Valley National Park).

[5] 16 U.S.C. § 462(f).

character of the ranch"[6] and recommends that "damage as the result of upstream mining activities" should be remedied by Grant-Kohrs Ranch.[7] To accept Atlantic Richfield's argument that the NPS is not authorized to require that such damage be remedied would preclude the NPS from rehabilitating the Grant-Kohrs Ranch National Historic Site to the condition it was in during the time period that it is intended to commemorate, thus depriving the Grant-Kohrs Ranch from fulfilling the principal purpose for which it was added to the National Park System.[8]

Restoration Rather than Remedial Action

Atlantic Richfield argues next that the mandates of the Organic Act and the Grant-Kohrs Act are not ARARs because they pertain to restoration of injured natural resources and not CERCLA remediation.[9]

EPA disagrees with the argument that measures to protect the environment from the consequences of hazardous substance releases are not authorized under remedial action authority if such measures also achieve the reestablishment of natural resources. CERCLA defines "remedial action" in broad terms that clearly include measures designed to mitigate or remedy adverse effects on the environment resulting from the release of hazardous substances. Such adverse effects include the degradation or elimination of native plant and animal species that, but for the release of hazardous substances, would be present within a site's environment. Remedial action measures include, without limitation, dredging or excavation of contaminated media, onsite or offsite treatment, and other actions necessary to reestablish native vegetative species that have been adversely impacted or eliminated as a result of exposure to hazardous substance releases.[10]

This authority to remedy adverse environmental effects is expressly manifested in CERCLA's requirement for remedial action to attain ARARs. In particular, attainment of location-specific ARARs is required to remedy adverse environmental effects in special areas that merit special protection. As described by EPA guidance, location-specific ARARs include "restrictions placed on the concentration of hazardous substances … solely because they are in specific locations. Some examples of special locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats."[11] Examples of Federal statutes that establish location-specific ARARs include, without limitation, the National Historic Preservation Act, the Archeological and Historic Preservation Act, the Wild and Scenic Rivers Act, the Coastal Zone Management Act, the Fish and Wildlife Coordination Act, the Wilderness Act, and others.[12]

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[6] *Cultural Landscape Inventory and Analysis, Grant-Kohrs Ranch National Historic Site,* United States Department of the Interior, NPS Rocky Mountain Region (1991), p. 27.

[7] Id at p. 38.

[8] The House Report accompanying the passage of the Grant-Kohrs Act expressly provides that the principal purpose of the Grant-Kohrs Ranch is to "recreate the historic ranch scene of the 1880-1900 period." *See* House Report (Interior and Insular Affairs Committee) No. 92-1222, Cong. Record Vol. 118, p. 3073 (July 18, 1972) (hereinafter "House Report").

[9] Duff correspondence.

[10] 42 U.S.C. § 9601(24).

[11] CERCLA Compliance with Other Laws Manual, (August, 1988), Volume I, p. 1-25.

[12] CERCLA Compliance with Other Laws Manual, (August, 1988), Volume II.

Like these statutes, the Grant-Kohrs Act, read in combination with the Organic Act, establishes for the Grant-Kohrs Ranch National Historic Site location-specific requirements. The attainment of these requirements is necessary to enable this National Historic Site to fulfill the statutory purposes for which it was established. Foremost among these statutory purposes is that the Grant-Kohrs Ranch National Historic Site be managed so that it is unimpaired for future generations.[13] This means, among other things, that the Ranch "will be a living memorial to the pioneers of the West, and that a concentrated effort will be made to preserve and *recreate the historic ranch scene of the 1880-1900 period*."[14] Accordingly, location-specific ARARs for the Grant-Kohrs Ranch include those restrictions or mitigation measures addressing concentrations of hazardous substances that are necessary to recreate the historic ranch landscape of the late nineteenth century and to preserve and sustain this landscape for future generations in a condition unimpaired by hazardous substances.

EPA recognizes that attainment of these location-specific ARARs, which will thereby enable the NPS to reestablish native riparian vegetative communities, is also a desirable outcome from a natural resource restoration standpoint. EPA believes that this reflects an appropriate integration of the goals established by Congress in authorizing both remedial action to address threats to public health and the environment as well as restoration to address injuries to natural resources. Notwithstanding the integration of these two statutory authorities, the legal authority for requiring that remedial action attain restrictions on hazardous substances necessary to reestablish native riparian vegetative communities is derived specifically from the requirements that ARARs be attained, absent a waiver, by remedial actions selected under section 121 of CERCLA.

Aspirational/Imprecise Standards

Atlantic Richfield Company also argues that the Organic Act and the Grant-Kohrs Act establish narrative standards that are administrative and aspirational that lack the precision required by the NCP.[15] EPA disagrees with this assertion. As set forth in the House Report accompanying the statute, the Grant-Kohrs Act requires that "the historic ranch scene of the 1880-1900 period" be recreated to the extent possible.[16] This is a specific standard that can be quantified with some precision. NPS has conducted extensive research to determine precisely what vegetative communities would have existed at the Grant-Kohrs Ranch National Historic Site during the 1880-1900 period.[17] This research can be used to define performance standards that must be achieved to attain these ARARs and to identify specific indicators to measure such attainment.

Moreover, the NPS has developed policies for interpreting the unimpaired standard of the Organic Act. These policies specify that an action or conditions constitute impairment of park resources or values if the action or conditions "harm the integrity of the park resources or values, including the opportunities that otherwise would be present for the enjoyment of

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[13] 16 U.S.C. § 1.

[14] House Report, p. 3073 (emphasis added).

[15] Duff Correspondence.

[16] House Report, p. 3073.

[17] *See*, e.g., *Baseline Vegetation Types for Grant-Kohrs Ranch,* Peter M. Rice, Division of Biological Sciences, University of Montana (March, 2002) (hereinafter "Rice Report (2002)").

those resources or values."[18] In particular, NPS guidance specifically provides that an "action that eliminates a naturally occurring native plant or animal population from the park … (or) actions that ultimately preclude an extirpated species from being restored to the park or preclude populations becoming self-sustaining are also likely to impair park resources."[19] When such impairment has occurred, NPS guidance specifies that "the appropriate condition" (i.e. unimpaired condition) "is an essentially natural condition, with natural population levels, (and) a natural distribution" of species.[20]

Accordingly, the location-specific ARARs identified for the Grant-Kohrs Ranch establish defined performance standards for the remedial action to attain. These performance standards require that the remedial action selected and implemented recreates the Ranch's historic landscape through the reestablishment of self producing and sustaining native riparian vegetative communities and species that likely would be present but for the effects of hazardous substances released from mining operations upstream.

As previously indicated, NPS has conducted extensive research and analysis in order to define specifically the native riparian vegetative species that should be used as indicators to determine whether these performance standards are attained.[21] This research indicates that seventeen baseline plant communities should be found within the riparian zone of the Grant-Kohrs Ranch National Historic Site.[22] Baseline plant communities are those that would be present but for the past and ongoing releases of toxic metals from upstream mining activities. Of these 17 plant communities, 12 are currently found in the Ranch riparian zones and 5 are absent. Each baseline plant community has been defined in terms of which native plant species would be expected within each community and the relative abundance of each species.[23]

Using these baseline plant communities as indicators, the remedial actions necessary to attain the performance standards associated with recreating the historic landscape can be evaluated, monitored, and adjusted as necessary. Recreating the historic landscape generally will not necessitate the complete removal of hazardous substances or, as Atlantic Richfield Company has put it, require a "pristine ecosystem." Rather, recreating the historic landscape means that the remedial action must achieve the natural reestablishment of self reproducing and sustaining native riparian vegetation communities through a natural successional process. Native riparian communities do not include a predominance of acid or metal tolerant species (e.g., tufted hairgrass, redtop bentgrass), but instead are composed primarily of communities native to southwestern Montana riparian areas (e.g., willows, river birch, alder, sedges and rushes).[24] In addition, recreating the historic landscape requires that the remedial action provides for the recuperation and stability of the river

[18] NPS Management Policies, Section 1.4.5, (2001).

[19] *Interim Final Guidance on Assessing Impacts and Impairment to Natural Resources*, NPS, Natural Resource Program Center (April, 2003).

[20] Id at p. 16.

[21] Rice Report (2002).

[22] Id.

[23] Id.

[24] Id.

channel, streambanks, wildlife habitat, irrigation ditches, and other components of the historic landscape that have been adversely affected by the release of hazardous substances.

To ensure the long term effectiveness and permanence of the remedy, intensive monitoring will be required. Such monitoring will measure the long term success of revegetation and recuperation of the river channel and other resources. Such monitoring also is required to ensure that the Grant-Kohrs Ranch National Historic Site is protected from future upstream releases of hazardous substances that would undermine the long term effectiveness of the remedy or threaten the successful reestablishment of native riparian vegetation communities. In addition, ongoing maintenance activities will be required to sustain the long term effectiveness of the remedy in maintaining the successful reestablishment of the historic landscape.

52) Page I.7, paragraph 4

Summary of Comments
In-situ treatment will achieve ARARs for vegetation.

Response
EPA agrees that in-situ reclamation, at appropriate places such as those described in the *Record of Decision*, will likely achieve vegetation ARAR standards. EPA does not agree that in-situ treatment in slickens areas will be successful or reliable in the long run, as explained elsewhere, and therefore does not agree that use of in-situ reclamation in slickens areas would achieve vegetation ARARs.

53) Page I.8, paragraph 1

Summary of Comments
Both remedies will achieve wetlands no net loss ARARs. EPA's Proposed Remedy will result in adverse impacts to wetland functions.

Response
EPA agrees that under either remedy, as well as under any other examined alternative, wetlands no net loss ARAR compliance can be achieved because the potential for creating wetlands during construction, where appropriate and consistent with landowner uses, is possible with this project. EPA encourages Atlantic Richfield Company to utilize this potential fully to create wetlands as the project is implemented. EPA does not agree that the excavation required under the Selected Remedy will result in adverse impacts to wetland function in the floodplain, and notes that Atlantic Richfield Company provides no basis for this statement. EPA has consulted with the FWS extensively on the selection of the remedy, and it supports EPA's Selected Remedy. The FWS is the agency primarily responsible for the monitoring and protection of wetlands for the Clark Fork Basin projects.

54) Page I.8, second paragraph

Summary of Comments
Atlantic Richfield Company's preferred remedy ranks highly for permanence and long term effectiveness because in-situ treatment would address terrestrial risk, and localized bank stabilization would reduce bank erosion of metals and geomorphic stability. Groundwater exposure would be prevented by ICs. Slickens areas would be addressed and prevent pulse

events. Atlantic Richfield Company's proposed techniques are proven and reliable. EPA's in-situ treatment panel report supports the permanence and reliability of in-situ treatment.

Response

This comment is addressed in issue 39 (page 3-105), among others. In short, EPA does not believe use of in-situ treatment in slickens areas is reliable or permanent, and EPA does not believe the large areas of streambank and impacted soils and vegetation areas that are unaddressed by Atlantic Richfield Company's preferred remedy do not fully address protectiveness or important pathways and therefore are not permanent or effective in the long term. The NCP specifically requires EPA to assess "the degree of certainty that the alternative will prove successful" when evaluating the long term effectiveness and permanence criteria—see section 430(e)(9)(iii)(C), 40 CFR § 300.430(e)(9)(iii)(C).

Finally, EPA notes that Atlantic Richfield Company refers to the reliability of groundwater controls through ICs. However, Atlantic Richfield Company's description of its preferred remedy does not include any mention or description of groundwater ICs. Atlantic Richfield Company's preferred remedy does nothing in relation to contaminated groundwater, and therefore is not permanent or effective over the long term.

EPA's Selected Remedy does carefully address the needs for streambank stabilization and describes that portion of the remedy with great care, after careful consideration by EPA's experts in this field. Because of this, EPA's streambank component will be effective over the long term and will adequately manage residual risks at the site. For further discussion of this component and the basis for this determination, see Section 2.1.2 of this *Responsiveness Summary* (page 3-12), which is incorporated herein by reference.

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55) Page II.9, second and third paragraph

Summary of Comments

Atlantic Richfield Company's preferred remedy reduces mobility through treatment. EPA's remedy also does this and reduces mobility too, but is not consistent with section 121(b)(1) of CERCLA because it uses off-site disposal when on site practicable treatment options are available.

Response

The Atlantic Richfield Company preferred remedy uses treatment, but not for large areas of impacted streambanks or soils and vegetation. The Selected Remedy also uses treatment of soils through in-situ treatment, but in areas where it will work reliably and in the larger area of Reach A where it is needed. EPA's use of removal and disposal of untreated wastes for the slickens area is fully consistent with section 121(b)(1) because that provision disfavors such disposal only when on-site treatment options are practicable. As demonstrated elsewhere, on-site treatment via in-situ methods for slickens areas is not practicable because it is not likely to work adequately or reliably over the long term and does not address groundwater issues associated with slickens area effectively.

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56) Page II.9, paragraph 5, and page II.10, paragraphs 2 and 3

Summary of Comments

EPA's Proposed Remedy will have significant traffic, dust, noise, access, loss of land use, and construction hazards.

Response

See EPA's response to community concerns at Section 2.1.9, page 3-39, of this *Responsiveness Summary*, and EPA response to worker concerns at issue 41, page 3-106. EPA acknowledges that these short term impacts are greater than they would be with Atlantic Richfield Company's preferred remedy, but EPA believes that they are manageable if the project is planned and implemented carefully. EPA believes that in the overall balance of tradeoffs among the balancing and modifying criteria, these impacts do not lead EPA to select a less intrusive remedy than that selected in this *Record of Decision*.

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57) Page II.9, paragraph 5

Summary of Comments

EPA underestimates the time period for implementation of the Proposed Remedy, based on the time period it is taking to implement the Streamside Tailings remedy. EPA's *Proposed Plan* will take much longer to implement than Atlantic Richfield Company's preferred remedy.

Response

EPA has considered the experience of the agencies in implementing the streamside tailings remedy in developing its estimates. EPA believes that the two projects are dissimilar in many respects, and that the Clark Fork Project can be implemented in 10 years if carefully planned up front. The *Record of Decision* acknowledges that this time period may be adjusted as remedial design is completed and more project detail is known.

EPA acknowledges that the Selected Remedy will take longer to implement than Atlantic Richfield Company's preferred remedy. EPA believes that in the overall balance of tradeoffs among the balancing and modifying criteria, this longer time frame for implementation does not lead EPA to select a less intrusive remedy than that selected in this *Record of Decision*.

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58) Page II.10, paragraphs 4 and 5, and page II.11, paragraph 1

Summary of Comments

The *Proposed Plan's* more extensive streambank work has high levels of short term environmental impacts and it will take longer to implement.

Response

EPA has consulted carefully with the FWS about the construction techniques used during implementation of the Selected Remedy, and has prepared a Biological Assessment under section 7 of the ESA to address these concerns. The FWS concurs with EPA's remedy selection and will continue to work closely with EPA as the project is implemented to avoid or mitigate the environmental impacts that may be associated with the streambank work.

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59) Page II.11, paragraph 4

Summary of Comments

EPA's *Proposed Plan* is not implementable because of landowner resistance for access and opposition to the buffer zone.

Response

EPA believes that careful coordination with the landowners, as described in several places in this *Record of Decision*, as well as fair treatment for lost land use caused by remedial

implementation, will result in general landowner cooperation for this project. EPA has modified the buffer zone requirement such that its width is flexible and can be tailored to landowner needs. EPA's initial discussion with several landowners has revealed a greater willingness to cooperate with implementation of the remedy if it is done with landowner needs in mind.

60) Page II.11, paragraph 5

Summary of Comments

There are not sufficient mature willows available to implement the streambank and buffer zone requirements of the *Proposed Plan*.

Response

Mature willow transplants from the Clark Fork River floodplain will be minimized for a variety of reasons. The removal of a large number of mature willows from the floodplain may potentially destabilize portions of the river. Therefore, Section 13.8.2 of Part 2, *Decision Summary*, and Appendix B of the *Record of Decision* discuss the growing of both small and medium size willows for the remediation effort. Mature willows will only be used in specific locations to minimize shear stresses against a streambank. Therefore, the use of mature willow transplants from the Clark Fork River floodplain only represent a small fraction of the total willows needed for remediation.

61) Page II.11, paragraph 6, and page II.12, paragraphs 1 and 2

Summary of Comments

The water rights and irrigation needs for the *Proposed Plan* project make it unimplementable.

Response

EPA notes that Atlantic Richfield Company has acquired substantial basin water rights throughout the years, which would be sufficient to meet any water rights needs that may result from this project. EPA and DEQ will work carefully with the Montana DNRC to ensure water rights compliance during the implementation of this project.

62) Page II.12, paragraph 3

Summary of Comments

EPA's *Proposed Plan* remedy is not cost effective as required by CERCLA and the NCP, because it costs more than Atlantic Richfield Company's Preferred Remedy.

Response

EPA has provided a detailed explanation of its consideration of the cost effectiveness criteria in Part 2, *Decision Summary*, Sections 10.2.7 and 14.3. The benefits for the environment and for human health provided by the Selected Remedy are proportional to the expected benefits from the implementation of the Selected Remedy as required by section 430(f)(1)(ii)(D) of the NCP, 40 CFR § 300.430(f)(1)(ii)(D). Accordingly, this decision complies with section 9621(a) and (b) of CERCLA, which address the need for the selection of a cost effective response. As stated in EPA guidance and in Part 2, *Decision Summary*, Section 14.3, it is important to note that more than one cleanup alternative can be cost effective, and that Superfund laws and regulations do not mandate selection of the most cost effective alternative. Additionally, the most cost effective remedy is not the least costly alternative

that meets EPA's threshold criteria. EPA recognizes the costs associated with the Selected Remedy are relatively high, but believes the costs are appropriate for the widespread contamination and extensive unacceptable risks at the site.

63) Page II.12, paragraph 4

Summary of Comments

When comparing Atlantic Richfield Company's preferred remedy and EPA's Proposed Remedy, Atlantic Richfield Company's preferred remedy meets the criteria better than does EPA's Proposed Remedy. EPA's remedy presents a solution that is worse than the problem.

Response

Atlantic Richfield Company's Section II analysis looks at each of the seven criteria that it chooses to examine individually, and assesses "compliance" with each. This is not how the remedy selection criteria and process is required to be applied. EPA must select a remedy that meets the threshold criteria. Atlantic Richfield Company's Preferred Remedy is not protective of human health or the environment, the overarching mandate of CERCLA, because it does not address the large area of tailings and impacted soils, does not sufficiently address streambank erosion and its contribution to land loss and in-stream chronic risk, and does not begin to completely address human health risks. It does not provide ARARs compliance either, because it does not address groundwater ARAR compliance or maximum practical efforts to achieve State water quality standards, nor does it provide a basis for floodplain and solid waste ARAR waivers. Thus the Atlantic Richfield Company preferred remedy does not meet the threshold criteria.

When looking at the remaining balancing criteria, Atlantic Richfield Company's analysis does not examine the tradeoffs among these criteria and attempt to balance these tradeoffs to come up with an appropriate remedy—it looks at each criteria in isolation and continually emphasizes the short term risks allegedly presented by the Selected Remedy. The NCP requires EPA to look at these criteria and their tradeoffs as a whole, and to emphasize long term effectiveness and reduction of toxicity, mobility, or volume in this analysis, 40 CFR § 300.430(f)(1)(ii)(E). Atlantic Richfield Company's analysis does not even address tradeoffs among the criteria, and emphasizes short term effectiveness and perceived risks, as well as the cost of the remedy, over all other criteria. This is not supportable.

Finally, Atlantic Richfield Company does not even attempt to address community or State acceptance, important criteria in remedy selection. The State adamantly opposed Atlantic Richfield Company's minimal preferred remedy because it would not do enough to address chronic aquatic risk, terrestrial risk, streambank stability, or compliance with ARARs. Many members of the community oppose Atlantic Richfield Company's preferred remedy and support EPA's Selected Remedy or want it to go further.

EPA's analysis of the nine criteria, as carefully reflected in the *Proposed Plan* and this *Record of Decision*, reflects the appropriate application of the nine criteria to this site, and results in the appropriate selection of a remedy for the Clark Fork River OU, as found in the Clark Fork River OU *Record of Decision*.

64) Part II of Atlantic Richfield Company's comment package and Tabs 8 and 9

Summary of Comments

Atlantic Richfield Company provides a detailed analysis of costs that it projects for both the *Proposed Plan* and its own preferred remedy, and asserts that the EPA cost estimate found in the *Proposed Plan* is inaccurate.

Response

EPA's current cost estimate for the Selected Remedy is found in a separate document titled *Cost Estimate for the U.S. Environmental Protection Agency's Cleanup Plan for the Clark Fork River Operable Unit* (to be released at the same time as this *Record of Decision*). That document was prepared after careful consideration of Atlantic Richfield Company's detailed cost information. Agency assumptions and considerations that form the basis of the current cost estimate are explained in detail in that document. The agencies' disagreements or acceptance of specific Atlantic Richfield Company cost comments on the Selected Remedy are found in that document, and it is incorporated herein by reference.

Atlantic Richfield Company's detailed cost estimate for its own preferred remedy was not examined in detail and is not responded to in this document. Those comments are outside the scope of the comment period for the *Proposed Plan*, and a detailed examination is unnecessary since EPA did not select Atlantic Richfield Company's preferred remedy.

EPA also notes that Atlantic Richfield Company's cost estimates are based on use of criteria and considerations in an early draft version of the CFR RipES document developed for use at this site. Atlantic Richfield Company's remedial design activities, on which it based many of its cost comments and criticism, were largely based on this early draft CFR RipES version. The final draft CFR RipES document will be released at the same time as this *Record of Decision*. It is considerably different than the early version used by Atlantic Richfield Company in the preparation of its comments. Accordingly, many of Atlantic Richfield Company's cost bases and assumptions are inaccurate. This further emphasizes why remedial design must follow the selection of a remedy—not preceed it—as required by the NCP.

65) Page IV.15, paragraphs 4 and 5

Summary of Comments

EPA disregarded the requirement that CERCLA remedies must be cost effective. EPA's *Proposed Plan* remedy contains unnecessary components such as the 50-foot buffer zone, streambank stabilization, and use of CFR RipES, and underestimates the value of in-situ treatment for slickens. EPA overestimates and overstates risks.

Response

EPA believes that all components of the Selected Remedy are necessary and appropriate. Responses to comments regarding bank stabilization and the buffer zone are found in great detail in Section 2.1.2 of this *Responsiveness Summary*, page 3-12. The CFR RipES remedial design tool has been modified since the publication of the *Proposed Plan*. CFR RipES is fully described in Part 2, *Decision Summary*, Section 13.6.1, and a description of CFR RipES development and field use is found in Section 2.1.18, page 3-61. EPA disagrees with Atlantic Richfield Company's assessment of risks at the site as limited to slickens areas, as stated in responses to issues 39, 40, 42, and others in this section, and are further addressed regarding

ecological health risks (Section 2.1.5, page 3-27) and human health risks (Section 2.1.8, page 3-34). EPA's *Record of Decision* contains a detailed analysis of the cost effectiveness requirements for CERCLA remedial actions in Part 2, *Decision Summary,* Sections 10.2.7 and 14.3.

66) Page IV.16, page 16 paragraph 1

Summary of Comments

Atlantic Richfield Company's preferred remedy is fully protective of human health and the environment.

Response

This often repeated assertion is responded to in this section at issues 39, 40, 42, 44, 46, and 54, among others. It is also responded to in Section 2 of this *Responsiveness Summary*, in response to comments about human health risks (Section 2.1.8, page 3-34), and in response to comments about ecological health risks (Section 2.1.5, page 3-27). EPA's Selected Remedy focuses its most aggressive remedial actions towards principal waste areas. Other areas that are addressed in this remedy, such as the impacted areas that are not principal threat waste areas, present unacceptable risk conditions. EPA believes in-situ treatment and a BMP approach to these areas is an appropriate remedy for these non-principal threat wastes. Additional discussion of the protectiveness of the Selected Remedy is found in Part 2, *Decision Summary,* Sections 11.1.13.4, and 13.5.

67) Page IV.16, paragraph 3

Summary of Comments

EPA did not address the NRRB's recommendation to clarify the relationship of risks to remedy components.

Response

First of all, the NRRB and its recommendations, and response of an EPA region to those recommendations, are not regulatory or statutory requirements. They represent an internal EPA process established by guidance and do not give Atlantic Richfield Company or other commenters substantive rights outside of the CERCLA statutory or NCP requirements.

EPA Region 8 did address this concern of the NRRB by further clarifying the contamination and pathways found and the unacceptable risks found at the site in the *Proposed Plan* (see pages 4 through 11 of the *Proposed Plan*). EPA then described the Proposed Remedy in some detail and linked the remedial components to the risks and pathways presented (see the *Proposed Plan* at pages 20 through 25). This demonstrated the relationship of risks to remedy components in response to the Review Board's concern.

A great deal of detail linking the remedy components to site risks is presented in Part 2, *Decision Summary*, Sections 7, 8, 11, and 13.1. Specific detail about the expected outcome or benefits of the Selected Remedy is presented in Part 2, *Decision Summary*, Section 13.4. EPA believes that this detail adequately addresses Atlantic Richfield Company's concern that the remedial action be related to site risks. In summary, the component to remove slickens addresses acute aquatic and obvious terrestrial risks found at the site, as well as potential wildlife risks from contamination. It also addresses human health risks presented by groundwater at the site by removing the worst of the contamination source to the

groundwater. The treatment of areas of impacted soils and vegetation addresses terrestrial and potential wildlife risks found at the site. The streambank stabilization and buffer zone component addresses chronic risk and ARAR compliance issues, the excessive erosion and land loss, and the threat of unraveling from lack of vegetation. There is no duplicative or unnecessary component among those components. The benefits from the Selected Remedy are proportional to the costs estimated for the remedy.

68) Page IV.17, paragraph 3

Summary of Comments

The 50-foot buffer zone of willows is unnecessary and unrelated to risk.

Response

The buffer zone is part of the streambank stabilization component and is essential to address ecological risks at the site. It is not a mass of willows, as Atlantic Richfield Company described, but an area of approximately 50 feet on each side of the river in Reach A and limited portions of Reach B. The 50-foot width can vary depending on site conditions and the width of the floodplain at a given piece of property.

Actions will be taken in this zone to address phytotoxic or poorly vegetated streambanks that are eroding because of a lack of vegetation. This erosion is releasing hazardous substances to the aquatic environment. Actions can range from removal of contaminated soils and revegetation to supplemental vegetation. Woody, deep binding vegetation is emphasized because that is what is necessary to stabilize the stream and prevent stream unravelling or the excessive or fast release of the substantial contamination that will be left within Reach A by the remedy. BMPs, described in detail in this *Record of Decision*, will then be employed, in cooperation with landowners, to protect these actions and ensure that vegetation is established and maintained. It is difficult to understand how these actions are not viewed as linked to the release of hazardous substances or effects from the release of hazardous substances by Atlantic Richfield Company. At the heart of its concern, Atlantic Richfield Company doesn't dispute the linkage but disputes the risks presented by streambank contributions to the environment. These risk disputes are previously addressed in this document.

For additional information regarding the streambank component, see Part 2, *Decision Summary*, Section 13.6.4.

69) Page IV.17, paragraph 4, and page IV.22, paragraphs 1 and 2

Summary of Comments

There is no basis for applying the streambank stabilization component to the entire length of Reach A, and no rationale is presented in the *Proposed Plan* for this decision.

Response

The *Proposed Plan* states that "the sub-alternative developed by EPA and made a part of each of these alternatives (that is, the application of streambank stabilization to the full length of Reach A) was judged to be crucial for addressing overall protection of the environment. It addresses sediment copper loading, erosion risks and exposure pathways. Other streambank protection sub-alternatives (that is, the limited bank length favored by Atlantic Richfield Company) do not fully address these pathways and are not reliable over time."

It is important to note that Atlantic Richfield Company acknowledges in earlier comments that the use of this component will reduce copper loading to the stream considerably (see issue 46, page 3-108, which notes that exceedances will occur 61 percent of the time with Atlantic Richfield Company's plan versus 21 percent of the time with EPA's plan). EPA's risk assessment found low level chronic but unacceptable risk from contaminated sediments, and the *Remedial Investigation* found that the unstable banks provided the greatest contribution of copper to the stream.

It is also important to note that the streambank component of the Selected Remedy will evaluate all of the Reach A streambank, but will not require action on all banks. For banks classified as Class 3 streambanks, the remedial action will be no action or minor action to enhance existing vegetation. See Part 2, *Decision Summary*, Section 13.6, and Appendix B of the *Record of Decision*. Thus, the extreme story that Atlantic Richfield Company attempts to portray in its comments is not accurate or based in fact.

70) Page IV.18, paragraphs 5 and 6

Summary of Comments

EPA has no basis to require education efforts to prevent ingestion of arsenic contaminated soils.

Response

Atlantic Richfield Company's remedial response would leave substantial waste and contamination in place, but opposes even minimal efforts to address the potential risks from children eating dirt. These requirements of the Selected Remedy are based on concern found in both the *Human Health Risk Assessment* and in various ATSDR health evaluations for risks to children if excessive dirt is eaten by them. A condition in children known as the pica child is rare, but can occur, and when it does, children eat excessive amounts of dirt when playing outside. EPA believes that a simple educational effort, done in conjunction with Powell County health authorities, will address this potential pathway and risk. The risks posed to a pica child are not within the normal risk range at Arrowstone Park, and EPA and ATSDR's 2001 Human Health Risk Addendum specifically notes this.

71) Page IV.19, paragraph 2

Summary of Comments

EPA's prior Deer Lodge Valley TCRA addressed all human health risks, and nothing further is needed for protection of human health.

Response

Atlantic Richfield Company incorrectly states that it did remediation work under the Deer Lodge Valley TCRA—it did response work under EPA's removal authority. Remediation work cannot occur until a remedial record of decision is issued by EPA. Atlantic Richfield Company also incorrectly states the Deer Lodge Valley TCRA work cleaned up all known yards and fields that exceeded risk based criteria. Atlantic Richfield Company did do work under the Deer Lodge Valley TCRA, but not all residences identified as exceeding the acceptable human health level for arsenic in soils were addressed, primarily because of lack of voluntary landowner participation. These sites remain to be addressed and the requirement to do so, as well as to provide for any follow-up operation and maintenance, is contained in the *Record of Decision*.

Additionally, the EPA *Human Health Risk Assessment* generally states that human health risks throughout the OU are within normally acceptable ranges, the remedial investigation did not sample each residential, agricultural, or recreational area along Reach A to verify that assumption. The *Human Health Risk Assessment* and its addendum did calculate RBCs that would be acceptable under EPA's risk range, and did that at the lower end of the range. The Selected Remedy requires the assumption that use areas are below the RBCs to be confirmed where it has not already been confirmed, and that is entirely consistent with EPA's *Human Health Risk Assessments* and EPA's direction from Congress to ensure that human health is protected.

Finally, the *Remedial Investigation* did note that four domestic wells sampled were above the current protective level for domestic consumption of 10 µg/L for arsenic. It is appropriate for EPA to require limited ICs and conduct well surveys and monitoring activities to ensure that this pathway and risk is known and addressed, and that ICs to prevent domestic groundwater wells within the floodplain are clearly and enforceably implemented.

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72) Page IV.19, paragraphs 3, 4, and 5, and page IV.20, paragraphs 1, 2, and 3, and page IV.23, paragraph 2

Summary of Comments

The *Proposed Plan* is not the appropriate place to state that funding for ICs must come from PRPs like Atlantic Richfield Company.

Response

Sections 104 and 121 of CERCLA, cited by Atlantic Richfield Company, do not state that remedial actions must be paid for by PRPs, but sections 106 and 107 of CERCLA do.

The *Proposed Plan* normally does not address where funding for a remedy component will come from. In this case, however, EPA added the statements that IC funding will come from the PRP to address local government concerns that the remedy will impose additional financial burdens on them. Atlantic Richfield Company's own comment notes that an existing Memorandum of Understanding with Powell County allows Atlantic Richfield Company to fund the types of ICs described in the *Proposed Plan* and the *Record of Decision*. Given that, the statements about IC funding are appropriate.

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73) Page IV.21, paragraphs 2 and 3

Summary of Comments

Existing State law, which bans domestic wells in the upper 25 feet in a floodway—see ARM § 36.15.602; and which bars any groundwater well unless it is not connected to surface water—see MCA § 85-2-337, are sufficient to protect human health and groundwater threats, and additional ICs or payment mechanisms are not necessary.

Response

EPA is willing to evaluate the effectiveness of these laws during remedial design to determine if they are adequate and if enforcement of these laws within Reach A occurs. The Selected Remedy does not automatically require new provisions beyond these—only the evaluations of these laws under current conditions.

74) Page IV.21 paragraph 4, and page IV.22, paragraphs 3 and 4, and page IV.23 in its entirety, and page IV.24, paragraph 1

Summary of Comments

EPA's proposed BMPs are overly intrusive, not cost effective, and should not be applied to the entire length of Reach A but only in selected areas. EPA is adopting a unilateral approach rather than a cooperative approach through existing programs.

Response

EPA notes that in Atlantic Richfield Company's preferred remedy description, it describes the need for BMPs as part of the remedy, and explains that these BMPs, which it favors, are intended to enhance land management, restrict grazing until vegetation is established, provide for off site watering, and provide for fencing and grazing rotation. This description of BMPs is not significantly different from the BMPs described in EPA's *Proposed Plan* and this *Record of Decision*. The BMPs that the *Record of Decision* describes will be applied in cooperation with landowners, and will serve the same function that Atlantic Richfield Company describes as necessary in its comments. EPA does not see a significant disagreement.

Atlantic Richfield Company also proposes that BMPs run the entire length of the river (see page 2 of Atlantic Richfield Company's comment package), similar to EPA's proposal. Again, the rhetoric of this comment by Atlantic Richfield Company doesn't match any actual disagreement. EPA believes that the BMPs described in the *Record of Decision* are necessary to protect the remedy and are within EPA's broad remedial authority under CERCLA.

Finally, both EPA and Atlantic Richfield Company are looking towards existing Department of Agriculture programs, such as EQIP or CRP, to form a basis and structure for the BMP program. Again, the rhetoric of Atlantic Richfield Company's comment does not correspond to any real disagreement. If these programs can be used effectively and enforcement mechanisms can be clearly defined, EPA also believes in working with them—that is why we specifically described such cooperation in our *Proposed Plan*. We look forward to working together with Atlantic Richfield Company and landowners on this issue following issuance of this *Record of Decision*.

75) Page IV.24, paragraph 2

Summary of Comments

Atlantic Richfield Company has already provided for funding of the maintenance of Arrowstone Park.

Response

If Atlantic Richfield Company's existing Memorandum of Understanding with Powell County, which was not provided to EPA, fulfills the *Record of Decision* requirements for deed restrictions and funding of the Park, then this requirement of the *Record of Decision* may have been met by Atlantic Richfield Company already, and can simply be documented in the site record. If not, additional measures will have to be taken.

76) Page IV.24, paragraphs 3 and 4, and page IV.25, paragraphs 1 through 5

Summary of Comments

The *Proposed Plan's* comments regarding natural resource damages are not accurate and are inappropriate; EPA should not have given the trustees access to the risk assessment for a year and a half, and additional natural resource damage requirements will burden landowners. Atlantic Richfield Company states its defense to natural resource damages under section 107(f)(1) of CERCLA and contends it applies to this site.

Response

The *Proposed Plan* language regarding the distinction between remediation and restoration simply recognizes ongoing efforts by State and Federal trustees to further assess injury and restoration actions to achieve baseline conditions. EPA takes no position on whether baseline conditions are or are not achieved at the site, since it is not a natural resource damage trustee and does not have expertise in this area. EPA also takes no position on the asserted defense to natural resource damages for the same reason, although other Federal agencies disagree with Atlantic Richfield Company's assertions here. Atlantic Richfield Company can more appropriately make this argument directly to natural resource damage trustees, where trustees can address these arguments as appropriate.

EPA's coordination of the ecological risk assessment with trustees was in accordance with section 104(b)(2) of CERCLA and NCP provisions at 40 CFR § 300.170. It was fully in compliance with the law.

77) Page IV.25, paragraph 6, and page IV.26, paragraphs 1 through 3

Summary of Comments

EPA ignores property rights in its description of the *Proposed Plan* and does not need access to property because the Proposed Remedy is not necessary in Atlantic Richfield Company's view.

Response

EPA fully appreciates that much of the Selected Remedy will be implemented on private property. The *Record of Decision* emphasizes the need for careful cooperation and dialogue between the remedy implementor and the landowner. The *Record of Decision* also emphasizes the need for reasonable and appropriate compensation to obtain access for the remedial action, especially for lost land use and BMP implementation. EPA will ensure that this happens as well.

78) Page IV.26, paragraph 3

Summary of Comments

Water rights will be difficult to obtain.

Response

EPA believes that irrigation water can be obtained through normal irrigation well permitting under existing State law. EPA also notes that Atlantic Richfield Company has obtained significant water rights in the basin that could be used for this project if that is determined to be necessary. EPA will work with Atlantic Richfield Company and the State DNRC to ensure that the water rights aspects of this remedy, if any, proceed in an orderly, efficient, and lawful way.

79) Page IV.26 paragraph 4, and page IV.27, paragraph 1

Summary of Comments

The risks at the site do not justify the remedy provisions.

Response

See EPA's response to issue 65, page 3-121. EPA's Risk Assessments and other documents, such as the USGS studies and recommendations, document widespread environmental terrestrial, aquatic, and stream stability risks, as clearly described in Part 2, *Decision Summary*, Section 7. The Selected Remedy components are related to mitigation of these risks and pathways, as described in various place in the *Record of Decision*.

80) Page IV.27, paragraph 2

Summary of Comments

There are not human health risks at the site, as EPA states on page 7 of the *Proposed Plan*.

Response

Atlantic Richfield Company quotes only one part of one sentence from a long section of the *Proposed Plan* that discusses human health risks. See EPA's response to issue 65, page 3-121, for a complete discussion of EPA's views on human health risks and the remedy components in the Selected Remedy that address those risks.

81) Page IV.27, paragraph 2, through page IV.29, paragraph 2

Summary of Comments

Atlantic Richfield Company disagrees that there is any unacceptable risk to the aquatic environment at the Clark Fork River OU.

Response

EPA responded to Atlantic Richfield Company's criticisms and comments on the *Ecological Risk Assessment* in a lengthy document dated May 15, 2001, which is incorporated herein by reference. EPA stands by the findings of the risk assessment and by the finding of unacceptable risk described in the *Proposed Plan* and this *Record of Decision*, which includes aquatic risk. Both acute and chronic risks are documented and discussion is provided in Part 2, *Decision Summary*, Sections 13.5.1 and 13.5.2.

Atlantic Richfield Company sent a letter after the May 15, 2001, response to comments that emphasized the lack of actual measurements of storm water events, which were emphasized in EPA's *Ecological Risk Assessment*. EPA notes that there is no formal monitoring program established to monitor and record these events—just because they are not recorded does not mean they do not happen. Runoff waters from natural precipitation events were evaluated as part of the monitoring at the Governor's Demonstration. In a 20-month period, 15 runoff events were recorded from an untreated micro-watershed area along the Clark Fork River. Maximum concentrations in runoff water from barren slickens were reported to be 7,380 mg/L copper, 2,350 mg/L zinc, and 23 mg/L arsenic (Atlantic Richfield Company 1997). The pH of runoff water from these events ranged from 3.9 to 4.7. Section 13.5.1 of Part 2, *Decision Summary*, provides additional discussion of the causative factor in fish mortality due to a storm event that occurred in 1989. Recent data from the nearby Anaconda Regional Water, Waste, and Soils OU (CDM/FPC 2001) from surface water sampling and subsequent analysis during storm events in the summer of 2001 revealed elevated concentrations of metal and arsenic in storm water runoff.

Atlantic Richfield Company also criticizes as misleading the use in the *Proposed Plan* of a photograph that shows colored water runoff during a storm event at the Clark Fork with a paragraph below it that states that such water contributes high levels of dissolved copper to the river that are harmful to aquatic life. The data results described above and in Section 2.1.5.4 of this *Responsiveness Summary* (page 3-28) demonstrate that runoff water during storm events in this area do contain high levels of dissolved contaminants, and a great deal of research, described in EPA's *Ecological Risk Assessment*, documents that such high levels are harmful to aquatic life. There is nothing misleading about the photograph or the paragraph in question—only hard visual demonstrative evidence that Atlantic Richfield Company refuses to acknowledge.

Atlantic Richfield Company also cites recent studies that show no impairment to aquatic receptors in the Clark Fork River. EPA has examined this data and believes that the ecological risk findings contained in the *Ecological Risk Assessment* and the *Proposed Plan* and *Record of Decision* are consistent with this data. See a more detailed explanation of this in EPA's July 2003 memorandum, *Response to Comments and Other Information Received during the Public Comment Period for the Clark Fork River OU Proposed Plan*.

See also the response in Section 3.2 to issues 8 and 9 (pages 3-86 to 3-87).

82) Page IV.28

Summary of Comments

Atlantic Richfield Company indicates they do not believe that "pulse events" are likely, and, if they occur at all, they do not present an unacceptable risk to aquatic receptors. This is a comment that Atlantic Richfield Company made previously in great detail in its review comments regarding EPA's Public Review Draft of the Clark Fork River *Ecological Risk Assessment* (December 1999).

Response

EPA previously provided a detailed point-by-point response on this issue in the document titled *USEPA Response to Comments from AERL on the Clark Fork River Ecological Risk Assessment, May 2001*. That document was transmitted to Barry Duff, Atlantic Richfield Company Project Manager, on May 15, 2001. The response is found on pages 20 through 29 of that document, and is hereby referenced for this *Responsiveness Summary*.

83) Page IV.29

Summary of Comments

Atlantic Richfield Company indicates that EPA has not shown that there are unacceptable risks to terrestrial receptors other than vegetation in slickens areas and that EPA inappropriately continues to rely on screening level values in its determination of risks to terrestrial receptors.

Response

EPA's *Ecological Risk Assessment*, October 2001, states on pages 12 through 15 that, "there is good evidence that soil organisms (worms, microbes) are adversely impacted by soils from slickens areas." It also states that, "the hazard to some terrestrial animals is predicted to be quite high. However, direct observations to support this prediction are lacking, so the actual level of risk to terrestrial receptors from metal exposures is subject to uncertainty." The *Proposed Plan* recognized these limitations by stating that there was considerable uncertainty

associated with this potential risk. The impacts to vegetation continue to be the main concern regarding terrestrial risks.

The remedy as outlined in the *Record of Decision* will address those areas where actual impacts on vegetation are apparent, as measured by objective standards defined in CFR RipES. While slickens are the areas most severely affected, the impacts to vegetation are not limited to slickens areas. Atlantic Richfield Company's suggestions that EPA should not address the areas with impacted vegetation ignores not only this terrestrial risk, but the groundwater and aquatic risks as well. An important objective of the cleanup is to establish a healthy vegetative community throughout the floodplain to protect the river from unraveling during a high flow event and to limit excessive erosion that would contribute metals and arsenic to the river.

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84) Page IV.29

Summary of Comments

Atlantic Richfield Company indicates that reduced fish populations in the Clark Fork River are attributable to habitat and other factors and not to the influence of metals.

Response

EPA responded to this detailed comment on pages 38 through 44 of its May 15, 2001, response to AERL comments. That response is hereby incorporated by reference.

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85) Page IV.30

Summary of Comments

Atlantic Richfield Company indicates there is no established risk to Clark Fork River benthic macroinvertabrates.

Response

EPA responded to this detailed comment on pages 29 through 38 of its May 15, 2001, response to AERL comments. That response is hereby incorporated by reference.

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86) Page IV.30, paragraphs 3 and 4, and page IV.31, paragraphs 1 through 3

Summary of Comments

The findings by USGS consultant Dr. Jim Smith are not supportable and should not be used by EPA in the remedy decision making process.

Response

See response to issues 1, 4, and 5 in Section 3.2, *Summary of Comments and Responses* (pages 3-82 to 3-86).

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87) Page IV.31, paragraph 5, through page IV.32, paragraph 4

Summary of Comments

The streambank component of the remedy is not necessary to protect the environment.

Response

See EPA's response to comments in Section 2.1.6 of this *Responsiveness Summary* (page 3-30), and the response to issues 1, 4, and 5 in Section 3.2, *Summary of Comments and Responses* (pages 3-82 to 3-86).

88) Page IV.32, paragraph 6, and page IV.33, paragraph 1

Summary of Comments
The estimated length of stream in Reach A of 56 miles is incorrect and inconsistent with the FS estimated length.

Response
See response to issue 27 in Section 3.2, *Summary of Comments and Responses* (page 3-96).

89) Page IV.33, paragraph 2

Summary of Comments
The cost estimate should not assume that active streambank stabilization will be needed in all portions of Reach A.

Response
EPA's Selected Remedy defines more accurately where certain types of streambank stabilization will be employed and where active stabilization is not necessary. The cost estimate appropriately takes these considerations into account in estimating the cost of streambank work.

90) Page IV.33 paragraph 3

Summary of Comments
Channel reconstruction should not be used in the *Proposed Plan*.

Response
EPA agrees. See response to issue 22 in Section 3.2, *Summary of Comments and Responses* (page 3-93).

91) Page IV.33, paragraphs 5, and page IV.34, paragraphs 1 and 2

Summary of Comments
Removal of slickens and the areas of impacted soils that are too deep or too wet is not necessary.

Response
EPA disagrees. EPA's July 2003 memorandum provides a detailed explanation of the reasons why EPA selected removal for the slickens areas, and that response is incorporated herein by reference. EPA explains the basis for the too wet and too deep exceptions for in-situ treatment of impacted soils and vegetation in issue 29 in Section 3.2, *Summary of Comments and Responses* (page 3-101). EPA's experience with in-situ treatment at nearby sites like Anaconda indicate that reliable and permanent in-situ treatment can be done only under certain conditions, and the too wet and too deep conditions described in the *Record of Decision* do not meet those conditions.

92) Page IV.34, paragraph 3

Summary of Comments
EPA should allow soil cover and revegetation for areas designated for removal, consistent with the NCP.

Response

The NCP establishes an expectation that EPA will use treatment to address principal threats posed by a site wherever practicable (NCP § 300.430(a)(1)(iii)(A)). A source material is one that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or air, or acts as a source for direct exposure.

Arsenic in tailings, mixed tailings, and soils has been determined to be the principal threat to human health within the Clark Fork River OU. For mobile waste in floodplains associated with acute risks, such as the exposed tailings and phytotoxic streambanks, removal and permanent disposal outside of the floodplain is required.

Placement of cover soil over exposed tailings was considered in the *Feasibility Study* (Atlantic Richfield Company 2000) as an option in Alternative 2 (see Section 5.3.1.2.2.2 and Figure 5.3 of the *Feasibility Study* document). In the comparative analysis of alternatives, Alternative 2 was considered to be only moderately protective of human and environmental health, and would have a low to moderate achievement of compliance with ARARs (see Table 6.1 of the *Feasibility Study*).

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93) Page IV.34, paragraph 4

Summary of Comments

EPA's statements about the area of impacted soils and vegetation being 700 acres are not accurate.

Response

EPA agrees that the areas could be smaller or larger and exact estimates are not known at this time. EPA has indicated in Part 2, *Decision Summary,* Section 5.5, the range of acreage totals for this category.

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94) Page IV.35, paragraph 3, Appendix 2, and Tab 2

Summary of Comments

Atlantic Richfield Company criticizes EPA's riparian evaluation system as unreliable and biased.

Response

Atlantic Richfield Company invested a great deal of time and money criticizing an early and preliminary draft version of CFR RipES. The version of CFR RipES that will be released with the *Record of Decision* has been changed considerably from that version, after consideration of Atlantic Richfield Company's comments on CFR RipES and other technical information. For example, the number of questions, the weighting associated with each question, and the actual questions themselves have changed dramatically from the December 2000 draft. The current version of CFR RipES included three more years of field testing and field validation. EPA has found the current version to be reliable and accurate. EPA will release the CFR RipES version in final draft form and seek input from landowners and other stakeholders. If comments are received that indicate further refinement is necessary, EPA will make changes to the document. See also EPA's response to comments at Section 2.1.18 of this *Responsiveness Summary* (page 3-61).

95) Page IV.35, paragraph 4 and Tab 6

Summary of Comments

EPA's description of streambank stabilization techniques in the *Proposed Plan* is unclear.

Response

The *Record of Decision* contains a much more detailed description of the streambank stabilization component. See Appendix B to the *Record of Decision* for this detail and for the basis for these designs. See also EPA response to comments at Section 2.1.6 of this *Responsiveness Summary* (page 3-30).

96) Page IV.35, paragraph 5

Summary of Comments

EPA's *Human Health Risk Assessment* and Atlantic Richfield Company's prior work under the Deer Lodge Valley TCRA indicate that further human health remedial requirements are unnecessary.

Response

See EPA's response to issue 26 in Section 3.2, *Summary of Comments and Responses* (page 3-95), and issue 80 in this section (page 3-128). EPA has actively addressed human health risks resulting from arsenic exposure in residential areas near Deer Lodge, including playgrounds and parks, and residential areas along the East Side Road. This *Record of Decision* specifies that any similar exposures would also have to be addressed to ensure that human health is protected. This *Record of Decision* also specifically identifies that ICs, such as limiting residential use of the floodplain and potable water wells in the floodplain, will be implemented to ensure public health protection. Seven specific actions to reduce risks to human health are presented in Part 2, *Decision Summary*, Section 13.4. Some residences are identified under the Deer Lodge Valley Historically Irrigated Lands TCRA as exceeding the action level for arsenic in residential areas and were not addressed under the TCRA. These areas will be revisited and remediated consistent with that action. Other follow-up operation and maintenance activities from this action will be implemented.

EPA does not believe that other historically irrigated lands within the Clark Fork River OU exceed EPA's action level for reasonably anticipated land use for those lands. This shall be confirmed via sampling of these lands if necessary and confirmation that residential development is not planned for these areas. Confirmation sampling for in-situ treated areas is also required to ensure that these areas are below action levels for current and reasonably anticipated uses (which is likely to be agricultural for most lands) after treatment.

97) Page IV.35, paragraph 6, and page IV.36, paragraph 1

Summary of Comments

EPA's sequencing of actions that prioritize work on the Class I streambanks will produce hopscotching and inefficient work.

Response

EPA recognizes the need to work with landowners and attempt to complete work on a given landowner's property in one or two field seasons. These concepts and this flexibility are recognized in the *Record of Decision* and can be further refined in remedial design.

98) Pages IV.36 and IV.37

Summary of Comments

Atlantic Richfield Company restates certain landowner concerns regarding in-situ treatment for slickens areas, weed control, and safety issues.

Response

These issues were responded to in this *Responsiveness Summary*, Section 2, *Stakeholder Issues and Lead Agency Responses*. EPA believes it has been responsive to landowner concerns, as indicated in the changes to the *Proposed Plan* found in this *Record of Decision*, which are described in Part 2, *Decision Summary*, Section 15.

99) Page IV.39, Appendix A

Summary of Comments

The listed documents were not included in the Administrative Record.

Response

EPA has included most of the listed documents in the Administrative Record. Records that pertain to the Warm Springs Ponds OUs and the Butte Priority Soils OUs were not included because they did not pertain to the Clark Fork River remedy selection and were not relied on by EPA in making its Clark Fork River OU decision. Atlantic Richfield Company's document entitled *AERL's response to the July 5, 2001, Remedy Review Board Recommendations for the Clark Fork River OU, November 1, 2002,* was not included in the Administrative Record because under EPA guidance, Atlantic Richfield Company had no role in responding to the NRRB's comments—this is a function reserved to EPA Region 8 since the remedy review board is an internal deliberative process set up by EPA guidance.

The comments found in these many documents are included in the administrative record, and those that pertain to the selection of the remedial action and the *Proposed Plan* have been responded to either in separate detailed responses from EPA (as is the case for the comments on the *Ecological* and *Human Health Risk Assessments*) or in the prior responses to stakeholder or Atlantic Richfield Company comments above. The only exception to this statement is the detailed ARAR comments submitted by Atlantic Richfield Company and included in the administrative record. These comments are identical to comments Atlantic Richfield Company has submitted on other nearby Clark Fork Basin superfund sites. EPA incorporates its detailed response to these comments found in the responsiveness summary sections of the Streamside Tailings operable unit (EPA 1996) and the Anaconda Regional Water, Waste and Soils operable unit (EPA 1998).

100) Tab 3

Summary of Comments

Atlantic Richfield Company criticizes the selection of removal for slickens and certain impacted soils and vegetation areas because it does not produce environmental benefits.

Response

EPA has given a detailed rationale for its decision to remove slickens and certain impacted soils and vegetation areas in its July 2002 memorandum and attachments and in numerous responses to comments above. The technical memorandum found at Tab 3 does not add anything new to Atlantic Richfield Company's many prior comments on this topic.

101) Tab 5

Summary of Comments

Atlantic Richfield Company presents a basis for waiving State floodplain and solid waste standards based on the equivalent level of performance waiver provision of CERCLA and the NCP.

Response

See response to issues 48 and 49, pages 3-109 to 3-110. EPA believes that the technical impracticability waiver is the appropriate waiver for active management of waste in the floodplain and the State ARARs which apply to that action. Atlantic Richfield Company's Tab 5 document also makes a claim for waivers or variances for engineering related solid waste requirements relating to landfill requirements such as liners. EPA does not believe a waiver of these requirements for in-situ treated areas is needed, since the liner requirements do not become applicable for in-situ treatment methods described in the *Record of Decision*.

102) Tab 6

Summary of Comments

Atlantic Richfield Company submitted a remedial design for EPA consideration.

Response

As noted in Section 3.1, *Introduction*, of this *Responsiveness Summary*, remedial design occurs after selection of the remedial action and release of the *Record of Decision*. Atlantic Richfield Company's submittal of a remedial design for a portion of the Clark Fork River OU is therefore premature and outside the scope of the comment period on the *Proposed Plan*, as described in CERCLA and the NCP. Substantial detail and adjustments to the proposed action described in the *Proposed Plan* have been made in the *Record of Decision*. Additionally, Atlantic Richfield Company used an early draft version of CFR RipES in completing this design and that document has been substantially revised, and may be further revised, before remedial design can occur.

Accordingly, EPA has not examined the preliminary design in depth and does not respond to it in this *Responsiveness Summary*. We are hopeful that the substantial work and expense that Atlantic Richfield Company directed to this effort will be useful in the future as we move towards remedy implementation.

To the extent this design work factored into Atlantic Richfield Company's criticisms and comments on EPA's cost estimate, EPA revised and detailed Cost Estimate for the EPA's Cleanup Plan for the Clark Fork River OU contains EPA's response to those comments and criticisms and provides a detailed basis for EPA's current cost estimate.

103) Tab 7

Summary of Comments

Atlantic Richfield Company proposed a detailed revision to the ongoing Clark Fork River monitoring activities conducted by USGS for EPA.

Response

Similar to Tab 6 discussed in issue 102 above, Atlantic Richfield Company's detailed monitoring plans are more appropriately developed and discussed after the selection of the

remedial action for the Clark Fork River OU. Accordingly, this *Responsiveness Summary* does not contain a detailed response to Atlantic Richfield Company's proposals. During remedial design, EPA will work with Atlantic Richfield Company and other stakeholders to determine the more exact monitoring plans that are needed during remedy implementation and afterwards. Until then, EPA intends to keep the existing monitoring program in place.

4 Stakeholder and PRP Categorized Comments

All of the comments provided by stakeholders and the Executive Summary of the PRP's comments are contained on the attached CD-ROM. To use this CD, insert it in the CD-ROM drive of your computer. The CD should auto-launch in Adobe Acrobat Reader as a PDF file. If CD does not auto-launch, click on "Start," and select "Run" in Windows. Type "D:/start.pdf," where "D" is your CD-ROM drive. This will open a home page from which to choose comment documents to review.

For stakeholder comments, the files are grouped into the following commenter types:

- **ATSDR:** Agency for Toxic Substances and Disease Registry
- **CFB Residents:** Clark Fork Basin Residents—anyone in Butte, Anaconda, Deer Lodge, Garrison, Missoula, Drummond, Clinton, Milltown, and the smaller communities
- **Group:** Citizen Groups and Organizations
- **Local Government:** City and County Officials, Conservation District Board
- **Meeting:** Oral comments provided to EPA at meeting or hearing
- **Natural Resources Trustees:** Federal, Tribal, and State Trustees
- **No Address:** People who did not supply an address
- **Others:** All Other Individuals
- **PRP:** Potentially Responsible Party

Upon opening the file, a table of contents is provided with the letter identification number and the commenter's name. For each letter, the original comment document appears on the left-hand side of the page. This document is marked with lines and numbers for where each comment within the document begins and ends. To the right, the number associated with each comment is listed, and the category and subcategory is identified. To see a response to a particular comment, refer to the specific category and subcategory in Section 2 of this *Responsiveness Summary*.

For the PRP, the comments were not categorized, but rather were responded to comment-by-comment in Section 3*, PRP Issues and Lead Agency Responses*.

If you do not have access to a computer, you may request a paper copy of your comments. To request this, please contact:

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If you desire a paper copy of all of the comments, a copying fee will be charged.