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Clark Fork River Operable Unit

of the Milltown Reservoir/Clark Fork River Superfund Site

Record of Decision

Appendix A:

Identification and Description of Applicable or Relevant and Appropriate Requirements

U.S. Environmental Protection Agency
Region 8

10 West 15th Street
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April 2004

List of Acronyms

ARAR	Applicable or Relevant and Appropriate Requirements
ATSDR	Agency for Toxic Substances and Disease Registry
BAT	Best Available Technology Economically Achievable
BCT	Best Conventional Pollutant Control Technology
BPCTCA	Best Practicable Control Technology Currently Available
BPJ	Best Professional Judgment
BTCA	Best Technology Currently Available
CCC	Criterion Continuous Concentration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended
CFROU	Clark Fork River Operable Unit
CMC	Criteria Maximum Concentration
DEQ	State of Montana Department of Environmental Quality
EPA	U.S. Environmental Protection Agency
GRKO	Grant-Kohrs Ranch National Historic Site
HWM	Hazardous Waste Management
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MGWPCS	Montana Groundwater Pollution Control System
MPDES	Montana Pollutant Discharge Elimination System
NCP	National Contingency Plan, as amended
NESHAPS	National Emissions Standards for Hazardous Air Pollutants
NPL	National Priorities List
NPDES	National Pollutant Discharge Elimination System
POTW	Public Owned Treatment Works
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
RD/RA	Remedial Design and Remedial Action
ROD	Record of Decision
SHPO	State Historic Preservation Officer (Montana)
SIP	State Implementation Plan
TBC	To Be Considered
TU	Turbidity Unit
UIC	Underground Injection Control
WQB-7	Circular WQB-7, Montana Numeric Water Quality Standards

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Introduction

Section 121(d) of CERCLA, 42 U.S.C. § 9621(d), certain provisions of the current National Contingency Plan (the NCP), 40 CFR Part 300, and guidance and policy issued by the Environmental Protection Agency (EPA) require that remedial actions taken pursuant to Superfund authority shall require or achieve compliance with substantive provisions of applicable or relevant and appropriate standards, requirements, criteria, or limitations from state environmental and facility siting laws, and from federal environmental laws, at the completion of the remedial action, during the implementation of the remedial action, or both, depending on the nature of the requirements, unless a waiver is granted[1]. If contaminant or location specific ARARs are not being met before the commencement of a remedial action, it is not necessary to invoke a waiver to justify their non-attainment during the action although they must be obtained (or appropriately waived) for remedial action to be complete and the remedy to be successful[2]. These requirements are threshold standards that any selected remedy must meet, unless adequate basis for a waiver is present. See Section 121(d)(4) of CERCLA, 42 U.S.C. § 9621(d)(4); 40 CFR § 300.430(f)(1). EPA calls standards, requirements, criteria, or limitations identified pursuant to section 121(d) "ARARs," or applicable or relevant and appropriate requirements.

ARARs are either applicable or relevant and appropriate. Applicable requirements are those standards, requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, or contaminant, remedial action, location, or other circumstance found at a CERCLA site. 40 CFR § 300.5. Relevant and appropriate requirements are those standards, requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to hazardous substances, pollutants, contaminants, remedial actions, locations, or other circumstances found at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site such that their use is well suited to the particular site. Id. Factors which may be considered in making this determination are presented in 40 CFR 300.400(g)(2). Compliance with both applicable and relevant and appropriate requirements is mandatory, unless compliance is waived. 42 U.S.C. § 121(d)(4); 40 CFR 300.430(f)(1)(ii)(B).

Each ARAR or group of related ARARs identified here is followed by a specific statutory or regulatory citation, a classification describing whether the ARAR is applicable or relevant and appropriate, and a description which summarizes the requirements and addresses how and when compliance with the ARAR will be measured (some ARARs will govern the conduct of the remedial action, some will define the measure of success of the remedial action, and some will do both)[3]. The descriptions given here are provided to allow the user

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[1] See 55 Fed.Reg. 8666, 8755 (March 8, 1990)

[2] EPA CERCLA Compliance with Other Laws Manual 1-8 (OSWER 9234.1-01, August 1988)

[3] 40 CFR § 300.435(b)(2); Preamble to the Proposed NCP, 53 Fed.Reg. 51440 (December 21, 1988); Preamble to the Final NCP, 55 Fed.Reg. 8755-8757 (March 8, 1990)

a reasonable understanding of the requirements without having to refer constantly to the statute or regulation itself. However in the event of any inconsistency between the law or regulations and the summary provided in this document, the applicable or relevant and appropriate requirement is ultimately the requirement as set out in the law or regulation, rather than any paraphrase of the law provided here.

Also contained in this list are policies, guidance or other sources of information which are "to be considered" in the implementation of the Record of Decision (ROD). Although not enforceable requirements, these documents are important sources of information which EPA and the State of Montana Department of Environmental Quality (DEQ) may consider during implementation of the remedy, especially in regard to the evaluation of the remedy's success in addressing public health and environmental risks.

Finally, this list contains a non-exhaustive list of other legal provisions or requirements which should be complied with during the implementation of the ROD[4].

ARARs are divided into contaminant specific, location specific, and action specific requirements, as described in the NCP and EPA guidance. For contaminant specific ARARs, ARARs are listed according to the appropriate media.

Contaminant specific ARARs include those laws and regulations governing the release to the environment of materials possessing certain chemical or physical characteristics or containing specific chemical compounds. Contaminant specific ARARs generally set health or risk based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment. Location specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of cleanup activities because they are in specific locations. Location specific ARARs relate to the geographic or physical position of the site, rather than to the nature of site contaminants. Action specific ARARs are usually technology or activity based requirements or limitations on actions taken with respect to hazardous substances.

Only the substantive portions of the requirements are ARARs[5]. Administrative requirements are not ARARs and thus do not apply to actions conducted entirely on-site. Administrative requirements are those which involve consultation, issuance of permits, documentation, reporting, record keeping, and enforcement. The CERCLA program has its own set of administrative procedures which assure proper implementation of CERCLA. The application of additional or conflicting administrative requirements could result in delay or confusion[6]1-12. Provision of statutes or regulations which contain general goals that merely express legislative intent about desired outcomes or conditions but are non-binding are not ARARs.[7]

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4 40 CFR § 300.400(g)(3); 40 CFR § 300.515(h)(2); Preamble to the Final NCP, 55 Fed.Reg. 8744-8746 (March 8, 1990)

5 40 CFR § 300.5. See also Preamble to the Final NCP, 55 Fed.Reg. 8756-8757 (March 8, 1990)

6 Preamble to the Final NCP, 55 Fed.Reg. 8756-8757 (March 8, 1990); Compliance with Other Laws Manual, Vol.1, pp. 1-11

7 Preamble to the Final NCP, 55 Fed.Reg. 8746 (March 8, 1990)

Many requirements listed here are promulgated as identical or nearly identical requirements in both federal and state law, usually pursuant to delegated environmental programs administered by both EPA and the states, such as many of the requirements of the federal Clean Water Act and the Montana Water Quality Act. The Preamble to the final NCP states that such a situation results in citation to the state provision as the appropriate standard, but treatment of the provisions as a federal requirement. ARARs and other laws which are unique to state law are identified separately by the State of Montana.

This list constitutes EPA's and DEQ's detailed description of ARARs for use in the implementation of the Milltown Reservoir/Clark Fork River Superfund Site, Clark Fork River operable unit, and resulting remedial design and remedial action decisions. The determination of the applicability of ARAR waivers to certain previously identified ARARs is also included here. ARARs waivers can be invoked after the ROD is issued if necessary and appropriate, and these waivers will be documented separately.

The ARAR analysis is based on section 121(d) of CERCLA, 42 U.S.C. § 9621(d); CERCLA Compliance with Other Laws Manual, Volumes I and II; OSWER Directives 9234.1-01 and -02 (August 1988 and August 1989 respectively; various CERCLA ARARs Fact Sheets issued as OSWER Directives; the Preamble to the Proposed NCP, 53 Fed. Reg. 51394 et seq. (December 21, 1988); the Preamble to the Final NCP, 55 Fed. Reg. 8666-8813 (March 8, 1990); and the NCP, 40 CFR Part 300; other applicable guidances; and the substantive provisions of law discussed in this document.

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Federal ARARs

I. Federal Contaminant Specific Requirements

A. Groundwater Standards—Safe Drinking Water Act (Relevant and Appropriate) [1]

The National Primary Drinking Water Standards (40 CFR Part 141), better known as maximum contaminant levels and maximum contaminant level goals (MCLs and MCLGs), are not applicable to the Clark Fork River Operable Unit (CFROU) because the aquifer underlying the area is not a current public water system, as defined in the Safe Drinking Water Act, 42 U.S.C. § 300f(4). These standards are relevant and appropriate standards, however, because the groundwater in the alluvial aquifer is a potential source of drinking water. Some domestic use of ground water occurs in the CFROU at various depths, and there are not specific laws or regulations which prevent the use of the CFROU aquifers. In addition, the aquifer discharges to the Clark Fork River which is designated as a potential source of drinking water. Since the Clark Fork River is also a potential source of drinking water, these standards are relevant and appropriate for that surface water as well.

Use of these standards for this action is fully supported by EPA regulations and guidance. The Preamble to the NCP clearly states that MCLs are relevant and appropriate for groundwater that is a current or potential source of drinking water (55 Fed.Reg. 8750, March 8, 1990), and this determination is further supported by requirements in the regulations governing conduct of the RI/FS studies found at 40 CFR § 300.430(e)(2)(i)(B). EPA's guidance on Remedial Action for Contaminated Groundwater at Superfund Sites states that "MCLs developed under the Safe Drinking Water Act generally are ARARs for current or potential drinking water sources." MCLGs which are above zero are relevant and appropriate under the same conditions (55 Fed.Reg. 8750-8752, March 8, 1990). See also, State of Ohio v. EPA, 997 F.2d 1520 (D.C. Cir. 1993), which upholds EPA's application of MCLs and non-zero MCLGs as ARAR standards for groundwater which is a potential drinking water source.

As noted earlier, standards such as the MCL and MCLG standards are promulgated pursuant to both federal and state law. Under the Safe Drinking Water Act, EPA has granted the State of Montana primacy in implementation of the Safe Drinking Water Act. The State has promulgated its own public water supply ground water standards through the Public Water Safety Act for most contaminants of concern, primarily through incorporation by reference of the federal standard. These standards, when the same or more stringent than federal standards, are also identified here.

[1] 42 U.S.C. §§ 300f et seq.

Chemical	MCLG	MCL
Arsenic	NA	10 ug/l[2]
Cadmium	5 ug/l[3]	5 ug/l[4]
Copper	1300 ug/l[5]	1300 ug/l[6]
Lead	NA [7]	15 ug/l[8]

All ground water standards are measured as dissolved constituents. All are identified as Performance Standards in the CFROU ROD.

These standards incorporate potentially relevant and appropriate Resource Conversation Act (RCRA) standards for groundwater found at 40 CFR Part 264, Subpart F, which is incorporated pursuant to state law at ARM 17.53.801. The RCRA standards are the same or less stringent than the MCLs or MCLGs identified above.

B. Surface Water—Ambient and Point Source Discharges—Clean Water Act (Applicable or Relevant and Appropriate)

CERCLA and the NCP provide that federal water pollution criteria that match designated or anticipated surface water uses are the usual surface water standards to be used at Superfund cleanups, as relevant and appropriate standards, unless the state has promulgated surface water quality standards pursuant to the delegated state water quality act. The State of Montana has designated uses for the Clark Fork River, and has promulgated specific numeric water quality standards accordingly. Those standards as well as other surface water standards are included in the State ARARs identified in section IV.A.1. below. These standards will be applied to all contaminants of concern identified in the CFROU ROD, both to point sources affected or created by the CFROU ROD cleanup and to ambient water in CFROU, except for the State copper standard, which is waived in the CFR ROD and replaced with the federal copper water quality criteria. The FWQC standards for CFROU ROD designated contaminants of concern are identified here.

[2] 40 CFR §§ 141.11(b) and 141.62.

[3] 40 CFR § 141.51

[4] 40 CFR § 141.62

[5] 40 CFR § 141.51

[6] 40 CFR § 141.80(c)(2) The requirement is an action level rather than a simple numerical standard.

[7] The MCLG for arsenic and lead is zero, which is not an appropriate standard for Superfund site cleanups.

[8] 40 CFR § 141.80(c)(1). The requirement is an action level rather than a simple numerical standard.

Chemical	FWQC[9] CMC (acute)	FWQC CCC (chronic)
Arsenic	340 ug/l	150 ug/l
Cadmium	2.0 ug/l	0.25 ug/l
Copper	**13 ug/l**	**9.0 ug/l**
Lead	65 ug/l	2.5 ug/l
Zinc	120 ug/l	120 ug/l

As noted, the **bolded** copper standard above is the replacement standard for the waived state water quality standard, and is a Performance Standard for the CFROU ROD. Federal Water Quality Criteria are measured as dissolved constituents. The criteria assume a hardness of 100 ug/l, and the standards will likely be modified as applied to the CFROU surface waters which have a different hardness value.

Additionally, since the Clark Fork River is a potential drinking water source, the MCLs are relevant and appropriate requirements. The federal arsenic level of 10 ug/l, measured as a dissolved standard, sets the performance standard for surface water for the ROD.

C. Surface Water—Point Source Discharges—Stormwater Regulations—Clean Water Act (Applicable)

If point sources of water contamination from identifiable metals contamination are retained or created by any CFROU remediation activity, applicable Clean Water Act standards would apply to those discharges. These include the general requirements and storm water regulations found at 40 CFR Parts 122 and 125 (general conditions and industrial activity conditions). The storm water regulations address non-agricultural sources of storm water discharges which adversely affect water quality. Generally, the permits require the permittee to implement Best Management Practices (BMP) and to take all reasonable steps to minimize or prevent any discharge which has a reasonable likelihood of adversely affecting human health or the environment.[10] At the CFROU, it is likely that the actions required by the remedy would meet these requirements. However, if there is evidence indicating potential or realized impacts on water quality due to any storm water discharge associated with the activity, substantive standards associated with an individual National Pollutant Discharge Elimination System (NPDES) permit or alternative general permit may

[9] Pursuant to Section 304(a) of the Clean Water Act. National Recommended Water Quality Criteria-2002. US EPA, EPA 822-R-02-047 November 2002.

[10] For further explanation of storm water applications, see the letter from EPA to Chuck Stilwell, ARCO, dated February 2, 1999, which describes that treatment, in addition to BMPs, may be necessary if in-stream standards are not met after implementation of BMPs. The letter addresses the nearby Butte Priority Soils operable unit of the Silver Bow Creek/Butte Area Site but similar reasoning would apply to the CFROU.

be required (or Montana Pollutant Discharge Elimination System (MPDES) permit or alternative general permit under the State program).

D. Air Standards—Clean Air Act (Applicable)

Federal air quality standards are not currently exceeded in the CFROU. Limitations on air emissions resulting from cleanup activities or emissions resulting from wind erosion of exposed hazardous substances are set forth-in the action specific requirements, below.

II. Federal Location Specific Requirements

A. Fish and Wildlife Coordination Act (Applicable)

These standards are found at 16 U.S.C. §§ 661 et seq. and 40 CFR § 6.302(g). They require that federally funded or authorized projects ensure that any modification of any stream or other water body affected by a federally funded or authorized action provide for adequate protection of fish and wildlife resources. Compliance with this ARAR necessitates EPA consultation with the U.S. Fish and Wildlife Service (USFWS) and the State of Montana Department of Fish, Wildlife, and Parks. Consultation occurred during the selection of the CFROU remedy, and further consultation with these agencies will occur during cleanup implementation, and specific mitigative or other measures may be identified to achieve compliance with this ARAR, as the streambank remediation measures are implemented. The purpose of consultation is to develop measures to prevent, mitigate, or compensate for project-related losses to fish and wildlife. Mitigative measures must be performed by the persons who implement any selected remedy.

B. Floodplain Management Order (Applicable)

This requirement (40 CFR Part 6, Appendix A, Executive Order No. 11,988) mandates that federally funded or authorized actions within the 100 year floodplain avoid, to the maximum extent possible, adverse impacts associated with development of a floodplain. Compliance with this requirement is detailed in EPA's August 6, 1985 "Policy on Floodplains and Wetlands Assessments for CERCLA Actions." If the selected remedial action adversely impacts the Clark Fork River floodplain, specific measures to minimize adverse impacts may be identified following EPA consultation with the appropriate agencies.

In addition, if the remedial action selected for the CFROU is found to potentially adversely impact the floodplain, the following information will be produced: a Statement of Findings which will set forth the reasons why the proposed action must be located in or affect the floodplain; a description of significant facts considered in making the decisions to locate in or affect the floodplain or wetlands including alternative sites or actions; a statement indicating whether the selected action conforms to applicable state or local floodplain protection standards unless waived in the CFROU ROD; a description of the steps to be taken to design or modify the proposed action to minimize the potential harm to or within the floodplain; and a statement indicating how the proposed action affects the natural or beneficial values of the floodplain.

C. Protection of Wetlands Order (Applicable)

This requirement (40 CFR Part 6, Appendix A, Executive Order No. 11,990) mandates that federal agencies and potentially responsible parties (PRPs) avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands if a practicable alternative exists. Section 404(b)(1), 33 U.S.C. § 1344(b)(1), also prohibits the discharge of dredged or fill material into waters of the United States. Together, these requirements create a "no net loss" of wetlands standard.

Compliance with this ARAR will be achieved through EPA consultation with the U.S. Fish and Wildlife Service, to determine the existence and category of wetlands present at the site, and any avoidance or mitigation and replacement which may be necessary. Avoidance, mitigation, or replacement activities will be done by the persons who implement any selected remedy. Avoidance or mitigation and replacement of wetlands is a specific requirement of the CFROU Selected Remedy and will be further examined and detailed during remedy implementation. In December 1994, ARCO published a report titled "Determination of Functionally Effective Wetland Area with Threatened/Endangered Species inventory." EPA also approved ARCO's August 1992 Evaluation Form for Determining Wetland Functional Value and Effective Wetland Area in Upper Clark Fork River superfund Sites for use in wetland evaluations. Additional information regarding wetlands is found in Appendix G-1 of the CFROU Feasibility Study. These documents will form the basis for further action during remedial design and implementation to ensure compliance with this ARAR.

D. The Endangered Species Act (Applicable)

This statute and implementing regulations (16 U.S.C. §§ 1531—1544, 50 CFR Part 402, and 40 CFR § 6.302(h)) require that any federal activity or federally authorized activity may not jeopardize the continued existence of any threatened or endangered species known to live or to have lived in the affected environment or destroy or adversely modify a critical habitat. This ARAR requires EPA to ensure that the selected remedy is sufficiently protective of the environment containing the threatened or endangered species, with an emphasis on reducing the risks from the contaminants of concern to the listed species described in the EPA risk assessment to an acceptable level, with consideration given to the special status of the listed or threatened species—see 40 CFR Sections 300.430(d)(2)(vii) and (e)(2)(i)(G) and EPA Guidance Document OSWER Dir. No. 9285.7-28P, Ecological Risk Assessment and Risk Management principles for Superfund Sites (October, 1999) page 3; and to ensure that the selected remedy is implemented in a manner such that effects on any existing threatened or endangered species from the active remedy implementation activities are avoided or mitigated—see page 4-12 of the CERCLA Compliance with Other Laws Manual: Volume II (EPA August 1989).

In December 1994, ARCO published a report titled "Determination of Functionally Effective Wetland Area with Threatened/Endangered Species." The CFROU Feasibility Study contains additional information regarding threatened and endangered species at Appendix A-10. The bald eagle, the bull trout, the Canada lynx, and the gray wolf were identified as animals potentially frequenting or occurring at the CFROU.

Compliance with this ARAR has to date involved consultation with USFWS, and a determination of the presence of listed or proposed species or critical habitats present at the CFROU. Consultation has focused on the bull trout. The USFWS has indicated a strong interest in the CFROU remedial action and generally agrees with EPA that the Selected Remedy is adequately protective of the sensitive species found at the CFROU as reflected in the USFWS Biological Opinion.

EPA submitted a Biological Assessment (BA) for the CFROU to the US FWS in December 2002. The State of Montana submitted additional comments on the BA subsequent to EPA's submission. The decision by EPA to perform the BA itself, rather than require the PRP to perform the study, was a site specific decision related to the nature of ARCO's objections to EPA's risk assessments and the schedule associated with this project. The US FWS issued a Biological Opinion (BO) in response to these documents in April 2004. Continued consultation with the USFWS and the Montana Department of Fish, Wildlife and Parks will be required as remedial designs are completed. The measures identified in the BO must be implemented by the persons performing the CFROU Selected Remedy. The primary focus of the continued consultation are the best management practices to be undertaken during streambank construction work as the CFROU Selected Remedy is implemented.

E. The National Historic Preservation Act (Applicable)

This statute and implementing regulations (16 U.S.C. § 470 et seq, 40 CFR § 6.301(b), 36 CFR Part 800) require federal agencies or federal projects to take into account the effect of any federally assisted undertaking or licensing on any district, site building, structure, or object that is included in, or eligible for, the Register of Historic Places. If effects cannot be avoided reasonably, measures should be implemented to minimize or mitigate the potential effect. In addition, Indian cultural and historical resources must be evaluated, and effects avoided, minimized, or mitigated.

Compliance with this ARAR has been undertaken through a phase I summary of existing information about sites within the CFROU which may be eligible or are currently included in the National Registry of Historic Places. The results of this search are found in the Remedial Investigation Report, and are summarized in the CFROU Feasibility Study, page 2-23. In addition, the Salish and Kootenai Confederated Tribes are conducting a cultural resources survey of the CFROU. The most notable resource identified to date which may be impacted by the CFROU Selected Remedy is the Grant-Kohrs Ranch National Historic Site, a National Historic Landmark (December 19, 1960) and listed on the National Registry of Historic Places.

Compliance with this ARAR will require continued consultation with the State Historic Preservation Office and the Salish and Kootenai Tribes. Although not generally applicable to the CFROU site, consultation requirements with SHPO are described generally in the First and Second Programmatic Agreements (Programmatic Agreement, April 6, 1992 and Second Programmatic Agreement, December 14, 1994). The Second Programmatic Agreement in particular describes a notification and consultation process, which must be observed during remedial design and remedial action activities at CFROU. Consultation requirements for the Salish and Kootenai Confederated Tribe are described in an agreement between EPA and the Tribe dated July 2003. Consultation will focus on the further

identification of specific eligible or listed resources which may be impacted by remedy implementation, avoidance of harmful effects to those areas if possible, and mitigative activities if avoidance is not possible.

F. Archaeological and Historic Preservation Act (Applicable)

The statute and implementing regulations (16 U.S.C. § 469 et seq., 40 CFR § 6.301(c)) establish requirements for evaluation and preservation of historical and archaeological data, including Indian cultural and historic data, which may be destroyed through alteration of terrain as a result of federal construction projects or a federally licensed activity or program. If eligible scientific, prehistorical, or archaeological data are discovered during site activities, they must be preserved in accordance with these requirements.

G. Historic Sites, Buildings, and Antiquities Act (Applicable)

This statute and implementing regulations (16 U.S.C. § 461 et seq., 40 CFR § 6.310(a)) state that in conducting an environmental review of an EPA action, the responsible official shall consider the existence and location of natural landmarks using information provided by the National Park Service pursuant to 36 CFR § 62.6(d) to avoid undesirable impacts upon such landmarks. The persons responsible for implementing the CFROU Selected Remedy will utilize this information during remedial design to accomplish the requirements of this act.

H. Migratory Bird Treaty (Applicable)

This requirement (16 U.S.C.§§ 703 et seq.) establishes a federal responsibility for the protection of the international migratory bird resource and requires continued consultation by EPA with the USFWS during remedial design and remedial construction to ensure that the cleanup of the site does not unnecessarily impact migratory birds. Specific mitigative measures may be identified for compliance with this requirement as appropriate for performance by the persons who implement the remedy.

I. Bald Eagle Protection Act (Applicable)

This requirement (16 U.S.C. §§ 668 et seq.) establishes a federal responsibility for protection of bald and golden eagles, and requires continued consultation by EPA with the USFWS during remedial design and remedial construction to ensure that any cleanup of the site does not unnecessarily adversely affect the bald and golden eagle. Specific mitigative measures may be identified for compliance with this requirement as appropriate, and will be done by the persons who implement any selected remedy.

J. Resource Conservation and Recovery Act (Relevant and Appropriate)

Any discrete waste units created or actively managed at the CFROU site cleanup must comply with the siting restrictions and conditions at 40 CFR § 264.18 (a) and (b). These sections require management units to be designed, constructed, operated, and maintained to avoid washout, if they are within or near the current 100 year flood plain.

K. Native American Grave Protection and Repatriation Act, 25 U.S.C. § 3001; 43 CFR §§ 10.1—10.17 (Applicable or Relevant and Appropriate)

NAGPRA and its implementing regulations provide for the disposition of Native American remains and objects inadvertently discovered on federal or tribal lands after November, 1990. 25 U.S.C. Section 3002(d). If the response activities result in the discovery of Native American human remains or related objects, the activity must stop while the head of the federal land management agency (if federal lands are involved) and appropriate Indian tribes are notified of the discovery. After the discovery, the response activity must cease and a reasonable effort must be made to protect the Native American human remains or related objects. The response activity may later resume. 42 CFR Section 10.4. Accordingly, depending on the facts of the discovery and the location of the response action, NAGPRA could be applicable or relevant and appropriate to the response action.

L. Solid Waste Disposal in National Parks (Applicable)

Part of the CFROU contains portions of the Grant-Kohrs National Historic Site (GRKO), managed by the National Park Service. The substantive statutory provisions of this act, found at 16 U.S.C. §§ 4601 - 22(c) et seq., and its implementing regulations, found at 36 CFR Part 6, are applicable to the creation or expansion of new solid waste disposal units within the boundary of the GRKO.[11]

M. The National Park Service Organic Act, 16 U.S.C. §§ 1-3, certain implementing regulations at 36 CFR Parts 1-0 and P.L. 92-406, and the enabling legislation for the GRKO (Relevant and Appropriate)

The Organic Act and the park specific enabling legislation establish the purposes and uses of the Grant Kohrs Ranch National Historic Site, while the regulations proscribe certain conduct within the park. The statutes and regulations establish standards, requirements, criteria, or limitations for the GRKO, and the National Park Service and EPA have identified these as relevant and appropriate ARARs for remedial work done at the GRKO. EPA issued a more specific description of these ARARs and their application to the CFROU in a letter dated May 17, 2000, which is attached. The application of this ARAR to the GRKO site is described more completely in the ROD section 13.7. EPA and the National Park Service will work cooperatively in the oversight and approval of remedial design and remedial action at the GRKO. Specific Performance Standards related to this ARAR are described more fully in the ROD at Section 13.7.

[11] These regulations would not apply to, nor be relevant and appropriate to, the use of in situ treatment on wastes on site at the GRKO.

III. Federal Action Specific Requirements

A. Solid Waste (Applicable), Surface Mining Control and Reclamation (Relevant and Appropriate), and RCRA (Relevant and Appropriate) Requirements

The contamination at the CFROU is primarily mining waste from mining mills and smelters in Butte. This waste may not be RCRA hazardous waste, although EPA reserves its rights to make a more formal determination in this regard at a later date. For any active management (i.e., treatment, storage, disposal, grading, or in-situ treatment) or removal of tailings or mixed tailings and soils[12] contamination, the following requirements are ARARs.

1. Requirements described at 40 CFR §§ 257.3-1(a), 257.3-3, and 257.3-4, governing waste handling, storage, and disposal, including retention of the waste, in general[13], and 257.3-5, relating to precautions necessary to ensure that cadmium is not taken up into crops, including pasture grasses that may enter the food chain, at levels which may be a risk to human health.

2. For any discrete waste units which are created or actively managed by the CFROU cleanup, reclamation and closure regulations found at 30 CFR Parts 816 and 784, governing coal and to a lesser extent, non-coal mining, are relevant and appropriate requirements[14].

3. Portions of RCRA regulations found at 40 CFR §§ 264.116 and .119(a) and (b) (governing notice and deed restrictions)are relevant and appropriate requirements for any waste management units created or actively managed at the CFROU[15].

B. Air Standards—Clean Air Act (Applicable)

These standards, promulgated pursuant to section 109 of the Clean Air Act[16], are applicable to releases into the air from any CFROU cleanup activities.

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[12] Federal and State solid waste requirements may also be relevant and appropriate for contaminated soils in certain circumstances. Generally, if soils materials are determined by the agencies to be able to be used in conjunction with other removal or remedial measures such as deep plowing or capping, these requirements are not considered relevant and appropriate. At the CFROU, the solid waste waiver described in the Record of Decision applies to both mixed tailings and soils and contaminated soils at the site.

[13] Solid waste regulations are promulgated pursuant to the federal Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, 42 U.S.C. §§ 6901 et seq. They are applicable regulations, although the State of Montana has the lead role in regulating solid waste disposal in the State of Montana.

[14] The Surface Mining Control and Reclamation Act is promulgated at 30 U.S.C. §§ 1201 - 1326.

[15] As noted earlier, federal RCRA regulations are incorporated by reference into applicable State Hazardous Waste Management Act regulations. See ARM 17.53.801. Use of select RCRA regulations for mining waste cleanups is appropriate when discrete units are addressed by a cleanup and site conditions are distinguishable from EPA generic determination of low toxicity/high volume status for mining waste. See Preamble to the Final NCP, 55 Fed.Reg. 8763 - 8764 (March 8, 1990), CERCLA Compliance with Other Laws Manual, Volume II (August 1989 OSWER Directive #9234.1-02) p. 6-4; Preamble to the Proposed NCP, 53 Fed.Reg. 51447 (Dec. 21, 1988); and guidance entitled Consideration of RCRA Requirements in Performing CERCLA Responses at Mining Wastes Sites, August 19, 1986 (OSWER).

[16] 42 U.S.C. §§ 7401 et seq.

1. Lead: No person shall cause or contribute to concentrations of lead in the ambient air which 3 exceed 1.5 micrograms per cubic meter (ug/m) of air, measured over a 90-day average. These standards are promulgated at ARM 17.8.222 as part of a federally approved State Implementation Plan (SIP), pursuant to the Clean Air Act of Montana, §§ 75-2-101 et seq. MCA. Corresponding federal regulations are found at 40 CFR § 50.12[17].

2. Particulate matter that is 10 microns in diameter or smaller (PM-10): No person shall cause or contribute to concentrations of PM-10 in the ambient air which exceed:

   – 150 ug/m3 of air, 24 hour average, no more than one expected exceedence per calendar year;

   – 50 ug/m3 of air, annual average.

These regulations are promulgated at ARM 17.8.223 as part of a federally approved SIP, pursuant to the Clean Air Act of Montana, §§ 75-2-101 et seq. MCA. Corresponding federal regulations are found at 40 CFR § 50.6.

Ambient air standards under section 109 of the Clean Air Act are also promulgated for carbon monoxide, hydrogen sulfide, nitrogen dioxide, sulfur dioxide, and ozone. If emissions of these compounds were to occur at the site in connection with any cleanup action, these standards would also be applicable. See ARM 17.8.222 and .223, and 40 CFR Part 50.

C. Point Source Controls—Clean Water Act (Applicable)

If point sources of water contamination are retained or created by any CFROU remediation activity, applicable Clean Water Act standards would apply to those discharges. The regulations are discussed in the contaminant specific ARAR section, above, and in the State of Montana identification of ARARs. These regulations include storm water runoff regulations found at 40 CFR Parts 121, 122, and 125 (general conditions and industrial activity conditions). These would also include requirements for best management practices and monitoring found at 40 CFR §§ 122.44(i) and 440.148, for point source discharges.

D. Dredge and Fill Requirements (Applicable)

Regulations found at 40 CFR Part 230 address conditions or prohibitions against depositing dredge and fill material into water of the United States. If remediation activities would result in an activity subject to these regulations, they would be applicable. Compliance with this requirement will be achieved at the site of dredge and fill activity within the CFROU during construction activities through the use of construction best management practices.

[17] Ambient air standards established as part of Montana's approved State Implementation Plan in many cases provide more stringent or additional standards. The federal standards by themselves apply only to major sources, while the State standards are fully applicable throughout the state and are not limited to major sources. See ARM 17.8.205 and 17.8.212-223. As part of an EPA approved State Implementation Plan, the state standards are also federally enforceable. Thus, the state standards which are equivalent to the federal standards are identified in this section. A more detailed list of State standards, which include standards which are not duplicated in federal regulations, is contained in the State ARAR identification section.

E. Underground Injection Control (Applicable)

Requirements found at 40 CFR Part 144, promulgated pursuant to the Safe Drinking Water Act, allow the re-injection of treated groundwater into the same formation from which it was withdrawn for aquifers such as the aquifer at the CFROU, and addresses injection well construction, operation, maintenance, and capping/closure. These regulations would be applicable to any reinjection of treated groundwater.

F. Transportation of Hazardous or Contaminated Waste (Relevant and Appropriate)

40 CFR Part 263 establishes regulations for the transportation of hazardous waste. These regulations would govern any on-site transportation of contaminated material. Any off-site transportation would be fully subject to applicable regulations and permitting.

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State of Montana ARARs

As provided by Section 121 of CERCLA, 42 U.S.C. § 9621, only those state standards that are more stringent than any federal standard and that have been identified by the state in a timely manner are appropriately included as ARARs.

IV. Montana Contaminant Specific Requirements

A. Water Quality

Surface Water Quality Standards (Applicable)

Under the Montana Water Quality Act, §§ 75-5-101 et seq., MCA, the state has promulgated water quality standards to protect, maintain, and improve the quality and potability of the state's surface water for water supplies, wildlife, fish and aquatic life, agricultural, industry, recreation, and other beneficial uses. The requirements listed below are applicable water quality standards with which any remedial action must comply.

ARM 17.30.607 (1)(a)-(n) (Applicable) classifies the waters of the Clark Fork River as follows:

Newly constructed channel below Pond 2 outfall to the mainstem of Warm Springs Creek	B-1
Mainstem from Warm Springs Creek to Cottonwood Creek (Deer Lodge)	C-2
Mainstem from Cottonwood Creek to Little Blackfoot River	C-1
Little Blackfoot River to Milltown Reservoir	B-1

In addition, Mill and Willow Creeks flow into the Clark Fork River at the upstream end of the operable unit, and they are classified as B-1.

The B-1 classification standards are contained in ARM 17.30.623 (Applicable) of the Montana water quality regulations. This section states:

Waters classified B-1 are suitable for drinking, culinary and food processing purposes, after conventional treatment; bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.

The B-1 classification standards at ARM 17.30.623 include the following criteria: 1) dissolved oxygen concentration must not be reduced below the levels given in department circular WQB-7; 2) the maximum allowable increase above naturally occurring turbidity is 5 nephelometric turbidity units; 3) temperature increases must be kept within prescribed limits; 4) no increases above naturally occurring concentrations of sediment or suspended sediment, settleable solids, oils, floating solids, which will or are likely to create a nuisance

or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish, or other wildlife are allowed; 5) true color must be kept within specified limits; 6) induced variation of hydrogen ion cncentration (pH) within the range of 6.5 to 8.5 must be less than 0.5 pH unit. Natural pH outside this range must be maintained without change. Natural pH above 7.0 must be maintained above 7.0.

ARM 17.30.623 (applicable) also provides that concentrations of carcinogenic, bioconcentrating, toxic, or harmful parameters which would remain in the water after conventional water treatment may not exceed the applicable standards set forth in the current version of circular WQB-7. Discharges shall conform with ARM Title 16, Chapter 20, subchapter 7 (the nondegradation rules) and may not cause receiving water concentrations to exceed the applicable standards specified in WQB-7 when stream flows equal or exceed the design flows specified in ARM 17.30.635(4).

The C-1 classification standards are contained in ARM 17.30.626 (Applicable) of the Montana water quality regulations. This section states:

Waters classified C-1 are suitable for bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

The C-1 classification standards at ARM 17.30.626 include the following criteria: 1) dissolved oxygen concentration must not be reduced below the levels given in department circular WQB-7; 2) the maximum allowable increase above naturally occurring turbidity is 5 nephelometric turbidity units; 3) temperature increases must be kept within prescribed limits; 4) no increases above naturally occurring concentrations of sediment or suspended sediment, settleable solids, oils, floating solids, which will or are likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish, or other wildlife are allowed; 5) true color must be kept within specified limits; 6) induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 8.5 must be less than 0.5 pH unit. Natural pH outside this range must be maintained without change. Natural pH above 7.0 must be maintained above 7.0.

ARM 17.30.626 also provides that concentrations of carcinogenic, bioconcentrating, toxic or harmful parameters may not exceed levels which render the water harmful, detrimental, or injurious to public health. Concentrations of toxic parameters also may not exceed the applicable standards specified in WQB-7. Discharges shall conform with ARM Title 16, Chapter 20, subchapter 7 (the nondegradation rules) and may not cause receiving water concentrations to exceed the applicable standards specified in WQB-7 when stream flows equal or exceed the design flows specified in ARM 17.30.635(4).

C-2 classification standards are found in ARM 17.30.627 (applicable) of the Montana Water Quality Regulations. This section states:

> Waters classified C-2 are suitable for bathing, swimming, and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; agricultural and industrial water supply.

The C-2 classification standards at ARM 17.30.627 include the following criteria: 1) dissolved oxygen concentration must not be reduced below the levels given in department circular WQB-7; 2) the maximum allowable increase above naturally occurring turbidity is 10 nephelometric turbidity units; 3) temperature increases must be kept within prescribed limits; 4) non increases above naturally occurring concentrations of sediment or suspended sediment, settleable solids, oils, floating solids, which will or are likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish, or other wildlife are allowed; 5) true color must be kept within specified limits; 6) induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 8.5 must be less than 0.5 pH unit. Natural pH outside this range must be maintained without change. Natural pH above 7.0 must be maintained above 7.0.

ARM 17.30.627 provides that concentrations of carcinogenic, bioconcentrating, toxic or harmful parameters may not exceed levels which render the water harmful, detrimental, or injurious to public health. Concentrations of toxic parameters also may not exceed the applicable standards specified in WQB-7. Discharges shall conform with ARM Title 16, Chapter 20, subchapter 7 (the nondegradation rules) and may not cause receiving water concentrations to exceed the applicable standards specified in WQB-7 when stream flows equal or exceed the design flows specified in ARM 17.30.635(4).

If these standards are violated due to hazardous substances or Superfund response action, they must be complied with as part of any selected remedial action.

For the primary contaminants of concern, the WQB-7 levels are listed below. WQB-7 provides that "whenever both Aquatic Life Standards and Human Health Standards exist for the same analyte, the more restrictive of these values will be used as the numeric Surface Water Quality Standard."

Chemical	WQB-7 Standard (total recoverable standards)	
Arsenic	**Acute**	**340 ug/l**
	Chronic	**150 ug/l**
	Human Health	**18 ug/l**
Cadmium	**Acute**	**2.1 ug/l @ 100 mg/l hardness**
	Chronic	**0.27 ug/l @ 100 mg/l hardness**
Copper	Acute	18 ug/l @ 100 mg/l hardness
	Chronic	12 ug/l @ 100 mg/l hardness
	Human Health	1,300 ug/l @ 100 mg/l hardness

The copper standard is waived in the CFROU ROD and replaced with the federal water quality criteria for copper.

Lead	**Acute**	**81 ug/l @ 100 mg/l hardness**
	Chronic	**3.2 ug/l @ 100 mg/l hardness**
	Human Health	**15 ug/l**

Zinc	**Acute**	**119 ug/l @ 100 mg/l hardness**
	Chronic	**119 ug/l @ 100 mg/l hardness**
	Human Health	**2,100 ug/l @ 100 mg/l hardness**

Bolded water quality standards are Performance Standards for the CFROU.

Additional restrictions on any discharge to surface waters are included in:

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

ARM 17.30.637 also states that no waste may be discharged and no activities conducted which, either along or in combination with other waste activities, will cause violation of surface water quality standards.

ARM 17.30.1203 (Applicable), adopts and incorporates the provisions of 40 CFR Part 125 for criteria and standards for the imposition of technology-based treatment requirements in MPDES permits. Although the permit requirement would not apply to on-site discharges, the substantive requirements of Part 125 are applicable, i.e., for toxic and nonconventional pollutants treatment must apply the best available technology economically achievable (BAT) ; for conventional pollutants, application of the best conventional pollutant control technology (BCT) is required. Where effluent limitations are not specified for the particular industry or industrial category at issue, BCT/BAT technology based treatment requirements are determined on a case by case basis using best professional judgment (BPJ). See CERCLA Compliance with Other Laws Manual, Vol. I, August 1988, p. 3-4 and 3-7. These State standards would apply to both point source discharges and ambient water quality within the CFROU.

Section 75-5-308, MCA, allows DEQ to grant short-term exemptions from the water quality standards or short-term use that exceeds the water quality standards for the purpose of allowing certain emergency remediation activities. Such exemptions typically extend for a period of 30-60 days. However, any exemption must include conditions that minimize to the extent possible the magnitude of the violation and the length of time the violation occurs. In addition, the conditions must maximize the protection of state waters by ensuring the maintenance of beneficial uses immediately after termination of the exemption. Water quality and quantity monitoring and reporting may also be included as conditions.

Montana Pollutant Discharge Elimination System (MPDES)—stormwater and other point sources.

ARM 17.30.1342 - 1344 set forth the substantive requirements applicable to all MPDES permits. The substantive requirements, including the requirement to properly operate and maintain all facilities and systems of treatment and control are applicable requirements.

Under ARM 17.30.601, ARM 17.30.1101 et seq., and ARM 17.30.1301 et seq., the Montana Department of Environmental Quality has issued general stormwater permits for certain activities. The substantive requirements of the following permits are applicable for the following activities:

- For construction activities: General Permit for Storm Water Discharges Associated with Construction Activity, Permit No. MTR 100000 (June 8, 2002);
- For mining activities: General Permit for Storm Water Discharges Associated with Mining and with Oil and Gas Activities, Permit No. MTR300000 (November 17, 2002)[1];
- For industrial activities: General Permit for Storm Water Discharges Associated with Industrial Activity, Permit No. MTR000000 (October 1, 2001).

Generally, the permits listed above require the permittee to implement Best Management Practices (BMP) and to take all reasonable steps to minimize or prevent any discharge which has a reasonable likelihood of adversely affecting human health or the environment.[2] However, if there is evidence indicating potential or realized impacts on water quality due to any storm water discharge associated with the activity, the substantive standards associated with an individual MPDES permit or alternative general permit may be required.

A related mine reclamation requirement is set out in ARM 17.24.633 (relevant and appropriate), which requires that all surface drainage from disturbed areas that have been graded, seeded or planted must be treated by the best technology currently available (BTCA) before discharge. Sediment control through BTCA practices must be maintained until the disturbed area has been reclaimed, the revegetation requirements have been met, and the area meets state and federal requirements for the receiving stream.

2. Groundwater Quality Standards (Applicable)

ARM 17.30.1006 (Applicable) classifies groundwater into Classes I through IV based upon the its specific conductance and establishes the groundwater quality standards applicable with respect to each groundwater classification. Based upon its specific conductance, the majority of the groundwater in the CFROU is considered Class I groundwater, with the remainder of the groundwater Class II.[3]

Concentrations of dissolved substances in Class I or II groundwater (or Class III groundwater which is used as a drinking water source) may not exceed the human health standards listed in department Circular WQB-7. For the primary contaminants of concern these levels are listed below. Ground water is measured in dissolved form, according to WQB-7.

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

[2] For further explanation of storm water applications, see the letter from EPA to Chuck Stilwell, ARCO, dated February 2, 1999, which describes that treatment, in addition to BMPs, may be necessary if in-stream standards are not met after implementation of BMPs.

[3] ARM 17.30.1006 provides that Class I groundwaters are those with specific conductance of less than 1000 microSiemens per centimeter at 25B C; Class II groundwaters: 1000 to 2500; Class III groundwaters: 2500 to 15,000; and Class IV groundwaters: over 15,000.

Chemical	WQB-7 Human Health Standards (December 2002 edition)
Arsenic	20 ug/1
Cadmium	5 ug/1
Copper	1300 ug/1
Lead	15 ug/1
Zinc	**2000 ug/1**

Zinc is not addressed under federal groundwater standards. Therefore, the State zinc standard is a Performance Standard for the CFROU ROD. Other state standards listed above are not as stringent or are duplicative of federal standards previously identified as Performance Standards.

For concentrations of parameters for which human health standards are not listed in WQB-7, ARM 17.30.1006 allows no increase of a parameter to a level that renders the waters harmful, detrimental or injurious to listed beneficial uses.

For Class I and II groundwaters, 17.30.1006 allows no increase of a parameter that causes a violation of the nondegradation provisions of § 75-5-303, MCA.

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

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

B. Air Quality

In addition to the standards identified in the federal action specific ARARs above, the State of Montana has identified certain air quality standards in the action-specific section of the State ARARs below.

V. Montana Location Specific Requirements

A. Floodplain and Floodway Management Act and Regulations (Applicable)

The Floodplain and Floodway Management Act and regulations specify types of uses and structures that are allowed or prohibited in the designated 100-year floodway[4] and floodplain[5]. These standards are applicable to all actions contemplated for this site within the floodplain.

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

2. Prohibited Uses. Uses prohibited anywhere in either the floodway or the floodplain are:

   a. solid and hazardous waste disposal; and

   b. storage of toxic, flammable, hazardous, or explosive materials.

   ARM 36.15.605(2) and 36.15.703. These standards are waived in the CFROU ROD for areas designated for in-situ treatment.

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

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

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

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

[5] The floodplain is the area adjoining the water course or drainway which would be covered by the floodwater of a base (100 year) flood except for sheet flood areas that receive less than one foot of water per occurrence. The floodplain consists of the floodway and flood fringe. ARM 36.15.101

[6] However, see EPA's 1997 Human Health Risk Assessment for a determination of likely land use at the CFR OU, based on local zoning requirements and other factors.

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

Section 76-5-403, MCA.

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

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

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

    3. the availability of alternate locations;

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

    5. the permanence of the obstruction or use; and

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

See 76-5-406, MCA; ARM 36.15.216 (substantive provisions only).

Conditions or restrictions that generally apply to specific activities within the floodway or floodplain are:

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

2. the proposed activity, construction, or use must be designed and constructed to minimize potential erosion, see ARM 36.15.605.

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

- Excavation of material from pits or pools—ARM 36.15.602 (1).
- Water diversions or changes in place of diversion—ARM 36.15.603.

- Flood control works—ARM 36.15.606.
- Roads, streets, highways and rail lines (must be designed to minimize increases in flood heights)—ARM 36.15.701(3) (c).
- Structures and facilities for liquid or solid waste treatment and disposal (must be floodproofed to ensure that no pollutants enter flood waters and may be allowed and approved only in accordance with MDEQ regulations, which include certain additional prohibitions on such disposal)—ARM 36.15.701(3) (d).
- Residential structures—ARM 36.15.702(1).
- Commercial or industrial structures—ARM 36.15.702(2).

B. Solid Waste Management Regulations (Applicable)

Regulations promulgated under the Solid Waste Management Act, §§ 75-10-201 et seq. MCA, specify requirements that apply to the location of any solid waste management facility. Under ARM 17.50.505, a facility for the treatment, storage or disposal of solid wastes:

- must be located where a sufficient acreage of suitable land is available for solid waste management;
- may not be located in a 100-year floodplain;
- may be located only in areas which will prevent the pollution of ground and surface waters and public and private water supply systems;
- must be located to allow for reclamation and reuse of the land;
- drainage structures must be installed where necessary to prevent surface runoff from entering waste management areas; and
- where underlying geological formations contain rock fractures or fissures which may lead to pollution of the ground water or areas in which springs exist that are hydraulically connected to a proposed disposal facility, only Class III disposal facilities may be approved[7].

Even Class III landfills may not be located on the banks of or in a live or intermittent stream or water saturated areas, such as marshes or deep gravel pits which contain exposed ground water. ARM 17.54.505(2)(j).

The above standards are waived in the CFROU ROD for those areas designated for in-situ treatment.

In addition, § 75-10-212 prohibits dumping or leaving any debris or refuse upon or within 200 yards of any highway, road, street, or alley of the State or other public property, or on privately owned property where hunting, fishing, or other recreation is permitted.

[7] Group III consist of primarily inert wastes, including industrial mineral wastes which are essentially inert and non-water soluble and do not contain hazardous waste constituents. ARM 17.50.503(1)(b)

However, the restriction relating to privately owned property does not apply to the owner, his agents, or those disposing of debris or refuse with the owner's consent.

C. Natural Streambed and Land Preservation Standards (Applicable)

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

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

ARM 36.2.410 establishes minimum standards which would be applicable if a remedial action alters or affects a streambed, including any channel change. Projects must be designed and constructed using methods that minimize adverse impacts to the stream (both upstream and downstream) and future disturbances to the stream. All disturbed areas must be managed during construction and reclaimed after construction to minimize erosion. Temporary structures used during construction must be designed to handle high flows reasonably anticipated during the construction period. Temporary structures must be completely removed from the stream channel at the conclusion of construction and the area must be restored to a natural or stable condition. Channel alternation must be designed to retain original stream length or otherwise provide hydrologic stability. Streambank vegetation must be protected except where removal of such vegetation is necessary for the completion of the project. When removal of vegetation is necessary, it must be kept to a minimum. Riprap, rock, and other material used in a project must be of adequate size, shape and density and must be properly placed to protect the streambank from erosion. The placement of road fill material in a stream, the placement of debris or other materials in a stream where it can erode or float into the stream, projects that permanently prevent fish migration, operation of construction equipment in a stream, and excavation of streambed gravels are prohibited unless specifically authorized by the district. Such projects must also protect the use of water for any useful or beneficial purpose. See 75-7-102, MCA.

VI. Montana Action Specific Requirements

A. Water Quality Statute and Regulations (Applicable)

Causing of pollution: Section 75-5-605 of the Montana Water Quality Act prohibits the causing of pollution of any state waters. Pollution is defined as contamination or other alteration of physical, chemical, or biological properties of state waters which exceeds that permitted by the water quality standards. Construction Best Management Practices described in the CFROU ROD are intended to meet this requirement during remedial action implementation.

Placement of Wastes: Section 75-5-605, MCA, states that it is unlawful to place or cause to be placed any wastes where they will cause pollution of any state waters. Placement of waste is not prohibited if the authorization for placement contains provisions for review of the placement of materials to ensure it will not cause pollution to state waters.

Nondegradation: Section 75-5-303, MCA, states that existing uses of state waters and the level of water quality necessary to protect the uses must be maintained and protected. Section 75-5-317, MCA, provides an exemption from nondegradation requirements which allows changes of existing water quality resulting from an emergency or remedial activity that is designed to protect the public health or the environment and that is approved, authorized, or required by the department. Changes determined to meet these requirements may be considered nonsignificant. In determining that remedial actions are protective of public health and the environment and in approving, authorizing, or requiring such remedial activities, no significant degradation should be approved, considering the criteria for a determination of non-significance set out in 75-5-301(5)(c), which (i) equate significance with the potential for harm to human health, a beneficial use or the environment, (ii) consider both the quantity and strength of the pollutant, (iii) consider the length of time the degradation will occur, and (iv) consider the character of the pollutant so that greater significance is associated with carcinogens and toxins that bioaccumulate or biomagnify and lesser significance is associated with substances that are less harmful or less persistent. Under ARM 17.30.715(1)(b), concentrations of carcinogenic parameters or parameters with a bioconcentration factor greater than 300 cannot exceed the concentration in the receiving water in order for a discharge to be considered nonsignificant and thus exempt from nondegradation requirements under § 75-5-317.

ARM 17.30.705 provides that for any surface water, existing and anticipated uses and the water quality necessary to protect these uses must be maintained and protected unless degradation is allowed under the nondegradation rules at ARM 17.30.701 et seq.

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

B. Montana Pollutant Discharge Elimination System (MPDES)-stormwater and other point sources (Applicable or Relevant and Appropriate)

ARM 17.30.1342 - 1344 set forth the substantive requirements applicable to all MPDES permits. The substantive requirements, including the requirement to properly operate and maintain all facilities and systems of treatment and control are applicable requirements.

Under ARM 17.30.601, ARM 17.30.1101 et seq., and ARM 17.30.1301 et seq., the Montana Department of Environmental Quality has issued general stormwater permits for certain activities. The substantive requirements of the following permits are applicable for the following activities:

- For construction activities: General Permit for Storm Water Discharges Associated with Construction Activity, Permit No. MTR 100000 (June 8, 2002);
- For mining activities: General Permit for Storm Water Discharges Associated with Mining and with Oil and Gas Activities, Permit No. MTR300000 (November 17, 2002)[8];
- For industrial activities: General Permit for Storm Water Discharges Associated with Industrial Activity, Permit No. MTR000000 (October 1, 2001).

Generally, the permits listed above require the permittee to implement Best Management Practices (BMP) and to take all reasonable steps to minimize or prevent any discharge which has a reasonable likelihood of adversely affecting human health or the environment.[9] However, if there is evidence indicating potential or realized impacts on water quality due to any storm water discharge associated with the activity, the substantive standards associated with an individual MPDES permit or alternative general permit may be required.

A related mine reclamation requirement is set out in ARM 17.24.633 (relevant and appropriate), which requires that all surface drainage from disturbed areas that have been graded, seeded or planted must be treated by the best technology currently available (BTCA) before discharge. Sediment control through BTCA practices must be maintained until the disturbed area has been reclaimed, the revegetation requirements have been met, and the area meets state and federal requirements for the receiving stream.

C. Air Quality

Air Quality Regulations (Applicable)

Dust suppression and control of certain substances likely to be released into the air as a result of earth moving, transportation and similar actions related to remedial activity at the CFROU may be necessary to meet air quality requirements. Certain ambient air standards for specific contaminants and particulates are set forth in the federal action specific section

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

[9] For further explanation of storm water applications, see the letter from EPA to Chuck Stilwell, ARCO, dated February 2, 1999, which describes that treatment, in addition to BMPs, may be necessary if in-stream standards are not met after implementation of BMPs. This letter was issued under the Butte Priority Soils operable unit, but similar reasoning applies to this site.

above. Additional air quality regulations under the state Clean Air Act, §§ 75-2-101 et seq., MCA, are discussed below.

ARM 17.8.604 (Applicable) lists certain wastes that may not be disposed of by open burning, including oil or petroleum products, RCRA hazardous wastes, chemicals, and treated lumber and timbers. Any waste which is moved from the premises where it was generated and any trade waste (material resulting from construction or operation of any business, trade, industry or demolition project) may be open burned only in accordance with the substantive requirements of 17.8.611 or 612.

ARM 17.8.308 (Applicable) provides that no person shall cause or authorize the production, handling, transportation or storage of any material, cause or authorize the use of any street, road, or parking lot, or operate a construction site or demolition project, unless reasonable precautions to control emissions of airborne particulate matter are taken. Normally, emissions of airborne particulate matter must be controlled so that they do not "exhibit an opacity of twenty percent (20%) or greater averaged over six consecutive minutes."

In addition, state law provides an ambient air quality standard for settled particulate matter. Particulate matter concentrations in the ambient air shall not exceed the following 30-day average: 10 grams per square meter. ARM 17.8.220 (Applicable). Whenever this standard is exceeded, the activity resulting in such exceedance shall be suspended until such time as conditions improve.

ARM 17.24.761 (Relevant and Appropriate) specifies a range of measures for controlling fugitive dust emissions during mining and reclamation activities. Some of these measures could be considered relevant and appropriate to control fugitive dust emissions in connection with excavation, earth moving and transportation activities conducted as part of the remedy at the site. Such measures include, for example, paving, watering, chemically stabilizing, or frequently compacting and scraping roads, promptly removing rock, soil or other dust-forming debris from roads, restricting vehicle speeds, revegetating, mulching, or otherwise stabilizing the surface of areas adjoining roads, restricting unauthorized vehicle travel, minimizing the area of disturbed land, and promptly revegetating regraded lands.

D. Solid Waste Management Regulations (Applicable)

As noted above, the Solid Waste Management Regulations are applicable to the disposal or active management of the tailings and similar wastes within the CFROU. Certain of these regulations are identified in the state location specific ARARs above. Action specific solid waste regulations are discussed below:

ARM 17.50.505(2) specifies standards for solid waste management facilities, including the requirements that:

1. Class II[10] landfills must confine solid waste and leachate to the disposal facility. If there is the potential for leachate[11] migration, it must be demonstrated that leachate will only

[10] Generally Class II landfills are licensed to receive Group II and Group III waste, but not regulated hazardous waste. Class III landfills may only receive Group III waste.

[11] Leachate is defined as a liquid which has contacted passed through, or emerged from solid waste and contains soluble, suspended, or miscible materials removed from the waste. ARM 17.50.502(29).

migrate to underlying formations which have no hydraulic continuity with any state waters;

2. adequate separation of group II wastes from underlying or adjacent water must be provided[12]; and

3. no new disposal units or lateral expansions may be located in wetlands.

ARM 17.50.506 specifies design requirements for landfills[13]. Landfills must either be designed to ensure that MCLs are not exceeded or the landfill must contain a composite liner and leachate collection system which comply with specified criteria.

ARM 17.50.511 sets forth general operational and maintenance and design requirements for solid waste management systems. Specific operational and maintenance requirements specified in ARM 17.50.511[14] that are relevant and appropriate are requirements for run-on and runoff control systems, requirements that sites be fenced to prevent unauthorized access, and prohibitions of point source and nonpoint source discharges which would violate Clean Water Act requirements.

ARM 17.50.523 specifies that solid waste must be transported in such a manner as to prevent its discharge, dumping, spilling or leaking from the transport vehicle.

ARM 17.50.530 sets forth the closure[15] requirements for landfills. Class II landfills must meet the following criteria:

1. install a cover that is designed to minimize infiltration and erosion;

2. design and construct the final cover system to minimize infiltration through the closed unit by the use of an infiltration layer that contains a minimum 18 inches of earthen material and has a permeability less than or equal to the permeability of any bottom liner, barrier layer, or natural subsoils or a permeability no greater than 1 X 10-5 cm/sec, whichever is less;

3. minimize erosion of the final cover by the use of a seed bed layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth and protecting the infiltration layer from frost effects and rooting damage; and

4. revegetate the final cover with native plant growth within one year of placement of the final cover.

ARM 17.50.530(1)(b) allows an alternative final cover design if the infiltration layer achieves reduction in infiltration at least equivalent to the stated criteria and the erosion layer provides protection equivalent to the stated criteria.

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12 The extent of separation shall be established on a case-by-case basis, considering terrain and the type of underlying soil formations, and facility design. The Waste Management Section of DEQ has generally construed this to require a 10 to 20 foot separation from groundwater.

13 A landfill is defined as an area of land or an excavation where wastes are placed for permanent disposal, and that is not a land application unit, surface impoundment, injection well, or waste pile. ARM 17.50.502(27).

14 ARM 17.50.511(1)(j), 17.50.511(l)(k) and 17.50.511(1)(l)

15 Closure means the process by which the operator closes all or part of the facility.

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

Section 75-10-206, MCA, allows variances[16] to be granted from solid waste regulations if failure to comply with the rules does not result in a danger to public health or safety or compliance with specific rules would produce hardship without producing benefits to the health and safety of the public that outweigh the hardship. In certain circumstances relating to waste nature and volume and the provisions of the Superfund law regarding ongoing maintenance and review, certain of the Solid Waste regulations regarding design of landfills, operational and maintenance requirements, and landfill closure and post-closure care may appropriately be subject to variance for the CFROU. Similarly, the ground water monitoring requirements of ARM 17.50.701 et seq. can be considered and coordinated with any other monitoring requirements under CERCLA. In general, the Solid Waste requirements listed in this section will not be used to require additional activities at the CFROU in situ treatment areas other than those activities described in the ROD—either through application of the previously invoked CERCLA waiver or through application of the variance described above.

E. Reclamation Requirements

The Strip and Underground Mine Reclamation Act, §§ 82-4-201 through 254, MCA, technically applies to coal and uranium mining, but that statute and the regulations promulgated under that statue and discussed in this section set out the standards that mine reclamation should attain. Those requirements identified here have been determined to be relevant and appropriate requirements for this action. Section 82-4-231 (Relevant and Appropriate) requires the reclamation and revegetation of the land as rapidly, completely, and effectively as the most modern technology and the most advanced state of the art will allow. In developing a method of operation and plans of backfilling, water control, grading, topsoiling and reclamation, all measures shall be taken to eliminate damages to landowners and members of the public, their real and personal property, public roads, streams, and all other public property from soil erosion, subsidence, landslides, water pollution, and hazards dangerous to life and property. Sections 82-4-231(10)(j) and (10)(k)(i) and ARM 17.24.751 (Relevant and Appropriate) provide that reclamation of mine waste materials shall, to the extent possible using the best technology currently available, minimize disturbances and adverse impacts of the operation on fish, wildlife, and related environmental values and achieve enhancement of such resources where practicable, and shall avoid acid or other toxic mine drainage by such measures as preventing or removing water from contact with toxic producing deposits. ARM 17.24.641 (Relevant and Appropriate) also provides that drainage from acid forming or toxic-forming spoil into ground and surface water must be avoided by preventing water from coming into contact

[16] See the letter from EPA to Chuck Stilwell, ARCO, dated May 21, 2002, which describes the application of variances to solid waste management rules for the Railroad Bed Time Critical Removal Action (TCRA) at the BPSOU.

with such spoil. ARM 17.24.505 (Relevant and Appropriate) similarly provides that acid, acid forming, toxic, toxic-forming or other deleterious materials must not be buried or stored in proximity to a drainage course so as to cause or pose a threat of water pollution.

Reclamation Activities—Hydrology Regulations (Relevant and Appropriate)

The hydrology regulations promulgated under the Strip and Underground Mine Reclamation Act, §§ 82-4-201 et seq., MCA, provide detailed guidelines for addressing the hydrologic impacts of mine reclamation activities and earth-moving projects and are relevant and appropriate for addressing these impacts in the CFROU.

ARM 17.24.631 (Relevant and Appropriate) provides that long-term adverse changes in the hydrologic balance from mining and reclamation activities, such as changes in water quality and quantity, and location of surface water drainage channels shall be minimized. Water pollution must be minimized and, where necessary, treatment methods utilized. Diversions of drainage to avoid contamination must be used in preference to the use of water treatment facilities. Other pollution minimization devices must be used if appropriate, including stabilizing disturbed areas through land shaping, diverting runoff, planting quickly germinating and growing stands of temporary vegetation, regulating channel velocity of water, lining drainage channels with rock or vegetation, mulching, and control of acid-forming, and toxic-forming waste materials.

ARM 17.24.633 (Relevant and Appropriate) provides water quality performance standards that may be invoked in the event that runoff from the treated areas threatens water quality or sediments in the stream, including the requirement that all surface drainage from a disturbed area must be treated by the best technology currently available (BTCA). Treatment must continue until the area is stabilized.

ARM 17.24.634 (Relevant and Appropriate) provides that, in reclamation of drainages, drainage design must emphasize channel and floodplain dimensions that approximate the pre-mining configuration and that will blend with the undisturbed drainage above and below the area to be reclaimed. The average stream gradient must be maintained with a concave longitudinal profile. This regulation provides specific requirements for designing the reclaimed drainage to:

1. approximate an appropriate geomorphic habit or characteristic pattern;
2. remain in dynamic equilibrium with the system without the use of artificial structural controls;
3. improve unstable premining conditions;
4. provide for floods and for the long-term stability of the landscape; and
5. establish a premining diversity of aquatic habitats and riparian vegetation.

ARM 17.24.635 through 26.4.637 (Relevant and Appropriate) set forth requirements for temporary and permanent diversions.

ARM 17.24.638 (Relevant and Appropriate) specifies sediment control measures to be implemented during operations.

ARM 17.24.639 (Relevant and Appropriate) sets forth requirements for temporary and permanent sedimentation ponds.

ARM 17.24.640 (Relevant and Appropriate) provides that discharge from sedimentation ponds, permanent and temporary impoundments, and diversions shall be controlled by energy dissipaters, riprap channels, and other devices, where necessary, to reduce erosion, prevent deepening or enlargement of stream channels, and to minimize disturbance of the hydrologic balance.

ARM 17.24.643 (Relevant and Appropriate) requires protection of groundwater resources.

ARM 17.24.645 (Relevant and Appropriate) sets forth requirements for groundwater monitoring.

ARM 17.24.646 (Relevant and Appropriate) sets forth requirements for surface water monitoring.

Reclamation and Revegetation Requirements (Relevant and Appropriate)

ARM 17.24.501 (Relevant and Appropriate) gives general backfilling and final grading requirements. Backfill must be placed so as to minimize sedimentation, erosion, and leaching of acid or toxic materials into waters, unless otherwise approved. Final grading must be to the approximate original contour of the land and final slopes must be graded to prevent slope failure, may not exceed the angle of repose, and must achieve a minimum long term static safety factor of 1:3. The disturbed area must be blended with surrounding and undisturbed ground to provide a smooth transition in topography.

ARM 17.24.519 (Relevant and Appropriate) provides that an operator may be required to monitor settling of regraded areas.

ARM 17.24.702(4), (5), and (6) (Relevant and Appropriate) requires that during the redistributing and stockpiling of soil (for reclamation):

1. regraded areas must be deep-tilled, subsoiled, or otherwise treated to eliminate any possible slippage potential, to relieve compaction, and to promote root penetration and permeability of the underlying layer; this preparation must be done on the contour whenever possible and to a minimum depth of 12 inches;

2. redistribution must be done in a manner that achieves approximate uniform thicknesses consistent with soil resource availability and appropriate for the postmining vegetation, land uses, contours, and surface water drainage systems; and

3. redistributed soil must be reconditioned by subsoiling or other appropriate methods.

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

ARM 17.24.711 (Relevant and Appropriate) requires that a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the area of land to be affected shall be established except on road surfaces and below the low-water line of permanent impoundments. See also § 82-4-233, MCA (Relevant and Appropriate). Vegetative cover is considered of the same seasonal variety if it consists of a mixture of species of equal or superior utility when compared with the natural vegetation during each season of the year (See also ARM 17.24.716 and 719 below regarding substitution of introduced species for native-species). This requirement may not be appropriate where other cover is more suitable for the particular land use or another cover is requested by the landowner.

ARM 17.24.713 (Relevant and Appropriate) provides that seeding and planting of disturbed areas must be conducted during the first appropriate period for favorable planting after final seedbed preparation.

ARM 17.24.714 (Relevant and Appropriate) requires use of a mulch or cover crop or both until an adequate permanent cover can be established. Use of mulching and temporary cover may be suspended under certain conditions.

ARM 17.24.716 (Relevant and Appropriate) establishes the required method of revegetation, and provides that introduced species may be substituted for native species as part of an approved plan.

ARM 17.24.717 (Relevant and Appropriate) relates to the planting of trees and other woody species if necessary, as provided in § 82-4-233, MCA, to establish a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the affected area and capable of self-regeneration and plant succession at least equal to the natural vegetation of the area, except that introduced species may be used in the revegetation process where desirable and necessary to achieve the approved land use plan.

ARM 17.24.718 (Relevant and Appropriate) requires the use of soil amendments and other means such as irrigation, management, fencing, or other measures, if necessary to establish a diverse and permanent vegetative cover.

ARM 17.24.719 (Relevant and Appropriate) sets forth requirements for livestock grazing on reclaimed land.

ARM 17.24.721 (Relevant and Appropriate) specifies that rills or gullies in reclaimed areas must be filled, graded or otherwise stabilized and the area reseeded or replanted if the rills and gullies are disrupting the reestablishment of the vegetative cover or causing or contributing to a violation of water quality standards for a receiving stream.

ARM 17.24.723 (Relevant and Appropriate) sets forth requirements for vegetation, soils, wildlife, and other monitoring.

ARM 17.24.724 (Relevant and Appropriate) specifies that revegetation success must be measured against approved unmined reference areas or by comparison with technical standards from historic data. More than one reference area or historic record must be established for vegetation types with significant variation due to a number of factors.

ARM 17.24.726 (Relevant and Appropriate) sets forth vegetation production, cover, diversity, density, and utility requirements.

ARM 17.24.728 (Relevant and Appropriate) sets forth performance standards for native species and introduced species in revegetated areas.

ARM 17.24.733 (Relevant and Appropriate) sets forth performance standards for composition and stocking of trees, shrubs, and half shrubs on the revegetated area and for measurement of revegetation success.

To Be Considered Documents (TBCs)

The use of documents identified as TBCs is addressed in the Introduction, above. A list of TBC documents is included in the Preamble to the NCP, 55 Fed. Reg. 8765 (March 8, 1990). Those documents, plus any additional similar or related documents issued since that time, will be considered by EPA and DEQ during the remedy implementation.

Other Laws (Non-Exclusive List)

CERCLA defines as ARARs only federal environmental and state environmental and siting laws. Remedial design, implementation, and operation and maintenance must nevertheless comply with all other applicable laws, both state and federal, if the remediation work is done by parties other than the federal government or its contractors.

The following "other laws" are included here to provide a reminder of other legally applicable requirements for actions being conducted at this operable unit. They do not purport to be an exhaustive list of such legal requirements, but are included because they set out related concerns that must be addressed and, in some cases, may require some advance planning. They are not included as ARARs because they are not "environmental or facility siting laws." As applicable laws other than ARARs, they are not subject to ARAR waiver provisions.

Section 121(e) of CERCLA exempts removal or remedial actions conducted entirely on-site from federal, state, or local permits. This exemption is not limited to environmental or facility siting laws, but applies to other permit requirements as well.

Other Federal Laws

Occupational Safety and Health Regulations

The federal Occupational Safety and Health Act regulations found at 29 CFR § 1910 are applicable to worker protection during conduct of remedial activities.

Other Montana Laws

1. Groundwater Act

Section 85-2-505, MCA, (Applicable) precludes the wasting of groundwater. Any well producing waters that contaminate other waters must be plugged or capped, and wells must be constructed and maintained so as to prevent waste, contamination, or pollution of groundwater.

Section 85-2-516, MCA, states that within 60 days after any well is completed a well log report must be filed by the driller with the DNRC and the appropriate county clerk and recorder.

2. Public Water Supply Regulations

If remedial action at the site requires any reconstruction or modification of any public water supply line or sewer line, the construction standards specified in ARM 17.38.101 (Applicable) must be observed.

3. Water Rights

Section 85-2-101, MCA, declares that all waters within the state are the state's property, and may be appropriated for beneficial uses. The wise use of water resources is encouraged for the maximum benefit to the people and with minimum degradation of natural aquatic ecosystems.

Parts 3 and 4 of Title 85, Chapter 2, MCA, set out requirements for obtaining water rights and appropriating and utilizing water. All requirements of these parts are laws which must be complied with in any action using or affecting waters of the state. Some of the specific requirements are set forth below.

Section 85-2-301, MCA, of Montana law provides that a person may only appropriate water for a beneficial use.

Section 85-2-302, MCA, specifies that a person may not appropriate water or commence construction of diversion, impoundment, withdrawal or distribution works therefor except by applying for and receiving a permit from the Montana Department of Natural Resources and Conservation. While the permit itself may not be required under federal law, appropriate notification and submission of an application should be performed and a permit should be applied for in order to establish a priority date in the prior appropriation system.

Section 85-2-306, MCA, specifies the conditions on which groundwater may be appropriated, and, at a minimum, requires notice of completion and appropriation within 60 days of well completion.

Section 85-2-311, MCA, specifies the criteria which must be met in order to appropriate water and includes requirements that:

1. there are unappropriated waters in the source of supply;
2. the proposed use of water is a beneficial use; and
3. the proposed use will not interfere unreasonably with other planned uses or developments.

Section 85-2-402, MCA, specifies that an appropriator may not change an appropriated right except as provided in this section with the approval of the DNRC.

Section 85-2-412, MCA, provides that, where a person has diverted all of the water of a stream by virtue of prior appropriation and there is a surplus of water, over and above what is actually and necessarily used, such surplus must be returned to the stream.

4. Controlled Ground Water Areas

Pursuant to § 85-2-507, MCA, the Montana Department of Natural Resources and Conservation may grant either a permanent or a temporary controlled ground water area. The maximum allowable time for a temporary area is two years, with a possible two-year extension.

Pursuant to § 85-2-506, MCA, designation of a controlled ground water area may be proposed if: (i) excessive ground water withdrawals would cause contaminant migration; (ii) ground water withdrawals adversely affecting ground water quality within the ground water area are occurring or are likely to occur; or (iii) ground water quality within the ground water area is not suited for a specific beneficial use.

5. Occupational Health Act, §§ 50-70-101 et seq., MCA.

ARM § 17.74.101 addresses occupational noise. In accordance with this section, no worker shall be exposed to noise levels in excess of the levels specified in this regulation. This regulation is applicable only to limited categories of workers and for most workers the similar federal standard in 29 CFR 1910.95 applies.

ARM § 17.74.102 addresses occupational air contaminants. The purpose of this rule is to establish maximum threshold limit values for air contaminants under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects. In accordance with this rule, no worker shall be exposed to air contaminant levels in excess of the threshold limit values listed in the regulation. This regulation is applicable only to limited categories of workers and for most workers the similar federal standard in 29 CFR § 1910.1000 applies.

6. Montana Safety Act

Sections 50-71-201, 202 and 203, MCA, state that every employer must provide and maintain a safe place of employment, provide and require use of safety devices and safeguards, and ensure that operations and processes are reasonably adequate to render the place of employment safe. The employer must also do every other thing reasonably necessary to protect the life and safety of its employees. Employees are prohibited from refusing to use or interfering with the use of safety devices.

7. Employee and Community Hazardous Chemical Information

Sections 50-78-201, 202, and 204, MCA, state that each employer must post notice of employee rights, maintain at the work place a list of chemical names of each chemical in the work place, and indicate the work area where the chemical is stored or used. Employees must be informed of the chemicals at the work place and trained in the proper handling of the chemicals.

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Clark Fork River Operable Unit

of the Milltown Reservoir/Clark Fork River Superfund Site

Record of Decision

Appendix B:

Clark Fork River OU Streambank Stabilization Design Consideration and Examples

U.S. Environmental Protection Agency
Region 8

10 West 15th Street
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April 2004

APPENDIX B

Clark Fork River OU Streambank Stabilization Design Consideration and Examples

Flood Hydrology on the Upper Clark Fork River

Because of the short periods of record for Clark Fork River gage stations within Reach A, a procedure to correlate the data with downstream stations having longer periods of record was conducted by R2 Resource Consultants (2000) to refine estimates of flood flows for various return periods. Two different calculations of peak flows at the Deer Lodge gage station (#12324200) are presented in Exhibit B-1 for several return flow periods. One calculation is based solely on the 21 years of actual gage data at the Deer Lodge station. The other calculation is correlated with a downstream gage having a longer period of record, which is used to extend the effective period of record at Deer Lodge to 48.4 years.

Bankfull flow of the Clark Fork River at Deer Lodge has been calculated to be about 1,900 cfs (Griffin and Smith 2001). At this stage, the flow begins to spill out of the channel and disperse onto the floodplain. When a river floodplain is broad relative to its channel width, as is the case for the upper Clark Fork, a flow stage above bankfull produces a large increase in overbank discharge. However, this occurs with a very small increase within the channel (Smith and Griffin 2002) because the increased flow is distributed over the floodplain at a shallow depth. Since both shear stress and velocity are functions of flow depth, these critical factors of erosion potential increase very slowly as total discharge increases beyond bankfull stage.

Referring to Exhibit B-1, a 25-year flood at 2,830 cfs is about 900 cfs above bankfull discharge. Throughout Reach A, the Clark Fork River has access to a floodplain in excess of one channel width wide on at least one side of the channel. Only in the town of Deer Lodge do high banks on both sides of the river confine the flows above bankfull stage causing an increase in flow depth instead of dispersing over the floodplain.

EXHIBIT B-1
Annual Peak Flow Calculations for the Clark Fork River at Deer Lodge USGS Gage No. 12324200

Return Period	Peak Flow (cfs) 21 Year Record	Peak Flow (cfs) 48.4 Year Record (Extrapolated)
2-year flood	987	1,090
5-year flood	1,610	1,750
10-year flood	2,050	2,220
20-year flood	2,490	2,680
25-year flood	2,630	2,830
50-year fllod	3,080	3,330
100-year flood	3,530	3,770

Streambank Stabilization Considerations

Designers of streambank stabilization projects must ensure that the materials placed within the channel or on the streambanks will remain stable over the full range of conditions expected during the design life of the project. Unfortunately, techniques to characterize stability thresholds are limited. Empirical data for shear stress or stream power are generally lacking, but the existing body of information is summarized here. The presence of dense, woody vegetation on streambanks can decrease erosion substantially by reducing the shear stress along the streambanks, and by increasing the cohesion of the soil comprising the streambanks (Griffin and Smith 2001).

The stability of a stream refers to how it accommodates itself to the inflowing water and sediment load. Erosion occurs when the hydraulic forces in the flow exceed the resisting forces of the channel boundary. The two traditional approaches for characterizing stream flow erosion potential use maximum permissible velocity or critical shear stress. Flow velocity can be measured directly, but shear stress cannot; however, shear stress is a better measure of the fluid force on the channel boundary than is velocity. Moreover, conventional guidelines, including ASTM standards, rely upon the shear stress as a means of assessing the stability of erosion control materials.

Vegetation has a profound effect on the stability of both cohesive and non-cohesive soils. It serves as an effective buffer between the water and the underlying soil. It increases the effective roughness height of the boundary, thereby increasing flow resistance and displacing the flow velocity upwards away from the soil. This reduces drag and lift acting on the soil surface. Since boundary shear stress is proportional to the square of the near-streambank velocity, a reduction in this velocity produces a much greater reduction in the forces causing erosion.

Vegetation armors the soil surface, but the roots and rhizomes of plants also bind the soil and introduce extra cohesion beyond any intrinsic cohesion of the streambank material. The presence of vegetation does not render underlying soils immune from erosion, but the threshold for erosion of a vegetated bank is usually the point of breakage or uprooting of the plants rather than the threshold for movement of the soil particles. Vegetation failure usually occurs at much greater flow intensity than does soil erosion.

The stability of a waterway or the suitability of various channel linings can be determined by first calculating actual mean velocity and shear stress. These values can then be compared with allowable velocity and shear stress for a particular treatment application.

Mechanics of Stabilizing Streambanks

Treatments are designed for streambanks where engineered safety needs to be combined with ecological function and aesthetics. This means they incorporate live, source-identified, site-adapted, vegetation with various applications of structural materials to protect the streambank from the erosive forces of the river water. The material is flexible (i.e. forgiving of grading mistakes), yet strong and easy to use. These materials are typically used in strong currents, high-energy sites, on steep slopes as erosion control material, and revegetation units for difficult sites where energy conditions require an instant solution of strength and stability and simultaneous re-establishment of vegetation. Another prime criteria for

inclusion in this approach is that the treatments all minimize disturbance to the aquatic and the terrestrial riparian system during installation.

Coconut fiber coir blankets, mats, and logs that can be pre-vegetated with native plants are widely accepted and used as appropriate materials to protect erodible streambanks. However, for protecting streambanks that are exposed to the most severe erosive forces, a heavier engineering approach may be required. In the United States, since the advent of heavy machinery for moving earth and large rock, the use of large rock has become the most frequently applied solution in these placations. However, there is a cost effective, functionally effective, and aesthetically pleasing alternative that uses smaller rock (4-to-6 inch) compatible to, and readily available in, most river systems. This material is used throughout Europe to stabilize rivers. Rock roll and chambered rock mattress are products consisting of heavy duty polypropylene (environmentally inert) net casings that are filled at the site with suitably sized rock native to the local area and placed at the toe of the most vulnerable streambanks. Heavy equipment is required for installation.

Typical applications in Europe of the chambered rock mattress are on steep embankments with high erosive forces where engineered safety has to be combined with ecological function and aesthetics. Typical uses include:

- Toe protection
- Steep bank slopes (1:1.5)
- Channel liners and bridge aprons
- Submerged dams and shelves
- Reservoir inlet and discharge channels
- Filling-in of scour holes
- Jetties and guide dams
- Breakwaters
- Drainage layers

A sediment filter screen within the net casing of the rock roll and chambered rock mattress may be included that will allow the enclosed rock to collect sediment and become integrated into the natural streambank as rooting medium for vegetation, while blocking sediment from entering the stream. A great advantage of this method of protecting the streambank toe is the reduced need to disturb either the streambank or the channel bottom. These net casings containing smaller rock do not require digging of keyways and will conform to subsurface contours.

In moderate shear stresses/water velocities, rock rolls are another treatment, and they act as small, flexible, and permanent gabions. In turbulent flows, rock rolls are used to provide a solid foundation on top of which pre-vegetation coir rolls can be installed. The roots of plants then quickly grow into the voids of the rock rolls giving long term erosion control and bank support. Rock rolls that are installed below coir units can also be used to support a filter fabric or biodegrading matting. This system retains the fines in the streambank while the roots of the plants from the pre-vegetated coir units establish themselves into the streambank and through the woven geotextile into the suitable fill.

Traditional Approach

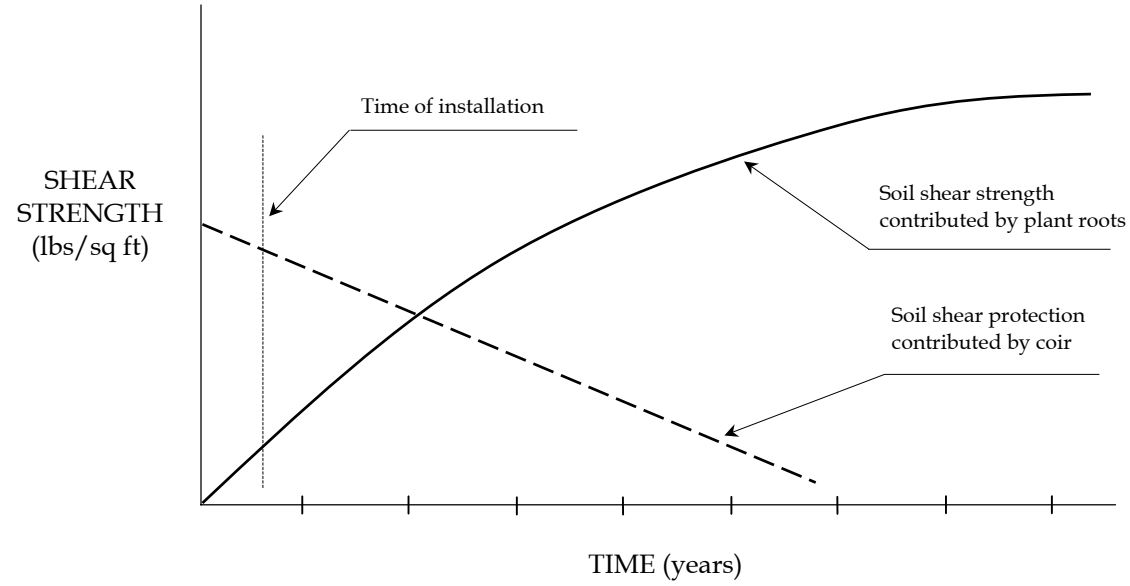
Traditional methods use a variety of methods for stabilizing various conditions of channel shear stress and flow velocity. Three typical levels of susceptibility to erosion and treatment types are:

1. Low to moderate (less than 3 to 4 feet per second velocity and less than 4 pounds per square feet shear stress), with treatment by revegetation
2. Moderate to high (less than 8 feet per second velocity and less than 6 pounds per square feet shear stress), with treatment by biotechnical methods (coir fabric, large rock toe protection, and revegetation)
3. High (exceeds 8 feet/sec velocity and exceeds 6 pounds per square feet shear stress), with hard structural treatment (rip-rap, with in-stream flow deflectors in some cases)

Bioengineering Approach

Commonly available bioengineered materials offer inherent resistance to shear stress on the order of 3 to 5 pounds per square foot. Several companies produce these materials in the form of logs in a variety of diameters for application along lines of high stress, and in mats for use on wider surfaces. These materials are available in several forms designed for particular applications in stabilizing disturbed sites with challenging potential for erosion. However, although these bioengineered materials (typically made of coir fiber from coconut husks) are very strong, they do biologically degrade over time, and are intended to supply stabilizing enforcement during the period necessary for live vegetation to become established and take over the mechanical soil stabilization duties (Exhibit B-2).

EXHIBIT B-2
Idealized relationship to show how over time the plant roots assume the entire role of reinforcing the soil strength to resist shear stress, as the coir biodegrades. Note that the actual strength is the sum of the two components, plus that of the soil's own cohesive strength.



Modern techniques have now been developed to grow the plants in the coir material in advance of application on site. In this way, the inherent strength of the coir is augmented from initial installation beyond the 3 to 5 pounds per square foot by whatever additional strength is also provided by the integrated roots of the live plants. These pre-vegetated coir products typically have the plants growing in the material for one growing season before installation on a project, so that the root systems of the plants are well developed and already providing substantial fiber strength and biomass to the coir product.

Unvegetated soil is generally strong in compression, but weak in tension. The fibrous roots of vegetation have the opposite characteristics; therefore, a composite of a soil permeated by plant roots has enhanced strength (Simon and Collison 2001). The amount by which plant roots augment soil strength varies immensely by species. According to Hoitsma and Payson (1998) vegetation resistance to shear stress is reported to vary from 0.35 to 8.50 pounds per square feet. Simon and Collison (2001), found that, even with the negative surcharge of the weight of trees, the net effect of adding riparian species to unvegetated banks was to double the effective strength when compared to unvegetated soil during a dry year (in Mississippi), using several species of riparian trees and grasses commonly used in revegetation projects in that region.

Goldsmith (1998) reports laboratory tests of strain resistance to shear stresses on blocks of riparian soil (medium sand texture) containing various kinds of plant root structures. These tests found that sedges increased resistance of the soil block to failure by a factor of 18.5 over a block of soil with no vegetation. Similar tests on a block with a single willow stem (0.6 inch diameter) and its associated sparse roots showed an increased resistance to failure by a factor of 3. A listing of ten studies measuring increases in soil cohesion due to the addition of roots of a variety of plant species shows universal increase that ranges from a factor of 2 to a factor of 17.5 (average increase = 5.7 times) (Coppin and Richards 1990). While we are less concerned with the load bearing strength of soils in the context of streambank stabilization and resistance to erosion, Goldsmith's comparison does reveal the magnitude of relative gains in soil strength contributed by the addition of plant roots. The following shear load to deform in pounds per square foot, according to Goldsmith, is as follows:

- Bare Soil (No Plant Roots): 64
- Soil with Sedge Roots: 1,184
- Soil with Willow Roots: 191

While every application is unique and all plant species differ in pertinent characteristics, we can be assured that integrating live plant roots into a coir product will significantly increase its inherent resistance to shear stresses. The intent is to transfer shear stress on the soil to tensile resistance of plant roots as a function of the interface friction along the root surfaces. This process can be greatly augmented and hastened by reinforcing a high-strength growth medium that comes with its own inherent resistance to shear stress. The tensile strength of plant roots also varies among species. Species of the genera *Salix* (willow), *Betula* (birch), and *Alnus* (alder) all have roots with tensile strengths in the range of 24.17 pounds per square feet to 27.92 pounds per square foot (Coppin and Richards 1990). Exhibit B-3 shows a comparison of properties of some of the different materials discussed above.

Pre-vegetated coir products described above can easily satisfy structural requirements for stabilizing streambanks in all but the most critical sites where public works infrastructure

installations have to be protected in place by absolutely rigid structures. These pre-vegetated coir products provide even further gains in protection of banks through the added friction to flowing water from roughness because the plants grow from the coir. This added roughness slows the water velocity at the critical surface boundary layer, and steadily increases in effectiveness over time.

EXHIBIT B-3
Comparison of Streambank Material Properties

Boundary Material	Critical Boundary Shear Stress (lb/ft^2)	Critical Water Velocity (ft/sec)	Reference
Bare Soils			
Sandy Loam	0.03 – 0.04	1.75	(Chang 1988)
Alluvial Silt	0.045 – 0.05	2	(Chang 1988)
Mixed Silt to Cobble	0.43	4	(Chang 1988)
Rock			
1-inch Gravel	0.33	2.5 – 5	(Chang 1988)
2-inch Gravel	0.67	3 – 6	(Chang 1988)
6-inch Gravel	2.0	4 – 7.5	(Chang 1988)
Large Rock (Rip-Rap) (D50 = 2 feet)	10.1	14 – 18	(Kouwen, Li, Simons 1980)
Gabion	10	14 – 19	(Goff 1999)
Rock Roll (16 – 20 in. diameter)	12 (estimate)	At Least 16	
Chamber Rock Mattress (1 feet thick by 5 feet wide)	15 (estimate)	At Least 16	
Vegetated Soil			
Long, Native Grasses	1.2 – 1.7	4 – 6	(Fischenich 2001)
Hardwood Trees	0.45 – 2.5	Unknown	(Fischenich 2001)
Bioengineering			
Coir Roll-Sod (Unvegetated)	5	15	(Santha 2003)
Coir Roll-Sod (Vegetated)	4 – 8	9.5	(Gray and Sotir 1996)
Coir Roll-Sod (Pre-vegetated)[a]	12+	At Least 15	(Di Pietro and Brunet 2002)
Coir Fiber Roll (Un-vegetated)	3 – 5	8 – 16	(Fischenich 2001, Santha 2003)
Coir Fiber Roll (Pre-vegetated)[a]	12+	At Least 16	(Di Pietro and Brunet 2002)

[a] Critical shear stress and water velocity are based upon values at installation. After installation, the roots of the plants grow into the streambank and the values increase greatly.

Anchoring the Critical Streambank Toe—Traditional methods typically offer a design utilizing large rock to anchor the streambank toe. The toe of the streambank slope is where shear stress is greatest against the streambank, and where streambank failure is most likely to happen. Angular rock is typically required for such applications to achieve stability. Most sources of such material are distant and expensive. A simpler solution utilizes smaller rounded rock, readily available within the floodplain, in rock rolls or rock mattresses. These are tubes of strong netting in various configurations that are filled with this smaller rock on site and laid in place to protect the streambank toe. The netting is typically made of an environmentally inert material that holds the rock in place 10 to 20 years, or until the banks are well protected by natural vegetation. Added benefits are that the rock used in the rock rolls is locally obtained in the valley and is round. This means that the rock is native to the floodplain and the round rock is similar to the rock in the streambed and that it will provide interstitial spaces for macroinvertebrate habitat, which are an indicator of water quality and

overall health. Large, angular rip-rap does not provide the same type and amount of such spaces.

Matching Streambank Stabilization Techniques and Materials to Site-Specific Criteria

The following paragraphs offer a general procedure for matching streambank stabilization techniques and materials to specific site applications in terms of actual erosion potential (Fischenich 2001).

Step 1: Estimate Mean Hydraulic Conditions

Flow of water in a channel is governed by the discharge, hydraulic gradient, channel geometry, and roughness coefficient. This functional relationship may be evaluated using normal depth computations that take into account principles of conservation of linear momentum, which take into account variations in momentum slope directly related to shear stress. Several models are available to aid in assessing hydraulic conditions. Notable examples include HEC-2, HEC-RAS, and WSP2. Channel cross sections, slopes, and Manning's coefficients should be determined based upon surveyed data and observed or predicted channel boundary conditions. Output from the model should be used to compute main channel velocity and shear stress at each cross section.

Step 2: Estimate Local/Instantaneous Flow Conditions

The computed values for velocity and shear stress may be adjusted to account for local variability and instantaneous values higher than mean. A number of procedures exist for this purpose. Most commonly applied are empirical methods based upon channel form and irregularity. Local maximum shear stress can be assumed from the following simple equations (Fischenich 2001):

$$\lambda_{max} = 1.5t \text{ (for straight channels)}$$
$$\lambda_{max} = 2.65(R_c/W)^{-0.5} \text{ (for sinuous channels)}$$

Where λ is the computed value of actual shear stress at a cross section, R_c is the radius of curvature, and W is the top width of the channel. These equations adjust for the spatial distribution of shear stress; however, temporal maximums in turbulent flows can be 10 to 20 percent higher. A further adjustment is needed to account for instantaneous maximums, and a factor of 1.15 is usually applied (Fischenich 2001).

Step 3: Determine Existing Stability

Existing stability should be assessed by comparing estimates of local and instantaneous shear and velocity to values for the materials available for use. Both the underlying soil and the soil/vegetation condition should be assessed. If the existing conditions are deemed stable and are in agreement with other project objectives, then no further action is required. Otherwise, proceed to Step 4.

Step 4: Select Channel Lining Material

If existing conditions are unstable, or if a different material is needed along the channel perimeter to meet project objectives, then the new material or stabilization measure should be selected by using the critical threshold values as a guideline. Only material with a threshold exceeding the predicted value plus safety factor should be selected.

Suggested Design Criteria for Clark Fork River Streambank Treatments

Exhibit B-4 shows the suggested maximum values of shear stress and flow velocity for the proposed streambank treatment designs for the Upper Clark Fork River.

EXHIBIT B-4
Allowable Maximum Values of Shear Stress and Flow Velocity for Bioengineered Streambank Treatment Designs

Treatment	Description	Maximum Allowable Shear Stress (lb/ft^2)	Maximum Allowable Flow Velocity (ft/sec)
Treatment 2	Pre-vegetated Coir	8[a]	9.5[a]
Treatment 3	Pre-vegetated Coir and Rock Roll	10[b]	15[b]
Treatment 4	Pre-vegetated Coir and Rock Mattress	12[b]	16[b]

[a] from Gray and Sotir (1996)
[b] from Di Pietro and Brunet (2002)

Examples of Streambank Treatments for Various Conditions

Once the data for various streambank reaches is completed and interpreted and the appropriate lengths of banks by classification is determined, appropriate streambank stabilization designs, depending on classification, can then can be determined. Components of the following designs includes a bio-engineering component for physically stabilizing the streambank and streambank toe if appropriate. Also included are revegetation plans for the riparian corridor that further serve to stabilize and protect the installed streambank erosion protection component but further serve to protect the riparian corridor from floodplain flow erosion as well. Over time, as these differing sizes of woody vegetation mature, both streambank and floodplain erosion protection will increase.

The following treatment designs are those designs developed as examples for the Upper Clark Fork River. Final decision on the actual design specifications will be made in the remedial design phase. As the streambank work progresses, site-specific designs or other designs will be necessary. The treatments are ordered from low shear stresses and flow velocities to high shear stresses and high velocities. The diagrams shown throughout this discussion are not drawn to scale.

1. **No Treatment Necessary**—This applies to streambanks where there is adequate deep, binding woody vegetation already in place, and no additional work on the site is necessary.

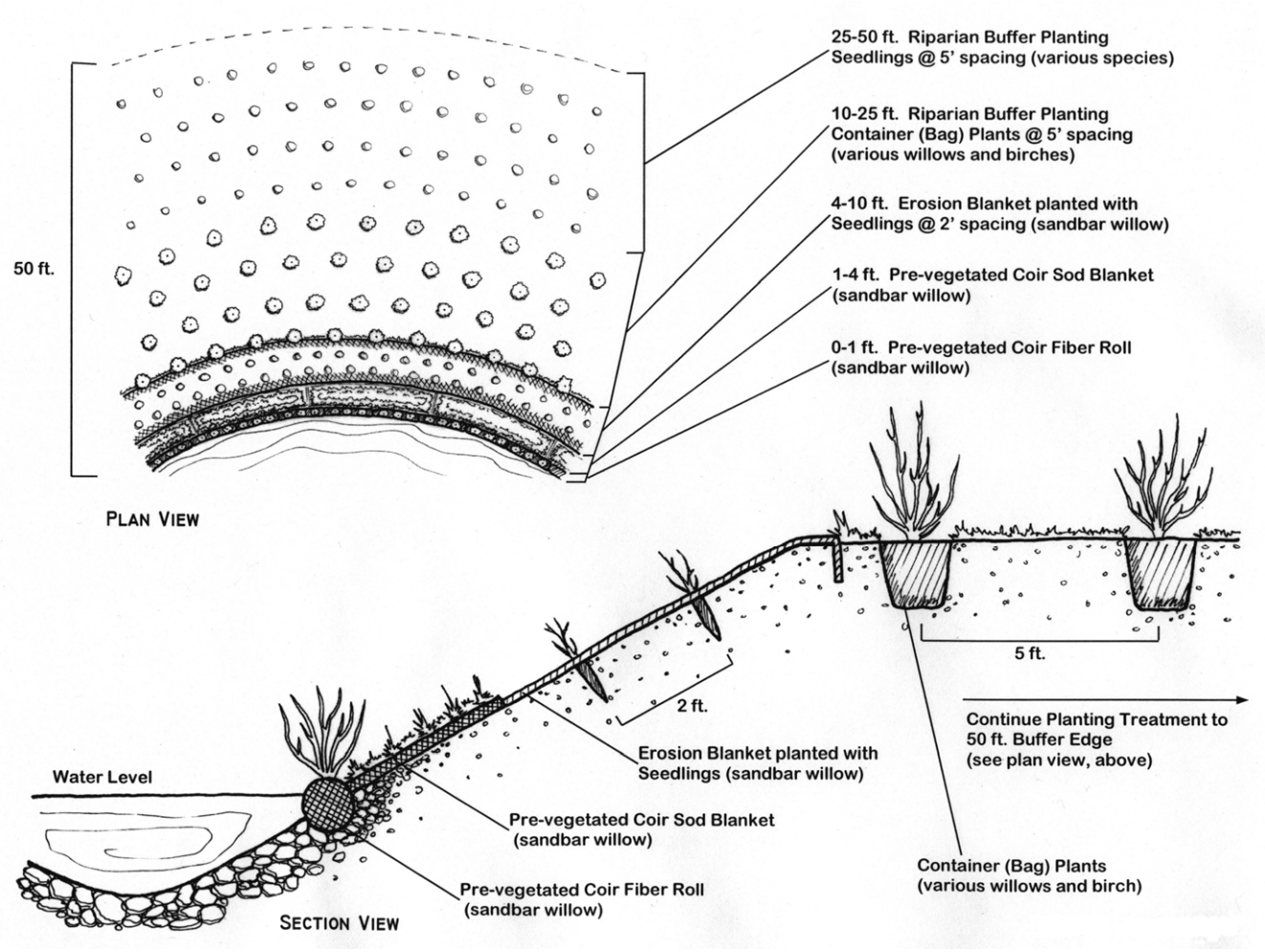
2. **Treatment 1 (vegetation augmentation)—**Augment existing vegetation with additional small-containerized plants. May require scalping and weed barriers for better survival. Assumption is that in this treatment, the average canopy cover of deep, binding woody vegetation is 50 percent. Therefore, the treatment will be the planting of 10 containerized plants at a level of 10 plants per 10 feet or 1 plant per linear feet of streambank. The mixture would be as follows:

- 25 percent *Salix exigua* (sandbar willow) wet areas
- 25 percent *Betula occidentalis* (water birch) wet areas
- 50 percent equal mixture of *Salix lutea* (yellow willow), wet areas; *Salix boothii* (Booth willow), wet areas; *Salix bebbiana* (Bebb willow), wet areas; *Alnus incana* (mountain alder), wet areas; *Cornus stolonifera* (red-osier dogwood), wet areas; *Prunus virginiana* (common chokecherry), dry areas; and *Amelanchier alnifolia* (western serviceberry), dry areas.

3. **Treatment 2 (low shear stresses/flow velocities)—**Pre-vegetated coir roll-sod with a toe protection of pre-vegetated fiber-rolls (comprised of sandbar willow [*Salix exigua*]) is considered Treatment 2 (see Exhibit B-5). Because of the sandy/gravelly streambank material (relatively unconsolidated in many places), the species mix for the roll-sods will be exclusively *Salix exigua* (sandbar willow). In other words, it is too sandy (therefore too droughty) for sedges to take hold. They need to have more silt/clay in the soil profile. Within the nominal 50-foot zone, the following will apply:

    a. 1-to-25 foot zone
        i. Pre-vegetated coir fiber-roll for toe protection (*Salix exigua* [sandbar willow]).
        ii. 3 feet of pre-vegetated coir roll-sod planted with *Salix exigua* (sandbar willow).
        iii. 6 feet of coir woven blanket (23 oz./square yard) planted with two rows of 10T containerized *Salix exigua* (sandbar willow) on a 2-foot spacing.
        iv. Three rows of bag plants of *Salix exigua* (sandbar willow) and *Betula occidentalis* (water birch) at a ratio of 2:1 (sandbar willow:water birch). The three rows will be on 5-foot spacing with the first plant at 10 feet and the last plant at 20 feet from the edge of the stream. These plants will be augered into the floodplain so that the roots are in constant contact with capillary fringe throughout the growing season.
        v. One row of bag plants of an equal mixture of *Salix lutea* (yellow willow), *Salix bebbiana* (Bebb willow), and *Salix boothii* (Booth willow).
    b. 25 to 50 foot zone
        i. Four rows of 10T containerized shrubs at a 5 foot spacing. The plants include *Salix lutea* (yellow willow) wet areas; *Salix boothii* (Booth willow) wet areas; *Salix bebbiana* (Bebb willow) wet areas; *Alnus incana* (mountain alder) wet areas; *Cornus stolonifera* (red-osier dogwood) wet areas; *Prunus virginiana* (common chokecherry) dry areas; and *Amelanchier alnifolia* (western serviceberry) dry areas.

EXHIBIT B-5
Streambank Treatment 2—Low Shear Stresses/Flow



4. **Treatment 3 (moderate shear stresses/flow velocities)—**Pre-vegetated coir roll-sod with a toe protection of pre-vegetated fiber-rolls comprised of *Salix exigua* (sandbar willow) on top of rock roll is considered Treatment 3 (see Exhibit B-6). Also included is tipped over mature willow on a spacing of 15 feet along the streambank to deflect and dissipate the energy of the stream. The design for the zone behind the immediate streambank work is the same as Type 2 Treatment.

   Exhibit B-7 illustrates the typical installation for the rock roll and pre-vegetated coir fiber roll.

EXHIBIT B-6
Streambank Treatment 3—Moderate Shear Stresses/Flow

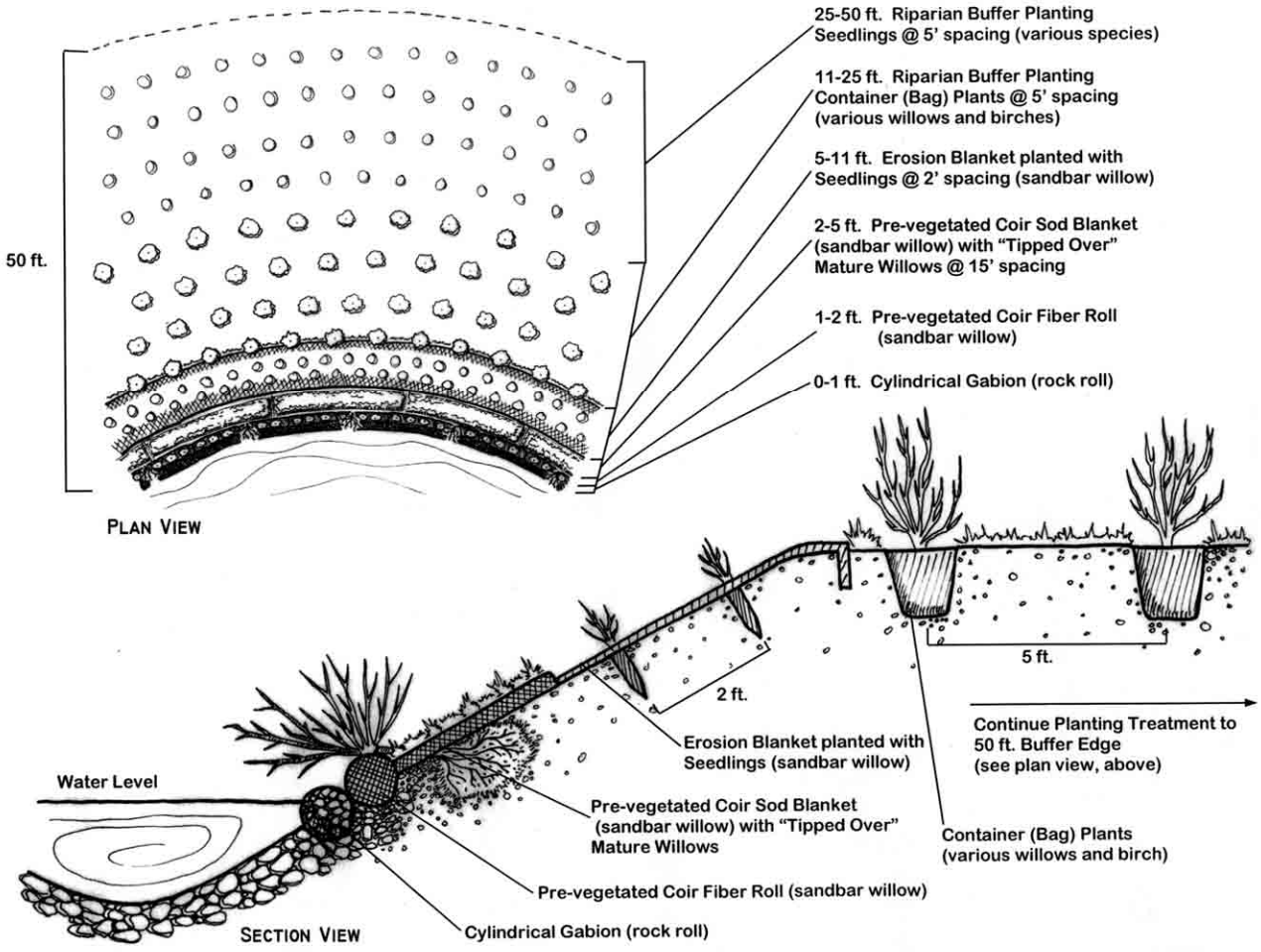
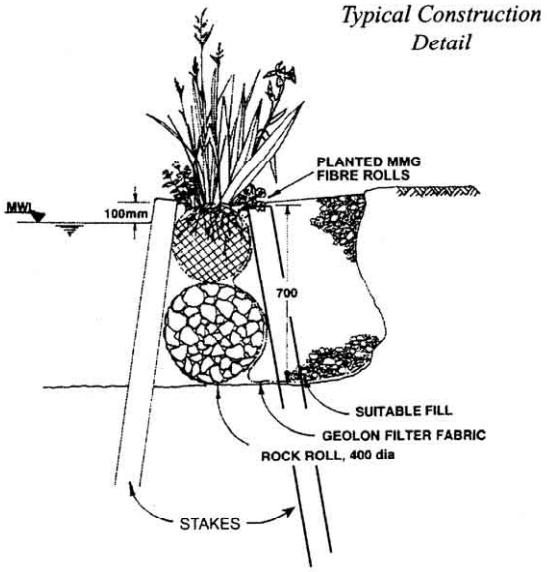
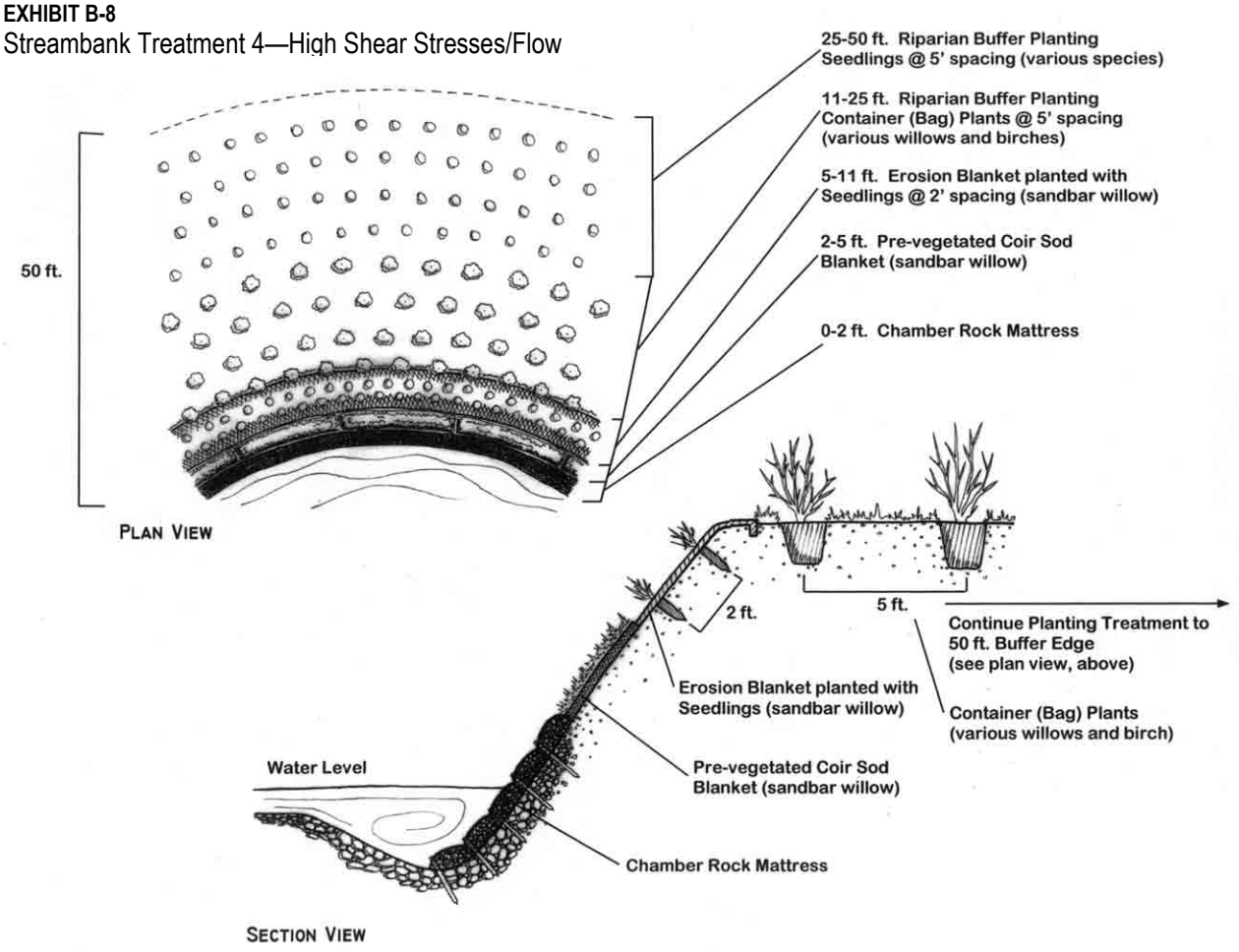


EXHIBIT B-7
Typical Construction Detail



5. **Treatment 4 (high shear stresses/flow velocities)**—Pre-vegetated coir roll-sod with a toe protection of rock mattress is considered Treatment 4 (see Exhibit B-8.) Also included is tipped over mature willow on a spacing of 15 feet along the streambank to deflect and dissipate the energy of the stream. The design for the zone behind the immediate streambank work is the same as Type 2 Treatment.

EXHIBIT B-8
Streambank Treatment 4—High Shear Stresses/Flow



Bio-Stabilization

As shown in the illustrations above, willow sprigs planted near the edge of the river and tipped-over willows (which deflect water flow away from the streambank) are to be the first structures to stabilize the banks of the river. Additional stabilization is achieved by planting "bagged" willows and mature willow transplants. These four types of bio-stabilization are implemented within the first 25 feet away from the river streambank. The second 25 feet away from the streambank is planted with additional bagged willows, and other woody vegetation including chokecherry, red dogwood, alder, serviceberry, water birch, and others. The intensity of woody plants is less for inside bends compared to outside bends of the river. Herbaceous communities are also to be established within this zone to provide riparian pastures for use by livestock and wildlife. This approach will provide herbaceous forage production for the landowner and maximum growth of woody vegetation to protect

against erosion, soil loss, and floodplain deformation. A key component in establishing successful woody and herbaceous vegetation within the riparian corridor buffer will be supplemental irrigation for 2 to 3 years following implementation. This will provide optimum growth of these stabilizing plants, thereby reducing the time to attain streambank stability, as well as overall floodplain stability. In addition, supplemental irrigation will hasten establishment of grasses and forbs, and retard the invasion of unwanted plant species, specifically weeds.

Salix exigua (sandbar willow) is considered either an obligate wetland species or a facultative wetland species. Therefore, *Salix exigua* (sandbar willow) needs to be close to the water table to survive. If supplemental watering is not available, planting depth of the root-control bags can be adjusted to compensate. The planting depth should be deep enough so that the plant is in constant contact with the capillary fringe throughout the growing season. Planting *Salix exigua* (sandbar willow) at this depth will not affect the health of the plant. *Salix exigua* (sandbar willow) evolved in an environment where sediment deposition of up to 1 to 2 meters after a single high flow event (e.g., flood) can occur. When this happens, the plant develops new roots along the entire length of the buried stems. Therefore, augering the holes deeper can be used to compensate for supplemental watering concerns.

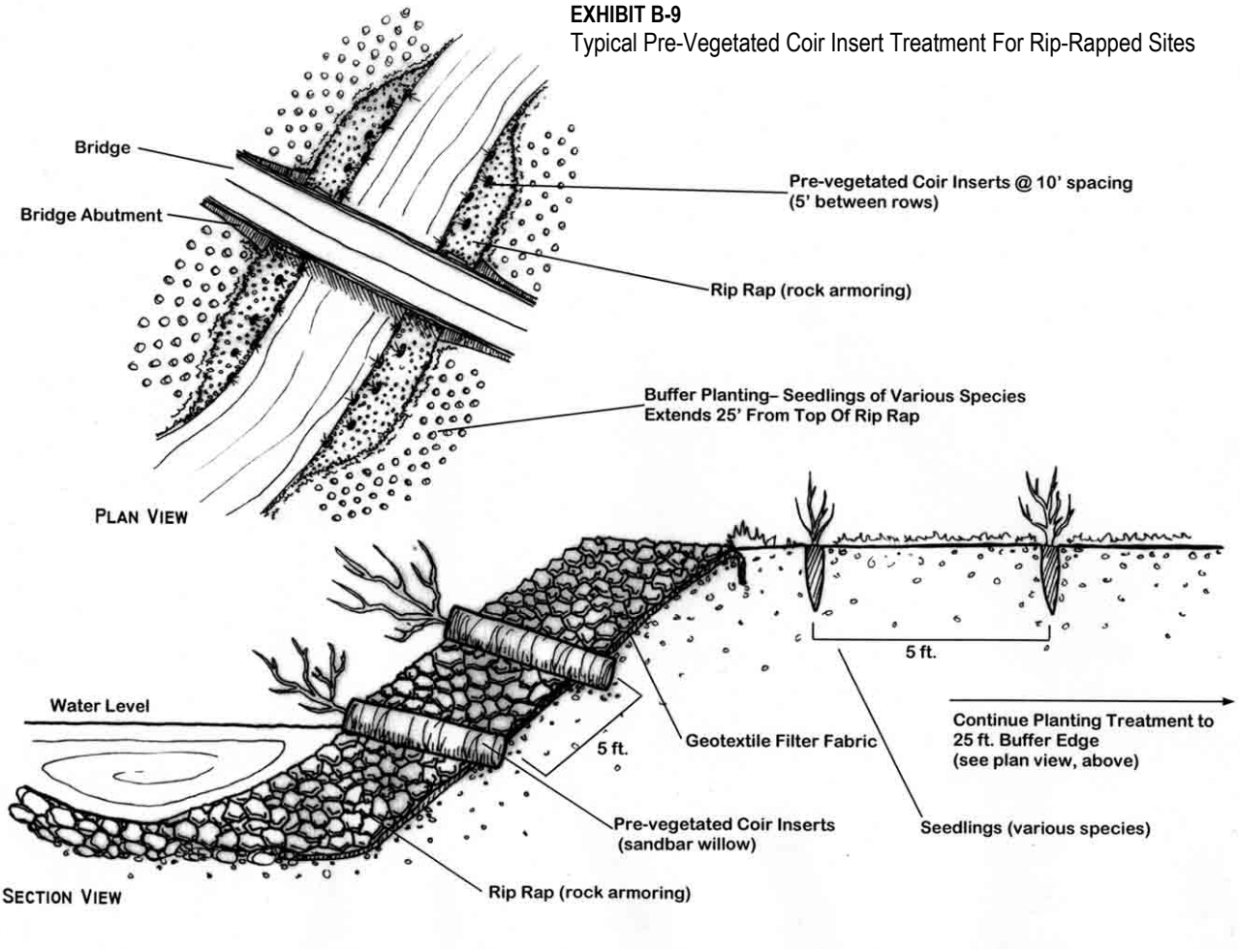
Additional Possible Streambank Treatments

The following examples are possible treatments for unique locations along the upper Clark Fork River. They have not been included in the cost analysis for the river.

1. **Modification of Existing Rip-Rap**—Existing rip-rap can be supplemented with pre-vegetated coir inserts (comprised of *Salix exigua* [sandbar willow]). Currently, rip-rap is associated with public infrastructure, such as bridges, irrigation diversion ditches, sewage lagoons, City of Deer Lodge, etc. The pre-vegetated coir inserts will be two rows, with the first row near the water level for the middle of the summer and another row 5 feet higher on the rock. The inserts will be spaced at 10 foot intervals. Behind the rip-rap, those areas outside an immediate transportation corridor right-of-way will include a buffer of 25 feet with four rows of 10T containerized shrubs at a 5 foot spacing. The plants include *Salix lutea* (yellow willow), wet areas; *Salix boothii* (Booth willow), wet areas; *Salix bebbiana* (Bebb willow), wet areas; *Alnus incana* (mountain alder), wet areas; *Cornus stolonifera* (red-osier dogwood), wet areas; *Prunus virginiana* (common chokecherry), dry areas; and *Amelanchier alnifolia* (western serviceberry) dry areas. See Exhibit B-9.

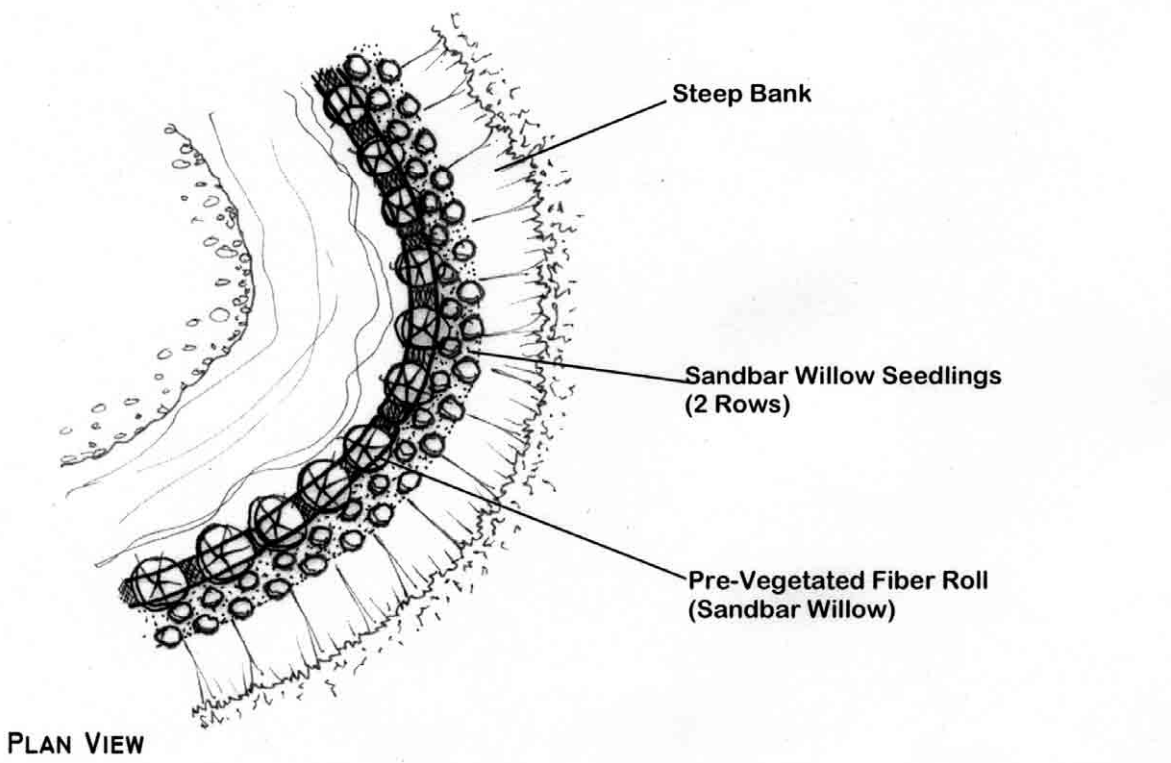
2. **In-stream Flow Deflectors or Low Rock Barbs**—See the Atlantic Richfield Company's Type 4 streambank stabilization option for a drawing of this type of structure (2002, *Feasibility Study,* Figure 5-12). (In the *Feasibility Study*, the Company does not include a cost estimate or a linear foot estimate.)

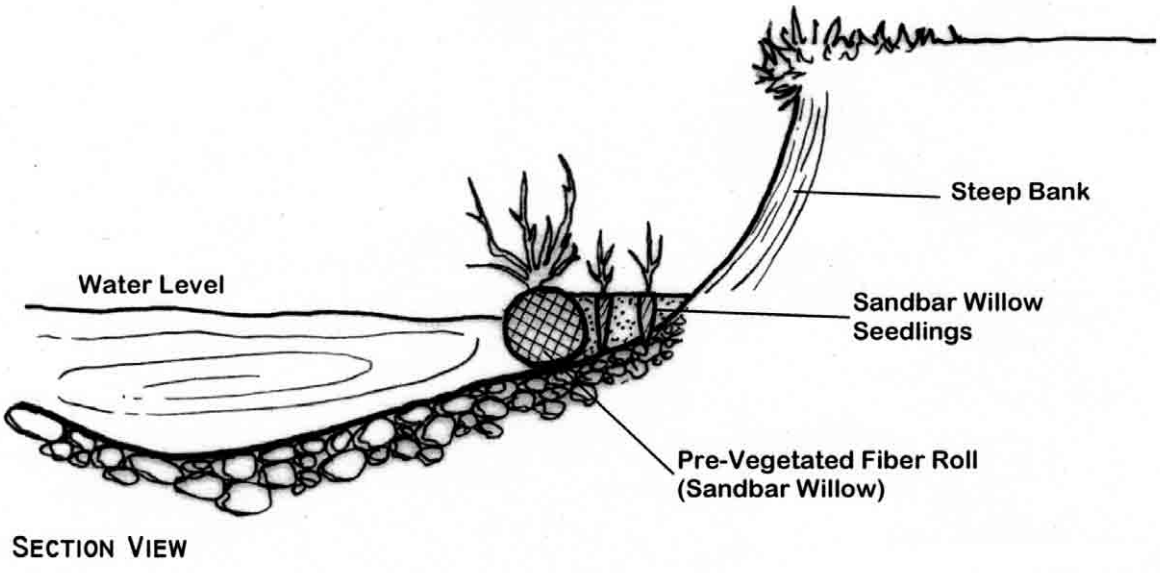
EXHIBIT B-9
Typical Pre-Vegetated Coir Insert Treatment For Rip-Rapped Sites



3. **Pre-vegetated Coir Fiber-rolls (comprised of *Salix exigua* [sandbar willow])**—Used along the base of high eroding banks. Immediately behind the fiber-rolls are two rows of small-containerized plants comprised of *Salix exigua* (sandbar willow). See Exhibit B-10.

EXHIBIT B-10
Typical Pre-Vegetated Coir Fiber Roll Treatment For Steep Banks





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Clark Fork River Operable Unit

of the Milltown Reservoir/Clark Fork River Superfund Site

Record of Decision

Appendix C:

Clark Fork River OU BMPs and Riparian Management Plan Considerations

U.S. Environmental Protection Agency
Region 8

10 West 15th Street
Suite 3200
Helena, Montana 59626

April 2004

APPENDIX C

Clark Fork River OU BMPs and Riparian Management Plan Considerations

Developing an Effective Riparian Grazing Management Plan

Benefits Of Proper Riparian Management To Ranchers

1. Water storage and availability
2. Increased vegetation
3. Better forage quantity and quality
4. Flood protection and reduction
5. Reduced streambank erosion
6. Increased water quality
7. Shelter for livestock
8. Acceptance and "security"

General Principles For Grazing Livestock In Riparian Zones

1. Tailor the approach to the specific situation and landowner objectives (have clearly defined goals and objectives).
2. Incorporate riparian management into an overall plan.
3. Select season of use so grazing occurs, as often as possible, during periods compatible with animal behavior, conditions in the riparian zone, and riparian objectives.
4. Determine *riparian* objectives.
5. *Monitor* change.
6. Limit livestock time in pastures with riparian areas.
7. Control (influence) distribution of livestock within a pasture.
8. Ensure adequate residual vegetation cover.
9. Provide adequate regrowth time and rest for plants.

Be actively involved by:

1. Determine an appropriate season for grazing a specific riparian zone.

2. Use various methods for reducing intensity and use in the riparian area through control and distribution of livestock within a pasture.

Techniques for Controlling Distribution of Livestock

1. Offstream water development
2. Stable access points
3. Salt and mineral block placement
4. Improve upland forage
5. Riding/herding
6. Drift fences
7. Turn-in location
8. Smaller pastures with a riparian area in each
9. Fencing: permanent or temporary

Early Season (Spring) Ranchers

Best Used When:

1. Succulent forage in the uplands that discourages livestock impacts in the riparian zone
2. Temperatures encourage livestock to stay out of the riparian zone
3. Wet soils discourage livestock use
4. Well-drained soils reduce soil compaction

Potential Advantages:

1. Less soil compaction and streambank shearing *if* livestock use is minimized
2. Provides time for regrowth of riparian and upland vegetation
3. Less browsing pressure on woody vegetation

Possible Drawbacks:

1. High potential for soil compaction, trampling, and erosion
2. Has potential for reducing plant vigor thereby changing plant community composition
3. Upland forage nutrition may be low
4. High potential to affect wildlife

Late Season (Fall) Grazing

Best Used When:

1. Mostly herbaceous plant communities rather than woody communities

2. Palatable cool season forage in uplands
3. Offstream water available or other conditions draw livestock out the riparian zone

Possible Benefits:

1. Drier conditions on the floodplain reduce soil compaction, streambank shearing, and erosion
2. Plants have a completed growth cycle (e.g., set seed)
3. Less impact on wildlife.

May be Detrimental When:

1. No regrowth due to soil moisture and temperature
2. No incentives to induce livestock to move out of the riparian zone
3. When woody species maintenance and regeneration objectives are not met

Hot Season (Mid-Summer) Grazing

Least Likely to be Negative When:

1. Conditions are closely monitored and grazing period is limited in duration and frequency
2. Actions taken to induce livestock to move out of the riparian zone
3. Opportunities are provided for regrowth based upon time of removal, climatic conditions, and frequency of use

Possible Disadvantages:

1. Greater tendency to hang in the riparian zone
2. More intense use may reduce plant vigor and change plant communities
3. Damage to trees and shrubs

Potential Advantages

1. Drier and more stable soils and streambanks
2. Potential for regrowth after hot season cessation of growth by plants
3. Palatability of riparian forage is greater than upland plants

Winter Grazing

Especially Beneficial When:

1. Pasture is large enough to feed away from the stream
2. Cold drainages or south-facing slopes reduce riparian use
3. Soil compaction, streambank shearing is more likely during other periods

Possible Advantages:

1. Minimal soil compaction and streambank damage—provided the livestock are removed before the soils/streambanks thaw
2. Livestock use will not affect plant development (plants are dormant)
3. Livestock distribution is easily influenced by location of feed and water

Possible Detrimental Impacts:

1. Grazing of dead material can reduce streambank protection and sediment trapping in the spring when run-off occurs
2. Browsing and physical damage to woody plants may be high

Conclusion of Good Riparian Management

1. What operators do to encourage livestock not to loiter in the riparian zone while they are in a pasture is more important than either season of use or length of time in the pasture per se.
2. Two common threads for good riparian management:
   a. Presence of offstream water developments; and
   b. Operator involvement.
3. Many useful techniques were not tied to any particular grazing "system."

Thus, riparian grazing might be incorporated into each of the traditional grazing systems, except season-long, ***as long as the condition of the riparian zone itself remains of primary concern.***

Management, not the system, is the key.

Developing a Riparian or Wetland Management Plan

An objective is defined as something toward which effort is directed; an aim or end of action. Objectives should contain the following five elements (e.g., five W's): 1) who, 2) what, 3) when, 4) where, and 5) why. For example, the John Doe Ranch (who) will provide for survival and recruitment of cottonwood trees from a frequency of 0 percent (what) in 2004 (when) to a frequency of 5 percent (what) in 2009 (when) along Big Creek in the Longhorn Pasture (where) to provide for future perching/resting sites for great blue herons (why). Do not confuse the management practice to achieve an objective (how) with the elements of the objective.

Once objectives have been clearly defined, the next step is to develop a management plan. The following discussion uses riparian or wetland areas as an example in how a management plan is developed and monitored.

Introduction and Development of a Plan

A management plan based only on objectives related to non-riparian (uplands) or wetland areas does not usually result in maintenance or improvement of riparian or wetland areas. Therefore, where maintenance or improvement of riparian or wetland areas is desired, the land use plan, activity plan objectives, and management prescriptions must be determined specifically for the riparian or wetland features while considering the needs of the entire watershed. The establishment of specific objectives, description of the desired plant community, and selection of key species should be an interdisciplinary effort. Management objectives need to be focused, achievable, measurable, repeatable, have a starting and ending point in time and location, be reasonable, clear, concise, and affordable. In short, management objectives need to have realistic and attainable goals. In addition, they should be dictated by the present condition and trend of the riparian or wetland habitat in relation to management goals, the resource potential for change, and the importance of other resource values. Major considerations in establishing management objectives in riparian or wetland areas should include the following:

1. Vegetation
    a. The potential of the site (that is, the riparian or wetland plant association).
    b. The desired plant community.
        i. If the potential of the site is woody vegetation, then the health and reproduction of woody vegetation should receive equal consideration as the herbaceous vegetation (depending on the riparian or wetland objectives). If one of the objectives for a riparian or wetland area is streambank stability, then woody vegetation vigor should be of utmost importance due to the vastly different streambank stability protection afforded by the woody vegetation when compared to the herbaceous vegetation.
        ii. The development and/or maintenance of different age classes (for example, seedlings, saplings, poles, and mature for trees; seedlings, saplings, and mature age classes for shrubs) of the key woody plant species on the site to maintain a viable plant community. (Once again, only if the potential of the site is for woody vegetation.)
        iii. The type of vegetation cover necessary to minimize the erosive effects of run-off events.
        iv. The vegetation structure necessary for wildlife cover diversity.
    c. The stabilization of streambanks.
    d. The value of the site for forage production.
    e. The amount of vegetation stubble required to trap and hold sediment deposits during run-off events to rebuild streambanks and restore/recharge aquifers. It is important to realize that on streams with high gradients and low silt loads, it is more difficult to improve them than those with low gradients and high silt loads (that is, mud management).

f. The kind and amount of "weedy species" present. The more persistent and difficult the weedy species are to control, the more limited the management opportunities. Therefore, proper understanding of the ecology of weeds present will help the manager(s) make realistic and attainable goals.

2. Water Quality/Quantity Issues

   a. Raising the elevation of the present water table and expanding the sponge effect.

   b. The improvement or maintenance of water quality and quantity or change in the timing of the flow.

3. Streambank Stability

   a. The establishment of proper stream channels, streambanks, and floodplain conditions and functions.

   b. The maintenance of long term adjustment processes that may affect channel or wetland conditions. These processes include sediment deposition, streambank development, floodplain development, and stream dynamics (meandering).

4. Wildlife

   a. The improvement or maintenance of the fishery habitat.

   b. The importance of the riparian or wetland community to riparian or wetland dependent wildlife and to wildlife species that occur primarily on upland sites but are periodically attracted to riparian or wetland areas.

5. Other

   a. The aesthetic values of a healthy riparian or wetland zone.

   b. The period of time that is acceptable or necessary for riparian or wetland rehabilitation/restoration.

   c. The reduction of upland erosion and stream sediment load and the maintenance of soil productivity.

Implementation of the Plan

Once a management plan has been written, the following steps should be taken:

1. Implement the management plan.

2. Design a monitoring plan that will evaluate the effectiveness of the management plan and provide information for identifying the cause of any failures. Monitoring needs to be done at the initiation of management plan in order to establish a baseline or "starting point."

3. Monitor the site or the stream reach over time. Management must be flexible enough to accommodate changes based on experience. Mistakes need to be documented and not repeated elsewhere.

4. Once the management plan is in progress, the most important element is frequent supervision.

5. Determine the outcome of the management plan. If it is successful, then proceed with the existing management plan. If the plan was either a partial or complete failure, then modify the management objectives. *Remember, mistakes need to be documented and not repeated elsewhere.*

Developing the Monitoring Plan

Key Areas—As objectives are considered and developed for riparian or wetland areas, key areas for monitoring must be located in representative portions of the riparian or wetland areas as well as in the uplands. These key areas will indicate where appropriate monitoring will be conducted and will provide the basis for decisions as to whether management objectives are being met or not. Key areas must possess (or have the potential to produce) all the specific elements in the objective(s) because these will provide data for evaluation of management efforts. In many cases, it is appropriate to select the key areas first and then develop objectives specific to each.

Key Plant Species—Key plant species will vary with the potential of each individual site. Selected key plant species should be those that are necessary to the operation of the natural stream functions. The type of vegetation present will affect channel roughness and the dissipation of stream energy. Willows and other large woody vegetation (trees) filter large water-borne organic material, and their root systems provide streambank stabilization. Sedges, rushes, grasses, and forbs capture and filter out the finer materials while their root masses help stabilize streambanks and colonize captured sediments. On sites where the potential exists for both woody and herbaceous vegetation, the cumulative effect of plant diversity greatly enhances stream function. Finally, it is essential that the physiological and ecological requirements of the key woody species, along with key herbaceous species, be understood so that a proper management program can be designed. This includes determining the effects of grazing/browsing on the particular growth characteristics of the species involved.

Utilization Guidelines (if appropriate)—Utilization target guidelines are a tool that can be used to help ensure that long-term objectives are met. Utilization levels of browse or forage can be monitored annually, or more often; whereas progress in reaching long-term resource objectives (such as streambank stabilization, rebuilding of the streamside aquifer, and the re-establishment of beaver, fish, moose, or other big game habitat) can only be determined over a longer period of time. The accomplishment of these long-term objectives relates directly or indirectly to the need to leave a certain amount of vegetation available for other functions (soil stabilization, trapping sediment, wildlife cover, or forage). Utilization monitoring provides a means of insuring that the necessary amount of vegetation is left to protect the site and provide for reaching other vegetation-dependent objectives.

Summary

The establishment of utilization targets for riparian or wetland key plant species and the management of browsing/grazing to ensure these targets are met are critical factors involved in proper riparian or wetland area management. The establishment of utilization

targets requires that the manager know the growth habitats and characteristics of the important plant species for which they are managing and how the plant species respond to browsing and grazing. The manager must know the characteristics, preferences, and requirements of the grazing/browsing animals. Therefore, utilization targets should be developed for riparian or wetland areas that:

1. Will maintain both woody species and herbaceous species in a healthy and vigorous state and promote their ability to reproduce and maintain different age classes in the desired riparian or wetland plant community.
2. Will leave sufficient plant residue necessary to protect streambanks during run-off events and provide for adequate sediment filtering, and dissipation of flood water energy.
3. Are consistent with other resource values and objectives (such as aesthetics, water quality, water quantity, and wildlife populations).
4. Will limit streambank instability to acceptable levels.

In many instances, proper utilization guidelines can only be derived over time through trial and error by monitoring, analyzing, and evaluating the results. Initial results may be different than expected. The manager should not hesitate to make changes in key species or utilization guidelines where required to meet objectives.

When establishing utilization targets to ensure riparian or wetland area improvements, guidelines should be considered that will provide a margin of safety for those years when production is less than average. This could take the form of reduction in the utilization targets for both riparian or wetland areas and upland areas to provide additional carryover forage and vegetation necessary for streambank protection and sediment filtering. The importance of providing for adequate vegetation vigor and regeneration at the end of the growing season can not be emphasized enough.

Finally, because of the variation in riparian or wetland sites and management, one standard utilization target is not appropriate. However, utilization should be considered, together with regrowth potential, to ensure the presence of vegetation stubble necessary to the operation of natural stream functions or accomplishment of other land use objectives.

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