EPA/ROD/R10-02/032
2002

EPA Superfund
Record of Decision:

BUNKER HILL MINING & METALLURGICAL COMPLEX
EPA ID: IDD048340921
OU 03
SMELTERVILLE, ID
09/12/2002

THE BUNKER HILL MINING AND METALLURGICAL COMPLEX OPERABLE UNIT 3

Record of Decision

September 2002

PART 1
DECLARATION

PART 1
DECLARATION

1.0 SITE NAME AND LOCATION

The Bunker Hill Mining and Metallurgical Complex Superfund Facility, located in the Coeur d'Alene Basin (the Basin), was listed on the National Priorities List (NPL) in 1983. The NPL facility has been assigned CERCLIS identification number IDD048340921. The facility includes mining-contaminated areas in the Coeur d'Alene River corridor, adjacent floodplains, downstream water bodies, tributaries, and fill areas, as well as the 21-square-mile Bunker Hill "Box" located in the area surrounding the historic smelting operations.

The United States Environmental Protection Agency (EPA) has identified three operable units (OUs): the populated areas of the Bunker Hill Box (OU 1); the non-populated areas of the Box (OU 2); and mining-related contamination in the broader Coeur d'Alene Basin (OU 3). This Record of Decision (ROD) is focused largely on the floodplain and river corridor of OU 3, which is also referred to as the Coeur d'Alene Basin in this ROD.

2.0 STATEMENT OF BASIS AND PURPOSE

This decision document selects a remedy for OU 3, which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Contingency Plan (NCP). The decision is based on the Administrative Record file for this operable unit.

In accordance with the NCP, including 40 CFR 300.430(b)(7), EPA has consulted with states, tribes, and natural resource trustees during development of the Selected Remedy and sought concurrence of states and tribes for remedial actions selected within their respective jurisdictions. Letters reflecting concurrence or support from these governments are attached to this Declaration.

3.0 ASSESSMENT OF THE SITE

The remedial action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Such a release or threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment.

4.0 DESCRIPTION OF SELECTED REMEDY

Overall Site Cleanup Strategy

The Selected Remedy includes remedial actions for (1) protection of human health in the communities and residential areas, including identified recreational areas, of the Basin upstream of Coeur d'Alene Lake (the Upper Basin and Lower Basin), (2) protection of the environment in the Upper Basin and Lower Basin, and (3) protection of human health and the environment in areas of the Spokane River.

The Selected Remedy includes a complete remedy for protection of human health in the communities and residential areas, including identified recreational areas, of the Upper Basin and Lower Basin. Certain potential exposures outside of the communities and residential areas of the Upper Basin and Lower Basin are not addressed by this ROD and will continue to present risks of human exposure to hazardous substances. These potential exposures impacting human health include:

- Recreational use at areas in the Upper Basin and Lower Basin where cleanup actions are not implemented pursuant to this ROD
- Subsistence lifestyles, such as those traditional to the Coeur d'Alene and Spokane Tribes
- Potential future use of groundwater that is presently contaminated with metals

For protection of the environment, the Selected Remedy identifies approximately 30 years of prioritized actions in areas of the Basin upstream of Coeur d'Alene Lake. During this period, EPA will evaluate the effectiveness and protectiveness of these remedial actions, as well as the technical practicability of attaining applicable or relevant and appropriate requirements (ARARs), in particular, the ambient water quality standards for lead, zinc, and cadmium and compliance with the Endangered Species Act (ESA) and Migratory Bird Treaty Act (MBTA). During the five-year review processes and at the end of this approximately 30-year period, EPA will evaluate and decide whether any additional CERCLA remedial actions are necessary to attain ARARs or to provide for the protection of human health and the environment, and whether any ARAR waivers should be applied.

EPA expressly recognizes that after the selected remedial actions are implemented, conditions in the Upper Basin and Lower Basin may differ substantially from EPA's current forecast of those future conditions, which is solely based on present knowledge. The tremendous amount of additional knowledge that will have been gained by the end of this period through long-term monitoring and five-year review processes may provide bases for future ARAR waivers. In addition, this new information and advances in science and technology may allow for additional actions to achieve ARARs and protect human health and the environment in a more cost-effective manner.

For the Spokane River, the Selected Remedy includes a complete remedy for protection of human health upstream of Upriver Dam and a complete remedy for protection of the environment between Upriver Dam and the Washington/Idaho border. Characterization of the risks to persons, including Spokane tribal members, and others who may practice a subsistence lifestyle in the Spokane River area, was not part of the RI/FS investigations. EPA and the Spokane Tribe are cooperating in planning additional testing and studies that will be implemented to evaluate the potential exposures to subsistence users. The results of those tests and studies will determine appropriate future response actions to be taken, if any.

EPA recognizes that the State of Idaho has not concurred in the selection of any remedial action beyond those selected in this ROD. Furthermore, after implementation of the remedies selected by this ROD, EPA commits not to take or select any additional remedial actions in the Upper Basin or Lower Basin without first consulting with the State of Idaho. EPA will continue to work with the regulatory stakeholder group, which was instrumental in developing the actions selected in this ROD. Land management agencies may elect to implement cleanup actions on properties within their management jurisdiction toward achieving the overall goals of the Selected Remedy.

State legislation under the Basin Environmental Improvement Act (Title 39, Chapter 81) established the process for the formation of the Basin Environmental Improvement Project Commission. This commission includes federal, state, tribal, and local governmental involvement. EPA anticipates working as a member of this commission for implementation of the ROD and development of priorities and sequencing of cleanup activities.

During development of the Selected Remedy in this ROD, EPA worked with the natural resources trustees as required by the NCP (40 CFR 300.430(b)(7)) and will continue to work with the trustees during implementation of the Selected Remedy.

The Bunker Hill Box is a part of the Basin and a major source of metals in surface water. A ROD was signed for the populated areas of Bunker Hill Box (OU1) in 1991, and a ROD was signed for the non-populated areas of the Box (OU2) in 1992. Additional remedies for the Bunker Hill Box have not been selected in the OU2 ROD because the Box is already the subject of ongoing remedial actions. EPA will integrate actions selected for the Box with those selected for OU 3.

Principal Threat Wastes

Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained and/or would present a significant risk to human health or the environment should exposure occur.[1] Principal threat materials in the Coeur d'Alene Basin may include, for example, metal concentrates spilled during mill operations or in transport to smelters. A time-critical removal action was conducted in 1999 to address all known metal surface concentrates associated with rail transport along the Wallace-Mullen Branch of the Union Pacific Railroad (UPRR). If additional concentrates or other materials that meet the definition of principal threat waste are encountered during remedy implementation, these materials would be managed in a manner that is protective of human health and the environment and consistent with the NCP.[2] The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP§300.430(a)(1)(iii)(A)). Where EPA determines that it is not practicable to use treatment to address principal threat waste, such waste may be transported off-site, consistent with the Off-Site Disposal Rule (40 CFR 300.440) or managed safely on-site, consistent with all ARARs identified in Section 13.2 of this ROD.

Major Components of the Selected Remedy

Figures 1, 2, and 3 show the remedial actions selected for the Upper Basin, Lower Basin, and Spokane River, respectively. For protection of human health in the community and residential areas of the Upper Basin and Lower Basin, the major components of the Selected Remedy include:

- Information and intervention programs for residential and recreational users

- Partial excavation and replacement of residential soils with lead concentrations above 1,000 milligrams per kilogram (mg/kg), a barrier such as a vegetative barrier to control or limit migration of soils with lead concentrations between 700 and 1000 mg/kg, and a combination of removals, barriers, and access restrictions at commercial and undeveloped properties and recreation areas.

---

[1] Additional information for defining principal threat wastes can be found in USEPA (1991b) *A Guide to Principal Threat and Low Level Threat Wastes.*

[2] Concentrations used to identify principal threat waste within the "Bunker Hill Box" were: 127,000 ppm antimony; 15,000 ppm arsenic; 71,000 ppm cadmium; 84,600 ppm lead; 33,000 ppm mercury (Source: Bunker Hill Non-Populated Areas ROD, ROD ID: EPA/ROD/R10-92/041, Date: 09/22/1992). Additional factors (e.g., mobility, repository waste acceptance criteria, etc.) should be evaluated on a site-specific basis prior to disposal of material associated with implementing the Selected Remedy.

- Vacuum loan program/dust mats and interior source removals and controls to reduce individual house dust lead concentrations and loadings, as necessary. (This would be coordinated with paint abatement programs.)

- Multiple alternative drinking water sources (wellhead or point-of-use treatment, connection to the public drinking water system, or a new well) for residences using groundwater having metals at concentrations exceeding maximum contaminant levels (MCLs).

- Property owners in the Basin will be able to request soil sampling necessary for lead disclosures required for property transactions, and the results will be made available to them in a timely manner.

For protection of the environment in the Upper Basin and Lower Basin, the major components of the remedy include:

- **Upper Basin.** The Selected Remedy includes excavation and disposal, containment, bioengineering, and surface water treatment actions to reduce dissolved metals in rivers and streams. The remedy will promote development of innovative technologies, potentially including surface water treatment in Canyon Creek and Ninemile Creek. Waste dumps and stream banks that are major sources of particulate metals will be stabilized to reduce erosion.

- **Lower Basin Floodplains.** A combination of capping and excavation will be conducted in high-priority floodplain areas (areas with high use by waterfowl, high levels of lead in sediments, availability of site access, and relatively low potential for recontamination during flood events). Soil treatment to reduce lead bioavailability may be applied in selected areas if effective treatment technologies are identified.

- **Lower Basin Beds and Banks.** Excavation of contaminated bank sediment and bank stabilization will be used for river banks that are highly susceptible to erosion. A pilot river bed sediment removal program will be conducted in the Coeur d’Alene River near Dudley. Splay areas where sediments naturally collect during floods will be engineered to act as traps for collection of contaminated sediments.

The Selected Remedy does not include remedial actions for Coeur d’Alene Lake. State, tribal, federal, and local governments are currently in the process of implementing a lake management plan outside of the Superfund process using separate regulatory authorities.

For shoreline sediment depositional areas along that reach of the Spokane River within the State of Washington upstream of the Spokane Indian Reservation, the Selected Remedy consists of a combination of access controls, capping, and removals. The remedy for the contaminated sediments behind Upriver Dam will be established following further study and engineering evaluation. Dredging or capping are the options anticipated for sediments behind the dam.

5.0 STATUTORY DETERMINATIONS

Consistent with 40 CFR 300.430(a)(i)(B) and 40 CFR 300.430(f)(1)(ii)(C)(1), the remedial action selected by this ROD is an interim measure and will neither be inconsistent with nor preclude implementation of the final remedy that will be identified in subsequent decision documents.

The measures selected in this remedy will provide an adequate level of protectiveness of human health and the environment; comply with federal, state, and tribal requirements that are applicable or relevant and appropriate within the scope of the Selected Remedy; result in a cost-effective action; utilize permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable; and satisfy the statutory preference for treatment as a principal element of the remedy (i.e., reduce the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment).

The remedial actions selected in this ROD are not intended to fully address contamination within the Basin. Thus, achieving certain water quality standards, such as state and federal water quality standards and criteria and maximum contaminant levels for drinking water, are outside of the scope of the remedial action selected in this ROD and are not applicable or relevant and appropriate at this time.[3] Similarly, special status species protection requirements under the MBTA and ESA are only applicable or relevant and appropriate as they apply to the remedial actions included within the scope of the Selected Remedy. The Selected Remedy is designed to provide prioritized actions towards meeting the statutory requirement of protectiveness of human health and the environment. Accordingly, the Selected Remedy, by its nature, need not be as protective as the final remedy is required to be under the statute. Here, the Selected Remedy is sufficiently protective in the context of its scope, even though it does not, by itself, meet the statutory protectiveness standard that a final remedy would have to meet.

---

[3] The water quality ARARs apply to point source discharges to surface water created as a result of implementation of the Selected Remedy. Similarly, maximum contaminant levels are applicable or relevant and appropriate at residences where an alternate drinking water supply is provided or drinking water is treated.

In addition, because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, statutory reviews will be conducted at least every five years after initiation of remedial action to ensure that the Selected Remedy is, or will be, protective of human health and the environment.

6.0 DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary (Part 2) of this ROD. Additional information can be found in the Administrative Record file for this operable unit.

- Chemicals of concern and their respective concentrations (See Section 7.1.1 Identification of COCs, Tables 7.1-1 through 7.1-5, Tables 7.1-21 and 7.1-22, and Tables 7.2-2 through 7.2-5).

- Baseline risk represented by the chemicals of concern (See Sections 7.1.1 Risk Characterization and 7.1.1 Total Subsistence Scenarios and Tables 7.1-12 through 7.1-19).

- Cleanup levels established for chemicals of concern and the basis for these levels (See Section 8, Section 12.1.1, Section 12.1.3, Section 12.2.3, and Section 12.4.3). For protection of ecological receptors, numerical cleanup criteria have not yet been established for all chemicals of concern in all media. It is anticipated, however, that they will be established during implementation of this ROD and documented in an Explanation of Significant Differences (ESD).

- A discussion of source materials constituting principal threats (See Section 11.0).

- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD (See Section 6, Section 7.1.1 Exposure Assessment, and Section 7.1.1 Subsistence Scenarios).

- Potential land and groundwater use that will be available at the site as a result of the Selected Remedy (See Section 12.1.3, Section 12.2.3, and Section 12.4.3).

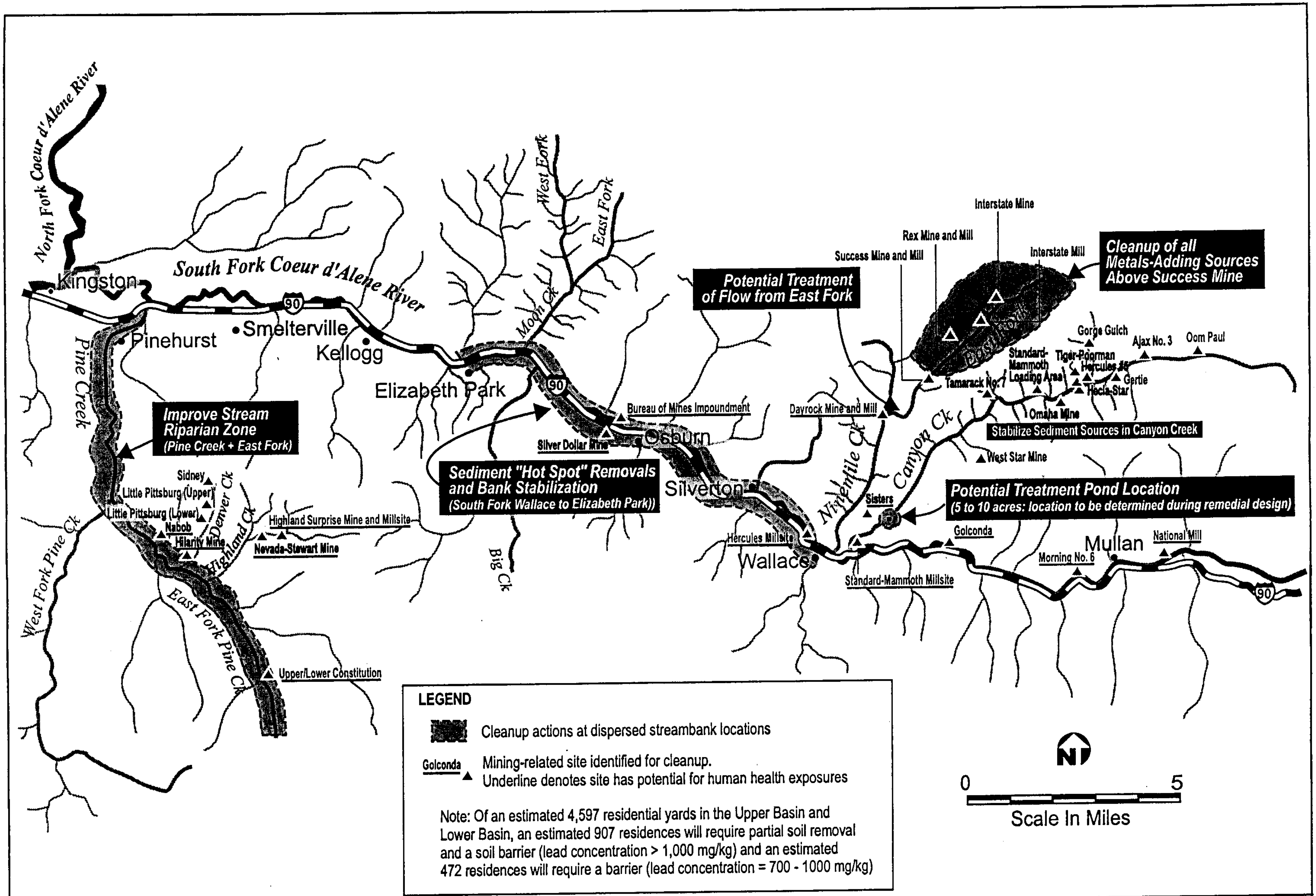
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected (See Section 12.1.3, Section 12.2.3, and Section 12.4.3).

- Key factor(s) that led to selecting the remedy (i.e., how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision (See Section 10).

Authorizing Signature

L. John Iani
Regional Administrator
EPA Region 10

12 Sept. 2002
Date

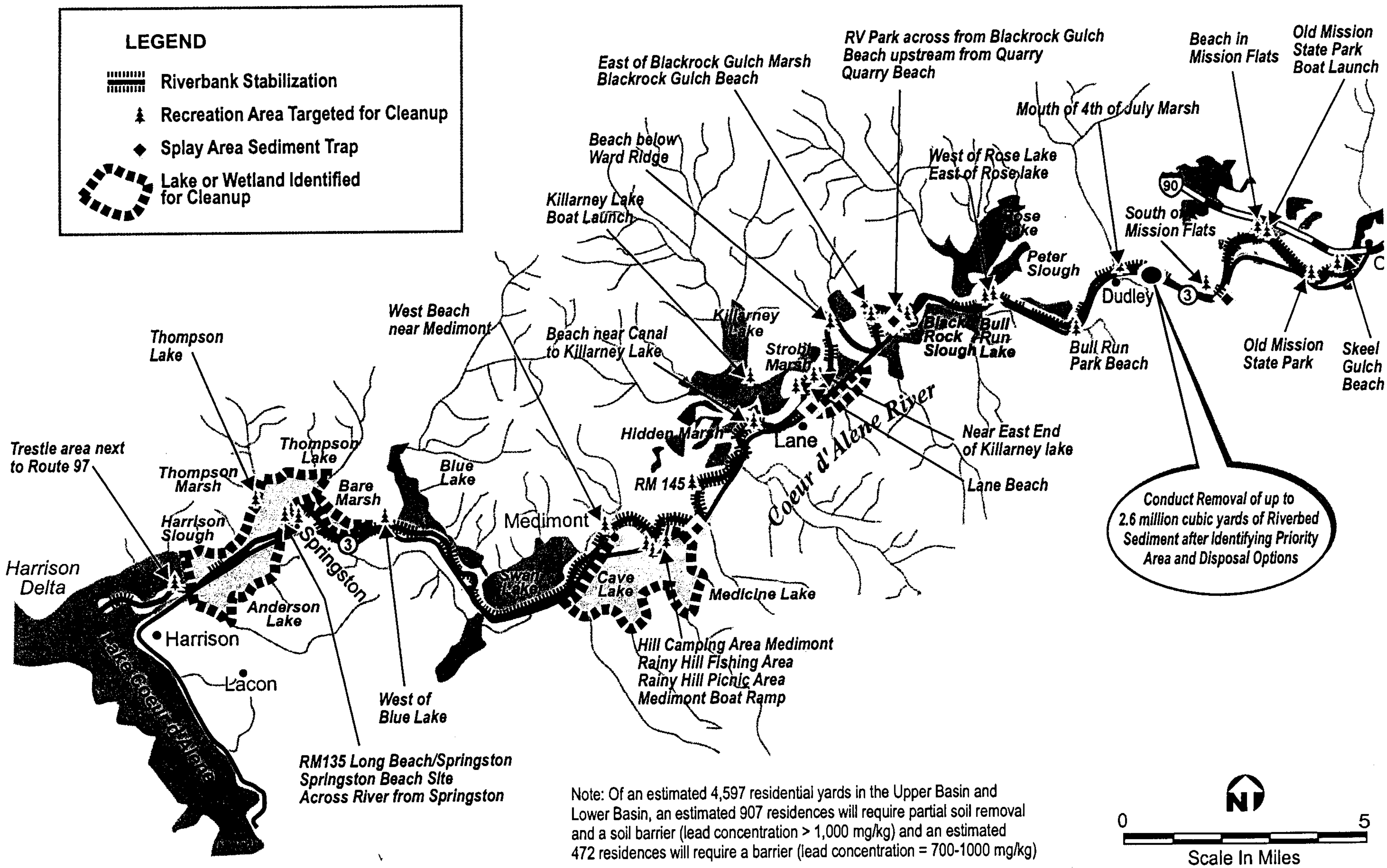


EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

Doc. Control: 4162500.07099.05.a
EPA No. 2.9

Figure 1
Upper Coeur d'Alene Basin Cleanup Actions

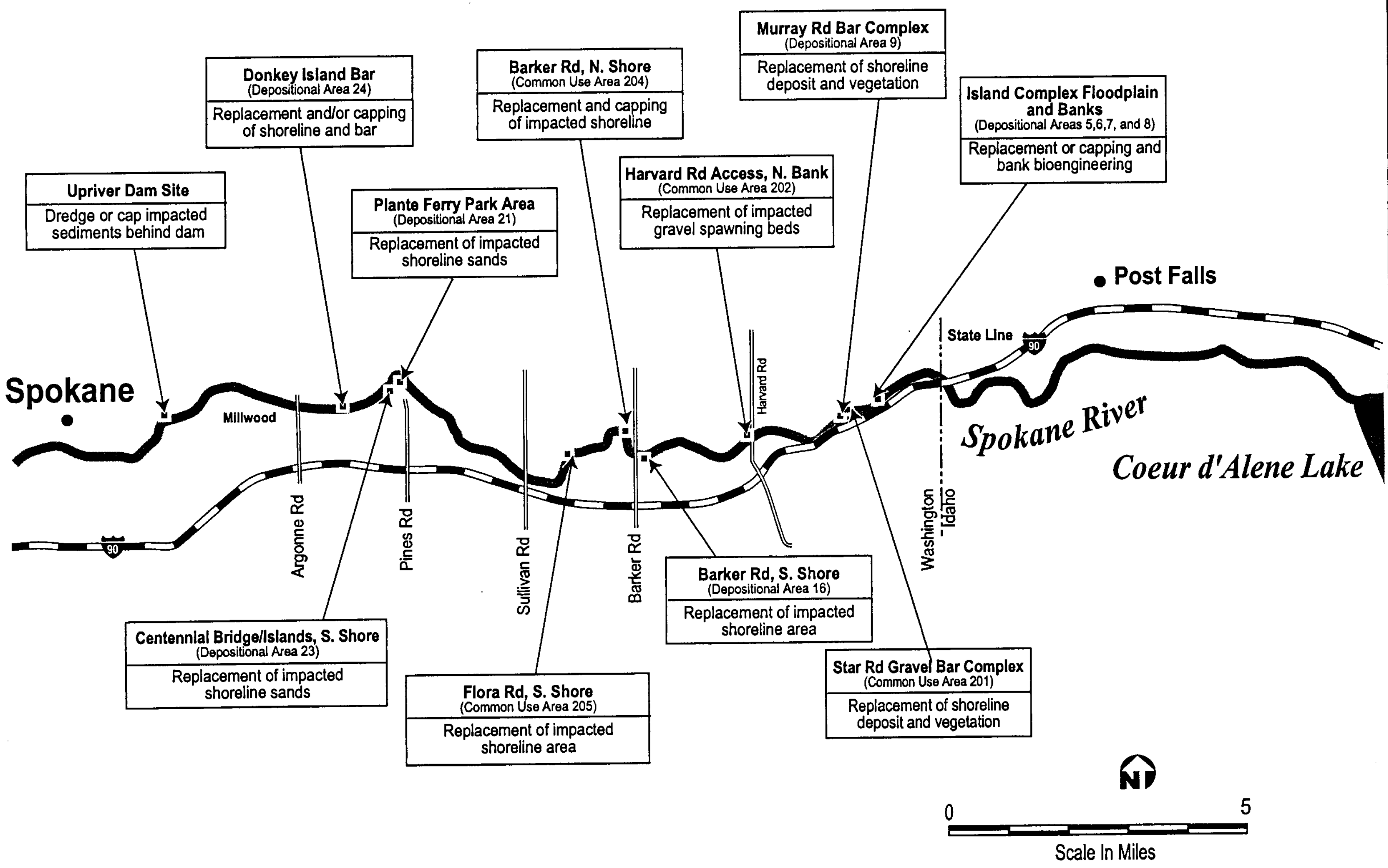


EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

Doc. Control: 4162500.07099.05.a
EPA No. 2.9

Figure 2
Lower Coeur d'Alene Basin Cleanup Actions



EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

Doc. Control: 4162500.07099.05.a
EPA No. 2.9

Figure 3
Spokane River Cleanup Actions

TABLE OF CONTENTS

PART 2 DECISION SUMMARY

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

PART 3 RESPONSIVENESS SUMMARY

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

FIGURES

TABLE OF CONTENTS (Continued)

TABLES

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

PART 3 TABLES

TABLE OF CONTENTS (Continued)

LIST OF ABBREVIATIONS AND ACRONYMS

ALAD	delta-aminolevulinic acid dehydratase
AMD	acid mine drainage
AOC	administrative order on consent or area of contamination
ARARs	applicable or relevant and appropriate requirements
ARPA	Archeological Resources Protection Act
ATSDR	Agency for Toxic Substances and Disease Registry
AWQC	ambient water quality criteria (national recommended water quality criteria)
BLM	Bureau of Land Management
CAC	Citizen's Advisory Committee
CDA	Coeur d'Alene
CDC	Centers for Disease Control
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
cfs	cubic feet per second
CIA	Central Impoundment Area
CIP	community involvement plan
COC	chemical of concern
COEC	chemical of environmental concern
COPC	chemical of potential concern
COPEC	chemical of potential environmental concern
CSM	conceptual site model
CTP	Central Treatment Plant
CUA	common use area
CV	coefficient of variation
cy	cubic yard
DA	depositional area
DOI	Department of Interior
DOJ	Department of Justice
ED_{20}	effective dose (corresponding to a 20% increase in an adverse effect, relative to the control response)
EE/CA	engineering evaluation/cost analysis
EPA	Environmental Protection Agency
EPC	exposure point concentration
ESA	Endangered Species Act
ESD	explanation of significant differences
FS	feasibility study
FSPA	field sampling plan amendment

LIST OF ABBREVIATIONS AND ACRONYMS (Continued)

HEPA	high efficiency particulate arresting
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
ICP	Institutional Controls Program
IDAPA	Idaho Administrative Procedures Act
IDEQ	Idaho Department of Environmental Quality
IDHW	Idaho Department of Health and Welfare
IEUBK	integrated exposure uptake biokinetic model
LDR	land disposal restriction
LHIP	Lead Health Intervention Program
LOAEL	lowest observed adverse effects level
LOEC	lowest observed effects concentration
MBTA	Migratory Bird Treaty Act
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
µg/L	micrograms per liter
µg/dL	micrograms per deciliter
µm	micrometer
mg/kg	milligrams per kilogram
MTCA	Model Toxics Control Act
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NCP	National Oil and Hazardous Substances Contingency Plan
NHANES	National Health and Nutrition Examination Survey
NHPA	National Historic Preservation Act
NOAEL	no observed adverse effects level
NOEC	no observed effects concentration
NPDES	National Pollutant Discharge Elimination System
NRD	natural resources damage
O&M	operation and maintenance
OSWER	Office of Solid Waste and Emergency Response
OU	operable unit
PHD	Panhandle Health District
PRG	preliminary remediation goal
PRP	potentially responsible party
RAO	remedial action objective
RBC	risk-based criteria
RCRA	Resource Conservation and Recovery Act
RfD	reference dose

LIST OF ABBREVIATIONS AND ACRONYMS (Continued)

RI	remedial investigation
RME	reasonable maximum exposure
ROD	Record of Decision
ROW	right-of-way
SAB	Service Advisory Board
SARA	Superfund Amendments and Reauthorization Act
SCS	Supplemental Control System
SVNRT	Silver Valley Natural Resources Trustees
TBC	to be considered
TCD	typical conceptual design
TMDL	total maximum daily load
TRV	toxicity reference value
TT	treatment technique
UCL_{95}	95 percent upper confidence level
UPRR	Union Pacific Railroad
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WAC	Washington Administrative Code

PART 2
DECISION SUMMARY

1.0 SITE LOCATION AND DESCRIPTION

The Bunker Hill Mining and Metallurgical Complex Superfund Facility, located in the Coeur d'Alene Basin, was listed on the National Priorities List (NPL) in 1983. The NPL facility has been assigned CERCLIS identification number IDD048340921. The facility includes mining-contaminated areas in the Coeur d'Alene River corridor, adjacent floodplains, downstream waterbodies, tributaries, and fill areas, as well as the 21-square mile Bunker Hill "Box" located in the area surrounding the historic smelting operations.

The United States Environmental Protection Agency (EPA) has identified three operable units (OUs): the populated areas of the Bunker Hill Box (OU 1); the non-populated areas of the Box (OU 2); and mining-related contamination in the broader Coeur d'Alene Basin (OU 3). This ROD is focused largely on the floodplain and river corridor of OU 3, which is also referred to as the Coeur d'Alene Basin (the Basin) in this ROD.

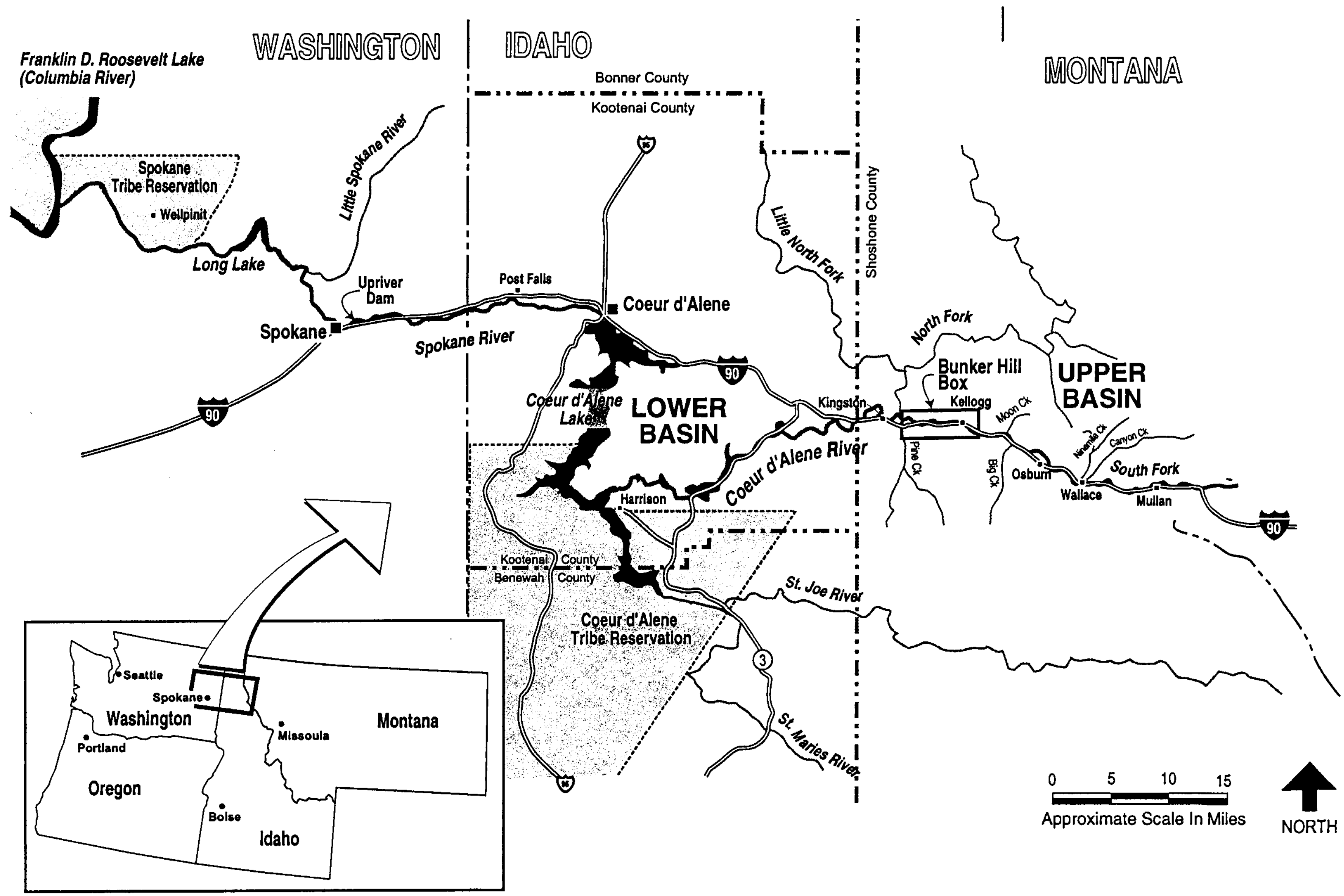
EPA is the lead agency for this decision document. The support agencies for those remedial actions selected within the boundaries of the respective state or tribal jurisdiction are the Idaho Department of Environmental Quality (IDEQ), the State of Washington Department of Ecology and the Coeur d'Alene Tribe. EPA will seek concurrence by the Spokane Tribe of Indians for future remedial actions selected within the boundary of the Spokane Indian Reservation, if any. The Selected Remedy in this decision document was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for the Operable Unit 3.

Within the Basin, historic mining practices, beginning in the late 1880s, have resulted in widespread contamination. This contamination threatens both human health and the environment. The site contaminants are primarily metals, and the metals considered of principal concern include lead and arsenic for protection of human health, and lead, cadmium, and zinc for protection of ecological receptors.

Figure 1.0-1 presents a map of the study area. The study area includes four geographic areas.

- The Upper Basin, the location of former and current mining, milling, and processing activities. (The mining-related waste materials in the Basin were and are released during these activities. The Upper Basin includes the South Fork and the Canyon Creek, Ninemile Creek, Big Creek, Moon Creek, and Pine Creek watersheds.)

- The Lower Basin, which includes the Coeur d'Alene River, adjacent lateral lakes, floodplain, and associated wetlands
- Coeur d'Alene Lake
- Depositional areas of the Spokane River, which flows from Coeur d'Alene Lake



EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

Doc. Control: 4162500.07099.05.a
EPA No. 2.9

Figure 1.0-1
Basin Study Area

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 MINING HISTORY

Mining within the Coeur d'Alene Basin began more than 100 years ago. The Basin has been one of the leading silver, lead, and zinc-producing areas in the world, with production of approximately 1.2 billion ounces of silver, 8 million tons of lead, and 3.2 million tons of zinc (Long 1998). The region surrounding the South Fork has produced over 97 percent of the ore mined in the Basin (SAIC 1993). The Bureau of Land Management (BLM) has identified nearly 900 mining or milling-related features in the region surrounding the South Fork (BLM 1999). Table 2.1-1 provides an overview of the history of milling and tailings disposal practices in the Basin.

Mining-related activities generated tailings (the part of the ore from which metals cannot be recovered economically, usually 80 to 90 percent of the ore), waste rock (non-ore rock excavated from a mine), concentrates, and smelter emissions. In addition, the water that drains from many abandoned adits contains elevated levels of metals. These are the sources of metals contamination in the Basin.

Until 1968, most tailings were discharged directly into the South Fork or its tributaries. Since 1968, tailings produced have generally been impounded or placed back in the mines. Current mining practices contribute relatively little contamination to the river system compared to the existing contamination resulting from pre-1968 practices. An estimated 62 million tons of tailings were discharged to streams prior to 1968. These tailings contained an estimated 880,000 tons of lead and more than 720,000 tons of zinc. Table 2.1-2 summarizes the quantities of tailings and metals disposed of by various methods.[4]

Most of the tailings were transported downstream, particularly during high flow events, and deposited as lenses of tailings or as tailings/sediment mixtures in the bed, banks, floodplains, and lateral lakes of the Upper Basin and Lower Basin and in Coeur d'Alene Lake. Some fine-grained material washed through the lake and was deposited as sediment within the Spokane River flood channel. The estimated total mass and extent of impacted materials (primarily sediments) exceeds 100 million tons dispersed over thousands of acres.

---

[4] Minerals are the source of metals (e.g., lead, cadmium, and zinc) released to the environment from historic mining activities. However, although the "mineral form" of these metals may influence their mobility and toxicity (i.e., bioavailability), the metals are hazardous substances under CERCLA. In the context of the CERCLA statute and the NCP regulations that implement CERCLA, "metal" as a hazardous substance generally means "total metals," and does not depend on the mineral it may be associated with.

In addition to transport in water, mining waste accumulated along the railroad lines as a result of spillage of ore and concentrates from railroad cars during transport, was used as fill material for construction of roads, railroads, and structures, and was transported as airborne dust.

2.2 REGULATORY HISTORY

The following is a history of CERCLA-related regulatory actions within the Basin.

- 1983, Bunker Hill Mining and Metallurgical Complex placed on the National Priorities List (NPL).

- 1986, Idaho settles natural resource damages (NRD) claim against the mining companies for $4.5 million.

- 1991, Bunker Hill Mining Company files for Chapter 11 bankruptcy. EPA subsequently resolved its claims against Bunker Hill Mining Company as part of the bankruptcy proceedings.

- 1991, Coeur d'Alene Tribe files a NRD lawsuit against Gulf Resources & Chemical Corporation, Pintlar Corporation, ASARCO, Inc. (ASARCO), Government Gulch Mining Company, Ltd., Federal Mining and Smelting Company, Hecla Mining Company (Hecla), Sunshine Mining Company (Sunshine Mining), Callahan Mining Corporation (Callahan), and Union Pacific Railroad Company (UPRR). That year, the Tribe settled with Callahan (prior to its merger with Coeur d'Alene Mines Corporation).

- July 1992, Bunker Limited Partnership (BLP) files for Chapter 11 bankruptcy. EPA subsequently resolved its claims against BLP as part of the bankruptcy proceedings.

- 1994, Gulf Resources files for Chapter 11 bankruptcy. EPA subsequently resolved its claims against Gulf Resources as part of the bankruptcy proceedings.

- May 1994, EPA and Idaho enter into a consent decree with the Upstream Mining Group (ASARCO, Coeur d'Alene Mines Corporation, Callahan, Hecla, Sunshine Precious Metals, and Sunshine Mining) for remedial work inside the Bunker Hill Box.

- 1995, potential responsible parties (PRPs), including UPRR and Stauffer Chemical, sign consent decree to implement Non-Populated Areas remedial actions, including:
  - Remediation of UPRR right-of-way through the Box (UPRR)
  - Closure of A-4 gypsum pond (Stauffer Chemical)

- March 1996, the Department of Justice (DOJ), on behalf of EPA, U.S. Department of Agriculture, and U.S. Department of the Interior, files a complaint in U.S. District Court for the District of Idaho against the ASARCO, Hecla, Sunshine Mining Company, and Coeur d'Alene Mines Corporation, seeking:
  - Declaration of mining company liability for response costs outside the Bunker Hill Box
  - Payment of natural resource damages inside and outside the Bunker Hill Box

- The case filed by DOJ is consolidated with a pending claim by Coeur d'Alene Tribe.

- September 1997, EPA and ASARCO sign an Administrative Order on Consent (AOC) for an engineering evaluation/cost analysis (EE/CA) to examine use of wetland treatment systems to address mine adit discharge in Canyon Creek.

- 1998, EPA initiates a remedial investigation and feasibility study (RI/FS) for the Coeur d'Alene Basin.

- August 1999, EPA issues a Unilateral Administrative Order for a removal action to address spillage of metal concentrates along the UPRR right-of-way.

- March 2000, EPA, the U.S. Forest Service (USFS), and ASARCO sign an AOC for an EE/CA at the Jack Waite Mine Site in the watershed of the North Fork of Coeur d'Alene River.

- June 2000, 9th Circuit Court of Appeals vacates the decision by U.S. District Court that limited the scope of the NPL facility to the 21-square-mile Bunker Hill Box. The mining companies are given the opportunity, but fail to appeal. The decision confirms that the NPL facility includes all areas of the Coeur d'Alene Basin where mining contamination has come to be located.

- August 2000, U.S. District Court approves the consent decree among Union Pacific, State of Idaho, Coeur d'Alene Tribe, and the United States for the railroad right-of-way. A $30 million settlement will provide for cleanup of mining contamination within the right-of-way and conversion of right-of-way for use as a recreational trail, consistent with the federal Rails-To-Trails Act. The trail will be operated by the State and Tribe, and the cleanup will be maintained in perpetuity by funding from Union Pacific.

- January 2001, U.S. District Court approves the consent decree between Sunshine Mining Company, the United States, and the Coeur d'Alene Tribe.

- May 2001, U.S. District Court approves the Consent Decree between the United States and defendants Coeur and Callahan. Settlement requires payment of $3.8 million plus conduct of removal action on Coeur's property and transfer of the 74-acre parcel.

- Between January and July 2001, the first phase of the trial regarding liability was conducted in district court in Boise, Idaho, with ASARCO and Hecla as principal defendants. The U.S. District Court has not yet ruled on the liability of ASARCO or Hecla.

2.3 PAST REMOVAL ACTIONS IN THE BASIN

Some of the most highly impacted source materials have been contained under CERCLA removal actions, mostly in the Upper Basin, to reduce human health and environmental risks. These removal actions are summarized in this section. In addition, extensive remedial actions have been conducted within the Bunker Hill Box in accordance with the OU 1 and OU 2 RODs. These response actions are described in Section 9.0.

2.3.1 Human Health

Ongoing actions to protect human health have included intervention programs and removal actions. The Lead Health Intervention Program, administered by the Panhandle Health District (PHD), provides personal health and hygiene information to help reduce exposure to metals. Services include educational programs, health monitoring programs, yard and home sampling, and nursing follow-up services.

The strategy for Basin removal actions is consistent with the 1998 clarification (USEPA 1998a) of the 1994 Lead Directive (USEPA 1994a). The response strategy also is consistent with actions taken in the Bunker Hill Box from 1989 through 2001, where intervention and soil cleanup actions have contributed to a 69 percent decline in average blood lead levels among Kellogg children (from 10.8 to 3.4 micrograms per deciliter [µg/dL]). Actions are first targeted at homes where pregnant women reside and homes where families have children 6 years of age and under. Schools, day care facilities, and other common areas typically used by children also are in the first tier of response. Basin removal actions have included both soil removals and treatment of drinking water or municipal hook-up for homes on contaminated private wells.

Basin soil removal actions have been conducted at 91 residential yards, 7 schools and day cares and 6 recreational areas and common-use areas from 1997 through 2001. Drinking water treatment, municipal hook-up, or bottled water have been provided to approximately 28 residences. The residential yard removals represent approximately 10 percent of the estimated total number of yards with lead concentrations greater than 1,000 milligrams per kilogram (mg/kg) in the Basin. In addition, the high-risk yard removals have reduced exposures to a significant percentage of children in the Basin since most of the remediated yards have children in residence. A summary of time-critical removal actions conducted to protect human health is presented in Table 2.3-1.

Union Pacific Railroad is conducting a cleanup within the 72-mile railroad right-of-way for the main line track and related sidings of Union Pacific Railroad's Wallace-Mullan Branch. This line extends from Mullan to Plummer Junction, Idaho. In 1999, UPRR conducted a time-critical removal action to prevent exposures to metal concentrates located within the railroad right-of-way. Current cleanup activities are mandated by a consent decree between the United States, the Coeur d'Alene Tribe, the State of Idaho, and UPRR. This 2000 consent decree followed an extensive engineering evaluation/cost analysis (EE/CA) which was performed under CERCLA removal authority. Considerable soil sampling characterization was performed as part of the EE/CA as well as during implementation of the consent decree. As delineated in the consent decree's statement of work (SOW) and its attachments, the cleanup uses combinations of removals and disposal/consolidation, protective barriers, and institutional controls. The cleanup includes removal of shallow contaminated soil and placement of an asphalt cap over part of the right-of-way for conversion to a recreational trail as part of the federal Rails-To-Trails Act. The trail will be operated by the State of Idaho and Coeur d'Alene Tribe, and the cleanup maintained in perpetuity by UPRR funding.

The UPRR cleanup is not designed, in and of itself, to clean up all portions of the right-of-way. EPA recognizes that additional actions may be warranted in portions of the right-of-way, particularly in floodplain areas that are susceptible to recontamination. As cleanup is implemented under the UPRR cleanup and the Selected Remedy, results may indicate additional actions are warranted within portions of the right-of-way. These actions will be conducted using appropriate regulatory authorities.

2.3.2 Ecological

Many cleanup actions have been conducted at source areas and at depositional areas throughout the Basin. These actions have occurred from 1989 to the present and have been conducted by the mining companies, UPRR, various state and federal agencies, and the Coeur d'Alene Tribe. The mining companies and government agencies have worked in concert on many of these actions. For example, the Silver Valley Natural Resource Trustees (SVNRT), a cooperative effort of the IDEQ and the mining companies, has conducted significant cleanup activities. However, given the extensive contamination present, the bulk of the mining-related wastes that are deposited throughout the river and floodplain still remain.

Most of the cleanup actions have focused on source areas within Canyon Creek, Ninemile Creek, Moon Creek, Pine Creek, and the South Fork Coeur d'Alene River in the Osburn area. Other minor actions have been conducted in the Upper South Fork watershed and in the lower Coeur d'Alene River and lateral lakes areas. A summary of past cleanup actions for ecological protection is presented in Table 2.3-2.

2.4 SITE INVESTIGATION ACTIVITIES

The first comprehensive study of human health effects outside of the Box was conducted in 1996 by the Idaho Department of Health and Welfare (IDHW) and the Agency for Toxic Substances and Disease Registry (IDHW 2000). The study indicated excessive levels of lead absorption by children. Elevated blood lead levels were associated with lead loading in dust mats and bare soil in outdoor play areas (IDHW 2000). In 1997, EPA collected samples of soil, sediment, groundwater, surface water, and other environmental media (e.g., indoor dust, lead-based paint, garden produce) in the Basin. In 1998, EPA began the RI/FS process. To guide field sampling efforts, a generic field sampling plan and quality assurance project plan were prepared that included descriptions of methods that would be used to collect and analyze samples, conduct field measurements, and manage data (USEPA 1997a). Numerous project-specific sampling plans were developed as field sampling plan addenda (FSPAs) to the base plan (USEPA 1999b, USEPA 1999c, USEPA 1999d). Each FSPA was developed to address specific data gaps identified after reviewing available historical data and results of previous field sampling and analysis efforts. FSPAs were developed in general accordance with EPA's data quality objectives process (USEPA 1994b). Detailed descriptions of the investigations are presented in Section 4.2 of Part 1 of the RI (USEPA 2001b).

More than 10,000 samples were collected to support the remedial investigation. These samples, combined with the 7,000 additional samples collected independently by IDEQ, United States Geological Survey (USGS), United States Fish and Wildlife Service (USFWS), the mining companies, EPA under other regulatory programs (e.g., National Pollution Discharge

Elimination System [NPDES]), and others provide a solid basis to support informed risk management decisions for Coeur d'Alene Basin mining waste contamination. However, the large geographic area of the Basin made it impractical to collect all the data needed to fully characterize each source area or watershed. Further data collection will be necessary to support remedial design for areas identified as requiring cleanup. This may include areas where previous cleanup actions have taken place, such as floodplain areas of the UPRR right-of-way (ROW) or other areas where previous removal actions have addressed some, but not all, contamination present.

A human health risk assessment (HHRA) and an ecological risk assessment (EcoRA) were conducted for the Basin. The HHRA and the EcoRA are described in Sections 7.1 and 7.2, respectively. EPA funded the State of Idaho to be the technical lead for preparation of the HHRA, consistent with EPA lead guidance documents, through a Memorandum of Agreement between EPA and IDEQ (USEPA and IDEQ 1999). The lead risks portion of the HHRA was prepared by IDEQ, with oversight provided by EPA staff and a review board appointed by the governor of Idaho. The non-lead risks portion of the HHRA was prepared by EPA.

Table 2.1-1
History of Tailings Disposal Practices in the Coeur d'Alene Basin

Date	Milestone
1886	Processing of ore initiated using jigging.
1891	Six mills operating, with a total capacity of 2,000 tons per day
1901-1904	Construction of plank dams on Canyon Creek near Woodland Park and on the South Fork near Osburn and Pinehurst to control tailings movement. Large volumes of tailings accumulate behind the dams.
1905	Jig tailings from the Morning mill contained about 8% lead and 7% zinc.
1900-1915	Recovery of zinc initiated during this period. Previously, zinc was not recovered, and mills primarily processed low-zinc ores.
1906	Total milling capacity in the basin was 7,000 tons per day
1910	Flotation introduced in the basin at the Morning mill. Increased metals recoveries were achieved using flotation. Flotation tailings were finer grained than jig tailings and were transported greater distances by streams.
1917	Plank dams at Woodland Park and Osburn breached by flood waters.
1918	Flotation had been adopted at most mills by this time.
mid-1920s	Tailings observed in Spokane River.
1925	Flotation tailings from the Morning mill contained <1% each of lead and zinc.
1926-1928	Bunker Hill mills began placing tailings at Page Pond and the present-day location of the Central Impoundment Area.
1932	Dredging operations initiated in Lower Coeur d'Alene below Cataldo. Dredging continued until 1967. Dredge spoils were placed at Mission Flats.
1933	Plank dam near Pinehurst breached by flood waters.
1940-1942	Addition of 12 new mills with a combined capacity of 2,000 tons per day. Total milling capacity in the basin was 12,000 tons per day.
1940s	A portion of the tailings that had accumulated behind the Osburn and Woodland Park plank dams were reprocessed for metals recovery.
Late 1950s	Reuse of tailings as stope fill initiated.
1960s	Start of I-90 construction. Tailings from Mission Flats and Bunker Hill tailings pond used in embankment construction.
1968 to present	Tailings produced during this time have generally been impounded or used as stope fill.

Table 2.1-2
Preliminary Estimate of Mill Tailings Produced in the Coeur d'Alene Mining District

Disposal Method[a]	Dates	Tailings (tons)	Metals Contained in Tailings (tons)		
			Silver	Lead	Zinc
To creeks	1884-1967	61,900,000	2,400	880,000[b]	>720,000
To dumps	1901-1942	14,600,000	400	220,000	>320,000
Mine backfill	1949-1997	18,000,000	200	39,000	22,000
To impoundments	1928-1997	26,200,000	300	109,000	180,000
Total	1884-1997	120,700,000	3,300	1,248,000	>1,242,000

[a]Long (1998) defines dumps as unsecured stockpiles of tailings. Impoundments are secured by dams or other structures. Many impoundments were built over and from older tailings dumps.
[b]Bookstrom, et al. (2001) report that an additional 57,000 ±5,500 tons of lead were contained in slimes lost indirectly to the South Fork.

Source: Long (1998)

Table 2.3-1
Removal Actions for Protection of Human Health By Year
(Not Including the Bunker Hill Box)

Actions	1997	1998	1999	2000	2001	Total through 2001
Residential yards	7	11	23	25[a]	25	91
Schools/day cares	1[b]	-	3	2	1	7
Recreational and common-use areas	-[d]	-	4	1	1	6
Educational signage	-	-	9	-	-	9
Bottled water	-	-	10	1	-	11
Start of end-of-tap water treatment[c]	-	-	4	1	-	5
Municipal water hookup	-	-	6	6	-	12
Cubic yards of contaminated soil removed	1,935	1,500	20,000	12,000	6,400	41,835
Cost	$149,000	$249,000	$2,100,000	$2,300,000	$2,300,000	$6,998,000

[a] 2000 yard tally includes 2 homes with exterior lead-based paint that were pressure-washed prior to removal of contaminated soil.
[b] Silver Hills Middle School was started in 1997 and completed in 1998 due to extremely large size and coordination with school schedules.
[c] Once started, end-of-tap water treatment has been provided each year and will continue until a more permanent solution (e.g., municipal water hookup) is made available.
[d] In 1997, BLM addressed health concerns at the Killarney Lake Boat Ramp (cleanup was not conducted under removal action authorities).

Table 2.3-2
Past Cleanup Actions for Ecological Protection

Site Name	Responsible Agency/Entity	Dates of Action	Description of Action
Upper South Fork			
Morning Mine No. 6	Hecla	1989 and 2000	Adit drainage directed to subsurface flow, rock-bed filter treatment system. Slaughterhouse Gulch was lined to reduce infiltration through the waste rock pile.
Canyon Creek			
Standard Mammoth Facility	ASARCO	1997-1998	Removal of tailings with disposal at Woodland Park Repository. Regraded, stabilized, capped and revegetated waste rock pile. Removed railroad grade and crossing
Canyon Creek from Tamarack to below Gem	SVNRT	1997-1998	Time-critical removal of ~127,000 cy of tailings and contaminated sediment with disposal at the Woodland Park Repository. Soils at removal areas were amended with organic materials, then revegetated. The stream channel of Canyon Creek was stabilized with bioengineering techniques.
Gem Millsite	SVNRT	2000-present	Pilot system (10 gallons per minute (gpm)) for treatment of drainage from the Gem Portal.
Lower Canyon Creek Floodplain	SVNRT	1997-1998	Time-critical removal of 472,000 cy of tailings and contaminated materials with disposal at the Woodland Park Repository. Soils at removal areas were amended with organic materials, then revegetated. The stream channel of Canyon Creek was stabilized with bioengineering techniques.
Woodland Park Repository	SVNRT	1997-1998	Construction of an unlined repository for disposal/consolidation of removals along Canyon Creek. Repository contains approximately 600,000 cy of contaminated materials. Repository capped with native soils and revegetated.
Ninemile Creek			
Interstate Tailings Removal	Hecla	1992-1993	Removal of tailings adjacent to East Fork Ninemile Creek (EFNMC) with consolidation to a nearby uphill area. Installation of straw bales along perimeter of tailings for erosion control.

Table 2.3-2 (Continued)
Past Cleanup Actions for Ecological Protection

Site Name	Responsible Agency/Entity	Dates of Action	Description of Action
Interstate Millsite	SVNRT, IDEQ, Hecla	1998	Non time-critical removal of ~60,000 cy of tailings, mill debris, and contaminated sediments from the mill site and from EFNMC for 1000 feet downstream. Disposal at an on-site repository. EFNMC stabilized with bioengineering structures in removal areas.
Success Mine/Mill Tailings and Waste Rock	EPA, IDEQ	1993	Time-critical removal action included relocation and riprap armoring for ~1,600 feet of EFNMC channel; relocation of streamside tailings; placement of in-stream structures for energy dissipation; capping of tailings pile with 1-foot thick overburden rock; installation of upgradient groundwater and surface water diversions.
Success Mine Site Passive Treatment	IDEQ	2000-present	Contaminated groundwater diverted by a subsurface grout wall (approximately 1,350 feet in length) to a treatment vault. Groundwater treated using apatite.
East Fork Ninemile Creek Floodplain	IDEQ, Hecla	1994	Time-critical removal of ~50,000 cy of flood plain tailings and contaminated sediments with disposal at the Day Rock Repository. Stream reconstruction, riparian stabilization, and revegetation.
Ninemile Creek Floodplain near Blackcloud	SVNRT	1994	Time-critical removal of ~44,000 cy of flood plain tailings and contaminated sediments with disposal at the Day Rock Repository. Stream reconstruction, riparian stabilization, and revegetation.
Day Rock Repository	SVNRT, IDEQ, Hecla	1994	Approximately 94,000 cy of materials from the floodplain removals were placed on top of the existing Day Rock repository and capped with native soils and growth media.
Moon Creek			
Silver Crescent and Charles Dickens	USFS	1998-2000	Non-time-critical removal of ~130,000 cy of tailings, waste rock, contaminated soils, and mill structures, with disposal at an on-site repository. Closure of four adits. Stream relocation and habitat reconstruction along approximately 3,300 feet of Moon Creek, and 10 acres of riparian revegetation.

Table 2.3-2 (Continued)
Past Cleanup Actions for Ecological Protection

Site Name	Responsible Agency/Entity	Dates of Action	Description of Action
Pine Creek			
Constitution Mine and Millsite	BLM	1998-Present	Non-time-critical removal included removal of contaminated soils around the mill with disposal at the Central Impoundment Area (CIA), and realignment of East Fork Pine Creek (EFPC) away from the toe of the tailings pile. Most of the tailings and waste rock dump are on private land and have not been addressed to date.
Denver Cr.	BLM	1996-2000	Time-critical removal of ~5,200 cy of tailings and contaminated soils. No actions have been conducted on the private portion of the pile. Stream channel stabilization.
Douglas Mine and Millsite	EPA	1996-1997	Time-critical removal of two existing tailings impoundments from the flood plain of the EFPC. 25,000 cy of contaminated materials were removed and placed into a temporary repository constructed east of Pine Creek Rd. near the mine.
Highland Creek Floodplain	BLM	1999	Time-critical removal of 8,100 cy major discrete tailings deposits along Highland Creek on public lands.
Highland-Surprise	BLM	1999	Diversion of Highland Cr. to reduce erosion of the lower waste rock dump. Most of the facilities at this site are on private land, thus no other actions have been taken to date.
Sidney (Red Cloud)	BLM	1998-2000	Non-time-critical removal of contaminated soils around the mill foundations with disposal at the CIA; run-on and run-off controls; and improvements to the upstream culvert on Red Cloud Creek to control flow through the site and reduce downstream erosion. Passive treatment of adit drainage with inflow prevention at the Sidney Shaft in Denver Creek. Rock dump regraded and hydroseeded in 2000 to minimize erosion.
Amy-Matchless Millsite	BLM	1996-2000	Time-critical removal of ~9,600 cy of tailings and contaminated soils in 1996 and 1997. In 1998, a non-time-critical removal action removed an additional 420 cy of residual tailings. Disturbed area covered with soil and revegetated. Mine adit was closed by backfilling. Waste rock dump regraded and revegetated.
Liberal King	BLM	1996-2000	Time-critical removal of ~9,400 cy of tailings and contaminated soils in 1998, 99 cy of millsite tailings and mill wastes were removed from the mill area. In 1999, non time-critical removal of an additional 1,800 cy of tailings, regrading backfill of a dry adit, import of growth medium, and revegetation. The 2000 actions included extensive grading and planting of riparian vegetation.

Table 2.3-2 (Continued)
Past Cleanup Actions for Ecological Protection

Site Name	Responsible Agency/Entity	Dates of Action	Description of Action
Nabob	BLM	1994-2000	Soil cover over the tailings pile and a portion of mill area; fence to limit access to the millsite and tailings; channel improvements along Nabob Creek stabilize the channel and prevent erosion of the tailings pile embankment.
South Fork			
South Fork Floodplain Removals	SVNRT	1998	Non-time-critical removals at several areas in the floodplain totaling about 128,000 cy of tailings and contaminated soils.
South Fork above Elizabeth Park	SVNRT	1995	Tailings removal and construction of an armored levee with rock grade-control structures to stabilize bank.
Moon Creek at Mouth (Elk Creek Pond)	SVNRT; USACE, EPA	1994; 2000	Limited tailings removal in 1994. Clean sand was imported for a recreational beach at this swimming hole. Time-critical removal of 28,000 cy of contaminated sediments and tailings in 2000.
Lower Coeur d'Alene River			
Cataldo Mission	CDA Tribe	1995	Removal of ~700 cy of tailings and contaminated soils from traditional campground areas in the vicinity of the Cataldo Mission.
Cataldo Boat Ramp	IDEQ	1996-1997	Placement of cabled log bank protection and brush wattling to reduce erosion and planting of bushes in the vicinity of contaminated soils to discourage human contact with the soils.
Dudley	SVNRT	1999	Pilot bank erosion project to evaluate effectiveness of rock berms in reducing bank erosion cased by piping, or undercutting by boat wake. The project included minor bank regrading and shaping along 750 feet of a straight portion of the river channel near Dudley, with installation of riprap channel bank armoring and rock berms along the overbank.
Medimont	IDEQ/Soils Conservation Service	1994	Placement of four types of bank erosion control: two with hay bales, two with riprap. Subsequent monitoring indicated that the hay-bale methods were not effective in this portion of the river.

Source: Compiled from Tables 1.5-20 through 1.5-26 of the Final Feasibility Study (USEPA 2001c).

3.0 COMMUNITY PARTICIPATION

Throughout EPA's RI/FS activities leading up to this ROD, extensive efforts have been made to inform and involve the public. EPA conducted the activities summarized in this section because the agency believes that community involvement is a key element in developing a successful cleanup plan.

In addition to the many activities discussed below, EPA has complied with the specific requirements for public participation under CERCLA by publishing a Proposed Plan for public comment in October, 2001. The Proposed Plan public comment period ran from October 29, 2001 to February 26, 2002. During the comment period, EPA held four public meetings. Complete transcripts of these public meetings are included in the Administrative Record and are available for public review in local information repositories. A Notice of Availability summarizing the Preferred Alternative was mailed to approximately 1,000 Basin residents. EPA also published newspaper advertisements in the *Coeur d'Alene Press*, the Idaho and Washington editions of the *Spokesman Review*, the *Shoshone News Press*, and the *St. Maries Gazette* announcing the availability of the Proposed Plan, the comment period and the public meetings. The advertisements also briefly described the Preferred Alternative.

EPA released a draft Community Involvement Plan (CIP) for public review in October 1998 and finalized the plan in early 1999. It described how EPA would share information about its activities and how people could become involved and provide input as the cleanup plan was being developed. In response to input from people in the Basin, EPA enhanced its community involvement efforts by adding more information sharing and public input opportunities than originally described in the CIP. A summary of EPA's community involvement activities is provided below.

Community Liaison. In early 1999, EPA hired a full-time community liaison based in Coeur d'Alene. The liaison is an on-scene resource who answers questions, acts as a conduit of information from the community back to EPA staff and managers in Seattle, WA, makes presentations to local organizations about EPA's work in the Basin and provides staff support to the Citizens' Advisory Committee (CAC) RI/FS Task Force.

Comment Periods. Rather than having one public comment period when the Proposed Plan was released, EPA provided four additional public comment periods on drafts of four documents prior to the release of the Proposed Plan. The four documents were the draft HHRA, the draft EcoRA, the draft RI and the draft FS. The comment period for each of these documents was extended beyond 30 days upon request and EPA provided a written response to comments on each of these documents. To make these documents easier for people to understand, EPA also prepared executive summaries for each of these documents.

Progress Report. In April 2001, the governments involved in developing the Basin cleanup plan distributed a progress report that was intended to give the public a sense of the priorities and cleanup approaches that were likely to be included in the Proposed Plan. EPA conducted four public meetings to update the public at the time the progress report was released.

Fact Sheets. During the RI/FS, EPA sent 10 fact sheets that announced major project milestones to a mailing list of approximately 1,000 people. In addition, two fact sheets were included as newspaper inserts in the *Coeur d'Alene Press* and *Shoshone News Press*. EPA also produced and mailed a Notice of Availability that summarized the Preferred Alternative in the Proposed Plan and provided information on the public meetings.

NewsBriefs. Beginning in fall 2000, EPA produced and either mailed or e-mailed 35 monthly *"NewsBriefs"* to more than 200 people each. *NewsBriefs* is now being sent to a longer mailing list of about 1,000 people. *NewsBriefs* provides updates from EPA and the many other state, tribal, and local agencies doing work in the Basin. It also provides a calendar of events for upcoming agency and community group meetings related to the Basin cleanup activities, and lists documents recently added to information repositories.

Briefing Sheets. EPA provided eight "briefing sheets" which described environmental sampling events in the Basin and the results of the sampling.

Resource manual. EPA provided about 100 resource manuals to citizen advisory group members and local elected officials to help them understand the various elements of the cleanup process and keep track of the written material they received from EPA.

Public Meetings, Workshops, Briefings with Elected Officials, and Meetings with Local Organizations. EPA hosted or participated in more than 200 meetings with the general public, elected officials, citizen groups, or community organizations since early 1999 (66 in 1999, 63 in 2000, 55 in 2001, and 15 so far in 2002). These include:

- 16 general public meetings or workshops, including three educational workshops on the HHRA, EcoRA, and FS; and four workshops to preview the Proposed Plan nearly three months prior to its release, in addition to the four formal public meetings on the Proposed Plan

- 41 meetings with local elected officials and congressional staff

- 24 meetings with the CAC RI/FS Task Force and/or the CAC "core" membership

- 16 meetings with the Washington CAC

- EPA's Regional Administrator or EPA officials from Washington D.C. visited the Basin 8 times and participated in 23 separate meetings

RI/FS Task Force. EPA supported the formation of the CAC's RI/FS Task Force and provided staff support to this group for more than two years. This group assisted EPA in making sure people in the Basin were well informed and knew how and when to get involved. The group also provided valuable input during the RI/FS and development of the Proposed Plan.

Washington CAC. EPA worked with the Washington CAC in its effort to provide input on the testing of Spokane River beaches and other elements of the RI/FS and Proposed Plan process.

State of Idaho's Consensus Building Process. EPA participated in and supported the State of Idaho's Consensus Building Process. This intensive six-month process brought diverse interests together to develop a range of common-ground recommendations on the priority areas for cleanup in the Basin.

Information Repositories. EPA established five information repositories in Basin communities where citizens can review detailed information about the cleanup work. The information at the repositories includes documents available for public review and comment and many other technical documents. The repositories were frequently advertised in fact sheets and newspaper notices as well as in *NewsBriefs.*

Basin Website. EPA has maintained a website for the Basin project that allows people to access technical documents, fact sheets, *NewsBriefs*, newspaper clippings and other resources directly from their computers.

Cooperative Agreements. EPA provided more than $100,000 in grant money via two separate cooperative agreements to counties and cities in the Basin. The grants were intended to allow the communities in the Upper Basin and Lower Basin to hire technical experts to help them provide input throughout the RI/FS process.

In addition to the above activities coordinated by EPA's Regional Office in Seattle, WA, during 2001, EPA's Community Involvement and Outreach Center in Washington D.C. hired a contractor to conduct public surveys at several Superfund sites around the country. The Coeur d'Alene Basin was one of the sites chosen to survey. The surveys were intended to gauge the effectiveness of EPA's community involvement programs. Approximately 1,800 Basin residents received the survey and 27 percent of those people returned the survey.

4.0 SCOPE AND ROLE OF THE SELECTED REMEDY

This section describes the scope and role of this Selected Remedy in relation to the overall site cleanup strategy. Section 4.1 describes the relationship of the Coeur d'Alene Basin (OU 3) to the Bunker Hill Box (OUs 1 and 2) and provides a description of each of the three OUs. Section 4.2 describes the relationship of the Selected Remedy to the long-term cleanup needs.

4.1 DESCRIPTIONS OF OPERABLE UNITS

EPA has identified three operable units in the Basin: the populated areas of the Bunker Hill Box (OU 1); the non-populated areas of the Box (OU 2); and mining-related contamination in the broader Coeur d'Alene Basin (OU 3). This ROD is focused on OU 3. Descriptions of the three operable units are provided in this section.

RODs have been signed in 1991 and 1992. The 1991 ROD addressed the residential soils component of OU 1. The 1992 ROD addressed OU 2 and the remaining components of OU 1. In November 2001, an amendment to the OU 2 ROD was signed to address the long-term management of acid mine drainage (AMD) from the Bunker Hill mine. In 1998, EPA initiated an RI/FS for OU 3. A Proposed Plan for OU 3 was released for public comment in October 2001 (USEPA 2001e).

4.1.1 Operable Unit 1 (Populated Areas of the Bunker Hill Box)

The populated areas operable unit of the Bunker Hill Box (OU 1) includes residential and commercial properties, ROWs, and public use areas in the towns of Kellogg, Wardner, Smelterville, Pinehurst, and several smaller unincorporated communities. Cleanup activities began in OU 1 as this was the area of greatest concern for human health exposure. In 1985, a Lead Health Intervention Program (LHIP) was initiated by the Centers for Disease Control and Prevention (CDC) and the Agency for Toxic Substances and Disease Registry (ATSDR) to minimize blood lead levels in children through health education, parental awareness, and biological monitoring. This ongoing program is administered by the Panhandle Health District in conjunction with the Idaho Department of Health and Welfare (IDHW).

In 1986, 16 public properties (including city parks and school playgrounds) were cleaned up as part of a CERCLA time-critical removal action. The yard soil removal program was initiated in 1989 as a CERCLA time-critical removal action to replace contaminated soils in yards of young children at highest risk of lead poisoning. Since 1994, the yard soil removal program has been implemented by the PRPs pursuant to the 1991 and 1992 RODs and 1994 Consent Decree. The PRPs are scheduled to remediate at least 200 residential yards each year until all yards, commercial properties, and ROWs with contaminated soils containing greater than or equal to 1,000 mg/kg of lead have been remediated to achieve a community-wide geometric mean of 350 mg/kg lead.

Remediating at least 200 residential yards each year is important because the pace of remediation affects the potential for remediated parcels to be recontaminated by soil and dust from parcels that have not been remediated.

House dust, long recognized as a primary source of lead exposure among children, is being monitored through the LHIP. Should house dust lead levels remain elevated following completion of yard soil remediation, homes with dust lead concentrations greater that 1,000 mg/kg will be evaluated for interior remediation. EPA, the State of Idaho, and the U.S. Army Corps of Engineers are conducting a House Dust Pilot Study. The purpose of the study is to evaluate three methods of cleaning homes to determine the most effective method for reducing contaminated dust in homes. Eighteen homes in Smelterville were cleaned and sampled in 2000 and 2001. The analysis of the study results is ongoing. If cleanup of home interiors is deemed necessary after completion of remediation, the results from the study will be considered when selecting the most effective cleaning method and to estimate cleaning costs (IDEQ 2001).

A five-year review of OU 1 was completed in 2000, which further describes OU 1 cleanup activities.

4.1.2 Operable Unit 2 (Non-Populated Areas of the Bunker Hill Box)

The non-populated areas operable unit of the BHSS (OU 2) includes the former industrial complex and mine operations area, river floodplain, hillsides, various creeks and gulches, surface water and groundwater, the Central Impoundment Area (CIA), and the Bunker Hill Mine and associated acid mine drainage (AMD). Site PRPs performed various removal activities pursuant to several orders prior to the 1992 ROD, including smelter stabilization efforts from 1989 to 1993, and hillsides revegetation and fugitive dust control efforts from 1990 to 1992.

Following completion of the ROD in 1992, PRPs signed a consent decree with EPA to perform cleanup activities in limited areas of OU 2, including the UPRR ROW, and the A-4 gypsum pond. In 1995, EPA and the State of Idaho entered into a State Superfund Contract to perform the remaining site remedial actions. Cleanup actions addressed in the ROD included a series of source removals, surface capping, reconstruction of surface water creeks, demolition of abandoned milling and processing facilities, engineered closures for waste consolidated on site, revegetation efforts, and surface water and groundwater controls in the Bunker Hill Box and treatment in a constructed wetlands treatment system.

There have been two ROD amendments (September 1996 and November 2001) and two Explanation of Significant Differences (January 1996 and April 1998) since the ROD was completed in 1992. A five-year review of OU 2 was completed in 2000. The review document further describes OU 2 cleanup activities.

In the 1995 Bunker Hill State Superfund Contract, EPA and the State of Idaho agreed to a two-phased site implementation strategy. Phase I largely addresses source removals aimed at consolidating extensive contamination from various areas of the site. Phase I cleanup activities were mostly complete in 2001. Phase II will address site surface water and groundwater cleanup and will be implemented following completion of source control and removal activities and evaluation of the effectiveness of these activities in meeting water quality improvement objectives.

OU 2 also includes the Bunker Hill Mine and associated AMD. The AMD contains very large loads of metals. The existing central treatment plant (CTP) has not been significantly upgraded since it was built in 1974, is not capable of consistently meeting current water quality standards, and requires repair and replacement to prevent equipment failure.

The 1992 non-populated areas ROD did not select response actions for the mine water. The ROD, therefore, did not address control of AMD from the Bunker Hill Mine or operation of the CTP in any significant way. The ROD briefly addressed the mine water by requiring that it continue to be treated in the CTP prior to discharge to a wetlands treatment system for removal of residual metals. During studies conducted between 1994 and 1996 by the United States Bureau of Mines, the wetlands treatment system was found to be incapable of meeting the treatment levels established in the ROD. The 1992 ROD did not contain or otherwise identify any plans for the control or long-term management of the mine water flows. The ROD also did not address the long-term management of treatment residuals (sludge) from the CTP, which are currently pumped into an unlined pond on the CIA. At current disposal rates it is estimated that the pond will be filled in 3 to 5 years.

Additional remedies for the Bunker Hill AMD were selected in the November 2001 amendment to the OU 2 ROD. These remedies include:

- AMD source control to reduce the quantity of surface water entering the mine and AMD generated within the mine

- Temporary AMD storage in an existing lined surface pond located at the CTP or within the mine (for times when the treatment plant is shut down for maintenance or repairs or when the mine water flow exceeds treatment capacity)

- AMD treatment in an upgraded treatment plant
- Management of treatment residuals (sludge)

4.1.3 Operable Unit 3 (Coeur d'Alene Basin)

At the time the 1992 non-populated areas ROD was written, it was widely recognized that mining-related contamination in the Basin was not limited to the areas within the Bunker Hill Box. Actions selected in the ROD did not address sources of contamination outside of the Box. To address contamination and water quality issues in the broader Coeur d'Alene Basin, EPA, the State of Idaho, the Coeur d'Alene Tribe, and other federal, state and local agencies formed the Coeur d'Alene Basin Restoration Project. The purpose of this project was to integrate water quality improvement programs in the Basin through coordination of the federal regulatory authorities under the Clean Water Act, CERCLA, RCRA, and other state, local, and tribal programs. However, the Coeur d'Alene Basin Restoration Project had limited success as a systematic approach to addressing contamination in the Basin.

The first comprehensive study of human health effects outside of the Box was conducted in 1996 by the IDHW and the ATSDR (IDHW 2000a). The study indicated excessive levels of lead absorption by children.

In September 1996, the United States District Court for the Western District of Washington ordered EPA and the State of Idaho to develop a schedule for completion of total maximum daily loads (TMDLs) for all water-quality impaired streams identified by the state, including the Coeur d'Alene River Basin. TMDL development was initiated in 1998. In August 2000, a TMDL for dissolved cadmium, lead, and zinc in surface waters of the Basin was jointly released by EPA and the State of Idaho.[5] The TMDL establishes waste load allocations for discrete point sources and load allocations for non-discrete sources. It has long been recognized that non-discrete sources are the primary sources of metals in surface water in the Basin. The CERCLA remedial process was identified as the most effective tool to address these non-discrete sources.

Because of the presence of environmental and human health impacts in areas outside of the Box and the limitations of the existing authorities to deal with these impacts, EPA initiated a RI/FS for the Coeur d'Alene Basin in 1998. The final EcoRA was released in May 2001, and the final HHRA was released in July 2001. In October 2001, the final RI and FS were released. Also in October 2001, the Proposed Plan was released for public comment. The public comment period ended on February 26, 2002.

[5] On September 4, 2001, a district court judge for the State of Idaho invalidated the TMDL on the procedural grounds that the IDEQ had not engaged in formal rulemaking when adopting the Basin TMDL. The impact of this court decision on TMDL implementation is currently unclear, and the final status of the TMDL has not yet been determined.

The Selected Remedy for OU 3 includes remedial actions for 1) protection of human health in the communities and residential areas, including identified recreational areas, of the Basin upstream of Coeur d'Alene Lake (the Upper Basin and Lower Basin), 2) protection of the environment in the Upper Basin and Lower Basin, and 3) protection of human health and the environment in areas of the Spokane River. At present, the risks to persons, including Spokane tribal members, and others who may practice a subsistence lifestyle in the Spokane River area have not been quantified. EPA and the Spokane Tribe are cooperating in planning additional testing and studies that will be implemented to evaluate the potential exposures to subsistence users. The results of those tests and studies will determine appropriate future response actions to be taken, if any.

The Selected Remedy includes a complete remedy for protection of human health in the communities and residential areas, including identified recreational areas, of the Upper Basin and Lower Basin. Certain potential exposures outside of the communities and residential areas of the Upper Basin and Lower Basin are not addressed by this ROD, and will continue to present risks of human exposure to hazardous substances. These potential exposures impacting human health include:

- Recreational use at areas in the Upper Basin and Lower Basin where cleanup actions are not implemented pursuant to this ROD
- Subsistence lifestyles, such as those traditional to the Coeur d'Alene and Spokane Tribes
- Potential future use of groundwater that is presently contaminated with metals.

For environmental protection, the Selected Remedy identifies approximately 30 years of prioritized actions in areas of the Basin upstream of Coeur d'Alene Lake. During this period, EPA will evaluate the effectiveness and protectiveness of these remedial actions as well as the technical practicability of attaining applicable or relevant and appropriate requirements (ARARs), in particular ambient water quality standards for lead, zinc, and cadmium. During the five-year review process and at the end of this approximately 30-year period, EPA will evaluate and decide whether any additional remedial actions are necessary to attain ARARs or to provide for the protection of human health and the environment, and whether any ARAR waivers should be applied.

EPA expressly recognizes that after the selected remedial actions are implemented, conditions in the Upper and Lower Basin may differ substantially from EPA's current forecast of those future conditions, which is solely based on present knowledge. The tremendous amount of additional knowledge that will be gained by the end of this period through long-term monitoring and five-year review processes may provide bases for future ARAR waivers. In addition, this new information and advances in science and technology may allow for additional actions to achieve ARARs and protect human health and the environment in a more cost-effective manner.

The Selected Remedy does not include remedial actions for Coeur d'Alene Lake. State, tribal, federal, and local governments are currently in the process of implementing a lake management plan outside of the Superfund process using separate regulatory authorities.

For the Spokane River, the Selected Remedy includes a complete remedy for protection of human health upstream of Upriver Dam and a complete remedy for protection of the environment between Upriver Dam and the Washington/Idaho border.

4.2 SITE CLEANUP STRATEGY

The remedy for OU 3 selected in this ROD is consistent with the overall cleanup strategy for the Basin. Cleanup activities began in OU 1, the area of the most imminent public health threats. The second priority for cleanup was OU 2. Cleanup activities in OU 2 are being implemented in two phases. Phase I addresses consolidating extensive contamination from various areas of the site. Phase II will address site surface water and groundwater cleanup.

This ROD extends the cleanup into the broader Basin (OU 3) and selects priority cleanup actions that will take approximately 30 years to implement. EPA recognizes that the State of Idaho has not concurred in the selection of any remedial action beyond those selected in this ROD. Furthermore, after implementation of the remedies selected by this ROD, EPA commits not to take or select any additional remedial actions in the Upper Basin or Lower Basin without first consulting with the State of Idaho. EPA will continue to work with the regulatory stakeholder group, which was instrumental in developing the actions selected in this ROD.

State legislation under the Basin Environmental Improvement Act established the process for the formation of the Basin Environmental Improvement Project Commission. The Commission includes federal, state, tribal, and local governmental involvement. EPA anticipates working as a member of the Commission. Actions selected in this ROD will be integrated with those selected in the Box to effectively clean up the Coeur d'Alene Basin.

5.0 SITE CHARACTERISTICS

This section describes the geography, topography, and nature and extent of contamination in the Coeur d'Alene Basin.

5.1 GEOGRAPHY AND TOPOGRAPHY

The Coeur d'Alene Basin RI/FS study area includes the Coeur d'Alene River Basin, Coeur d'Alene Lake, and the Spokane River. The contamination is mostly limited to floodplain areas, discrete mine and mill sites, and fill areas.

Based on the results of the RI (USEPA 2001b), the HHRA (IDHW 2001a), and the EcoRA (USEPA 2001a), the FS study area focused on the areas with the greatest human health and ecological risks. The study areas for development of human health and ecological alternatives are organized differently and are defined in the following sections.

5.1.1 Geographical Organization of the Human Health Alternatives

For development of the human health alternatives, eight major areas were identified based on projected human exposure scenarios and public use patterns. These specific areas are defined in the HHRA. For the purposes of this ROD, these areas have been consolidated into two principal geographic areas where the selected human health remedy will be implemented: the Upper Basin and the Lower Basin.

The Upper Basin generally includes mining-contaminated areas within the South Fork of the Coeur d'Alene River and its tributaries east of Cataldo.

The Lower Basin includes all of the Coeur d'Alene River west of Cataldo to Harrison, at the mouth of Lake Coeur d'Alene.

5.1.2 Geographical Organization of the Ecological Alternatives for the Upper Basin and Lower Basin

For development of ecological alternatives, two areas of the Basin upstream of Coeur d'Alene Lake were identified based on geomorphology, habitats, types of waste sources, mechanisms of release and transport of waste, and the natural resources affected by the release of wastes: the Upper Basin and the Lower Basin.

The Upper Basin encompasses the steep mountain canyons of the South Fork and its tributary gulches. The Upper Basin is the source area for most of the mining-related waste materials and includes the Canyon Creek, Ninemile Creek, Big Creek, Moon Creek, and Pine Creek tributary watersheds. The Upper Basin drains an area of 300 square miles. The channel and riparian zone of the South Fork and certain of its tributaries have undergone extensive channelization and other alterations as a result of mining-related activities and other anthropogenic activities, including the construction of the I-90 freeway.

The Lower Basin includes the lower Coeur d'Alene River, the lateral lakes, and extensive floodplain wetlands. Below Cataldo, the river flows into a broad, flat valley and takes on a meandering, depositional character with a fine sediment bottom. From Rose Lake downstream, the river surface elevation is controlled by Post Falls Dam on the Spokane River near the outlet from Coeur d'Alene Lake. Much of the tailings released to streams in the Upper Basin were transported to and deposited within the river channel and floodplains in the Lower Basin, largely during flood events.

For the purposes of the RI/FS, the Upper Basin and Lower Basin were further subdivided into one or more segments based on geomorphology, habitats, types of waste sources, mechanisms of release and transport of waste, and the natural resources affected by the release of wastes. Individual mining-related source areas in the Upper Basin were also identified based on mapping conducted by the BLM.

5.1.3 Coeur d'Alene Lake

Coeur d'Alene Lake encompasses 49.8 square miles at its normal full-pool elevation (2,128 feet above sea level), with a maximum water depth of 209 feet. The 2,128-feet elevation is the level defined by Avista's FERC license as the maximum permitted lake level. Its principal tributaries are the St. Joe's River and the Coeur d'Alene River. The lake has a drainage area of 3,741 square miles. The discharge from the lake forms the Spokane River. Coeur d'Alene Lake is a natural lake, but its elevation is controlled by the Post Falls Dam. The lake is classified as oligotrophic. A large volume of metals-contaminated sediment has been deposited on the lake bottom.

5.1.4 Spokane River

The Spokane River flows from Coeur d'Alene Lake and is dammed at six locations above its terminus at Lake Roosevelt. The river bed primarily consists of coarse gravel and cobbles, and the floodplain and riparian zone are relatively narrow. Metals contamination is present in depositional areas within the river's floodway. Priority depositional areas have been identified by the Washington Department of Ecology between the Washington-Idaho state line and Upriver Dam for environmental protection and upstream of Upriver Dam to the lake for human health protection.

At present, the risks to persons, including Spokane tribal members, and others who may practice a subsistence lifestyle in the Spokane River area have not been quantified. EPA and the Spokane Tribe are cooperating in planning additional testing and studies that will be implemented to evaluate the potential exposures to subsistence users. The results of those tests and studies will determine appropriate future response actions to be taken, if any.

5.2 NATURE AND EXTENT OF CONTAMINATION

Metals related to mining, milling, and smelting activities are present in soil, sediment, surface water, groundwater, and vegetation in the Basin. Sections 5.2.1 through 5.2.4 describe the nature and extent of contamination in the community and residential areas of the Upper Basin and Lower Basin, in non-community areas of the Upper Basin and Lower Basin, in Coeur d'Alene Lake, and in the Spokane River floodway upstream of the Spokane Indian Reservation.

5.2.1 Nature and Extent of Contamination Affecting Human Health in the Community and Residential Areas of the Upper Basin and Lower Basin

The primary media of concern for human health are:

- Contaminated soil where it occurs in residential yards, street rights-of-way, commercial and undeveloped properties, and common areas, and airborne dust generated at these locations

- Contaminated house dust, originating primarily from contaminated soil; interior house paint is also a potential source of lead

- Drinking water from local wells or surface water

- Contaminated aquatic food sources (e.g., fish)

- Contaminated homegrown vegetables

- Contaminated floodplain soil, sediments, and vegetation

People in the Basin can be exposed to chemicals of potential concern (COPCs) by ingesting soil, breathing dust, drinking water, and eating contaminated fish or homegrown vegetables. The COPCs for protection of human health are:

- Seven metals in soil: antimony, arsenic, cadmium, iron, lead, manganese, and zinc

- Seven metals in house dust: antimony, arsenic, cadmium, iron, lead, manganese, and zinc

- Five metals in groundwater: antimony, arsenic, cadmium, lead, and zinc

- Five metals in surface water: arsenic, cadmium, lead, manganese, and mercury

- Two metals in tap water: lead and arsenic

Although fish and vegetables were not screened for COPCs, indicator metals were selected for these based on toxicity and presence in the Basin. The selected indicator metals for fish consumption were cadmium, lead, and mercury; and for vegetable consumption were arsenic, cadmium, and lead. Although not considered a primary medium of concern in the HHRA, interior and exterior lead-based paint contributes to lead concentrations in yard soil and house dust. These are potentially important sources that are addressed on a case-by-case basis.

Exposures to lead in soil and dust from the home and surrounding communities are the primary human health concerns in the Basin. Table 5.2-1 shows geometric mean, arithmetic mean, minimum, and maximum lead concentrations in sampled yard soil and house dust in the Upper Basin and Lower Basin. Tables 5.2-2 and 5.2-3 present minimum, maximum, arithmetic mean, and geometric mean results for the seven COPCs in soil and house dust, respectively.

The identification of chemicals of concern (COCs) for protection of human health is described in Section 7.1. Minimum, maximum, and exposure point COC concentrations for various exposure scenarios and exposure points are also summarized in Section 7.1.

Drinking water obtained from private, unregulated sources is a potential exposure route. Table 5.2-4 presents the results of first-draw and flushed-line samples collected from private, unregulated drinking water sources in the Basin. Although groundwater contamination is observed in the Basin, an insufficient number of monitoring wells have been installed to fully characterize the nature and extent of groundwater contamination.

Soil, sediment, and surface water are impacted at beaches and recreational areas. Figure 5.2-1 shows graphically the widespread distribution of lead concentrations above EPA's emergency action level (2,000 mg/kg) for protection of human health in soil and sediment samples in the Basin. The figure shows four concentration ranges:

- 0 to 175 mg/kg (175 mg/kg equals the 90th percentile of the Upper Basin background soil lead concentration [Gott and Cathrall 1980].)

- 175 mg/kg to 500 mg/kg

- 500 mg/kg to 2,000 mg/kg
- Greater than 2,000 mg/kg

Figure 5.2-2 shows average metal concentrations in surface soil and sediment and average metal loads and concentrations in surface water in the Upper Basin and Lower Basin.

5.2.2 Nature and Extent of Contamination Affecting Ecological Receptors in the Upper Basin and Lower Basin

Contaminated media that potentially affect ecological receptors are surface water, soil, and sediment. In addition, groundwater is important as a pathway for migration of metals to surface water. The chemicals of ecological concern (COECs) for ecological protection are:

- Cadmium, copper, lead, and zinc in surface water
- Arsenic, cadmium, copper, lead, and zinc in soil
- Arsenic, cadmium, copper, lead, mercury, silver, and zinc in sediment

The identification and concentrations of COECs for protection of ecological receptors are described in Section 7.2. Cadmium, lead, and zinc are pervasive in all environmental media and generally present higher risks to ecological receptors than arsenic, copper, mercury, and silver. Therefore, cadmium, lead, and zinc are the focus of the discussion of the nature and extent of contamination presented in this section of the ROD.

To help characterize the nature and extent of contamination and to develop remedial alternatives, the contaminated media were grouped by “source type” in the FS. These source types are based on the mining-related primary sources (tailings, waste rock, and adit drainage) and the secondary sources, or impacted media (floodplain sediments, river banks and beds, wetlands, lateral lakes, dredge spoils, and lake bottom sediments) present in the Basin. Table 5.2-5 presents an overview of the quantities of impacted materials by source type in the Basin.

Upper Basin

The Upper Basin is the primary source of dissolved metals in the river system. Tables 5.2-6 and 5.2-7 show estimated average (expected) values of concentrations and loads (the amount of metal transported in a stream, in pounds per day), respectively, for dissolved cadmium, total lead, and dissolved zinc at sampling locations in the Basin. The estimated average values were calculated from surface water data collected during the period of 1991 to 1999 (USEPA 2001c).[6] The estimated average dissolved zinc load in the South Fork just above the confluence with the North

[6] At each sampling location, the metals concentrations and loads vary in time. A coefficient of variation (CV) is used to measure that variability. A high CV indicates relatively high variability relative to sampling mean.

Fork (South Fork at Pinehurst) is about 79 percent of the load that discharges to the lake (Lower Coeur d'Alene River at Harrison). Figure 5.2-3 shows the estimated average concentrations and loads of dissolved zinc in the river and tributaries in the Basin. The figure shows that zinc concentrations are substantially greater than 10 times the AWQC[7] in parts of the South Fork and some of its major tributaries.

The estimated average concentrations of dissolved cadmium, total lead, and dissolved zinc in the South Fork at Pinehurst are 9.1 µg/L, 56 µg/L, and 1,430 µg/L, respectively. Based on the estimated average values, about 1,550 pounds per day of dissolved zinc (53 percent of the total Upper Basin load) comes from sources inside the Bunker Hill Box and about 1,370 pounds per day of dissolved zinc (47 percent of the total Upper Basin load) comes from sources in the Upper Basin outside of the Bunker Hill Box.

Impacted sediments and associated groundwater in the valley fill aquifers of the Upper Basin are the largest sources of dissolved metals loading in the river and streams. Figure 5.2-4 shows the estimated proportions of the dissolved zinc load in the South Fork at Pinehurst (not including sources within the Bunker Hill Box) that are derived from impacted sediments and associated groundwater, tailings, waste rock, and adit drainage.[8] An estimated 71 percent of the load is derived from impacted sediments and associated groundwater. Surface water and groundwater percolates through the tailings-impacted sediments and dissolves metals. The water discharges into the streams and rivers, carrying the dissolved metal load with it. Metals loading is enhanced by the relatively large degree of surface water/groundwater interaction that occurs in some parts of the Upper Basin. In areas where the valley floor widens, streams lose water to the valley fill aquifer ("losing reach"). In areas where the valley floor constricts, groundwater discharges back into the streams ("gaining reach"), carrying additional metals load. The USGS studied the surface water/groundwater interaction (Barton 2000). Figure 5.2-5 shows the results of the study in lower Canyon Creek in September 1999. These studies show that most of the dissolved zinc load in the study areas was discharged to the streams in the gaining reaches.

An estimated 7 million cubic yards (cy) of tailings-impacted sediments are present in the Upper Basin (CSM Units 1 and 2), including an estimated 3 million cy of sediments that potentially cannot be accessed for excavation because they are beneath the I-90 embankment, other roads, or residential or commercial structures. In addition to the estimated 7 million cy of sediments directly impacted by tailings, analysis of deeper sediments samples indicates metals

[7] The national recommended water quality criteria, or ambient water quality criteria (AWQC), were used in the RI/FS as metrics to quantify existing surface water quality characteristics and the effectiveness of remedial actions for surface water. The values of AWQC used in the RI/FS are the EPA-approved Idaho and Washington water quality standards (Tables 8.2-2, 8.2-3, and 8.2-4). The national recommended water quality criteria have been updated for zinc (in 1999) and cadmium (in 1999 and 2000).

[8] Percentages of dissolved zinc load were estimated by combining the estimated volumes of source materials with the relative loading potentials of the source materials, as described in USEPA 2001f, *Probabilistic Analysis of Post-Remediation Metal Loading*.

concentrations generally exceed background concentrations to depths of 10 to 30 feet. These deeper sediments are potentially an important secondary source of metals.

Relatively little of the dissolved metals in the river system comes from discrete sources. Discrete sources include NPDES-permitted discharges (including the treatment plant for the Bunker Hill mine-water discharge) and unpermitted discrete discharges (adit and seep discharges). As shown in Figure 5.2-6, the estimated loads from the discrete discharges account for only about 8 percent of the estimated dissolved zinc load in the South Fork at Pinehurst.

Based on mapping conducted by BLM (BLM 1999), approximately 2,850 acres of land have been disturbed by mining-related activities or deposition of mining-related wastes in the Upper Basin (not including areas within the Bunker Hill Box). Approximately 295 acres of disturbed area were identified by BLM as riparian. Approximately 1,200 acres of other impacted floodplain areas were identified by BLM.

Lower Basin

In the Lower Basin, erosion of river banks and beds is a major source of metals, particularly lead, entering the Coeur d'Alene River. There are an estimated 1.8 million cy of impacted bank materials and an estimated 20.6 million cy of impacted bed sediments (including an estimated 3 million cy of bed sediments in the river delta downstream of Harrison) subject to erosion. The average concentration of lead in over 2,000 non-random sediment samples within the floodplain collected in the Lower Basin is 3,100 mg/kg.

The increase in total lead load below the confluence of the North Fork and South Fork is about 1,040 pounds per day, or about 69 percent of the load that discharges to the lake (Figure 5.2-7). Lead tends to bind more strongly to soil particles than does zinc, and the lead load is largely due to erosion of soil and sediment, particularly during high-flow periods. As a result, the total lead loads display a large variability with time. During low-flow periods, total lead loads as low as 30 pounds per day have been measured in the Coeur d'Alene River at Harrison. By contrast, during the 100-year flood event in February 1996, an estimated 1,400,000 pounds of lead were discharged to Coeur d'Alene Lake in a single day. The estimated average concentrations of dissolved cadmium, total lead, and dissolved zinc in the Coeur d'Alene River at Harrison, calculated from surface water data collected during the period of 1991 to 1999, are 1.9 µg/L, 52 µg/L, and 344 µg/L, respectively.

Lower Basin wetlands, 100-year floodplains, and lateral lake sediments are the major sources of metals ingested by waterfowl and other animals. Based on geostatistical analysis, there are about 18,300 acres of floodplain sediments that contain more than 530 mg/kg of lead in the surficial sediments, the lowest observed adverse effects level (LOAEL) for waterfowl. The area containing more than 530 mg/kg of lead represents an estimated 95 percent of the 19,200 acres of floodplain habitat present in the Lower Basin. There are about 15,400 acres of floodplain sediments that contain more than 1,800 mg/kg of lead, the mortality threshold concentration for waterfowl. The area containing more than 1,800 mg/kg of lead represents an estimated 80 percent of the 19,200 acres of floodplain habitat present in the Lower Basin. Table 5.2-8 shows the total areas and lead-impacted areas of wetland, lake, and riparian habitat in 27 wetland units identified by the USFWS in the Lower Basin.

The Lower Basin includes the Cataldo/Mission Flats area, where tailings were dredged from the river and placed within the 100-year floodplain from 1932 to 1967. An estimated 13 million cy of tailings-impacted dredge spoils cover about 680 acres at this location.

5.2.3 Nature and Extent of Contamination in Coeur d'Alene Lake

The beaches and wading areas adjacent to Coeur d'Alene Lake were sampled in 1998 and were found to be safe; i.e., concentrations of metals did not exceed risk-based levels for recreation. The only exception is Harrison Beach, which has been remediated as part of the UPRR removal action. Based on existing information, EPA has no reason to believe that mining contamination is present in the residential and commercial areas in the cities of Coeur d'Alene, Post Falls, and Harrison.

The water in Coeur d'Alene Lake meets the safe drinking water standards for metals, except when discharge from the Coeur d'Alene River is high (e.g., during high spring run-off or during flood events), which causes short-term lead concentrations that exceed the drinking water standard. The water in the lake exceeds the water quality standards for protection of aquatic life, which are more stringent than the drinking water standards, for cadmium and zinc and intermittently for lead.

A large volume of metals-impacted sediment has been deposited in Coeur d'Alene Lake. There are an estimated 44 to 50 million cy of contaminated sediments at the bottom of the lake. Studies by the USGS suggest that, under current lake conditions, there may be some movement of the metals from the sediment into the water column in the dissolved phase. The rate of release of metals in the sediments into the water column could increase if the lake water quality deteriorates due to nutrient enrichment. Currently, however, more metals enter the lake annually from the Coeur d'Alene River than flow out of the lake into the Spokane River. Table 5.2-9 shows the net retention of metals in the lake, where retention is the difference between the metal load into the lake and the load out of the lake, expressed as a percentage of the load into the lake. Cadmium retention ranged from 47 to 56 percent and averaged 52 percent. Lead retention ranged from 82 to 92 percent and averaged 89 percent. Zinc retention ranged from 31 to 43 percent and averaged 38 percent.

5.2.4 Nature and Extent of Contamination in the Spokane River Upstream of the Spokane Indian Reservation

Contaminated media that potentially affect humans are soil and sediment at shoreline and sediment depositional areas. The COCs for protection of human health are arsenic and lead. The identification and concentrations of COCs for protection of human health are described in Section 7.1.

The beaches and wading areas adjacent to the Idaho portion of the Spokane River were sampled in 1998 and were found to be safe; i.e., concentrations of metals did not exceed risk-based levels for recreation. Sediment depositional areas in the State of Washington portion of the Spokane River were sampled in 1998 and 1999 (Groisbois 1999), summer/fall 1999 (USEPA 2000d), and August/September 2000 (USEPA 2001i). Several depositional areas were found to contain lead and/or zinc at concentrations exceeding the risk-based levels. These areas are discussed in Section 7.1.3.

The water in the Spokane River meets the safe drinking water standards for metals.

Contaminated media that potentially affect ecological receptors are surface water, soil, and sediment. The COPECs for protection of ecological receptors are:

- Cadmium, copper, lead, and zinc in surface water
- Arsenic, cadmium, copper, lead, and zinc in soil
- Arsenic, cadmium, copper, lead, mercury, silver, and zinc in sediment

The identification of COECs for protection of ecological receptors is described in Section 7.2.

Figures 5.2-8, 5.2-9, and 5.2-10 present concentrations of cadmium, lead, and zinc, respectively, measured in 63 Spokane River sediment samples. Based on these data, about 25 percent of samples contained cadmium above the upper background concentration, about 82 percent of samples contained lead above the upper background concentration, and about 90 percent of samples contained zinc above the upper background concentration.[9] The average concentration of lead in 265 sediment samples collected in the Spokane River floodway between Coeur d'Alene Lake and Long Lake is 400 mg/kg.

Because there are relatively few depositional areas along the Spokane River, the volume of contaminated sediments is small compared to the Upper Basin and Lower Basin. An estimated volume of 260,000 cy of contaminated sediments are present upstream of Upriver Dam.

---

[9] 90th percentile upper background concentrations were estimated by Ecology using the 2 millimeter and finer fraction of upland soil samples (WDOE 1994).

Additional contaminated sediments are present downstream of Upriver Dam, but have not been quantified.

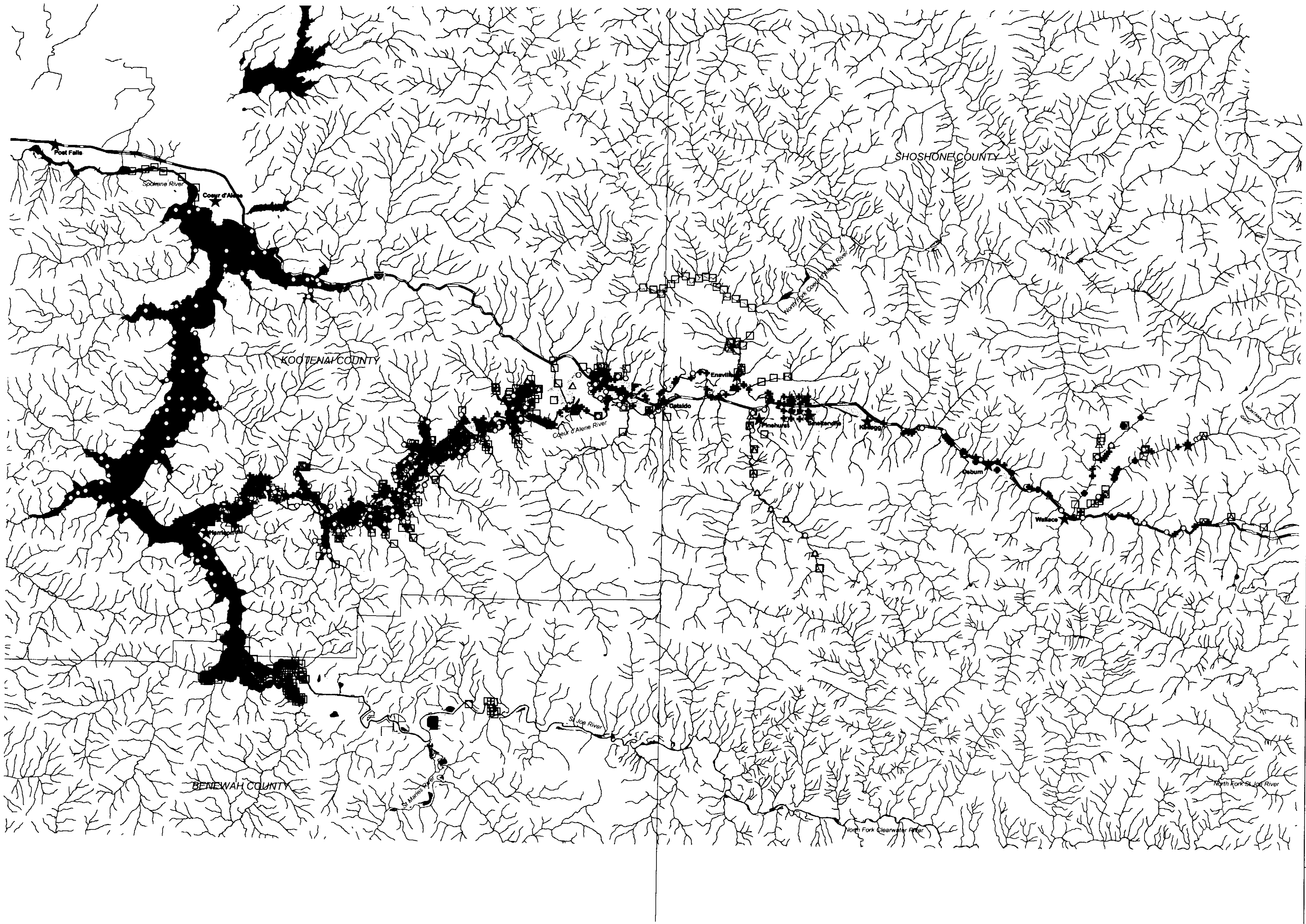
Surface water in the Spokane River has been impacted by metals including particulate lead transported into the Spokane River, particularly during winter storm events and spring runoff. In total metals analysis of samples from the Spokane River analyzed for the RI, 21 percent contained cadmium exceeding a screening level of 0.9 µg/L, 48 percent contained lead exceeding a screening level of 0.66 µg/L, and 68 percent contained zinc exceeding a screening level of 30 µg/L.[10] The estimated average concentrations of total lead and dissolved zinc in the Spokane River at Post Falls, calculated from surface water data collected during the period of 1991 to 1999, are 2.1 µg/L, and 58 µg/L, respectively. Dissolved cadmium was not detected.

Transport of particulate lead into the Spokane River, particularly during winter storm events and spring runoff, has resulted in deposition of lead-contaminated sediments in shoreline and subaqueous depositional areas and periodic exceedances of lead AWQC.

---

[10] The screening levels for lead and cadmium are equal to the federal AWQC for these metals for a hardness equal to 30 mg $CaCO_3$/L. The screening level for zinc is a risk-based concentration for protection of aquatic plants.

Figure 5.2-1
Range of Lead Concentrations in Surface Soils and Sediments in the Coeur d'Alene River Basin

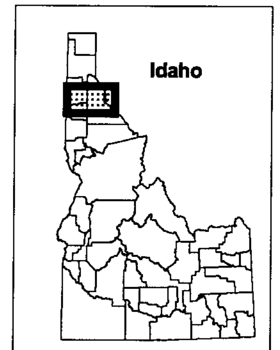


Legend

- ★ CITIES
- STREAMS
- RIVERS/LAKES
- FLOOD PLAIN

Lead Concentration Ranges (in ppm)

- □ 0 - 175
- △ 175 - 500
- ○ 500 - 2000
- ✚ >2000



Location Map

Notes:

1) Base map coverages obtained from the Bureau of Land Management (BLM) and The Coeur d' Alene Indian Tribe.

2) Lead concentrations obtained from the following sources:

McCully Frick and Gilman
RCG Hagler, Bailly Sampling Data
URS Greiner Woodward Clyde
USGS
USFW

N

SCALE: 1:300000

0 5 Miles

027-RI-C9-102Q
Coeur d' Alene Basin RI/FS
RECORD OF DECISION

EPA
REGION 10

Document Control Number: 4162500.07099.05.a
EPA No. 2.9
Project: n:\projects\rod\rod-01_03.apr
VIEW: Pb sediments
LAYOUT: Fig 5.2-4B-Size
05/02/02

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

Date of Plot: May 02, 2002

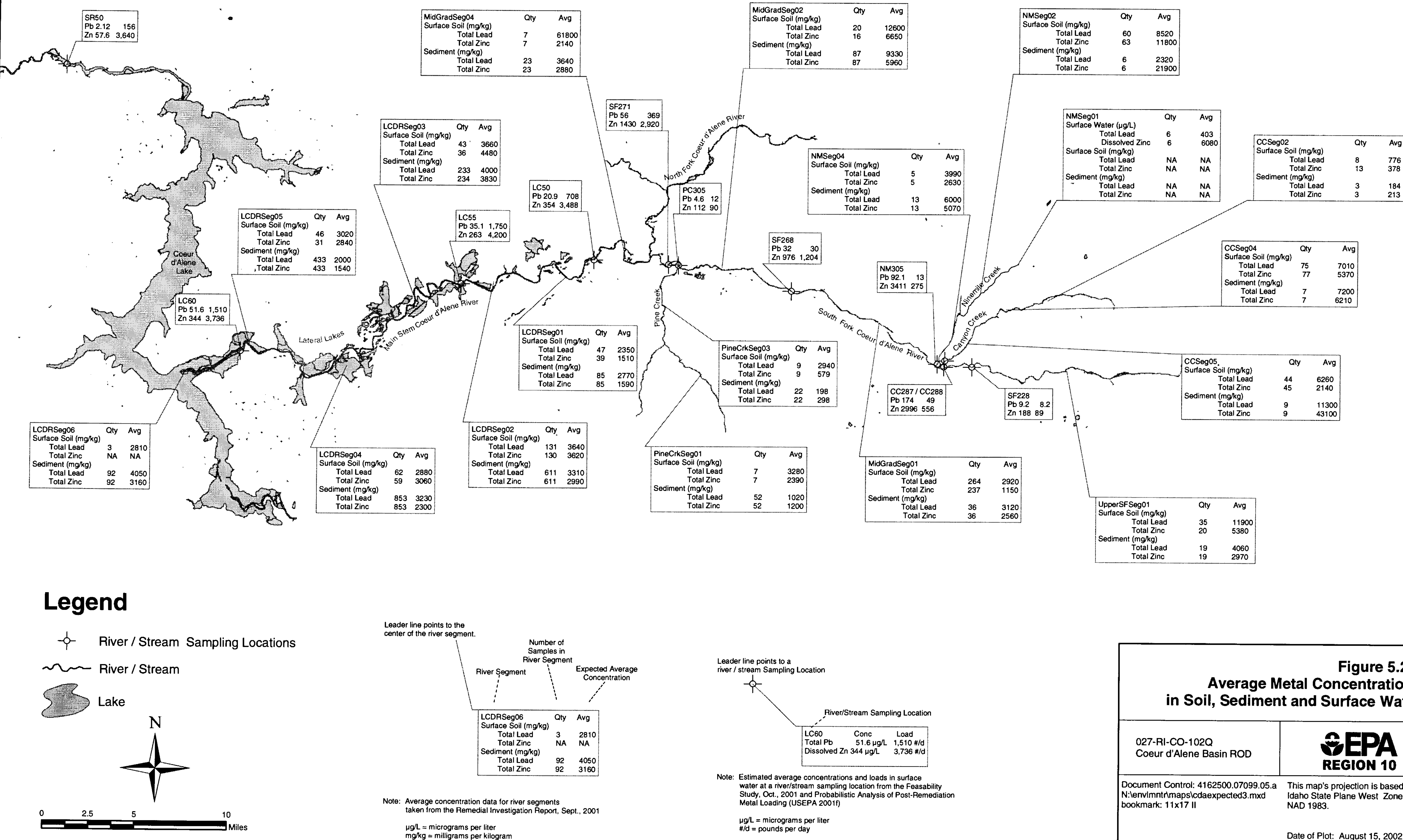


Figure 5.2-2
Average Metal Concentrations in Soil, Sediment and Surface Water

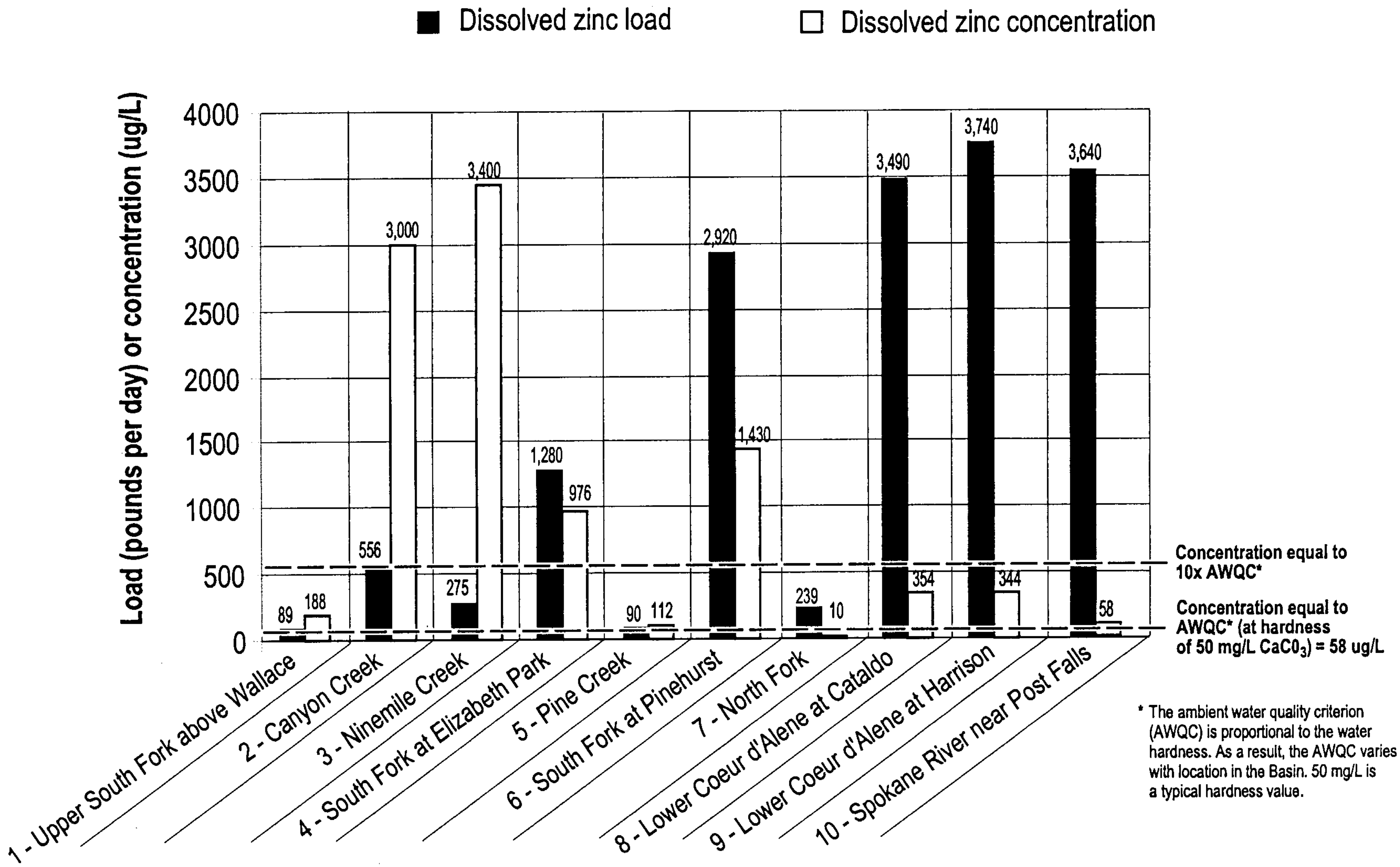
027-RI-CO-102Q
Coeur d'Alene Basin ROD

EPA REGION 10

Document Control: 4162500.07099.05.a
N:\envlmntr\maps\cdaexpected3.mxd
bookmark: 11x17 II

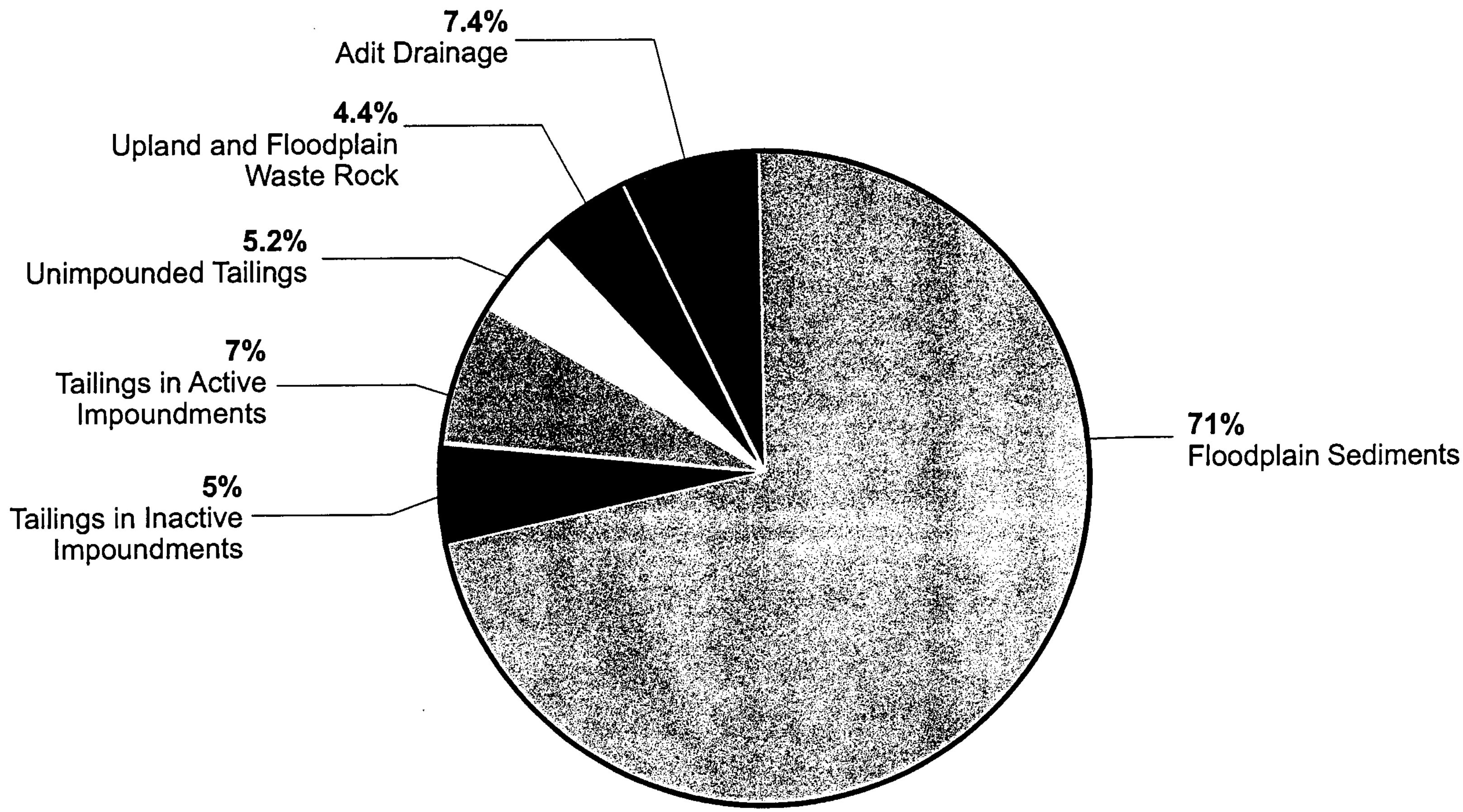
This map's projection is based on Idaho State Plane West Zone, NAD 1983.

Date of Plot: August 15, 2002



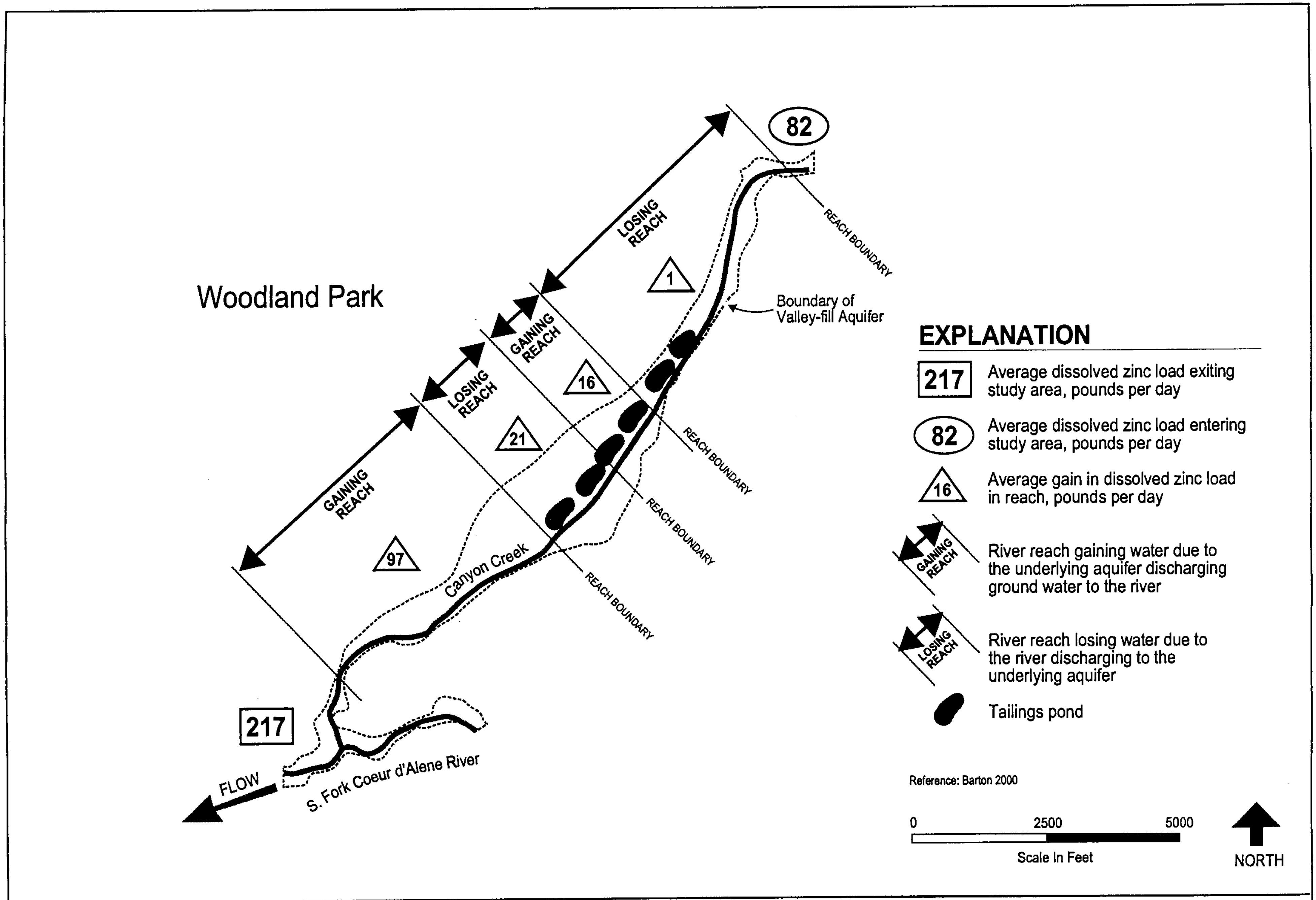
Note: Estimates based on analysis of available data from 1991 - 1999

Figure 5.2-3
Estimated Average Values of Dissolved Zinc Loads and Concentrations (1991-1999 Data)



Note: Percentages of dissolved zinc load were estimated by combining the estimated volumes of source materials with the relative loading potentials of the source materials, as described in USEPA 2001f, "Probabilistic Analysis of Post-Remediation Metal Loading"

EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RECORD OF DECISION	Doc. Control: 4162500.07099.05.a EPA No. 2.9	**Figure 5.2-4** **Estimated Sources of Dissolved Zinc Load in the Upper Basin (not including the Bunker Hill Box)**

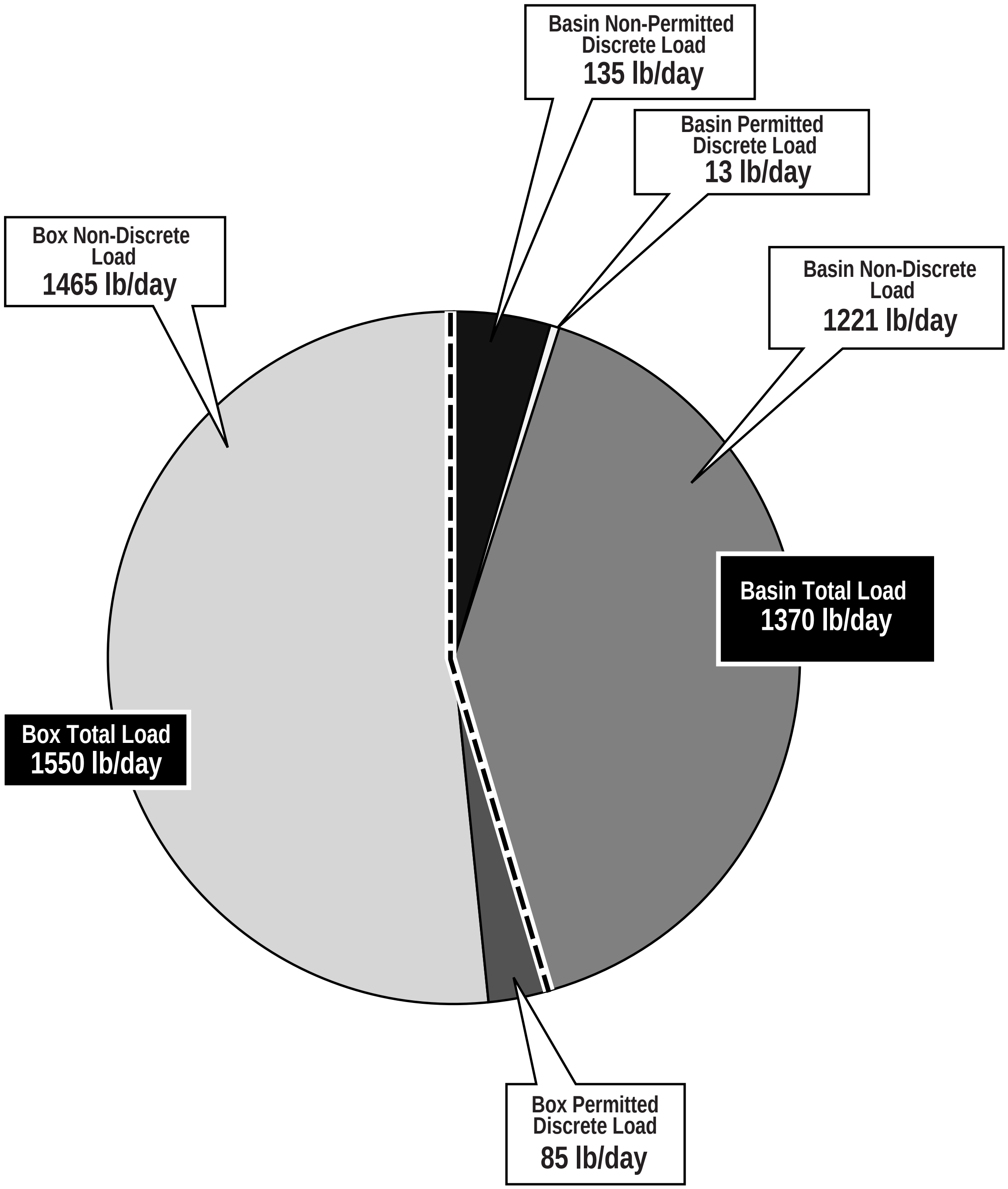


EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

Doc. Control: 4162500.07099.05.a
EPA No. 2.9

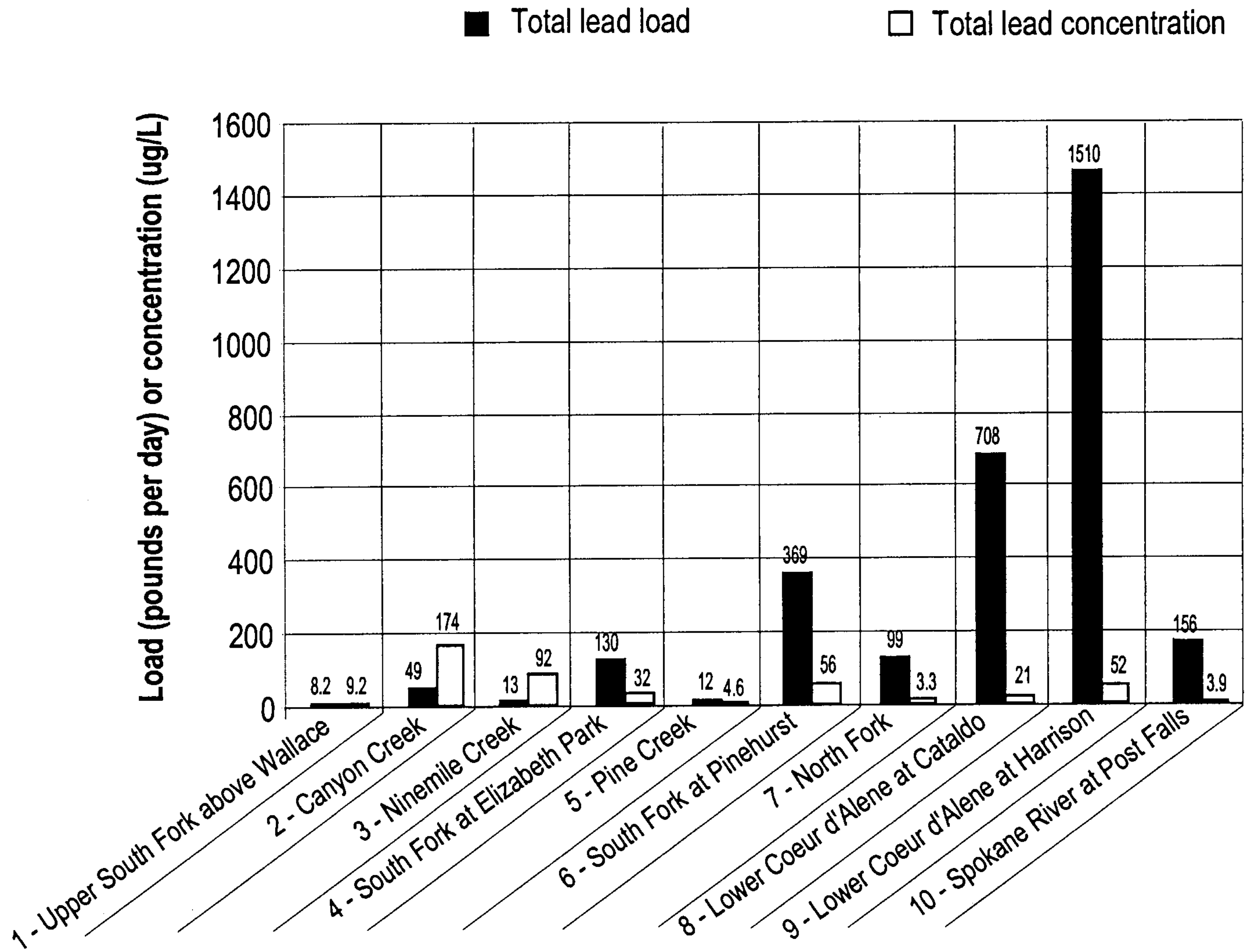
Figure 5.2-5
Dissolved Zinc Loads in Canyon Creek at Woodland Park, September 17, 18, and 19, 1999



Notes:

1. Non-discrete loads include waste piles and nonpoint sources (mining wastes that were disposed directly into the receiving water in the past).
2. Total dissolved zinc loads in Basin and Box equal to estimated average loads based on 1991 to 1999 data (USEPA 2001c). Loads from the Box are expected to decrease with time as a result of capping of the CIA, source removals in Smelterville Flats and the gulches (2.0 million cy), discontinuation of discharge of mine water on the CIA, and other actions. Monitoring will be conducted to evaluate the effectiveness of these actions.
3. Permitted loads based on data provided by EPA Office of Water (USEPA 2000c)
4. Basin non-permitted discrete loads from Feasibility Study (USEPA 2001c), Part 3, Appendix D, Table D-26)

Figure 5.2-6
Discrete and Non-Discrete Sources of Dissolved Zinc Load in the South Fork



Note: Estimates based on analysis of available data from 1991 - 1999

EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

Doc. Control: 4162500.07099.05.a
EPA No. 2.9

Figure 5.2-7
Estimated Average Values of Total Lead Loads and Concentrations (1991-1999 Data)

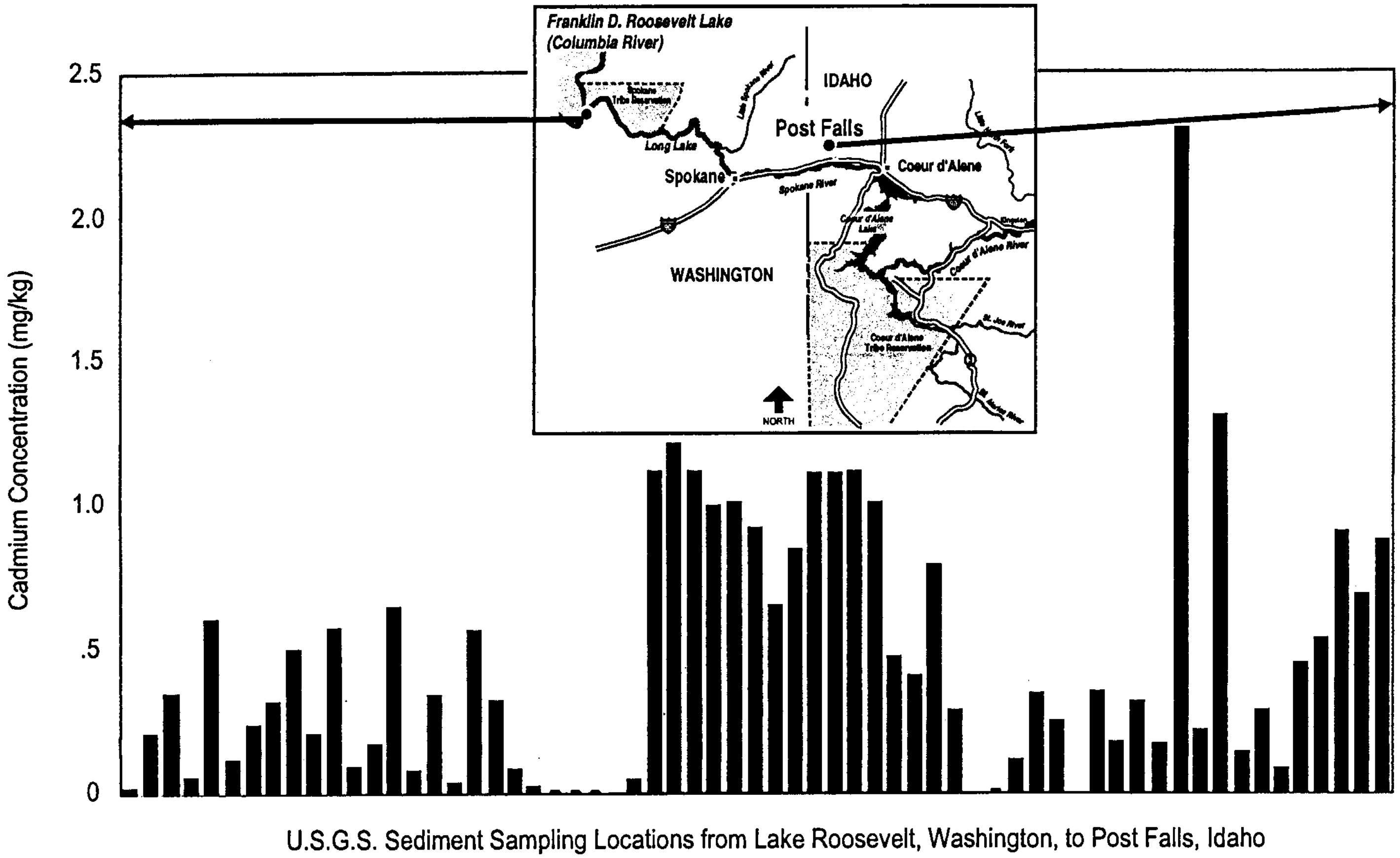
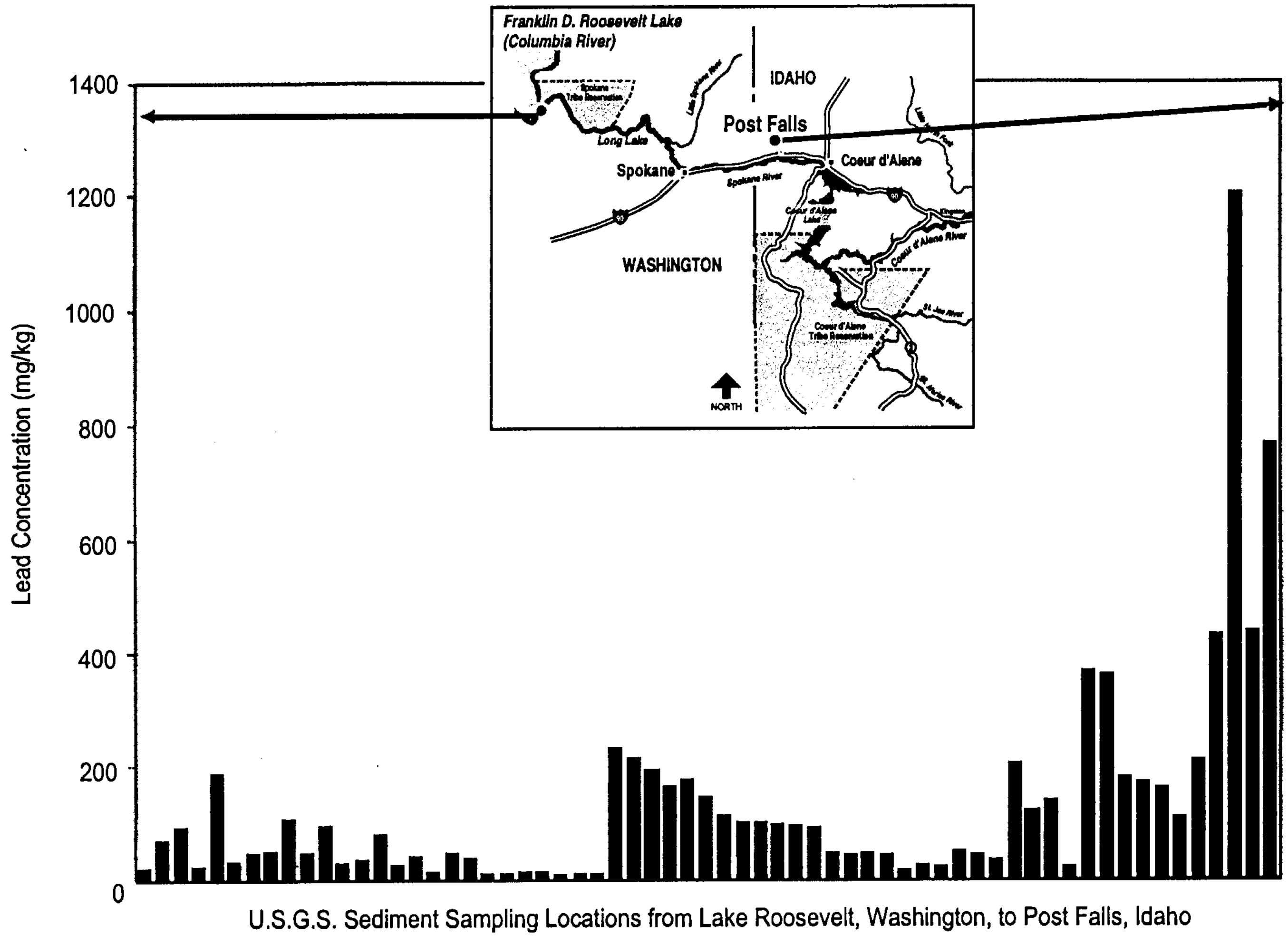
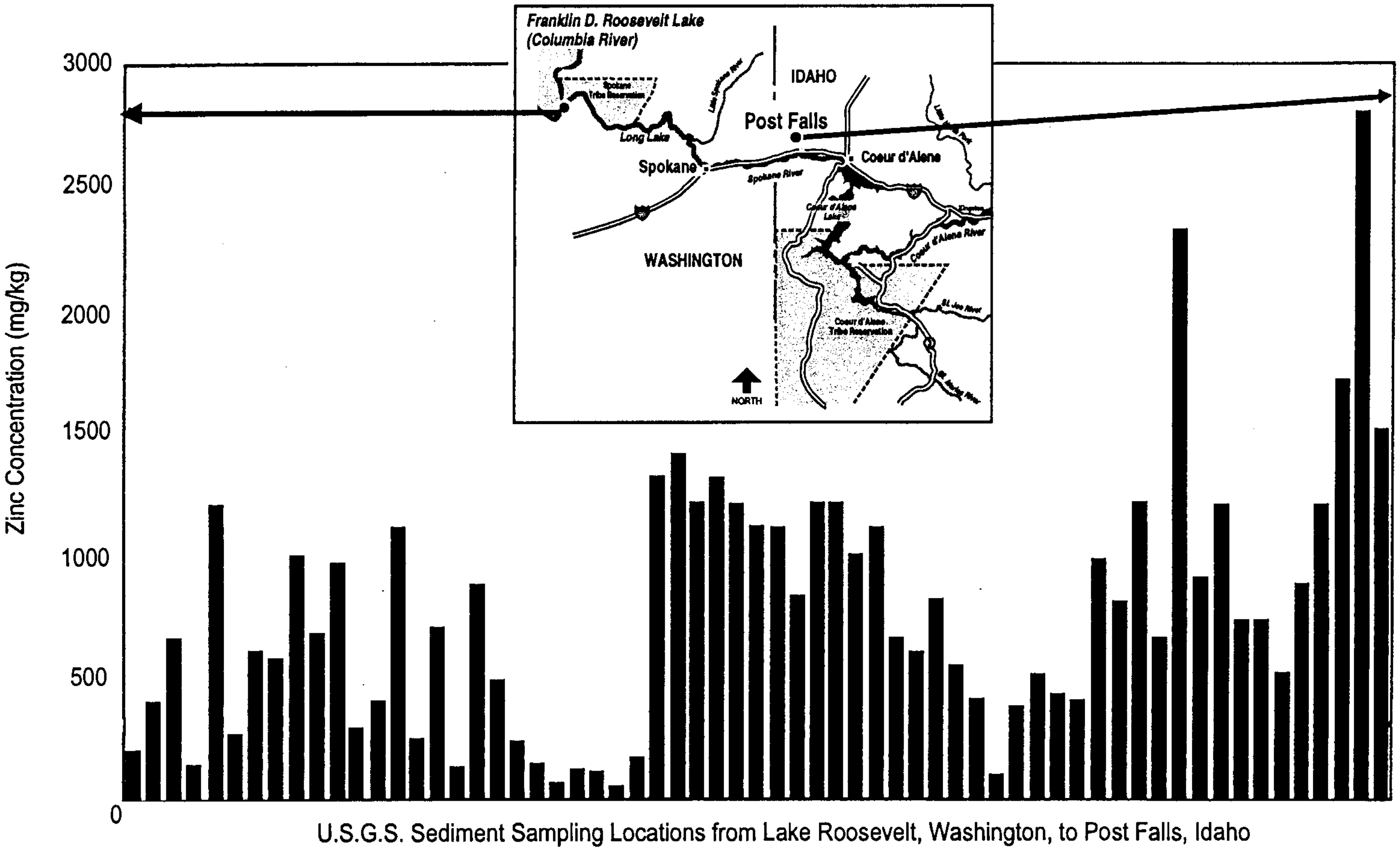


Figure 5.2-8
Total Cadmium Concentrations in Spokane River Sediments



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RECORD OF DECISION	Doc. Control: 4162500.07099.05.a EPA No. 2.9	**Figure 5.2-9** **Lead Concentrations in Spokane River Sediments**



EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

Doc. Control: 4162500.07099.05.a
EPA No. 2.9

Figure 5.2-10
Zinc Concentrations in Spokane River Sediments

Table 5.2-1
Summary of Lead Concentrations in the Upper and Lower Basin

Medium	No. of Samples	Minimum, mg/kg	Maximum, mg/kg	Arithmetic Mean, mg/kg	Geometric Mean, mg/kg
Lower Basin					
Yard Soil	160	15	7,350	487	110
House Dust	31	49	3,140	512	301
Upper Basin					
Yard Soil	834	22	20,218	821	460
House Dust	268	23	29,725	997	659

Notes:
House dust lead concentrations were measured from vacuum bag samples
Source: Human Health Risk Assessment (IDHW 2001a)

Table 5.2-2
Summary of Analytical Results for Metals in Soil

Chemical	No. of Detections	No. of Samples	Maximum Concentration (mg/kg)	PRG (mg/kg)	No. of Detections Exceeding PRG	Percentage of Samples Exceeding PRG	Background Concen-tration (mg/kg)[b]	No. of Detections Exceeding Background Concentrations
Antimony	2,966	4,029	623	30	313	7.8	5.8	1,239
Arsenic[a]	4,186	4,208	3,610	0.38	4,186	99	22	1,346
Cadmium	3,939	4,208	194	37	184	4.4	2.86	2,290
Iron	3,980	3,980	256,000	22,000	1,527	38	65,000	369
Lead	4,208	4,208	67,100	400	1,336	32	175	3,065
Manganese	4,002	4,002	26,400	3,100	500	12	3,600	450
Zinc	4,208	4,208	25,800	22,000	3	0.07	280	2,806

[a] Carcinogen; PRG are protective of cancer health effects
[b] 90th percentile from Gott and Cathrall (1980).

Notes:
COPC - chemical of potential concern
NA - not available
PRG - preliminary remediation goal (from tables in EPA Web site at http://www.epa.gov/region09/waste/sfund/prg)
SV - screening value (0.1 times EPA PRGs for noncarcinogens and same as PRGs for carcinogens)

Table 5.2-3
Summary of Analytical Results for Metals in House Dust

Chemical	No. of Detections	No. of Samples [b]	Maximum Concentration (mg/kg)	Soil PRG (mg/kg)	No. of Detections Exceeding PRG	Percent Detections Exceeding PRG
Antimony	160	160	318	30	29	18
Arsenic[a]	160	160	635	0.38	160	100
Cadmium	159	160	375	37	5	3.1
Iron	160	160	60,800	22,000	115	72
Lead	160	160	59,500	400	134	84
Manganese	160	160	5,460	3,100	3	1.9
Zinc	160	160	57,500	22,000	2	1.3

[a] Carcinogen; the PRG for arsenic is protective of cancer health effects at a target risk of 1 in 1 million.
[b] Samples collected from vacuum bags and floor mats.

Notes:
There are no background values available for house dust.
COPC - chemical of potential concern
NA - not available
PRG - preliminary remediation goal for residential soil (from tables in EPA Web site at: http://www.epa.gov/region09/waste/sfund/prg)

Table 5.2-4
Summary of Analytical Results for Metals in Drinking Water

Chemical	No. of Detections	No. of Samples	Maximum Concentration (µg/L)	PRG (µg/L)	No. of Detections Exceeding PRG	Percentage of Samples Exceeding PRG	MCL (µg/L)	No. of Detections Exceeding MCL
First Draw Samples								
Arsenic[a]	45	102	7.6	0.045	45	44	10	0
Cadmium	45	102	33.6	18	1	1.0	5	5
Lead	101	102	78.5	4	36	35	15	11
Flushed Line Samples								
Arsenic[a]	45	100	9.2	0.045	45	45	10	0
Lead	83	100	9.5	4	2	2.0	15	0

[a] Carcinogen; PRGs are protective of cancer health effects

Notes:
COPC - chemical of potential concern
MCL - Maximum Contaminant Level
PRG - preliminary remediation goal (from tables in EPA Web site at http://www.epa.gov/region09/waste/sfund/prg)

Table 5.2-5
Summary of Estimated Basin Ecological Source Quantities

Source Type	Units	Quantity
Upper Basin		
Floodplain Sediments[a]	cy	7,100,000
Tailings[b]	cy	11,000,000
Waste Rock[c]	cy	11,700,000
Adit Drainage[d]	#Zn/d	101
Lower Basin		
River bed Sediments, including the Harrison Delta[e]	cy	20,600,000
Bank Wedges[e]	cy	1,780,000
Wetland Sediments[e]	cy	5,900,000
Lateral Lake Sediments[e]	cy	5,900,000
Floodplain Sediments[e]	cy	10,200,000
Cataldo/Mission Flats Dredge Spoils	cy	13,600,000
Coeur d'Alene Lake		
Lake Bottom Sediments	cy	44,000,000 to 50,000,000
Spokane River[f]		
Shoreline and River bed Sediments	cy	260,000

[a] Impacted sediment present in the current and historic 100-year floodplain. Total volume does not include either less impacted, generally deeper and more dispersed sediments that are potential source of zinc loading or impacted materials within fills or embankments (e.g., I-90 and UPRR rights-of-way); these additional sediment volumes may be as high as approximately 20,000,000 cy.
[b] Tailings volumes include unimpounded tailings and impounded tailings in both inactive and active facilities.
[c] Waste rock volumes include waste rock in floodplains and uplands, as well as waste rock at active facilities.
[d] Data used to calculate average zinc loading are available for only 53 of 114 discharging adits in the upper basin. Although data are available for the largest loaders, the cumulative average zinc load from all discharging adits may exceed the amount shown in this table.
[e] Volumes estimates for all impacted media in the lower basin, CSM Unit 3, are based on lead concentrations exceeding 1,000 mg/kg. Additional volumes of impacted sediments that are potential sources of zinc loading are not included in these estimates.
[f] Contaminated sediments upstream of Upriver Dam. Additional contaminated sediments are present downstream of Upriver Dam, but have not been quantified.

Notes:
This is a condensed summary with approximate quantities—for a detailed accounting of sources and remedial actions see the FS Part 3, Sections 5 and 6 and appendices as referenced therein (USEPA 2001c). Quantities of source materials within the BHSS are not included in this table.
cy - cubic yards
#Zn/d - pounds of zinc per day

Table 5.2-6
Estimated Average (Expected) Values of Metals Concentrations in Surface Water in the Basin, 1991-1999 Data

Sampling Location	Dissolved Cadmium			Total Lead			Dissolved Zinc		
	Estimated Expected Value in µg/L	CV	Number of Samples	Estimated Expected Value in µg/L	CV	Number of Samples	Estimated Expected Value in µg/L	CV	Number of Samples
South Fork and Tributaries									
SF220 (below Mullan)	0.7	0.55	41	11.1	0.59	41	130	0.68	41
SF228 (below Trowbridge Gulch)	1.1	0.46	46	9.2	0.90	46	188	0.74	47
SF239 (Silverton)	7.2	0.70	56	43	1.13	56	1,080	0.74	56
SF249 (Osburn)	7.45	0.48	37	27	0.66	37	1,110	0.52	37
SF259 (SF at above Big Creek)	8.1	0.45	38	25	0.71	38	1,200	0.48	38
SF268 (near Elizabeth Park)	6.8	0.61	67	32	1.58	67	976	0.59	67
SF270 (Smelterville)	11.3	0.52	45	43	1.26	45	1,674	0.55	45
SF271 (Pinehurst)	9.1	0.63	108	56	1.34	69	1,430	0.63	111
Canyon Creek									
CC2	NA	NA	NA	3.2	1.57	36	26.2	0.43	36
CC276	0.7	0.23	41	11.9	1.53	41	122	1.41	41
CC278	2.5	0.67	38	13.3	0.4	38	378	0.67	38
CC291	3.9	0.51	35	20.4	0.35	35	650	0.65	35
CC282	7.1	0.55	23	114	1.8	23	1,100	0.52	23
CC284	8.4	0.51	42	72.6	1.46	42	1,370	0.56	42
CC285	10.8	0.85	38	213	2.45	39	1,460	0.8	38
CC287 and CC288	21.9	0.74	92	174	1.99	93	2,996	0.71	93
Ninemile Creek									
NM291	1.1	0.48	32	7.7	1.36	32	318	1.56	32
NM293	17.3	0.76	24	24.6	0.69	24	4,670	2.16	23
NM295	15.8	0.68	18	23.2	0.50	18	3,000	0.61	18

Table 5.2-6 (Continued)
Estimated Average (Expected) Values of Metals Concentrations in Surface Water in the Basin, 1991-1999 Data

Sampling Location	Dissolved Cadmium			Total Lead			Dissolved Zinc		
	Estimated Expected Value in µg/L	CV	Number of Samples	Estimated Expected Value in µg/L	CV	Number of Samples	Estimated Expected Value in µg/L	CV	Number of Samples
NM296	33.2	0.55	54	587	7.2	54	6,070	0.53	54
NM298	42.7	0.66	50	234	0.88	50	7,140	0.69	50
NM303	27.7	0.42	42	99.4	0.43	42	4,590	0.8	42
NM305	21.7	0.48	96	92.1	0.80	98	3,411	0.47	96
Pine Creek									
PC307	2.6	0.21	39	4.5	1.19	39	974	0.237	39
PC308	11.7	0.27	33	9.6	0.54	33	4,430	0.269	33
PC305	0.54	2.68	12	4.6	1.3	38	112**	0.45**	38
Big Creek									
BC260 (mouth of Big Creek)	1 (max. detected)*	NA	NA	28 (max. detected)*	NA	NA	6.9 (max. detected)*	NA	NA
Moon Creek									
MC262 (mouth of Moon Creek)	0.68	0.33	58	3.7	1.2	57	121	0.39	58
Main Stem									
LC50 (Cataldo)	3.2	1.3	101	20.9	1.43	44	354	0.61	102
LC55 (Rose Lake)	2.3	1.02	71	35.1	1.34	35	263	0.88	12
LC60 (Harrison)	1.9	0.37	91	51.6	1.08	32	344	0.48	91
Spokane River									
SR50 (Post Falls, ID)	NA	NA	9	2.12	0.87	9	57.6	0.48	10
SR55 (near Otis Orchard, WA)	NA	NA	7	2.31	0.77	7	50.7	0.52	7
SR60 (Greenacres)	NA	NA	7	2.41	0.92	7	51.2	0.47	7
SR65 (near Trentwood)	NA	NA	7	2.41	0.97	7	50.7	0.61	7
SR70 (Spokane)	NA	NA	7	2.21	1.13	7	53.1	1.22	7

Table 5.2-6 (Continued)
Estimated Average (Expected) Values of Metals Concentrations in Surface Water in the Basin, 1991-1999 Data

Sampling Location	Dissolved Cadmium			Total Lead			Dissolved Zinc		
	Estimated Expected Value in µg/L	CV	Number of Samples	Estimated Expected Value in µg/L	CV	Number of Samples	Estimated Expected Value in µg/L	CV	Number of Samples
SR75 (Spokane)	NA	NA	10	2.72	1.02	9	50.1	0.58	9
SR85 (Long Lake)	NA	NA	13	1.45	0.50	8	27.3	1.74	13

Notes:
* Data-based value from USEPA (2001b), Part 2, Big Creek
** Without two outliers

CV - coefficient of variation
NA - not applicable

Table 5.2-7
Estimated Average (Expected) Values of Metals Loads in Surface Water in the Basin, 1991-1999 Data

Sampling Location	Dissolved Cadmium			Total Lead			Dissolved Zinc		
	Estimated Expected Value in pounds/day	CV	Number of Samples	Estimated Expected Value in pounds/day	CV	Number of Samples	Estimated Expected Value in pounds/day	CV	Number of Samples
South Fork and Tributaries									
SF220 (below Mullan)	0.22	1.11	41	5	1.65	41	35	0.67	41
SF228 (below Trowbridge Gulch)	0.50	1.05	46	8.2	3.9	46	89.4	1.23	47
SF239 (Silverton)	7.8	0.88	56	140	4.9	56	1,110	0.83	56
SF249 (Osburn)	5.9	0.75	37	39.4	2.25	37	877	0.77	37
SF259 (SF above Big Creek)	8.3	0.88	38	49.5	2.64	38	1,200	0.85	38
SF268 (near Elizabeth Park)	8.9	0.68	67	130	5.89	67	1,280	0.691	67
SF270 (Smelterville)	16.4	0.90	45	116	3.43	45	2,100	0.64	45
SF271 (Pinehurst)	20.9	0.87	108	369	5.53	69	2,920	0.61	111
Canyon Creek									
CC276	0.1	0.73	41	1.2	2.16	41	8.2	1.29	41
CC278	0.2	0.58	38	1.5	0.83	38	34	1.06	38
CC291	0.5	0.67	35	3	1.04	35	75	0.57	35
CC282	1.5	0.71	23	40.1	3.46	23	239	0.77	23
CC284	1.4	0.81	42	13.4	1.99	42	227	0.7	42
CC285	2.9	1.1	39	98.1	5.08	38	400	0.82	38
CC287 and 288 combined	5.5	1.20	92	48.6	3.14	93	556	0.67	93
Ninemile Creek									
NM291	0.03	1.34	32	0.3	4.2	32	33.1	0.84	32
NM293	0.5	1.06	24	0.8	1.37	24	99.6	11.86	23
NM295	0.6	0.91	18	1.3	1.3	18	125	1.74	18
NM296	1.3	0.7	54	3.7	0.69	54	251	0.88	54
NM298	1.3	0.77	50	8.6	1.41	50	210	0.72	50
NM303	1.3	0.74	42	5.3	1.07	42	203	0.79	42
NM305	1.6	0.86	96	13.1	2.63	98	275.5	0.92	96

Table 5.2-7 (Continued)
Estimated Average (Expected) Values of Metals Loads in Surface Water in the Basin, 1991-1999 Data

Sampling Location	Dissolved Cadmium			Total Lead			Dissolved Zinc		
	Estimated Expected Value in pounds/day	CV	Number of Samples	Estimated Expected Value in pounds/day	CV	Number of Samples	Estimated Expected Value in pounds/day	CV	Number of Samples
Pine Creek									
PC307	0.07	1.18	39	0.2	7.51	39	26.1	1.21	39
PC308	0.05	0.92	33	0.04	1.36	33	18.5	0.99	33
PC305	5.4	96.4	12	12.3	19.9	38	90.2**	2.93**	36
Big Creek									
BC260 (mouth of Big Creek)	Not detected to 0.03*	NA	NA	1.7 to 91.1 (measured)*	*	NA	0.9 to 4.7 (measured)*	NA	NA
Moon Creek									
MC262 (mouth of Moon Creek)	0.05	2.24	58	0.42	6.00	57	9.9	3.06	58
Main Stem									
LC50 (Cataldo)	26.9	1.32	101	708	6.78	44	3,220	0.73	102
LC55 (Rose Lake)	28.1	1.34	71	1,750	6.89	35	4,260	0.69	12
LC60 (Harrison)	29	1.39	91	1,510	4.11	32	3,736***	1.02	91
Spokane River									
SR50 (Post Falls, ID)	NA	NA	9	156	3.86	9	3,640	3.67	10
SR55 (near Otis Orchard, WA)	NA	NA	7	247	5.68	7	5,000	4.65	7
SR60 (Greenacres)	NA	NA	7	380	9.19	7	5,560	5.06	7
SR65 (near Trentwood)	NA	NA	7	434	10.4	7	7,030	6.7	7
SR70 (Spokane)	NA	NA	7	278	6.45	7	7,110	7.24	7
SR75 (Spokane)	NA	NA	10	285	3.81	9	4,310	2.41	9
SR85 (Long Lake)	NA	NA	13	110	0.99	8	2,210	3.12	13

* Data-based value from USEPA (2001k), Part 2 Big Creek
** Without two outliers
*** Updated value; see Section C.4.3 of USEPA 2001f "Probabilistic Analysis of Post-Remediation Metal Loading."

Notes:
CV - coefficient of variation
TMDL - total maximum daily load

Table 5.2-8
Summary of Floodplain Areas Affected by Lead, by Wetland Unit

Wetland Unit	Wetland Area, Acres		Lateral Lake Area, acres		Riparian Areas, Acres	
	Total	Lead≥530[a] mg/kg	Total	Lead≥530[a] mg/kg	Total	Lead≥530[a] mg/kg
Harrison Slough	41	40	679	669	34	30
Harrison Marsh	59	58	157	157	35	34
Thompson Marsh	60	59	125	122	21	16
Thompson Lake	303	299	260	256	32	25
Anderson Lake	47	44	527	505	39	36
Bare Marsh	165	160	0	0	17	17
Blue Lake	57	53	320	316	37	37
Black Lake	40	17	379	368	64	272
Swan Lake	367	362	475	471	210	205
Cave Lake	196	190	753	746	123	116
Medicine Lake	210	198	242	230	85	83
Blessing Slough	178	168	0	0	76	76
Moffit Slough	114	114	146	146	66	66
Campbell Marsh	174	173	107	106	135	129
Hidden Marsh	436	418	204	199	44	38
Killarney Lake	155	152	491	482	48	42
Strobl Marsh	275	269	0	0	79	77
Lane Marsh	430	425	0	0	82	80
Black Rock Slough	235	232	204	201	169	166
Bull Run	16	16	114	106	8	8
Rose Lake	436	409	362	357	142	135
Porter Slough	135	126	0	0	0	0
Orling Slough	58	49	54	52	16	15
Canyon Marsh	101	50	25	25	22	19
Cataldo Slough	151	114	325	314	246	228
Mission Slough	284	280	151	150	115	108
Whiteman Slough	177	171	0	0	43	32
27 units	4,901	4,646	6,100	5,979	1,986	1,844

Source: U.S. Fish and Wildlife Service, Upper Columbia Fish and Wildlife Office (July 2001)

[a] - 530 mg/kg represents the Lowest Observable Effect Level (LOEL) for waterfowl (Beyer et al. 2000)

References:
Kern, J.W. 1999. *Statistical Model for the Spatial Distribution of Lead Concentration in Surficial Sediments in the Lower Coeur d'Alene River Floodplain with Estimates of Contaminated Soils and Sediments.* Draft (August 26, 1999). Prepared for the U.S. Fish and Wildlife Service, Spokane, Washington.
Beyer, W. N., D. J. Audet, G. H. Heinz, D. J. Hoffman, and D. Ray. 2000. "Relation of Waterfowl Poisoning to Sediment Lead Concentrations in the Coeur d'Alene River Basin". *Ecotox.* 9: 207 - 218.

Table 5.2-9
Metals Loads and Retention in Coeur d'Alene Lake

Parameter	1994 (low discharge)	1995 (average discharge)	1997 (high discharge)	1999 (120% of average discharge)
Annual mean discharge (cfs)	2,970	6,300	10,300	7,530
Zinc				
Total Inflow (kg)	460,000	880,000	1,400,000	1,570,000
Total Outflow (kg)	260,000	580,000	860,000	1,080,000
Percent Retained	43	35	41	31
Lead				
Total Inflow (kg)	88,000	470,000	1,300,000	590,000
Total Outflow (kg)	16,000	37,000	100,000	51,300
Percent Retained	82	92	92	91
Cadmium				
Total Inflow (kg)	3,800	7,200	11,000	10,400
Total Outflow (kg)	1,700	3,600	5,800	4,940
Percent Retained	56	51	47	53

Note: Refers to whole-water recoverable metals loads

6.0 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

This section describes current and anticipated future land, groundwater, and surface water uses.

6.1 CURRENT LAND USE

The Basin includes areas within Shoshone, Kootenai, and Benewah counties in Idaho and Spokane and Stevens counties in Washington. The majority of the population of the Basin lives in the cities of Spokane, Coeur d'Alene, and Post Falls, which have populations exceeding 177,000, 24,000, and 7,000 people, respectively. All other communities in the Basin have populations less than 2,000. In Kootenai and Shoshone counties, over 38 percent of the total population is in rural areas.

Land use includes residential, commercial, light industrial, agriculture, mining, and recreation. The I-90 freeway generally parallels the South Fork of the Coeur d'Alene River from Cataldo east to the Idaho/Montana border. The UPRR right-of-way parallels the entire length of the river as well as a portion of the southern lake shore. This inactive rail line is currently being addressed and converted to a recreational trail.

Much of the Basin is rural, undeveloped land, a large part of which is federally or state-managed. These undeveloped lands and the numerous streams in the Basin provide a variety of recreation opportunities. Undeveloped areas include upland forest habitats and lowland floodplains with riverine, riparian, wetland, and lake habitats. The quality of these habitats and their ability to support natural populations of flora and fauna has been impacted to varying degrees by historic mining activity in the Basin.

The Basin is the ancestral home of the Coeur d'Alene and Spokane Tribes. Coeur d'Alene reservation lands are present in the Lower Basin, and Spokane reservation lands are adjacent to the lower Spokane River. Historically, the Coeur d'Alene and several other tribes, including the Spokanes, relied solely on resources of the Basin for sustenance. Subsistence lifestyles are a current land use and are a potential future land use in the contaminated areas of the Lower Basin; however, this lifestyle cannot currently be safely practiced in these areas due to the extent of this contamination. The Coeur d'Alene Tribe currently advises its members not to use these contaminated resources for subsistence.

Risks to persons, including Spokane tribal members, and others who may practice a subsistence lifestyle in the lower Spokane River now or in the future have not been quantified. EPA and the Spokane Tribe are cooperating in planning additional testing and studies that will be

implemented to evaluate the potential exposures to subsistence users. The results of those tests and studies will determine appropriate future response actions to be taken, if any.
When compared to conditions statewide, a number of indicators show that socio-economic conditions in the Basin upstream of Coeur d'Alene Lake are depressed. These indicators include:

- Higher unemployment
- Higher percentages of persons living below the poverty level
- Lower rates of high school and college graduation
- Higher per capita welfare payments
- Generally decreasing tax base

The socio-economic status of families has been noted to be a significant factor affecting children's blood lead levels in numerous studies (Pirkle et al. 1998, Brody et al. 1994, Clark et al. 1985, Bornschein et al. 1985). In the Basin, young children often have limited places to play, and when not at their home or at school are often found on commercial properties or other common areas.

6.2 ANTICIPATED FUTURE LAND USES

It is anticipated that future land use will be similar to current or reasonably foreseeable future land use. Although population levels in the Basin have declined in recent years, the City of Coeur d'Alene has experienced substantial population growth, and it is possible that population growth could expand into the Basin. It is not anticipated that areas of the Lower Basin floodplains that are currently undeveloped or used for agriculture could be developed for residential use due to regulatory restrictions on residential development in the floodplain. Increased recreational use of beaches may occur as a result of several factors: 1) increasing tourism in the Basin; 2) easier access due to the conversion of the UPRR right-of-way, which parallels the river, into a trail; and 3) increased population.

6.3 SURFACE WATER AND GROUNDWATER USES

The State of Idaho has identified designated beneficial uses for the surface water of the Idaho portion of the Basin. All waters are designated by statute for agricultural and industrial water supply, wildlife habitat, and aesthetics. In addition, all waters in the Basin are designated for cold water aquatic life and secondary contact recreation, although the cold water aquatic life use is not attained or only partially attained in some waters. Less-impacted waters may be designated for salmonid spawning, primary contact recreation, and drinking water supply; however, these uses are limited in some parts of the area of mining impacts. The designated uses are shown in Table 6.3-1. The lateral lakes in the Lower Basin, which are not listed in Table 6.3-1, are all designated for agricultural and industrial water supply, wildlife habitat, aesthetics, cold water aquatic life, and primary or secondary contact recreation.

The use designations do not reflect pre-mining use and condition of the stream. The designated uses generally reflect current surface water uses, with some exceptions where the designated uses are not currently attained. For example, Ninemile Creek, from and including East Fork Ninemile Creek to its mouth, is designated for cold water aquatic life and salmonid spawning. These uses are not currently attained in Ninemile Creek downstream of mining impacts. Similarly, cold water aquatic life is not attained in Canyon Creek downstream of mining impacts. The designated uses and areas of current non-attainment or partial attainment are presented in Table 6.3-1.

In addition to its designations for cold water aquatic life, drinking water supply, primary contact recreation, and salmonid spawning, Coeur d'Alene Lake is designated as a special resource water. Special resource waters are those specific segments or bodies of water which are recognized as needing intensive protection to preserve outstanding or unique characteristics or maintain current beneficial use (IDAPA 58.01.02§003). The lake is important to the economy of the region. Its aesthetic qualities and the recreation opportunities it affords enhance the area as a place to live and promote tourism.

The flowing water sections of the Spokane River in Washington are classified as Class A (excellent) (WAC 173-201A). The Spokane River from Long Lake Dam to Ninemile Bridge is classified as Lake Class. The characteristic uses of these classes include, but are not be limited to:

- Water supply (domestic, industrial, agricultural)
- Stock watering
- Fish and shellfish migration, rearing, spawning, and harvesting
- Wildlife habitat
- Recreation (primary contact recreation, sport fishing, boating, and aesthetic enjoyment)
- Commerce and navigation

East of Coeur d'Alene Lake, groundwater and surface water are used as drinking water sources. Within the Upper Basin and Lower Basin, about 57 percent of residences obtain water from a public source and 43 percent obtain water from a private source. Table 6.3-2 describes the public drinking water systems in these areas, and Table 6.3-3 shows the estimated number of residences using private drinking water sources within the human health alternatives study area. Although groundwater data are limited, future use of groundwater from shallow, unconfined aquifers within the area of mining impacts in the Upper Basin and Lower Basin as drinking water may be limited by concentrations of cadmium, lead, and zinc that exceed maximum contaminant levels (MCLs) until cleanup is implemented. Although the Selected Remedy is expected to result in improvements to groundwater quality, it is not intended to satisfy the groundwater protection strategy for returning beneficial uses of groundwater as outlined in the NCP.

In addition to the beneficial use of groundwater as a drinking water supply, groundwater may influence surface water quality. In some parts of the Basin, surface water is in communication with groundwater. The interaction between surface water and groundwater is a route for migration of metals between these two media. The South Fork and its tributaries are important areas of interaction between surface water and groundwater. As described in Section 5.2.2, a significant load of metals is conveyed from groundwater to surface water is this area. This loading affects the ability to achieve surface water quality standards in the Basin. Because the groundwater protection strategy is also intended to protect critical environmental systems, such as fisheries in the Upper Basin, loading of metals from groundwater to surface water will be evaluated as the Selected Remedy is implemented.

The Spokane Valley-Rathdrum Prairie Aquifer, a sole source aquifer, underlies an area of about 327 square miles, including 125 square miles in Washington and 202 square miles in Idaho. Groundwater from the aquifer provides most of the water used in Spokane County for domestic, municipal, and industrial (other than aluminum production) purposes, and a large part of the irrigation supply. The total amount of groundwater pumped from the Spokane Valley portion of the aquifer in 1977 was about 164,000 acre-feet, of which about 70 percent was withdrawn for municipal and domestic use (Molenaar 1988). The Spokane Valley-Rathdrum Prairie Aquifer in western Idaho and eastern Washington receives an estimated 30 percent of its water from Coeur d'Alene Lake and the upper Spokane River (Wyman 1993).

On the Spokane Reservation, large terrace deposits of glacial outwash serve as aquifers near the Spokane River.

Table 6.3-1
Surface Water Designated Beneficial Uses in Idaho

Waters	Aquatic Life	Recreation	Other
South Fork Coeur d'Alene River - Canyon Creek to mouth	COLD	SCR	
Pine Creek - East Fork Pine Creek to mouth	COLD; SS	SCR	
Pine Creek - source to East Fork Pine Creek	COLD; SS	PCR	DWS
East Fork Pine Creek - source to mouth[a]			
Government Gulch - source to mouth	COLD; SS	SCR	
Big Creek - source to mining impact area	COLD; SS	PCR	DWS
Big Creek - mining impact area to mouth	COLD; SS	SCR	
Shields Gulch - source to mining impact area	COLD; SS	PCR	DWS
Shields Gulch - mining impact area to mouth		SCR	
Lake Creek - source to mining impact area	COLD; SS	PCR	DWS
Lake Creek - mining impact area to mouth	COLD; SS	SCR	
Placer Creek - source to mouth[a]			
South Fork Coeur d'Alene River - from and including Daisy Gulch to Canyon Creek	COLD	SCR	
Willow Creek - source to mouth[a]			
South Fork Coeur d'Alene River - source to Daisy Gulch	COLD; SS	PCR	DWS
Canyon Creek - from and including Gorge Gulch to mouth	COLD	SCR	
Canyon Creek - source to Gorge Gulch	COLD; SS	PCR	DWS
Ninemile Creek - from and including East Fork Ninemile Creek to mouth	COLD; SS	SCR	
Ninemile Creek - source to East Fork Ninemile Creek	COLD; SS	PCR	DWS
Moon Creek - source to mouth[a]			
West Fork Moon Creek - source to mouth[a]			
Bear Creek - source to mouth	COLD; SS	PCR	DWS
Coeur d'Alene River - Latour Creek to mouth	COLD	PCR	
Coeur d'Alene Lake	COLD; SS	PCR	DWS SRW
Spokane River - Coeur d'Alene Lake to Post Falls Dam	COLD; SS	PCR	DWS
Spokane River - Post Falls Dam to Washington/Idaho border	COLD; SS	PCR	DWS

Source of designated uses: IDAPA 58.01.02, Section 110

[a] These waters, although undesignated, are protected for cold water aquatic life and primary or secondary contact recreation (IDAPA 58.01.02, Section 101–Undesignated Uses)

Notes:
All waters are designated for agricultural and industrial water supply, wildlife habitat, and aesthetics.
COLD - Cold water aquatic life
DWS - Drinking water supply
PCR - Primary contact recreation
SCR - Secondary contact recreation
SRW - Special resource water
SS - Salmonid spawning

Table 6.3-2
Coeur d'Alene River Basin East of Coeur d'Alene Lake Public Drinking Water Systems

Type of System	Water Source	Population	Connections	Comments
Community public water system	Wells	4,490	1,875	
	Surface water	7,013	3,446	Central Shoshone Water District (population = 4,052, connections = 2,293) is temporarily using surface water while well undergoes corrosivity evaluation.
	Unknown	574	226	
Non-community transient public water system	Wells	385	120	
	Unknown	500	1	
Non-transient, non-community public water system	Wells	445	2	
	Surface water	490	13	
	Unknown	170	2	

Table 6.3-3
Estimated Number of Residences with Private, Unregulated Drinking Water Sources

Area of Investigation	Number of Residences[a]	Number of Residences within Water District	Estimated Number of Private, Unregulated Sources[b]	Nearest Water District	Availability of Suitable Alternative Aquifer
Upper Basin					
Upper Basin	4,633	3,417	1,216	East Shoshone County, Central Shoshone County, Kingston, and Pinehurst Water Districts	None to medium
Lower Basin					
Cataldo	1,642	842	400	Cataldo Water District	Medium
Harrison			400	Harrison Water District	High

[a]Based on site reconnaissance and demographic data from the human health risk assessment (IDHW 2001a).
[b]Assumes 100 percent of residences outside water district service boundaries have private, unregulated sources.
[c]Osburn has a moratorium on new well construction.

7.0 SUMMARY OF RISKS

This section provides a summary of the pertinent information from the human health and ecological risk assessments, focusing on the chemicals of concern (COCs) and other pertinent issues that are the basis for the response actions at the site. COCs are defined as "those chemicals of potential concern (COPCs) and media/exposure points that trigger the need for cleanup (the risk drivers)" (USEPA 1998c). This section does not provide a complete summary of the entire baseline risk assessment or other screening assessments conducted for the site but focuses on the information that is driving the need for the specific remedial actions described in this ROD.

7.1 SUMMARY OF HUMAN HEALTH RISK ASSESSMENTS

This section of the ROD summarizes the results of the baseline HHRA completed for the Harrison to Mullan portion of the site (CSM Units 1, 2, and 3) (IDHW 2001a). Also summarized are the results of two screening level risk assessments completed for Coeur d'Alene Lake (CSM Unit 4) and the Spokane River, Washington State (CSM Unit 5) (Appendix B of IDHW 2001a and USEPA 2000d). Unlike the baseline risk assessment, these screening level risk assessments did not estimate risks; rather, site-specific "safe" levels of COPCs were calculated and site concentrations were compared to the calculated levels. Locations within CSM Units 4 and 5 with chemicals at concentrations above the specified levels were further evaluated and are the subject, in some cases, of remedial action.

Typically, a baseline risk assessment estimates site risks if no action was taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. However, current conditions in the Basin are reflective of ongoing actions taken to reduce lead exposure. These efforts include the Lead Health Intervention Program (LHIP), which includes annual blood lead screening conducted by the PHD, and high-risk removal actions completed by EPA since 1997.

The lead section of the HHRA was prepared in accordance with EPA national guidance applying the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK). The national guidance recommends using the IEUBK Model for "setting site-specific residential risk-based preliminary remediation goals (PRGs) at CERCLA sites" and describes the model as the "best tool currently available for predicting the potential blood lead levels of children exposed to lead in the environment" (USEPA 1998c). The HHRA also has been peer-reviewed by EPA Technical Review Workgroup for Lead (USEPA Technical Review Workgroup for Lead 2000).

For the HHRA, the IEUBK was used in two ways: (1) using the EPA recommended default parameters and site-specific soil and house dust concentrations and (2) using site-specific parameters derived from conditions observed within the Bunker Hill Box. The default approach is representative of conditions assuming no action has occurred. The site-specific analysis reflects local conditions including ongoing actions taken to reduce childhood lead exposure. The site-specific model (hereafter referred to as the Box model) was calibrated using paired blood lead and environmental data collected from ongoing remedial activities in the Box. The Box data included more than 10 years of information regarding lead in blood, soil, and dust. Approximately 4,000 children have participated in annual blood lead surveys in the Box since 1988.

Specifically, the Box model differed from the default model in two ways: (1) the Box model reduced the bioavailability input from 30 percent to 18 percent and (2) accounted for exposure to “neighborhood” soil in addition to yard soil and house dust. The results of the Box model are the basis for the 700 mg/kg soil action level described in this ROD. If the default model were used, a soil action level of 400 mg/kg would have been required to meet the target risk of a typical child having no more than a 5 percent probability of a blood lead level of 10 μg/dL or higher. The results of the Box model are supported by the quantitative analysis of the paired blood lead and environmental data. The regression analysis, which related blood lead levels to soil, dust, and paint lead exposure variables, indicated that blood lead levels are most strongly influenced by lead in house dust. Both contaminated soils and lead-based paint were identified as contributors to house dust lead levels in the Basin.

There are many uncertainties in assessing risks to people from chemicals occurring in the environment. These are described in more detail in Chapter 7 of the HHRA. Uncertainty reflects limitations in knowledge and simplifying assumptions that must be made in order to quantify health risks. Risk assessments involve several components, including analysis of toxicity and exposure, each with inherent uncertainty. The major uncertainties include representing chemical concentrations in environmental media, quantifying how people come in contact with chemicals, interpreting the toxicological significance of the exposure, and predicting how conditions may change in the future. In the case of lead, uncertainties related to exposure to adverse health effects are reduced by reliance on blood lead as a measure of risk. For example, the uncertainties of the Box model were less than those typically encountered at CERCLA sites due to the use of the extensive Box database, which includes comprehensive environmental air, soil, and dust data, paired with blood lead screenings conducted annually since 1988. The screenings consistently recruited 50 percent or more of the eligible children living in the Box. In addition, for both lead and arsenic, the understanding of toxicity is better than most based on epidemiological and laboratory studies that have been subjected to multiple scientific reviews (NAS 1993, 1999, and 2001).

7.1.1 Baseline Risk Assessment, Harrison to Mullan

There are four primary tasks in a baseline risk assessment: (1) identification of COPCs; (2) exposure assessment; (3) toxicity assessment; and (4) risk characterization. Risk characterization is the summarizing step of risk assessment. The risk characterization integrates information from the preceding components of the risk assessment and synthesizes an overall conclusion about risk that is transparent, reasonable, and useful for decision-makers. The risk assessment process identifies COCs that represent an ongoing or potential threat to human health for particular groups of people at particular locations. As previously noted, this section focuses on the COCs identified as the risk drivers for response actions described in this ROD, and does not summarize the entire risk assessment.

Due to the large geographical area involved, the study area (from Harrison to Mullan) was divided into eight principal subareas for the HHRA. These sub-areas were defined around existing communities, including consideration of identified routes of potential human exposure, public use patterns, and the results of environmental annual blood lead screening in each area. The geographic areas are described in Section 5.1.1 of this ROD.

Identification of COCs

A total of eight metals were initially selected as COPCs and evaluated in-depth in the HHRA. Two metals – lead and arsenic – have been identified as the COC's for the response actions described in this ROD. Lead is the primary COC because lead exposures are predicted to exceed target health goals at the largest number of locations and blood lead levels above 10 µg/dL are observed in the Basin. Arsenic is identified as a COC because concentrations exceeded target health goals the second most frequently, although significantly less often than lead. Other metals with media-specific concentrations exceeding health goals, such as cadmium and iron, were limited to isolated locations or were co-located with lead and arsenic, and therefore are not a primary concern. However, under certain circumstances, actions may be taken to address cadmium in drinking water in private wells where cadmium may not be co-located with arsenic and/or lead. Cadmium in drinking water was not found to be a concern in the majority of the Basin; only five homes out of 100 had water concentrations exceeding cadmium's MCL. Only one of these five homes also exceeded cadmium's health-based PRG in tap water. All of these homes were on private wells and alternate sources of water have been provided to residents. Cadmium is a COC under a future drinking water scenario if groundwater near source areas in the vicinity of Ninemile and Canyon Creek were ever used as a drinking water source. Based on cadmium MCL exceedances in groundwater, both in current drinking water from private wells and future drinking water scenarios, cadmium in private wells will be addressed by the Selected Remedy described in this ROD.

Tables 7.1-1 through 7.1-4 present all chemicals and scenarios with risks and hazards above target health goals that will be addressed by the Selected Remedy. These tables provide exposure point concentrations (EPCs) for each of the chemicals detected in each media and scenario for each of the evaluated areas. The EPCs were used in the risk equations to calculate cancer risks and non-cancer hazards. The table includes the range of concentrations detected for each COC, the EPC, and how the EPC was derived. Lead and arsenic concentrations are shown in these tables as are cadmium, iron, and zinc in the limited places where exposure to these additional chemicals resulted in hazards exceeding target health goals.

The majority of the COPCs were COCs for one of the two Lower Basin subsistence scenarios evaluated in the HHRA, referred to as the traditional scenario. For the modern subsistence scenario, the COCs were lead and arsenic. Subsistence scenarios are discussed separately in Section 7.1.1 Subsistence Scenarios because the Selected Remedy does not address risks/hazards from Lower Basin subsistence lifestyles. The chemicals and media exceeding target health goals for subsistence receptors are shown on Table 7.1-5.

Exposure Assessment

The exposure pathways reviewed, including pathways evaluated qualitatively and quantitatively evaluated are presented in Table 7.1-6, which presents the conceptual site model for human health in tabular form. The receptors and pathways evaluated are in the following five current exposure scenarios:

- Residential—evaluated for children and adults who live in the Basin. This evaluation was conducted for a variety of pathways with potential exposure to affected media in the home, in the yard and community, and from homegrown vegetables. In addition, a potential future drinking water evaluation for shallow groundwater in the Burke/Nine Mile area was performed. In general, EPA default exposure factors for residential exposures were used to quantify risks. The exposure factors are presented on Table 7.1-7.

- Neighborhood recreational—evaluated, in addition to the residential scenario, for community soils (lead only), and incremental exposures for elementary-aged school children at play in neighborhood creeks (exposure to sediments and surface water) and waste piles. Site-specific exposure factors were generally used for this scenario and are presented in Table 7.1-8.

- Public recreational—evaluated for children and adults who use developed parks and playgrounds, and undeveloped recreational areas, whether they are residents or visitors. Exposure scenarios included the incidental ingestion of soils, sediments, and surface water and the ingestion of fish by sport fishermen.

Site-specific exposure factors were generally used for this scenario and are presented in Table 7.1-9.

- Occupational—evaluated for adult construction workers who would have relatively short-term exposures to surface and subsurface soils during construction projects. EPA default exposure factors for occupational exposures were used to quantify risks, see Table 7.1-10.

- Subsistence—evaluated for two scenarios for both children and adults practicing a subsistence lifestyle, traditional and modern. All subsistence scenarios were assumed to take place within the confines of the Lower Basin. The traditional subsistence lifestyle assumed people live in the flood plain of the lower Coeur d'Alene River and practice an aboriginal lifestyle. The modern subsistence lifestyle assumed people migrate to the flood plain during the summer and engage in subsistence activities. In either scenario, people were assumed to consume native vegetation and fish containing metals, although consumption rates for the modern subsistence scenario were lower.

The risks from the presence of lead and other metals were evaluated separately for each of the scenarios.

Toxicity Assessment

Table 7.1-11 provides cancer and non-cancer risk information relevant to the eight COPCs evaluated in the risk assessment for soil, sediment, fish, and vegetables. Arsenic is the only carcinogen.

Lead is evaluated by comparing predicted blood lead levels from site exposures with blood lead levels known to be a health concern. The toxicity of lead is well understood and a wealth of human data is available from many years of study that links specific health effects to levels of lead in the blood. Lead induced neurological effects and decrements in IQ have been affirmed by multiple consensus reviews prepared by EPA, the National Academy of Sciences (NAS), the CDC, and the Agency for Toxic Substances Disease Registry (USEPA 1986, NAS 1993, CDC 1991, DHHS 1999).

The 1993 NAS lead review concluded the following:

> *The toxic effects of lead range from recently revealed subtle, subclinical responses to overt serious intoxication. It is the array of chronic effects of low-dose exposure that is of current public-health concern…We have several reasons for emphasizing low-dose exposure. As recently noted by (Landrigan 1989), the*

> *subtle effects of lead are bona fide impairments, not just inconsequential physiologic perturbations or slight decreases in reserve capacity.*

The NAS has received a request and is considering a peer review of the scientific information and risk analysis that forms the basis of the Selected Remedy described in this ROD.

While lead is a systemic poison (i.e., it adversely affects many systems and organs in the body), the effect of greatest concern at blood lead levels observed in the Basin is lead's potential to cause neurological developmental effects in children. Pregnant women also are a sub-population sensitive to the effects of lead. Recognition of low-dose health effects and the need for primary prevention is accepted among mainstream medical groups (see the American Academy of Pediatrics Statement at: http://www.aap.org/policy/re9815.html or the CDC Lead Prevention Fact Sheet http://www.cdc.gov/nceh/lead/factsheets/leadfcts.htm). Recent studies have suggested that clinical treatment (chelation therapy), which effectively lowers blood lead levels in treated children, is unable to prevent subtle neurological health effects (Rogan et al. 2001). Furthermore, subtle health effects may occur at blood lead levels below 10 µg/dL. Correlation and regression analyses of data on blood lead levels and various health outcomes point to a spectrum of undesirable effects that become apparent in populations having a range of blood lead levels from 10 to 15 µg/dL. These include effects on heme metabolism and erythrocyte pyrimidine nucleotide metabolism, serum vitamin D levels, mental and physical development of infants and children, and blood pressure in adults (USEPA 1990a and b; Wasserman et al. 1994; Rothenberg et al. 1999). Although correlations between blood lead levels persist when examined across a range of blood lead levels below 10 µg/dL, the risks associated with blood lead levels below 10 µg/dL are less certain (Schwartz 1994). More recent literature further supports the possibility of adverse consequence of exposures that result from blood lead levels below 10 µg/dL (Lanphear et al. 2000).

The toxicity criteria for arsenic also are based on human data. Both the slope factor and the reference dose for arsenic are derived from human epidemiological studies of long-term exposure to arsenic in drinking water. The arsenic health effects of concern are skin, lung, and bladder cancers and adverse non-cancer effects on the skin and circulatory system (NAS 1999, 2001).

EPA's reference dose (RfD) for iron is provisional at this time. Because iron is an essential nutrient, the RfD must be protective of both iron deficiency and iron toxicity. Iron's provisional RfD is the upper limit of mean dietary iron intakes (dietary plus supplemental) from the second National Health and Nutrition Examination Survey (NHANES II) database, which contains information from 20,000 individuals. This upper limit is the highest available value that ensures sufficient iron to protect against iron deficiency and is not associated with adverse health effects for the American population aged 6 months to 74 years, i.e., lifetime exposures. However, certain sub-populations such as infants, pre-adolescent children, and pregnant women require higher intakes than the RfD for less than lifetime exposures (as long as 12 years for children). As a result, there is insufficient information at this time to quantify the dose that is associated with toxic effects and it is not known how much higher the provisional RfD could be and still not be associated with toxicity. Iron toxicity to children in the United States has been associated primarily with poisoning incidences from iron supplements where relatively large amounts of iron were ingested (Berkovitch et al 1994; Morse et al 1997). Consequently, iron exposures in the Basin that were up to two times iron's RfD are not likely to present a serious health concern. Since Basin exposures to iron are below two times the RfD, iron exposures are unlikely to present a health concern and are not the focus of remedial actions described in this ROD.

Risk Characterization

Lead health risks are discussed separately from non-lead risks because the methodologies for assessing risk are different.

Lead Risk Summary. Lead health risk methods are unique owing to the ubiquitous nature of lead exposures and the reliance on blood lead concentrations to describe lead exposure, toxicity, and risks. Lead risks are characterized by predicting blood lead levels with computer models and guidance developed by EPA (USEPA 1994c and 1998c).

In contrast to risk assessment methodologies for cancer or non-cancer risks, lead risk assessments use central tendency exposure values to predict a central tendency (geometric mean) blood lead level, rather than the reasonable maximum exposure values used in non-lead risk assessments. The predicted geometric mean blood lead level is then used in conjunction with a modeled log-normal distribution to estimate the probability of exceeding a blood lead level of 10 µg/dL. This emphasis on blood lead integrates exposure, toxicity, and risk, which are separated in other types of risk assessment. For other chemicals, risk is described in terms of an external dose (e.g., mg/kg-day).

As previously mentioned, the EPA IEUBK Model was used to evaluate lead risks and to develop soil action levels to achieve target health goals for reducing lead exposure pathways for children. These goals are described in EPA national guidance (USEPA 1998c), which recommends that a "soil lead concentration be determined so that a typical child or group of children exposed to lead at this level would have an estimated risk of no more than 5 percent of exceeding a blood lead of 10 µg/dL." The guidance recommends that risks be assessed using an exposure unit defined as the individual residence and other areas where routine exposures are occurring. The guidance also recommends the evaluation of blood lead data where available, while noting that blood lead data should "not be used alone to assess risk from lead exposure or to develop soil lead cleanup levels." The HHRA was developed consistent with national guidance.

Tables 7.1-12a and 7.1-12b show the results of the default risk model and the Box model, and present the lead soil concentrations that would result in more than a 5 percent probability that a typical child would exceed a blood lead level of 10 µg/dL. The results of the Box model, which was the better predictor, indicate that children in the Upper Basin are predicted to have a greater than 5 percent risk of exceeding the 10 µg/dL blood lead level of concern for the baseline residential exposure scenario. Lower Basin children from homes located in the flood plain, or those that engage in extended recreational activities in flood plain areas, also are at a greater than 5 percent risk of experiencing elevated blood lead levels based on estimated soil concentrations in those areas.

Site-specific analysis of blood lead data paired with environmental lead data suggests exposure pathways that reflect exposures at both individual residence and neighborhood levels. The analysis showed that, for most children, the home is the largest source of lead exposure. Blood lead levels appear to be most closely related to lead in house dust (Figure 7.1-1) followed by effects of lead in yard soil, the condition of interior lead-based paint, and the lead content of exterior paint. House dust lead concentrations are total lead in dust and thus include all sources of lead, such as lead dust from yard and neighborhood soils and paint.

The HHRA concluded that both lead in soils and paint will need to be addressed to effect sufficient reductions in house dust lead concentrations. Site-specific analysis of alternative risk reductions scenarios, summarized in Tables 7-12a and 7-12b, indicate that reduction of soil lead concentrations to less than 700 mg/kg will be necessary to achieve the 5 percent risk criteria. Programs for paint abatement and stabilization would be developed and implemented concurrently with the soil remediation activities to mitigate exposure and minimize recontamination.

Significant exposures also may result from recreation in areas with high lead concentrations in the Upper Basin and throughout the floodplain areas west of the Box. This is a likely reason for the higher than predicted blood lead levels observed among Lower Basin children. Currently signs are posted at various Lower Basin recreational areas describing the hazards of lead and providing information on how lead exposures can be prevented during recreational activities. Additionally, swimming and water sport activities in disturbed sediment-laden surface water can result in substantial increases in intake and lead absorption. Potential exposures to neighborhood stream sediments in the Burke/Ninemile area and at public swimming areas in the Lower Basin are of particular concern.

Non-Lead Metals Risk Summary. Summaries of the non-lead metal pathway/exposure scenarios that exceed target risk goals are presented in Tables 7.1-13 through 7.1-19.

Health risks for chemicals that cause cancer are calculated differently than those for chemicals that cause non-cancer health effects. For non-cancer risks, if a person is exposed to a chemical dose equal to or less than the “threshold,” no adverse effects are expected. The “hazard quotient” for a chemical is the exposure dose from the site (mg/kg-day) divided by the RfD (mg/kg-day). If the hazard quotient is near 1, then no adverse effects are anticipated. Cancer risks are calculated assuming that carcinogens, at any non-zero dose, contribute to cancer risk. Cancer risks are presented as the incremental increase in the likelihood of developing cancer. A cancer risk level of 1×10^{-6} describes an incremental increased risk of one in a million for a given individual. EPA uses the general excess order of magnitude risk range of (10^{-6} to 10^{-4}) (1/1,000,000 to 1/10,000) as a “target range” within which risks are managed as part of a Superfund cleanup. Cancer risks exceeding 10^{-4} and hazard quotients greater than 1 are discussed below. Note that all final risk and hazard estimates are presented to one significant figure only in the summary tables as recommended by EPA (USEPA 1989a) to reflect the uncertainty and imprecision of the estimates. Therefore, a hazard quotient of 1 could range between 0.95 and 1.4 and a risk of 2×10^{-5} could range between 1.5×10^{-5} and 2.4×10^{-5}.

The results of the risk characterization for non-lead metals reported in the human health risk assessment indicate that some exposure areas could pose an unacceptable threat of non-cancer effects for some individuals and exposure media under Reasonable Maximum Exposure (RME) conditions. The RME is defined as the highest exposure that is reasonably expected to occur at a site (USEPA 1989a).

Hazards are greatest for children up to 84 months of age exposed to metals in yard soils, and arsenic was the chemical with the highest hazards. Other media/scenarios with exceedances above target health goals are young children and children/adults in the Burke/Ninemile area who could ingest cadmium and zinc in groundwater in the future (groundwater in the Burke/Ninemile area is not currently used as a drinking water source), and children/adults ingesting cadmium in homegrown vegetables. Since lead and cadmium are co-located in garden soils ($r^2 = 0.9$), the Selected Remedy will address risks associated with cadmium in homegrown vegetables through the remediation of lead-contaminated garden soils. Iron hazards also exceeded one or contributed significantly to the total hazard exceeding one in a number of areas. However, iron is not a focus of the Selected Remedy because (1) it is co-located with lead and arsenic in the limited areas where its hazard quotient exceeded one, and (2) there are uncertainties surrounding its toxicity because it is an essential nutrient.

Arsenic is the only carcinogen evaluated at the site. Only cancer risks estimates for residential exposures in the Lower Basin and the Side Gulches were equal to or exceeded 10^{-4}. All other individuals in all other exposure areas had cancer risks within EPA’s acceptable cancer risk range. Cancer risks are summarized on Tables 7.1-13 and 7.1-19 for residential and subsistence scenarios, respectively. For the residential scenarios, yard surface soil contributed the most to cancer risk and, in the Side Gulches, tap water in private wells also contributed significantly to cancer risk (see Table 7.1-13). The HHRA concluded that arsenic concentrations in some Basin yard soils may need to be addressed, independently of lead, to reduce risks and hazards. Table 7.1-20 provides various potential soil cleanup levels for arsenic based on a variety of target risk goals and exposure scenarios. In general, arsenic risks did not exceed target risk goals in drinking water, however, high concentrations of arsenic in a few scattered private wells may be a health concern (no arsenic concentrations in any tap water sampled thus far exceeded the new MCL of 10 μg/L).

No single neighborhood recreational cancer risks or non-cancer hazards exceeded target health goals in the Upper Basin or Lower Basin; therefore, this scenario is not included on the risk/hazard summary tables in this document. However, the Lower Basin, Kingston area, Side Gulches, and Burke/Ninemile area presented hazards near the target hazard index of one and risks were in the low 10^{-5} range. Thus, some combinations of child/adult residential plus neighborhood recreational scenarios could result in hazard/risk estimates that are higher than those discussed in this summary (other combinations than these two could also result in higher risks).

There were no exceedances of target health goals for the occupational scenario viewing the Basin as a whole; however, individual projects in specific locations where high-concentration materials might be disturbed would need to ensure workers are not over-exposed.

Subsistence Scenarios

While subsistence exposures could not be evaluated using the IEUBK Model because the magnitude of these exposures exceeded constraints of the Model, estimates of subsistence lead intake were evaluated. For subsistence lifestyles practiced in the Lower Basin, blood lead levels significantly above 10 μg/dL would be likely, which is of particular concern for children and pregnant women as discussed above. These exposures include but are not limited to, recreating on contaminated beaches, swimming in the Coeur d'Alene River, gathering and eating water potatoes and other tribal cultural plants throughout the wetlands, and eating large amounts of fish.

All populations and pathways for subsistence lifestyles, including fish and water potatoes, exceeded target risk goals for non-lead metals, see Figures 7.1-2 through 7.1-4 and Tables 7.1-17 through 7.1-19. For the Modern Subsistence scenario, arsenic and iron were the only chemicals with hazard quotients greater than 1, similar to residential hazards. For the Traditional Subsistence scenario, methylmercury in fish, manganese in soil and sediment, and cadmium in water potatoes also had hazard quotients greater than 1 in addition to arsenic and iron.

Surface soil and sediment contributed the most to cancer risks for the subsistence scenarios. Cancer risks were higher than residential risks for the Modern Subsistence scenario, but similar to those for the highest residential exposures. Risks for the Traditional Subsistence scenario were an order of magnitude higher than those for the residential scenario.

7.1.2 Summary of Screening Level Risk Assessment, Coeur d'Alene Lake

Unlike the HHRA, risks were not estimated for the Coeur d'Alene Lake screening level risk assessments. Rather, site-specific "safe" levels of COPCs were calculated based on recreational usage. The calculated levels are referred to as risk-based concentrations (RBCs), and site concentrations were compared to the calculated levels. A screening approach was selected for this area (CSM Unit 4) to expeditiously determine if recreational use presented an unacceptable risk to people frequenting the beaches.

Twenty-four beaches and wading areas adjacent to Coeur d'Alene Lake and the Idaho portion of the Spokane River were included in the screening level evaluation. EPA, the local health department, and BLM personnel familiar with the area selected the 24 beaches and parks most frequently used by the public as areas of concern. Sampling activities were conducted at these common use areas (CUAs) to collect surface soil, sediment, and water. Analytical results for seven COPCs (the same as in the HHRA, except manganese and iron, which were excluded because concentrations were sufficiently low, and copper, which was included because it was a concern in the Box) were compared to RBCs considered protective of human health under recreational use conditions. CUAs identified as exceeding a RBC were further evaluated in the HHRA. In contrast, sites with concentrations below the health-protective RBCs were considered to pose no public health risks and were excluded from further consideration.

Because children are the most sensitive population group, RBCs were developed to ensure protection of children and these RBCs would also be protective of adults. The RBC for soil and sediment assumes children will be exposed to beach sand through ingestion and dermal contact and will ingest more soil (i.e., eat more dirt) than they would in their home setting on a daily basis. The RBC for water assumes children will play in the near-shore area and be exposed to site chemicals through incidental ingestion of disturbed (or stirred-up) sediments in water and through dermal absorption of chemicals. Children are assumed to play in soil/sediment and water two days per week (all day, 10+ hours) for four months of the year.

Lead RBC values were calculated using the IEUBK Model for lead. RBCs were calculated using EPA's target risk goal of a typical child having no more than a 5 percent risk of a blood lead level above 10 µg/dL. An initial soil/sediment RBC of 1,400 mg/kg was identified as protective at beaches if soil at the homes contained no greater than 200 mg/kg of lead. If lead concentrations in soil or sediment exceeded 1,400 mg/kg, then the CUA was retained for further evaluation. After screening soil, a second step involved combining sediment and surface water exposures. If combined exposures resulted in a predicted risk of a typical child having greater than a 5 percent risk of exceeding a blood lead level of 10 µg/dL, then the site was retained for further evaluation.

For chemicals other than lead, RBCs were calculated using standard EPA risk equations and solving for a concentration. Target risk goals were established at 1×10^{-5} for carcinogens and a hazard quotient of 0.1 for non-carcinogens (one-tenth of the EPA RfD). Arsenic was the only carcinogen evaluated in this assessment. Arsenic has both carcinogenic and non-carcinogenic potential effects. The RBC for arsenic was selected based on non-carcinogenic potential in children because this RBC was lower than the RBC based on the cancer endpoint. Furthermore, because arsenic's soil RBC is below an estimate of its natural background concentration of 35 mg/kg for the Lake Coeur d'Alene area, site soil and sediments were screened against the background level rather than the RBC.

Once calculated, RBCs were compared to an upper 95th confidence limit of the arithmetic mean for non-lead chemical concentrations in soil, sediment, and surface water at each site. For lead, the arithmetic sample mean was used as the exposure point concentration. Drinking water concentrations (only two locations had a drinking water source) were compared to drinking water MCLs.

The comparison of RBCs to site concentrations revealed that only two of the 24 sites evaluated had chemicals in soil and sediment exceeding their respective RBC, Harrison Beach North and Blackwell Island. Lead and arsenic were present in concentrations above the RBC and were identified as COCs at Harrison Beach North and at Blackwell Island in soil and sediment. In addition, lead in drinking water at the Harrison Beach Campground was found to be approximately equal to the tap water action level for lead (lead does not have an MCL; instead, tap water levels requiring differing "actions" are set based on certain criteria). These two areas were retained for further evaluation in the HHRA. The other 22 sites required no action. The HHRA concluded that Blackwell Island did not have risks above target health goals (see Section 7.1.1); therefore, no actions are required at that location. Harrison Beach was evaluated in the HHRA as part of the Lower Basin area and has been remediated as part of the UPRR removal action.

The HHRA recognized fish consumption in Coeur d'Alene Lake as a data gap; therefore, a comprehensive fish sampling field effort was started in 2002.

7.1.3 Summary of Screening Level Risk Assessment, Spokane River, Washington State

The Spokane River screening evaluation followed the methodology for the Coeur d'Alene Lake screening evaluation—RBCs were developed and CUA concentrations were compared to the RBC values. CUAs with metal concentrations in sediment below the RBCs were considered to require no further actions, while CUAs with concentrations over RBCs were further evaluated. The same COPC metals that were identified in the HHRA were evaluated along the Spokane River.

Eighteen CUA sites located on public and private lands along the banks of the Spokane River, from the Washington/Idaho border to the confluence with the Columbia River were selected for sampling (CSM Unit 5). As with the Coeur d'Alene Lake sites, CUA selection involved personnel from local agencies (Washington Department of Ecology, Spokane Regional Health District, USFS) and local stakeholders providing information to the EPA on the areas most frequently used by people where the largest amounts of fine-grained sediment were regularly deposited. The rocky and boulder-dominated beach areas along the upper river are generally not a health concern because it is the finer-grained shore-line sediments that stick to children's hands and are ingested. Finally, because the northern side of the lower Spokane River near the confluence with the Columbia River is tribal land, the Spokane Tribe of Indians provided information to EPA on the areas most frequently used by the Tribe.

The RBCs developed for the Spokane River, Washington were similar to those developed for the Idaho Lake sites in that they were based on recreational river use and child exposures two days per week for four months a year. However, because of requests made in public participation forums by concerned residents and differing regulations in Washington State than in Idaho, different lead model inputs and target health goals were used to develop the Spokane RBCs. In addition, the Spokane area has different background concentrations of metals than the area surrounding Coeur d'Alene Lake. Therefore, the RBCs developed for the Spokane sites were not the same as those developed for Coeur d'Alene Lake. Lead in particular is lower, 700 mg/kg rather than 1,400 mg/kg. Although the screening levels differed in the two screening assessments, the final lead action levels along the Coeur d'Alene River, Lateral Lakes, and the Spokane River are consistent at 700 mg/kg.

Assumptions regarding the amount of soil, dust, and beach sediment ingested were different for the Spokane River than those used for Coeur d'Alene Lake. The Spokane assessment did not include suspended sediment ingestion as was done for Coeur d'Alene Lake and the Spokane RBC was based on differential weighing of exposures between river and the residence. For the Spokane River assessment, the weighting was reversed to give two-thirds weight to the River exposure during exposure days. For Coeur d'Alene Lake, during each of the two days per week of exposure, two-thirds of the exposure came from the residence and one-third came from the Lake.

The arsenic RBC is lower because of the target health goal of 1×10^{-6} required for use in Washington State rather than the 1×10^{-5} goal used in Idaho and because background arsenic concentrations in the Spokane area are also lower. The selected RBC for arsenic of 10 mg/kg is a local natural background concentration for the metal as identified by the Washington State

Department of Ecology (Ecology 1994). This background value is based on upland soil analysis, not sediment sampling.

For each metal except lead, the RBC was compared to a 95 percent upper confidence limit (UCL_{95}) of the mean concentration in sediment at each CUA. The lead RBC was compared to the mean concentration. Generally, measured concentrations of the metals were highest upstream of the Upriver Dam pool (that is, approximately river mile 84) and were considerably lower downstream of this area. For most locations downstream of Upriver Dam, sediment concentrations were only slightly elevated above background concentrations. While the RBCs were developed to be protective only of recreational-type exposures, the beach concentrations downstream of Upriver Dam indicate no use restrictions for other types of exposures that would be required to protect public health.

Of the 18 CUAs evaluated, only one, River Road 95, had both lead and arsenic concentrations exceeding the RBCs. Three additional CUAs (Harvard Road North, Barker Road North, and North Flora Road) had arsenic concentrations over the arsenic RBC of 10 mg/kg. Arsenic concentrations at these locations represent cancer risks in the 10^{-5} range, above Washington State's target risk goal of 1×10^{-6} for the general public. Therefore, these four areas were retained for further evaluation. Arsenic and lead concentrations at these four locations are presented on Table 7.1-21.

Arsenic concentrations exceeded the RBC at 6 of the 18 sites: Harvard Road S., Plante's Ferry Park, People's Park, Riverside Park at W. Fort George Wright Bridge, Jackson Cove, and Horseshoe Point Campground. However, for these sites, there are additional areas of uncertainty that may warrant consideration. These are:

- The concentrations of arsenic were only marginally greater than the natural background concentration of 10 mg/kg.

- The arsenic concentrations at the six beaches ranged from 12 to 16 mg/kg, which may be within the natural background range for fine particles of river sediments. (The Spokane arsenic background concentration of 10 mg/kg is based on particles of a larger size than the sampled particles, and the larger-size particles sampled from the Spokane River had lower concentrations.)

- The additional cancer risk from exposures to arsenic concentrations of 2 to 6 mg/kg greater than the background concentration is not significantly greater than the risk due to naturally occurring levels of arsenic (an increase in the chance of developing cancer of 1 to 2 in 1,000,000). Note that there are risks above 1×10^{-6} from exposures to the natural background concentration of 10 mg/kg.

The screening-level risk assessment did not evaluate fish consumption along the river; however, the USGS sampled fish for the State of Washington Department of Ecology in the area and analyzed them for several metals, including lead. The lead data from whole fish was evaluated in the HHRA for the subsistence scenarios and some lead concentrations in the whole fish data were found to be a potential concern (contributing to blood lead levels above the target health goal) for children and pregnant women if they ingested large amounts of fish. Lead concentrations in filet and whole fish are presented on Table 7.1-22.

In response to metals contamination, the Washington State Department of Health and Spokane Regional Health District have issued two health advisories for the upper reaches of the Spokane River. The first advisory alerts visitors to the presence of elevated lead in shoreline and beach sediments frequented by river and park users. The second alerts visitors to elevated lead concentrations in fish. Recommended fish consumption limits for children and adults have been established, with particular emphasis toward children and pregnant women or women considering pregnancy.

The locations identified in the screening level risk assessment as above RBCs or background levels were further assessed by EPA in coordination with the State of Washington Department of Ecology. Additional sampling was performed in depositional areas upstream of Upriver Dam. Analysis of these additional data resulted in 10 beaches selected for cleanup (the four identified in the screening level risk assessment, plus six additional depositional areas identified in subsequent sampling events, see Figure 12.4-1 for locations). These 10 beaches were identified for cleanup in accordance with the State of Washington Model Toxics Control Act (WAC 173-340-740).

7.1.4 Basis for Remedial Action

The response actions selected in this ROD are necessary to protect human health and the environment from both ongoing and threatened releases of hazardous substances into the environment. Such a release or threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment. A summary of risks to human health is presented below.

Specifically for the Upper Basin and Lower Basin:

- The Box model predicts lead risks above target risk goals for approximately 25 percent of the residential yards in the Basin.
- Analyses show that lead in house dust is the primary pathway of exposure for children, and that yard and community soils and lead paint contribute lead to house dust.

- Lead exposure in other areas, recreational soils and sediments, whole fish, and waste piles may contribute significantly to children's blood lead levels.

- Predicted arsenic exposures from yard soils in the Upper Basin and Lower Basin and from drinking water in selected private wells exceed target health goals. Generally, arsenic exposure occurs in yards requiring remediation for lead exposure.

- A small number of private wells exceed the MCL for cadmium.

- Cadmium and zinc levels in shallow groundwater near Canyon Creek and Ninemile Creek are predicted to result in hazards above target health goals if the water is used as a drinking water source in the future.

- Cadmium levels in homegrown vegetables result in hazards above target health goals.

- Risks above target health goals are predicted for all chemicals and media if subsistence lifestyles are practiced in the Lower Basin.

Specifically for Coeur d'Alene Lake:

- No sites exceeded target health goals; thus, actions are not required around the lake to protect human health except at Harrison Beach, which has been remediated as part of the UPRR removal action.

- Fish species caught for human consumption are being sampled in 2002.

Specifically for Spokane River, Washington:

- Four locations between Upriver Dam and the Idaho border exceeded background concentrations for arsenic, equating to an incremental increase in cancer risks from recreational use in the 10^{-5} range, above Washington State's target cancer goal of no more than a 1×10^{-6} additional chance of contracting cancer for exposure from a site.

- One of the above four locations exceeded the RBC for lead, indicating potential risks to children of exceeding the 10 µg/dL level of concern.

- Lead concentrations in fish, both whole and filet, could potentially contribute to blood lead levels above the 10 µg/dL level of concern.

- Further assessment of additional beaches (not evaluated in the initial screening level assessment) by Washington State under the State's Model Toxics Control Act (MTCA) regulations resulted in six additional beaches selected for cleanup due to concentrations above RBCs and/or background concentrations under MTCA protocols. These six beaches plus the four locations identified in the screening level risk assessment were selected as requiring actions to protect human health.

At present, the risks to persons, including Spokane tribal members and others who may practice a subsistence lifestyle in the Spokane River area, are not fully understood. EPA and the Spokane Tribe are cooperating in planning additional testing and studies that will be implemented to evaluate the potential exposures to subsistence users. The results of those tests and studies will determine appropriate future response actions to be taken, if any.

As previously mentioned, the Selected Remedy includes a complete remedy for protection of human health in the communities and residential areas of the Upper Basin and Lower Basin. Certain potential exposures outside of the communities and residential areas of the Upper Basin and Lower Basin are not addressed by this ROD, and will continue to present risks of human exposure to hazardous substances. These potential exposures impacting human health include:

- Recreational use at areas in the Upper Basin and Lower Basin where cleanup actions are not implemented pursuant to this ROD

- Subsistence lifestyles, such as those traditional to the Coeur d'Alene and Spokane Tribes

- Potential future use of groundwater that is presently contaminated with metals

7.2 SUMMARY OF ECOLOGICAL RISKS

The EcoRA for the Coeur d'Alene Basin (USEPA 2001a) was prepared as part of the Coeur d'Alene Basin RI/FS. The report characterized risks for aquatic and terrestrial organisms (i.e., plants and animals) exposed to hazardous substances associated with mining activities in the Coeur d'Alene River Basin in Idaho and the (downstream) Spokane River in Washington. The EcoRA evaluated potential threats to the environment in the absence of any remedial action under current and future land uses (which are assumed to be similar to current land uses for the purpose of assessing ecological risks). It identified and characterized the toxicity of chemicals of potential ecological concern (COPECs), possible exposure pathways, ecological receptors, assessment and measurement endpoints, and a range of possible risks under current conditions. These aspects of the document are explained in the various sections of the EcoRA and are summarized below.

EPA established the Coeur d'Alene Basin Ecological Risk Assessment Work Group (EcoRA Work Group) to provide an avenue for stakeholder input during development of the EcoRA. Membership in the EcoRA Work Group was open to any parties who expressed an interest and asked to be included. Using regularly scheduled teleconferences and milestone meetings, the EcoRA Work Group provided a forum by which interested parties could be involved early and often in the evaluation process. Groups to which information was provided include the State of Idaho, State of Washington, Coeur d'Alene Tribe, Spokane Tribe, Colville Tribe, USFWS, and other governmental partners, public interest group members, newspaper reporters, legislative staffers, mining company representatives, and other parties.

The EcoRA study area was the same as the RI/FS study area, which is described in Section 1.0 (Figure 1.0-1). It included the Coeur d'Alene River and associated tributaries, Coeur d'Alene Lake, and the Spokane River downstream to the Washington State Highway 25 bridge at Fort Spokane on the Spokane Arm of Lake Roosevelt. Collectively, this area is referred to as the Coeur d'Alene Basin. The specific portion of the study area upstream of Coeur d'Alene Lake is usually referred to as the Upper Basin and Lower Basin.

The study area was divided into five units (called conceptual site model [CSM] units) that were differentiated based on geomorphology, mixes of hazardous substances, and habitats (Figures 7.2-1 through 7.2-5). As a result of differences in habitats among the CSM units, the ecological receptors also vary, as discussed below in the next section (Habitat Types). The CSM units are briefly described here.

CSM Unit 1 (Figure 7.2-1) contains many of the primary sources for mining-related hazardous substances (metals) including mine workings, waste rock and other mining waste, mine tailings, concentrates, and other process wastes, and artificial fill (tailings and waste rock in roads, railroads, and building foundations). CSM Unit 1 includes the upper watershed of the South Fork (above Wallace) and associated creeks (Canyon Creek and Ninemile Creek). It also includes Prichard Creek, Beaver Creek, Moon Creek, Big Creek, and Pine Creek, all of which discharge to the North Fork or into the South Fork downstream of Wallace.

CSM Unit 2 (Figure 7.2-2) contains the remainder of the primary sources of mining-related hazardous substances within the surface water and sediments of mid-gradient streams and small tributaries within the main stem watershed downstream to Cataldo. Most of the Bunker Hill Superfund Site is in CSM Unit 2. The primary sources within this CSM unit are similar to those in CSM Unit 1.

CSM Unit 3 (Figure 7.2-3) consists of the low-gradient part of the main stem of the Coeur d'Alene River, from the Old Highway Bridge at Cataldo to Coeur d'Alene Lake. It includes the lateral lakes that occur within the floodplain of the river. Mining-related hazardous substances within this CSM unit are found in the beds and banks of the river, contaminated floodplain soils, surface water, groundwater, and biota (plants and animals) that have accumulated metals.

CSM Unit 4 (Figure 7.2-4) consists of Coeur d'Alene Lake, where mining-related hazardous substances include contaminated sediments and surface water. In addition, nutrients are of significant concern because they can change the trophic status of the lake and can cause secondary releases of metals from contaminated sediments.

CSM Unit 5 (Figure 7.2-5) consists of the Spokane River. Mining-related hazardous substances are found mainly in contaminated sediments and surface water.

The EcoRA included three main components, including Problem Formulation, Analysis, and Risk Characterization. These phases are presented in various sections of the EcoRA report, and key portions are briefly summarized here.

7.2.1 Habitat Types

Within the Basin, ecological risks associated with mining-related hazardous substances were evaluated within six habitat types. The occurrence of these habitats within different portions of the Basin varies, and the typical species associated with the habitats also vary from one portion of the Basin to another. The habitats and a few typical species include the following:

- Riverine habitat includes the wetlands and deepwater habitats within the channels of creeks and rivers of CSM Units 1, 2, 3, and 5. Typical fish expected to occur in this habitat include westslope cutthroat and bull trout, sculpin, mountain whitefish, and, in some portions of the Basin, introduced species such as rainbow, brook, and brown trout. In lower-elevation areas, typical fish species include chinook salmon, smallmouth bass, northern squawfish, and sucker. Characteristic wildlife species include salamanders, common merganser, osprey, bald eagle, spotted sandpiper, American dipper, water shrew, raccoon, mink, and river otter.

- Lacustrine habitat includes wetlands and deepwater habitats that occur in depressions (such as the lateral lakes and Coeur d'Alene Lake) or in dammed river channels (such as the Spokane River upstream of Post Falls Dam). Most plants occur as phytoplankton or as submerged vegetation. Typical fish include many of the same ones as in riverine habitat, in addition to largemouth bass, yellow perch, and northern pike. Characteristic birds and mammals include tundra swan, lesser scaup, common goldeneye, common merganser, osprey, bald eagle, tree swallow, little brown myotis (bats), and river otter.

- Palustrine habitat includes wetlands that are dominated by trees, shrubs, and other persistent emergent wetland plants. This habitat occurs in smaller areas within CSM Units 1, 2, 4, and 5, relative to larger areas within CSM Unit 3. Typical plants include wild rice, water potato, equisetum (horsetail), cattail, cottonwood, and willow. Characteristic wildlife species include spotted frog, salamanders, great blue heron, Canada goose, tundra swan, wood duck, mallard, bald eagle, common snipe, little brown myotis (bats), raccoon, mink, beaver, muskrat, and white-tailed deer.

- Riparian habitat is terrestrial habitat that is associated with one of the previously mentioned wetland habitats, most often the riverine habitat. It occurs along stream channels and around lakes within CSM Units 1, 2, 4, and 5, but is much more extensive in CSM Unit 3. Typical plants include reed canary grass, cow-parsnip, spiraea, cottonwood, alder, and willow. Common wildlife include salamander, spotted frog, northern harrier, American kestrel, wild turkey, great horned owl, Swainson's thrush, American robin, song sparrow, shrew, long-legged myotis (bats), raccoon, mink, white-tailed deer, muskrat, mice, and vole.
- Agricultural habitat includes portions of CSM Unit 3 that are used mostly for pasture and hay fields. Redtop, reed canary grass, oats, and barley are typical plants in this habitat, which may be seasonally flooded and used by waterfowl and other wetland species. Common wildlife species include Canada goose, northern harrier, wild turkey, common snipe, American robin, shrew, white-tailed deer, mice, and vole.

- Upland habitat occurs outside the floodplains of the creeks and the South Fork within CSM Units 1 and 2. Typical plants include grasses, shrubs, pine, hemlock, red cedar, Douglas-fir, and Rocky Mountain maple. Representative birds and mammals include American kestrel, ruffed grouse, wild turkey, great horned owl, Swainson's thrush, shrew, mule deer (which also serves as a surrogate for elk), mouse, and vole.

The bird species listed above, except for ruffed grouse and wild turkey, are protected under the Migratory Bird Treaty Act (MBTA). This statute protects almost all species of native birds in the United States from unregulated "take," which can include poisoning at contaminated sites. The MBTA is the primary tool of the USFWS and other federal agencies in managing migratory birds.

Some of the species mentioned above are considered to be “special-status species” for the EcoRA. These include federally listed endangered or threatened species, those identified by the USFWS as species of concern, state-listed sensitive plant species, and culturally significant plant species. Examples include the bald eagle, black tern, gray wolf, lynx, bull trout, westslope cutthroat trout, spotted frog, Ute ladies’-tresses, and water potato.

7.2.2 Ecological Receptors

Although more than 80 different species were evaluated in the risk assessment, it is not feasible to evaluate ecological risks to every plant, animal, and microbial species that may be present and potentially exposed within the Coeur d’Alene Basin. Consequently, receptors of high ecological or societal value or those believed to be representative of broader groups of organisms were selected for evaluation. Representative ecological receptors were selected on the basis of current information on habitat types present and potential for exposure in the Basin. Each receptor was chosen to represent a trophic category and particular feeding behaviors (e.g., diving birds versus shorebirds) that would represent different modes of exposure to COPECs. Thus, the species that were chosen for evaluation represent numerous trophic levels including hundreds of similarly exposed species in the Basin. The following criteria were used to select potential receptors:

- The receptor does or could use habitats present in the Basin.
- The receptor is important to either the structure or function of the ecosystem.
- The receptor is statutorily protected (i.e., threatened or endangered species, migratory birds) or is otherwise highly valued by society (i.e., species of cultural importance).
- The receptor is reflective and representative of the assessment endpoints for the Coeur d’Alene Basin.
- The receptor is known to be either sensitive or highly exposed to COPECs in the Coeur d’Alene Basin.

Where appropriate, the same receptors were used for more than one CSM unit to increase efficiency and consistency of the EcoRA and to allow for the comparative evaluation of CSM units (Table 7.2-1). Many of the receptors selected for evaluation are listed above for the different habitat types.

7.2.3 Ecological Management Goals and Assessment Endpoints

Ecological management goals, assessment endpoints, and measures for the Coeur d'Alene EcoRA were developed through consultation with the EcoRA Work Group and are consistent with the NCP and EPA guidance. The ecological management goals are:

- Maintenance (or provision) of soil, sediment, water quality, food source, and habitat conditions capable of supporting a "functional ecosystem" (as defined below) for the aquatic and terrestrial plant and animal populations in the Coeur d'Alene Basin

- Maintenance (or provision) of soil, sediment, water quality, food source, and habitat conditions supportive of individuals of special-status biota (including plants and animals) and migratory birds, protected under the MBTA, likely to be found in the Coeur d'Alene Basin

These ecological management goals include the need to reduce the toxicity and/or toxic effects of hazardous substances released by mining activities to ecological receptors within the Basin, and also the need to provide habitat conducive to the recovery of special-status species. By protecting the integrity of the food chain, water, and other natural resources, as well as habitat structure, the ecological management goals should be fulfilled. The ecological endpoints to evaluate these objectives are summarized below.

Assessment endpoints for the Coeur d'Alene Basin were developed in collaboration with the EcoRA Work Group, and are consistent with the NCP and EPA guidance. The selection of the assessment endpoints is crucial to the EcoRA because they define the important ecological values that are to be protected. They are developed on the basis of known information concerning the contaminants present, the receiving site, and the risk management goals. The assessment endpoints for the Coeur d'Alene Basin were based on the following principal criteria:

- Ecological relevance
- Political and societal relevance
- Susceptibility to known or potential stressors
- Consistency with ecological management goals

The protection of assessment endpoints for the Coeur d'Alene Basin as a whole will be considered to result in a "functional ecosystem" if soil, sediment, water quality, food source, and habitat conditions are capable of supporting natural populations of plants and animals; there are no direct adverse effects on migratory birds or special-status species; and habitat conditions are conducive to recovery of special-status species. Assessment endpoints were developed for four levels of biological organization: individual; population; community; and habitat, ecosystem, and landscape. Assessment endpoints for each level are described in the following text.

Assessment endpoints were identified on the basis of potential effects on individuals of migratory birds and threatened or endangered species within the Coeur d'Alene Basin. The effect levels for these endpoints were established to eliminate adverse effects to individuals by considering no-effect or minimal-effect levels of metals for the receptor species.

Assessment endpoints that pertain to potential effects on populations of species that are characteristic of natural habitats within the Basin were identified for the following: fish, amphibians, birds, mammals, and special-status plants (e.g., those that have cultural significance and those that are of special concern to state or federal agencies). Effect levels for these endpoints were established to eliminate adverse effects that may be experienced by greater than 20 percent of the naturally occurring populations.

Assessment endpoints also were identified that pertain to potential effects within the Basin on aquatic and terrestrial plant and invertebrate communities that are characteristic of natural habitats in the region. The effect levels for these endpoints were established to eliminate adverse effects to organisms that make up aquatic and terrestrial plant and invertebrate communities.

In addition, assessment endpoints were identified that pertain to potential direct and indirect effects of mining-related hazardous substances on habitats, ecosystems, and the landscape within the Coeur d'Alene Basin for the following: soil processes (based on viability and sustainability of the soil microbial community to support nutrient cycling and other ecosystem processes necessary for higher plants and animals), and physical and biological characteristics (landscape attributes necessary for sustaining plant and animal communities).

These assessment endpoints were evaluated through a series of measures (sometimes referred to as measurement endpoints) that are described below in the Analysis of Ecological Risk section.

7.2.4 Chemicals of Potential Ecological Concern

The media evaluated in the EcoRA included soil, sediment, and surface water. Groundwater, although contaminated in the Basin, was not evaluated. Animals do not come into contact with it, and the exposure of plants could best be evaluated through concentrations of COPECs in the soil (i.e., reference toxicity data are not available for evaluation of plant exposures to groundwater). Furthermore, groundwater interacts with surface water, which was evaluated in the EcoRA. The COPECs for the Coeur d'Alene Basin were tentatively identified during the evaluation of nature and extent of contamination in the draft Technical Work Plan for the RI/FS (USEPA 1998b). The following COPECs were carried forward to the EcoRA and were the focus of all subsequent evaluations in that report:

- Soil - arsenic, cadmium, copper, lead, and zinc
- Sediment - arsenic, cadmium, copper, lead, mercury, silver, and zinc
- Surface water - cadmium, copper, lead, and zinc

The EcoRA relied on numerous sets of historical data that included concentrations of COPECs in both abiotic media (soil, sediment, and surface water) and biological media (plant and animal tissue) collected by EPA, USGS, USFWS, BLM, University of Idaho, and other investigators. Additionally, URS Greiner, Inc., USGS, and CH2M HILL collected additional soil, sediment, groundwater and surface water samples on behalf of EPA beginning in 1997.

The abiotic media data (including soil, sediment, and surface water) were evaluated initially using general data qualification review and reduction protocols (presented in Appendix A of the EcoRA). The data were then further reduced for the specific uses of the EcoRA. The data qualification review served as a mechanism to apply consistent rules for qualification of data independent of the laboratories or individual data validators, and then to resolve multiple values within a given sample to arrive at a single value per chemical per sample. Following data qualification, the data set was reduced using an automated data selection processor. The data reduction routine was used to select the best value for each analyte or group of analytes.

For evaluation of terrestrial receptors, the data for soil and sediment were combined within a given habitat type and were evaluated as a single medium. The basis for evaluating soil and sediment as a single medium was that, in many cases, soils from either the same sampling location or from sampling locations very close to each other were labeled “soil” in some sampling events and “sediment” in others. This occurred predominantly in the agricultural floodplain areas and was a result of the condition of the site during sampling. When the ground was dry during sampling, the samples were typically identified as “soil,” whereas when it was wet or flooded, the samples were identified as “sediment.” Similarly, the same substrate material represents soil for terrestrial receptors during dry periods and sediment for waterfowl during flooded periods. In either case, the soil-sediment originated from the same source material so the approach for evaluating them together was considered valid.

For evaluation of aquatic receptors, the surface water and sediment data were reduced to those samples occurring in lakes, rivers, and wetlands. Sediments were not combined with soils for aquatic receptors because the evaluation was limited to specific habitat types that are typically wet year-round (lakes, rivers, wetlands).

Section 2.4 and Appendix A of the EcoRA provide a discussion of the data quality objectives (DQOs) as well as the data qualification and reduction procedures used to create the final database that was used for risk evaluations.

Tables 7.2-2 through 7.2-5 provide a summary of the occurrence and distribution of COPECs by medium (soil-sediment, sediment, and surface water) in various portions of the Basin. The tables show the frequency of detection as well as minimum, maximum, mean, and UCL_{95} of the mean concentrations. Analyses in subsequent portions of the EcoRA were conducted to determine which of the COPECs posed risks to ecological receptors; these chemicals vary by receptor and medium and are referred to as COECs.

7.2.5 Analysis of Ecological Risk

Three categories of measures were evaluated during the analysis phase: measures of exposure, measures of effects, and measures of ecosystem and receptor characteristics. The measures are described in the following text.

Exposure Analysis

The exposure analysis evaluated the contact or co-occurrence of mining-related hazardous substances and the assessment endpoint receptors. The measures of exposure used in the EcoRA were developed for each of the assessment endpoints and habitats within each of the CSM units. They included concentrations of COPECs in soil-sediment, surface water, and biota (plants and animals) to which the receptors could be exposed.

Many studies have been conducted in the Coeur d'Alene Basin to characterize exposures of plants and animals to mining-related hazardous substances, as summarized in Section 2.4 of the EcoRA. These include measurements of chemical concentrations in both abiotic media (soil-sediment, and surface water) and biological media (plant and animal tissue). COPEC concentrations in abiotic media are summarized in Tables 7.2-2 through 7.2-5. Data from the numerous studies of accumulation of metals in biota in the Coeur d'Alene Basin may be segregated into three groups based on their potential usability in the exposure estimates. Some data were used to estimate food-web exposures to consumer species (e.g., results from whole-body analyses of fish, invertebrates, and small mammals; analyses of plant tissues). Other data were used for estimating metals exposure of the species from which the tissues were obtained (e.g., metal concentrations in target organs [liver, kidney, and blood]; measures of delta-aminolevulinic acid dehydratase [ALAD] inhibition in blood). The last group of data, including metal concentrations in mammal hair, bird feathers, and fish fillets, were not readily usable in EcoRAs because of limitations on interpretability of their relation to ecological effects.

The potential routes of exposure indicate the means by which chemicals are transferred from a contaminated medium to ecological receptors. The routes by which ecological receptors may be exposed to COPECs in the Coeur d'Alene Basin include:

- Birds and mammals - ingestion of soil-sediment, surface water, and food

- Fish - ingestion and direct contact with sediment and surface water
- Benthic invertebrates - ingestion and direct contact with sediment or surface water
- Aquatic plants - root uptake and direct contact with sediment and surface water
- Amphibians - direct contact with surface water and soil-sediment
- Terrestrial plants - root uptake from soil-sediment
- Terrestrial invertebrates - ingestion and direct contact with soil-sediment
- Soil processes - direct contact of microbes with soil-sediment

Birds and mammals experience exposure through multiple pathways including ingestion of abiotic media (soil, sediment, and surface water) and biotic media (food) as well as inhalation and dermal contact. To address this multiple pathway exposure, modeling was required. Exposure estimates for each representative species were generated based on model assumptions, life history parameters, and estimated concentrations in exposure media (soil, sediment, and surface water) and food sources as described in Section 3.1 of the EcoRA. The end product or exposure estimate for external exposures for birds and mammals is a dosage (amount of chemical per kilogram receptor body weight per day [mg/kg/d]) rather than a media concentration as is the case for the other receptor groups (fish and other aquatic organisms, terrestrial plants, terrestrial invertebrates, and soil [microbial] processes). This is a function of both the multiple pathway approach as well as the typical methods used in toxicity testing for birds and mammals (as described in Section 3.2 of the EcoRA). Summaries of total (i.e., sum over all pathways) and partial (pathway-specific) exposure estimates are presented and compared to toxicity values in Section 4.1 of the EcoRA.

Exposure-point concentrations for soil-sediment and surface water incorporated into the exposure model for birds and mammals were the upper UCL concentrations. These values were selected to provide a conservative representation of exposures most likely to be experienced by birds and mammals within the Coeur d'Alene Basin. Because wildlife are mobile and their exposure is best represented by the average concentration within areas they inhabit, UCL_{95} is the measure traditionally used for estimation of exposure for wildlife.

Internal exposures consist of concentrations of COPECs in tissues of receptor species. These concentrations were measured directly from certain field-collected birds and/or mammals; for others, they were modeled using site-specific or literature-derived information. They were then compared to available literature information for concentrations of chemicals in specific tissues that are associated with adverse effects. This provided another measure of the potential nature and magnitude of effects birds and mammals may experience in the Coeur d'Alene Basin.

Fish and other aquatic organisms can also have both external and internal exposures, although they are not typically described as separate pathways. External exposure occurs as a consequence of living in a contaminated medium. Uptake of metals can be through the skin (dermal), through the gills, or through the diet, including ingestion of contaminated food, water, and possibly sediment. Internal exposures, which provide absolute evidence of exposure, were measured as concentrations of chemicals in tissues including whole body, muscle, kidney, and liver. Those data were presented separately in the EcoRA because information is available that allows the estimation of risks based on tissue concentrations.

Exposure estimates for amphibians consisted of external exposure only. These receptors are similar to aquatic organisms in that exposure is measured using concentrations of contaminants in abiotic media (e.g., surface water). Although amphibians are also exposed to sediment, these exposures were not estimated because corresponding toxicity data for sediment were not available for this receptor group. Exposure for amphibians was evaluated by considering the full distribution of dissolved COPEC concentrations in surface water from each CSM unit and/or watershed.

Exposures estimated for soil-associated biota (terrestrial plants, terrestrial invertebrates, and soil microbial processes) consisted of external exposure only. These receptors are similar to aquatic organisms and amphibians in that exposure is measured using concentrations of contaminants in abiotic media (e.g., soil-sediment). Exposure for soil-associated biota was evaluated by considering the full distribution of COPEC concentrations in soil-sediment from each CSM unit and/or watershed. Exposure for soil-associated biota was only evaluated based on soil-sediment samples from terrestrial habitat types (i.e., agricultural, riparian, and upland). Exposure evaluations were performed separately for each terrestrial habitat type within a CSM unit and/or watershed.

Ecological Effects Analysis

Two kinds of measures were evaluated for ecological effects: (1) measures of effects and (2) measures of ecosystem and receptor characteristics. Measures of effects are the quantifiable changes in an attribute of an assessment endpoint in response to a stressor. As with the measures of exposure, the measures of effect were developed for each of the assessment endpoints and habitats within each of the CSM units. The measures of effects also are defined according to the potential exposure media within each of the habitats in each CSM unit. The measures of effects are briefly stated as:

- Effects on health, survival, or reproduction of migratory birds or on special-status animal species at the individual level

- Effects on survival, reproduction, or abundance for fish, amphibian, avian, mammalian, or special-status plant species at the population level

- Effects on aquatic or terrestrial plant community composition, density, species diversity, or community structure

- Effects on aquatic or terrestrial invertebrate community composition, abundance, density, species diversity, or community structure

The ecological effects characterization consists of an evaluation of available toxicity or other effects information that can be used to relate the exposure estimates to a level of adverse effects. Stressor-response (i.e., effects) data that may be used to evaluate ecological risks resulting from chemical exposures fall into three general categories: (1) literature-derived or site-specific single-chemical toxicity data, (2) site-specific ambient media toxicity tests, and (3) site-specific field surveys (Suter et al. 2000). All three categories of data were available for the assessment of ecological risks in the Coeur d'Alene Basin and are summarized below.

- Single-chemical toxicity data consist of results of toxicity tests with single chemicals (or materials) as reported in published literature or performed on a site-specific basis. These data may also be represented as summaries of literature toxicity data (e.g., water quality criteria). Single-chemical toxicity data developed for use in the Coeur d'Alene Basin EcoRA are summarized in Section 3.2 of the EcoRA, while Appendix E of the EcoRA presents further details of the individual studies.

- Site-specific toxicity tests have been done in the Coeur d'Alene Basin. This testing provides important information on the toxic effects that have been observed in site-relevant organisms exposed to site media (soil, sediment, and/or surface water). The toxicity testing done in the Basin also is summarized in Section 3.2 of the EcoRA for each receptor group, and Appendix E of the EcoRA presents details for the primary studies.

- Site-specific field surveys have been conducted on most of the receptor groups. These surveys also provide vital information concerning effects observed in the Basin. A summary of the site-specific field surveys is presented in Section 3.2 of the EcoRA for each receptor group, while Appendix E of the EcoRA provides further details of primary surveys.

The relationship between the various receptor groups and ecological effects information available for each measure of effect are shown in Figure 7.2-6. The end-product of the ecological effects characterization is a range of toxicity reference values (TRVs) that was combined with the exposure estimates (birds and mammals) or the EPCs (fish and other aquatic organisms, amphibians, terrestrial plants, terrestrial invertebrates, and soil microbial process) to estimate potential risks in the risk characterization. Measures of ecosystem and receptor characteristics were also evaluated for their potential effects on identified receptors, including habitat for special-status or other species. These are factors that influence the behavior and location of ecological entities of the assessment endpoint (such as fish), the distribution of a stressor (such as water temperature), and the life-history characteristics of the assessment endpoint (such as reproduction) that may affect exposure in response to the stressor. Examples of these measures include bank stability, substrate composition and mobility, water temperature, spatial distribution and connectivity of habitat, riparian vegetation habitat quality, sediment deposition rate, and turbidity (total suspended solids). Evaluation of these measures was based on results from a number of studies conducted within the Basin, primarily CSM Units 1, 2, and 3. It focused on the relationships between mining-related hazardous substances and the indirect effects those stressors have had on physical and biological conditions within the Basin.

7.2.6 Characterization of Ecological Risk

The risk characterization phase of the EcoRA combined the results of the exposure analysis with those from the ecological effects analysis to determine which stressors posed risks to which receptors (assessment endpoints).

Potential risks to the representative species were quantified for each exposure pathway for which data were available. For single-chemical toxicity data, chemical-specific risk estimates were derived using a combination of methods. For birds, mammals, and aquatic biota, the HQ method was used whereby point estimates of exposure were compared to point estimates of effects. (Note that the “point estimates” for birds and mammals are the UCL_{95} of the mean.) For amphibians, terrestrial plants, soil invertebrates, and soil processes, full distributions of exposure and effects were compared, with risk being represented by the percent overlap of the two distributions. The magnitudes of the estimated risks for each receptor group are discussed with other lines of evidence in the risk description section (4.2) of the EcoRA. Because receptors were evaluated at differing levels of ecological organization (i.e., individual-, population-, and community-level), risk estimation was based on measures of exposure and effects appropriate for each level of ecological organization.

Risk estimates were also made based on available site-specific toxicity tests and field surveys. These risk estimates were derived by following the decision processes outlined in Suter et al. (2000). Results from site-specific toxicity tests were judged supportive of a conclusion of risk if statistically significant toxicity relative to controls or dose-response relationships for exposure of test species to site media were observed. Results from field survey data were judged supportive of a conclusion of risk if observations differed significantly from appropriate reference observations, or if measured parameters (such as ALAD activity of waterfowl blood) were outside of bounds assumed to be representative for that species. Wherever possible, correlation between observed responses in toxicity tests and field surveys with field concentrations of COPECs was made to provide information concerning causation of observed responses. The results of the risk estimation for each line of evidence and receptor group are presented in Section 4.1 of the EcoRA.

Determination of risk to receptors was performed by weight-of-evidence evaluation. The strengths, weaknesses, and relative power of each piece of available information (i.e., line of evidence) were considered individually and in combination to develop conclusions concerning the presence or absence of risks. For the chemical stressors, the results were presented as tables and graphs that show the frequency at which COPEC concentrations exceed the various potential effect levels for the different receptors. Based on the potential risks of adverse effects to those ecological receptors (and similarly exposed species), the EcoRA identifies the final COECs.

For physical and biological stressors, the evaluation of effects of mining-related hazardous substances relied on comparison of assessment areas within the Basin to reference areas with similar exposure to non-mining-related stressors (e.g., forestry, roads, development). This process served to isolate a level of effect attributable to mining-related hazardous substances. Several lines of evidence (i.e., measures of ecosystem and receptor characteristics) were used to assess adverse effects on the physical and biological characteristics endpoint. Examples of these measures include riparian habitat suitability index, streambank stability, substrate composition and mobility, and water temperature. Analysis of these lines of evidence included field observations and interpretation of aerial photographs to assess the spatial distribution and connectivity within riverine and riparian habitats. Fragmentation of these habitats can affect receptors by limiting the ability to migrate, acting as barriers to biotic interactions, and/or increasing susceptibility to predation. The detailed evaluation of secondary effects on physical and biological ecosystem characteristics is presented in Appendix K of the EcoRA. The results described were considered to represent adverse effects that are secondarily related to hazardous substances occurring within various portions of the Basin.

Uncertainties are inherent in all risk assessments, and the EcoRA (Section 4.3 of the EcoRA) presented a discussion of various uncertainties and limitations associated with the risk assessment process, or with the available data, that may result in under- or over-estimation of risks. The nature and magnitude of uncertainties depend on the amount and quality of data available, the degree of knowledge concerning site conditions, and the assumptions made to perform the assessment.

Uncertainties associated with problem formulation include use of historical data that may not completely meet EPA data usability criteria, inconsistent labeling of sample location types or lack of labeling for some data, and pooling of soil and sediment data by habitat type for terrestrial evaluations. However, despite the uncertainties described here, there is a very large volume of chemical and biological data for the Coeur d'Alene Basin that is suitable for evaluation of risks to ecological receptors. Data that were found to be questionable through the general review and evaluation were not used.

The uncertainties associated with the exposure characterization include exposure pathways not retained for quantitative evaluation, identification of ecological receptors, selection of representative species, exposure route assumptions, regression modeling, and speciation of metals. Uncertainties associated with the ecological effects characterization include evaluation of chemical toxicity (selection and use of toxicity reference values), and assumptions regarding use of bioassay test organisms or test results, and allometric scaling factors.

Uncertainties and limitations associated with the risk characterization include use of HQs as an indicator of potential ecological risk, lack of data for some multi-pathway risk estimates, joint multi-chemical toxicity, lack of multiple lines of evidence for certain receptor groups, treatment of estimated exposures that exceeded no observed adverse effect levels but not lowest observed adverse effect levels, and use of risk estimates for representative species to characterize risks to other plants and wildlife.

Results of the risk characterization are summarized below in the Conclusions section (7.2.9).

7.2.7 COEC Concentrations Protective of Receptors

Concentrations of COECs in environmental media (soil, sediment, and water) were identified that preserve the desired attributes of the assessment endpoints, and below which adverse effects are expected either to be absent or to be within defined limits of effects levels. These concentrations are often determined by levels of contaminants that would be protective of the most sensitive ecological receptor that is exposed to a particular medium.

These COEC concentrations need to account for the presence of special-status species and protected migratory birds where the level of protection should be higher (i.e., the acceptable effect threshold is lower) than that sought for population-level, community-level, or landscape-level endpoints. This is accomplished by considering the relative sensitivity of special-status species and migratory birds to metals compared to sensitivity of other species in their group, selecting toxicity test endpoints that offer protection at the individual level as a basis for TRVs, or applying a safety factor to TRVs developed using surrogate species. The availability of site-specific information for migratory birds has allowed the selection of TRVs or exposure parameters that reflect the protection of individuals. The availability of site-specific comparative toxicity testing with bull trout has allowed the evaluation of the relative sensitivity of bull trout to metals, compared to the sensitivity of other aquatic organisms.

The protective-level COEC concentrations are presented as ranges for the various receptor groups that were evaluated (i.e., birds and mammals combined, soil biota combined, etc.), segregated by the level of assessment (e.g., individual- or population-level) and the medium (e.g., soil or sediment). The protective-level COEC concentrations for aquatic organisms are set to cover the group as a whole, with consideration of possible effects on special-status species.

Protective-level COEC concentrations for birds and mammals that were evaluated at the individual level are based on no observed adverse effect level (NOAEL) values, whereas the lowest observed adverse effect level (LOAEL) or dose causing effects in 20 percent of test animals (ED20) (i.e., a less restrictive value) was used for receptors evaluated at the population level. Because soil is not the most appropriate source medium for evaluation of risks for all wildlife species, protective-level COEC concentrations were developed for representative species on the basis of the habitat types in which they predominantly occur. Species that occur in riparian, agricultural, or upland habitats were identified as "terrestrial" and protective-level COEC concentrations were calculated for soil (Table 7.2-6). Species that occur in riverine, lacustrine, and palustrine habitats were identified as being "aquatic" and protective-level COEC concentrations were calculated for sediment (Table 7.2-7).

Protective-level COEC concentrations for soil-associated biota (e.g., plants, invertebrates, and microbial processes) were based on toxicity data from the published literature and were based on no observed effect concentrations (NOECs) and lowest observed effect concentrations (LOECs) for each receptor group (Table 7.2-6).

Table 7.2-8 lists protective-level COEC concentrations for surface water based on the national AWQC, adjusted for hardness for specified metals. The national chronic criteria are estimates of the highest concentrations of materials in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect.

EPA published an update to the AWQC for cadmium (66 FR 18935; April 12, 2001) at about the same time as final changes were being incorporated into the EcoRA, and it was not feasible to re-analyze risks to aquatic organisms in time to make corresponding changes in the final EcoRA. Revised protective concentrations for cadmium are, however, shown in Table 7.2-8 and in later sections of the ROD. In relatively soft waters of the Basin, the updated cadmium AWQC is lower than the 1998 cadmium AWQC used in the EcoRA, and use of the 2001 criterion would result in larger estimated cadmium risks to aquatic biota than the risks identified in the EcoRA if the risks were recalculated.

All median values for background surface water were below the national chronic criteria AWQC (assuming hardness of 30 mg/L as CaCO3). Background values for metals are described in EPA's *Final Technical Memorandum* (USEPA 2001h). The 95th percentile of the background dissolved lead concentrations exceeded the national chronic criteria calculated at hardness of 30 mg/L as CaCO3 in the following areas: the Upper South Fork, the Page-Galena mineral belt area, and the South Fork basin as a whole ("entire South Fork"). The 75th percentile of the data exceeded the national chronic criteria in the Page-Galena mineral belt area. These results imply that the national criteria AWQC would only be exceeded in a very limited number of mineralized locations in the stated drainages at some times if mining-related impacts did not exist. All of the calculated values for zinc and cadmium, including the 95th percentile (assuming hardness of 30 mg/L as CaCO3), were well below the national criteria. Therefore, the AWQC are generally protective for surface-water biota. However, in areas of low hardness (e.g., 10 mg/L as CaCO3) the AWQC may not be protective, particularly with respect to individuals of special-status species such as bull trout and cutthroat trout.

Protective-level COEC concentrations for sediment are either toxicity-based or regional background concentrations of metals in sediment in the Basin (Table 7.2-9). The higher value of either background or the toxicity screening value is recommended as the protective-level COEC concentration. On the basis of the determinations of regional variations in soil and sediment upper background values (USEPA 2001h), separate background values for sediment were determined for CSM Units 1 and 2, CSM Units 3 and 4, and CSM Unit 5.

7.2.8 Ecological Goals for Physical and Biological Characteristics

Qualitative goals were developed for physical and biological characteristics (assessed as measures of ecosystem and receptor characteristics, such as stream bank stability, water temperature, etc.) that have been adversely affected by releases of mining-related hazardous substances (Table 7.2-10). The goals for these characteristics describe either a range of conditions found in the Coeur d'Alene Basin prior to mining activities or the range of conditions in these characteristics currently found in selected reference areas. These ecological goals are applicable to those CSM units that showed unacceptable risks for the specific physical characteristic, and are considered to be the equivalent of the protective-level COEC concentrations identified for hazardous substances (previous section).

7.2.9 Conclusions

A large volume of data regarding the impacts of mining-related hazardous substances is available for the Coeur d'Alene Basin and, while some data gaps may exist, there is more than adequate evidence to demonstrate the magnitude of the impacts to the ecosystem. High concentrations of metals are pervasive in the soil, sediment, and surface water in the Basin, and these metals pose substantial risks to the plants and animals that inhabit the Basin. The risk assessment evaluated impacts to more than 80 different species (see Table 7.2-1). The species evaluated represent numerous trophic levels, including hundreds of species that are similarly exposed. Species evaluated include "special-status species," such as those listed as endangered or threatened under the ESA, those listed by the USFWS as species of concern, state-listed sensitive plant species, and culturally significant plant species. The National Marine Fisheries Service has indicated that no anadromous fish species are present in the Coeur d'Alene Basin because the Grand Coulee Dam blocks passage of anadromous fish into the Basin. Examples of the special-status species evaluated in the EcoRA include the bald eagle, black tern, gray wolf, lynx, bull trout, Ute ladies'-tresses, and the water potato.

The results of the EcoRA indicate that most watersheds in which mining has occurred and a large portion of the Basin downgradient of mining areas are ecologically degraded as a direct or secondary effect of mining-related hazardous substances. This ecological degradation has resulted in demonstrated, observable effects in the Basin. In addition, the results of the EcoRA show that, if remediation is not conducted in the Basin, effects can be expected to continue for the foreseeable future. These demonstrated effects and the future risks predicted in the EcoRA, which are summarized below, were used as the basis for identifying remedial actions in the FS and this ROD.

Conclusions concerning the nature and extent to which mining-related hazardous substances present risks to ecological receptors within the Coeur d'Alene Basin were based on the weight-of-evidence analyses. The general conclusion is that heavy metals, primarily lead and zinc, present significant ecological risks to most ecological receptors throughout the Basin (Table 7.2-11). Few receptors were identified for which no ecological risks are estimated. In all receptor classes, ecological risks from at least one COEC in at least one area of the Basin were identified. Because multiple lines of evidence were available for evaluation of risks for some receptors in all receptor classes (except soil invertebrates and soil microbial processes), the strength of many risk conclusions is considered to be high. Brief summaries of the available lines of evidence and risk conclusions for each receptor class are presented below.

Birds

Conclusions for effects on birds are as follows:

- Risks to health and survival from at least one metal in at least one area were identified for 21 of 24 avian representative species.

- No risks were identified for ospreys, bald eagles, and northern harriers in the Lower Basin, Coeur d'Alene Lake, and Spokane River areas. Additional data obtained after finalization of the EcoRA have identified potential risks to fish-eating birds in the Upper Basin.

- Lead and zinc present the greatest risks to birds in the Coeur d'Alene Basin, with risks to at least one avian receptor estimated for 11 (for lead) and 10 (for zinc) of 13 areas, that were evaluated in the Coeur d'Alene Basin. Risks from these COECs are not only spatially widespread, but also are broadly distributed taxonomically and of great magnitude. For example, the HQ for exposure of spotted sandpipers to lead in Ninemile Creek was 387, based on a LOAEL for toxic effects.

- There is extensive documentation of lead poisoning among waterfowl due to contaminated sediments in the Lower Basin that is not associated with hunting (from lead shot) or fishing (from lead sinkers). Lead poisoning has been documented in Basin waterfowl year-round in the floodplain stretching from Smelterville to Coeur d'Alene Lake.

- Waterfowl deaths due to lead poisoning associated with the ingestion of contaminated sediments have been reported for decades. Ninety-five percent of available habitat in the Lower Basin has lead concentrations above the LOAEL for waterfowl (530 mg/kg), and 80 percent has lead concentrations that are lethal to waterfowl (greater than 1,800 mg/kg).

- In the Coeur d'Alene River basin, lead poisoning (primarily due to ingestion of contaminated sediments) is responsible for 96 percent of the total tundra swan mortality, compared to 20 to 30 percent (primarily due to ingestion of lead shot) at the Pacific flyway and national level.

- Members of 12 species of migratory birds and mammals have been killed through ingestion of lead-contaminated soils and sediments. Since 1981, a total of 27 species of wildlife have been documented with various degrees of lead exposure that exceed background.

- The number of waterfowl carcasses found in 1997 represented the largest documented die-off in the Coeur d'Alene River Basin since 1953. This and other wildlife data collected over the past 20 years are supportive of the fact that lead concentrations in soil and sediment in the Coeur d'Alene Basin still occur at toxic levels. Therefore, animal deaths by lead poisoning from the ingestion of contaminated soils and sediment are expected to continue.

- Risks from cadmium, copper, and mercury were spatially and taxonomically much less broadly distributed and of lower magnitude, although they presented risks to at least one bird receptor in 5 for cadmium, 3 for copper, and 1 for mercury of the 13 areas.

- Arsenic did not present a risk to any avian receptor in any location in the Basin.

- Strength of risk conclusions, as determined by the abundance, quality, and concurrence of available lines of evidence, was high for eight avian species (Canada goose, tundra swan, wood duck, mallard, osprey, bald eagle, northern harrier, and great horned owl), moderate for five (American kestrel, spotted sandpiper, American dipper, American robin, and song sparrow), and low for eleven species (great blue heron, lesser scaup, common goldeneye, common merganser, ruffed grouse, wild turkey, common snipe, black tern, belted kingfisher, tree swallow, and Swainson's thrush).

Mammals

Conclusions for mammals are as follows:

- Risks to health and survival from at least one COEC in at least one area were identified for 12 of 18 mammalian receptor species.
- No risks were identified for fisher, wolverine, river otter, gray wolf, lynx, or beaver.
- No single COEC stands out as a predominant risk driver for mammals. Zinc, lead, and arsenic were the most common risk drivers, presenting risks within at least one CSM unit or segment in the Coeur d'Alene Basin for 9 of 18 receptors for zinc, 8 of 18 receptors for lead, and 7 of 18 receptors for arsenic. For example, HQs of 20 or higher were found for zinc for the masked shrew and long-legged myotis in Canyon Creek watershed, and the HQ for arsenic was 4.4 for muskrats in CSM Unit 3.
- Cadmium, copper, and mercury presented risks within at least one CSM unit or segment in the Coeur d'Alene Basin to 2, 4, and 3 species, respectively. Only in CSM Unit 3 did any COEC (zinc) present a risk to 50 percent or more of all mammalian receptors. Arsenic, cadmium, copper, and mercury did not present a risk to more than 25 percent of receptors in any area.
- Spatially, risks from zinc were most widespread (9 of the 13 areas) and copper the least widespread. Lead, cadmium, arsenic, and mercury posed risks in 8, 6, 5, and 5 areas, respectively.
- With the exception of receptors for which no risks were identified, the strength of risk conclusions, as determined by the abundance, quality, and concurrence of available lines of evidence, was generally low for most mammalian receptors. This is because few lines of evidence were available for most mammals and, when multiple lines of evidence were available, there was generally little concurrence. Conversely, given the generally conservative nature of the exposure models, risk conclusions for receptors estimated not to be at risk (fisher, wolverine, river otter, gray wolf, lynx, and beaver) are considered strong.

Fish and Other Aquatic Organisms

Review of the available evidence of risks to aquatic receptors (fish, invertebrates, and plants) leads to the following conclusions:

- Approximately 20 miles of the South Fork and 13 miles of tributaries are unable to sustain reproducing fish populations. Species density and diversity are reduced throughout the Basin, and the Ninemile and Canyon Creeks are essentially devoid of fish and other aquatic life in the area of mining impacts. Impacted species include the native bull trout, which is listed as "threatened" under the ESA.

- Some fish species (e.g., sculpins) are absent from areas of high metals concentrations.

- Exposure of aquatic organisms to metals was confirmed by the presence of elevated concentrations of metals in the tissues of fish, invertebrates, and plants in many portions of the Basin.

- Based upon comparison of metals concentrations to acute AWQC, surface waters are commonly lethal to some aquatic life in the following areas: upper Beaver Creek, Big Creek, Canyon Creek, Ninemile Creek Segments 2 and 4, Pine Creek Segments 1 and 3, Prichard Creek Segments 1 and 2, the entire South Fork Coeur d'Alene River, and the Coeur d'Alene River down to Harrison (see Figures 7.2-1 through 7.2-5 for stream and segment locations). For example, HQs for acute zinc exposure exceed 10 in more than 90 percent of the water samples from lower Canyon Creek and from lower Ninemile Creek. In addition, acute cadmium and lead HQs also are commonly greater than 10 in those areas.

- Toxicity testing using water from heavily contaminated portions of Canyon Creek and the South Fork indicated that substantial dilution with clean water (10-fold or more) is required to eliminate acute toxicity, consistent with the findings of the surface water-to-AWQC comparisons listed above.

- Based upon comparison of metals concentrations in surface waters to chronic AWQC, growth and reproduction of surviving aquatic life would be substantially reduced in the following areas: Big Creek; Canyon Creek Segments 3, 4, and 5; Ninemile Creek Segments 2 and 4; Pine Creek Segment 1; Prichard Creek Segments 1 and 2; the entire South Fork Coeur d'Alene River; and the Coeur d'Alene River down to Harrison.

- Site-specific toxicity testing and/or biological surveys indicate lethal effects of waters or reduced populations of aquatic life in lower Canyon Creek, lower Ninemile Creek, and the South Fork from Canyon Creek to Enaville.

- Because the bull trout and westslope cutthroat trout are evaluated on an individual level due to ESA coverage, and toxicity for some individuals can occur at levels below the AWQC, there may be areas where the AWQC is not protective of these species. This is particularly true in areas where there may be low hardness.

- Concentrations of metals in water exceed chronic AWQC by some amount in virtually all areas assessed that are downstream of sources of mining waste, indicating some adverse effects on growth and reproduction of aquatic life in all areas.

- Biological surveys in the Spokane River have suggested that metals toxicity contributes to high mortality rates of trout.

- Toxic effects of contaminated sediment are believed to contribute to adverse effects on aquatic life in Big Creek Segment 4, Canyon Creek, Ninemile Creek, Pine Creek, Prichard Creek Segment 3, the entire South Fork, the Coeur d'Alene River, the Spokane River, and, possibly, some parts of Coeur d'Alene Lake.

- Physical disturbances caused by land alterations, and modifications of stream channels caused by construction of infrastructure, adversely affect the ability of streams to support aquatic organisms in some portions of the Coeur d'Alene Basin. Those factors were considered, in part, by using reference areas as a comparison when evaluating biological surveys and habitat conditions.

- The strength of risk conclusions, as determined by exceedances of criteria, site-specific toxicity tests, and biological surveys, is moderate to high in many CSM units and segments.

Amphibians

Conclusions for amphibians are as follows:

- Risks to health and survival from heavy metals are present for three of the four amphibian species evaluated.
- Available lines of evidence suggest that COPECs in the Coeur d'Alene Basin do not present a significant risk to long-toed salamanders.

- Cadmium, lead and/or zinc present risks to both Idaho giant salamanders and Coeur d'Alene salamanders throughout CSM Unit 1 (except for Big, Moon, and Prichard Creeks and the Upper South Fork) and CSM Unit 2. These salamander species do not occur in CSM Units 3, 4, or 5.

- Cadmium, lead and/or zinc present risks to spotted frogs in CSM Units 1 and 2. No risks were identified for the spotted frogs in CSM Unit 3 and they do not occur in CSM Units 4 or 5.

The strength of risk conclusions, as determined by the abundance, quality, and concurrence of available lines of evidence, is considered moderate for spotted frogs, Idaho giant salamanders, and Coeur d'Alene salamanders; and high for long-toed salamanders.

Risks to health and survival from heavy metals are present for three of four species. Cadmium, lead, or zinc (singly or in combination) present risks to spotted frogs, Idaho giant salamanders, and Coeur d'Alene salamanders throughout most of CSM Unit 1 (except for Big, Moon, and Prichard creeks, and the Upper South Fork), and in CSM Unit 2. These salamander species do not occur in CSM Units 3, 4, or 5; no risks were identified for the frogs in CSM Unit 3. More than 10 percent of the measured concentrations of dissolved cadmium or zinc in the CSM Unit 1 and 2 watersheds exceeded the LOEC for amphibian embryos. In addition, there was more than 10 percent overlap in the range of soil-sediment concentrations of COPECs and the LOEC, indicating that toxic effects are likely to occur.

The strength of risk conclusions, as determined by the abundance, quality, and concurrence of available lines of evidence, is considered moderate for spotted frogs, Idaho giant salamanders, and Coeur d'Alene salamanders; and high for long-toed salamanders.

Terrestrial Plants

Review of available evidence of risks for plants leads to these conclusions:

- Available information suggests that exposure to arsenic, cadmium, copper, lead, and/or zinc in CSM Units 1, 2, 3, 4, and 5 may present significant risks to populations of selected plant receptors and to the plant community in general. More than 20 percent of the measured COPEC concentrations in soil exceeded ecological effects levels for plants in many areas, and biological surveys documented adverse effects on vegetation in some of those same areas.

- The strength of risk conclusions, as determined by the abundance, quality, and concurrence of available lines of evidence, is considered moderate for Ute ladies'-tresses, cottonwood, willow, and Rocky Mountain maple; low for porcupine sedge and prairie cordgrass; and high for the plant community.

Soil Invertebrates

Conclusions for soil invertebrates are as follows:

- Arsenic, cadmium, copper, lead, and/or zinc present risks to the soil invertebrate community in CSM Units 1, 2, 3, and 5. More than 20 percent of the measured COPEC concentrations in soil exceeded ecological effects levels for soil invertebrates in many areas.

- The strength of risk conclusions, as determined by the abundance, quality, and concurrence of available lines of evidence, is considered low because only a single line of evidence was available.

Soil Processes

Conclusions for risks to soil processes are as follows:

- Arsenic, cadmium, copper, lead, and/or zinc present risks to soil processes in CSM Units 1, 2, and 3. More than 20 percent of the measured COPEC concentrations in soil exceeded ecological effects levels for soil processes in many areas.

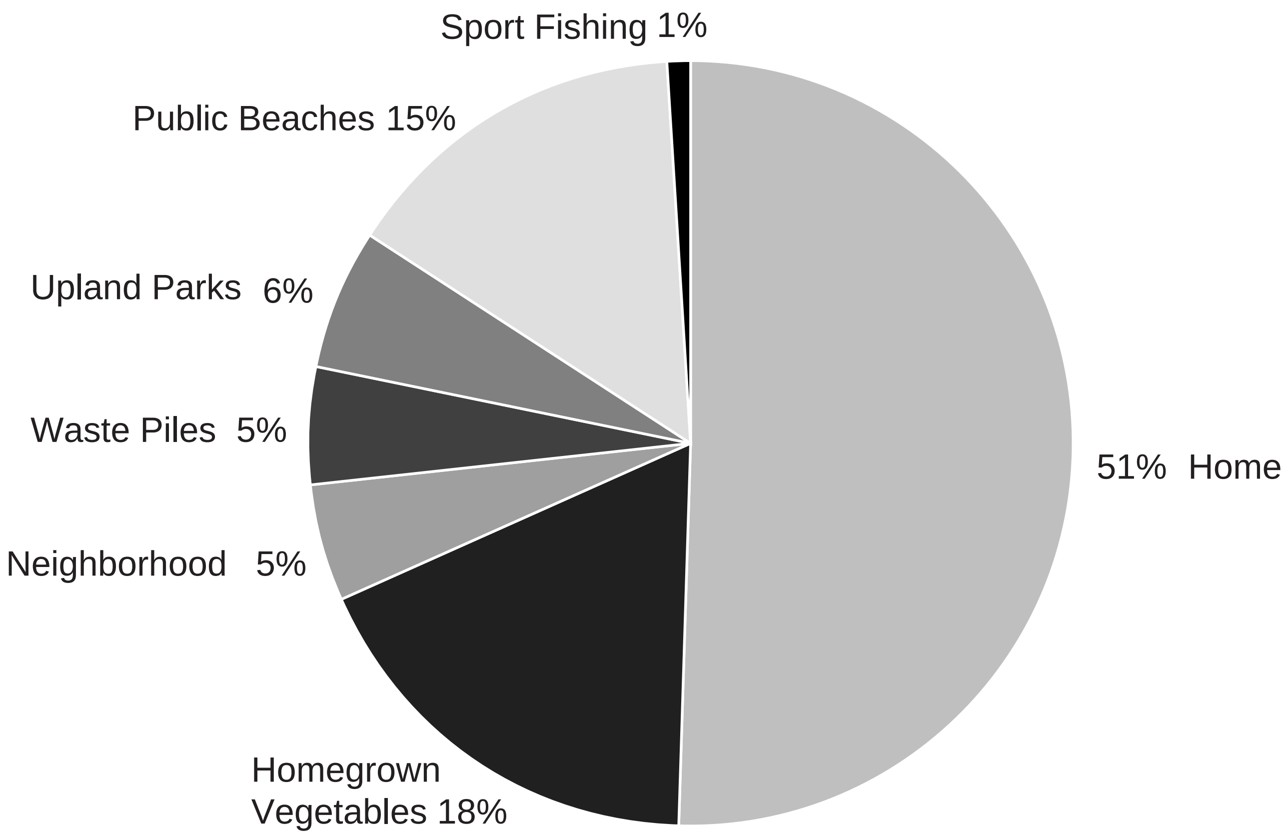
- The strength of risk conclusions, as determined by the abundance, quality, and concurrence of available lines of evidence, is considered low because only a single line of evidence was available.

Physical and Biological Characteristics

Risks to plants and animals also are associated with physical and biological characteristics evaluated in this assessment. Increased bank instability, changes in stream substrate composition and mobility, increased water temperature (from the loss of riparian vegetation along streams), and habitat fragmentation pose a risk to aquatic organisms in affected riverine habitat of the South Fork and its tributaries (Table 7.2-12). Elevated levels of suspended solids pose a risk to aquatic organisms in the Coeur d'Alene River. Increased sediment deposition rates pose risks to aquatic organisms in affected portions of Coeur d'Alene Lake. Decreased spatial distribution and connectivity of riparian habitat, and habitat suitability, pose risks to wildlife using the affected riparian habitat on the South Fork and its tributaries.

Selection of Remedial Action

The remedial action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Such a release or threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment.



NOTE: Percentages are for a hypothetical average child, and exposures for individual children would be determined by the characteristics of their yard and that child's activities. Data were compiled from the Human Health Risk Assessment, IDHW 2001.

Figure 7.1-1
Average Child's Basin-Wide Lead Exposure

Figure 7.1-2
Total RME Noncancer Hazard - Modern and Traditional Subsistence Exposure Scenarios, All Chemicals (Child Age 0 to 6 Years)

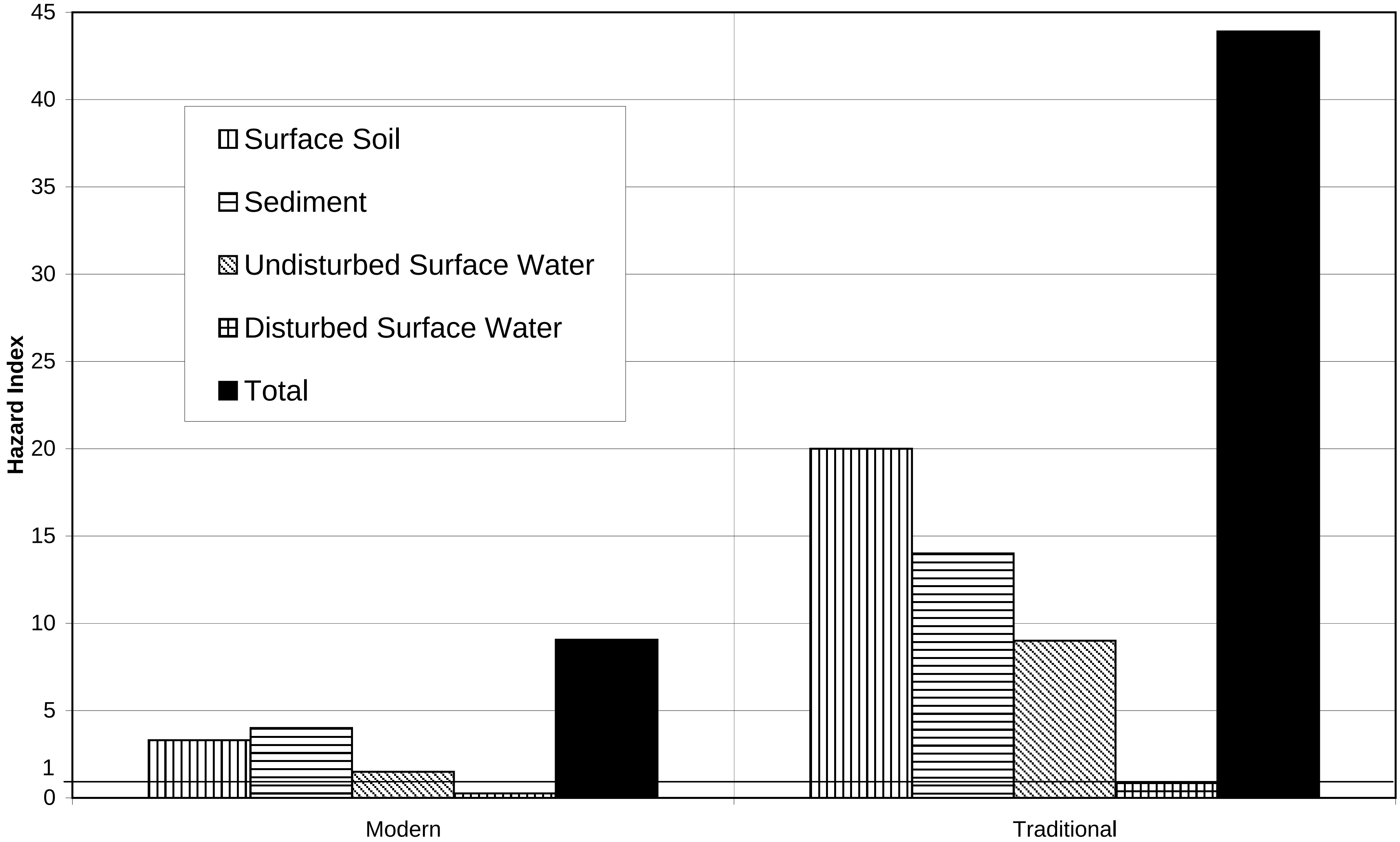
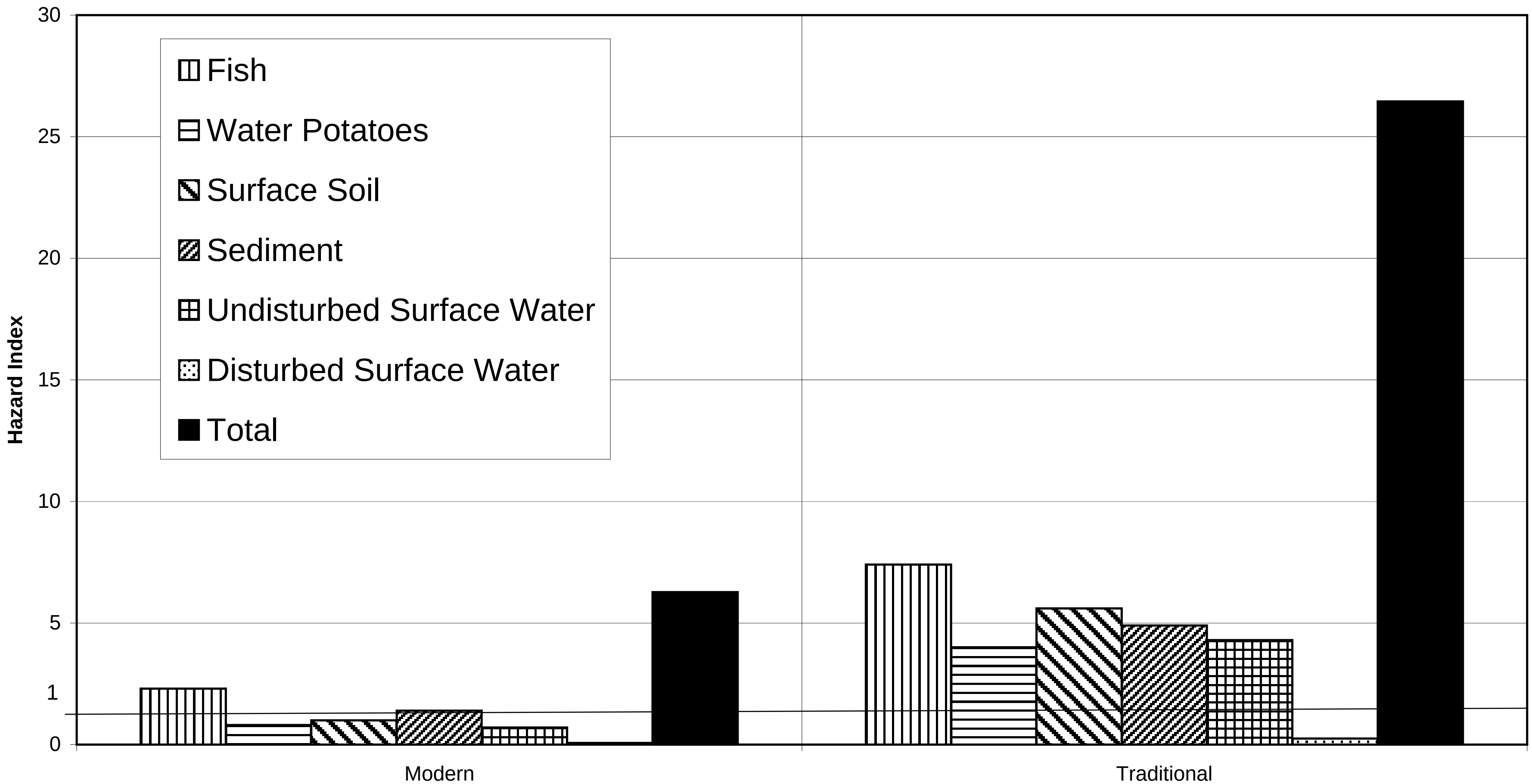


Figure 7.1-3
Total RME Noncancer Hazard - Modern and Traditional Subsistence Exposure Scenarios, All Chemicals (Adult/Child)



Note: The fish ingestion pathway was evaluated for the Adult only receptor age group, all other pathways were evaluated for the combined Adult/Child receptor age group.

Figure 7.1-4
Total RME Cancer Risk - Modern and Traditional Subsistence Exposure Scenarios (Adult/Child)

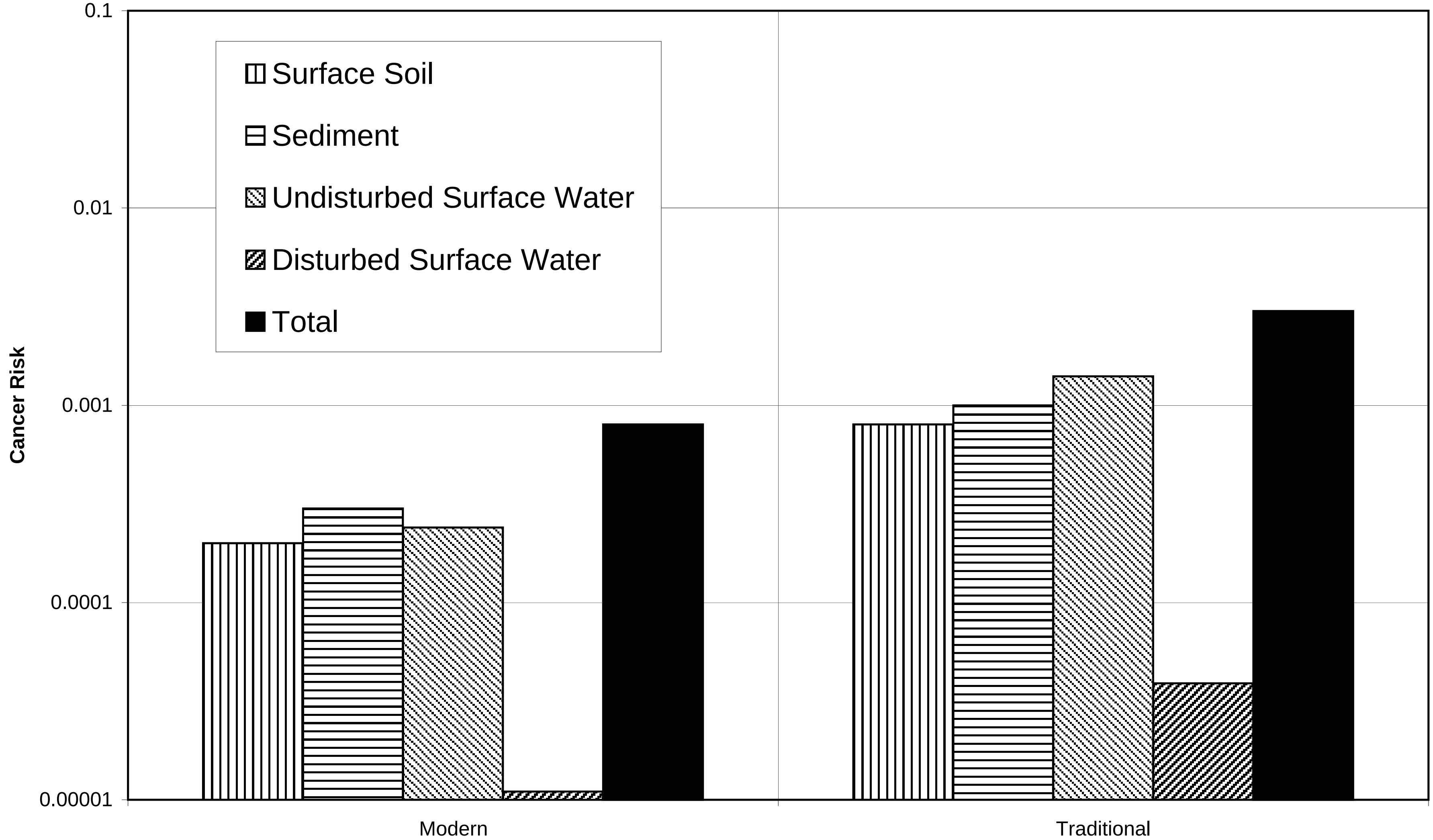
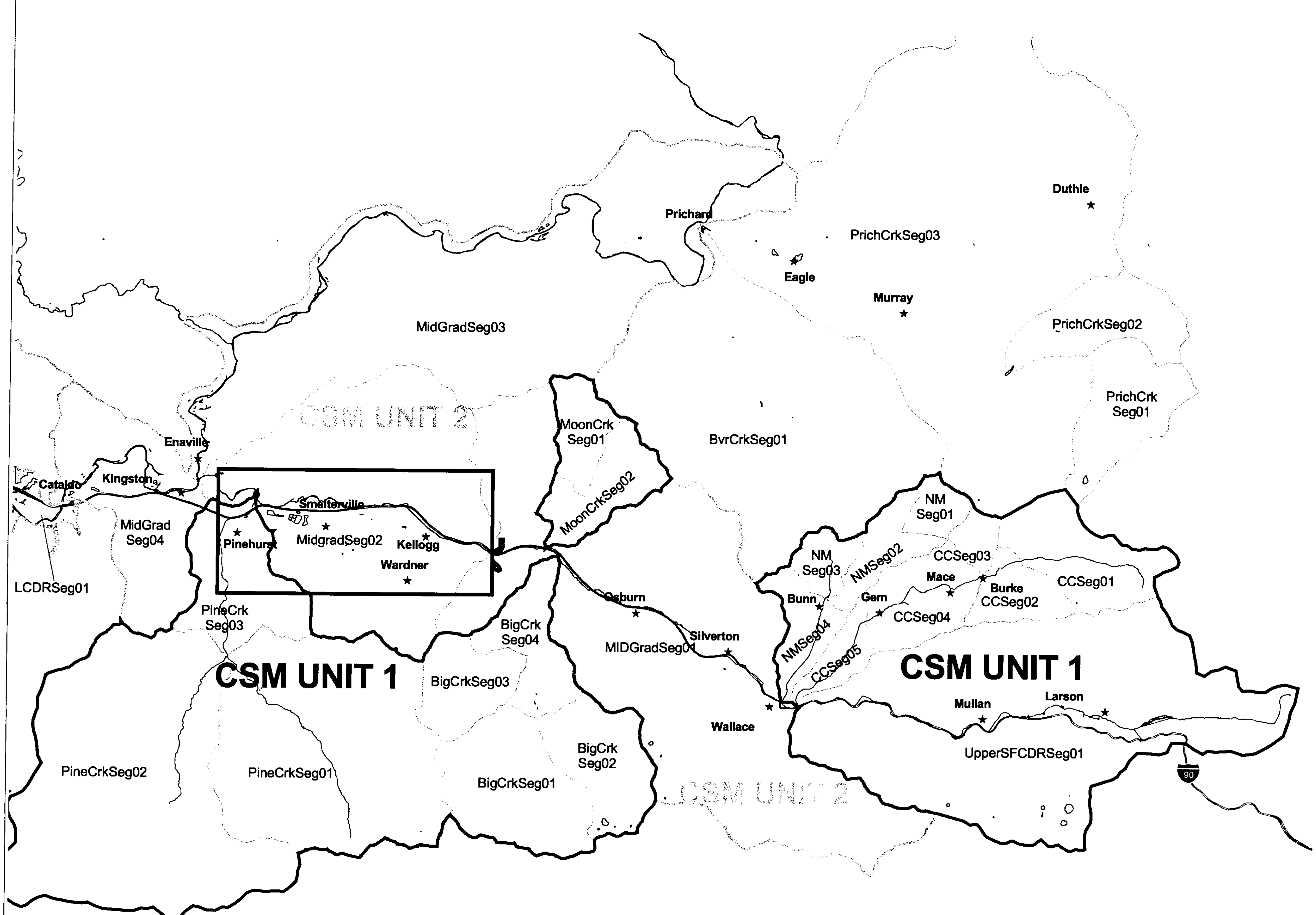
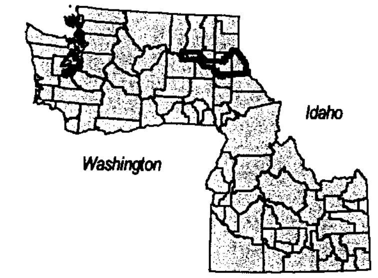


Figure 7.2-1
CSM Unit 1 Boundaries



LEGEND

- ★ City
- CSM Unit Boundary for FS
- Bunker Hill Superfund Site Boundary
- Interstate 90
- Lakes and Rivers
- Segment Boundary



Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 170,000

0 — 4 Miles

N

027-RI-C0-102Q
Coeur d' Alene Basin RI/FS
RECORD OF DECISION

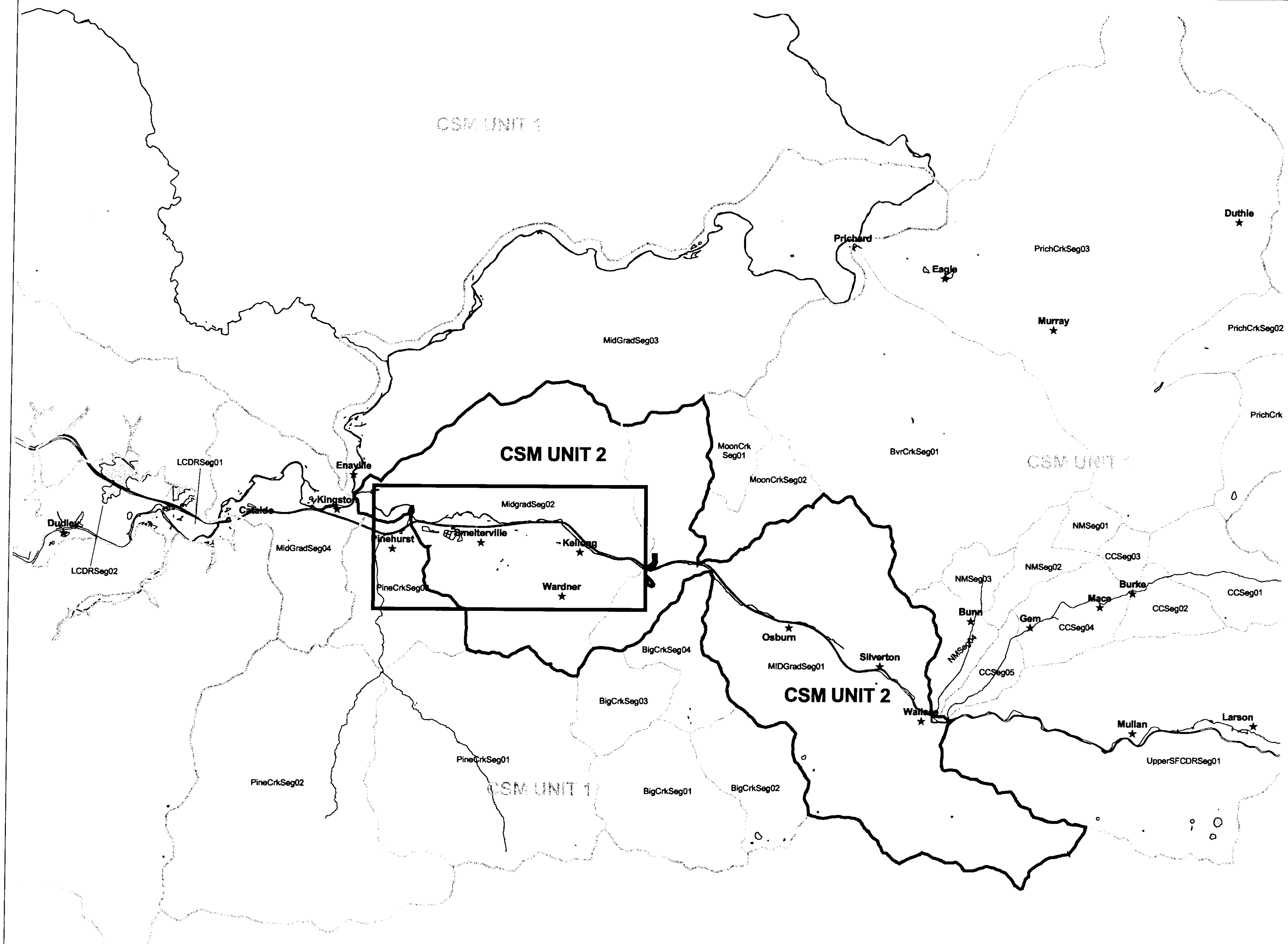
EPA REGION 10

Document Control Numbers:
URS DCN: 4162500.07099.05.a
EPA No. 2.9
CH2M HILL DCN: WKP0032
Generation 1
n:\Projects\RI_FS\csm_units11-16_050102.apr
V: CSM1
E: 1
L: CSM1
3/18/02

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

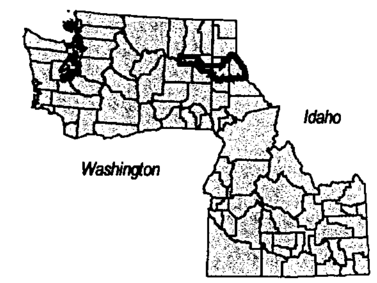
Date of Plot: August 14, 2002

Figure 7.2-2
CSM Unit 2 Boundaries



LEGEND

- ★ City
- CSM Unit Boundary for FS
- Bunker Hill Superfund Site Boundary
- Interstate 90
- Lakes and Rivers
- Segment Boundary



Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 170,000

0 4 Miles

N

027-RI-C0-102Q
Coeur d' Alene Basin RI/FS
RECORD OF DECISION

EPA REGION 10

Document Control Numbers:
URSG DCN: 4162500.07099.05.a
EPA No. 2.9
CH2M HILL DCN: WKP0032
Generation 1
n:\Projects\RI_FS\csm_units11-16_050102.apr
V: V CSM2
E: 2
L: L CSM2
05/01/02

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: August 14, 2002

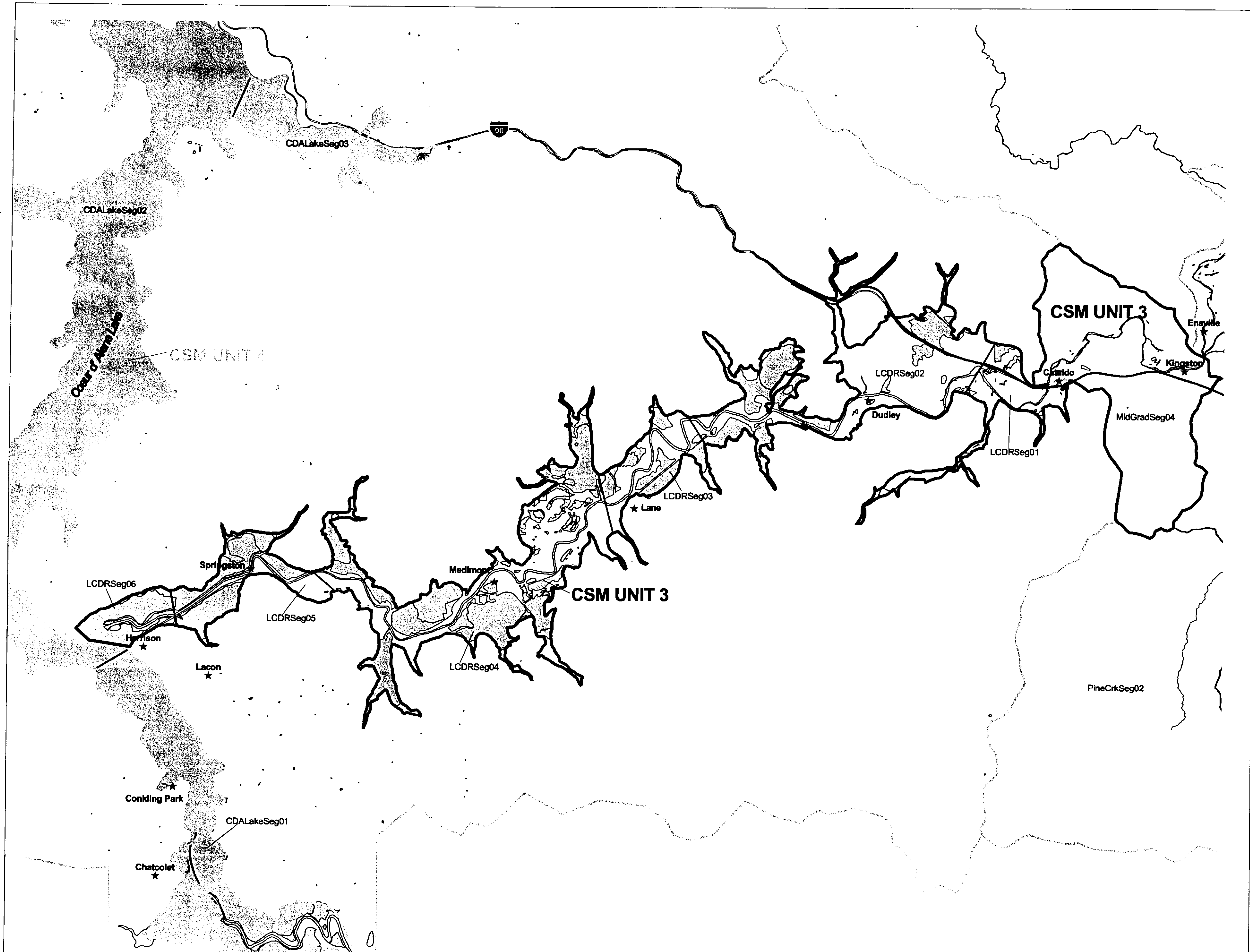
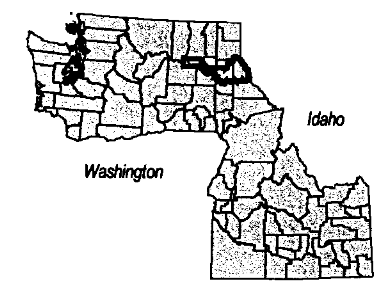


Figure 7.2-3
CSM Unit 3 Boundaries

LEGEND

- ★ City
- CSM Unit Boundary for FS
- Interstate 90
- Lakes and Rivers
- Segment Boundary



Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 140,000

0 2 Miles

N

027-RI-C0-102Q
Coeur d' Alene Basin RI/FS
RECORD OF DECISION

EPA REGION 10

Document Control Numbers:
URSG DCN: 4162500.07099.05.a
EPA No. 2.9
CH2M HILL DCN: WKP0032
Generation 1
n:\Projects\RI_FS\csm_units11-16_050102.apr
V: V CSM3
E: 3
L: L CSM3
05/01/2002

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: May 01, 2002

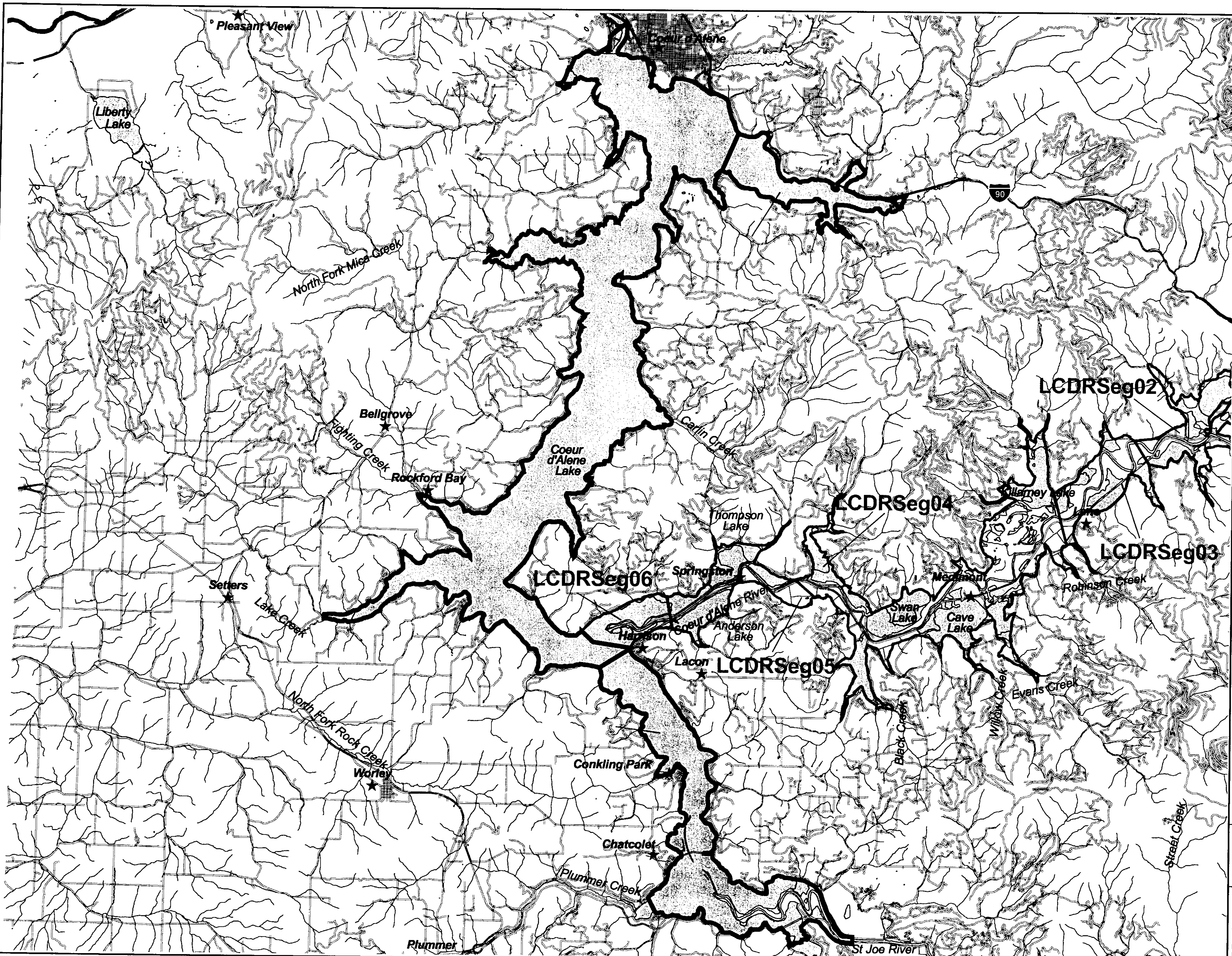
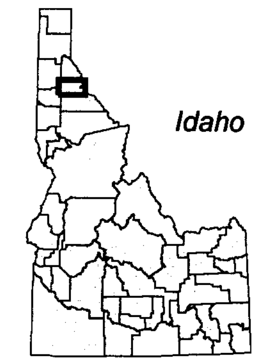


Figure 7.2-4
CSM Unit 4 Boundaries

LEGEND

- Stream
- Road
- Interstate 90
- ★ City
- Coeur d'Alene Lake Watershed
- River Segment
- Lake/River



Location Map

NOTES

1) **Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.**

SCALE 1:72,000

0.5 0 0.5 Miles

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

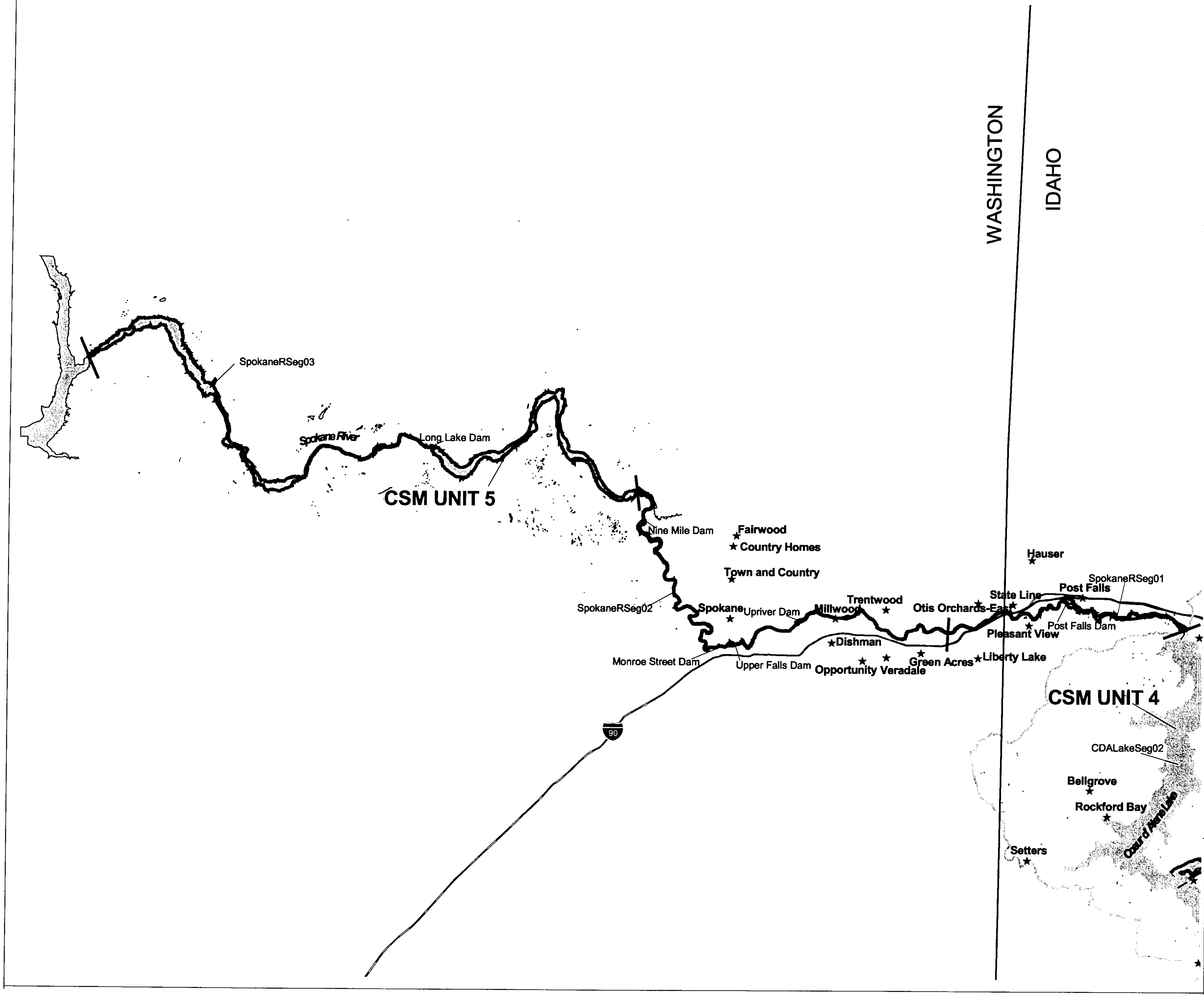
EPA REGION 10

Document Control 4162500.07099.05.a
EPA No. 2.9
Generation 1
n:\Projects\watersheds\
14_h2oshed_8-23-00_050102.apr
V:CDA lake
E: CDA lake
L: FS-Part 3 8.0-1
09/04/02

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

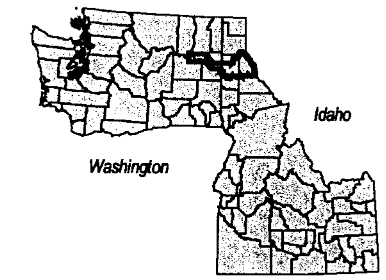
Date of Plot: September 4, 2002

Figure 7.2-5
CSM Unit 5 Boundaries



LEGEND

- ★ City
- CSM Unit Boundary for FS
- Interstate 90
- Lakes and Rivers
- Segment Boundary



Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 400,000

0 5 Miles

N

027-RI-C0-102Q
Coeur d' Alene Basin RI/FS
RECORD OF DECISION

EPA REGION 10

Document Control Numbers:
URSG DCN: 4162500.07099.05.a
EPA No. 2.9
CH2M HILL DCN: WKP0032
Generation 1
n:\Projects\RI_FS\csm_units11-16_050102.apr
V: CSM5
E: 5
L: Part 3 Fig 1.0-6
05/01/02

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: May 01, 2002

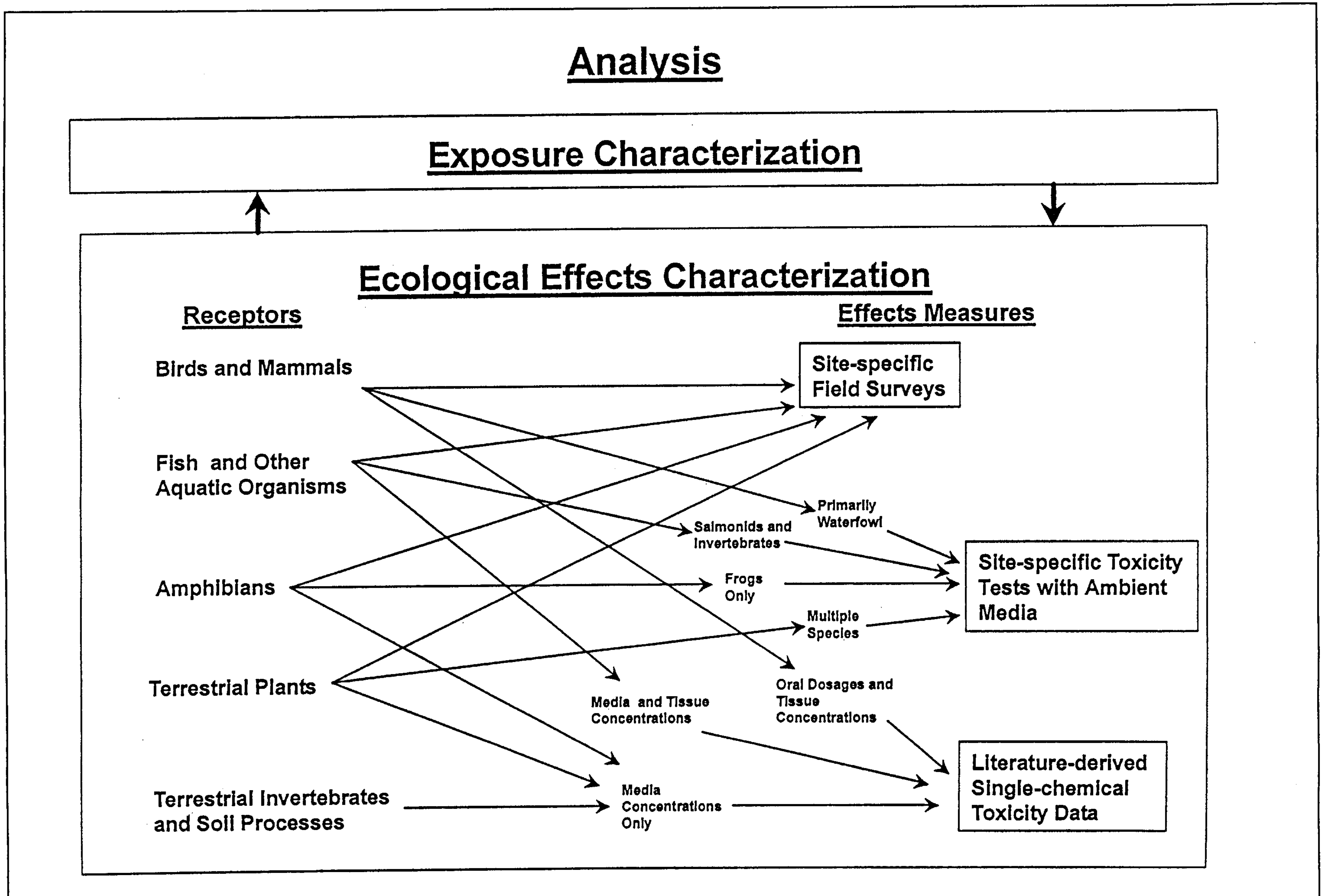


Figure 7.2-6
Ecological Effects Characterization

Table 7.1-1
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations
Current/Future Residential Exposure Scenario

Scenario Timeframe: Current/Future

Geographical Area	Exposure Point[a]	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure[b]
			Min	Max					
Lower Basin	**Exposure Medium: Soil**								
	Yard Soil - Direct Contact	arsenic	4.3	115	mg/kg	28/28	48.53	mg/kg	95% UCL
		iron	9,710	93,000	mg/kg	25/25	37,703	mg/kg	95% UCL
		lead	15	7,350	mg/kg	160/160	110	mg/kg	geometric mean
	House Dust - Direct Contact	lead	49	3,140	mg/kg	31/31	301	mg/kg	geometric mean
Upper Basin[c]	**Exposure Medium: Soil**								
	Yard Soil - Direct Contact	arsenic	2.9 – 6.9	66.1 – 1150	mg/kg	53/53 – 308/309	21.46 – 50.74	mg/kg	95% UCL
		iron	5,910 – 13,000	46,700 – 123,000	mg/kg	54/54 – 282/282	20,198 – 27,190	mg/kg	95% UCL
		lead	22 – 94	3,356 – 20,218	mg/kg	70/70 – 262/262	257 – 771	mg/kg	geometric mean
	House Dust - Direct Contact	lead	23 – 429	1,750 – 29,725	mg/kg	26/26 – 35/35	466 – 1,004	mg/kg	geometric mean
	Exposure Medium: Groundwater (concentrations represent total metals in water)								
	Tap Water - Ingestion	arsenic	0.19	9.2	µg/L	11/16	8.4[d]	mg/kg	Max
All Areas	**Exposure Medium: Plant Tissue**								
	Homegrown Vegetables – Ingestion	cadmium	0.02	1.85	mg/kg	35/35	0.319	mg/kg	95% UCL
		lead	0.48	48.6	mg/kg	24/24	7.8	mg/kg	arithmetic mean

Notes:
Min – minimum
Max – maximum
Exposure Point Concentration: Estimate of the average concentration a person would encounter at the location where the exposure occurs.
Statistical Measure: The statistical measure describes how the exposure point concentration was calculated from the data.
95% UCL: 95 percent upper confidence limit of the mean
[a]The exposure point concentration for lead in house dust that was used in the lead model is the geometric mean of vacuum bag data.
[b]The exposure point concentration for lead in yard soil that was used in the Lead Model is the geometric mean.
[c]The Upper Basin was divided into seven sub-areas, the ranges of values presented for the Upper Basin represent the ranges of the seven sub-areas.
[d]This concentration is the average of static (first-draw water) and purged (flushed line water) samples.

Table 7.1-2
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations
Current/Future Neighborhood Recreational Exposure Scenario

Scenario Timeframe: Current/Future

Geographical Area	Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration[a]	Exposure Point Concentration Units	Statistical Measure
			Min	Max					
Upper Basin[b]	**Exposure Medium: Soil/Sediment**								
	Neighborhood Stream Sediments - Direct Contact	lead	88	67,100	mg/kg	17/17	29,500	mg/kg	95th percentile
	Exposure Medium: Surface Water (concentrations are total metals)								
	Surface Water - Direct Contact	lead	0.3	1,650	µg/L	79/80	296	µg/L	95th percentile
	Exposure Medium: Soil								
	Waste Piles - Direct Contact	lead	83	63,700	mg/kg	27/27	49,800	mg/kg	95th percentile

Notes:
Min – minimum
Max – maximum
Exposure Point Concentration: Estimate of the average concentration a person would encounter at the location where the exposure occurs.
Statistical Measure: The statistical measure describes how the exposure point concentration was calculated from the data.
[a]Not used directly in the lead model, used to assess incremental increases in blood lead over residential blood lead levels.
[b]Concentrations only exceeded for the Burke/Ninemile sub-area of the Upper Basin.

Table 7.1-3
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations
Current/Future Public Recreational Exposure Scenario

Scenario Timeframe: Current/Future

Geographical Area	Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
			Min	Max					
Lower Basin	**Medium: Soil/Sediment**								
	Floodplain Soil/Sediment near the Lower CDAR - Direct Contact	arsenic	2	492	mg/kg	388/388	119	mg/kg	95% UCL
		iron	4,450	256,000	mg/kg	388/388	105,451	mg/kg	95% UCL
		manganese	92	26,400	mg/kg	388/388	9,886	mg/kg	95% UCL
		lead	15	29,200	mg/kg	388/388	5,750[a]	mg/kg	95th Percentile
	Medium: Surface Water (concentrations are total metals in water)								
	Disturbed Surface Water - Direct Contact	lead	117	81,500	µg/L	122/122	31,700[b]	µg/L	95th Percentile
Upper Basin	**Medium: Soil/Sediment**								
	Surface Soil and beach sediments near confluence of North and South Forks CDAR Direct Contact (only location exceeding)	arsenic	73	266	mg/kg	19/19	163	mg/kg	95% UCL
		iron	39,900	174,000	mg/kg	19/19	100,621	mg/kg	95% UCL
		manganese	3,000	14,800	mg/kg	19/19	8,585	mg/kg	95% UCL

Notes:
CDAR – Coeur d'Alene River
Min – minimum
Max – maximum
Exposure Point Concentration: Estimate of the average concentration a person would encounter at the location where the exposure occurs.
Statistical Measure: The statistical measure describes how the exposure point concentration was calculated from the data.
95% UCL: 95 percent upper confidence limit of the mean
[a]Not used directly in the lead model. This value is the 95th percentile for sediment only, used in the lead evaluation to estimate incremental increases in children's blood lead in combination with lead in Lower Basin soils and disturbed surface water samples.
[b]Not used directly in the lead model. Used to assess incremental increases in blood lead in combination with lead in Lower Basin soils and sediment.

Table 7.1-4
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations
Future Residential Use of Tap Water

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical of Concern	Total Metal Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Nine Mile								
Tap Water - Ingestion	Cadmium	0.1	996	µg/L	70/80	130.85	mg/kg	95% UCL
	Zinc	2.8	145,000	µg/L	79/80	19,756	mg/kg	95% UCL

Notes:
Min – minimum
Max – maximum
Exposure Point Concentration: Estimate of the average concentration a person would encounter at the location where the exposure occurs.
Statistical Measure: The statistical measure describes how the exposure point concentration was calculated from the data.
95% UCL: 95 percent upper confidence limit of the mean

Table 7.1-5
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations
Future Subsistence Scenario in the Lower Basin

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration[a]	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Medium: Soil								
Floodplain Surface Soil - Direct Contact	Antimony	1.2	58.6	mg/kg	142/155	21.16	mg/kg	95% UCL
	Arsenic	5.4	492	mg/kg	155/155	124.44	mg/kg	95% UCL
	Cadmium	0.21	86.4	mg/kg	155/155	30.45	mg/kg	95% UCL
	Iron	12,700	222,000	mg/kg	155/155	97,440	mg/kg	95% UCL
	Manganese	511	25,200	mg/kg	155/155	8,960	mg/kg	95% UCL
	Lead	15.3	7,250	mg/kg	155/155	4,900	mg/kg	95th Percentile
Medium: Sediment								
Floodplain Sediment - Direct Contact	Antimony	1	73.7	mg/kg	211/233	25.2	mg/kg	95% UCL
	Arsenic	1.5	375	mg/kg	233/233	120.96	mg/kg	95% UCL
	Cadmium	0.24	105	mg/kg	228/233	39.33	mg/kg	95% UCL
	Iron	4,450	256,000	mg/kg	233/233	113,073	mg/kg	95% UCL
	Manganese	92.3	26,400	mg/kg	233/233	10,700	mg/kg	95% UCL
	Lead	18.3	29,200	mg/kg	233/233	5,750	mg/kg	95th Percentile
Medium: Plant Tissue								
Water Potatoes (with skin) - Ingestion	Cadmium	0.0675	3.71	mg/kg	88/95	0.489	mg/kg	95% UCL
	Lead	0.33	127	mg/kg	95/95	94	mg/kg	95th Percentile
Water Potatoes (without skin) - Ingestion	Lead	0.25	1.98	mg/kg	93/93	0.53	mg/kg	95th Percentile

Table 7.1-5 (Continued)
Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations
Future Subsistence Scenario in the Lower Basin

Exposure Point		Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration[a]	Exposure Point Concentration Units	Statistical Measure
			Min	Max					
Medium: Surface Water									
Undisturbed Surface Water at Lower CDAR - Direct Contact		Arsenic	7	20	µg/L	4/9	20	µg/L	Max
		Lead	2	430	µg/L	91/93	110	µg/L	95th Percentile
Medium: Animal Tissue									
Fish Fillets from CdA Lateral Lakes - Ingestion	**Species**								
	Northern Pike	Methylmercury	0.025	0.48	mg/kg	63/63	0.133	mg/kg	95% UCL
	Bullhead	Lead	0.03	0.69	mg/kg	126/126	0.1	mg/kg	geometric mean
	Northern Pike	Lead	0.03	0.15	mg/kg	63/63	0.03	mg/kg	geometric mean
	Perch	Lead	0.09	2.41	mg/kg	123/123	0.34	mg/kg	geometric mean

Notes:
Min – minimum
Max – maximum
CdA – Coeur d'Alene
Exposure Point Concentration: Estimate of the average concentration a person would encounter at the location where the exposure occurs.
Statistical Measure: The statistical measure describes how the exposure point concentration was calculated from the data.
95% UCL: 95 percent upper confidence limit of the mean.
[a]The exposure point concentrations for lead were not used in the Lead Model, but rather were used to calculate potential lead intake rates. These rates were compared to residential intakes derived from the Lead Model. Various concentrations were compared to the residential intakes, the highest values are presented in this table.

Table 7.1-6
Selection of Exposure Pathways
Baseline Risk Assessment, Harrison to Mullan

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Tailing Deposits and Slag Piles (Soil)	Surface Water[a]	Stream and River Water	Recreational	Child/Adult	Ingestion Dermal	NA NA	Quant. Quant.	Children/adults may be in direct contact with surface water during intermittent recreational activities; therefore, the ingestion and dermal pathways were be quantitatively evaluated.
			Stream and River Sediment	Recreational	Child/Adult	Ingestion Dermal	NA NA	Quant. Quant.	Children/adults may be in contact with impacted sediments during intermittent recreational / tribal activities (e.g., swimming and beach play).
			Native Plants *	Subsistence	Child/Adult	Ingestion	NA	Quant.	Water potatoes growing in surface water/sediments were evaluated as a surrogate for other food plants for which there was insufficient data.
			Cattle[b] *	Residential	Child/Adult	Ingestion	NA	Qual.	Children and adults eat potentially affected cattle that graze on grasses growing in impacted sediment.
			Wild Fowl[b] *	Recreational	Child/Adult	Ingestion	NA	Qual.	Children and adults hunt and eat potentially affected wild fowl that are found in floodplain.
			Fish from lower CdA River[c]	Recreational	Child/Adult	Ingestion	NA	Quant.	Children and adults may collect fish that are potentially affected by impacted surface water and sediments; therefore, this pathway will be quantitatively evaluated.

Table 7.1-6 (Continued)
Selection of Exposure Pathways
Baseline Risk Assessment, Harrison to Mullan

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current (continued)		Surface Soil[d]	Surface Soil	Residential Recreational	Child/Adult	Ingestion Dermal	NA NA	Quant. Quant.	Children and adults may potentially be in direct contact with impacted surface soils during outdoor activities at their homes and/or parks; therefore, the ingestion and dermal pathways will be quantitatively evaluated.
			Vegetables *	Residential	Child/Adult	Ingestion	NA	Quant.	Children and adults eat vegetables from gardens potentially containing impacted soils; therefore, this pathway will be evaluated quantitatively. Susistence populations may collect native plants growing in impacted soils.
			Native Plants[e]*	Subsistence	Child/Adult	Ingestion	NA	Qual.	
			Game[g] *	Subsistence	Child/Adult	Ingestion	NA	Qual.	Game animals (e.g., deer, beaver, and muskrats), except for water fowl, are unlikely to contain significant levels of metals, see text.
		Groundwater[f]	Tap Water	Residential	Child/Adult	Ingestion Dermal	NA NA	Quant. Quant.	Residents currently use groundwater for drinking and for household activities; therefore, this pathway will be quantitatively evaluated if elevated concentrations are observed.
		Air	Resuspended Particulates from Surface Soils	Residential Recreational	Child/Adult	Inhalation	NA	Qual.	The inhalation pathway is likely negligible at the site as compared to the ingestion and dermal contact pathways for soil, except air exposures were quantified for lead.

Table 7.1-6 (Continued)
Selection of Exposure Pathways
Baseline Risk Assessment, Harrison to Mullan

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Tailing Deposits Slag Piles (Soil)	Groundwater/ Surface Soil	Subsurface Soil	Residential	Child/Adult	Ingestion Dermal	NA NA	Qual. Qual.	If affected soils below ground surface remain undisturbed, exposures are not likely to occur. Residential subsurface soil disturbance is likely minimal. Where there are risks to residents from surface soil, subsurface soil is also considered a risk and will be remediated.
				Occupational	Adult	Ingestion Dermal	NA NA	Quant. Quant.	If affected soils below ground surface remain undisturbed, occupational exposures are likely to be minimal. The occupational exposure pathway under a future, short-term construction scenario with intensive soil contact was quantitatively addressed.
						Inhalation	NA	Quant.	
		Surface Water[a]	Stream and River Water	Subsistence Recreational	Child/Adult	Ingestion Dermal	NA NA	Quant. Quant.	Children and adults may be in direct contact with surface water during intermittent recreational activities; therefore, the ingestion and dermal pathways will be quantitatively evaluated.
			Stream and River Sediment	Subsistence Recreational	Child/Adult	Ingestion Dermal	NA NA	Quant. Quant.	Children/adults may be in contact with impacted sediments during intermittent recreational / tribal activities (e.g., swimming and beach play).

Table 7.1-6 (Continued)
Selection of Exposure Pathways
Baseline Risk Assessment, Harrison to Mullan

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (continued)			Fish from lower CdA River[c]	Subsistence Recreational	Child/Adult	Ingestion	NA	Quant.	Children and adults may collect fish that are potentially affected by impacted surface water and sediments; therefore, this pathway will be quantitatively evaluated.
		Surface Soil[d]	Surface Soil	Residential Subsistence[h] Recreational	Child/Adult	Ingestion Dermal	NA NA	Quant. Quant.	Children and adults may potentially be in direct contact with impacted surface soils during outdoor activities at their homes and/or parks; therefore, the ingestion and dermal pathways will be quantitatively evaluated.
		Groundwater[f]	Tap Water	Residential	Child/Adult	Ingestion Dermal	NA NA	Quant. Quant.	Groundwater for future scenario is not currently being used as a drinking water source; groundwater identified under the current scenario is being used and will continue to be used. Future groundwater use near Canyon Creek and Ninemile Creek was quantified.
		Air	Resuspended Particulates from Surface Soils	Residential Subsistence Recreational	Child/Adult	Inhalation	NA	Qual.	The inhalation pathway is likely negligible at the site as compared to the ingestion and dermal contact pathways for soil, only lead was quantified for air exposures.

Table 7.1-6 (Continued)
Selection of Exposure Pathways
Baseline Risk Assessment, Harrison to Mullan

NA – Not applicable to CdA site; Quant. = quantitative analysis in the risk assessment; Qual. = qualitative analysis in the risk assessment; SW = surface water

[a]In addition to impacts from surface soil erosion / stormwater runoff / impacted sediment, surface water is also affected by surface seepage of the groundwater.

[b]Cattle graze in floodplain on grasses that grow in contaminated sediment. Wild fowl, also found in floodplain, are hunted and eaten by people.

[c]In addition to impacts from contaminated surface water, fish are also affected by contaminated sediments.

[d]In addition to direct contact with tailing deposits and waste piles, other soils have been impacted by depositions from water- and air- transported materials.

[e]Terrestrial plant pathways were qualitatively discussed, data insufficient to evaluate risks (e.g., data from Hawthorne berries).

[f]In addition to impacts from soil leachate, groundwater is also affected by surface water infiltration.

[g]Limited samples have been collected from a variety of terrestrial game animals, e.g., muskrat, beavers, and deer; however, data is insufficient for quantification, qualitatively discussed in the risk assessment.

[h]No subsistence populations have homes on impacted soils; however, subsistence exposures to surface soil were quantified under future conditions, assuming populations live in the floodplain in the Lower Basin.

Note:

***** Pathway also complete under a future exposure scenario

Table 7.1-7
Residential Exposure Factors for Non-Lead Chemicals

Exposure Parameter	RME Value	Reference	CT Value	Reference
Exposure Assumptions for Ingestion of Chemicals in Yard Soil				
IRa: Ingestion rate - adult (mg/day)	100	USEPA 1991b	50	USEPA 1993
IRch: Ingestion rate - child (mg/day)	200	USEPA 1991b	100	USEPA 1993
EF: Exposure frequency (days/yr)	350	USEPA 1991b	260	A
EDa: Exposure duration - adult (years)	24	USEPA 1991b	7	USEPA 1993
EDch: Exposure duration - child (years)	6	USEPA 1991b	2	USEPA 1993
CF: Conversion factor (kg/mg)	1.0E-06	NA	1.0E-06	NA
BWa: Body weight - adult (kg)	70	USEPA 1991b	70	USEPA 1991b
BWch: Body weight - child (kg)	15	USEPA 1991b	15	USEPA 1991b
ATc: Averaging time - cancer (days)	25,550	USEPA 1989c	25,550	USEPA 1989c
ATnc: Averaging time - noncancer, child/adult (days)	10,950	USEPA 1989c	3,285	USEPA 1989c
ATnc: Averaging time - noncancer, child (days)	2,190	USEPA 1989c	730	USEPA 1989c
Exposure Assumptions for Dermal Contact with Chemicals in Yard Soil				
SAa: Skin surface area - adult (cm^2)	2,500	USEPA 1998b	2,500	USEPA 1998b
SAch: Skin surface area - child (cm^2)	2,200	USEPA 1998b	2,200	USEPA 1998b
AFa: Adherence factor - adult (mg/cm^2-event)	0.1	USEPA 1998b	0.1	USEPA 1998b
AFch: Adherence factor - child (mg/cm^2-event)	0.2	USEPA 1998b	0.2	USEPA 1998b
EF: Exposure frequency (events/year)	350	USEPA 1991b	260	A
ED: Exposure duration - adult (years)	24	USEPA 1991b	7	USEPA 1993
ED: Exposure duration - child (years)	6	USEPA 1991b	2	USEPA 1993
BWa: Body weight - adult (kg)	70	USEPA 1991b	70	USEPA 1991b
BWch: Body weight - child (kg)	15	USEPA 1991b	15	USEPA 1991b
ABS: Dermal absorption factor (unitless)	chem. specific	USEPA 1998b	chem. Specific	USEPA 1998b
CF: Conversion factor (kg/mg)	1.0E-06	NA	1.0E-06	NA
ATc: Averaging time - cancer (days)	25,550	USEPA 1989c	25,550	USEPA 1989c
ATnc: Averaging time - noncancer, child/adult (days)	10,950	USEPA 1989c	3,285	USEPA 1989c
ATnc: Averaging time - noncancer, child (days)	2,190	USEPA 1989c	730	USEPA 1989c
Exposure Assumptions for Ingestion of Tap Water				
IRa: Ingestion rate - adult (L/day)	2	USEPA 1991b	1.4	USEPA 1993
IRch: Ingestion rate - child (L/day)	1	USEPA 1999f	1	USEPA 1999f
EDa: Exposure duration - adult (years)	24	B	7	USEPA 1993
EDch: Exposure duration - child (years)	6	B	2	USEPA 1993
BWa: Body weight - adult (kg)	70	USEPA 1991b	70	USEPA 1991b
BWch: Body weight - child (kg)	15	USEPA 1991b	15	USEPA 1991b
EF: Exposure frequency (days/yr)	350	USEPA 1991b	234	USEPA 1993
CF: Conversion factor (mg/µg)	1.0E-03	NA	1.0E-03	NA
ATc: Averaging time - cancer (days)	25,550	USEPA 1989c	25,550	USEPA 1989c

Table 7.1-7 (Continued)
Residential Exposure Factors for Non-Lead Chemicals

Exposure Parameter	RME Value	Reference	CT Value	Reference
ATnc: Averaging time - noncancer, child/adult (days)	10,950	USEPA 1989c	3,285	USEPA 1989c
ATnc: Averaging time - noncancer, child (days)	2,190	USEPA 1989c	730	USEPA 1989c
Exposure Assumptions for Ingestion of Homegrown Vegetables				
IRveg: Intake rate of homegrown vegetables (g/kg-day)	5.04	C	0.492	C
EF: Exposure frequency (days/yr)	365	D	365	D
ED: Exposure duration (years)	30	USEPA 1991b	9	USEPA 1993
CF: Conversion factor (kg/g)	1.0E-03	NA	1.0E-03	NA
ATc: Averaging time - cancer (days)	25,550	USEPA 1989c	25,550	USEPA 1989c
ATnc: Averaging time - noncancer (days)	10,950	USEPA 1989c	3,285	USEPA 1989c

Notes:
[a]Exposure frequency was based on 3 months limited soil exposure due to snow-covered/frozen ground.
[b]USEPA 1991b recommends an adult/child exposure duration of 24/6 years for ingestion of soil; for consistency, an exposure duration of 24/6 years was selected for ingestion of tap water.
[c]Ingestion rate is seasonally adjusted and incorporates the body weights of all participants in the study (children and adults) from USEPA 1997b.
[d]Ingestion rate of vegetables is an average daily consumption rate, therefore 365 days/year was selected as the frequency of exposure for both the RME and CT cases.

Table 7.1-8
Neighborhood Recreational Exposure Factors for Non-Lead Chemicals

Exposure Parameter	RME Value	Reference	CT Value	Reference
Exposure Assumptions for Ingestion of Chemicals in Waste Pile Soil				
IR: Ingestion rate (mg/day)	300	A	120	A
EF: Exposure frequency (days/yr)	17	B	8.5	B
ED: Exposure duration (years)	7	C	2	USEPA 1993
CF: Conversion factor (kg/mg)	1.0E-06	NA	1.0E-06	NA
BW: Body weight (kg)	28	D	28	D
ATc: Averaging time - cancer (days)	25,500	USEPA 1989c	25,550	USEPA 1989c
ATnc: Averaging time - noncancer (days)	2,555	USEPA 1989c	730	USEPA 1989c
Exposure Assumptions for Dermal Contact with Chemicals in Waste Pile Soil				
SA: Skin surface area (cm^2)	5,080	USEPA 1997b	5,080	USEPA 1997b
AF: Soil to skin adherence factor (mg/cm^2-event)	0.2	USEPA 1998b	0.2	USEPA 1998b
ABS: Dermal absorption factor (unitless)	chem-specific	USEPA 1998b	Chem-specific	USEPA 1998b
EF: Exposure frequency (events/year)	34	E	17	E
ED: Exposure duration (years)	7	C	2	USEPA 1993
CF: Conversion factor (kg/mg)	1.0E-06	NA	1.0E-06	NA
BW: Body weight (kg)	28	D	28	D
ATc: Averaging time - cancer (days)	25,550	USEPA 1989c	25,550	USEPA 1989c
ATnc: Averaging time - noncancer (days)	2,555	USEPA 1989c	730	USEPA 1989c
Exposure Assumptions for Ingestion of Chemicals in Upland Soil (Parks/Schools/Elk Creek Area)				
IR: Ingestion rate (mg/day)	300	A	120	A
EF: Exposure frequency (days/yr)	34	F	17	F
ED: Exposure duration (years)	7	C	2	USEPA 1993
CF: Conversion factor (kg/mg)	1.0E-06	NA	1.0E-06	NA
BW: Body weight (kg)	28	D	28	D
ATc: Averaging time - cancer (days)	25,500	USEPA 1989c	25,550	USEPA 1989c
ATnc: Averaging time - noncancer (days)	2,555	USEPA 1989c	730	USEPA 1989c
Exposure Assumptions for Dermal Contact with Chemicals in Upland Soil (Parks/Schools/Elk Creek Area)				
SA: Skin surface area (cm^2)	5,080	USEPA 1997b	5,080	USEPA 1997b
AF: Soil to skin adherence factor (mg/cm^2-event)	0.2	USEPA 1998b	0.2	USEPA 1998b
ABS: Dermal absorption factor (unitless)	chem-specific	USEPA 1998b	Chem-specific	USEPA 1998b
EF: Exposure frequency (events/year)	68	G	34	G
ED: Exposure duration (years)	7	C	2	USEPA 1993
CF: Conversion factor (kg/mg)	1.0E-06	NA	1.0E-06	NA
BW: Body weight (kg)	28	D	28	D
ATc: Averaging time - cancer (days)	25,550	USEPA 1989c	25,550	USEPA 1989c
ATnc: Averaging time - noncancer (days)	2,555	USEPA 1989c	730	USEPA 1989c
Exposure Assumptions for Ingestion of Chemicals in Floodplain Soil/Sediment				
IR: Ingestion rate (mg/day)	300	A	120	A
EF: Exposure frequency (days/yr)	21	H	10	H
ED: Exposure duration (years)	7	C	2	USEPA 1993

Table 7.1-8 (Continued)
Neighborhood Recreational Exposure Factors for Non-Lead Chemicals

Exposure Parameter	RME Value	Reference	CT Value	Reference
CF: Conversion factor (kg/mg)	1.0E-06	NA	1.0E-06	NA
BW: Body weight (kg)	28	D	28	D
ATc: Averaging time - cancer (days)	25,500	USEPA 1989c	25,550	USEPA 1989c
ATnc: Averaging time - noncancer (days)	2,555	USEPA 1989c	730	USEPA 1989c
Exposure Assumptions for Dermal Contact with Chemicals in Floodplain Soil/Sediment				
SA: Skin surface area (cm^2)	5,080	I	5,080	I
AF: Soil to skin adherence factor (mg/cm^2-event)	0.2	USEPA 1998b	0.2	USEPA 1998b
ABS: Dermal absorption factor (unitless)	chem-specific	USEPA 1998b	Chem-specific	USEPA 1998b
EF: Exposure frequency (events/year)	96	J	48	J
ED: Exposure duration (years)	7	C	2	USEPA 1993
CF: Conversion factor (kg/mg)	1.0E-06	NA	1.0E-06	NA
BW: Body weight (kg)	28	D	28	D
ATc: Averaging time - cancer (days)	25,550	USEPA 1989c	25,550	USEPA 1989c
ATnc: Averaging time - noncancer (days)	2,555	USEPA 1989c	730	USEPA 1989c
Exposure Assumptions for Ingestion of Surface Water				
IR: Ingestion rate (mL/hour)	30	USEPA 1998d	30	USEPA 1998d
ET: Exposure time (hours/day)	1	USEPA 1997b	1	USEPA 1997b
EF: Exposure frequency (days/yr)	96	I	I	
ED: Exposure duration (years)	7	C	2	USEPA 1993
CF1: Conversion factor (mg/µg)	0.001	NA	0.001	NA
CF2: Conversion factor (L/mL)	0.001	NA	0.001	NA
BW: Body weight (kg)	28	D	28	D
ATc: Averaging time - cancer (days)	2.6E+04	USEPA 1989c	2.6E+04	USEPA 1989c
ATnc: Averaging time - noncancer (days)	2,555	USEPA 1989c	730	USEPA 1989c

Reference Notes:
[a]The RME value of 300 mg/day is the 90th percentile soil intake from van Wijnen (1990); the CT value of 120 mg/day is the mean soil intake from the same study, as cited in USEPA 1999f.
[b]Exposure frequency is calculated as: 34 weeks/year x 7 hours/day x 1 day/week / 14 hours/day = 17 days/year for the RME; 34 weeks/year x 7 hours/day x once every other week, 0.5 / 14 hours/day = 8.5 days/year.
[c]Neighborhood exposure assumes children between the ages of 4 and 11 are playing in the waste piles.
[d]Value is the 50th percentile for boys and girls, ages 4 to 11.
[e]Exposure frequency is calculated as: 34 weeks/year x 1 event/week = 34 events/year for RME; 34 weeks/year, once every other week = 17 events/year for CT.
[f]The exposure frequency is calculated as: 34 weeks/year x 7 hours/day x 2 days/week / 14 hours/day = 34 days/year for the RME; this assumes weekend outdoor exposure. For the CT, exposure frequency is 34 weeks/year x 7 hours/day x 1 day/week / 14 hours/day = 17 days/year.
[g]Exposure frequency is calculated as 34 weeks/year x 2 events/week = 68 events/year for RME, and 34 weeks/year x 1 event/week = 34 events/year.
[h]Exposure frequency is calculated as 24 weeks/year x 3 hours/day x 4 days/week / 14 hours/day = 21 days/year for the RME case; 3 hours/day is the high end of the 50th percentile range (1 to 3 hours/day) from USEPA 1997b. For the CT case, exposure frequency is 24 weeks/year x 3 hours/day x 2 days/week / 14 hours/day = 10 days/year.

Table 7.1-8 (Continued)
Neighborhood Recreational Exposure Factors for Non-Lead Chemicals

[i]Exposure frequency is calculated as 24 weeks/year x 4 events/week = 96 events/year for RME; and 24 weeks/year x 2 events/week = 48 events/year for the CT case.

[j]At Lower Basin and Kingston (north-south confluence), a skin surface area of 7,960 cm^2 was used to reflect the possibility that swimming and therefore exposure of the entire body to contaminants in sediment could occur at these locations. It was assumed that swimming would occur during 16 weeks of the year (the warmest months), while wading and playing along the shoreline without swimming would occur during 8 weeks of the year. The median skin surface area for male children age 4 to 11 is 9,400 cm^2 (USEPA 1997b). The skin surface area was calculated as follows: ((16 weeks x 9,400 cm^2) + (8 weeks x 5,080 cm^2)) / 24 weeks = 7,960 cm^2

Table 7.1-9
Public Recreational Exposure Factors for Non-Lead Chemicals

Exposure Parameter	RME Value	Reference	CT Value	Reference
Exposure Assumptions for Ingestion of Chemicals in Upland Soil (Parks/Schools)				
IRa: Ingestion rate - adult (mg/day)	100	USEPA 1991b	50	USEPA 1993
IRch: Ingestion rate - child (mg/day)	300	A	120	A
EFa: Exposure frequency - adult (days/yr)	30	B	15	B
EFch: Exposure frequency - child (days/yr)	34	B	17	B
EDa: Exposure duration - adult (years)	24	USEPA 1991b	7	USEPA 1993
EDch: Exposure duration - child (years)	6	USEPA 1991b	2	USEPA 1993
CF: Conversion factor (kg/mg)	1.0E-06	NA	1.0E-06	NA
BWa: Body weight - adult (kg)	70	USEPA 1991b	70	USEPA 1991b
BWch: Body weight - child (kg)	15	USEPA 1991b	15	USEPA 1991b
ATc: Averaging time - cancer (days)	25,550	USEPA 1989c	25,550	USEPA 1989c
ATnc: Averaging time - noncancer, child/adult (days)	10,950	USEPA 1989c	3,285	USEPA 1989c
ATnc: Averaging time - noncancer, child (days)	2,190	USEPA 1989c	730	USEPA 1989c
Exposure Assumptions for Dermal Contact with Chemicals in Upland Soil (Parks/Schools)				
SAa: Skin surface area - adult (cm^2)	2,500	USEPA 1998b	2,500	USEPA 1998b
SAch: Skin surface area - child (cm^2)	2,200	USEPA 1998b	2,200	USEPA 1998b
AFa: Adherence factor - adult (mg/cm^2-event)	0.1	USEPA 1998b	0.1	USEPA 1998b
AFch: Adherence factor - child (mg/cm^2-event)	0.2	USEPA 1998b	0.2	USEPA 1998b
EF: Exposure frequency (events/year)	68	C	34	C
ED: Exposure duration - adult (years)	24	USEPA 1991b	7	USEPA 1993
ED: Exposure duration - child (years)	6	USEPA 1991b	2	USEPA 1993
BWa: Body weight - adult (kg)	70	USEPA 1991b	70	USEPA 1991b
BWch: Body weight - child (kg)	15	USEPA 1991b	15	USEPA 1991b
ABS: Dermal absorption factor (unitless)	chem. Specific	USEPA 1998b	chem. Specific	USEPA 1998b
CF: Conversion factor (kg/mg)	1.0E-06	NA	1.0E-06	NA
ATc: Averaging time - cancer (days)	25,550	USEPA 1989c	25,550	USEPA 1989c
ATnc: Averaging time - noncancer, child/adult (days)	10,950	USEPA 1989c	3,285	USEPA 1989c
ATnc: Averaging time - noncancer, child (days)	2,190	USEPA 1989c	730	USEPA 1989c
Exposure Assumptions for Ingestion of Chemicals in Floodplain Soil/Sediment				
IRa: Ingestion rate - adult (mg/day)	100	USEPA 1991b	50	USEPA 1993
IRch: Ingestion rate - child (mg/day)	300	A	120	A
EF: Exposure frequency (days/year)	32	D	16	D
EDa: Exposure duration - adult (years)	24	USEPA 1991b	7	USEPA 1993
EDch: Exposure duration - child (years)	6	USEPA 1991b	2	USEPA 1993
CF: Conversion factor (kg/mg)	1.0E-06	NA	1.0E-06	NA
BWa: Body weight - adult (kg)	70	USEPA 1991b	70	USEPA 1991b
BWch: Body weight - child (kg)	15	USEPA 1991b	15	USEPA 1991b
ATc: Averaging time - cancer (days)	25,550	USEPA 1989c	25,550	USEPA 1989c
ATnc: Averaging time - noncancer, child/adult (days)	10,950	USEPA 1989c	3,285	USEPA 1989c
ATnc: Averaging time - noncancer, child (days)	2,190	USEPA 1989c	730	USEPA 1989c

Table 7.1-9 (Continued)
Public Recreational Exposure Factors for Non-Lead Chemicals

Exposure Parameter	RME Value	Reference	CT Value	Reference
Exposure Assumptions for Dermal Contact with Chemicals in Floodplain Soil/Sediment				
SAa: Skin surface area - adult (cm^2)	18,000	USEPA 1998b	18,000	USEPA 1998b
SAch: Skin surface area - child (cm^2)	6,500	USEPA 1998b	6,500	USEPA 1998b
AFa: Adherence factor - adult (mg/cm^2-event)	0.1	USEPA 1998b	0.1	USEPA 1998b
AFch: Adherence factor - child (mg/cm^2-event)	0.2	USEPA 1998b	0.2	USEPA 1998b
EF: Exposure frequency (events/year)	32	D	16	D
ED: Exposure duration - adult (years)	24	USEPA 1991b	7	USEPA 1993
ED: Exposure duration - child (years)	6	USEPA 1991b	2	USEPA 1993
BWa: Body weight - adult (kg)	70	USEPA 1991b	70	USEPA 1991b
BWch: Body weight - child (kg)	15	USEPA 1991b	15	USEPA 1991b
ABS: Dermal absorption factor (unitless)	chem. Specific	USEPA 1998b	chem. Specific	USEPA 1998b
CF: Conversion factor (kg/mg)	1.0E-06	NA	1.0E-06	NA
ATc: Averaging time - cancer (days)	25,550	USEPA 1989c	25,550	USEPA 1989c
ATnc: Averaging time - noncancer, child/adult (days)	10,950	USEPA 1989c	3,285	USEPA 1989c
ATnc: Averaging time - noncancer, child (days)	2,190	USEPA 1989c	730	USEPA 1989c
Exposure Assumptions for Ingestion of Surface Water				
IR: Ingestion rate (mL/hour)	30	USEPA 1998d	30	USEPA 1998d
ET: Exposure time (hours/day)	1	USEPA 1997b	1	USEPA 1997b
EDa: Exposure duration - adult (years)	24	E	7	USEPA 1993
EDch: Exposure duration - child (years)	6	E	2	USEPA 1993
BWa: Body weight - adult (kg)	70	USEPA 1991b	70	USEPA 1991b
BWch: Body weight - child (kg)	15	USEPA 1991b	15	USEPA 1991b
EF: Exposure frequency (days/yr)	32	D	16	D
CF: Conversion factor (mg/µg)	1.0E-03	NA	1.0E-03	NA
ATc: Averaging time - cancer (days)	25,550	USEPA 1989c	25,550	USEPA 1989c
ATnc: Averaging time - noncancer, child/adult (days)	10,950	USEPA 1989c	3,285	USEPA 1989c
ATnc: Averaging time - noncancer, child (days)	2,190	USEPA 1989c	730	USEPA 1989c
Exposure Assumptions for Ingestion of Fish				
IR: Ingestion rate of fish (g/day)	46	ATSDR 1989c	25	USEPA 1997b
EF: Exposure frequency (days/yr)	365	F	365	F
ED: Exposure duration (years)	30	USEPA 1991b	9	USEPA 1993
CF: Conversion factor (kg/g)	1.0E-03	NA	1.0E-03	NA
ATc: Averaging time - cancer (days)	25,550	USEPA 1989c	25,550	USEPA 1989c
ATnc: Averaging time - noncancer (days)	10,950	USEPA 1989c	3,285	USEPA 1989c

Reference Notes:
[a]The RME value of 300 mg/day is the 90th percentile soil intake from van Wijnen (1990); the CT value of 120 mg/day is the mean soil intake from the same study, as cited in USEPA 1999f.
[b]RME exposure frequency for adult: 34 weeks/year x 7 hours/day x 2 days/week / 16 hours/day = 30 days/year; for child: 34 weeks/year x 7 hours/day x 2 days/week / 14 hours/day = 34 days/year. Two days/week assumes weekend outdoor exposure. The CT exposure frequency for adults is: 34 weeks/year x 7 hours/day x 1 day/week / 16 hours/day = 15 days/year; for a child, 34 weeks/year x 7 hours/day x 1 day/week / 14 hours/day = 17 days/year.

Table 7.1-9 (Continued)
Public Recreational Exposure Factors for Non-Lead Chemicals

[c]Exposure frequency is calculated as: 34 weeks/year x 2 events/week = 68 events/year for the RME case; 34 weeks/year x 1 event/week = 34 events/year for the CT case.
[d]Professional judgment
[e]USEPA 1991b recommends an adult/child exposure duration of 24/6 years for ingestion of soil; for consistency, an exposure duration of 24/6 years was selected for ingestion of tap water.
[f]Ingestion rate of fish is an average daily consumption rate, therefore 365 days/year was selected as the frequency of exposure for both the RME and CT cases.

Table 7.1-10
Occupational Exposure Factors for Non-Lead Chemicals

Exposure Parameter	RME Value	Reference	CT Value	Reference
Exposure Assumptions for Ingestion of Chemicals in Construction Site Soil				
IR: Ingestion rate (mg/day)	300	USEPA 1999f	200	USEPA 1999f
EF: Exposure frequency (days/yr)	195	A	43	A
ED: Exposure duration (years)	25	USEPA 1991b	6.6	USEPA 1997b
CF: Conversion factor (kg/mg)	1.0E-06	NA	1.0E-06	NA
BW: Body weight (kg)	70	USEPA 1991b	70	USEPA 1991b
ATc: Averaging time - cancer (days)	25,500	USEPA 1989c	25,550	USEPA 1989c
ATnc: Averaging time - noncancer (days)	9,125	USEPA 1989c	2,409	USEPA 1989c
Exposure Assumptions for Dermal Contact with Chemicals in Construction Site Soil				
SA: Skin surface area (cm^2)	2,500	USEPA 1998b	2,500	USEPA 1998b
AF: Soil to skin adherence factor (mg/cm^2-event)	0.1	USEPA 1998b	0.1	USEPA 1998b
ABS: Dermal absorption factor (unitless)	Chem-specific	USEPA 1998b	chem-specific	USEPA 1998b
EF: Exposure frequency (events/year)	195	A	43	A
ED: Exposure duration (years)	25	USEPA 1991b	6.6	USEPA 1997b
CF: Conversion factor (kg/mg)	1.0E-06	NA	1.0E-06	NA
BW: Body weight (kg)	70	USEPA 1991b	70	USEPA 1991b
ATc: Averaging time - cancer (days)	25,550	USEPA 1989c	25,550	USEPA 1989c
ATnc: Averaging time - noncancer (days)	2,555	USEPA 1989c	730	USEPA 1989c

Reference Note:
A-Professional judgment

Table 7.1-11
Toxicity Data Summary

NON-CANCER TOXICITY DATA—ORAL/DERMAL									
Chemical of Concern	**Chronic/ Subchronic**	**Oral RfD Value**	**Oral RfD Units**	**Dermal RfD**	**Dermal RfD Units**	**Endpoint/Primary Target Organ**	**Combined Uncertainty/ Modifying Factors**	**Sources of RfD/ Target Organ**	**Dates of RfD: Target Organ (MM/DD/YY)**
Antimony	Chronic	4.00E-04	mg/kg-day	NA	mg/kg-day	LOAEL/longevity, blood chemistry	1,000	IRIS	10/25/99
Arsenic	Chronic	3.00E-04	mg/kg-day	NA	mg/kg-day	NOAEL/skin pigmentation	3	IRIS	10/25/99
Cadmium (food)	Chronic	1.00E-03	mg/kg-day	2.50E-05	mg/kg-day	NOAEL/proteinuria	10	IRIS	10/25/99
Cadmium (water)	Chronic	5.00E-04	mg/kg-day	NA	NA	NOAEL/proteinuria	10	IRIS	10/25/99
Iron	NS	3.00E-01	mg/kg-day	NA	mg/kg-day	NS	1	Region III RBCs & NCEA	10/25/99
Lead[a]									
Manganese (food)	Chronic	1.40E-01	mg/kg-day	NA	mg/kg-day	NOAEL/Central Nervous System	1	IRIS	10/25/99
Manganese (water)	Chronic	4.70E-02	mg/kg-day	NA	mg/kg-day	NOAEL/Central Nervous System	3	IRIS	10/25/99
Methylmercury	Chronic	1.00E-04	mg/kg-day	NA	mg/kg-day	prenatal developmental effects	10	IRIS	10/25/99
Zinc	Subchronic (10 weeks)	3.00E-01	mg/kg-day	NA	mg/kg-day	LOAEL/enzyme-level effects	3	IRIS	10/25/99
CANCER TOXICITY DATA—ORAL/DERMAL									
Chemical of Concern	**Oral Cancer Slope Factor**	**Dermal Cancer Slope Factor[b]**	**Units**	**Weight of Evidence/ Cancer Guideline Description**	**Source**	**Date (MM/DD/YY)**	--	--	--
Arsenic	1.50E+00	NA	$(mg/kg\text{-}d)^{-1}$	A	IRIS	10/25/99	--	--	--

[a]Toxicity criteria not applicable for lead; see discussion in text
[b]The oral slope factor will be used to evaluate dermal exposures (USEPA Region 9 PRG Tables)

Notes:
N/A – Not Applicable
NS – Not Specified
-- – no value available
NOAEL – No observed adverse effect level
LOAEL – Lowest observed adverse effect level
IRIS – Integrated Risk Information System
NCEA – National Center for Environmental Assessment
Weight of Evidence/Cancer Guideline Description
A - Human carcinogen

Table 7.1-12a
Predicted Lead Risk for a Typical Child
Upper Basin, Side Gulches, and Kingston

Predicted Risk (Percent) of Attaining a Blood Lead Level of 10 μg/dL for a Typical 9-84 Month Child		
Soil Action Level	**EPA Default Model**	**Box Model**
2,000 mg/kg	64–70%	24-31%
1,500 mg/kg	50–58%	14-20%
1,000 mg/kg	32–46%	7-12%
800 mg/kg	30–36%	6-7%
600 mg/kg	20–33%	3-4%
400 mg/kg	5-6%	1

Note:
Adapted from HHRA Figures 8-8a-g

Predicted risks are ranges of all subareas excluding the Lower Basin. Lower Basin risks are presented separately because exposures associated with elevated blood lead levels are associated with exposures to Coeur d'Alene River sediments rather than residential soil. Lower Basin exposure patterns were described in the HHRA based on PHD LHIP follow-up investigations of children with elevated blood lead levels.

Table 7.1-12b
Predicted Lead Risk for a Typical Child
Lower Basin

Predicted Risk (Percent) of Attaining A Blood Lead Level of 10 μg/dL for a Typical 9-84 Month Child		
Soil Action Level	**EPA Default Model**	**Box Model**
2,000 mg/kg	59%	16%
1,500 mg/kg	48%	11%
1,000 mg/kg	38%	7%
800 mg/kg	31%	5%
600 mg/kg	17%	2%
400 mg/kg	-	-

Note:
Adapted from HHRA Figures 8-8a-g

Table 7.1-13
RME Risk Characterization Summary - Carcinogens Residential Exposure Scenario - Child/Adult

Scenario Timeframe: Current/Future
Receptor Population: Residents
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Lower Basin							
Soil	Surface Soil	Yard Soil	Arsenic	7E-05	N/A	8E-06	8E-05
Groundwater	Groundwater	Tap Water	Arsenic	2E-05	N/A	N/A	2E-05
						Total Risk:	1E-04
Upper Basin[a]							
Soil	Surface Soil	Yard Soil	Arsenic	7E-05	N/A	8E-06	8E-05
Groundwater	Groundwater	Tap Water	Arsenic	2E-04	N/A	N/A	2E-04
						Total Risk:	3E-04

[a]Only the Side Gulches area had cancer risks exceeding 10^{-4}.

Notes:
RME – reasonable maximum exposure
N/A – Route of exposure is not applicable to this medium

Table 7.1-14
RME Risk Characterization Summary - Non-Carcinogens
Residential Exposure Scenario - Child

Scenario Timeframe: Current/Future
Receptor Population: Residents
Receptor Age: Child (0 to 6 years)

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ[a]	Non-Carcinogenic Hazard Quotients/Indices[a]			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Lower Basin								
Soil	Surface Soil	Yard Soil	Arsenic	Skin	1	N/A	0.14	1
			Iron	Blood	2	N/A	N/A	2
							Total Soil Hazard Index[b]	3
Upper Basin[c]								
Soil	Surface Soil	Yard Soil	Arsenic	Skin	0.6 – 1	N/A	0.06 - 0.1	0.6 - 1
			Iron	Blood	0.9 – 1	N/A	N/A	0.9 - 1
							Total Soil Hazard Index	2 - 3
Groundwater	Groundwater	Tap Water	Arsenic	Skin	2	N/A	N/A	2
							Total Tap Water Hazard Index	2
Groundwater	Groundwater	Future Drinking Water	Cadmium	Kidney	17	N/A	N/A	17
			Zinc	Blood	4	N/A	N/A	4
							Total Future Groundwater Hazard Index	21
All Areas								
Soil	Plant Tissue	Homegrown Vegetables	Cadmium	Kidney	2	N/A	N/A	2
							Total Soil Hazard Index	2

[a]None of the chemicals within one media/receptor group have similar target organ endpoints; therefore, separate total summaries by target organ are not provided.
[b]Note that all hazard quotients and indices are rounded to one significant figure per EPA guidance, and a hazard of 1, for example, could range between 0.95 and 1.4. Therefore, totals may not look as if they add up correctly.
[c]The Upper Basin was evaluated as seven separate sub-areas; consequently hazards for soil are provided as ranges based on the results from the seven areas. For groundwater, current tap water, only the Side Gulches area had concentrations exceeding target health goals. For groundwater, future drinking water, only the Burke/Ninemile area had shallow groundwater evaluated.

Notes:
RME - reasonable maximum exposure
N/A - Route of exposure is not applicable to this medium

Table 7.1-15
RME Risk Characterization Summary - Non-Carcinogens Residential Exposure Scenario - Child/Adult

Scenario Timeframe:	Current/Future
Receptor Population:	Residents
Receptor Age:	Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ[b]	Non-Carcinogenic Hazard Quotients/Indices[a]			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Upper Basin[c]								
Soil	Surface Soil	Yard Soil	Arsenic	Skin	0.4	N/A	0.04	0.4
			Iron	Blood	0.3	N/A	N/A	0.3
							Total Soil Hazard Index	0.7
Groundwater	Groundwater	Tap Water	Arsenic	Skin	1	N/A	N/A	1
							Total Tap Water Hazard Index	1
							Total Receptor Hazard Index	2
Groundwater	Groundwater	Future Drinking Water	Cadmium	Kidney	9	N/A	N/A	9
			Zinc	Blood	2	N/A	N/A	2
							Total Tap Water Hazard Index	11
All Areas								
Soil	Plant Tissue	Homegrown Vegetables	cadmium	Kidney	2	N/A	N/A	2
							Total Soil Hazard Index	2

[a]Note that all hazard quotients and indices are rounded to one significant figure per EPA guidance, and a hazard of 1, for example, could range between 0.95 and 1.4. Therefore, totals may not look as if they add up correctly.
[b]None of the chemicals within one media/receptor group have similar target organ endpoints; therefore, separate total summaries by target organ are not provided.
[c]The Upper Basin was evaluated as seven separate sub-areas; consequently hazards for soil are provided as ranges based on the results from the seven areas. For groundwater, current tap water, only the Side Gulches area had concentrations exceeding target health goals. For groundwater, future drinking water, only the Burke/Ninemile area had shallow groundwater evaluated.

RME – reasonable maximum exposure
N/A – Route of exposure is not applicable to this medium

Table 7.1-16
RME Risk Characterization Summary - Non-Carcinogens Public Recreational Exposure Scenario - Child

Scenario Timeframe: Current/Future
Receptor Population: Visitor
Receptor Age: Child (0 to 6 years)

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ[b]	Non-Carcinogenic Hazard Quotients/Indices[a]			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Lower Basin								
Soil/Sediment	Soil/Sediment	Floodplain Soil/Sediment in Lower CDAR	Arsenic	Skin	0.4	N/A	0.1	0.5
			Iron	Blood	0.6	N/A	N/A	0.6
			Manganese	Central Nervous System (CNS)	0.4	N/A	N/A	0.4
							Total Soil Hazard Index	2
Upper Basin								
Soil/Sediment	Soil/Sediment	Surface Soil and Beach Sediments near confluence of North and South Forks CDAR was only location with exceedances	Arsenic	Skin	0.6	N/A	0.1	0.7
			Iron	Blood	0.6	N/A	N/A	0.6
			Manganese	Central Nervous System (CNS)	0.3	N/A	N/A	0.3
							Total Soil Hazard Index	2

[a]Note that all hazard quotients and indices are rounded to one significant figure per EPA guidance, and a hazard of 1, for example, could range between 0.95 and 1.4. Therefore, totals may not look as if they add up correctly.
[b]None of the chemicals within one media/receptor group have similar target organ endpoints; therefore, separate total summaries by target organ are not provided.

Notes:
RME – reasonable maximum exposure
N/A – Route of exposure is not applicable to this medium
CDAR – Coeur d'Alene River

Table 7.1-17
RME Risk Characterization Summary - Carcinogens Subsistence Exposure Scenario - Child/Adult

Scenario Timeframe:	Future	
Receptor Population:	Subsistence Residents	
Receptor Age:	Child/Adult	

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	**Inhalation**	**Dermal**	**Exposure Routes Total**
Traditional Subsistence							
Soil	Surface Soil	Floodplain Surface Soil	Arsenic	6E-04	N/A	2E-04	8E-04
Sediment	Sediment	Floodplain Sediment	Arsenic	4E-04	N/A	7E-04	1E-03
Undisturbed Surface Water	Undisturbed Surface Water	Lower CDAR	Arsenic	1E-03	N/A	N/A	1E-03
						Total Risk	3E-03
Modern Subsistence							
Soil	Surface Soil	Floodplain Surface Soil	Arsenic	1E-04	N/A	7E-05	2E-04
Sediment	Sediment	Floodplain Sediment	Arsenic	1E-04	N/A	2E-04	3E-04
Undisturbed Surface Water	Undisturbed Surface Water	Lower CDAR	Arsenic	2E-04	N/A	N/A	2E-04
						Total Risk	7E-04

Notes:
RME – reasonable maximum exposure
N/A – Route of exposure is not applicable to this medium
CDAR – Coeur d'Alene River

Table 7.1-18
RME Risk Characterization Summary - Non-Carcinogens
Subsistence Exposure Scenario - Child

Scenario Timeframe: Future
Receptor Population: Subsistence Residents
Receptor Age: Child (0 to 6 years)

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotients/Indices[a]			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Traditional Subsistence								
Soil	Surface Soil	Floodplain Surface Soil	Antimony	Blood	1	N/A	N/A	1
			Arsenic	Skin	5	N/A	2	7
			Cadmium	Kidney	0.6	N/A	0.14	0.8
			Iron	Blood	7	N/A	N/A	7
			Manganese	Central Nervous System (CNS)	4	N/A	N/A	4
							Total Soil Hazard Index	19
Sediment	Sediment	Floodplain Sediment	Antimony	Blood	0.7	N/A	N/A	0.7
			Arsenic	Skin	3	N/A	2	5
			Cadmium	Kidney	0.5	N/A	0.3	0.8
			Iron	Blood	4	N/A	N/A	4
			Manganese	CNS	3	N/A	N/A	3
							Total Sediment Hazard Index	14
Undisturbed Surface Water	Undisturbed Surface Water	Lower CDAR	Arsenic	Skin	7	N/A	N/A	7
							Total Undisturbed Surface Water Hazard Index	7
							Total Receptor Hazard Index	39
							Blood Hazard Index	13
							Skin Hazard Index	18
							Kidney Hazard Index	2
							CNS Hazard Index	6
Modern								
Soil	Surface Soil	Floodplain Surface Soil	Arsenic	Skin	0.8	N/A	0.3	1
			Iron	Blood	1	N/A	N/A	1
			Manganese	CNS	0.6	N/A	N/A	0.6
							Total Soil Hazard Index	3
Sediment	Sediment	Floodplain Sediment	Arsenic	Skin	1	N/A	0.7	2
			Iron	Blood	1	N/A	N/A	1
			Manganese	CNS	0.8	N/A	N/A	0.8
							Total Sediment Hazard Index	3
Undisturbed Surface Water	Undisturbed Surface Water	Lower CDAR	Arsenic	Skin	1	N/A	N/A	1
							Total Undisturbed Surface Water Hazard Index	1
							Total Receptor Hazard Index	7
							Blood Hazard Index	2
							Skin Hazard Index	4
							CNS Hazard Index	1

Table 7.1-18 (Continued)
RME Risk Characterization Summary - Non-Carcinogens
Subsistence Exposure Scenario – Child

[a]Note that all hazard quotients and indices are rounded to one significant figure per EPA guidance, and a hazard of 1, for example, could range between 0.95 and 1.4. Therefore, totals may not look as if they add up correctly.

Notes:
RME – reasonable maximum exposure
N/A – Route of exposure is not applicable to this medium
CDAR – Coeur d'Alene River

Table 7.1-19
RME Risk Characterization Summary - Non-Carcinogens
Subsistence Exposure Scenario - Child/Adult

Scenario Timeframe: Future
Receptor Population: Subsistence Residents
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotients/Indices[a]			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Traditional								
Soil	Surface Soil	Floodplain Surface Soil	Arsenic	Skin	1	N/A	0.5	2
			Iron	Blood	2	N/A	N/A	2
			Manganese	Central Nervous System (CNS)	1	N/A	N/A	1
						Total Soil Hazard Index		5
Sediment	Sediment	Floodplain Sediment	Arsenic	Skin	0.8	N/A	2	2
			Iron	Blood	1	N/A	N/A	1
			Manganese	CNS	0.7	N/A	N/A	0.7
						Total Sediment Hazard Index		4
Undisturbed Surface Water	Undisturbed Surface Water	Lower CDAR	Arsenic	Skin	3	N/A	N/A	3
						Total Undisturbed Surface Water Hazard Index		3
Surface Water/Sediment	Plant Tissue	Water Potato (with skin)	Cadmium	Kidney	4	N/A	N/A	4
						Total Water Potato (with skin) Hazard		4
Surface Water/Sediment	Animal Tissue	Northern Pike in Lower CDAR	Methylmercury	CNS	10	N/A	N/A	10
						Total Northern Pike Hazard Index		10
						Total Receptor Hazard Index		26
						Blood Hazard Index		3
						Skin Hazard Index		7
						CNS Hazard Index		12
						Kidney Hazard Index		4
Modern								
Soil	Surface Soil	Floodplain Surface Soil	Arsenic	Skin	0.2	N/A	0.2	0.4
			Iron	Blood	0.3	N/A	N/A	0.3
						Total Soil Hazard Index		0.7
Sediment	Sediment	Floodplain Sediment	Arsenic	Skin	0.2	N/A	0.4	0.7
			Iron	Blood	0.4	N/A	N/A	0.4
						Total Sediment Hazard Index		1
Undisturbed Surface Water	Undisturbed Surface Water	Lower CDAR	Arsenic	Skin	0.5	N/A	N/A	0.5
						Total Undisturbed Surface Water Hazard Index		0.5
Surface Water/Sediment	Animal Tissue	Northern Pike in Lower CDAR	Methylmercury	CNS	3	N/A	N/A	3
						Total Northern Pike Hazard Index		3
						Total Receptor Hazard Index		5
						Blood Hazard Index		0.7
						Skin Hazard Index		2
						CNS Hazard Index		3

Table 7.1-19 (Continued)
RME Risk Characterization Summary - Non-Carcinogens
Subsistence Exposure Scenario - Child/Adult

[a]Note that all hazard quotients and indices are rounded to one significant figure per EPA guidance, and a hazard of 1, for example, could range between 0.95 and 1.4. Therefore, totals may not look as if they add up correctly.

Notes:
RME – reasonable maximum exposure
N/A – Route of exposure is not applicable to this medium
CDAR – Coeur d'Alene River

Table 7.1-20
Potential Soil Cleanup Levels for Arsenic Using Various Target Risk Goals and Scenarios

	Residential Soil Ing. And Dermal (child 0-6) mg/kg	Residential Soil Ing. and Dermal (child/adult) mg/kg	Public Recreational Soil/Sed Ing. and Dermal (child 0-6) mg/kg	Public Recreational Soil/Sed Ing. and Dermal (child/adult) mg/kg	Neighborhood Recreational Waste Pile Ing. And Dermal (child 4-11) mg/kg	Neighborhood Recreational Soil/Sed Ing. And Dermal (child 4-11) Lower Basin and Kingston mg/kg	Neighborhood Recreational Soil/Sed Ing. And Dermal (child 4-11) All other areas mg/kg
Arsenic – Cancer (10^{-4} risk)		64		420	1,663	815	1,016
Arsenic – Cancer (10^{-5} risk)		6		42	166	81	102
Arsenic – Cancer (10^{-6} risk)		1		4	17	8	10
Arsenic – Noncancer (Hazard goal of one)	35	123	234	810	748	367	457

Table 7.1-21
Summary of Chemicals of Concern and Exposure Point Concentrations in Spokane River CUA Sediment

Scenario Timeframe: Current
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Conc.	Exposure Point Conc. Units	Statistical Measure[a]
		Minimum Conc.	Maximum Conc.					
River Road 95 Sediment	Arsenic	21.4	35.1	mg/kg	7/7	29.3	mg/kg	95% UCL
	Lead	656	2,360	mg/kg	7/7	1,410	mg/kg	Mean
Harbor Road North	Arsenic	15.1	23.6	mg/kg	7/7	20.2	mg/kg	95% UCL
	Lead	261	534	mg/kg	7/7	424	mg/kg	Mean
Barker Road North	Arsenic	13	45.6	mg/kg	7/7	36.2	mg/kg	95% UCL
	Lead	106	822	mg/kg	7/7	478	mg/kg	Mean
North Flora Road	Arsenic	15.9	24.8	mg/kg	9/9	21.4	mg/kg	95% UCL
	Lead	496	1,040	mg/kg	9/9	681	ppm	Mean

[a]The statistical measure describes how the exposure point concentration was calculated from the data. A 95% UCL is the 95 percent upper confidence limit of the average concentration.

Notes
Conc – concentration
mg/kg – milligrams of chemical per kilograms of sediment
Mean – average concentration

Table 7.1-22
Summary of Chemicals of Concern and Exposure Point Concentrations in Spokane River Fish Tissue

Exposure Point		Chemical of Concern	Concentration Detected (Wet Weight)		Frequency of Detection (mg/kg)	Exposure Point Concentration	Statistical Measure
			Min (mg/kg)	Max (mg/kg)			
Fillet Fish from Spokane River – Ingestion	Wild Rainbow Trout	Lead	0.03	0.48	19/19	0.12	geometric mean
	Hatchery Rainbow Trout	Lead	0.02	0.23	5/5	0.11	geometric mean
	Large Scale Sucker	Lead	0.02	0.28	20/20	0.07	geometric mean
	Mountain Whitefish	Lead	0.02	0.07	10/10	0.03	geometric mean
Whole fish from Spokane River – Ingestion	Wild Rainbow Trout	Lead	0.6	1.14	3/3	0.79	geometric mean
	Hatchery Rainbow Trout	Lead	1.59	1.59	1/1	1.59	Max
	Large Scale Sucker	Lead	1.77	4.34	4/4	2.56	geometric mean
	Mountain Whitefish	Lead	0.56	0.65	2/2	0.6	geometric mean

Notes:
Min – minimum
Max – maximum

Table 7.2-1
Summary of Representative Species Evaluated in Coeur d'Alene Basin

Species		Level of Biological Organization to be Assessed				Habitat Types and CSM Units[a]					
Common Name	**Scientific Name**	**Individual-level**	**Population-level**	**Community-level**	**Habitat/ Ecosystem-level**	**Riverine**	**Lacustrine**	**Palustrine**	**Riparian**	**Upland**	**Agricultural**
Birds											
Great blue heron	*Ardea herodias*	X	X			3		3,4,5			
Canada goose	*Branta canadensis*	X	X			5		3,4,5			3
Tundra swan	*Cygnus columbianus*	X	X				3	3,4			
Wood duck	*Aix sponsa*	X	X					3,4,5			
Mallard	*Anas platyrhynchos*	X	X			5		1,2,3,4,5			
Lesser scaup	*Aythya affinis*	X	X				3,4,5				
Common goldeneye	*Bucephala clangula*	X	X			5	3,4,5				
Common merganser	*Mergus merganser*	X	X			2,3,5	3,4,5				
Osprey	*Pandion haliaetus*	X	X			2,3,5	3,4,5				
Bald eagle (T&E)	*Haliaeetus leucocephalus*	X	X			3	3,4,5	3			
Northern harrier	*Circus cyaneus*	X	X					3,4	3,5		3
American kestrel	*Falco sparverius*	X	X						3,5		3
Ruffed grouse	*Bonasa umbellus*		X							1,2	
Wild turkey	*Meleagris gallopavo*		X						1,2,3,5	1,2	3
Spotted sandpiper	*Actitis macularia*	X	X			1,2,3,5					
Common snipe	*Gallinago gallinago*	X	X					2,3,4			3
Black tern (species of concern)	*Chlidonias niger*	X	X				3,4	3,4			
Great horned owl	*Bubo virginianus*	X	X						1,2,3,5		3
Belted kingfisher	*Ceryle alcyon*	X	X			3,4,5					
Tree swallow	*Tachycineta bicolor*	X	X			1,2,3,5	3,4,5				
American dipper	*Cinclus mexicanus*	X	X			1,2					
Swainson's thrush	*Catharus ustulatus*	X	X						1,2	1,2	
American robin	*Turdus migratorius*	X	X						1,2,3,5		3
Song sparrow	*Melospiza melodia*	X	X						1,2,3,5		
Mammals											
Water shrew	*Sorex palustris*		X			1,2					
Masked shrew	*Sorex cinereus*		X							1,2	
Vagrant shrew	*Sorex vagrans*		X						2,3,5		3
Long-legged myotis (species of concern)	*Myotis volans*	X	X						1,2,3,5	1,2	

Table 7.2-1 (Continued)
Summary of Representative Species Evaluated in Coeur d'Alene Basin

Species		Level of Biological Organization to be Assessed				Habitat Types and CSM Units[a]					
Common Name	Scientific Name	Individual-level	Population-level	Community-level	Habitat/ Ecosystem-level	Riverine	Lacustrine	Palustrine	Riparian	Upland	Agricultural
Little brown myotis	*Myotis lucifugus*		X			3,5	3,4,5	2,3,4,5			
Raccoon	*Procyon lotor*		X			1,2,3,5		1,2,3,4,5	1,2,3,5	1,2	3
Fisher (species of concern)	*Martes pennanti*	X	X						1,2	1,2	
Wolverine (species of concern)	*Gulo gulo luscus*	X	X						1,2	1,2	
Mink	*Mustela vison*		X			1,2,3,5		1,2,3,4,5	1,2,3,5		
River otter	*Lontra canadensis*		X			3,5	3,4,5				
Gray wolf (T&E)	*Canis lupus*	X	X					3	1,2,3	1,2	3
Lynx (T&E)	*Lynx canadensis*	X	X							1,2	
White-tailed deer	*Odocoileus virginianus*		X					4	1,2,3,5		3
Mule deer	*Odocoileus hemionus*		X							1,2	
Beaver	*Castor canadensis*		X					1,2,3,4,5	1,2,3,5		
Muskrat	*Ondatra zibethicus*		X					1,2,3,4,5	1,2,3,5		
Deer mouse	*Peromyscus maniculatus*		X						1,2,3,5	1,2	3
Meadow vole	*Microtus pennsylvanicus*		X						1,2,3,5		3
Fish											
Bull trout (T&E)	*Salvelinus confluentus*	X				1,2,3,5	3,4,5				
Westslope cutthroat trout (species of concern)	*Oncorhynchus clarki lewisi*	X				1,2,3,5	3,4,5				
Chinook salmon	*Oncorhynchus tshawytscha*		X			2,3	4				
Rainbow trout	*Oncorhynchus mykiss*		X			2,3,5					
Mountain whitefish	*Prosopium williamsoni*		X			2,3					
Large-scale sucker	*Catostomus macrocheilus*		X			3,5					
Brown bullhead	*Ameiurus melas*		X				3				
Northern pike	*Esox lucius*		X			3	3,4				
Sculpins			X			1,2					
Smallmouth bass	*Micropterus dolomieu*		X			3					
Largemouth bass	*Micropterus salmoides*		X				3				
Yellow perch	*Perca flavescens*		X				3				
Walleye	*Stizostedion vitreum*		X				5				

Table 7.2-1 (Continued)
Summary of Representative Species Evaluated in Coeur d'Alene Basin

Species		Level of Biological Organization to be Assessed				Habitat Types and CSM Units[a]					
Common Name	**Scientific Name**	**Individual-level**	**Population-level**	**Community-level**	**Habitat/ Ecosystem-level**	**Riverine**	**Lacustrine**	**Palustrine**	**Riparian**	**Upland**	**Agricultural**
Aquatic Invertebrates											
Mixed invertebrates				X		1,2,3,5					
Crayfish			X					1,2,3,4,5			
Odonates			X					1,2,3,4,5			
Zooplankton				X			3,4,5				
Benthic invertebrates				X			3,4,5				
Aquatic Plants											
Phytoplankton				X		3,5	3,4,5				
Periphyton				X		1,2,5		3,4			
Wild rice	*Zizania aquatica*		X					3,4			
Water potato	*Sagittaria* spp.		X					3,4			
Cattail	*Typha latifolia*		X					1,2,3,4,5			
Algae				X			3,4				
Submerged vegetation				X			3,4,5				
Amphibians											
Idaho (Pacific) giant salamander (species of concern)	*Dicamptodon aterrimus*	X	X			1,2					
Coeur d'Alene salamander (species of concern)	*Plethodon idahoensis*	X	X						1,2		
Spotted frog (species of concern)	*Rana pretiosa*	X	X					1,2,3	2		
Long-toed salamander	*Ambystoma macrodactylum*		X					4,5	3,5		
Terrestrial Plants											
Ute ladies'-tresses (T&E)	*Spiranthes diluvialis*		X						1,2,3,5		
Cottonwood	*Populus* spp.		X					4	1,2,3,5		
Willow	*Salix spp.*		X					4	1,2,3,5		
Rocky Mountain maple	*Acer glabrum*		X							1,2	
Porcupine sedge (state sensitive species)	*Carex hystericina*		X					5	5		
Prairie cordgrass (state sensitive species)	*Spartina pectinata*		X						5		
Plant community				X					1,2,3,5	1,2	

Table 7.2-1 (Continued)
Summary of Representative Species Evaluated in Coeur d'Alene Basin

Species		Level of Biological Organization to be Assessed				Habitat Types and CSM Units[a]					
Common Name	Scientific Name	Individual-level	Population-level	Community-level	Habitat/ Ecosystem-level	Riverine	Lacustrine	Palustrine	Riparian	Upland	Agricultural
Terrestrial Invertebrates											
Mixed invertebrates				X					1,2,3,5	1,2	
Soil microbial processes				X					1,2,3,5	1,2	
Soil Processes					X				1,2,3,5	1,2	
Landscape Characteristics					X	1,2,3			1,2,3		

[a] The numbers in these columns refer to individual CSM Units (1, 2, 3, 4, or 5)

Table 7.2-2
Concentrations of Chemicals of Potential Ecological Concern
Soil-Sediment Combined

CSM Unit	Chemical	Number of Samples	Number of Detections	Minimum Detected, mg/kg	Maximum Detected, mg/kg	Mean, mg/kg	95% UCL of Mean, mg/kg
1 & 2	Arsenic	327	322	1.40	3,610	82.2	102
1 & 2	Cadmium	410	311	0.113	543	27.0	32.1
1 & 2	Copper	364	335	5.79	3,100	153	174
1 & 2	Lead	482	403	5.16	67,100	6,865	7,800
1 & 2	Mercury	259	212	0.011	51.5	3.93	4.78
1 & 2	Silver	256	221	0.170	347	23.1	27.5
1 & 2	Zinc	420	337	10.0	83,900	3,792	4,480
3	Arsenic	1,269	1,152	1.00	634	111	116
3	Cadmium	1,401	1,291	0.210	200	25.2	26.1
3	Copper	804	771	2.10	554	119	123
3	Lead	1,483	1,404	9.00	35,600	3,665	3,802
3	Mercury	703	644	0.010	23	2.57	2.699
3	Silver	680	635	0.269	97.9	17.8	18.6
3	Zinc	1,408	1,327	7.70	21,800	3,269	3,405
4	Arsenic	345	220	0.710	275	18.1	22.4
4	Cadmium	345	301	0.130	148	7.2	9.09
4	Copper	219	219	5.60	283	35.6	40.0
4	Lead	345	345	4.80	12,100	269	351
4	Mercury	218	102	0.020	4.8	0.562	0.718
4	Silver	218	101	0.240	22.8	2.26	2.83
4	Zinc	345	345	10.2	9,100	612	717
5	Arsenic	59	59	5.90	83.4	33.3	37.4
5	Cadmium	59	59	2.10	28	14.2	15.6
5	Copper	59	59	17.3	144	46.5	51.5
5	Lead	59	59	54.7	3,500	624	730
5	Mercury	59	36	0.110	0.78	0.333	0.385
5	Silver	59	33	0.540	4.7	1.72	2.02
5	Zinc	59	59	265	6,500	2,375	2,628

Table 7.2-3
Chemicals of Potential Ecological Concern
Aquatic Sediments

CSM Unit	Chemical	Number of Samples	Number of Detections	Minimum Detected, mg/kg	Maximum Detected, mg/kg	Mean, mg/kg	95% UCL of Mean, mg/kg
1 & 2	Arsenic	74	72	2.00	384	107	124
1 & 2	Cadmium	68	61	0.560	177	26.6	33.5
1 & 2	Copper	74	73	16.0	706	143	173
1 & 2	Lead	74	74	9.00	40,500	6,039	7,983
1 & 2	Mercury	64	52	0.030	25.1	4.57	6.10
1 & 2	Silver	71	51	1.00	120	23.592	30.1
1 & 2	Zinc	74	74	22.0	9,900	2,574	3,031
3	Arsenic	1,110	993	1.00	634	111	116
3	Cadmium	1,110	1,083	0.280	200	25.7	26.7
3	Copper	562	562	2.10	554	129	134
3	Lead	1,117	1,116	14.8	35,600	3,834	3,998
3	Mercury	533	503	0.020	23.0	2.71	2.87
3	Silver	560	520	0.269	97.9	18.3	19.2
3	Zinc	1,117	1,117	14.3	21,800	3,268	3,416
4	Arsenic	330	206	0.710	275	18.5	23.1
4	Cadmium	330	289	0.130	148	7.381	9.35
4	Copper	204	204	5.60	283	36.7	41.4
4	Lead	330	330	4.80	12,100	276	361
4	Mercury	204	96	0.020	4.80	0.588	0.753
4	Silver	204	94	0.240	22.8	2.25	2.86
4	Zinc	330	330	10.2	9,100	626	736
5	Arsenic	52	52	5.90	83.4	35.8	40.1
5	Cadmium	52	52	2.10	28.0	15.2	16.6
5	Copper	52	52	21.4	144	48.9	54.3
5	Lead	52	52	54.7	3,500	660	777
5	Mercury	52	29	0.110	0.780	0.362	0.423
5	Silver	52	33	0.540	4.70	1.72	2.02
5	Zinc	52	52	441	6,500	2,574	2,825

Table 7.2-4
Chemicals of Potential Ecological Concern
Aquatic Surface Water – Dissolved Metals

CSM Unit	Chemical	Number of Samples	Number of Detections	Minimum Detected, µg/L	Maximum Detected, µg/L	Mean, µg/L	95% UCL of Mean, µg/L
1 & 2	Cadmium	2,321	1,878	0.020	408	10.7	11.3
1 & 2	Copper	486	153	0.100	260	5.18	8.02
1 & 2	Lead	2,304	1,825	0.001	578	21.4	22.8
1 & 2	Zinc	2,342	2,195	0.101	17,300	1,487	1,561
3	Cadmium	182	178	0.020	4.80	1.96	2.05
3	Copper	3	2	1.10	14.0	7.550	48.3
3	Lead	181	178	1.50	22.0	6.64	7.06
3	Zinc	182	181	78.0	920	342	360
4	Cadmium	31	4	2.70	3.20	2.95	3.19
4	Copper	7	6	1.70	18.0	12.2	17.0
4	Lead	26	4	1.00	1.01	1.00	1.01
4	Zinc	31	9	1.00	13.0	5.18	7.93
5	Cadmium	72	21	0.120	1.00	0.784	0.917
5	Copper	6	3	0.560	1.50	1.02	1.81
5	Lead	73	38	0.340	1.20	0.949	0.992
5	Zinc	72	68	1.00	92.0	48.5	53.8

Table 7.2-5
Chemicals of Potential Ecological Concern
Aquatic Surface Water – Total Metals

CSM Unit	Chemical	Number of Samples	Number of Detections	Minimum Detected, µg/L	Maximum Detected, µg/L	Mean, µg/L	95% UCL of Mean, µg/L
1 & 2	Cadmium	2,179	1,809	0.050	407	11.0	11.6
1 & 2	Copper	460	173	0.160	310	6.92	10.5
1 & 2	Lead	2,217	1,946	0.060	4,260	74.0	82.9
1 & 2	Zinc	2,213	2,083	0.940	18,000	1,568	1,646
3	Cadmium	89	88	0.890	21.0	2.64	3.14
3	Copper	7	5	1.40	11.0	7.28	10.7
3	Lead	89	88	2.50	430	39.1	50.6
3	Zinc	88	87	120	690	354	378
4	Cadmium	27	4	4.00	6.00	4.50	5.68
4	Copper	7	1	2.40	2.40	2.40	NM
4	Lead	24	2	0.170	4.80	2.49	17.1
4	Zinc	28	19	1.10	60.0	20.1	27.4
5	Cadmium	34	9	0.160	0.460	0.284	0.361
5	Copper	6	3	0.790	2.30	1.60	2.88
5	Lead	65	63	0.510	8.00	2.24	2.56
5	Zinc	60	60	7.20	100	51.1	56.8

Notes:
NM - not measured

Table 7.2-6
COEC Concentrations for Soil (mg/kg) Protective for Terrestrial Biota[a]

Analytes Evaluated	Soil Biota[b]	Wildlife[b]			90th Percentile of Soil-Sediment Background		
	Population/ Community	Individual/ NOAEL-based	Population/ LOAEL-based	Population/ ED20-based	Upper Basin[c]	Lower Basin[d]	Spokane River[e]
Arsenic	16.8	14	67	40	22	12.6	9.34
Cadmium	10	9.8	105	386	2.7	0.678	0.72
Copper	100	496	751	1,021	53	25.2	23.9
Lead	450	2.5	159	522	171	47.3	14.9
Zinc	106	27	434	261	280	97.1	66.4

[a] Birds and mammals occurring in upland, agricultural, and riparian habitats; terrestrial plants and invertebrates; and soil processes.
[b] Based on various lines of evidence available for evaluation (such as comparisons to single-chemical laboratory toxicity studies; toxicity testing using soil, sediment, or water from the Coeur d'Alene Basin; and field studies in the Basin).
[c] Gott and Cathrall (1980)
[d] USEPA (2001h)
[e] WDOE (1994)

Notes:
ED_{20} - effective dose - 20 percent response
LOAEL - lowest observed adverse effect level
NOAEL - no observed adverse effect level

Table 7.2-7
COEC Concentrations for Sediment (mg/kg) Protective for Aquatic Birds and Mammals[a]

Analytes Evaluated	Wildlife[b]			Site-specific Individual-level Protective Conc. for Waterfowl[b]	90th Percentile of Soil-sediment Background		
	Individual/ NOAEL-based	Population/ LOAEL-based	Population/ ED20-based		Upper Basin[c]	Lower Basin[d]	Spokane River[e]
Arsenic	54	222	138	NA	22	12.6	9.34
Cadmium	11.7	173	664	NA	2.7	0.678	0.72
Copper	1,606	2,157	2,209	NA	53	25.2	23.9
Lead	3.65[f]	249[f]	718[f]	93.3[g]	171	47.3	14.9
Mercury	0.2	2.5	7	NA	0.3	-[h]	0.032
Zinc	5.3	519	390	NA	280	97.1	66.4

[a] Birds and mammals occurring in palustrine, lacustrine, and riverine habitats.
[b] Based on various lines of evidence available for evaluation (such as comparisons to single-chemical laboratory toxicity studies; toxicity testing using soil, sediment, or water from the Coeur d'Alene Basin; and field studies in the Basin).
[c] Gott and Cathrall (1980)
[d] USEPA (2001h)
[e] WDOE (1994)
[f] For comparison, Beyer et al. (2000) derived a waterfowl no-effect concentration of 24 mg/kg and a lowest-effect concentration of 530 mg/kg and concluded that waterfowl mortality would occur if concentrations exceed 1,800 mg/kg.
[g] 10th percentile of individual-level sediment PRGs calculated for tundra swans, Canada geese, mallards, and wood ducks.
[h] Mercury was not measured in lower Basin sediment samples. Therefore, a background concentration could not be calculated.

Notes:
ED_{20} - effective dose - 20 percent response
LOAEL - lowest observed adverse effect level
NOAEL - no observed adverse effect level

Table 7.2-8
COEC Concentrations for Surface Water Protective for Aquatic Organisms

Analytes Evaluated	Acute Concentrations (μg/L)[b]					Chronic Concentrations (μg/L)[b]					
	Hardness-adjusted Values					Hardness-adjusted Values					Aquatic Plant - Lowest Chronic Value
	10	25	30	50	100	10	25	30	50	100	
Cadmium	0.21[a]	0.52	0.62	1.0	2.0	0.049[a]	0.094[a]	0.11[a]	0.15[a]	0.25[a]	2
Copper	1.5[a]	3.6	4.3	7	13	1.3[a]	2.7	3.2	5.0	9.0	1
Lead	4.9	13.9	17	30	65	0.2[a]	0.54[a]	0.66[a]	1.2	2.5	500
Zinc	16.7[a]	36.2	42	65	117	16.7[a]	36.2	43	66	118	30

[a] Background surface water concentrations are greater than the hardness-adjusted protective values in certain locations and selected background statistical percentiles. See Table 2-14 of USEPA (2001a) for specific areas where background concentrations may exceed the protective concentration.

[b] National Ambient Water Quality Criteria for copper, lead, and zinc as published in the National Recommended Water Quality Criteria – Correction, EPA 822-ZZ-99-001, April, 1999. The National Ambient Water Quality Criteria for cadmium as published on April 12, 2001, 66 FR 18935.

Note:
Hardness values (10, 25, 30, 50, and 100) are mg/L $CaCO_3$

Table 7.2-9
COEC Concentrations for Sediment Protective for Aquatic Organisms

Analytes Evaluated	COEC Concentrations (mg/kg dw)		
	CSM Units 1 and 2	CSM Units 3 and 4	CSM Unit 5
Arsenic	22	13	9.3
Cadmium	2.7	0.68	0.72
Copper	53	28[a]	28[a]
Lead	171	47	35[a]
Mercury	0.3	0.17[a]	0.17[a]
Silver	1.1	0.73[a]	0.73[a]
Zinc	280	98[a]	98[a]

[a] Concentrations based on toxicity reference values; other protective concentrations default to background concentrations for those portions of the Basin.

Table 7.2-10
Protective Goals for Physical and Biological Characteristics

Physical Characteristic	CSM Unit	Ecological Goals
Riparian Habitat		
Habitat suitability index	1	Habitat suitability index for the riparian habitat that is either within the range of historical conditions prior to mining activities or within the range of conditions currently found in selected reference areas
Spatial distribution and connectivity	1	Spatial distribution and connectivity of riparian habitat that is either within the range of historical conditions prior to mining activities or within the range of conditions currently found in selected reference areas
Riverine Habitat		
Bank stability	1 and 2	Bank stability that is either within the range of historical conditions prior to mining activities or within the range of conditions currently found in selected reference areas
Substrate composition and mobility	1 and 2	Substrate composition and mobility that is either within the range of historical conditions prior to mining activities or within the range of conditions currently found in selected reference areas
Water temperature	1 and 2	Water temperature that is either within the range of historical conditions prior to mining activities or within the range of conditions currently found in selected reference areas
Spatial distribution and connectivity	1 and 2	Spatial distribution and connectivity of riverine habitat that is either within the range of historical conditions present in the basin or within the range of conditions currently found in selected reference areas
Total suspended solids	3	Total suspended solids that are either within the range of historical conditions prior to mining activities or within the range of conditions currently found in selected reference areas
Lacustrine Habitat		
Sediment deposition rate	4	Sediment deposition rate that is either within the range of historical conditions prior to mining activities or within the range of conditions currently found in selected reference areas

Table 7.2-11
Summary of Results From the Coeur d'Alene Basin Ecological Risk Assessment

Receptor Type	Number of Receptors Evaluated	Lines of Evidence	Risk to Receptors	COPEC Posing Risk (COPECs = As, Cd, Cu, Pb, Hg, Zn)	Receptors with No Identified Risk	Areas with No Identified Risk
Birds	24	Single-chemical external exposure, single-chemical internal exposure (blood), single-chemical internal exposure (liver or kidney), ambient toxicity tests, biological surveys	21 of 24 receptors showed risk from at least one metal, maximum LOAEL-based HQ for Pb=387 (spotted sandpiper), HQ for Zn=35 (song sparrow), HQ for Cd=6.12 (song sparrow)	Pb followed by Zn, then Cd and Cu pose greatest risks; risks from Hg are minimal; risks from As are absent; at least one COPEC in almost every CSM Unit or segment presented a risk for all but three avian species	Osprey, bald eagle, northern harrier	Beaver and Prichard Creeks in CSM Unit 1
Mammals	18	Single-chemical external exposure, single-chemical internal exposure (liver or kidney), ambient toxicity test	12 of 18 receptors showed risk from at least 1 metal; maximum ED_{20}-based HQ for Zn=25.5 (masked shrew), HQ for As=4.4 (muskrat), HQ for Cu=1.55 (masked shrew)	Although no one COPEC was the dominant risk driver, risks from Zn and Pb were most widely distrbuted, followed by Cd, As, Hg, and Cu	Fisher, wolverine, river otter, gray wolf, lynx, beaver	Beaver and Prichard Creeks in CSM Unit 1
Fish and Other Aquatic Organisms	13+	Single-chemical toxicity testing, site-specific toxicity testing, biological surveys	Risks to survival, growth, and reproduction of fish and benthic invertebrates because of concentrations of metals 10 times that of acute and chronic ambient water quality criteria in more than 25 and 50 percent of samples, respectively, from some areas	Cd, Cu, Pb, and Zn pose a risk in surface water to fish and other aquatic organisms; As, Cd, Cu, Pb, and Zn in sediment pose a potential risk to fish and other aquatic organisms	None identified	No areas identified

Table 7.2-11 (Continued)
Summary of Results from The Coeur d'Alene Basin Ecological Risk Assessment

Receptor Type	Number of Receptors Evaluated	Lines of Evidence	Risk to Receptors	COPEC Posing Risk (COPECs = As, Cd, Cu, Pb, Hg, Zn)	Receptors with No Identified Risk	Areas with No Identified Risk
Amphibians	4	Single-chemical toxicity data, ambient media toxicity tests, biological surveys	Risk posed to three of four receptors	Cd, Cu, Pb, and Zn pose risks; Cd and Pb present individual risk to three receptors in four locations; Cu presents individual-level risks at six locations; Zn presents individual-level risk at seven locations; Pb presents greatest risk in upper basin, Cd presented greatest risk in lower basin, Zn presents risks throughout	Long-toed salamander	Big, Moon, and Prichard Creeks in CSM Unit 1
Terrestrial Plants	6	Single-chemical toxicity data, ambient media toxicity tests, biological surveys	All six plant receptors at risk	As, Cd, Pb, Zn, and Cu pose risk to plants at community or population level; As, Cd, Pb, and Zn pose risk to Ute ladies'-tresses in CSM Units 1,2, 3 and 5	None identified	Beaver and Prichard Creeks in CSM Unit 1
Soil Invertebrates	1	Single-chemical toxicity data	Receptors at risk	Pb and Zn pose risk in CSM Units 1, 2, 3, and 5; Cd poses risk in Canyon Creek and Upper South Fork in CSM 1 and all segments of 2, 3, and 5; Cu poses risk in Big, Canyon, and Ninemile Creeks and the Upper South Fork in CSM Unit 1, and in all segements of Units 2 and 3; As poses risk in Pine Creek and Upper South Fork in CSM Unit 1 and in all of CSM Units 2 and 3	None identified	Beaver and Prichard Creeks in CSM Unit 1

Table 7.2-11 (Continued)
Summary of Results from The Coeur d'Alene Basin Ecological Risk Assessment

Receptor Type	Number of Receptors Evaluated	Lines of Evidence	Risk to Receptors	COPEC Posing Risk (COPECs = As, Cd, Cu, Pb, Hg, Zn)	Receptors with No Identified Risk	Areas with No Identified Risk
Soil processes	1	Single-chemical toxicity data	Receptors at risk	Pb and Zn pose risk in all segments of CSM Units 1, 2, and 3; Cd poses risk in five of six segments in CSM Unit 3; Cu poses risk in Canyon and Ninemile Creeks and the Upper South Fork in CSM Unit 1 and in 2 segments of CSM Unit 3; As poses risk in CSM Unit 3	None identified	Beaver and Prichard Creeks in CSM Unit 1

Notes:
NA - not applicable
No soil data were available from the Beaver or Prichard Creek watersheds.

Table 7.2-12
Summary of Results from the Measures of Ecosystem and Receptor Characteristics Analysis in the Coeur d'Alene Ecological Risk Assessment

Watershed	Measure	Level of Adverse Effects	Nature of Secondary Effects	Extent of Adverse Effects - Narrative
Upper South Fork Coeur d'Alene River	Riparian HSI	Low	• Stream channel and riparian areas modified by tailings pond and mining facility development. • Recovery of riparian vegetation impaired by floodplain deposits and tailings ponds. • Historic inputs of contaminated bedload and mine tailings material to the stream channel. • Floodplain deposits of hazardous substances in downstream areas. • Ecological connectivity has been fragmented by degraded conditions in downstream segments.	Mining related activities and impacts increase on a downstream gradient. Conditions range from relatively intact riparian and riverine habitat conditions in the upper half of the drainage, to increasingly degraded conditions in downstream reaches. Ecological connectivity of intact habitats fragmented by degraded conditions in the Mid-Gradient SFCDR watershed.
	Bank Stability	None		
	Substrate Composition and Mobility	None		
	Temperature	None		
	Spatial Distribution and Connectivity	Moderate		
Canyon Creek	Riparian HSI	None to High	• Historic inputs of contaminated bedload and mine tailings material to the stream channel. • Floodplain deposits of hazardous substances in the downstream segments of the watershed. • Recovery of riparian vegetation limited in some areas by loss of topsoil (due to ore recovery activities), and phytotoxic levels of contaminants in soils. • Channel destabilization due to inputs of bedload material and loss of bank vegetation. • High stream temperatures due to lack of shading vegetation. • Disrupted surface water/groundwater relationships due to riparian zone impacts. • Ecological connectivity fragmented due to extensive degradation in downstream segments.	Relatively intact conditions in CCSeg01 and portions of CCSeg02. Loss of bank and stream channel structure in CCSeg03, CCSeg04, and CCSeg05. Bank and channel instability in these areas exacerbated by lack of riparian vegetation. Lack of shade and degraded channel structure contributes to high stream temperatuers in CCSeg05. Ecological connectivity of intact habitats fragmented by degraded conditions in downstream segments of the watershed, and in the Mid-Gradient SFCDR watershed.
	Bank Stability	None to Moderate		
	Substrate Composition and Mobility	None to Moderate		
	Temperature	High		
	Spatial Distribution and Connectivity	High		

Table 7.2-12 (Continued)
Summary of Results from the Measures of Ecosystem and Receptor Characteristics Analysis in the Coeur d'Alene Ecological Risk Assessment

Watershed	Measure	Level of Adverse Effects	Nature of Secondary Effects	Extent of Adverse Effects - Narrative
Ninemile Creek	Riparian HSI	None to High	Similar conditions to the Canyon Creek watershed	Loss of channel structure in NMSeg01, NMSeg02, and NMSeg04 due to historic inputs of bedload and tailings material. Degraded riparian vegetation structure and high stream temperatures due to lack of shade in downstream areas of watershed. Ecological connectivity fragmented by degraded conditions within the watershed and downstream in Mid-Gradient SFCDR watershed.
	Bank Stability	None to Moderate		
	Substrate Composition and Mobility	Moderate		
	Temperature	High		
	Spatial Distribution and Connectivity	High		
Big Creek	Riparian HSI	None to Moderate	• Historic inputs of contaminated bedload and mine tailings material to the stream channel. • Channel destabilization due to inputs of bedload material and loss of bank vegetation. • Recovery of riparian vegetation limited in some areas by tailings pond development and potentially phytotoxic soils. • Ecological connectivity fragmented due to extensive degradation in downstream segments.	Limited mining related impacts in BigCrkSeg01, BigCrkSeg02, and BigCrkSeg03. More extensive mining related impacts in lower half of BigCrkSeg04, including milling facilities and wastepiles, tailings pond development, and floodplain deposits of contaminated material. Degraded riparian vegetation structure in tailings pond areas. Ecological connectivity of intact headwaters habitats fragmented by degraded conditions in BigCrkSeg04 and the Mid-Gradient SFCDR watershed.
	Bank Stability	Low		
	Substrate Composition and Mobility	Low		
	Temperature	Low		
	Spatial Distribution and Connectivity	High		
Moon Creek	Riparian HSI	None to Low	• Historic inputs of contaminated bedload and mine tailings material to the stream channel. • Floodplain deposits of hazardous substances in downstream areas.	Historic mining activities impacted the stream channel and riparian habitats of the mainstem of Moon Creek along most of its length. However, stream channel and riparian vegetation structure appears to have recovered in many areas. Ecological connectivity of intact habitats in MoonCrkSeg01 and MoonCrkSeg02
	Bank Stability	None to Low		
	Substrate Composition and Mobility	None	• Bank instability and deposition of fine grained material in the stream channel.	

Table 7.2-12 (Continued)
Summary of Results from the Measures of Ecosystem and Receptor Characteristics Analysis in the Coeur d'Alene Ecological Risk Assessment

Watershed	Measure	Level of Adverse Effects	Nature of Secondary Effects	Extent of Adverse Effects - Narrative
Moon Creek (continued)	Temperature	None	• Ecological connectivity fragmented due to extensive degradation in downstream segments.	fragmented by degraded conditions in the Mid-Gradient SFCDR watershed.
	Spatial Distribution and Connectivity	High		
Pine Creek	Riparian HSI	High	• Historic inputs of contaminated bedload and mine tailings material to the stream channel. • Floodplain deposits of hazardous substances in downstream areas. • Channel destabilization due to inputs of bedload material and loss of bank vegetation. • Impaired recovery of riparian vegetation. • Ecological connectivity fragmented due to extensive degradation in downstream segments.	Historic mining activities impacted the stream channel and riparian habitats of PineCrkSeg01 (East Fork Pine Creek) along much of its length, and PineCrkSeg03 below the East Fork. Extensive floodplain and riparian zone impacts present in these segments. Remedial actions to reduce contamination and rehabilitate riparian and channel structure have been conducted by BLM. Ecological connectivity of intact habitats fragmented by degraded conditions in the Mid-Gradient SFCDR watershed.
	Bank Stability	None to High		
	Substrate Composition and Mobility	Low to Moderate		
	Temperature	None		
	Spatial Distribution and Connectivity	High		
Beaver Creek	No Measures Evaluated	-	Insufficient Information available to evaluate risks for all receptors.	
Prichard Creek	Riparian HSI	Moderate		
	Bank Stability	Low		
	Substrate Composition and Mobility	Low		
	Temperature	Low		
	Spatial Distribution and Connectivity	Moderate		

Table 7.2-12 (Continued)
Summary of Results from the Measures of Ecosystem and Receptor Characteristics Analysis in the Coeur d'Alene Ecological Risk Assessment

Watershed	Measure	Level of Adverse Effects	Nature of Secondary Effects	Extent of Adverse Effects - Narrative
MidGradient SFCDR	Riparian HSI	High	• Extensive deposits of contaminated jig and floatation mining tailings material present in floodplains and riparian areas. • Channel destabilization due to inputs of bedload material and loss of bank vegetation. • Recovery of riparian vegetation limited in some areas by phytotoxic levels of hazardous substances in mining related floodplain deposits. • Degraded riparian and riverine habitat conditions throughout MidGradSeg01 and MidGradSeg02 contribute to fragmented ecological connectivity.	Floodplain deposits of jig and floatation era mine tailings present in depositional areas throughout the mid-gradient SFCDR. Loss of stabilizing riparian vegetation from phytotoxic effects, and large historic inputs of bedload material contribute to channel and substrate instabililty in the stream system. Degraded riparian and riverine structure and physical function throughout MidGradSeg01 and MidGradSeg02 contribute to fragmented ecological connectivity throughout the watershed.
	Bank Stability	Moderate to High		
	Substrate Composition and Mobility	Moderate		
	Temperature	High		
	Spatial Distribution and Connectivity	High		
North Fork Coeur d'Alene River	Riparian HSI	None		
	Bank Stability	Not Rated		
	Substrate Composition and Mobility	Not Rated		
	Temperature	Moderate		
	Spatial Distribution and Connectivity	None		
Mainstem Coeur d'Alene River	Riparian HSI	None		
	Bank Stability	None		
	Substrate Composition and Mobility	Not Rated		
	Temperature	None		
	Spatial Distribution and Connectivity	Not Rated		

Table 7.2-12 (Continued)
Summary of Results from the Measures of Ecosystem and Receptor Characteristics Analysis in the Coeur d'Alene Ecological Risk Assessment

Watershed	Measure	Level of Adverse Effects	Nature of Secondary Effects	Extent of Adverse Effects - Narrative
Lower Coeur d'Alene River	Riparian HSI	Not Rated	• Extensive deposits of contaminated jig and floatation mining tailings material present in sediments on the river bottom and in lateral lakes and wetlands, and on the river bank and floodplain. • Degraded channel stability due to extensive bedload inputs. • Recovery of bank and riparian vegetation possibly limited by phytotoxic effects. • Recovery of bank and riparian vegetation possibly limited by phytotoxic effects. • Extensive bank erosion contributes to high levels of suspended solids and elevated sediment deposition rates.	Deposits of contaminated material along 260,000 feet (49 miles) of shoreline, averaging approximately 90 feet in width (CSM segments LCDRSeg02-LCDRSeg06). Actively eroding streambank identified along 57,900 feet (11 miles) of shoreline in all CSM segments, the majority associated with contaminated deposits.
	Bank Stability	Not Rated		
	Suspended Solids	Moderate		
	Sediment Deposition Rate	Low to High		
Coeur d'Alene Lake	Sediment Deposition Rate	None to High		Core sampling locations at the mouth of the Coeur d'Alene River and approximately 2.25 miles to the NW (CDALakeSeg02) indicate deposition rates corresponding to moderate to high adverse effects. All other locations throughout CDALakeSeg02 indicate no adverse effects. One location at the northern end of CDALakeSeg01 indicated deposition rates having a low level of adverse effects. The southern end of CDALakeSeg01 and CDALakeSeg03 were used as reference areas.

Table 7.2-12 (Continued)
Summary of Results from the Measures of Ecosystem and Receptor Characteristics Analysis in the Coeur d'Alene Ecological Risk Assessment

Watershed	Measure	Level of Adverse Effects	Nature of Secondary Effects	Extent of Adverse Effects - Narrative
Upper Spokane River	Sediment Deposition Rate	None		Due to lack of adverse effects in areas of Coeur d'Alene Lake away from the mouth of the Coeur d'Alene River, no adverse effects are expected in the Spokane River

Notes:
HSI - Habitat Suitability Index

8.0 REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) provide a general description of the goals of the overall cleanup. RAOs have been developed for the protection of human health and ecological receptors. The Selected Remedy provides prioritized actions toward achieving the RAOs.

8.1 HUMAN HEALTH

The RAOs for human health protection are shown in Table 8.1-1. The primary RAOs for the selected human health remedy are designed to:

- Reduce human exposure to lead-contaminated soils, sediments, and house dust exceeding health risk goals particularly in children up to 84 months of age

- Reduce human exposure to soils and sediments that would exceed a cancer risk of one in ten thousand

- Reduce ingestion of groundwater or surface water withdrawn or diverted from a private, unregulated source that contains COCs exceeding drinking water standards and risk-based levels[11] (The drinking water standards are shown in Table 8.1-2.)

8.2 ECOLOGICAL

The RAOs developed for ecological protection are shown in Table 8.2-1. Overall, the RAOs are designed to:

- Return the rivers and tributaries to conditions that will fully support healthy fish and other aquatic receptors, with an emphasis on native species, including sensitive native fish such as the westslope cutthroat trout and the bull trout (listed as “threatened” under the ESA).

- Return the wetland, lake, riparian, riverine, and upland areas to conditions protective of waterfowl, migratory birds, and other plants and animals that live in these areas.

---

[11] The State of Idaho has adopted the federal drinking water standards for the chemicals of potential concern by reference (IDAPA 58.01.08.050).

The RAOs are long-term goals that were used to develop the comprehensive ecological alternatives that are described in Section 9, but are not the objectives of the remedy selected in this ROD. The Selected Remedy establishes benchmarks (actions and criteria), which are near-term objectives that will serve as landmarks and measurements to evaluate the progress of the remedy toward achievement of the long-term goals. The Selected Remedy identifies prioritized actions to address environmental risks in the Upper Basin and Lower Basin. The benchmarks identified for the Selected Remedy are discussed in Section 12 and shown in Table 12.2-1.

Potential cleanup criteria for surface water are set forth in the Idaho Water Quality Standards and Wastewater Treatment Requirements, the Washington Water Quality Standards, tribal standards, or federal criteria, which have been established through the Clean Water Act to protect aquatic organisms. These standards and criteria were drivers for development of the comprehensive alternatives and for identification of the priority actions included in the Selected Remedy. State, tribal, and federal standards and criteria for protection of aquatic life in surface water are listed in Tables 8.2-2, 8.2-3, and 8.2-4.[12]

40 CFR 131.11 provides states the opportunity to adopt site-specific water quality criteria (SSC) that are "...modified to reflect site specific conditions." The State of Idaho promulgated SSC for cadmium, lead, and zinc in the flowing waters of the Upper Basin as a permanent rule in March 2002 (IDAPA 58.01.02.284). The status of the SSC as potential ARARs for cleanup in the Basin is discussed in Section 13.2.

Table 7.2-8 presents concentrations of metals in surface water that represent the lowest chronic effects levels of metals that may affect aquatic plants. However, these effects levels for plants are screening-level benchmarks. The AWQC also take into account the protection of aquatic plants. Therefore, the AWQC are considered adequately protective for aquatic plants and animals.

Protection of certain species is required by the MBTA and the ESA. In order to comply with these ARARs, cleanup criteria will be protective of these species within the areas where they may occur. Based on the EcoRA, 19 of 22 migratory bird species evaluated are at risk. These species are representative of hundreds of species that are similarly exposed. Protection of MBTA and ESA species was a driver for development of the comprehensive alternatives and for identification of the priority actions for soil, sediment, and surface water included in the Selected Remedy.

[12] Cleanup levels would not be less than background concentrations of metals in surface water.

As described in Section 12.2.3, Benchmark Cleanup Criteria, a benchmark cleanup criterion of 530 mg/kg for lead in Lower Basin soil and sediment has been selected for implementation of the Selected Remedy. This criterion may be revised as additional information becomes available to ensure protectiveness of the remedy.

In riparian areas where remedial actions are conducted (e.g., banks and tributaries), risks to riparian receptors will be mitigated using removal and replacement with clean soil or capping with clean soil to isolate contaminants and reduce or eliminate exposure pathways.

Table 8.1-1
Remedial Action Objectives for Protection of Human Health

Environmental Media	Remedial Action Objectives
Soils, Sediments and Source Materials	Reduce mechanical transportation of soil and sediments containing unacceptable levels of contaminants into residential areas and structures. Reduce human exposure to soils, including residential garden soils, and sediments that have concentrations of contaminants of concern greater than selected risk-based levels for soil. (As described in Sections 7 and 12 of this ROD.)
House Dust	Reduce human exposure to lead in house dust via tracking from areas outside the home and air pathways, exceeding health risk goals.
Groundwater and Surface Water as Drinking Water	Reduce ingestion by humans of groundwater or surface water withdrawn or diverted from a private, unregulated source, used as drinking water, and containing contaminants of concern exceeding drinking water standards and risk-based levels for drinking water.
Aquatic Food Sources	Reduce human exposure to unacceptable levels of contaminants of concern via ingestion of aquatic food sources (e.g., fish and water potatoes).

Table 8.1-2
ARARs for Drinking Water

Metal	MCL[1] or TT[2], μg/L
Arsenic	10
Cadmium	5
Lead	TT[3]; Action Level = 15

[1]Maximum Contaminant Level (MCL) - The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCL goals as feasible using the best available treatment technology and taking cost into consideration.
[2]Treatment technique (TT) - A required process intended to reduce the level of a contaminant in drinking water.
[3]Lead is regulated by a treatment technique that requires systems to control the corrosiveness of their water. If more than 10% of tap water samples exceed the action level, water systems must take additional steps.

Note:
μg/L - micrograms per liter

Table 8.2-1
Remedial Action Objectives for Protection of Ecological Receptors

Subject	Remedial Action Objective
Ecosystem and physical structure and function	Remediate soil, sediment, and water quality and mitigate mining impacts in habitat areas to be capable of supporting a functional ecosystem for the aquatic and terrestrial plant and animal populations in the Coeur d'Alene Basin. Maintain (or provide) soil, sediment, and water quality and mitigate mining impacts in habitat areas to be supportive of individuals of special-status biota that are protected under the Endangered Species Act and the Migratory Bird Treaty Act.
Soil, sediment, and source materials	Prevent ingestion of arsenic, cadmium, copper, lead, mercury, silver, and zinc by ecological receptors at concentrations that result in unacceptable risks. Reduce loadings of cadmium, copper, lead, and zinc from soils and sediments to surface water so that loadings do not cause exceedances of potential surface water quality ARARs. Prevent transport of cadmium, copper, lead, and zinc from soils and sediments to groundwater at concentrations that exceed potential surface water quality ARARs. Prevent dermal contact with arsenic, cadmium, copper, lead, mercury, silver, and zinc by ecological receptors at concentrations that result in unacceptable risks.
Mine water, including adits, seeps, springs, and leachate	Prevent discharge of cadmium, copper, lead, and zinc in mine water, including adits, seeps, springs, and leachate to surface water at concentrations that exceed potential surface water quality ARARs.
Surface water	Prevent ingestion of cadmium, copper, lead, and zinc by ecological receptors at concentrations that exceed potential surface water quality ARARs. Prevent dermal contact with cadmium, copper, lead, and zinc by ecological receptors at concentrations that exceed potential surface water quality ARARs.
Groundwater	Prevent discharge of groundwater to surface water at concentrations of cadmium, copper, lead, and zinc that exceed potential surface water quality ARARs.

Note:
The Selected Remedy is designed to achieve the benchmarks (actions and criteria) shown in Table 12.2-1. The Selected Remedy for ecological protection provides prioritized actions toward achieving the RAOs.

Table 8.2-2
Water Quality Standards and Criteria for Protection of Aquatic Life in Surface Water in the Upper Basin (CSM Units 1 and 2)

Metal	EPA-Approved Idaho Water Quality Standards[a,c]						Idaho Site-Specific Criteria[a,d]						National Ambient Water Quality Criteria[a,e]					
	Acute			Chronic			Acute			Chronic			Acute			Chronic		
Hardness[b]	**30**	**50**	**100**	**30**	**50**	**100**	**30**	**50**	**100**	**30**	**50**	**100**	**30**	**50**	**100**	**30**	**50**	**100**
Cadmium	1.0	1.7	3.7	0.42	0.62	1.0	0.61	1.0	2.1	0.42	0.62	1.0	0.62	1.0	2.0	0.11	0.15	0.25
Copper	5.5	8.9	17	4.1	6.3	11	5.5	8.9	17	4.1	6.3	11	4.3	7.0	13	3.2	5.0	9.0
Lead	17	30	65	0.66	1.2	2.5	80	129	248	9.1	15	28	17	30	65	0.66	1.2	2.5
Zinc	41	64	114	38	58	105	88	123	195	88	123	195	42	65	117	43	66	118

[a]Standards and criteria in micrograms per liter (µg/L)
[b]Hardness in milligrams of calcium carbonate per liter ($mgCaCO_3/L$)
[c]EPA-approved Idaho Water Quality Standards, IDAPA 58.01.02.210, as submitted by Idaho to EPA by May 30, 2000.
[d]Idaho site-specific criteria (SSC) for cadmium, lead, and zinc, IDAPA 58.0102.284, as adopted by Idaho on March 15, 2002. Copper criteria apply statewide (IDAPA 58.0102.210).
[e]National Ambient Water Quality Criteria for copper, lead, and zinc as published in the National Recommended Water Quality Criteria – Correction, EPA 822-ZZ-99-001, April 1999. The National Ambient Water Quality Criteria for cadmium as published on April 12, 2001, 66 FR 18935.

Notes:
Idaho and national guidelines set a maximum hardness to be used in calculating the criteria at 400 mg/L.

Equations used to calculate water quality standards and criteria

Metal	Acute criteria equation	Chronic criteria equation
Cadmium (EPA-Approved State Standard)	{1.136672-(ln(H)*0.041838)}*{exp(1.128*ln(H)-3.828)}	{1.101672-(ln(H)*0.041838)}*{exp(0.7852*ln(H)-3.49)}
Cadmium (State SSC)	0.973*exp(1.0166*ln(H)-3.924)	{1.101672-(ln(H)*0.041838)}*{exp(0.7852*ln(H)-3.49)}
Cadmium (National AWQC)	{1.136672-(ln(H)*0.041838)}*{exp(1.0166*ln(H)-3.924)}	{1.101672-(ln(H)*0.041838)}*{exp(0.7409*ln(H)-4.719)}
Copper (EPA-Approved State Standard and State SSC)	0.96*exp(0.9422*ln(H)-1.464)	0.96*exp(0.8545*ln(H)-1.465)
Copper (National AWQC)	0.96*exp(0.9422*ln(H)-1.700)	0.96*exp(0.8545*ln(H)-1.702)
Lead (EPA-Approved State Standard and National AWQC)	{1.46203-(ln(H)*0.145712)}*{exp(1.273*ln(H)-1.46)}	{1.46203-(ln(H)*0.145712)}*{exp(1.273*ln(H)-4.705)}
Lead (State SSC)	exp(0.9402*ln(H)+1.1834)	exp(0.9402*ln(H)-0.9875)
Zinc (EPA-Approved State Standard)	0.978*exp(0.8473*ln(H)+0.8604)	0.986*exp(0.8473*ln(H)+0.7614)
Zinc (State SSC)	exp(0.6624*ln(H)+2.2235)	Same as acute
Zinc (National AWQC)	0.978*exp(0.8473*ln(H)+0.884)	0.986*exp(0.8473*ln(H)+0.884)

Table 8.2-3
Water Quality Standards and Criteria for Protection of Aquatic Life in the Lower Basin, Coeur d'Alene Lake, and Spokane River Within Idaho (CSM Units 3, 4, and 5)

Metal	EPA-Approved Idaho Water Quality Standards[a,c]						Coeur d'Alene Tribe Water Quality Standards[a,d]						National Ambient Water Quality Criteria[a,e]					
	Acute			Chronic			Acute			Chronic			Acute			Chronic		
Hardness[b]	**20**	**30**	**50**	**20**	**30**	**50**	**20**	**30**	**50**	**20**	**30**	**50**	**20**	**30**	**50**	**20**	**30**	**50**
Cadmium	0.82	1.0	1.7	0.37	0.42	0.62	0.65	1.0	1.7	0.31	0.42	0.62	0.42	0.62	1.0	0.080	0.11	0.15
Copper	4.6	5.5	8.9	3.5	4.1	6.3	3.7	5.5	8.9	2.9	4.1	6.3	2.9	4.3	7.0	2.3	3.2	5.0
Lead	14	17	30	0.54	0.66	1.2	11	17	30	0.42	0.66	1.2	11	17	30	0.42	0.66	1.2
Zinc	35	41	64	32	38	58	29	41	64	27	38	58	30	42	65	30	43	66

[a]Standards and criteria in micrograms per liter (μg/L)
[b]Hardness in milligrams of calcium carbonate per liter (mg$CaCO_3$/L)
[c]EPA-approved Idaho Water Quality Standards, IDAPA 58.01.02.210, as submitted by Idaho to EPA by May 30, 2000.
[d]Tribal water quality standards apply only within reservation lands and water bodies.
[e]National Ambient Water Quality Criteria for copper, lead, and zinc as published in the National Recommended Water Quality Criteria – Correction, EPA 822-ZZ-99-001, April 1999. The National Ambient Water Quality Criteria for cadmium as published on April 12, 2001, 66 FR 18935.

Notes:
Idaho, Coeur d'Alene Tribe, and national guidelines set a maximum hardness to be used in calculating the criteria at 400 mg/L. Statewide Idaho water quality standards also set a minimum hardness to be used in calculating the criteria at 25 mg/L. If hardness is <25 mg/L within reservation lands and water bodies, tribal standards are more stringent.

Equations used to calculate water quality standards and criteria

Metal	Acute criteria equation	Chronic criteria equation
Cadmium (EPA-Approved State Standard and Tribe)	{1.136672-(ln(H)*0.041838)}*{exp(1.128*ln(H)-3.828)}	{1.101672-(ln(H)*0.041838)}*{exp(0.7852*ln(H)-3.49)}
Cadmium (National AWQC)	{1.136672-(ln(H)*0.041838)}*{exp(1.0166*ln(H)-3.924)}	{1.101672-(ln(H)*0.041838)}*{exp(0.7409*ln(H)-4.719)}
Copper (EPA-Approved State Standard and Tribe)	0.96*exp(0.9422*ln(H)-1.464)	0.96*exp(0.8545*ln(H)-1.465)
Copper (National AWQC)	0.96*exp(0.9422*ln(H)-1.700)	0.96*exp(0.8545*ln(H)-1.702)
Lead (EPA-Approved State Standard, Tribe, and National AWQC)	{1.46203-(ln(H)*0.145712)}*{exp(1.273*ln(H)-1.46)}	{1.46203-(ln(H)*0.145712)}*{exp(1.273*ln(H)-4.705)}
Zinc (EPA-Approved State Standard and Tribe)	0.978*exp(0.8473*ln(H)+0.8604)	0.986*exp(0.8473*ln(H)+0.7614)
Zinc (National AWQC)	0.978*exp(0.8473*ln(H)+0.884)	0.986*exp(0.8473*ln(H)+0.884)

Table 8.2-4
Water Quality Standards and Criteria for Protection of Aquatic Life in Surface Water in the Spokane River Within Washington (CSM Unit 5)

Metal	EPA-Approved Washington Water Quality Standards[a,c]						Spokane Tribe Water Quality Standards[a,d]						National Ambient Water Quality Criteria[a,e]					
	Acute			Chronic			Acute			Chronic			Acute			Chronic		
Hardness[b]	**30**	**50**	**100**	**30**	**50**	**100**	**30**	**50**	**100**	**30**	**50**	**100**	**30**	**50**	**100**	**30**	**50**	**100**
Cadmium	1.0	1.7	3.7	0.42	0.62	1.0	1.0	1.7	3.7	0.42	0.62	1.0	0.62	1.0	2.0	0.11	0.15	0.25
Copper	5.5	8.9	17	4.1	6.3	11	4.3	7.0	13	3.2	5.0	9.0	4.3	7.0	13	3.2	5.0	9.0
Lead	17	30	65	0.66	1.2	2.5	17	30	65	0.66	1.2	2.5	17	30	65	0.66	1.2	2.5
Zinc	41	64	114	38	58	105	41	64	114	38	58	105	42	65	117	43	66	118

[a]Standards and criteria in micrograms per liter (µg/L)
[b]Hardness in milligrams of calcium carbonate per liter ($mgCaCO_3/L$)
[c]EPA-approved Washington Water Quality Standards, WAC 173-201A-040, as submitted by Washington to EPA by May 30, 2000.
[d]Tribal water quality standards apply only within reservation lands and water bodies.
[e]National Ambient Water Quality Criteria for copper, lead, and zinc as published in the National Recommended Water Quality Criteria – Correction, EPA 822-ZZ-99-001, April 1999. The National Ambient Water Quality Criteria for cadmium as published on April 12, 2001, 66 FR 18935.

Equations used to calculate water quality standards and criteria

Metal	Acute criteria equation	Chronic criteria equation
Cadmium (EPA-Approved State Standard and Tribe)	{1.136672-(ln(H)*0.041838)}*{exp(1.128*ln(H)-3.828)}	{1.101672-(ln(H)*0.041838)}*{exp(0.7852*ln(H)-3.49)}
Cadmium (National AWQC)	{1.136672-(ln(H)*0.041838)}*{exp(1.0166*ln(H)-3.924)}	{1.101672-(ln(H)*0.041838)}*{exp(0.7409*ln(H)-4.719)}
Copper (EPA-Approved State Standard)	0.96*exp(0.9422*ln(H)-1.464)	0.96*exp(0.8545*ln(H)-1.465)
Copper (Tribe and National AWQC)	0.96*exp(0.9422*ln(H)-1.700)	0.96*exp(0.8545*ln(H)-1.702)
Lead (EPA-Approved State Standard, Tribe, and National AWQC)	{1.46203-(ln(H)*0.145712)}*{exp(1.273*ln(H)-1.46)}	{1.46203-(ln(H)*0.145712)}*{exp(1.273*ln(H)-4.705)}
Zinc (EPA-Approved State Standard and Tribe)	0.978*exp(0.8473*ln(H)+0.8604)	0.986*exp(0.8473*ln(H)+0.7614)
Zinc (National AWQC)	0.978*exp(0.8473*ln(H)+0.884)	0.986*exp(0.8473*ln(H)+0.884)

9.0 DESCRIPTIONS OF ALTERNATIVES

This section describes the comprehensive alternatives for protection of human health and the environment that were developed and evaluated in the FS. Human health and ecological alternatives for the basin were developed, analyzed, and compared following EPA guidance (USEPA 1988). This section summarizes the components of each of the alternatives, which are organized as follows:

- **Section 9.1.** Alternatives for protection of human health in the residential and community areas of the Upper Basin and Lower Basin

- **Section 9.2.** Alternatives for protection of ecological receptors in the Upper Basin and Lower Basin

- **Section 9.3.** Alternatives for Coeur d'Alene Lake

- **Section 9.4.** Alternatives for protection of human health and ecological receptors for the Spokane River between the Washington-Idaho state line and Upriver Dam

The Selected Remedy is described in Section 12. The alternative development process for both human health and ecological protection included identification of all potentially applicable technologies and process options; screening of technologies and process options on the basis of technical implementability only; and evaluation and screening of retained technologies and process options based on effectiveness, implementability, and cost. The retained process options were then assembled into alternatives that cover a range of remedial options, including "no action," as required by the NCP.

The remedial alternatives are not mutually exclusive choices and do not limit the choice of a remedy. The Selected Remedy can combine elements of the various alternatives, refine or modify those elements, or add to them. Alternatives are developed and evaluated in the remedy selection process to the level of detail appropriate to provide information needed to support a Proposed Plan and ROD. This level of detail is considered a planning level, not a design level. Remedial actions require appropriate site-specific remedial designs, which may generally include collection of site-specific chemical, hydrologic, hydraulic, and geotechnical data from areas identified as requiring cleanup. These areas may include those where previous cleanup actions have taken place, such as floodplain areas of the UPRR right-of-way or other areas where previous removal actions have addressed some, but not all, contamination present. Remedial design and construction (remedial action) are post-ROD activities that are based on the remedy selected in the ROD.

Cleanup plans for the Basin have also been developed by the State of Idaho (State of Idaho Cleanup Plan) and the mining companies (Mining Companies Cleanup Plan). Because the ecological components of these plans enhance the range of remedial options available to decision makers, these plans are presented as ecological Alternatives 5 (State of Idaho Cleanup Plan) and 6 (Mining Companies Cleanup Plan), based on interpretation of available documentation. The human health alternatives include the human health components of these plans, with minor exceptions, and the State Plan and Mining Companies Plan are not presented as distinct alternatives for protection of human health.

9.1 HUMAN HEALTH ALTERNATIVES FOR THE COMMUNITY AND RESIDENTIAL AREAS

Human health alternatives were developed for the primary potential exposure media:

- Soil
- Drinking water
- House dust
- Aquatic food sources

Risk from eating homegrown vegetables is addressed by the yard soil alternatives. The ultimate effectiveness of the aquatic food sources alternatives would be highly dependent on the reductions of fish uptake of metals achieved through implementation of ecological remedies.

9.1.1 Soil Alternatives

Soil Alternative S1—No Action

This alternative would leave contaminated soil in place with no change in existing conditions. It would not remove contaminated soil from residential yards and gardens in the Basin, it would provide no information, education, or counseling for residents with contaminated yards, and it would not monitor blood lead levels to evaluate the impacts of continued exposure. The no action alternative provides a baseline from which to compare the action alternatives.

Soil Alternative S2—Information and Intervention

This alternative would include deed notices, pamphlet distribution, press releases, public meetings, publicly posted notices, and advisory signs in public areas to both inform the public of risk mitigation and new risk information and solicit public input and involvement. This alternative also would include a program similar to the PHD’s Lead Health Intervention Program, which provides personal health and hygiene information to help mitigate exposure to contaminants. Services also include biological monitoring, yard and home sampling, and nursing follow-up services. An institutional controls program that would include local construction regulations (developed and implemented in conjunction with local zoning, building, or planning commissions) may also be considered in certain areas if risk conditions warrant.

Soil Alternative S3—Information and Intervention and Access Modifications

In addition to information and intervention, this alternative would include constructing fences or other barriers around certain areas and providing maintenance to prevent or limit access to certain areas where risk level and persistency warrant. This alternative is not intended for use at residential properties.

Soil Alternative S4—Information and Intervention and Partial Removal and Barriers

In addition to information and intervention, this alternative would include removing a limited amount of contaminated soil and placing clean barriers. Contaminated yards would be excavated to a typical depth of about 1 foot. Garden areas would be provided with a minimum of 2 feet of clean fill. In order to mitigate potential exposure pathways, the excavated areas would be backfilled with clean soils and/or capped. Where appropriate, structure exteriors would be pressure-washed before remedial measures are performed, to reduce the potential for recontamination from lead-based paint. Risk would be further reduced by installing visual markers to delineate the limits of soil removal. In addition to residential yards, common use areas such as streets, alleys, rights-of-way, and playgrounds would also be candidates for remediation if soil contamination and exposure risks warrant. This alternative would also include revegetation and interim dust control during soil excavation. For recreational areas, this alternative would include site improvements to reduce exposure risks. These would be specific to individual recreational areas and, in addition to partial soil removal and access restrictions, could include stabilizing river banks, constructing paved boat ramps and parking areas, excavating or capping day-use and overnight camping areas, and providing picnic tables.

Soil Alternative S5—Information and Intervention and Complete Removal

In addition to information and intervention, this alternative would include complete removal and disposal of soil that exceeds action levels. The depth of contaminated soil is expected to vary considerably within the Basin, but complete removal is considered to be excavation of residential yard and garden areas to a depth of 4 feet. If warranted, structure exteriors would be pressure-washed to reduce the potential for recontamination from lead-based paint. This alternative would include backfilling the properties with clean soil to re-establish site grades and revegetating the reclaimed ground surface. It would also include interim dust control during soil excavation. This alternative is not envisioned for recreational areas.

9.1.2 Drinking Water Alternatives

Drinking Water Alternative W1—No Action

This alternative would leave contaminated drinking water sources in place with no changes in existing use. It would take no action to prevent exposure to COCs in drinking water, and would provide no information or education to exposed residents. The no action alternative provides a baseline from which to compare the action alternatives.

Drinking Water Alternative W2—Public Information

This alternative would include pamphlet distribution, press releases, public meetings, and publicly posted notices to inform the public of risk mitigation and new risk information and solicit public input and involvement. This alternative would require an ongoing effort and would be intended primarily for use at the community level. It is generally not considered feasible for individual residences, except for raising general awareness of risks.

Drinking Water Alternative W3—Public Information and Residential Treatment

In addition to public information, this alternative would include wellhead filtration (if applicable) and point-of-use filtration. Filters would be placed at each tap or other point of use in residences. If possible, a single filter would be placed on the main residence service line to avoid potential confusion and change-out costs for multiple filters. A change-out program would be required to ensure that filters are changed on the required schedule.

Drinking Water Alternative W4—Public Information and Alternative Source, Public Water Utility

In addition to public information, this alternative would include constructing drinking water conveyances from public water utilities to residences or common-use areas. Information programs would be used to better inform residents about lead risks from in-home plumbing.

Drinking Water Alternative W5—Public Information and Alternative Source, Groundwater

For properties currently supplied by contaminated water wells or other unregulated sources this alternative would include (in addition to public information) constructing new wells into a suitable alternative aquifer, installing necessary appurtenances, and abandoning existing contaminated wells. The suitability of the alternative aquifer (for example, water yield and quality) would need to be evaluated before drilling any new wells. After well construction, groundwater sampling would be conducted to verify that new wells supply water capable of achieving the RAOs. Subsequent monitoring would also be conducted to ensure continual achievement of RAOs. Information programs would be used to better inform residents about lead risks from in-home plumbing.

Drinking Water Alternative W6—Public Information and Multiple Alternative Sources

This alternative would include public information, in addition to one of the above-described alternatives, depending on geographic issues. For areas inside water districts, the alternative would provide individual residences or common areas with a hookup to the existing public conveyance system. For areas outside water districts (mostly in the tributary gulches), it is assumed that public water utilities will not be able to provide an alternative water source because of the annexation and engineering issues of constructing distribution systems; therefore, the assumed alternative for these areas would be to provide either point-of-use treatment or new groundwater wells. Alternative W6 would include a survey of residences during remedial design to determine whether they were served by public water utilities, and to determine residences at which COCs in drinking water exceed maximum contaminant levels.

9.1.3 House Dust Alternatives

House Dust Alternative D1—No Action

The No Action alternative would leave contaminated house dust in place and would not change existing conditions. It would take no action to prevent exposure, and provide no information or education to exposed residents. The no action alternative provides a baseline from which to compare the action alternatives.

House Dust Alternative D2—Information and Intervention and Vacuum Loan Program/Dust Mats

This alternative has three major components. First, information and intervention for house dust would include pamphlet distribution, press releases, public meetings, and publicly-posted notices to inform the public of remedial actions and to provide exposure education. In addition, public input and involvement would be sought. This program has been administered as part of the PHD’s Lead Health Intervention Program in the Bunker Hill Box for approximately 15 years and throughout the basin since 1996. The second component of this alternative would be initiation of a Vacuum Loan Program similar to the one used in the Bunker Hill Box, which allows residents to use a heavy-duty vacuum cleaner equipped with high-efficiency particulate air (HEPA) filters. The third component would be free dust mats for entryways, which would be provided to residents to reduce tracking exterior dust into the home. Monitoring would also be conducted to ensure continued achievement of RAOs.

House Dust Alternative D3—Information and Intervention, Vacuum Loan Program/Dust Mats, Interior Source Removal, and Contingency Capping/More Extensive Cleaning

In addition to the components of Alternative D2, this alternative would include interior cleaning, and removing and replacing some household items that are either difficult to clean effectively or which provide a source for recontamination. Interior cleaning would include a one-time cleaning of hard surfaces and heating and cooling systems and removal and replacement of major interior dust sources such as carpet and some soft furniture. In addition, this alternative would consider crawl spaces, attics, and basements. Contaminated crawl spaces would be capped with a sand or synthetic cover to prevent generation of dust and tracking of soil into the home. Accessible attics and basements would also be cleaned. The exact scope of this alternative will depend on the conditions of each residence. These activities would occur only after exterior sources of contamination had been permanently remediated, to ensure cost-effectiveness and prevent recontamination. Based on observations from yard remediation in the Bunker Hill Box, once exterior yard soil is cleaned up, relatively few homes (a maximum of 20 percent of the homes that required yard cleanup, or about 100 to 200 homes) are expected to require the additional interior cleaning provided by Alternative D3. Temporary relocation of residents might be required during cleaning to protect their safety. Monitoring would also be conducted to ensure that RAOs continue to be achieved after the Selected Remedy is implemented.

9.1.4 Aquatic Food Sources Alternatives

Aquatic Food Sources Alternative F1—No Action

This alternative would take no action to address the potential human health risk to residents and tribal members of eating contaminated fish. It would take no action to prevent exposure and provide no information or education to people likely to consume contaminated fish. The no action alternative provides a baseline from which to compare the action alternatives.

Aquatic Food Sources Alternative F2—Information and Intervention

In addition to the information and intervention efforts of other alternatives, this alternative would educate fishermen and other recreational users of the potential health risk of consuming contaminated fish caught in waterways and wetlands. All printed materials, press releases, and public meetings developed to inform the public of basin metals issues would include information about the fish risks, how to reduce exposure, prevention, and other pertinent issues. Fish hazard information programs would be expanded to the Coeur d'Alene Indian Reservation communities, as appropriate, to ensure that tribal members are kept informed. Targeted community education programs would be implemented in Benewah, Kootenai, and Shoshone Counties. A well-maintained signage program to educate fishermen and other water users of metals hazards would be implemented at all river/lake access sites and common use areas, including the Coeur d'Alene

River Trail system corridor. Idaho Department of Fish and Game, Idaho State Parks, USFS, and BLM field personnel who regularly contact basin fishermen and recreational users would be trained in metals risk management and supplied with appropriate pamphlets and signs.

Aquatic Food Sources Alternative F3—Information and Intervention and Monitoring

This alternative would build on the efforts of informing and educating fishermen of risks from consumption of metals-contaminated fish included under Alternative F2. An effort to gain more fish metals load data from each of the lateral lakes, the South Fork, lower Coeur d'Alene River, and Coeur d'Alene Lake is the keystone of this alternative. The current limited fish flesh data from three lateral lakes would be expanded so that lake-specific recommendations and intervention can be accurately provided to the public. Surface waters and fish species that are totally free of metals risks would be identified and highlighted. As basin cleanup and mitigation efforts proceed, periodic resampling would provide valuable effectiveness monitoring data for biological response to cleaner waters, sediment, and upstream soils. A trained seasonal "river ranger" program would be instituted to make daily contacts with fishermen and boaters to inform and educate them of metals hazards and prevention methods. Fishermen would be directed to lakes or rivers where fish metals risks are known to be the lowest.

9.2 ECOLOGICAL ALTERNATIVES FOR THE UPPER BASIN AND LOWER BASIN

Six ecological alternatives were developed for the Upper Basin and Lower Basin. These are:

- Alternative 1—No Action
- Alternative 2—Contain/Stabilize with Limited Removal and Treatment
- Alternative 3—More Extensive Removal, Disposal, and Treatment
- Alternative 4—Maximum Removal, Disposal, and Treatment
- Alternative 5—State of Idaho Cleanup Plan
- Alternative 6—Mining Companies Cleanup Plan

Remedial actions were identified for various contamination sources under each of the alternatives. Table 9.2-1 describes the generalized approach each alternative takes to remediating source types.

Each alternative consisted of typical conceptual designs (TCDs) that are applied on a site-by-site basis. Table 9.2-2 presents descriptions of TCDs used with Alternatives 2, 3, and 4. Tables 9.2-3, 9.2-4, and 9.2-5 present unit costs for these TCDs. Tables 9.2-6 and 9.2-7 present descriptions and unit costs of TCDs used with Alternatives 5 and 6, respectively. The TCDs associated with these alternatives vary in design details from the TCDs used to develop Alternatives 2, 3, and 4. As a result, the unit costs are different.

Table 9.2-8 presents a summary of the volumes of waste material addressed by each of the alternatives. Table 9.2-9 summarizes the numbers of acres of waterfowl feeding area contaminated with lead at concentrations exceeding the LOAEL for waterfowl (530 mg/kg) that are addressed by each of the alternatives.

For the purpose of comparing the effectiveness of the six alternatives, estimates were made of the reduction in zinc loads at the completion of remedy implementation (USEPA 2001f). The estimates were made for the South Fork at Pinehurst and the Coeur d'Alene River at Harrison, and do not include sources within the Bunker Hill Box. The results are shown in Table 9.2-10. Alternative 4 is estimated to result in the greatest reduction in zinc load following remedy implementation: a 73 percent reduction at Pinehurst and a 64 percent reduction at Harrison. Alternative 3 is predicted to result in about 15 and 11 percent smaller reductions in zinc loads compared to Alternative 4 at Pinehurst and Harrison, respectively. Alternative 2 is predicted to result in about a 59 percent smaller reduction in zinc load compared to Alternative 4 at both Pinehurst and Harrison. Alternatives 5, 6, and 1 result in increasingly smaller reductions in zinc load.

Alternative 1—No Action

Alternative 1 includes no actions to control exposures of ecological receptors to contaminants. Risks to fish and other aquatic receptors, birds, and terrestrial receptors would continue to exist for the foreseeable future.

Alternative 2—Contain/Stabilize with Limited Removal and Treatment

Actions are generally aimed at controlling sources having the highest metal loadings to groundwater and surface water and the highest levels of ecological exposure. Limited removals and in-place and on-site waste containment would be used to control ecological and human exposures and metal transport via erosion and leachate loading to groundwater and surface water. Bioengineering would be used to provide bank and stream stabilization, control erosion of contaminated sediments, and support natural recovery of riverine and riparian habitat. Chemical treatment would be limited to passive treatment of drainage from the adits that are the major metals loaders and of groundwater collected as part of hydraulic isolation (limited to the Hecla-Star tailings pounds in Canyon Creek and the Cataldo/Mission Flats dredge spoil area). Residual risks would be associated with contaminated media left in place or only partially contained.

Alternative 3—More Extensive Removal, Disposal, and Treatment

Alternative 3 would extend the level of cleanup included under Alternative 2 through the use of more extensive and effective removal, containment, and treatment, including:

- Regional repositories for disposal of contaminated materials excavated from source areas in the Upper Basin
- A regional active water treatment plant for treatment of collected groundwater, leachate, and adit drainage water
- More extensive use of hydraulic isolation, including inaccessible current and historic 100-year floodplain sediments and additional tailings impoundments in the Upper Basin
- Comprehensive removal of river bed and bank sediments

A passive treatment pond near the mouth of Canyon Creek is also included as part of Alternative 3. The pond would be used to reduce metal loadings to the South Fork before upstream source control was accomplished.

Disposal of materials removed from the Lower Basin (including river banks, levees, and beds; wetlands; and lateral lakes) would be at a regional repository or by confined aquatic disposal (CAD).

Alternative 4—Maximum Removal, Disposal, and Treatment

Alternative 4 would include removal of sources to the maximum practical extent with disposal in regional repositories. It would extend the use of active water treatment, and employ hydraulic isolation to contain metals within floodplain sediments. Residual risks resulting from contaminated materials left in place or only partially contained would be minimized to the greatest extent practicable.

Alternative 5—State of Idaho Plan

Alternative 5, developed by IDEQ, would focus on containing or stabilizing the largest sources of metals loading to surface water. Alternative 5 includes measures similar to Alternatives 2 and 3; it includes regional repositories and passive water treatment, but does not include an active water treatment plant. In developing the alternative, IDEQ sought to achieve a balance between benefit, cost, and impact to the environment in both the long term and short term.

Alternative 6—Mining Companies Plan

Alternative 6 consists of prioritized actions primarily focused on regrading or removing source material from water courses to reduce erosion and the potential for contact with surface and groundwater that could result in leaching and surface water loading. Local areas of bioengineered and vegetative stream bank stabilization are included. Mine water management and/or passive treatment are included for four major adits. Regional repositories and active water treatment plants are not included.

9.3 COEUR D'ALENE LAKE

Two alternatives were developed for Coeur d'Alene Lake. These are:

- Alternative 1—No Action
- Alternative 2—Institutional Controls

As described in Sections 5.2.3 and 7.1.2, Harrison Beach, which is the subject of cleanup as part of the UPRR action, is the only area evaluated that had risks exceeding target health goals. Consequently, alternatives were not developed for protection of human health.

As described in the FS (USEPA 2001c), active remediation (e.g., dredging, capping) of lakebed sediments was not retained for alternative development based on technical implementability and cost. Although a large volume of contaminated sediments are present in the lake bottom, under current conditions, more metals enter the lake annually from the Coeur d'Alene River than flow out of the lake into the Spokane River.

Alternative 1—No Action

The no action alternative is developed to provide a basis for comparing existing and future environmental impacts that would be present if no remedy is implemented in Coeur d'Alene Lake. Alternative 1 would include monitoring.

Alternative 2—Institutional Controls

This alternative includes institutional controls such as signage, monitoring, and implementation of the Lake Management Plan (Coeur d'Alene Tribe, et al. 1996). The latter is summarized in the following paragraphs.

A lake management study was initiated in 1991. One of the objectives of this study was to develop a lake management plan that would identify actions needed to achieve water quality goals. It was not deemed appropriate to apply a single water management strategy to the entire lake, therefore, the lake was divided into the following four water quality management zones:

- **Nearshore** (water depths less than 20 feet)
- **Shallow, southern lake** (south of the mouth of the Coeur d'Alene River and including the shallow lakes such as Benewah, Chatcolet, Hidden, and Round)
- **Lower rivers** (lower reaches of the St. Joe and Coeur d'Alene Rivers that are affected by backwater from the lake)
- **Deep, open water** (north of the mouth of the Coeur d'Alene River)

Management goals for the nearshore zone primarily involve implementation of best management practices to control erosion from watersheds that feed the lake. Residential and municipal sewer systems will also be addressed to reduce nutrient loadings entering the lake from these sources.

In the shallow, southern lake, best management practices would also be employed to reduce sediments entering the lake through erosion from littoral areas of the lake, riverbanks, and watersheds. Where necessary, municipal water treatment plants would be upgraded to reduce nutrient contributions to the lake. Establishment of "no wake" zones was suggested in the Lake Management Plan for erosional stream banks.

The principal focus of the Lake Management Plan in the lower Coeur d'Alene River is to reduce riverbank erosion. This would be accomplished through bank stabilization.

In the deep, open water zone, management practices to improve water and sediment quality would primarily be those employed in the other three zones. Deep waters in the lake would be a beneficiary of actions taken to reduce erosion and nutrient loading from within the Basin.

9.4 SPOKANE RIVER

Five alternatives have been developed for the Spokane River upstream of the Spokane Indian Reservation. These are:

- Alternative 1—No Action
- Alternative 2—Institutional Controls
- Alternative 3—Containment with Limited Removal and Disposal

- Alternative 4—More Extensive Removal, Disposal, and Treatment
- Alternative 5—Maximum Removal and Disposal

The State of Idaho and the Mining Companies did not develop cleanup plans for the Spokane River.

Alternatives for the Spokane River address both human health and ecological protection and were developed based on specific input from the State of Washington. The scope of the alternatives is limited to sites from the Washington/Idaho border downstream to Upriver Dam. The Washington State Department of Ecology, EPA, the Spokane Tribe, and the U.S. Department of Interior are continuing to evaluate the river downstream of Upriver Dam, and the need for actions in these areas will be considered in the future.

Alternative 1—No Action

Alternative 1 includes no actions to control exposures of humans and ecological receptors to contaminants. Risks to humans, fish and other aquatic receptors, birds, and terrestrial receptors would continue to exist for the foreseeable future.

Alternative 2—Institutional Controls

Institutional controls would include the maintenance of the existing health postings and advisories at beaches and restriction of vehicular access at certain key locations. Although pedestrian access to the sites would not be restricted, the postings and advisories may encourage some individuals to reduce their exposure to the contaminated deposits. Restricting vehicular access would help reduce erosion of the contaminated deposits and allow vegetation to naturally re-establish.

Alternative 3—Containment with Limited Removal and Disposal

Alternative 3 includes actions focused on addressing potential human health risks. Containment actions, supplemented by removals where necessary, would be used to reduce or eliminate the direct contact and ingestion human health exposure pathways. Beach material posing potential human health risks would generally be left in place and covered with a clean layer of imported beach material. In locations where habitat may be adversely affected by the grade changes created by a cover, other actions such as excavation and disposal, or excavation and on-site consolidation, would be used. In these areas, the excavated areas would be backfilled with suitable material to restore desired grades and elevations. In-stream sediments would receive no action under Alternative 3.

Alternative 4—More Extensive Removal, Disposal, and Containment

Alternative 4 includes actions to address potential human health risks and ecological risks. Actions for beach and bank deposits would include all areas addressed under Alternative 3, as well as critical habitat areas that may pose significant ecological risks. The affected beach and bank materials would be excavated and disposed of off-site, permanently eliminating the human health and ecological exposure pathways of concern. All excavated areas would be backfilled with suitable material, to restore desired grades and elevations. In-stream sediments (behind Upriver Dam) exceeding PRGs would be capped to minimize direct ecological exposures.

Alternative 5—Maximum Removal and Disposal

Alternative 5 includes more extensive beach and in-stream sediment cleanup actions to remove, where practicable, all materials posing significant human health or ecological risks. The affected beach and bank materials would be excavated and disposed of off-site, permanently eliminating the human health and ecological exposure pathways of concern. All excavated areas would be backfilled with suitable material, to restore desired grades and elevations. In-stream sediments behind Upriver Dam that exceed PRGs would be dredged and disposed of off-site, eliminating the ecological exposures of concern.

Table 9.2-1
Summary of Ecological Alternatives Developed for the Upper and Lower Basins

Source/Area	Alternative 2 Contain/Stabilize with Limited Removal and Treatment	Alternative 3 More Extensive Removal, Disposal, and Treatment	Alternative 4 Maximum Removal, Disposal, and Treatment	Alternative 5 State of Idaho Cleanup Plan	Alternative 6 Mining Companies Cleanup Plan
Upper Basin					
Floodplain Sediment	Removals of tailings-impacted deposits in the current 100-year floodplain (excluding in-stream deposits) with disposal in local repositories; bank and stream stabilization using bioengineering methods	Same as Alternative 2 plus removal of accessible tailings-impacted deposits on the channel-side of I-90, with disposal in regional repositories;[a] selected areas of hydraulic isolation with treatment of groundwater in a regional water treatment plant;[b] and passive treatment of Canyon Creek surface water[d]	Same as Alternative 3 but with maximum removal of tailings-impacted deposits and maximum use of hydraulic isolation with treatment of groundwater at a regional water treatment plant[c]	Selected removals from the 100-year floodplain, with capping; bioengineering and vegetative stabilization of selected stream banks and floodplains; selected use of riprap.	Limited removals; bank and stream stabilization using bioengineering methods
Tailings Piles/ Impoundments	Regrading and capping in place, as practical; otherwise, removal with disposal in on site or local repositories. Hydraulic isolation used for the Hecla-Star tailings impoundments in Canyon Creek	Similar to Alternative 2 but greater use of removals with disposal in on-site, local, or regional repositories; and greater use of hydraulic isolation	Maximum excavation and use of regional repositories	Removal from the 100-year floodplain with disposal in local or regional repositories; in-place closure of existing impoundments	Soil cover in place; limited removal (Hecla-Star complex at Burke) with disposal in an offsite repository

Table 9.2-1 (Continued)
Summary of Ecological Alternatives Developed for the Upper and Lower Basins

Source/Area	Alternative 2 Contain/Stabilize with Limited Removal and Treatment	Alternative 3 More Extensive Removal, Disposal, and Treatment	Alternative 4 Maximum Removal, Disposal, and Treatment	Alternative 5 State of Idaho Cleanup Plan	Alternative 6 Mining Companies Cleanup Plan
Upper Basin (Continued)					
Waste Rock Piles	Within the 100-year floodplain, in-place regrading and capping, as practical, or removal; no action otherwise	Similar to Alternative 2 but with more removal and less regrading	Removal from the 100-yr floodplain with disposal in regional repositories; regrading and vegetative cover otherwise.	Regrading or relocation out of the 100-year floodplain, with selected capping	Removal from the 100-yr floodplain; no action otherwise
Adits	Major load sources—Treatment using passive, on-site technologies Minor load sources—No action	Major Load Sources—Collection and conveyance to a regional water treatment plant Minor Load Sources—Treatment using passive, on-site technologies	Major load sources—Same as Alternative 3, but applied to more adits Minor load sources—Same as Alternative 3, but applied to more adits	Major load sources (14 total)—Treatment using passive, on-site technologies Minor load sources—No action	Major load sources—Infiltration and water level control followed by wetland treatment if necessary Minor load sources—No action
Lower Basin					
River Banks and Levees	Partial removal of contaminated "bank wedges" with disposal in a regional repository at Cataldo/Mission Flats	Complete removal of contaminated "bank wedges;" disposal in a regional repository at Cataldo/Mission Flats or consolidation using CAD (confined aquatic disposal) in one or more of the lateral lakes	Same as Alternative 3	Partial removal and stabilization by grading and bioengineering. Implementation of a river management plan to prevent unacceptable erosion of the banks.	Revegetation, bioengineering, and limited removals based on susceptibility of banks to erosion.

Table 9.2-1 (Continued)
Summary of Ecological Alternatives Developed for the Upper and Lower Basins

Source/Area	Alternative 2 Contain/Stabilize with Limited Removal and Treatment	Alternative 3 More Extensive Removal, Disposal, and Treatment	Alternative 4 Maximum Removal, Disposal, and Treatment	Alternative 5 State of Idaho Cleanup Plan	Alternative 6 Mining Companies Cleanup Plan
Lower Basin (Continued)					
River Bed	No action	Complete removal of affected sediments; same disposal options as for river banks and levees	Same as Alternative 3	Partial removal and disposal of contaminated sediments to eliminate hot spots and create hydraulic capacity as needed.	No action
Wetlands	Strobl Marsh and Thompson Marsh—Limited removals, capping and protective dikes to control potential re-contamination from flood events	Strobl Marsh, Campbell Marsh, Orling Slough, Hidden Marsh, Moffit Slough, Thompson Marsh, Lane Marsh, and wetland areas of Thompson, Killarney, Swan, and Medicine Lakes—Sediment removal; same disposal options as for river removals; revegetation with native plants and soil amendments	Maximum sediment removal; revegetation with native plants and soil amendments; disposal same as for Alternative 3	Spot removals, capping and/or chemical treatments and re-vegetation in areas with high lead concentrations and high use by water fowl, including within or surrounding Orling Slough, Strobl Marsh, Lane Marsh (including seven splay areas), Hidden Marsh, Campbell Marsh, Thompson Marsh, Moffit Slough; Medicine Lake, Swan Lake, and Thompson Lake.	Habitat shifting techniques, and consideration of selective in situ chemical stabilization and/or capping with biosolid material of some of the most lead-enriched sediments

Table 9.2-1 (Continued)
Summary of Ecological Alternatives Developed for the Upper and Lower Basins

Source/Area	Alternative 2 Contain/Stabilize with Limited Removal and Treatment	Alternative 3 More Extensive Removal, Disposal, and Treatment	Alternative 4 Maximum Removal, Disposal, and Treatment	Alternative 5 State of Idaho Cleanup Plan	Alternative 6 Mining Companies Cleanup Plan
Lower Basin (Continued)					
Lateral Lakes	Thompson Lake—Dredging from the shore to a water depth of approximately 6 feet with disposal in a repository adjacent to the lake	Thompson, Killarney, Swan, and Medicine Lakes—Dredging from the shore to water depths of about six feet; same disposal options as for river removals	Maximum dredging; disposal same as for Alternative 3	Included with wetlands	Similar to wetlands
Other Floodplain Areas	Soil amendments to promote vegetation for erosion control and chemical stabilization to reduce metal availability to ecological receptors and transport to surface water	Sediment removal; disposal in a local repository at Cataldo/Mission Flats; revegetation with native plants and soil amendments	Same as wetlands	Soil treatment and re-vegetation for highly contaminated areas	Similar to wetlands
Cataldo/Mission Flats	Hydraulic isolation (using a groundwater cutoff wall with a reactive barrier for passive in situ treatment of groundwater); surface water diversion structures, as needed; amend soils to provide a suitable growth medium combined with planting of suitable vegetation. Construction of an engineered repository for disposal of river bank, levee, and wetland removals.	Same as Alternative 2 except treatment of groundwater at a regional water treatment plant	Removal and disposal in an on-site regional repository	Groundwater cutoff walls; spot removals, soil treatment and re-vegetation	No action

Table 9.2-1 (Continued)
Summary of Ecological Alternatives Developed for the Upper and Lower Basins

[a] Regional repositories in Canyon Creek, Ninemile Creek, and along the South Fork Coeur d'Alene River, in addition to the Lower Basin

[b] Active water treatment assumes high-density sludge hydroxide precipitation with media filtration, processes that are similar to what is being used for the BHSS Central Treatment Plant. It is assumed that the regional treatment plant would be located near Pinehurst. Pipelines would be used in Canyon Creek, Ninemile Creek, and the South Fork Coeur d'Alene River to transport collected adit discharge and groundwater to the regional treatment plant. Collected groundwater from the Cataldo/Mission Flats dredge disposal area would be pumped to the regional treatment plant.

[c] One plant located near Pinehurst as for Alternative 3

[d] Passive treatment of surface water diverted from lower Canyon Creek. Assumed capacity of 60 cfs, and flows greater than 60 cfs would be bypassed.

Table 9.2-2
Descriptions of Typical Conceptual Designs (TCDs) Used with Alternatives 2, 3, and 4

TCD	Purpose	Application Criteria
Excavation	Removal of materials from areas where they are subject to erosion or leaching.	Tailings, waste rock mixtures, contaminated floodplain sediments, and waste rock piles that are potentially erodable or significant sources of metals loading.
Regrade/Consolidate/ Vegetative Cover	Isolate waste from human or ecological contact Decrease potential for erosion of waste Doesn't significantly decrease infiltration	Erodable or otherwise unstable waste rock piles without significant leaching potential under Alts 2 and 3. Waste rock with minimal leaching potential under Alt 4.
Low Permeability Cap	Significantly reduce infiltration	Contaminated sediments, tailings, waste rock and waste rock/tailings mixtures that are potentially significant sources of metals loading under Alt 2. Waste rock and waste rock/tailings mixtures that are not potential significant sources of metals loading under Alts 3 and 4.
Low Permeability Cap with Erosion Protection	Significantly reduce infiltration + minimize erosion of waste below the nominal 100-year flood level at sites where relocation above the flood level could not be implemented due to steep ground slopes.	Waste rock or waste rock/tailings mixtures that are not significant sources of metal loading under Alt 2. Waste rock piles subject to erosion that are remotely located or relatively small sources of metals loading under Alt 3. Would not be used under Alt 4.
Local Repository Above Flood Level	Provide a relatively high degree of protectiveness for wastes that are potentially significant sources of metals loading.	Used for contaminated sediments, tailings, and tailings/waste rock mixtures under Alt 2. Used for tailings and tailings/waste rock mixtures under Alt 3. Used for waste rock with erosion or leaching potential under Alt 4.
Regional Repository	Provide the highest level of protection among the containment TCDs.	Used for tailings and contaminated sediments under Alt 3. More general use under Alt 4, including all tailings, all tailings/waste rock mixtures that are potentially significant sources of metals loading, all floodplain sediments containing levels of metals above PRGs, and all tailings currently contained in abandoned tailings impoundments. May also be used for some lower-level wastes where it is the most cost effective TCD.
Tailings Impoundment Closure	To address the closure of abandoned tailings impoundments or cells under Alternatives 2 and 3.	All abandoned tailings impoundments and cells under Alts 2 and 3.

Table 9.2-2 (Continued)
Descriptions of Typical Conceptual Designs (TCDs) Used with Alternatives 2, 3, and 4

TCD	Purpose	Application Criteria
Hydraulic Isolation Using Slurry Wall	To minimize the discharge of contaminated groundwater to the surface water system, thereby reducing the dissolved metals loading to the surface water system.	Areas where metals impacts to groundwater are not controlled by removal and containment of source materials under Alts 3 and 4.
Hydroxide Precipitation with Media Filtration	To remove heavy metals from an aqueous stream using active treatment.	Active treatment used to provide relatively high metals removal rates and treatment reliability for water containing high metals loads. It would also be used for treating flow rates in excess of those that could practically be treated using passive treatment. Active treatment used under Alts. 3 and 4 for adits identified as major loaders, leachate from regional repositories, and contaminated groundwater.
Permeable Reactive Barrier	To remove metals through adsorption/precipitation reactions using apatite or another chemical reagent within a permeable reactive barrier or treatment bed. Typically for oxidizing or low iron conditions.	Generally applicable for lower flow volumes such as drainage from adits, seeps, leachate from repositories, and runoff from waste piles. Used under Alt 2 for adits identified as major loaders. Used under Alts 3 and 4 for adits not identified as major loaders, but discharging metals at levels of concern. Potentially used for leachate from repositories and contaminated groundwater under Alternatives 3 and 4.
Passive Treatment Pond	To remove metals from surface water using passive treatment	Used to treat moderate to high surface water flow rates under Alternative 3. Storm flows would typically not be treated. Used where source-by-source treatment is very costly and/or difficult to implement.
Current Deflector	Directs stream energy away from erodable areas, or uses series of deflectors to dissipate stream energy. Creates scour holes, pools and other habitat features. May be oriented to serve as sediment traps.	Apply throughout Upper Basin where stream bank and bedload stabilization, and dissipation of stream energy is desirable.
Bank Stabilization Using Bioengineered Revetments	Protects eroding streambanks or rehabilitates banks after excavation.	Applicable in low to high energy stream environments in Upper Basin
Vegetative Bank Stabilization	Stabilizes eroding streambanks or reconstructs them after excavation and removal of bank material. Rock toe prevents undermining.	Applicable in low energy stream environments in Upper Basin and Lower Basin. May be used in higher-energy stream environments in conjunction with current deflectors.

Table 9.2-2 (Continued)
Descriptions of Typical Conceptual Designs (TCDs) Used with Alternatives 2, 3, and 4

TCD	Purpose	Application Criteria
Floodplain/Riparian Planting	Stabilize exposed floodplains, or floodplains disturbed by remedial activities.	Applicable in floodplain areas in the Upper Basin and Lower Basin.
Off-Channel Hydrologic Features	Attenuate stream energy during high flow periods; improve habitat for aquatic and riparian species.	Applicable in floodplain areas in Upper Basin where extensive remedial excavation occurs.
Channel Realignment	Alter stream channel to form a more stable morphology	Primarily applicable in lower-gradient stream reaches in the Upper Basin.
Soil Amendment	Modify surface soil so that it will support vegetative growth by using nutrients and other amendments.	Apply in non-wetland floodplain areas such as existing or historical agricultural and grazing lands.
Subaqueous Disposal	Contain dredge spoils in an area where they are isolated from the environment and from potential receptors including fish and diving waterfowl.	Applicable to lacustrine sediments and potentially to wetland sediments. Need sufficient water depth and area for volume of dredge spoils and sufficient material for a clean cap. Need community acceptance of subaqueous disposal as an option.
Dredge and Barge	Remove contaminated sediment from lacustrine and palustrine environments and transport the material to a disposal facility.	Dredging is applicable to sediment with concentrations exceeding an action level in locations that are accessible to dredging equipment. This TCD could be applied to all sediment or to a subset such as sediments within a depth window accessed by diving waterfowl.
Dredge and Pipeline	Same as above	Same as above (dredging). Selection of conveyance equipment would be based on economic and material availability and suitability to a particular site.
Sediment Trap	Remove contaminated bedload and suspended load from the river to prevent it from spreading to downstream locations.	Applicable to areas where the river has historically left its banks. Used to collect sediment in a controlled manner before it spreads over the floodplain.
Hydraulic Control Structure	Control flow of water and sediments between the river and adjacent lakes and wetland areas.	Applicable to existing or proposed connections between the river and adjacent water bodies where water flow or sediment transport could lead to re-contamination prior to complete source control in upstream source areas.
Local Repository (Lower Basin)	Contain dredge spoils in an area where they are isolated from the environment and from potential receptors including fish and diving waterfowl.	Applicable to lacustrine sediments and potentially to wetland sediments. Need sufficient water depth and area for volume of dredge spoils and sufficient material for a clean cap. Need community acceptance of subaqueous disposal as an option.

Table 9.2-2 (Continued)
Descriptions of Typical Conceptual Designs (TCDs) Used with Alternatives 2, 3, and 4

TCD	Purpose	Application Criteria
Dike/Levee Enhancement	To heighten a levee system to protect back-levee areas from flooding.	Applicable prior to source control to protect back-levee areas. Applicable when the existing levee, if any, is too low, or where no levee exists.
Wetland Cap	To isolate contaminated materials in place.	Applicable to wetland or floodplain areas where installing a cap provides a sufficient level of protectiveness and leaching of contaminants to groundwater is not a significant concern. Applicable in relatively quiescent areas that are protected from recontamination.

Table 9.2-3
Summary of Estimated Unit Costs for Removal, Containment, and Treatment TCDs
Alternatives 2, 3, and 4

TCD	Description	Unit	Direct Capital Costs	Indirect Capital Costs	Annual O&M Costs
Removal and Containment TCDs					
C1	Excavation	CY	$2.70	$1.60	$0
C1a	Excavation Below Water Table	CY	$26.00	$16.00	$0
C1b	Sediment Excavation	CY	$10.00	$6.00	$0
C2a	Regrade/Consolidate/Revegetate	AC	$56,000	$34,000	$565
C2b	Regrade/Consolidate/Revegetate	AC	$110,000	$66,000	$1,100
C2c	Erosion Protection	AC	$11,000	$6,600	$200
C3	Low Permeability GCL Cap	AC	$151,000	$91,000	$1,500
C4	Low Permeability GCL Cap w/Seepage Coll & Trmt	AC	$170,000	$100,000	$3,100
C5	Low Permeability GCL Cap w/Erosion Protection	AC	$170,000	$100,000	$3,100
C6*	Local Repository w/Erosion Protection	CY	$10.40	$6.20	$0.19
C7*	Local Repository Above Flood Level	CY	$9.70	$5.80	$0.18
C8a*	Regional Repository, 1 million cy	CY	$13.10	$7.90	$0.24
C8b*	Regional Repository, 10 million cy	CY	$7.70	$4.60	$0.11
C8c*	Regional Repository, 50 million cy	CY	$6.20	$3.70	$0.07
C9	Tailings Impoundment Closure	AC	$170,000	$100,000	$2,700
C10	Adit Drainage Collection	LS	$6,200	$3,700	$88
C11	Hydraulic Isolation Using Slurry Wall	LF	$280	$168	$9
C12	Hydraulic Isolation Using Lined Channel	LF	$500	$300	$16.10
OTHER					
HAUL-1	Haul to Repository	CY-MI	$0.89	$0.53	$0
ACC-1	Temporary Access Road	MI	$200,000	$120,000	Assume road will not be maintained.
Active Treatment TCDs					
CONVEYANCE					
PIPE-1	Conveyance Pipeline-6”	LF	$39	$23.00	$0.24
PIPE-2	Conveyance Pipeline-12”	LF	$58	$35	$0.35
PIPE-3	Conveyance Pipeline-24”	LF	$94	$56	$0.57
PIPE-4	HDPE Conveyance Pipeline Cost Factor, $/dia- in.	DIA IN	$5.10	$3.10	$0.03
PRIMARY ACTIVE TREATMENT: HIGH DENSITY SLUDGE HYDROXIDE PRECIPITATION					
Variations with Media Filtration					
TRMT-1a	5,000 gpm	GPM	$2,180	$1,640	$352
TRMT-1b	45,000 gpm	GPM	$1,190	$893	$192
TRMT-2a	w/Sulfide Feed - 5,000 gpm	GPM	$2,270	$1,700	$366
TRMT-2b	w/Sulfide Feed - 45,000 gpm	GPM	$1,230	$923	$198
Variations with Microfiltration					
TRMT-3a	5,000 gpm	GPM	$3,550	$2,660	$573
TRMT-3b	45,000 gpm	GPM	$2,580	$1,940	$416
TRMT-4a	w/Sulfide Feed - 5,000 gpm	GPM	$3,650	$2,740	$589
TRMT-4b	w/Sulfide Feed - 45,000 gpm	GPM	$2,620	$1,970	$423

Table 9.2-3 (Continued)
Summary of Estimated Unit Costs for Removal, Containment, and Treatment TCDs
Alternatives 2, 3, and 4

TCD	Description	Unit	Direct Capital Costs	Indirect Capital Costs	Annual O&M Costs
Passive and In-Situ Treatment TCDs					
PASSIVE TREATMENT					
PT-1a	Permeable Reactive Trench w/Apatite	CY	$440	$264	$213
PT-1b	Permeable Reactive Trench w/Organic Mixture	CY	$51	$31	$45
PT-2a	Permeable Reactive Bed w/Apatite	CY	$530	$318	$256
PT-2b	Permeable Reactive Bed w/Organic Mixture	CY	$53	$32	$47
PT-3	Aerobic Wetland	MSF	$2,700	$1,600	$436
PT-4	Anaerobic Wetland	MSF	$7,700	$4,600	$5,800
IN-SITU TREATMENT					
PT-5a	Shallow Soil Mixing	CY	$12	$7.20	$0.20
PT-5b	Deep Soil Mixing w/Deep Tiller	CY	$16	$9.60	$0.30
PT-5c	Deep Soil Mixing w/Excavator	CY	$22	$13	$0.40
PT-5d	Deep Soil Mixing w/Auger	CY	$52	$31	$1.10
PT-6a	Underwater Applied with Barge	MSF	$840	$504	$16.90
PT-6b	Underwater Applied with Spreader or Diffuser	MSF	$850	$510	$17
PT-6c	Underwater Applied w/ Spray Equipment from Shore	MSF	$820	$492	$16.50
Human Health TCDs					
HH1	Access Restrictions (Fence)	LF	$25	$15	$0.20
HH2	Upland Waste Pile Soil Cover	AC	$43,000	$26,000	$433
HH3	Millsite Decontamination	LS	$100,000	$60,000	$403
HH4	Millsite Demolition/Disposal	CY	$120	$72	$1.20

* Does not include haul costs

Notes:
AC - acre
CY - cubic yard
CY-MI - cubic yard - mile
DIA INCH - diameter inch
EA - each
GPM - gallons per minute
LF - linear foot
LS - lump sum
MI - mile
MSF - thousand square feet
TCD - typical conceptual design

Table 9.2-4
Summary of Estimated Bioengineering TCD Unit Costs, Alternatives 2, 3, and 4

Unit Price Code/TCD	Description	Unit	Direct Capital Costs	Indirect Capital Costs	Annual O&M Costs
Current Deflectors					
CD-1	Current Deflector-Groynes (Spur Dikes, Spurs)	EA	$1,330	$798	$31
CD-2	Current Deflector-Bank Deflector with Root Wad	EA	$1,160	$696	$28
CD-3	Current Deflector-Riprap Groynes	EA	$1,260	$756	$31
CD-4	Current Deflector-Log Weir & Dam Structure	EA	$1,850	$1,100	$45
CD-5	Current Deflector-Angled Vortex Rock Weir w/Rootwads	EA	$1,260	$756	$31
CD-6	Current Deflector-Riprap Turning Rock Wall	EA	$1,470	$882	$36
CD-7	Current Deflector-Riprap Tieback	EA	$1,350	$810	$33
CD-Avg	Current Deflector Average Cost	EA	$1,380	$828	$33
Vegetative Bank Stabilization					
VBS-1	Brush Mattress w/Rock Toe	LF	$37	$22	$0.90
VBS-2	Brush Layer	LF	$19	$11	$0.50
VBS-3	Live Stake, Live Post & Joint Planted Fascines	LF	$53	$32	$1.30
VBS-Avg	Category Average	LF	$36	$22	$0.88
Bank Stabilization Using Bioengineered Revetments					
BSBR-1	Vegetated Geogrid	LF	$75	$45	$1.90
BSBR-2	Live Cribwall	LF	$140	$84	$3.40
BSBR-3	Low Energy Tree Revetment	LF	$41	$25	$0.99
BSBR-4	Moderate Energy Tree Revetment	LF	$70	$42	$1.70
BSBR-5	Tree Deflector	LF	$62	$37	$1.50
BSBR-6	Woody Debris & Vegetated Geogrid System	LF	$110	$66	$2.70
BSRB-Avg	Category Average	LF	$80	$50	$1.90
Floodplain/Riparian Planting					
FP/RP-1	Floodplain/Riparian Planting	SF	$0.39	$0.20	$0.01
FP/RP-2	Floodplain Planting	SF	$1.49	$0.89	$0.02
FP/RP-Avg	Category Average	SF	$0.94	$0.56	$0.01
Off-Channel Hydrologic Features					
OFFCH-1	Groundwater-Fed Side Channel	SY	$17	$10	$0.20
OFFCH-2	Surface-Fed Side Channel	SY	$29	$17	$0.40
OFFCH-3	Off-Channel Pond	SY	$42	$25	$0.59
OFFCH-Avg	Category Average	SY	$29	$17	$0.40
Channel Realignment					
CH REAL-1	Channel Realignment	SY	$29	$17	$0.40

Notes:
EA - each
LF - linear foot
SF - square foot
SY - square yard
TCD - typical conceptual design

Table 9.2-5
Summary of Estimated Unit Costs for Lower Basin TCDs, Alternatives 2, 3, and 4

Unit Price Code/TCD	Description	Unit	Total Unit Cost	Annual O&M Costs
LB-1	Excavate Coeur d'Alene River banks (barge-based excavator)	CY	$ 4.92	0
LB-2	Soil amendment	AC	$ 1,636	$23
LB-3a	Subaqueous disposal in lateral lake	CY	$ 5.23	$0.32
LB-3b	Subaqueous disposal in Coeur d'Alene Lake	CY	$ 6.20	$0.38
LB-4a	Dredge and barge	CY	$ 8.81	0
LB-4b	Dredge and pipeline	CY	$ 7.59	0
LB-5	Sediment trap	EA	$ 270,000	$109,000
LB-6	Hydraulic control structure	EA	$ 57,200	$920
LB-7a	Dike/levee construction	LF	$ 151	$2.40
LB-7b	Dike/levee enhancement	LF	$ 97	$1.60
LB-8	Wetland cap	CY	$ 8.02	$0.13
LB-9	Local repository	CY	$ 6.96	$0.42

Notes:
AC - acre
CY - cubic yard
EA - each
LF - linear foot
TCD - typical conceptual design

Table 9.2-6
Description of Alternative 5 (State Of Idaho) TCDs and Estimated Unit Costs

DEQ Design	Action	Estimated Unit Costs [a]			Assumptions
		Direct Capital Costs	Indirect Costs	Annual O&M Costs	
1	Excavate waste and dispose locally	$8.50/cy	$5.10	$0	Consists of $3.50/cy for excavation of dry materials and $5/cy for a 1-hr rt haul.
2	Excavate waste or soil and dispose in region landfill	$18.50/cy	$11	$0	Consists of $3.50/cy for excavation of dry materials and $15/cy for a 3-hr rt haul.
3	Excavate stream sediments or banks and dispose	$19.50/cy	$12	$0	Consists of $3.50/cy for excavation of wet materials and $15/cy for a 3-hr rt haul plus $1/cy for access improvements and dewatering or water controls.
4	General grading	$2/cy	$1.20	$0.02	Assumes regrade an average 3' depth over area.
5	Relocate	$6/cy	$3.60	$0.06	Consists of moving waste from drainages onto high ground, soil cover, rip-rap toe protection and stream stabilization.
6	Toe stabilization	$50 lf	$30	$0.91	Assumes rip-rap 10' up slope w/ 3' diameter rock.
7	Cap - general	$16.50/cy	$9.90	$0.17	Includes $15/cy delivered material and $1.50/cy for spreading and grading.
8	Cap - low permeability	$20.50/cy	$12	$0.21	Includes $18.50/cy delivered material and $2.50/cy for spreading, grading and compacting.
9	Cap - geocover system	$45,000	$27,000	$820	Consists of 6" subgrade @ $2/cy, geosynthetic liner @ $3/sy, 12" drain layer @ $6/cy, surface water control @ $0.25/sy, and soil and vegetation @ $11/cy.
10	Upland vegetation	$5,000/ac	$3,000	$50	Mechanical planting for erosion control.
11	Wetland vegetation	$11,000/ac	$6,600	$160	Hand/mechanical planting for stabilization, biofiltration and habitat.
12	Streamwork - Riprap	$13/lf	$7.80	$0.21	Assumes 3' up the slope or river bank if for erosion control. In-stream rock structures for habitat improvement.
13	Bioengineering streambanks	$40/lf	$24	$0.97	Includes a combination of plantings, soil wraps, root wads, matting, rip-rap, sills, barbs and other hydraulic features @ $30/lf plus streambank preparation @ $10/lf.
14	Excavate river bed, bank wedges and floodplain by barge	$50/cy	$30	$0.81	Consists of excavation from a barge @ $30/cy, dewatering and access improvements @ $2/cy and a three hours haul @ $18/cy. Wedges assumed as 1 cy/lf.

Table 9.2-6 (Continued)
Description of Alternative 5 (State of Idaho) TCDs and Estimated Unit Costs

DEQ Design	Action	Estimated Unit Costs [a]			Assumptions
		Direct Capital Costs	Indirect Costs	Annual O&M Costs	
15	Bioengineering streambank wedge after excavation	$30/lf	$18	$0.73	Includes a combination of plantings, soil wraps, root wads, matting, rip-rap, sills, barbs and other hydraulic features. Assumes that excavation prepared banks.
16	Bioengineering streambank w/o excavation	$60/lf	$36	$1.50	Includes grading of banks @ $30/lf plus a combination of plantings, soil wraps, root wads, matting, rip-rap, sills, barbs and other hydraulic features @ $30/lf. Assumes difficult access or access by barge.
17	Adit Closure	$62,000	$37,000	$880	Includes gate or barrier and water collection and conveyance system.
18	Adit Water Treatment	$1,000,000	$600,000	$60,000	Unit cost is based upon bid specifications for the Success treatment project and scaled up to a 1cfs adit discharge.
19	Groundwater Cutoff	$150/lf	$90	$4.80	Unit cost is EPA's estimate for LB-3C.
20	Soil Amendment	$20,000/ac	$12,000	$400	Unit cost is based upon EPA's estimate of $1,600/cy assuming mixing of the top one foot.
21	Subaqueous Capping/Treatment	$37,000/ac	$22,000	$750	Equivalent to EPA's $850/1,000 sf. Capping material may include soil, biosolids, or chemical amendment
22	Mill Site Demolition	$250,000	$150,000	$2,500	Based upon Bunker Hill industrial complex demolition costs for buildings. Costs for minor structures such as crib walls are some fraction.
23	Repository Construction	$5.50/cy	$3.30	$0.10	Generally equivalent to EPA's 1,000,000 cy repository but with only a single liner system and cover. DEQ includes a passive treatment to immobilize metals in leachate during dewatering. Hauling material to repository is included in DEQ excavation unit costs. Construction of access road included in DEQ infrastructure allowance.

[a] The State of Idaho was a source of the estimated direct capital costs.

Table 9.2-7
Alternative 6 (Mining Companies) TCDs and Estimated Unit Costs

TCD	Description	Direct Capital Unit Cost[a]	Indirect Cost[a]	Annual O&M Cost
PRP01	General Grading	$10,400/acre	$6,250	$100
PRP02	Slope Regrade	$10.30/cy	$6.20	$0.10
PRP03	Toe Pullback at Stream	$210/lf	$130	$2.10
PRP04	Capping	$67,000/acre	$40,000	$680
PRP05	Revegetation	$2,000/acre	$1,200	$2
PRP06	Material Removal and Disposal at Repository	$18/cy	$10.80	$4.10
PRP07	Stream Cleanout/Disposal at Repository	$89/lf	$53	$20
PRP08	Stream Stabilization	$36/lf	$22	$0.73
PRP09	Adit Source Control	$1,100,000/ea	$660,000	$13,000
PRP10	Adit Discharge Drain Piping	$38/lf	$23	$0.23
PRP11	Block Access	$9,100/ea	$5,500	$130
PRP12	Treatment Wetland Construction	$3,900/gpm	$2,300	$240
PRP13	Riparian enhancement	$5/lf	$3	$0.12
PRP14	Bioengineering BMPs	$42/lf	$25	$1.00
PRP15	Tailings removal	$58/lf	$35	$1.40
PRP16	Streambank actions	$53/lf	$32	$1.30

[a] The mining companies were the source of estimated direct capital costs.

Table 9.2-8
Summary of Basin Source Quantities Addressed by Alternative

Area/Source Type	Units	Total Quantity	Quantity of Source Material Addressed, by Upper Basin and Lower Basin Ecological Alternative				
			2	3	4	5	6
Upper Basin							
Floodplain Sediments[a]	cy	7,100,000	2,000,000	5,700,000	7,100,000	195,000	170,000
Tailings[b]	cy	11,000,000	3,800,000	8,600,000	9,300,000	2,800,000	3,500,000
Waste Rock[c]	cy	11,700,000	5,600,000	7,000,000	9,800,000	2,500,000	5,300,000
Adit Drainage[d]	#Zn/d	101	89	101	101	94	65
Lower Basin							
River bed Sediments[e]	cy	20,600,000	0	20,600,000	20,600,000	350,000	0
Bank Wedges[e]	cy	1,780,000	610,000	1,780,000	1,780,000	180,000	27,000
Wetland Sediments[e]	cy	5,900,000	480,000	2,000,000	5,900,000	240,000	0
Lateral Lake Sediments[e]	cy	5,900,000	67,000	570,000	5,900,000	94,000	0
Floodplain Sediments[e]	cy	10,200,000	430,000	2,300,000	10,200,000	2,300,000	0
Cataldo/Mission Flats Dredge Spoils	cy	13,600,000	10,900,000	10,900,000	10,900,000	10,900,000	25,000
Spokane River[f]			**Quantity of Source Material Addressed, by Spokane River Alternative**				
			2	**3**	**4**	**5**	**Not used**
Beach/Bank Deposits and In-Stream Sediments	cy	260,000	0	20,000	110,000	260,000	

[a]Sediment total volume does not include either less-impacted, generally deeper and more dispersed sediments that are potential source of zinc loading or impacted materials within fills or embankments (e.g., I-90 and UPRR rights-of-way); these additional sediment volumes may be as high as approximately 20,000,000 cy.
[b]Tailings volumes include unimpounded tailings and impounded tailings in both inactive and active facilities.
[c]Waste rock volumes include waste rock in floodplains and uplands, as well as waste rock at active facilities.
[d]Data used to calculate average zinc loading are available for only 53 of 114 discharging adits in the upper basin. Although data are available for the largest loaders, the cumulative average zinc load from all discharging adits may exceed the amount shown in this table.
[e]Volumes estimates for all impacted media in the lower basin, CSM Unit 3, are based on lead concentrations exceeding 1,000 mg/kg. Additional volumes of impacted sediments that are potential sources of zinc loading are not included in these estimates.
[f]The study area for the Spokane River ecological alternatives is limited to selected sites identified by the Washington State Department of Ecology between the Washington-Idaho state line and Upriver Dam.

Notes:
This is a condensed summary with approximate quantities—for a detailed accounting of sources and remedial actions see the FS Part 3, Sections 5 and 6 and appendices as referenced therein. Quantities of source materials within the BHSS are not included in this table.
Quantities of source material potentially addressed by institutional controls (e.g., access restrictions) or bioengineering actions (e.g., floodplain/riparian zone revegetation or bank stabilization) are not included.
Alternative 1 is no action. Alternatives 2 through 6 are integrated alternatives for the Upper Basin and Lower Basin. Alternatives 2 through 5 were developed separately for the Spokane River.
cy - cubic yards   #Zn/d - pounds per day of zinc

Table 9.2-9
Lower Basin Contaminated Habitat Area Remediated by Alternative

Wetland Unit	Contaminated Area, Acres[a]				Total Habitat Area Remediated by Alternative, Acres				
	Wetland	Lake	Riparian	Total	2	3	4	5	6
Harrison Slough	40	668	30	738	0	0	738	0	0
Harrison Marsh	58	157	34	249	0	0	249	0	0
Thompson Marsh	59	122	16	197	197	197	197	197	0
Thompson Lake	299	256	25	580	580	580	580	580	0
Anderson Lake	44	505	36	585	0	0	585	0	0
Bare Marsh	160	0	17	177	0	0	177	0	0
Blue Lake	53	316	37	406	0	0	406	0	0
Black Lake	17	368	27	412	0	0	412	0	0
Swan Lake	362	471	205	1,038	0	1,038	1,038	1,038	0
Cave Lake	190	746	116	1,052	0	0	1,052	0	0
Medicine Lake	198	230	83	511	0	511	511	511	0
Blessing Slough	168	0	76	244	0	0	244	0	0
Moffit Slough	114	146	66	326	0	326	326	326	0
Campbell Marsh	173	106	129	408	0	408	408	408	0
Hidden Marsh	418	199	38	655	0	655	655	655	0
Killarney Lake	152	482	42	676	0	676	676	0	0
Strobl Marsh	269	0	77	346	346	346	346	346	0
Lane Marsh	425	0	80	505	0	505	505	505	0
Black Rock Slough	232	201	166	599	0	0	599	0	0
Bull Run	16	106	8	130	0	0	130	0	0
Rose Lake	409	357	135	901	0	0	901	0	0
Porter Slough	126	0	0	126	0	0	126	0	0
Orling Slough	49	52	15	116	0	116	116	116	0
Canyon Marsh	50	25	19	94	0	0	94	0	0
Cataldo Slough	114	314	228	656	0	0	656	0	0
Mission Slough	280	150	108	538	0	0	538	0	0
Whiteman Slough	171	0	32	203	0	0	203	0	0
27 units	4,646	5,979	1,844	12,469	1,123	5,358	12,469	4,682	0

\

[a] Areas of contamination estimated by U.S. Fish and Wildlife Service, Upper Columbia Fish and Wildlife Office (July 2001). Area of contamination defined as that containing lead at a concentration greater than 530 mg/kg, the Lowest Observable Effect Level (LOEL) for waterfowl (Beyer, et al. 2000)

References:
Kern, J.W. 1999. Statistical Model for the Spatial Distribution of Lead Concentration in Surficial Sediments in the Lower Coeur d'Alene River Floodplain with Estimates of Contaminated Soils and Sediments. Draft (August 26, 1999). Prepared for the U.S. Fish and Wildlife Service, Spokane, Washington.
Beyer, W. N., D. J. Audet, G. H. Heinz, D. J. Hoffman, and D. Ray. 2000. Relation of Waterfowl Poisoning to Sediment Lead Concentrations in the Coeur d'Alene River Basin. Ecotox. 9: 207 - 218.

Table 9.2-10
Estimated Effectiveness of the Ecological Alternatives for the Upper Basin and Lower Basin for Reducing Dissolved Metals Loads in the Coeur d'Alene River

Alternative	Estimated Percent Zinc Load Reduction at Completion of Remedy Implementation	
	Pinehurst	Harrison
4	73	64
3	62	57
2	30	26
5	13	12
6	8	9
1	0	0

Note: estimates of dissolved zinc load reductions do not include consideration of loads from the Bunker Hill Box.
Reference: USEPA (2001f). *Probabilistic Analysis of Post-Remediation Metal Loading.*

10.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section describes the evaluation of the comprehensive alternatives for protection of human health and the environment using the CERCLA criteria. EPA uses nine criteria to evaluate the remedial alternatives individually and against each other in order to select a remedy. These criteria are shown in Table 10.0-1. The purpose of the comparative analysis is to evaluate the relative performance of the alternative with respect to the nine evaluation criteria so that the advantages and disadvantages of each are clearly understood. The Selected Remedy is described in Section 12.

The results of the comparative analysis are organized in four sections. These are:

- Section 10.1: Human Health in Community and Residential Areas
- Section 10.2: Environmental Protection in the Upper Basin and Lower Basin
- Section 10.3: Coeur d'Alene Lake
- Section 10.4: Spokane River

The results are also summarized in a series of tables. In these tables, each of the alternatives is given a rating (lowest, low, medium, or highest) for each evaluation criterion. The tables also provide the basis for each rating.

the evaluation of the balancing criteria (state and tribe acceptance and community acceptance) for the Preferred Alternative in the Proposed Plan is presented in section 12.7.

10.1 HUMAN HEALTH ALTERNATIVES

Based on the comparative analysis, EPA believes the best balance of tradeoffs is represented by Alternative S4 for soil, Alternative D3 for house dust, Alternative W6 for drinking water, and Alternative F3 for aquatic food sources.

For soil, Alternatives S4 and S5 are the only alternatives believed likely to meet the human health RAOs. Consequently, Alternatives S1, S2, and S3 are not considered adequately protective. The increased implementability, fewer short-term impacts to the community, and lower cost of the partial removals under Alternative S4 outweigh the somewhat greater reduction of residual risk resulting from complete removals under Alternative S5. A summary of the comparison of alternatives for soil is presented in Table 10.1-1.[13]

[13] Costs for soil alternative S4 differ from those presented for the Selected Remedy because the analysis of Alternative S4 in the FS included 10 recreational areas and the Selected Remedy included 31 recreational areas.

For house dust, both Alternatives D2 and D3 are expected to achieve the human health RAOs at most homes where residents participate in the programs. Alternative D1 is not considered protective for risks from house dust. Alternative D3 provides for additional cleaning at some homes where exterior soil remediation, dust mats, and vacuum loan programs do not provide sufficient reductions in exposure to contaminated house dust. The greater reduction in residual risk and greater long-term reliability of extensive cleaning under Alternative D3 outweigh the lower cost of the vacuum loan and dust mat programs under Alternative D2. A summary of the comparison of alternatives for house dust is presented in Table 10.1-2.

For drinking water, Alternatives W3, W4, W5, and W6 are all potentially protective and ARAR-compliant. Alternatives W1 and W2 are not expected to be protective or ARAR-compliant where MCLs are exceeded. Alternative W6 provides the best balance of tradeoffs because the most appropriate technology at each site would be used. Protectiveness and compliance with ARARs could be achieved at all sites, including those where no suitable alternative aquifer exists and connection to a public water source would not be feasible. Where a suitable alternative aquifer does exist or connection to a public water source is feasible, these actions would be taken and would be expected to have greater long-term reliability than point-of-use treatment (Alternative W3). A summary of the comparison of alternatives for drinking water is presented in Table 10.1-3.

For aquatic food sources, Alternative F3 is expected to more effectively limit exposures to metals than Alternatives F1 or F2. The use of monitoring is expected to more reliably identify areas of potential exposures and be more likely to result in reduced consumption of aquatic food sources in areas of exposure. A summary of the comparison of alternatives for aquatic food sources is presented in Table 10.1-4.

10.2 ECOLOGICAL PROTECTION IN THE UPPER BASIN AND LOWER BASIN

Some of the key issues for evaluating the ecological alternatives identified through the comparative analysis using the nine CERCLA criteria are discussed below.

Impacted Sediments

Over 100 million tons of impacted sediments are distributed over thousands of acres in the Upper Basin and Lower Basin. As described in Section 7, the impacted sediments are a major source of metals exposures for ecological receptors, as well as humans engaged in recreation and subsistence practices. Impacted sediments are believed to be the major source of metals loading in the Basin. In the Upper Basin, tailings-impacted floodplain sediments and associated groundwater are the major sources of dissolved metals to the rivers and streams. In the Lower Basin, erosion of river bank and bed sediments is the major source of particulate lead. This particulate lead is a continuing source of contamination for the Coeur d'Alene River, Coeur d'Alene Lake, and the Spokane River. Lead transported in the river system has impacted recreational areas in the Lower Basin and the Spokane River, resulting in posted health advisory signs at beaches and swimming areas. During flood events, lead transported by the river also impacts the wetlands and floodplains. The potential exists for future particulate lead transport and recontamination of recreation and feeding areas cleaned up as part of the Selected Remedy. Therefore, addressing impacted sediments is a key issue for protection of human health and the environment.

Large-scale cleanup of impacted sediments, however, would be difficult and costly, presenting major technical and administrative challenges, as well as significant adverse short-term impacts. Likely impacts to the local communities and natural environment include increased truck traffic, dust and noise generation, potential disruption of services and recreation opportunities, and reduced aesthetic quality. Much of the sediment in the Upper Basin is not considered accessible due to its location beneath I-90 and other infrastructure. Private property ownership issues must also be addressed as a component of cleanup.

The alternatives vary in the degree to which they address the contaminated sediments, with Alternatives 3 and 4 addressing the sediments to a greater degree than Alternatives 1, 2, 5, and 6. As summarized in Table 9.2-9, Alternatives 1 through 6 include cleanup of 0 acres, 1,123 acres, 5,358 acres, 12,469 acres, 4,682 acres, and 0 acres, respectively, of contaminated sediments in wetland, lake, and riparian feeding areas in the Lower Basin. As summarized in Table 9.2-8, Alternatives 1 through 6 include dredging of 0 cy, 0 cy, 20,600,000 cy, 20,600,000 cy, 350,000 cy, and 0 cy, respectively, of river bed sediments, which are a potential source of particulate lead in surface water. Alternatives 1 through 6 include removal of 0 cy, 610,0000 cy, 1,780,000 cy, 1,780,000 cy, 180,000 cy, and 27,000 cy, respectively, of contaminated sediments in Lower Basin riverbanks, which also are a potential source of particulate lead in surface water. The greater use of removals under Alternatives 3 and 4 would improve the long-term effectiveness and permanence of these alternatives compared to alternatives that rely more heavily on in-place bank stabilization measures. In addition, Alternatives 3 and 4 include bioengineering measures to stabilize remediated banks, which would promote the return of a fully-functioning ecosystem to a greater degree than alternatives that include armoring to stabilize the banks. Bank armoring, while potentially effective for stabilizing the banks, uses materials such as riprap and therefore does not employ materials, such as plants and woody debris, that would promote the return of a fully-functioning ecosystem.

Time to Achieve Overall Cleanup Goals

The time needed to achieve overall cleanup goals, including AWQC and risk-based sediment cleanup goals, will be lengthy and require a period of natural recovery for all the alternatives. The probable time period decreases dramatically with the aggressiveness and completeness of the alternative. As noted in Table 9.2-10, the estimated percent zinc load reductions at the completion of remedy implementation at Pinehurst are approximately 0, 30, 62, 73, 13, and 8 for Alternatives 1 through 6, respectively. The estimated percent reductions at Harrison are approximately 0, 26, 57, 64, 12, and 9 for Alternatives 1 through 6, respectively. These pronounced differences result in considerable differences in the estimated length of time necessary to achieve AWQC, and hence, protectiveness of aquatic life. As noted in Table 10.2-1 and graphed in Figure 10.2-1, the expected lengths of time to achieve AWQC, on average, at Pinehurst is estimated to be approximately 225, 161, 46, 198, and 205 percent longer for Alternatives 1, 2, 3, 5, and 6, respectively, compared to Alternative 4. At Harrison, the expected lengths of time to achieve AWQC, on average, are approximately 278, 195, 45, 239, and 253 percent longer for Alternatives 1, 2, 3, 5, and 6, respectively, compared to Alternative 4. These longer periods are particularly noteworthy when considering that the estimated lengths of time to achieve AWQC, even under the aggressive Alternative 4, are lengthy. While it is not presently possible to estimate the time to achieve AWQC due to uncertainty with respect to the effectiveness of remedial actions to be implemented in the Box, modeling of Alternative 4 suggests the expected time to achieve AWQC, on average, will be on the order of approximately 280 and 210 years at Pinehurst and Harrison, respectively, as graphed in Figure 10.2-2.

Benefits to aquatic life begin long before the point in time when AWQC are finally met. As remedies are implemented, resulting in reduced metals concentrations, aquatic conditions begin to improve and benefits accrue as concentrations drop further over time. Such benefits will occur much sooner with the more aggressive alternatives (i.e., Alternatives 3 and 4). As graphed in Figures 10.2-3 and 10.2-4, water quality conditions at completion of remediation (Time 0 on the graphs), as represented by multiples of AWQC, will be considerably better under Alternatives 3 and 4 than the other alternatives. Although the resulting conditions will not be fully supportive of aquatic life, the reduced dissolved metals concentrations will allow a substantial improvement to the fisheries and ecosystem, as described in more detail in Section 12.2.1 Dissolved Metals in Rivers and Streams and the Interim Fishery Benchmarks Technical Memorandum (URS 2001d). The population and species diversity of fish and aquatic organisms will continue to improve as cleanup progresses in the Basin.

Availability of Materials

The availability of materials for covering, backfilling, and revegetating waste piles, removal areas, and repositories is limited. These materials include topsoil (either natural or manufactured) and uncontaminated fill. Mining of native topsoil could create adverse environmental impacts at borrow locations. Larger quantities of these materials would be required to implement alternatives that include more comprehensive levels of cleanup, such as Alternatives 3 and 4.

Repository Siting

There are limitations on the availability of suitable sites for large engineered repositories for disposal of excavated or dredged contaminated media. A larger number and capacity of repositories would be required to implement alternatives that include more comprehensive levels of cleanup, such as Alternatives 3 and 4.

Long-Term Management and Associated Costs

An effective remedy would likely require substantial long-term management with associated costs. Institutional programs to protect human health and the environment would be needed. Depending on the remedy, long-term management may include operation and maintenance of engineered controls, such as repositories, and water treatment systems. Required periodic cleanups of remediated areas that are recontaminated by subsequent flood events would add to long-term management costs, as would the long-term monitoring and periodic site reviews required under Superfund.

Balance of Tradeoffs

Based on the comparative analysis, EPA believes Alternative 3 represents the best balance of tradeoffs for a long-term cleanup approach, as summarized in Table 10.2-1. Alternatives 3 and 4 provide substantially greater protection of the environment and shorter times to achieve compliance with ARARs than Alternatives 1, 2, 5, and 6. Alternatives 3 and 4 would result in more than twice the reduction of metals loads in surface water relative to the other alternatives, as shown in Table 9.2-10. Alternatives 3 and 4 also would provide more safe feeding area for waterfowl and other receptors than Alternatives 1, 2, 5, and 6, as summarized in Table 9.2-9. Finally, as a result of the greater extent of bed and bank removals included under Alternatives 3 and 4, these alternatives would provide for more comprehensive and permanent reductions in particulate lead transported in the river system than Alternatives 1, 2, 5, and 6.

Although Alternative 4 would provide greater long-term effectiveness than Alternative 3, this consideration is outweighed by the greater implementability, fewer short-term impacts to the communities and the environment, and the lower cost of Alternative 3 compared to Alternative 4. Alternative 3 relies more on groundwater and surface water treatment to reduce dissolved metals loads from the Upper Basin and Mission Flats than Alternative 4, which relies more heavily on removals. In addition, Alternative 4 includes actions in areas (for example, waste rock piles that are not located near streams) that pose relatively little risk. Because it relies on extensive removals, Alternative 4 would likely be more difficult to implement than Alternative 3. As a result, Alternative 3 would be more cost effective, have fewer community and environmental impacts from excavation and trucking, and require less repository space and topsoil or growth media than Alternative 4. Since Alternative 3 includes more treatment than Alternative 4, it satisfies CERCLA's preference for reduction of toxicity, mobility, or volume through treatment to a greater extent than Alternative 4.

10.3 COEUR D'ALENE LAKE

Based on the comparative analysis, the best balance of tradeoffs is represented by Alternative 2. Alternative 2 contains measures to reduce the likelihood of an increased rate of metals release from the 44 to 50 million cubic yards of contaminated sediments in the lake. Alternative 1 contains no measures to control metals release from sediments. The increased long-term effectiveness of Alternative 2 outweighs its marginal increase in cost and marginal reduction in implementability relative to Alternative 1. Table 10.3-1 summarizes the comparative analysis of the alternatives for Coeur d'Alene Lake. The details of the evaluation can be found in Part 3 Section 8 of the FS.

Alternative 2 provides for implementation of the Lake Management Plan. The Plan was developed by local regulatory stakeholders. It has not been fully implemented to date. However, those entities have expressed an interest in implementing the Plan under their independent authorities.

10.4 SPOKANE RIVER

Based on the comparative analysis, the best balance of tradeoffs is represented by a combination of Alternatives 3, 4, and 5. The best balance of tradeoffs at each individual site would depend on site-specific characteristics including the potential risks to human and ecological receptors, potential for recontamination and other long-term maintenance requirements, and cost.

Alternatives 3, 4, and 5 are all potentially protective and ARAR-compliant. Alternatives 1 and 2 are not expected to be protective or comply with sediment ARARs. Table 10.4-1 summarizes the comparative analysis of the alternatives for the Spokane River. The details of the evaluation can be found in Section 7 of Part 3 of the FS.

10.5 CONCLUSIONS FROM COMPARATIVE ANALYSIS

Based on the comparative analysis, EPA determined that Alternatives S4, D3, W6, and F3 for protection of human health and Ecological Alternative 3 for protection of the environment represent the best balance of tradeoffs in the Upper Basin and Lower Basin and that a combination of Alternatives 3, 4, and 5 represents the best balance of tradeoffs for the Spokane River.

Implementation of the human health remedy in the community and residential areas can be achieved within a reasonable timeframe. However, given the amount of work to be performed under Ecological Alternative 3, the vast area involved, and the broad variety of media and source types to be addressed, EPA, in consultation with stakeholders, has determined that an adaptive management strategy is a more reasoned approach to implement the environmental cleanup of the Basin. This approach starts with existing information and progressively incorporates lessons learned from experience as remedial actions are implemented, monitored, and refined. During implementation, EPA will learn which remedial actions are most effective. This process can help assure that as progress toward the long-term cleanup goals for the Basin is made, actions could be prioritized within available funds and be cost-effective. EPA recognizes that combined improvements from cleanup activities and natural recovery will be required to achieve ARARs.

The Selected Remedy, which is described in Section 12.0, is an interim measure and represents a significant remedial response toward meeting the goal of full protection of human health and the environment in the Basin. The Selected Remedy includes the full remedy needed to protect humans from exposures that currently occur in the community and residential areas, including identified recreational areas, of the Upper Basin and Lower Basin, as well as at Spokane River recreational sites upstream of Upriver Dam. For environmental protection, the Selected Remedy identifies approximately 30 years of prioritized actions in areas of the Basin upstream of Coeur d'Alene Lake. It also includes cleanup of Spokane River sites between the Washington/Idaho border and Upriver Dam.

Specifically, EPA has selected a remedy that will:

- Provide a cost-effective remedial action
- Allow cleanup activities for human health and environmental protection to proceed concurrently
- Prioritize remediation of upstream sources while beginning actions in selected downstream areas
- Provide measurable, tangible benefits to humans and environmental receptors (e.g. fish, birds) within a relatively short time in the areas addressed
- Balance priorities identified by stakeholders (states, tribes, federal trustees, and the public)
- Build upon past remedial work performed by others

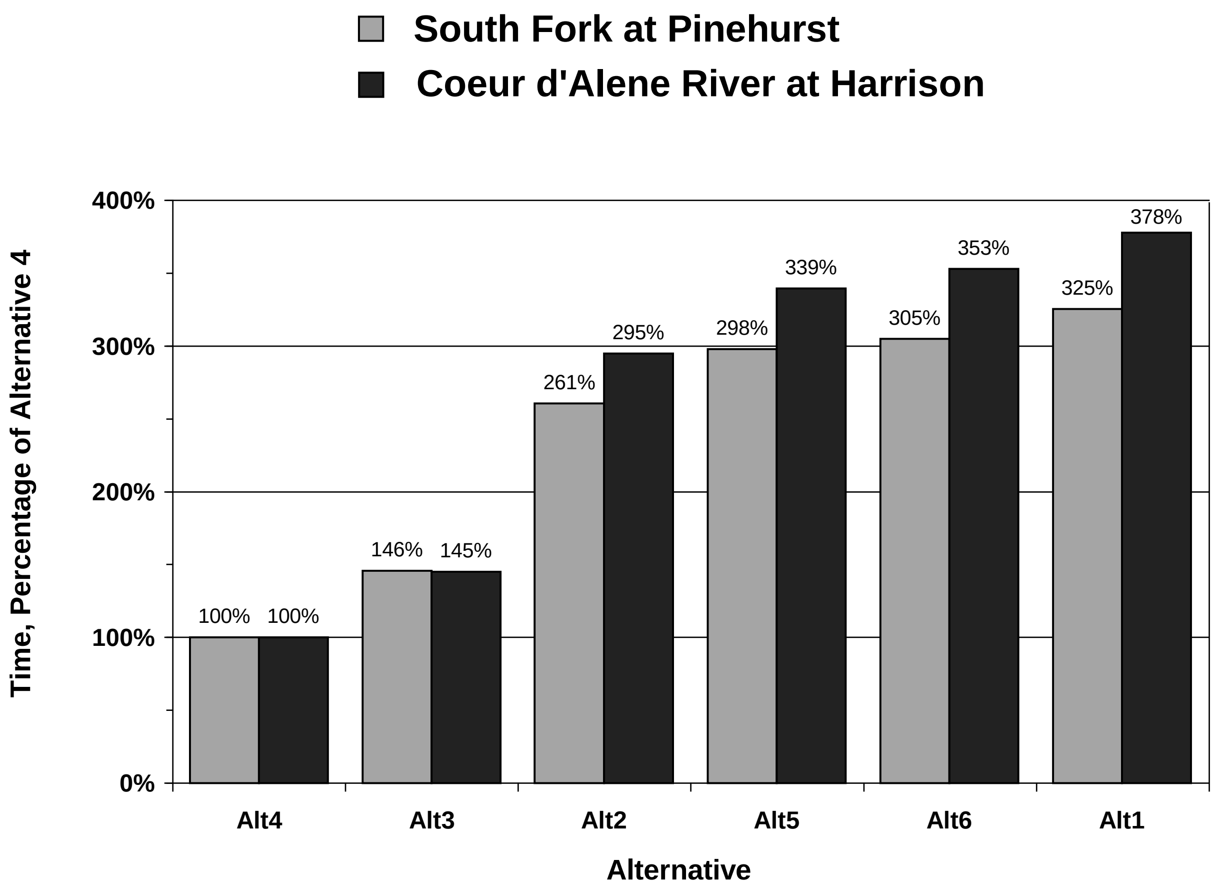
- Expend a level of effort annually that would allow the cleanup to efficiently move forward while applying the experience gained
- Moderate short-term environmental and socioeconomic impacts
- Take advantage of innovative, more cost-effective technologies as they emerge

The Selected Remedy meets the criteria established in the NCP and EPA guidance. EPA's threshold criteria in selecting a final remedy include overall protection of human health and the environment and compliance with ARARs. The Selected Remedy includes the complete remedy for human health in the communities and residential areas, including identified recreational areas, of the Upper Basin and Lower Basin and along the Spokane River upstream of Upriver Dam. It would be protective of human health and comply with human health ARARs in these areas. Although the Selected Remedy is not anticipated to be fully protective of the environment and achieve environmental ARARs, it represents what EPA believes is a significant step toward these goals. The Selected Remedy would comply with those ARARs that are included within the scope of the proposed work. Compliance with ARARs would be achieved as work is planned and performed.

The Selected Remedy should neither be inconsistent with nor preclude implementation of the final remedy (see 40 CFR 300.430(a)(1)(ii)(B)). The Selected Remedy for environmental protection includes prioritized Upper Basin and Lower Basin actions derived from FS Ecological Alternative 3, which is the level of cleanup EPA believes, based on existing information, is necessary to achieve long-term cleanup goals, as well as the full remedy for the Spokane River between the state line and Upriver Dam.

The Selected Remedy has therefore been determined by EPA to represent the best balance of tradeoffs using the CERCLA balancing criteria. The Selected Remedy would achieve long-term effectiveness by reducing residual risks resulting from exposure to lead in soil, house dust, drinking water, and aquatic food sources to acceptable levels. An institutional controls program and follow-up health services would be used to maintain remedy effectiveness over time. The Selected Remedy would go a long way towards achieving long-term effectiveness and permanence by beginning to control the sources and reduce ecological exposure in high-use areas. It would achieve substantial reductions in residual risks to aquatic receptors resulting from metals in surface water and to waterfowl and other animals resulting from metals in wetland and lateral lake sediments. The Selected Remedy includes treatment of surface water in the Canyon and Ninemile Creek areas, which is consistent with EPA's preference to reduce toxicity, mobility, or volume through treatment.

The Selected Remedy would provide short-term effectiveness through prioritizing human health actions and focusing environmental emphasis on dissolved metals in rivers and streams, lead in floodplain soil and sediment, and particulate lead in surface water, while limiting adverse impacts on the communities and ecosystems. As construction is completed at individual sites, RAOs for those soils, sediments, and source materials addressed by the Selected Remedy would be achieved. Implementation of the human health remedies is a top priority, and it is anticipated the human health RAOs would be achieved within a relatively short time. The Selected Remedy includes sequenced cleanup actions that would be both technically and administratively implementable. Requirements for repository space and relatively scarce materials such as topsoil or growth media would be spread out over time to enhance implementability. The Selected Remedy achieves a significant reduction in residual risk relative to its cost. It would be cost effective as its costs are proportional to its overall effectiveness.



EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

Doc. Control: 4162500.07099.05.a
EPA No. 2.9

Figure 10.2-1
Estimated Relative Time to Reach AWQC Without Bunker Hill Box Loading

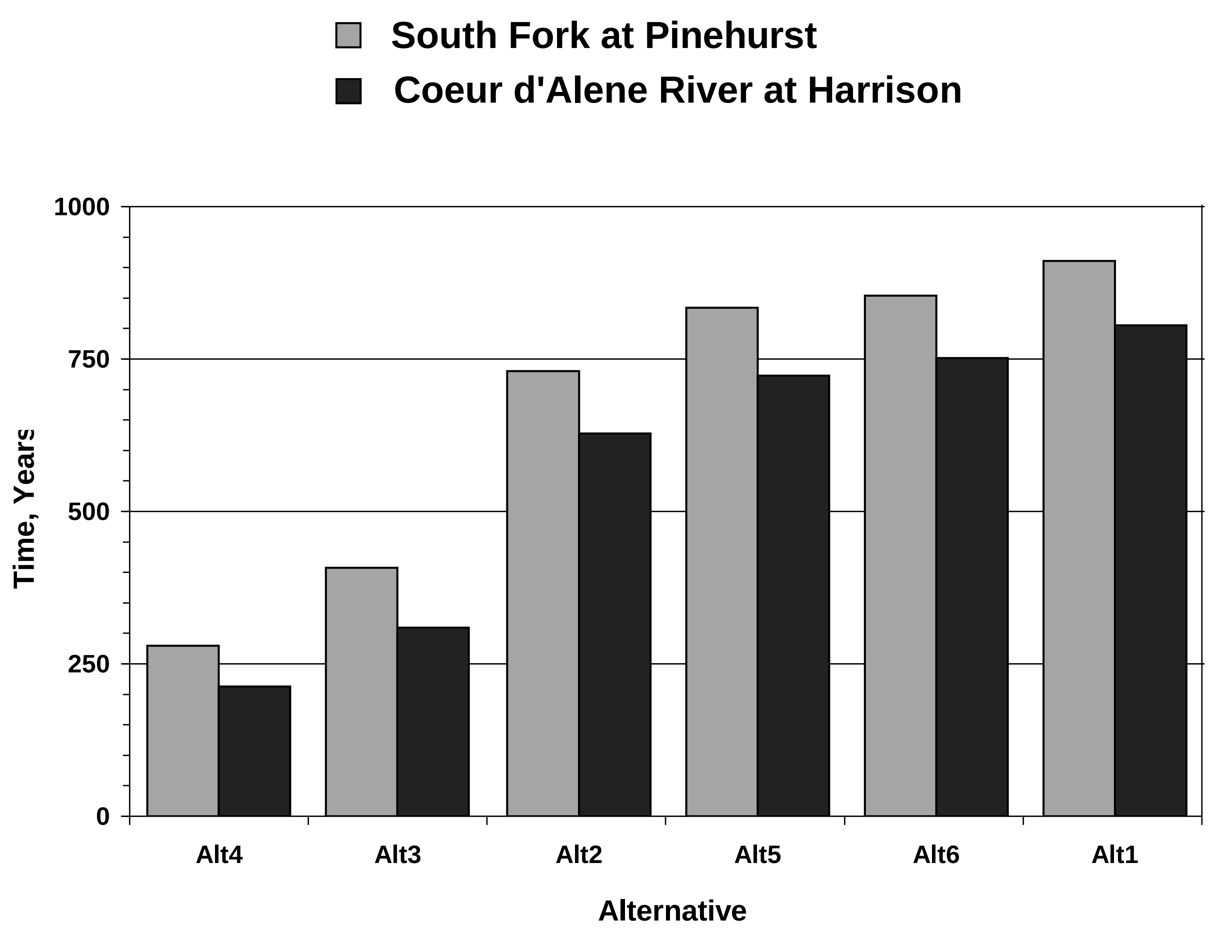
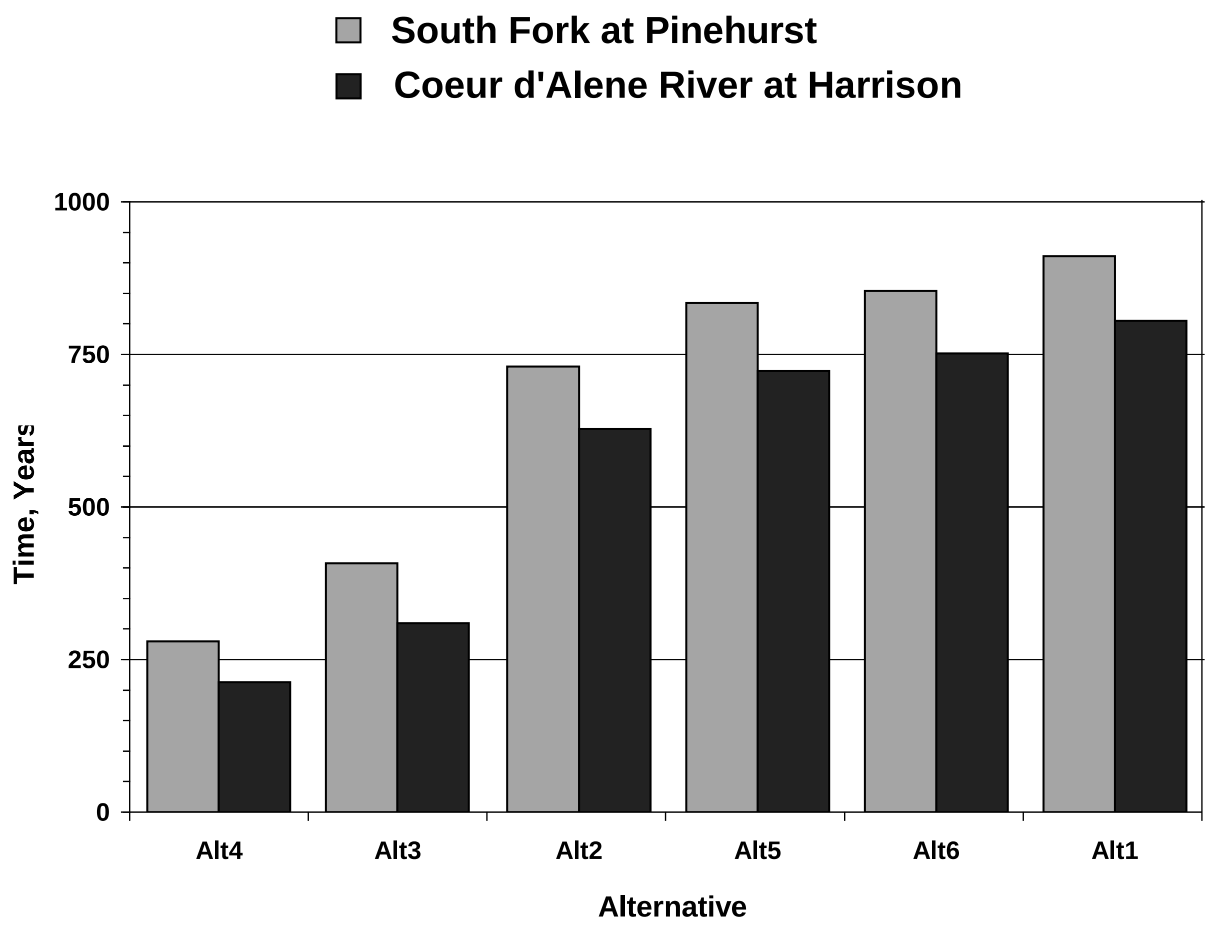


Figure 10.2-2
Estimated Time to Reach AWQC Without Bunker Hill Box Loading

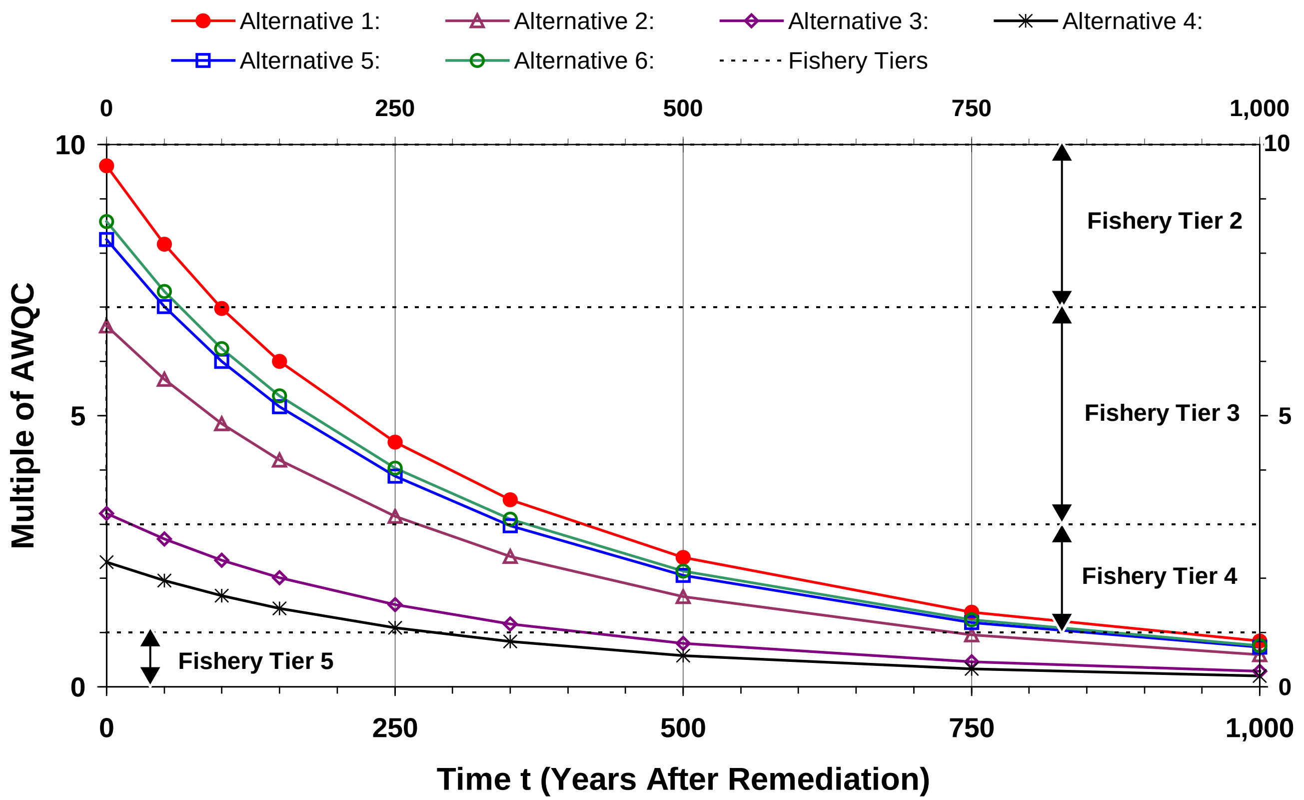


EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

Doc. Control: 4162500.07099.05.a
EPA No. 2.9

Figure 10.2-2
Estimated Time to Reach AWQC Without Bunker Hill Box Loading



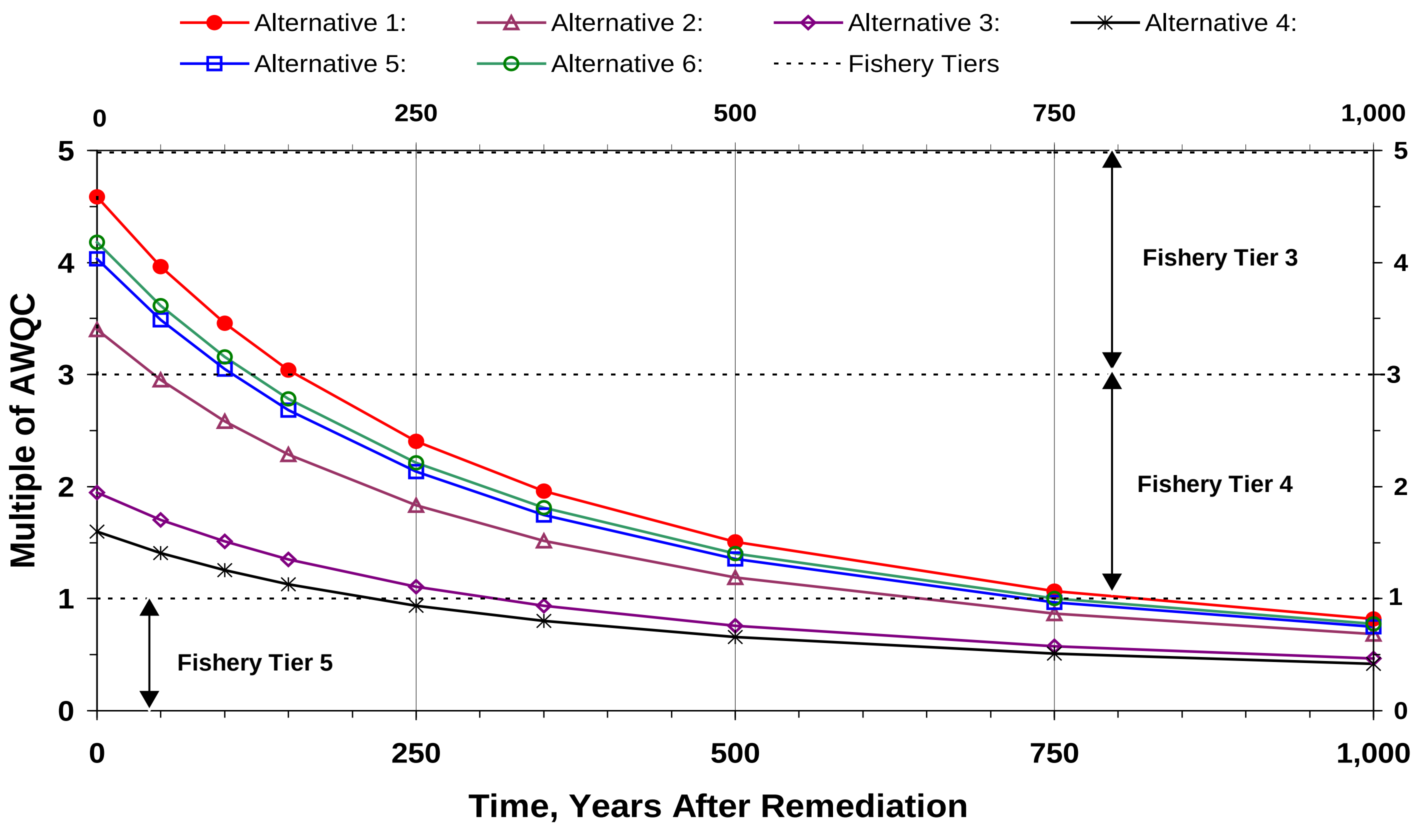
Note:
If historic loadings from the Box were included without any future reduction, AWQC multiple would increase by a factor of approximately:

Alt 1	2.1
Alt 2	2.6
Alt 3	4.0
Alt 4	5.2
Alt 5	2.3
Alt 6	2.2

Fishery Tier Definitions

Tier 0: No migrating or resident fish observed (concentrations generally >20X chronic AWQC)
Tier 1: Presence of migrating fish only, no fish observed during resident fish surveys (concentrations below <20X acute AWQC)
Tier 2: Presence of resident salmonids (trout) of any species, sculpin absent (concentrations from 7X to 10X chronic AWQC)
Tier 3: Presence of 3 or more classes of resident salmonids, including young of the year (YOY) sculpin absent (concentrations from 3X to 7X chronic AWQC)
Tier 4: Presence of 3 or more classes of resident salmonids, including YOY and sculpin (concentrations from 1X to 3X chronic AWQC)
Tier 5: Presence of 5 salmonid age classes, including YOY, sculpin, and bull trout. Fauna dominated by native species at high densities (0.1 to >0.3 fish/m^2) (least impacted watersheds with concentrations <1X chronic AWQC)

Figure 10.2-3
Comparison of Expected Values of Zinc AWQC Ratio at Pinehurst Without Bunker Hill Box Loading



Note:
If historic loadings from the Box were included without any future reduction, AWQC multiple would increase by a factor of approximately:

Alt 1	1.7
Alt 2	2.0
Alt 3	2.6
Alt 4	3.0
Alt 5	1.8
Alt 6	1.8

Fishery Tier Definitions

Tier 0: No migrating or resident fish observed (concentrations generally >20X chronic AWQC)

Tier 1: Presence of migrating fish only, no fish observed during resident fish surveys (concentrations below <20X acute AWQC)

Tier 2: Presence of resident salmonids (trout) of any species, sculpin absent (concentrations from 7X to 10X chronic AWQC)

Tier 3: Presence of 3 or more classes of resident salmonids, including young of the year (YOY) sculpin absent (concentrations from 3X to 7X chronic AWQC)

Tier 4: Presence of 3 or more classes of resident salmonids, including YOY and sculpin (concentrations from 1X to 3X chronic AWQC)

Tier 5: Presence of 5 salmonid age classes, including YOY, sculpin, and bull trout. Fauna dominated by native species at high densities (0.1 to >0.3 fish/m^2) (least impacted watersheds with concentrations <1X chronic AWQC)

Figure 10.2-4

Comparison of Expected Values of Zinc AWQC Ratio at Harrison Without Bunker Hill Box Loading

Table 10.0-1
Evaluation Criteria for Superfund Remedial Alternatives

Criterion		Description
Threshold criteria	Overall protection of human health and the environment	Determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
	Compliance with ARARs	Evaluates whether the alternative meets federal, state, and tribal environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.
Balancing criteria	Long-term effectiveness and permanence	Considers the ability of an alternative to maintain protection of human health and the environment over time.
	Reduction of toxicity, mobility, or volume through treatment	Evaluates an alternative's use of treatment to reduce a) the harmful effects of principal contaminants, b) their ability to move in the environment, and c) the amount of contamination remaining after remedy implementation.
	Short-term effectiveness	Considers the length of time needed to implement an alternative and the risk the alternative poses to workers, residents, and the environment during implementation.
	Implementability	Considers the technical and administrative feasibility of implementing the alternative, including factors such as the availability of materials and services.
	Cost	Includes estimated present worth capital and operations and maintenance (O&M) costs. O&M costs are estimated for a 30-year period using a discount rate of 7%.
Modifying criteria	State/tribal acceptance	Considers whether the States and Tribes agree with the EPA's analyses and recommendations, as described in the RI/FS and the Proposed Plan.
	Community acceptance	Considers whether the local community agrees with the EPA's analyses and the Selected Remedy. Comments received on the Proposed Plan during the public comment period are an important indicator of community acceptance.

Table 10.1-1
Comparison of Soil Alternatives for Protection of Human Health in Residential and Community Areas

Criterion	Alternative S1 No Action	Alternative S2 Information and Intervention	Alternative S3 Access Modifications	Alternative S4 Partial Removal	Alternative S5 Complete Removal
Overall Protection of Human Health and the Environment	**Lowest** Would not be protective. Unlikely to achieve health risk goals.	**Low** Limited reduction in exposure from behavior modification, would not achieve full protection. Not preventative- intervention would occur only after child exhibits elevated blood lead. Unlikely to achieve health risk goals.	**Low** Access would be limited at recreation areas, but exposures at the home would be the same as Alternative S2. Unlikely to achieve health risk goals.	**Highest** Removal and replacement of top layer of contaminated soil with clean cap would result in a large increase in protectiveness relative to Alternative S3. Addresses exposures at recreational areas. Expected to achieve health risk goals.	**Highest** Most protective for yards and community areas where all contaminated soil would be removed; however, does not address exposures at recreational areas. Expected to achieve health risk goals, with possible exception of frequent recreational users.
Compliance with ARARs	**Not applicable** No ARARs apply to Alternative S1.	**Not applicable** No ARARs apply to Alternative S2.	**Not applicable** No ARARs apply to Alternative S3.	**Highest** Could be implemented in compliance with action and location-specific ARARs.	**Highest** Could be implemented in compliance with action and location-specific ARARs.
Long-Term Effectiveness and Permanence	**Not evaluated** Alternative does not meet the threshold criteria.	**Low** Residual risks would be associated with contaminated soil left in place. Long-term reliability of institutional controls would rely on voluntary compliance and participation.	**Low** Residual risks would be associated with contaminated soil left in place. Long-term reliability of institutional controls would rely on voluntary compliance and participation.	**Medium** Large reduction in residual risk and reliability of controls relative to Alternative S3 because contaminated soil would be removed. Some residual risk from potential exposure to deeper contaminated soils not removed.	**Medium** Complete soil removal would result in least residual risk and greatest reliability for yards and community areas. Residual risks would remain in recreational areas.
Reduction of Toxicity, Mobility, or Volume through Treatment		None of the alternatives include treatment			
Short-Term Effectiveness Short-term impacts to community and environment - Time to achieve RAOs		**Low** Few impacts to community and environment; however, would not achieve human health RAOs because yard soil is not addressed.	**Low** Relatively few impacts to community and the environment; however, would not achieve human health RAOs because yard soils are not addressed.	**Highest** Would achieve human health RAOs after the completion of remedial actions in all areas. Some impacts to community from traffic and dust generation.	**Medium** Would achieve human health RAOs after the completion of remedial actions in all areas except recreational areas. Most impacts to community from increased truck traffic and dust generation.
Implementability		**Highest** Few implementability considerations.	**Highest** Relatively few implementability considerations.	**Medium** Availability of topsoil for capping of yards may be limited. Some limitations may be encountered siting repositories for contaminated soil.	**Lowest** Availability of topsoil for capping of yards may be limited. Most limitations for siting repositories for contaminated soil. Complete removal more difficult than partial removal.
Cost		Total estimated present worth cost = $5,400,000 Estimated present worth O&M cost = $0	Total estimated present worth cost = $2,900,000 Estimated present worth O&M cost = $110,000	Total estimated present worth cost = $81,000,000 Estimated present worth O&M cost = $640,000	Total estimated present worth cost = $123,000,000 Estimated present worth O&M cost = $740,000
State/Tribal Acceptance	Evaluated for the selected remedy in Section 12.7				
Community Acceptance	Evaluated for the selected remedy in Section 12.8				

Note:
Costs for Alternative S4 differ from those presented for the selected remedy because the analysis of Alternative S4 in the FS included 10 recreational areas and the selected remedy includes 31 residential areas.

Table 10.1-2
Comparison of House Dust Alternatives for Protection of Human Health in Residential and Community Areas

Criterion	Alternative D1 No Action	Alternative D2 Information & Intervention and Vacuum Loan Program/Dust Mats	Alternative D3 Extensive Cleaning
Overall Protection of Human Health and the Environment	**Lowest** Unlikely to achieve health risk goals.	**Medium** Likely to be protective where contamination moderately exceeds action levels and residents participate in program. Expected to achieve health risk goals where residents participate in program.	**Highest** Most protective alternative. Expected to achieve health risk goals.
Compliance with ARARs	**Not applicable** No ARARs apply to Alternative D1.	**Highest** Could be implemented in compliance with ambient air quality regulations.	**Highest** Could be implemented in compliance with ambient air quality regulations.
Long-Term Effectiveness and Permanence	**Not evaluated** Alternative does not meet the threshold criteria	**Medium** Would be less effective at reducing residual risks than extensive cleaning. Long-term reliability of vacuum loan program would depend on participation of residents.	**Highest** Greatest reduction of residual risk. Long-term reliability would depend on participation of residents.
Reduction of Toxicity, Mobility, or Volume through Treatment	**Not evaluated** Alternative does not meet the threshold criteria	None of the alternatives include treatment	None of the alternatives include treatment
Short-Term Effectiveness - Short-term impacts to community and environment - Time to achieve RAOs	**Not evaluated** Alternative does not meet the threshold criteria	**Low** Short-term impacts to residents and workers could be limited using health and safety precautions. Expected to achieve RAOs where residents participate in program.	**Medium** Short-term impacts to residents and workers could be limited using health and safety precautions. Expected to meet human health RAOs when cleaning is implemented.
Implementability	**Not evaluated** Alternative does not meet the threshold criteria	**Highest** Administrative and technical feasibility has been demonstrated in Basin.	**Medium** No significant administrative or technical feasibility difficulties anticipated.
Cost	**Not evaluated** Alternative does not meet the threshold criteria	Total estimated present worth cost = $1,400,000[a] Estimated present worth O&M cost = $0	Total estimated present worth cost = $4,300,000 Estimated present worth O&M cost = $0
State/Tribal Acceptance	Evaluated for the Selected Remedy in Section 12.7	Evaluated for the Selected Remedy in Section 12.7	Evaluated for the Selected Remedy in Section 12.7
Community Acceptance	Evaluated for the Selected Remedy in Section 12.8	Evaluated for the Selected Remedy in Section 12.8	Evaluated for the Selected Remedy in Section 12.8

[a]Cost for monitoring

Table 10.1-3
Comparison of Drinking Water Alternatives for Protection of Human Health in Residential and Community Areas

Criterion	Alternative W1 No Action	Alternative W2 Public Information	Alternative W3 Public Information and Residential Treatment	Alternative W4 Public Information and Alternative Source, Public Water Utility	Alternative W5 Public Information and Alternative Source, Groundwater	Alternative W6 Public Information and Multiple Alternative Sources
Overall Protection of Human Health and the Environment	**Lowest** Would not be protective where MCLs are exceeded.	**Low** Least protective of action-oriented alternatives.	**Medium** Potentially protective, but long-term effectiveness would be limited by reliability and maintenance of treatment units.	**Highest** A reliable source of clean water would be provided at most locations where MCLs are exceeded. Implementability would be a limitation at locations far from a public water source.	**Highest** A source of clean water would be provided at most locations where MCLs are exceeded. Implementability would be a limitation in some areas where no suitable alternative aquifer exists.	**Highest** Clean water would be provided at all locations where MCLs are exceeded. Most appropriate technology would be selected for each site.
Compliance with ARARs	**Lowest** Would not comply with ARARs where MCLs are exceeded.	**Lowest** Would not comply with ARARs where MCLs are exceeded.	**Medium** Would usually comply with action-specific ARARs at locations where maintenance of treatment units is conducted, but would not address groundwater contamination.	**Highest** Would comply with action-specific ARARs in all areas where connection to a public water source is feasible, but would not address groundwater contamination.	**Highest** Would comply with action-specific ARARs in all areas where a suitable alternative aquifer is present, but would not address groundwater contamination.	**Highest** Would comply with action-specific ARARs at almost all locations, but would not address groundwater contamination.
Long-Term Effectiveness and Permanence	**Not evaluated** Alternative does not meet the threshold criteria	**Low** Includes no actions to permanently reduce residual risks where MCLs are exceeded. Long-term reliability of institutional controls would be limited.	**Medium** Long-term effectiveness would be limited by reliability and maintenance of treatment units.	**Highest** Would be very effective and reliable all areas where connection to a public water source is feasible.	**Medium** Long-term reliability of groundwater wells may be less than public water supply.	**Highest** Most appropriate technology would be selected for each site.
Reduction of Toxicity, Mobility, or Volume through Treatment		No treatment included	**Highest** Most reduction of toxicity using point-of-use treatment units	No treatment included	No treatment included	**Medium** Reduction of toxicity would occur at locations where point-of-use treatment units are used.
Short-Term Effectiveness - Short-term impacts to community and environment - Time to achieve RAOs		**Low** Unlikely to achieve RAOs for drinking water	**Highest** Relatively short period to implement, which would be followed almost immediately by achievement of drinking water RAOs.	**Medium** Relatively long period to implement in areas outside of water district, which would be followed almost immediately by achievement of drinking water RAOs.	**Medium** Relatively long period to implement completely, which would be followed almost immediately by achievement of drinking water RAOs.	**Highest** Relatively short period to implement, which would be followed almost immediately by achievement of drinking water RAOs.
Implementability		**Highest** Few implementability considerations.	**Highest** Relatively few implementability considerations.	**Medium** Potential administrative considerations and limitations on capacity in areas within water districts. Numerous administrative and technical considerations related to designing and constructing water systems outside of water districts.	**Low** Implementability would be very limited in areas where no suitable aquifer exists. Moratoriums on construction of new wells exist in some areas.	**Highest** Most implementable technology could be selected.
Cost		Total estimated present worth cost = $430,000 Estimated present worth O&M cost = $0	Total estimated present worth cost = $1,400,000 Estimated present worth O&M cost = $530,000	Total estimated present worth cost = $10,000,000 Estimated present worth O&M cost = $90,000	Total estimated present worth cost = $2,900,000 Estimated present worth O&M cost = $160,000	Total estimated present worth cost = $2,200,000 Estimated present worth O&M cost = $100,000
State/Tribal Acceptance	Evaluated for the selected remedy in Section 12.7					
Community Acceptance	Evaluated for the selected remedy in Section 12.8					

Table 10.1-4
Comparison of Aquatic Food Sources Alternatives for Protection of Human Health

Criterion	Alternative F1 No Action	Alternative F2 Information and Intervention	Alternative F3 Information and Intervention and Monitoring
Overall Protection of Human Health and the Environment	**Lowest** No reduction in potential exposure and not protective	**Medium** Anticipated to produce some reduction of exposure. Long-term protectiveness would primarily depend on reductions of metals in environmental media.	**Highest** Monitoring would be expected to result in a greater reduction of exposure than Alternative F2. Long-term protectiveness would primarily depend on reductions of metals in environmental media.
Compliance with ARARs	No ARARs specifically address consumption of aquatic food sources.		
Long-Term Effectiveness and Permanence	**Not evaluated** Alternative does not meet the threshold criteria	**Medium** Long-term effectiveness primarily depends on reductions of metals in environmental media. Program anticipated to last for 30 years.	**Medium** Long-term effectiveness primarily depends on reductions of metals in environmental media. Program anticipated to last for 30 years.
Reduction of Toxicity, Mobility, or Volume through Treatment		None of the alternatives include treatment	
Short-Term Effectiveness - Short-term impacts to community and environment - Time to achieve RAOs		**Medium** Remedy could be implemented rapidly; however, reduction of fish consumption anticipated to be limited. Minimal impacts to community or environment.	**Highest** Remedy could be implemented rapidly; monitoring is anticipated to result in greater reduction of fish consumption in areas of exposure. Minimal impacts to community or environment.
Implementability		**Highest** Could be readily implemented.	**Highest** Could be readily implemented.
Cost		Total estimated present worth cost = $230,000 Estimated present worth O&M cost = $0	Total estimated present worth cost = $910,000 Estimated present worth O&M cost = $0
State/Tribal Acceptance	Evaluated for the Selected Remedy in Section 12.7		
Community Acceptance	Evaluated for the Selected Remedy in Section 12.8		

Table 10.2-1
Comparison of Ecological Alternatives for the Upper Basin and Lower Basin

Criterion	Alternative 1 No Action	Alternative 2 Contain/Stabilize with Limited Removal and Treatment	Alternative 3 More Extensive Removal, Disposal and Treatment	Alternative 4 Maximum Removal, Disposal and Treatment	Alternative 5 State of Idaho Cleanup Plan	Alternative 6 Mining Companies Cleanup Plan
Overall Protection of Human Health and the Environment	**Lowest** Not protective	**Medium** Intermediate level of long-term effectiveness and time to achieve RAOs, including ARARs. Potential short-term impacts and implementability problems.	**Highest** Slightly lower long-term effectiveness and slightly longer time to achieve RAOs, including ARARs, compared to Alternative 4 balanced by lesser short-term impacts and greater implementability.	**Highest** Slightly greater long-term effectiveness and slightly shorter time to achieve RAOs, including ARARs, compared to Alternative 3 balanced by greater short-term impacts and reduced implementability.	**Low** More protective than Alternative 6, particularly in the Lower Basin, but less protective than Alternative 2. Lower protectiveness relative to Alternative 2 balanced by fewer short-term impacts and implementability concerns.	**Low** Least protective of action alternatives.
Compliance with ARARs	**Lowest** Would not comply with ARARs within a reasonable timeframe	**Medium** Intermediate time to achieve ARARs compliance. Estimated times to achieve AWQC 161% and 195% longer than Alternative 4 at Pinehurst and Harrison, respectively.	**Highest** Second shortest time to achieve ARARs compliance. Estimated times to achieve AWQC 46% and 45% longer than Alternative 4 at Pinehurst and Harrison, respectively.	**Highest** Shortest time to achieve ARARs compliance.	**Low** Second longest time to achieve ARARs compliance. Estimated times to achieve AWQC 198% and 239% longer than Alternative 4 at Pinehurst and Harrison, respectively.	**Low** Longest time to achieve ARARs compliance among action alternatives. Estimated times to achieve AWQC 205% and 253% longer than Alternative 4 at Pinehurst and Harrison, respectively.
Long-Term Effectiveness and Permanence	**Not evaluated** Alternative does not meet the threshold criteria	**Low** Residual risk includes moderate potential for future erosion of impacted bed and bank sediments in Lower Basin and loading from sediments in Upper Basin. Most wetlands unremediated. Estimated reductions of dissolved metals load of 30% and 26% at Pinehurst and Harrison, respectively, at completion of remedy implementation. Passive water treatment used, which may be less reliable than active treatment. Includes cleanup of 1,123 acres of wetland and lateral lake feeding area. Effectiveness of soil treatment in Lower Basin is uncertain.	**Medium** Substantially greater long-term effectiveness than Alternatives 2, 5, and 6 due to more extensive actions to control metals loads from sediments and river beds. Estimated reduction of dissolved metals load of 62% and 57% at Pinehurst and Harrison, respectively, at completion of remedy implementation. Hydraulic isolation used to limit loading from inaccessible sediments in Upper Basin, which may be less reliable than removals. Includes cleanup of 5,358 acres of wetland and lateral lake feeding area. Active water treatment used, which may be more reliable than passive treatment.	**Highest** Fewest residual risks. Greatest long-term effectiveness and permanence as a result of most widespread use of removal and disposal. Estimated reduction of dissolved metals load of 73% and 64% at Pinehurst and Harrison, respectively, at completion of remedy implementation. Most extensive remediation of wetlands and lateral lakes. Includes cleanup of 12,469 acres of wetland and lateral lake feeding area.	**Low** Residual risks result from limited actions to address sediments and associated dissolved metals loads in Upper Basin. Generally similar level of long-term effectiveness in Lower Basin as Alternative 2. Estimated reduction of dissolved metals load of 13% and 12% at Pinehurst and Harrison, respectively, at completion of remedy implementation. Passive water treatment used, which may be less reliable than active treatment. Includes cleanup of 4,682 acres of wetland and lateral lake feeding area. Effectiveness of soil treatment in Lower Basin is uncertain.	**Lowest** Highest residual risks among action alternatives, resulting from fewest actions to address sediments in Upper Basin and contaminated banks, beds, and wetlands in Lower Basin. Estimated reduction of dissolved metals load of 8% and 9% at Pinehurst and Harrison, respectively, at completion of remedy implementation. Relies primarily on institutional controls to reduce waterfowl exposure to metals. Uses passive water treatment, which may be less reliable than active treatment.
Reduction of Toxicity, Mobility, or Volume through Treatment		**Medium** Drainage from major adits using passive treatment; no groundwater treatment. Total reduction through treatment similar to Alternative 5.	**Highest** Maximum reduction of water toxicity through treatment of adit drainage, groundwater, and surface water.	**Highest** Maximum reduction of water toxicity through treatment of adit drainage and groundwater.	**Medium** Drainage from major adits using passive treatment; no groundwater treatment. Total reduction through treatment similar to Alternative 2.	**Low** Wetlands treatment of drainage from four adits. Least reduction of toxicity through treatment of action alternatives.
Short-Term Effectiveness - Short-term impacts to community and environment		**Medium** Intermediate level of potential short-term water quality impacts. Moderate potential for short-term habitat loss. Greater potential risks to community from increased truck traffic and dust generated by remedial activities than Alternatives 5 and 6.	**Low** Substantial potential for short-term water quality impacts, especially from river bed dredging, and for short-term loss of habitat. Second greatest potential risks to community from increased truck traffic and dust generated by remedial activities among alternatives.	**Lowest** Greatest potential for short-term water quality impacts and short-term loss of habitat . Greatest potential risks to community from increased truck traffic and dust generated by remedial activities among alternatives.	**Medium** Relatively little potential for short-term water quality impacts. Moderate potential for short-term habitat loss. Relatively few risks to the community from remedy implementation.	**Highest** Relatively little potential for short-term water quality impacts or habitat loss. Relatively small risks to the community from remedy implementation.
- Time to achieve RAOs		**Low** Longer implementation period than Alternative 5, but shorter period of natural recovery would be needed to achieve surface water RAOs.	**Medium** Relatively long implementation period, but soil/sediment RAOs would be achieved at most locations, and a relatively short period of natural recovery would be needed to achieve surface water RAOs.	**Medium** Longest implementation period, but soil/sediment RAOs would be achieved at the largest number of locations, and the shortest period of natural recovery would be needed to achieve surface water RAOs.	**Low** Relatively short implementation period, but soil/sediment RAOs would be achieved at a limited number of locations, and a long natural recovery period would be needed to achieve surface water RAOs.	**Lowest** Relatively short implementation period, but soil/sediment RAOs would be achieved at relatively few locations, and the longest natural recovery period would be needed to achieve surface water RAOs.
Implementability		**Medium** Potential concerns with availability of topsoil (or other growth media) and clean fill needed for revegetation of removal areas and repositories. Siting of repositories with 2.5 million cy capacity may be feasible. Potential problems with feasibility of sediment removals.	**Low** Limited availability of topsoil (or other growth media) and clean fill needed for revegetation of removal areas and repositories. Substantial siting problems associated with 26 million cy of repository capacity. Potential problems with feasibility of sediment removals and hydraulic isolation.	**Lowest** Greatest implementability problems related to availability of materials, technical feasibility, and siting of repositories with 67 million cy of capacity.	**Highest** Relatively small materials requirements. Siting of repositories with 1.4 million cy capacity should be feasible.	**Highest** Least materials requirements. Siting of repositories with 260,000 cy capacity should be feasible.

Table 10.2-1 (Continued)
Comparison of Ecological Alternatives for the Upper Basin and Lower Basin

Criterion	Alternative 1 No Action	Alternative 2 Contain/Stabilize with Limited Removal and Treatment	Alternative 3 More Extensive Removal, Disposal and Treatment	Alternative 4 Maximum Removal, Disposal and Treatment	Alternative 5 State of Idaho Cleanup Plan	Alternative 6 Mining Companies Cleanup Plan
Cost		Total estimated present worth cost = $370,000,000 Estimated present worth O&M cost = $44,000,000	Total estimated present worth cost = $1,300,000,000 Estimated present worth O&M cost = $133,000,000	Total estimated present worth cost = $2,600,000,000 Estimated present worth O&M cost = $200,000,000	Total estimated present worth cost = $257,000,000 Estimated present worth O&M cost = $25,000,000	Total estimated present worth cost = $194,000,000 Estimated present worth O&M cost = $21,000,000
State/Tribal Acceptance	Evaluated for the selected remedy in Section 12.7					
Community Acceptance	Evaluated for the selected remedy in Section 12.8					

Table 10.3-1
Comparison of Alternatives for Coeur d'Alene Lake

Criterion	Alternative 1 No Action	Alternative 2 Implement Lake Management Plan
Overall protection of human health and the environment	**Low** Potentially not protective of human health and the environment. Includes no measures to control nutrients, which may affect the rate of release of metals from the lake bed sediments.	**Medium** Potentially protective of human health and the environment. Includes measures to control nutrients, which may reduce the rate of release of metals from the extremely large volume of contaminated lake bed sediments compared to no action.
Compliance with ARARs	**Low** Potentially higher rate of release of metals compared to Alternative 2 may result in longer time to achieve AWQC.	**Medium** Potentially lower rate of release of metals compared to Alternative 1 may result in shorter time to achieve AWQC.
Long-term effectiveness and permanence	**Lowest** Includes no actions to reduce residual risk	**Medium** Includes measures to potentially reduce release of metals from lake bed sediments. Long-term reliability would depend on continued enforcement of institutional controls designed to reduce nutrient loads.
Reduction of toxicity, mobility, or volume through treatment	**Lowest** No treatment included	**Medium** Although specific sources have not been identified, the Lake Management Plan contains provisions for treatment of sources of nutrients.
Short-term effectiveness Protection of community, workers, environmental impacts Time to achieve RAOs	**Highest** No impacts to community, workers or environment **Low** Includes no actions to reduce the time to meet surface water RAOs	**Medium** Actions identified under the Lake Management Plan may result in risks to community and workers and environmental impacts. Medium- Reductions in nutrient loads would potentially reduce time to achieve surface water RAOs.
Implementability	**Highest** No implementability considerations	**Low** Implementation may require passage of new ordinances and coordination between agencies. There may be private property ownership issues for some actions.
Cost	Total estimated present worth cost = $1,300,000 (see note) Estimated present worth O&M cost = $1,300,000 (see note)	Total estimated present worth cost = $8,800,000 Estimated present worth O&M cost = $8,800,000
State/Tribal Acceptance	Evaluated for the Selected Remedy in Section 12.7	
Community Acceptance	Evaluated for the Selected Remedy in Section 12.8	

Note: Estimated costs for Alternative 1 include costs for monitoring.

Table 10.4-1
Comparison of Alternatives for the Spokane River

Criterion	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Containment with Limited Removal and Disposal	Alternative 4 More Extensive Removal, Disposal, and Containment	Alternative 5 Maximum Removal and Disposal
Overall Protection of Human Health and the Environment	**Lowest** Would not be protective.	**Lowest** May be ineffective in reducing risks to humans. Would not reduce risks to ecological receptors.	**Medium** Would effectively contain sediments posing risks to humans, and would effectively contain some, but not all, sediments posing risks to ecological receptors.	**Medium** Removal and disposal of sediments would provide more reliable protection of humans as well as ecological receptors in critical habitat areas compared to Alternative 3.	**Highest** Removal and disposal of all sediments posing significant human health and ecological risks would provide the most reliable protection.
Compliance with ARARs	**Lowest** Would not comply with ARARs for sediments.	**Lowest** Would not comply with ARARs for sediments.	**Medium** Would comply with ARARs for sediments.	**Medium** Would comply with ARARs for sediments. Complies with MTCA, including MTCA requirement to use permanent solutions to the maximum extent practicable.	**Highest** Would comply with ARARs for sediments. Complies with MTCA, including MTCA requirement to use permanent solutions to the maximum extent practicable.
Long-Term Effectiveness and Permanence	**Not evaluated** Alternative does not meet the threshold criteria.	**Not evaluated** Alternative does not meet the threshold criteria.	**Low** Moderate residual risks to ecological receptors. Low residual risks to humans. Moderate maintenance requirements. Some additional actions due to recontamination could be needed.	**Medium** Low residual risks to humans and ecological receptors. Moderate maintenance requirements. Some additional actions due to recontamination could be needed.	**Highest** Very low residual risks to humans and ecological receptors. No long-term maintenance requirements. Some additional actions due to recontamination could be needed.
Reduction of Toxicity, Mobility, or Volume through Treatment			None of the alternatives include treatment		
Short-Term Effectiveness - Short-term impacts to community and environment - Time to achieve RAOs			**Highest** Limited short-term impacts to community and environment resulting from hauling and construction activities within the floodplain. **Low** Longest time to achieve RAOs among the action-oriented alternatives.	**Medium** Limited short-term impacts to community from hauling, but potentially significant impacts to the environment from construction activities within the floodplain. **Medium** Second shortest time to achieve RAOs.	**Low** Limited short-term impacts to community from hauling, but most significant impacts to the environment from construction activities within the floodplain. **Highest** Shortest time to achieve RAOs
Implementability			**Highest** No significant technical or administrative feasibility concerns. Services and materials readily available.	**Highest** No significant technical or administrative feasibility concerns. Services and materials readily available.	**Medium** Potentially somewhat greater feasibility considerations due to larger scope of actions. Potential limitations on local landfill capacity.
Cost		Total estimated present worth cost = $900,000 Estimated present worth O&M cost = $890,000	Total estimated present worth cost = $1,800,000 Estimated present worth O&M cost = $940,000	Total estimated present worth cost = $6,500,000 Estimated present worth O&M cost = $1,300,000	Total estimated present worth cost = $28,000,000 Estimated present worth O&M cost = $1,700,000
State/Tribal Acceptance	Evaluated for the selected remedy in Section 12.7				
Community Acceptance	Evaluated for the selected remedy in Section 12.8				

11.0 PRINCIPAL THREAT WASTE

Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained and/or would present a significant risk to human health or the environment should exposure occur.[14] Principal threat materials in the Coeur d'Alene Basin may include, for example, metal concentrates spilled during mill operations or in transport to smelters. A time-critical removal action was conducted in 1999 to address all known surface concentrates associated with rail transport along the Wallace-Mullen Branch of the UPRR. If additional concentrates or other materials that meet the definition of principal threat waste are encountered during remedy implementation, these materials would be managed in a manner that is protective of human health and the environment and consistent with the NCP.[15] The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP§300.430(a)(1)(iii)(A)). Where EPA determines that it is not practicable to use treatment to address principal threat waste, such waste may be transported off-site, consistent with the Off-Site Disposal Rule, 40 CFR 300.440, or managed safely on-site, consistent with all ARARs identified in Section 13.2 of this ROD.

---

[14] Additional information for defining principal threat wastes can be found in USEPA (1991b) "A Guide to Principal Threat and Low Level Threat Wastes."

[15] Concentrations used to identify principal threat waste within the Bunker Hill Box were: 127,000 ppm antimony; 15,000 ppm arsenic; 71,000 ppm cadmium; 84,600 ppm lead; 33,000 ppm mercury (Source: Bunker Hill Non-Populated Areas ROD, ROD ID: EPA/ROD/R10-92/041, Date: 09/22/1992). Additional factors (e.g., mobility, repository waste acceptance criteria, etc.) should be evaluated on a site-specific basis prior to disposal of material associated with implementing the Selected Remedy.

12.0 SELECTED REMEDY

This section presents the rationale, description, estimated costs, and expected outcomes of the Selected Remedy, which includes interim measures. The Selected Remedy is identified in Table 12.0-1.[16] The Selected Remedy in accordance with 40 CFR 300.430(a)(i)(B) includes final remedial actions for human health in the community and residential areas, including identified recreational areas, of the Basin upstream of Coeur d'Alene Lake (the Upper Basin and Lower Basin) as well as final remedial actions for all of the human health remedy upstream of Upriver Dam and all of the environmental remedy from the Idaho/Washington border to Upriver Dam. The remedial action selected by this ROD for environmental protection in the Upper Basin and Lower Basin will neither be inconsistent with nor preclude implementation of the final remedy which will be identified in subsequent decision documents. The remedy selected by EPA was developed through comprehensive discussions among EPA, states, tribes, federal trustees, and the public, including the Idaho-led Consensus-Building Process.

State legislation under the Basin Environmental Improvement Act established the process for the formation of the Basin Environmental Improvement Project Commission. This commission includes federal, state, tribal, and local governmental involvement. EPA anticipates working as a member of this commission for implementation of the ROD and development of priorities and sequencing of cleanup activities.

The Selected Remedy is described in four parts:

Section 12.1: Protection of Human Health in the Community and Residential Areas of the Upper Basin and the Lower Basin

The Selected Remedy includes all of the remedy for protection of human health in the community and residential areas, including identified recreational areas. No further actions for protection of human health in community and residential areas are anticipated. Certain potential exposures outside of the community and residential areas of the Upper Basin and Lower Basin are not addressed by this ROD, and will continue to present risks of human exposure to hazardous substances. These potential exposures impacting human health include:

[16] The estimated costs in this table and in subsequent detailed cost estimate tables are based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to –30 percent of the actual project cost, consistent with RI/FS guidance.

- Recreational use at areas in the Upper Basin and Lower Basin where cleanup actions are not implemented pursuant to this ROD
- Subsistence lifestyles, such as those traditional to the Coeur d'Alene and Spokane Tribes
- Potential future use of groundwater that is presently contaminated with metals

Section 12.2: Environmental Protection in the Upper Basin and Lower Basin

For environmental protection, an adaptive management strategy has been adopted for the Upper Basin and the Lower Basin. The Selected Remedy consists of approximately 30 years of prioritized actions designed to achieve benchmarks for environmental protection. These actions will be implemented concurrently with the human health actions.

The Selected Remedy includes benchmarks for ecological protection; however, the long-term goals are to provide full protection of the environment as well as to return the opportunity for individuals to practice subsistence lifestyles without limits from mining contamination. During the five-year review process and at the end of this approximately 30-year period, EPA will evaluate and decide whether any additional remedial actions under CERCLA are necessary to attain ARARs and to provide for the protection of human health and the environment, and whether any ARAR waivers should be applied.

Section 12.3: Coeur d'Alene Lake

The Selected Remedy does not include remedial actions for Coeur d'Alene Lake. State, tribal, federal, and local governments are currently in the process of implementing a Lake Management Plan outside of the Superfund process using separate legal authorities.

Section 12.4: Spokane River

The beaches and wading areas adjacent to the Idaho portion of the Spokane River were sampled in 1998 and were found to be safe; i.e., concentrations of metals did not exceed risk-based levels for recreation. The Selected Remedy for the Spokane River includes all of the human health remedy upstream of Upriver Dam and all of the environmental remedy from the Idaho/Washington border to Upriver Dam. Additional sampling is included in the Selected Remedy to determine the need to address areas upstream of the state line for environmental protection and downstream of Upriver Dam for human health and environmental protection. Quantification of risks to persons, including Spokane tribal members, and others who may practice a subsistence lifestyle in the Spokane River area, was not part of the RI/FS investigations. EPA and the Spokane Tribe are cooperating in planning additional testing and studies that will be implemented to evaluate the potential exposures to subsistence users. The results of those tests and studies will determine appropriate future response actions to be taken, if any.

Management of materials generated by cleanup activities is described in Section 12.5, and monitoring is described in Section 12.6.

The cleanup actions selected in this ROD will be sequenced during the approximately 30 years of cleanup. Some of the considerations for the sequencing of the cleanup include the following:

- Cleanup of community and residential areas, including the identified recreational areas, to minimize human health exposure is a top priority. Input from local community residents will be considered as the remedy is implemented. It is anticipated that cleanup of these areas will be conducted concurrently with the ecological remedy.

- Some cleanup actions related to ecological protection will require additional information to fill data needs prior to initiating the cleanup.

- Downstream areas subject to recontamination will generally be cleaned up after upstream sources of contamination have been stabilized; however, cleanup in some downstream areas will be conducted prior to completion of upstream source stabilization. Examples include river bank stabilization and waterfowl feeding areas with high use and relatively low recontamination potential.

- The level of funding available will influence the rate and extent of cleanup actions.

- The sequencing of remedial actions will consider the need to limit short-term impacts to the communities and provide certainty to communities for commerce and economic stability.

As the Selected Remedy is implemented, additional information will become available, and the specific actions taken could differ from those currently envisioned, based on this additional information. If changes to the remedy are selected, the changes can be documented in one of three ways. Examples of the changes and documentation requirements are given on page 6-58 of the EPA guidance document (USEPA 1999a).

- Non-significant or minor changes will be documented in the site file. Depending on the nature of the change, EPA may also prepare a fact sheet for public distribution. Non-significant or minor changes do not undergo formal public review and comment.

- Significant changes will be documented in an ESD. A notification and description of the ESD will be published in major local newspapers. The ESD will be made available to the public by placing it in the Administrative Record file and information repository. Although not required, EPA may elect to hold an additional public comment period or public meeting on the planned ESD.

- Fundamental changes will be documented in a ROD Amendment. A revised Proposed Plan will be published that highlights the proposed changes. The portion of the ROD being amended will be evaluated using the nine CERCLA evaluation criteria. EPA will conduct the public participation and documentation procedures specified in the NCP. The final decision to amend is not made until after consideration of public comment.

The following sections describe the Selected Remedy for protection of human health and the environment in the Coeur d'Alene Basin.

12.1 HUMAN HEALTH PROTECTION IN THE COMMUNITY AND RESIDENTIAL AREAS OF THE UPPER BASIN AND THE LOWER BASIN

Exposures to lead in soil and dust from the home, surrounding communities, and recreational areas are the primary human health concerns in the affected communities in the Basin. In particular, preventing excessive lead exposures in young children and pregnant women is a top priority. Table 12.1-1 shows the estimated number of residences in the Basin with lead concentrations in yard soil that require remediation. Additional human health concerns include arsenic in residential soils, lead in fish from the lateral lakes, and metals such as cadmium, arsenic, and lead in shallow drinking water wells in the side gulches and main valley of the Upper Basin and floodplain areas of the Lower Basin.

EPA has selected a remedy for protection of human health in the community and residential areas that consists of the following elements, which are summarized in Table 12.1-2:

- Soil and house dust: Alternatives S4 (Information and Intervention and Partial Removal and Barriers) and D3 (Information and Intervention, Vacuum Loan Program/Dust Mats, Interior Source Removal, and Contingency Capping/More Extensive Cleaning)

- Drinking water: Alternative W6 (Public Information and Multiple Alternative Sources)

- Aquatic food sources: Alternative F3 (Information and Intervention and Monitoring)

The Selected Remedy is the complete human health remedy in the community and residential areas, including identified recreational areas. This remedy also was the Preferred Alternative in the Proposed Plan. It is the most appropriate remedy because:

- The remedy satisfies the CERCLA threshold criteria and provides the best balance of tradeoffs with respect to the CERCLA balancing and modifying criteria

- The remedy satisfies the statutory requirements outlined in CERCLA §121

12.1.1 Description of the Selected Remedy

This section describes the Selected Remedy for soil and house dust, drinking water, and aquatic food sources, including institutional controls.

Soil and House Dust

Young children are primarily exposed to lead in dust on the floors of their homes (CDC 1991, Manton et al. 2000, Succop et al. 1998, Lanphear et al. 1998). Lead in house dust reflects contaminated soil from the yard, neighborhood, and surrounding community (IDHW 2001a, IDHWDG 1999). Preventative actions include source removal and containment inside and outside the home. Remedies that do not include source removal and containment would not adequately prevent exposure. A long-term basin-wide institutional controls program, as well as actions to prevent recontamination, will be implemented to maintain the integrity of the human health remedy.

The Selected Remedy, which is consistent with the remedy developed by the State of Idaho, incorporates experience from successful cleanup actions within the Bunker Hill Box. For example, removal of contaminated yard soil has been shown to be effective in reducing house dust concentrations in the Box for a large number of homes. Figure 12.1-1 shows Smelterville soil and dust lead geometric means for the years 1990 to 2001 in homes with children participating in the LHIP.

Soil Action Levels. As described in Section 7.0 of this ROD, the Box model was used to develop the action level for lead in soil, which was established to reduce exposure pathways so that a typical child would have a 5 percent or less probability of a blood lead level greater than 10 µg/dL and a 1 percent or less probability of a blood lead level greater than 15 µg/dL. A tiered approach to lead soil cleanup levels was developed based on the results of the model. The Box model supported a soil remediation level for lead starting at approximately 700 mg/kg. Therefore, for soil with lead concentrations between 700 mg/kg and 1,000 mg/kg, a barrier (such as vegetation) will be required to prevent direct exposure to soil and migration of soil to dust in homes. For soil with lead concentrations above 1,000 mg/kg, partial removal and a soil barrier will be required. This tiered approach was developed after considering a number of factors, such as protectiveness, implementability, cost-effectiveness, and community acceptance.

Section 7 of this ROD also evaluated human health risks from arsenic in residential soils. A number of factors were considered to select a soil arsenic cleanup level for this site, including the nature and extent of site contamination, the nature of human health risks, the exposure pathways, and the potential impacts and costs associated with physical remediation activities in the community. A range of arsenic soil concentrations from 64 mg/kg (1 in 10,000 cancer risk) to 123 mg/kg (non-cancer risk) was identified as protective of human health based on a residential soil ingestion and dermal exposure scenario. EPA selected an arsenic soil cleanup level of 100 mg/kg, which is within the acceptable human health risk range and represents a balancing of factors for an arsenic soil remediation level at which engineering actions (e.g., soil removal) should begin at this site. It is estimated that a small percentage of residential yards in the Basin have arsenic soil concentrations above 100 mg/kg that are not co-located with lead above 700 mg/kg. Recreational areas with arsenic levels in excess of 100 mg/kg will be prioritized for cleanup based on use.

In addition, Section 7 also discussed cadmium concentrations in some homegrown vegetables that exceed target health goals. Since lead and cadmium are co-located in garden soil, the Selected Remedy will address risks associated with cadmium levels in homegrown vegetables through the cleanup of lead-contaminated garden soil.

Remedy Components. The Selected Remedy for soil and house dust is composed of the following components:

- Sampling
- Remediation of residential yards
- Remediation of street rights-of-way
- Remediation of commercial properties and common use areas
- Remediation of recreational areas
- Dust suppression during remedial activities

- Disposal of contaminated materials
- Health intervention program
- Remediation of interior house dust, if necessary
- Relocation, if necessary

Sampling. Prior to initiating remedial actions on a specific property, soil sampling will be completed. House dust sampling will be initiated for homes with young children or pregnant women in residence (as part of the health intervention services described in this section). Soil sampling will be conducted in accordance with established sampling procedures for the site, and will occur on a yard-by-yard basis. Property owners in the Basin will be able to request soil sampling and the results will be made available to them in a timely manner. Only those properties with soil sampling results above the soil action levels will require remediation.

Residential Yards. Yard soil with lead concentrations between 700 mg/kg and 1,000 mg/kg will require a barrier, such as vegetation, that will need to be continuous and sustainable with no bare soil exposed. The barrier will also need to reduce direct exposure to contaminated soil and migration of soil to dust in homes. In general, yard soil with lead concentrations greater than 1,000 mg/kg or arsenic concentrations greater than 100 mg/kg will be removed to a depth of one foot and backfilled with clean soils. For those yards with contamination at depth, a visual marker will be placed prior to backfilling. In contaminated garden areas, clean soil will be provided to a depth of two feet.

For each residential yard, the exact nature of the remediation (e.g., depth of excavation, which bushes to remove) will be considered on a case-by-case basis. However, for consistency, the following areas will generally be remediated within each yard:

- Sod areas
- Road shoulders (if curb and gutter are not present) to asphalt or pavement and to the lateral extension of property lines
- Alleys (if unpaved) to the extension of the lot lines
- Landscaped areas
- Garden areas
- Unpaved driveways

- Play areas
- Garages with dirt floors
- Storage areas

During the excavation process, all existing sod and soil coverings will be removed and disposed of along with the soil. Larger trees and shrubs generally will be left in place. After soil removal and backfilling, the yard will be revegetated. Lawn areas of remediated yards will generally be revegetated with sod. Steep hillsides not currently planted with vegetation will be stabilized and hydroseeded with native grasses. To the extent practicable, all yard landscaping will be returned to its original condition. The maintenance of barriers will be the responsibility of the property owners.

The cleanup of residential yards includes drainage improvements to ensure that contaminated material from areas yet to be cleaned is not transported to remediated areas. These drainage improvements will improve the long-term protectiveness of the partial removals.

Where appropriate, the exteriors of structures will be pressure-washed before remedial measures are performed to reduce the potential for recontamination from lead-based paint. This will be coordinated with the Department of Housing and Urban Development paint abatement programs. Programs for paint abatement and stabilization will be coordinated with the soil cleanup and sequenced to mitigate exposures as quickly as possible while limiting the possibility of recontamination.

Street Rights-of-Way. All ROWs within the Site will be managed to minimize exposure and contaminant migration. The remedial action determinations for ROWs will be based on location, use, and contaminant concentrations. In general, all contaminated ROWs will be addressed by a combination of access controls, capping (barriers consistent with land use), or removal/replacement. ROWs include all state, county, local, and private roads.

Commercial Properties and Common Use Areas. Commercial properties and common use areas include public buildings, parks, playgrounds, churches, and commercial buildings. Risks posed by commercial properties and common use areas are similar to those in residential settings; therefore, the cleanup actions for these properties will be similar to those proposed for residential yards. A combination of removals, barriers, and access restrictions will be used at commercial properties and common use areas based on location, use, and contaminant concentrations. Barriers will include vegetation, a minimum of six inches of clean soils or gravel, or a paved surface. Final decisions regarding barrier performance standards will be developed during remedial design or as a component of the institutional controls program.

Commercial properties used predominantly by sensitive populations will require a 12-inch soil barrier.

Recreational Areas. Formal recreational areas such as boat ramps, picnic areas, and campgrounds with surface soil containing lead concentrations greater than 700 mg/kg will be capped. Recreational areas with arsenic levels above 100 mg/kg will be prioritized for cleanup based on use. Vegetative barriers will not be used at formal recreational areas due to maintenance concerns related to the high traffic and use of these areas. Soils in recreational areas also may be excavated, if appropriate. Figure 12.1-2 shows the locations of the 31 recreational areas in the Lower Basin that have been prioritized for cleanup. Other recreational areas may be evaluated for cleanup based on factors such as risk of exposure, location, and use.

It is important to note that there are other areas identified in this ROD, specifically mine and mill sites in the Upper Basin and recreational areas along the Spokane River in Washington State, that include cleanup activities to protect human health. These areas and the estimated costs associated with their cleanup activities are summarized in Sections 12.2 and 12.4, respectively.

Dust Suppression for Remedial Activities. Dust suppression measures will be implemented throughout the remediation process to reduce exposure of workers and residents to airborne contaminants. Dust suppression will include, but not be limited to:

- Watering of residential yard areas prior to excavation activities
- Watering during excavation, as necessary
- Placement of tarps or covers over excavated materials
- Use of tarps or covers over truck beds to reduce blowing dust and spillage during transportation to the waste repository
- Daily cleanup of all spilled or tracked soils from sidewalks, roadways, etc.

Disposal of Contaminated Materials. Contaminated materials will generally be disposed of in repositories located within the Basin. A process for evaluating repository locations and design requirements is described in Section 12.5 of this ROD. EPA and the State of Idaho will work with affected citizens and other Basin stakeholders in the development and selection of repository locations.

Health Intervention Program. The Selected Remedy will include a lead health intervention program similar to the Bunker Hill Box LHIP, which provides personal health and hygiene information and vacuum cleaner loans to help mitigate exposure to contaminants. The intervention program will include monitoring dust levels and lead concentrations in homes with young children or pregnant women during implementation of the Selected Remedy. The monitoring data will be used to direct nurse visits before lead exposure and blood lead concentrations peak in the late summer. This targeted education effort will be an added measure to mitigate exposure while the cleanup process is ongoing. The decision process for evaluating homes that will require intervention activities is described in Figure 12.1-3. The process is based on dust mat monitoring results, and includes consideration of the rate of dust entering homes (dust loading rate g/m^2/day) and the concentration of lead in the dust entering the homes (mg/kg). The HHRA identified lead loading rates as a strong predictor of blood lead levels. Along with age, lead loading rates accounted for 50 percent of the variability in blood lead levels observed in the Basin. The lead loading rate is the product of the dust loading rate and the dust lead concentration. Considering both dust loading rate and dust lead concentration provides more information than using lead loading rates alone.

The LHIP also provides a voluntary, annual blood-lead screening program that is funded by ATSDR. The results of the annual screening are evaluated to identify and serve children with elevated blood lead levels. The results of the blood lead screening program indicate that average blood lead levels, and the percentage of children in the Basin with elevated blood leads, have remained fairly stable from 1996 through 2000 despite varying participation rates. In 2001, the screening results showed declines in both the average blood lead levels and the percentage of children with elevated blood lead levels. It is important to note that only about 2 percent to 25 percent of eligible children, depending on the year, have been tested annually in the Basin over the last 5 years. This compares to more than 50 percent of eligible children who have been tested in the Box since 1988. More than 4,000 children in the Box have participated in blood lead surveys since 1988, compared to approximately 420 children in the Basin since 1996. Blood lead screening will continue to be offered to identify and treat families with excessive lead exposures, and it is hoped that annual participation rates will increase. The results of the blood lead screening program are shown by year on Tables 12.1-3 through 12.1-8 for 1996 – 2001 and summarized for all years on Table 12.1-9.

Interior House Dust. It is expected that soil remediation, including covers of one foot of clean soil or barriers, will substantially reduce lead concentrations inside each home. However, once yard cleanups are completed and lead soil concentrations have been reduced at all contaminated properties, it is possible that some homes will have dust lead levels requiring interior cleaning. For these homes, a contingency of interior cleaning and paint abatement (available via a state program) will be available (FS Alternative D3). Several factors will be considered to determine if interior house dust cleaning is required, such as an evaluation of the concentration of lead in the dust entering homes (dust lead concentrations), the amount of dust entering homes (dust loading rate g/m^2/day), and lead loading rates. Currently, these measurements are based on dust mat monitoring results. As previously mentioned, the lead loading rate is the product of the dust loading rate and the dust lead concentration. Cost estimates for dust abatement of these homes are based on the Smelterville house cleaning pilot study (IDEQ 2001). The unit costs are expected to decrease if a lower level of cleaning proves to be effective, and as a result of the economy of scale of cleaning a larger number of homes.

Relocation. Relocation is proposed as a last resort for homes with contamination above action levels, where extensive recontamination is likely, or where adequate cleanup would be extremely difficult. For the vast majority of homes that fall above the action level, every effort will be made to find a way to ensure that the preferred soil alternative is effective in the long term. The governments will work with individual families and property owners to find the best solution.

Drinking Water

Prior to initiating drinking water response actions, drinking water sampling will be completed for homes on private wells. Basin property owners on private wells will be able to request drinking water sampling, and the results will be made available to them in a timely manner. To reduce current exposure to metals in drinking water, an alternate water supply will be provided to residences or areas where the existing water supply contains metals at concentrations greater than the drinking water standards shown in Table 8.1-2. Residences with affected private wells within water districts will be connected to the existing public water supply system. For residences outside of water districts (mostly in the tributary gulches), the alternate water supply will most likely consist of point-of-use treatment or new groundwater wells installed into a suitable aquifer. The estimated numbers of residences with drinking water containing metals at concentrations exceeding one or more MCL are shown in Table 12.1-10.

Actions for protection of groundwater and potential future drinking water supplies are not addressed as part of the Selected Remedy.

Aquatic Food Sources

The potential for lead exposure by consumption of fish and other aquatic food sources (e.g., water potatoes) will be managed through educational resources available to fishermen and other recreational users and health advisories for subsistence fishing. The educational resources and advisories will be issued by the IDHW and include information about the potential health risk of consuming contaminated fish caught from lateral lakes. IDHW and ATSDR will review the levels of metals in aquatic food sources to determine if education or consumption advisories are warranted. A fish consumption advisory already exists in the Lower Basin and along part of the Spokane River. The Selected Remedy also includes monitoring of metals in fish tissue from fish caught in Coeur d’Alene Lake to determine if fish are safe to eat by simulating tribal and recreational fish consumption. Reductions in the levels of metals in fish are expected to occur as a result of implementation of the ecological remedies but may not be sufficient to adequately reduce human health risks in the short term.

Institutional Controls

Institutional controls will be required to limit future exposures to contaminated soil that is left in place and groundwater not addressed by the Selected Remedy. It is anticipated that the existing Institutional Controls Program (ICP) in the Box will be used as a model for the Basin. The ICP includes records maintenance, permitting, surveillance, inspections, and local construction regulations developed and implemented in conjunction with local zoning, building, or planning commissions. For drinking water, expansion of the Bunker Hill "area of drilling concern" will advise drillers of the nonpotable nature of contaminated aquifers. For commercial and residential development, permitting will ensure that a local entity could evaluate the area for development and require standardized measures to prevent exposure to contaminants.

Implementation of the Selected Remedy

As implementation of the human health remedy moves forward, EPA and the State of Idaho, along with other stakeholders, will continue to work together to develop innovative and common sense approaches that meet the remedial action objectives. For example, the State of Idaho has developed a pilot program that will: (1) conduct a review of potential residential lead exposures (including interior and exterior lead sources), (2) develop remedial plans tailored to specific residential conditions, (3) increase involvement of homeowners in the remediation of their yards, and (4) create business opportunities for local contractors and workers. The first step will be to coordinate with property owners to request access for sampling of residential properties to better assess the need and locations for residential remedial actions. EPA is supportive of cleanup approaches that increase community support and participation while also meeting the goals of protection of human health and the environment. EPA and the State of Idaho will continue to work together to ensure that these shared goals are met during implementation of the Selected Remedy.

12.1.2 Estimated Remedy Costs

The estimated remedy costs are summarized in the following tables:

- Tables 12.1-11 through 12.1-14: Summaries of Estimated Costs for Soil and House Dust. The total estimated present worth cost for the Selected Remedy for soil and house dust, including yards, infrastructure, repositories, rights-of-way, commercial properties, and recreation areas, is $89,000,000. The net present worth of 30 years of operation and maintenance (O&M) is $920,000.

    - The total estimated present worth cost includes $21,000,000 for vegetative barriers and partial soil removals, $1,400,000 for information and intervention, $970,000 for drainage improvements, $3,200,000 for potential recontamination, $2,700,000 for repositories, $2,100,000 for mobilization, $2,300,000 for administration, and $10,000,000 for contingencies. The estimated present worth O&M cost for repositories is $200,000. The total estimated present worth cost for cleanup of residential soils is $44,000,000.

- The total estimated present worth cost for street rights-of-way, commercial properties, and common areas is $35,000,000. The estimated present worth O&M cost is $0.

- The total estimated present worth cost for recreation areas is $5,900,000. The estimated present worth O&M cost for recreational areas is $720,000.

- The total estimated present worth cost for house dust programs is $4,300,000. The estimated present worth O&M cost of the house dust programs is $0.

- Table 12.1-15: Summary of Estimated Costs for Drinking Water. The total estimated present worth cost for the Selected Remedy for drinking water is $2,200,000. The net present worth of 30 years of O&M is $100,000.

- Table 12.1-16: Summary of Estimated Costs for Aquatic Food Sources. The total estimated present worth cost for the Selected Remedy for aquatic food sources is $910,000. The net present worth of 30 years of O&M is $0.

The estimated total present worth cost for the human health Selected Remedy is $92,000,000. The estimated net present worth of 30 years of O&M is $1,000,000.[17]

The costs presented are present worth costs. The present worth cost is the sum of the present value of the capital costs and the present value of the O&M costs over the period of performance. Consistent with current CERCLA guidance, estimates of present worth costs assume a discount rate of 7 percent (USEPA 2000b).

The estimated costs in these detailed cost estimate tables are based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to –30 percent of the actual project cost, consistent with RI/FS guidance.

---

[17] Costs for cleanup at mine and mill sites with potential human health exposures are included in the estimated costs for the Selected Remedy for protection of the environment in the Upper Basin and Lower Basin.

12.1.3 Expected Outcomes of Selected Remedy

This section describes the expected outcomes of the Selected Remedy in terms of cleanup levels and residual risks, land uses, groundwater uses, and socio-economic and community impacts.

Cleanup Levels and Residual Risks

A tiered approach to lead soil remediation will be implemented. Soil with lead concentrations between 700 mg/kg and 1,000 mg/kg will require a barrier, such as vegetation, to prevent exposure and distribution of dust. Soil with lead concentrations above 1,000 mg/kg will require partial removal and a soil barrier on residential yards and common use areas. The Selected Remedy is expected to reduce the residual risk from lead in soil and house dust such that a typical child has no more than a 5 percent probability of having a blood lead level above 10 µg/dL and no more than a 1 percent probability of having a blood lead level above 15 µg/dL. The 100 mg/kg soil action level for arsenic, which is often co-located with lead, is expected to result in a residual lifetime RME excess cancer risk for a residential exposure scenario that is within EPA's target range of 10^{-6} to 10^{-4}. In addition, soil removals in garden areas are expected to reduce the residual risk from cadmium in homegrown vegetables such that the hazard quotient is less than 1. As previously mentioned, this will be accomplished through the removal of lead-contaminated soil, which is co-located with cadmium in garden soil.

The drinking water action levels are equal to the MCLs, as defined in Table 8.1-2. Implementation of the Selected Remedy is expected to reduce exposures to metals in drinking water such that the residual lifetime RME excess cancer risk for a residential exposure scenario is within EPA's target range of 10^{-6} to 10^{-4} and the residual risk from cadmium is less than a hazard quotient of 1.

Land Uses

Implementation of the Selected Remedy will allow residential land use. Commercial properties that are remediated may be redeveloped for residential land use.

The remedy does not address risks associated with practicing subsistence lifestyles, therefore, implementation of the Selected Remedy will not enable the practice of subsistence lifestyles in those areas of the Upper Basin and Lower Basin. Institutional controls programs will be used to limit exposures to contaminated fish and other aquatic food sources. The long-term goal is to create areas that support the practice of subsistence lifestyles.

Groundwater Uses

The remedy does not address potential future groundwater use. Additional available uses of groundwater will not result from implementation of the Selected Remedy.

Socio-Economic and Community Impacts

Implementation of the Selected Remedy is expected to improve the socio-economic conditions of the Coeur d'Alene Basin. Basin-wide sampling, analysis, and remediation of soil in residential properties will provide property owners the information necessary for lead disclosures required for property transactions. In addition, the increased protection of human health, focused on children, may create the certainty needed for many families. Soil remediation of selected recreational areas (picnic areas, beaches, and campgrounds) also will provide more certainty about lead exposure and will enhance recreation by visitors and local users. Other aspects of the remedy, such as establishing vegetative cover, remediating schoolyards, rights-of-way and commercial property, and providing drainage improvements to protect the remedy, will be coordinated with paint abatement programs and community redevelopment projects and should make the communities a more attractive place to locate business. The work associated with implementation of the Selected Remedy may provide additional jobs for the local labor force and contractors, including local supply contractors. Additionally, remediation dollars spent in the Silver Valley may create other opportunities for local businesses.

12.2 ENVIRONMENTAL PROTECTION IN THE UPPER BASIN AND LOWER BASIN

The remedial actions selected for environmental protection in the Upper Basin and Lower Basin, which are summarized in Table 12.2-1, will take approximately 30 years to implement.[18] During this period, EPA will evaluate the effectiveness and protectiveness of these remedial actions as well as the technical practicability of attaining ARARs, in particular ambient water quality standards for lead, zinc, and cadmium and compliance with the ESA and MBTA. During the five-year review process and at the end of this approximately 30-year period, EPA will evaluate and decide whether any additional remedial actions under CERCLA are necessary to attain ARARs and to provide for the protection of human health and the environment, and whether any ARAR waivers should be applied. Accordingly, consistent with 40 CFR 300.430(f)(1)(ii)(C), the remedial action selected by this ROD for environmental protection in the Upper Basin and Lower Basin is an interim measure and will become part of a final remedial action that will attain ARARs, unless an ARAR waiver is invoked at that time.

---

[18] The remedial actions described in this section include actions to protect human health at former mine and mill sites in the Upper Basin.

EPA expressly recognizes that after the selected remedial actions are implemented, conditions in the Upper and Lower Basin may differ substantially from EPA's current forecast of those future conditions, which is solely based on present knowledge. The tremendous amount of additional knowledge that will be gained by the end of this period through long term monitoring and five-year review processes may provide future bases for ARAR waivers. In addition, this new information and advances in science and technology may allow for additional actions to achieve ARARs and protect human health and the environment in a more cost-effective manner.

EPA recognizes that the State of Idaho has not concurred in the selection of any remedial action beyond those selected in this ROD. Furthermore, after implementation of the remedies selected by this ROD, EPA commits not to take or select any additional remedial actions in the Upper Basin or Lower Basin without first consulting with the State of Idaho. EPA will also continue to work with the regulatory stakeholder group, which was instrumental in developing the actions selected in this ROD.[19] Land management agencies may elect to implement cleanup actions on properties within their management jurisdiction toward achieving the overall goals of the Selected Remedy.

The Selected Remedy for environmental protection in the Upper Basin and Lower Basin consists of priority cleanup actions that could be implemented within an approximately 30-year period and would make significant progress toward protection of human health and the environment, ARAR compliance, effectiveness, implementability, and cost effectiveness. This remedy was also the Preferred Alternative in the Proposed Plan.

The priority actions included in the remedy were selected to achieve benchmarks, which are near-term objectives that will serve as landmarks and measurements to evaluate the progress of the remedy toward achievement of the long-term goals. The identification of benchmarks and prioritization of actions were based on knowledge gained during the RI/FS process and extensive discussions with stakeholders in meetings and weekly conference calls. Key areas of focus included identification of benchmarks that would be achievable within the time period of the Selected Remedy, appropriate measures of success, and actions necessary to achieve the benchmarks. These discussions drew heavily on the large amount of environmental data collected over time (e.g. water quality data and fish surveys) and the extensive experience of stakeholders in the Basin. The benchmarks are shown in Table 12.2-1.

12.2.1 Description of the Selected Remedy

The Selected Remedy is a prioritization of the numerous actions needed for protection of human health and the environment. As discussed in Section 7.2 of this ROD, the Coeur d'Alene Basin

[19] The regulatory stakeholder group that participated in the development of the Selected Remedy included the states of Idaho and Washington, the Coeur d'Alene and Spokane Tribes, U.S. Fish and Wildlife Service, U.S. Bureau of Land Management, and U.S. Forest Service. The U.S. Geological Survey provided technical assistance.

EcoRA evaluated data regarding the impacts of mining-related hazardous substances on the environment. The EcoRA determined that sufficient information exists to demonstrate the presence of high concentrations of metals in the soil, sediment, and surface water in the Basin. These metals pose substantial risks to the animals and plants that inhabit the Basin. The results of the EcoRA indicate that most Basin watersheds in which mining has occurred and a large portion of the Basin down gradient of mining areas are ecologically degraded by mining-related hazardous substances. This ecological degradation has manifested itself in observable effects in the Basin plants and animals. Furthermore, if remediation is not conducted, the effects will continue for the foreseeable future.

These demonstrated effects and future risks predicted in the EcoRA provide the basis for identifying ecological remedial actions in the ROD. Given the extensive area of contamination, EPA worked with Basin stakeholders to identify priority actions for protecting the environment. Priority issues were grouped into three areas as an initial primary focus with respect to environmental protection:

- **Dissolved metals (particularly zinc and cadmium) in rivers and streams.** High concentrations of these metals have harmful effects on fish and other aquatic receptors, as described in Section 7.2. Some native fish, including the cutthroat trout, bull trout, and sculpin, are particularly sensitive to dissolved metals.

- **Lead in floodplain soil and sediment.** Existing lead contamination has harmful effects on waterfowl and other ecological receptors, as described in Section 7.2.

- **Particulate lead in the surface water.**[20] Lead transported downstream in the river system is a continuing source of contamination for the Coeur d'Alene River, Coeur d'Alene Lake, and the Spokane River. Lead transported in the river system has impacted recreational areas in the Lower Basin and the Spokane River, resulting in posted health advisory signs at beaches and swimming areas. During flood events, lead transported by the river also impacts the wetlands and floodplains. The potential exists for future particulate lead transport and recontamination of recreation and feeding areas cleaned up as part of the Selected Remedy.

These three priority issues represent the primary environmental problems in the Basin. The prioritized actions of the Selected Remedy were identified based on their potential to achieve benchmarks for reduction of environmental impacts related to these three priority issues. These actions were incorporated into the selected remedies for Ninemile Creek, Canyon Creek, Pine

[20] Particulate lead is associated with sediment particles transported in surface water. Particulate lead is subject to deposition in quiescent areas, whereas dissolved and colloidally-bound lead are not deposited in quiescent areas.

Creek, the South Fork, and the lower Coeur d'Alene River, as well as associated riparian areas, lateral lakes, wetlands, and agricultural areas in the Lower Basin.

Protection of riparian and riverine resources is an important environmental consideration in the Basin. Based on the results of the risk assessment, toxic conditions exist for migratory birds, other wildlife, and vegetation in the riparian and riverine corridor throughout the Basin. Actions taken within the riparian and riverine zones will also be designed to increase protection of receptors in these habitats. These actions will constitute an important step toward a fully functional riparian and riverine corridor.

In addition to environmental protection, the actions described in the following sections would have significant human health benefits, particularly for children who recreate in the Lower Basin and individuals who would choose to practice a subsistence lifestyle. The potential exposure pathways include ingestion or dermal contact with soil and sediment at beaches and other common use areas; ingestion of native vegetables; ingestion of fish caught in Basin waters; exposure to soil at waste piles; and ingestion of untreated surface water. The PHD has identified children with elevated blood lead levels whose exposure was traced to use of beaches and recreational areas in the Lower Basin.

Based on current estimates of remedy effectiveness, the Selected Remedy would be expected to achieve about 50 to 70 percent of the dissolved metals load reduction in the Upper Basin (URS 2002a), measured in the South Fork at Pinehurst, that would be anticipated from full implementation of Ecological Alternative 3 for about 19 percent of the estimated cost of Ecological Alternative 3. Table 12.2-1 summarizes the Selected Remedy for environmental protection in the Upper Basin and Lower Basin.

Dissolved Metals in Rivers and Streams

High levels of dissolved metals, particularly zinc and cadmium, exist in the river system in the Basin. The Upper Basin is the primary source of dissolved metals. Dissolved metals concentrations and impacts from mining currently prevent the river system from fully supporting aquatic receptors, including native fish.

The widespread occurrence of tailings-impacted sediments will make it difficult to reduce dissolved metals concentrations throughout the entire Basin to levels that comply with federal and state water quality standards and fully support some sensitive native fish species. However, further improvements to the ecosystem can begin in the short term through implementation of the Selected Remedy and continue for many decades when remedial actions are combined with natural recovery. Implementing the Selected Remedy will allow some localized portions of the impacted areas to return to levels that would greatly improve the ecosystem.

The benchmark of the Selected Remedy is reduction of dissolved metals to concentrations that allow substantial improvement to the fisheries and the ecosystem of the South Fork and some of its tributaries. Fish and aquatic organisms that are more tolerant of metals than native fish could return more quickly. The population and species diversity of fish and aquatic organisms are expected to continue to improve as cleanup progresses in the Basin. To the degree practical, as actions affecting surface water quality are implemented, adjacent riparian and riverine areas would be addressed in order to protect species that inhabit these areas. Re-establishment of fish populations using stocking is not anticipated.

As part of the development of the fisheries benchmarks, EPA and others examined fisheries conditions throughout the Coeur d'Alene River Basin (USEPA 2001d). The fisheries conditions were grouped into tiers based on fish populations, types of species present, and other factors. The tiers range from Tier 0 (no fish present) to Tier 5 (fully-functional native fishery, including the presence of sensitive species). Water chemistry and habitat conditions associated with each tier were compiled based on observed conditions in the Basin. The fishery tier definitions are provided in Table 12.2-1. These water chemistry and habitat conditions are based on the current understanding of the conditions consistent with the fisheries tiers. As fishery conditions are monitored during and after cleanup, the benchmark chemistry and habitat conditions may need to be modified.

EPA coupled the data characterizing existing water quality conditions and fish populations with a probabilistic model that examined anticipated outcomes of conducting varying amounts of the response actions comprising Alternative 3. Through this means, EPA was able to prioritize cleanup areas for the Selected Remedy and estimate outcomes in terms of anticipated water quality conditions and consequent fish populations. Priority areas for the Selected Remedy have been identified based upon where the most load reduction can be practically achieved and where the best opportunities exist for re-establishing a sustainable trout fishery, with an emphasis on native fish. Implementation of the Selected Remedy will result in progress toward compliance with state and federal water quality standards and criteria. An example of this analysis is provided in the subsequent description of the Selected Remedy for Ninemile Creek.

Table 12.2-1 identifies the benchmarks and summarizes the remedial actions for Upper Basin areas, including Canyon Creek, Ninemile Creek, Pine Creek, and the South Fork. Ninemile Creek and Pine Creek are initial priority areas for fisheries improvements. The discharge from Canyon Creek is a priority for reducing metals loads to the South Fork.

Table 12.2-2 summarizes the fisheries benchmarks, the water chemistry and physical conditions that exist currently, and those that would be needed to achieve the fisheries benchmarks. The Selected Remedy includes those actions that, based on existing information, would be needed to achieve the fisheries benchmarks. These actions were used to develop the estimated costs presented in Section 12.2.2. As the remedy is implemented and monitored, the cleanup actions ultimately taken could differ, based on the additional knowledge gained, from those currently identified.

Ninemile Creek. Ninemile Creek was identified as a focus of the Selected Remedy for the following reasons:

- Ninemile Creek is essentially devoid of fish in the area of mining impacts
- Habitat conditions for aquatic receptors and other animals are good compared to other highly-impacted areas, such as Canyon Creek
- Water quality impacts largely stem from a few large sources in unpopulated areas of the East Fork
- The Selected Remedy could build upon removal actions already completed or underway
- The experience gained in Ninemile Creek could be applied to other highly-impacted drainages, such as Canyon Creek

The description of the Selected Remedy for Ninemile Creek is organized by three stream reaches. These are:

- East Fork above the Success mine site
- East Fork from Success to its confluence with the mainstem
- Mainstem Ninemile Creek

Areas identified for cleanup during implementation of the Selected Remedy are shown in Figure 12.2-1.

East Fork Above the Success Mine Site. The benchmark for this reach is to improve conditions to allow natural re-establishment of a salmonid fishery, with an emphasis on native species (Tier 3 fishery). The fishery would not necessarily include the presence of metals-sensitive species (such as the bull trout), reproduction, or the presence of juveniles. It is estimated that a reduction of metals loads of greater than 80 percent will be needed to achieve dissolved metals concentrations of less than 7 times the zinc chronic AWQC, which is the target concentration range for a Tier 3 fishery.

In addition to reductions in metals concentrations in the creek water, the cleanup would be designed to mitigate mining impacts on the riverine and riparian zone to protect fish, migratory birds, and other animals. An additional 1.7 miles of low-risk riverine and riparian area would be gained from the cleanup.

Initial actions in the East Fork of Ninemile Creek will include cleanup of dissolved metals sources in the reach from the headwaters area to the Success mine site. The source areas within the East Fork drainage identified for cleanup are shown in Figure 12.2-2. This cleanup has been initiated through removal actions by the mining companies and the State of Idaho at the Success and the Interstate Mill Site, as well as the planned cleanup actions at the Rex Mine and Mill site. Surface water monitoring data show that, historically, the Interstate and Success sites are the largest sources of metals loads to Ninemile Creek. Specific performance goals for the removal actions at these source areas have not been established. As part of the Selected Remedy, performance goals will be established based on the benchmarks for this reach. Should the performance goals not be achieved as a result of the removal actions, additional actions will be undertaken as part of the Selected Remedy. Initial monitoring results for the Interstate and Success sites are presented in Harvey (undated) and Golder Associates (2001), respectively.

East Fork from Success to Its Confluence with the Mainstem. Because current metals concentrations are higher in this reach, it is not anticipated that re-establishment of a resident fishery would occur as a result of implementation of the Selected Remedy. The benchmark for this reach is to improve conditions to enable migration of fish between the upstream reaches and the mainstem (Tier 1 fishery).

The State of Idaho is conducting a removal action at the Success site that consists of groundwater collection and treatment and surface water run-on controls. Depending on how successful the removal action is, additional actions in this reach could include scale-up to full-scale treatment at the Success site, relocation of the Success tailings pile, or construction of a treatment pond to remove metals from the creek water. The Selected Remedy would include monitoring of the removal action to ensure the actions are consistent with the benchmarks established for the Selected Remedy.

The treatment pond, if needed to achieve the benchmarks for the mainstem of Ninemile Creek, would treat creek water collected from the East Fork upstream of its confluence with the mainstem. The location of the treatment pond and its design capacity would be selected during remedial design, dependent on the results of treatability testing and siting considerations. Conceptually, the treatment pond would be very similar to the treatment pond identified for Canyon Creek. The treatment pond is described in further detail in the subsequent section that describes the Selected Remedy for Canyon Creek. It is anticipated that initial design studies would be implemented in Canyon Creek, and the experience gained would be applied in Ninemile Creek, if surface water treatment is needed. Preliminary estimates indicate a treatment pond with a design capacity of 10 cubic feet per second could remove 60 to 70 percent of the annual load of zinc that discharges from the East Fork into the mainstem of Ninemile Creek. The load reductions and estimated costs for the treatment pond are based on the assumption that all remedial actions in the East Fork have been implemented.

Mainstem Ninemile Creek. The benchmark for this reach is to improve conditions to enable migration of fish between the South Fork of the Coeur d'Alene River and the East Fork of Ninemile Creek (Tier 1 fishery). The Selected Remedy does not include cleanup actions within this reach to improve water quality. Improvements in water quality would result from cleanup actions implemented in the East Fork. At the mouth of Ninemile Creek, a culvert currently impedes fish passage. This would also need to be addressed, but is not included in the Selected Remedy.

The actions implemented in the Ninemile Creek watershed during the Selected Remedy would also include measures to address protection of human health at the Day Rock mine and mill site. The potential exists that some or all of the site may be preserved for its historical value. Any remedial design/action would be conducted in accordance with the National Historic Preservation Act (NHPA), 16 U.S.C. § 470f, 36 CFR Parts 60, 63, and 800 as described in Section 13.

EPA used a probabilistic analysis that predicted water quality conditions that would result from conducting varying amounts of the response actions comprising Alternative 3 to establish fisheries benchmarks and evaluate the scope of cleanup needed to achieve the benchmarks. An example of this analysis for the mainstem of Ninemile Creek follows.

Figure 12.2-3 illustrates the use of the probabilistic analysis to predict the probability of achieving the water quality conditions (expressed as multiples of the zinc AWQC) consistent with various fisheries tiers as a function of the cleanup effectiveness. Under complete implementation of Alternative 3, the probabilistic analysis predicted less than a 25 percent probability of achieving water quality conditions consistent with a Tier 3 fishery (less than 7 times the chronic AWQC) for the mainstem of Ninemile Creek. Further, the analysis predicted approximately a 50 percent probability of achieving water quality conditions consistent with a Tier 2 fishery (less than 10 times the chronic AWQC), and greater than a 90 percent probability of achieving water quality conditions consistent with a Tier 1 fishery (less than 20 times the acute AWQC) under Alternative 3.[21]

---

[21] For a Tier 1 fishery (migratory corridor), the water quality benchmark is based on the acute AWQC because the fish would be present in the stream reach for only a limited time.

EPA and stakeholders recognized several tradeoffs associated with complete implementation of Alternative 3 in Ninemile Creek.

- High concentrations of metals in the reach of the East Fork from Success downstream to the confluence of the East Fork and the mainstem would limit re-establishment of a resident fishery throughout Ninemile Creek.

- There would be concerns with the implementability of Alternative 3 in the mainstem due to the presence of private development.

- Significant short-term impacts would be associated with complete implementation of Alternative 3.

- The estimated present worth cost of complete implementation of Alternative 3 in Ninemile Creek is $59 million. The additional actions for full implementation of Alternative 3 were considered less effective than actions to reduce dissolved metals from other impacted tributaries, e.g., Canyon Creek.

Because of these tradeoffs, EPA and stakeholders elected to establish a benchmark for the mainstem of achieving a migratory corridor for fish from the South Fork to the East Fork of Ninemile Creek. The probabilistic analysis was used to evaluate the scope of Alternative 3 response actions needed to achieve the benchmark, as follows.

For complete implementation of Alternative 3 above Success together with the removal actions at the Success, Interstate, and Rex sites, the probabilistic analysis predicted a 35 percent probability of achieving water quality conditions consistent with a Tier 1 fishery (20 times the acute AWQC) in the mainstem as a result of implementation of the Selected Remedy, as shown in Figure 12.2-3. There is evidence for fish migration at concentrations greater than 20 times AWQC, and the Selected Remedy may achieve the benchmark despite an estimated probability of achieving less than 20 times the acute AWQC that is less than 50 percent. However, should monitoring indicate the benchmark would not be achieved, the Selected Remedy includes a contingency for construction of a treatment pond to treat the discharge from the East Fork, in addition to the cleanup actions described above. For an estimated average removal of 69 percent of the dissolved metals load in the East Fork by the treatment pond, the estimated probability of achieving water quality conditions consistent with a Tier 1 fishery would increase to approximately 80 percent.

Figure 12.2-4 depicts the anticipated results of the Selected Remedy in Ninemile Creek compared to Alternative 3. This figure indicates the Selected Remedy will remove approximately 84 percent of the dissolved metal load, remediate approximately 62 percent of the volume of contaminated material, take up 87 percent of the regional repository requirements, and represent 61 percent of the cost relative to full implementation of Alternative 3. These percentages were calculated assuming all actions contemplated under the Selected Remedy, including additional actions at the Interstate, Rex, and Success sites and construction of a treatment pond near the confluence of the East Fork and the mainstem, will need to be implemented to achieve the water quality benchmarks.

The long-term goals for Ninemile Creek include the return of a fully-functional native fishery and full protection of riparian and riverine zone birds and other animals. EPA believes that additional cleanup actions on the mainstem and an extended period of natural recovery would be needed to achieve the long-term goals in Ninemile Creek.

Pine Creek. Considerable cleanup work has already been conducted in the Pine Creek watershed, particularly by the BLM. Pine Creek currently supports an adult fishery, including brook trout and a smaller population of native cutthroat trout. However, populations and reproduction in some reaches of the creek are limited, primarily by stream structure and riparian zone conditions that have been degraded by mining impacts, with metals concentrations being a secondary limiting factor. The benchmark for Pine Creek is to improve conditions to allow natural increases in salmonid populations, with an emphasis on native fish, and to improve conditions to allow for spawning and rearing.

Areas identified for cleanup during the Selected Remedy are shown in Figure 12.2-5. The actions implemented in the Pine Creek watershed would build on the work already conducted by the BLM. Actions would include bank and bed stabilization and riparian zone revegetation to mitigate the effects of mining impacts. The actions would also include hot spot removals within the stream and at former mine and mill sites, including the Upper and Lower Constitution, Highland-Surprise, Nevada-Stewart, Hilarity, Little Pittsburg, Sidney (Denver Creek), and Nabob. Several of these sites (Upper and Lower Constitution, Highland Surprise, Nevada-Stewart, Hilarity, and Nabob) are also a concern for protection of recreational users. As with work in Ninemile Creek, lessons learned while implementing the Selected Remedy in Pine Creek can be applied to other areas in the Basin requiring additional cleanup.

During the development of the priority actions included in the Selected Remedy for Pine Creek, EPA, in consultation with stakeholders, evaluated other potential response actions anticipated in Alternative 3 in light of what they would accomplish over an approximately 30-year time period. Dissolved metals concentrations in Pine Creek are currently generally much lower than in Ninemile Creek and Canyon Creek, and it was concluded that the cleanup of sites that are smaller sources of metals discharges than those included in the Selected Remedy would not be necessary at this time to achieve the benchmarks of increasing salmonid populations and improving spawning and rearing conditions.

Conversely, it was concluded that a lower level of cleanup would be ineffective in reducing metals concentrations from current conditions (10 to 20 times the AWQC in the East Fork of Pine Creek) to conditions needed to achieve the fisheries benchmarks (less than 7 times the chronic AWQC to support a salmonid fishery). Mitigation of mining impacts would be needed to provide stream structure and riparian zone conditions supportive of the benchmarks for fisheries improvements, as well as to provide protection of riparian zone animals. A lower level of cleanup would also not be protective of recreational users at former mine and mill sites.

Figure 12.2-6 depicts the anticipated results of the Selected Remedy in Pine Creek compared to Alternative 3. This figure indicates the Selected Remedy will remove approximately 29 percent of the dissolved metal load, remediate approximately 26 percent of the volume of contaminated material, take up less than 1 percent of the regional repository requirements, and represent 32 percent of the cost relative to full implementation of Alternative 3.

The long-term goals for Pine Creek include the return of a native fishery and full protection of riparian and riverine zone birds and other animals. EPA believes that additional cleanup actions and a period of natural recovery would be needed to achieve the long-term goals in Pine Creek.

Canyon Creek. Canyon Creek is essentially devoid of fish below Burke as a result of high metals concentrations and severely degraded riverine and riparian conditions. Canyon Creek contributes more dissolved metals load to the South Fork than any other tributary, approximately 20 to 25 percent of the load in the South Fork at its confluence with the North Fork. The benchmark for Canyon Creek is to reduce dissolved metals loads discharging from the creek into the South Fork by at least 50 percent.

Implementation of a source-by-source cleanup in Canyon Creek, as is anticipated under Alternative 3, would be very difficult, costly, and time consuming. The Selected Remedy for approximately 30 years of work in Canyon Creek will focus on identifying cost-effective technologies for improving downstream water quality in the South Fork and mainstem Coeur d'Alene River and, ultimately, in Coeur d'Alene Lake and the Spokane River.

One potentially cost-effective approach that will be evaluated is to intercept the creek water in lower Canyon Creek and remove metals using passive treatment. Under this approach, the individual metals sources in the Canyon Creek watershed would not be addressed during the Selected Remedy. Should creek water treatment prove effective after pilot studies, full-scale treatment would be implemented as part of the Selected Remedy in Canyon Creek. The development of innovative and potentially cost-effective water treatment in Canyon Creek would be effective in achieving desired reductions and potentially have application in other parts of the Basin (e.g., Ninemile Creek). If passive treatment does not prove effective, alternative treatment and control systems to achieve the benchmark of at least 50 percent reduction of dissolved metals loads would be evaluated. Alternative actions may be used based on an evaluation against CERCLA remedy selection criteria.

Because this approach is not anticipated to achieve the long-term goal of ecosystem recovery within Canyon Creek, EPA believes additional work would be necessary in Canyon Creek. Source control efforts conducted elsewhere in the Basin (e.g., Success and Interstate in Ninemile Creek) will be monitored and evaluated such that subsequent efforts in Canyon Creek can be performed in a cost-effective manner.

A conceptual drawing of a passive treatment system using a treatment pond is depicted in Figure 12.2-7 (USEPA 2001g). Creek water would be diverted into the treatment pond at flow rates up to the treatment design capacity. At higher flows, the creek flow above the design capacity would be bypassed without treatment. The diverted water would percolate through a bed of reactive media, which would remove metals from the water. The treated water would be discharged back into the creek.

Because groundwater containing relatively high concentrations of metals discharges to surface water throughout the reach downstream of the Hecla-Star tailings ponds, a diversion location as far downstream as is feasible would maximize removal of metals. The location of the treatment pond and its design capacity would be selected during remedial design, dependent on the results of treatability testing and siting considerations. A possible location of the treatment pond is shown in Figure 12.2-8.

The expected value of the dissolved zinc load in Canyon Creek after remedy implementation is estimated to be 234 pounds per day, a reduction of 322 pounds per day compared to the expected value calculated from surface water data collected from 1991 to 1999. The expected value is based on a probabilistic analysis of potential treatment pond performance and considers potential load reductions from removal actions conducted by SVNRT and stabilization of sediment sources that will be conducted as part of the Selected Remedy. The analysis of potential treatment pond performance is based on an assumed design capacity of 60 cfs. The sediment stabilization measures are described later in this section.

The Hecla-Star Tailings Ponds in lower Canyon Creek are a potentially significant source of dissolved metals to groundwater and surface water. The nature and extent of metals loading from the tailings ponds may affect placement and sizing of the treatment pond, and additional characterization of the loading may be conducted during design and siting studies for the treatment pond.

Disposal of treatment residuals (spent media and collected sediment) will be evaluated during remedial design. For the purpose of estimating costs, it was assumed the residuals will be disposed of in a solid waste repository. Regeneration of spent media is an option that will be evaluated during remedial design.

Selected remedies in Canyon Creek also include stabilization of dumps and stream banks that are sources of sediment and particulate metals in the creek, the South Fork, and the lower Coeur d'Alene River. The locations identified for stabilization are Tamarack, Omaha, Standard-Mammoth Loading Area, Standard-Mammoth mill, Hercules No. 5, Oom Paul, Ajax No. 3, Hecla (Burke), Tiger-Poorman, West Star, Gertie, and Gorge Gulch. The locations of these sources areas are shown in Figure 12.2-9.

The actions implemented in the Canyon Creek watershed during the Selected Remedy would also include protection of human health at two former mine and mill sites where potential exposures were identified (Standard-Mammoth mill and Sisters mine). Areas identified for cleanup in the Selected Remedy are shown in Figure 12.2-9.

Additional actions may also be needed at the Burke concentrator. This site is currently fenced to limit access. The potential exists that some or all of the site may be preserved for its historical value. Should people be allowed on the site as a result of the historical preservation, or should access otherwise become available, cleanup actions would be needed to limit exposures to metals. The location of the Burke concentrator is shown in Figure 12.2-9.

During the development of the priority actions included in the Selected Remedy for Canyon Creek, EPA, in consultation with stakeholders, evaluated other potential response actions anticipated in Alternative 3 in light of what they would accomplish over an approximately 30-year time period. Canyon Creek is the source of 20 to 25 percent of the dissolved metals load in the South Fork, and a relatively large reduction of metals load from Canyon Creek would be needed to meet the benchmark for improvements in the South Fork fish migration corridor, as well as to meet benchmarks for reductions in dissolved metals concentrations in the Spokane River. A source-by-source cleanup in Canyon Creek was considered; however, this approach would require extensive removals and thus be difficult to implement within the 30-year timeframe of the Selected Remedy. The effectiveness of this approach would be uncertain, and the cost would be high.

Not controlling the metals loading from Canyon Creek was also considered. Not controlling the metals loading from Canyon Creek would result in continued significant and unacceptable metals discharges to downstream waters and would not contribute to achieving the benchmark of improving the fisheries and ecosystem of the South Fork or reducing dissolved metals concentrations in the Spokane River.

Figure 12.2-10 depicts the anticipated results of the Selected Remedy in Canyon Creek compared to Alternative 3. This figure indicates the Selected Remedy will remove approximately 73 percent of the dissolved metal load, take up approximately 13 percent of the regional repository requirements, and represent 23 percent of the cost relative to full implementation of Alternative 3. The low percentage of regional repository space required reflects the Selected Remedy's focus on reducing metal loading to the South Fork, not Canyon Creek.

The long-term goals for Canyon Creek include the return of a native fishery and full protection of riparian and riverine zone birds and other animals. EPA believes that additional cleanup actions and an extended period of natural recovery would be needed to achieve the long-term goals for Canyon Creek.

South Fork. The fisheries benchmark for the South Fork[22] is to improve conditions to support a higher fish density (Tier 2+ to 3 fishery). Improvements in conditions would result largely from implementation of the selected remedies for Canyon Creek, Ninemile Creek, and Pine Creek. In the floodplain of the South Fork (in areas outside of the Bunker Hill Box), tailings "hot spots" would be excavated and disposed of. Under separate regulatory authorities, BLM is also evaluating the need for excavation and/or capping of BLM-owned lands in this area. These activities would be consistent with the overall goal of protection of human health and the environment. Streamside actions would include stabilization and bioengineering of the stream channel and banks. These actions would enhance the South Fork as a migratory corridor for fish by increasing the amount of pools and shade and would provide initial protection of animals that inhabit the riparian zone. Locations of tailings hot spots are shown in Figure 12.2-11.

The remedy in the South Fork watershed would also include cleanup at six sites that have been selected because of potential human health exposures, but also have ecological impacts:

- National Millsite
- Morning No. 6 Mine and Millsite
- Golconda
- Hercules Millsite in Wallace
- U.S. Bureau of Mines Impoundment
- Silver Dollar Mine

The locations of the National, Morning, and Golconda sites are shown in Figure 12.2-12. The locations of the Hercules, U.S. Bureau of Mines, and Silver Dollar sites are shown in Figure 12.2-11.

---

[22] For the purposes of describing the Selected Remedy, this area includes the South Fork from its headwaters to its confluence with the North Fork and all tributaries except Canyon Creek, Ninemile Creek, Pine Creek, and tributaries within the Bunker Hill Box.

During the development of the priority actions included in the Selected Remedy for the South Fork, EPA, in consultation with stakeholders, evaluated other potential response actions anticipated in Alternative 3 in light of what they would accomplish over an approximately 30-year time period. Sediments and associated groundwater are the primary sources of dissolved metals originating from the South Fork floodplain. More extensive metals reductions would involve additional removal or containment of sediments (with or without treatment of associated groundwater). The additional removal or containment and treatment actions would involve sediments that are generally lesser sources of metals or more difficult to access due to the depth of the sediment or their location beneath infrastructure or private property. It was concluded that these additional actions would contribute less to achieving the benchmark of improving the South Fork as a fish migration corridor, would be less implementable, and would be more costly compared to the “hot spot” removal actions included in the Selected Remedy.

Conversely, removal of the remaining accessible floodplain hot spots, as is planned during the Selected Remedy, would be readily implementable and cost-effective for reducing dissolved metals load and increasing protection of humans and other animals that use these areas. A lower level of cleanup than is proposed for the Selected Remedy would also not be protective of humans potentially exposed to metals at the seven former mine and mill sites identified for cleanup.

As with Ninemile, Canyon, and Pine Creeks, lessons learned while implementing the Selected Remedy in the South Fork can be applied to other areas in the Basin requiring cleanup.

Figure 12.2-13 depicts the anticipated results of the Selected Remedy in the South Fork compared to Alternative 3. This figure indicates the Selected Remedy will remove approximately 7 percent of the dissolved metal load, remediate approximately 6 percent of the volume of contaminated material, take up 2 percent of the regional repository requirements, and represent 5 percent of the cost relative to full implementation of Alternative 3. The low percentages reflect that cleanup in the tributaries is more cost effective than cleanup in the South Fork at this time.

The long-term goals for the South Fork include the return of a native fishery and full protection of riparian- and riverine-zone birds and other animals. EPA believes that additional cleanup actions and an extended period of natural recovery would be needed to achieve the long-term goals for the South Fork.

Other Upper Basin Areas. Improvements in water quality in the river system will be strongly dependent on reductions in metals loading achieved in areas along the South Fork, including the Bunker Hill Box. Approximately one-half of the dissolved metals load in the South Fork above the North Fork confluence comes from the river reach that includes the Bunker Hill Box. Actions taken to date within the Bunker Hill Box are expected to result in improvements in water quality; however, it is anticipated that additional actions will be needed to meet cleanup goals. These additional actions would likely include control of metals loading from groundwater to surface water, including the reach adjacent to the CIA. As described in Section 4.1.2, implementation of Phase II of the Non-Populated Areas ROD will address site surface water and groundwater cleanup. EPA anticipates surface water and groundwater cleanup actions to be implemented through future RODs, amendments to RODs, or ESDs for the Bunker Hill Box and to parallel implementation of the Selected Remedy.

Lead in Floodplains Soil and Sediment

Soil and sediment throughout the floodplains of the lower Coeur d'Alene River Basin are contaminated with lead that has washed downstream over the years from Upper Basin mining activities. Sediments are also remobilized and transported into Coeur d'Alene Lake and the Spokane River. Lead-contaminated sediments in the floodplains (including wetlands, bottom sediment of the lateral lakes, and low-lying upland areas) have caused adverse effects to wildlife. Notably, waterfowl (e.g., tundra swan and ducks) ingest highly contaminated sediment to the extent that many have suffered toxic effects or died from ingestion of lead. The USFWS has documented numerous deaths among waterfowl and small mammals in the South Fork and Coeur d'Alene River floodplain.

A long-term goal is to reduce metals exposure of plants, wildlife, and fish throughout these areas to levels that are protective of the ecosystem. Because the total contaminated floodplain area in the Lower Basin is so large, it is important to prioritize areas to improve specific, priority areas within the ecosystem. For example, one benchmark is to reduce waterfowl mortality by providing additional safe feeding areas. Site-specific data from waterfowl feeding studies indicate a lead cleanup level of 530 mg/kg in sediment for protection of waterfowl.

It was recognized that all areas needing long-term cleanup could not be addressed effectively in the Selected Remedy. Resource agencies have identified high-priority areas in the Lower Basin based on potential for contributing to lead poisoning of wildlife, high use by waterfowl, high levels of lead in sediments, availability of site access, and relatively low potential for recontamination during flood events. The areas identified as top priorities are:[23]

- Thompson Lake (300 acres of wetland area and 256 acres of lake area)
- Thompson Marsh (59 acres of wetland area and 122 acres of lake area)
- Bare Marsh (165 acres of wetland area)

[23] The acres of lake area shown are the entire areas of the lakes. To develop estimated costs, it is anticipated contaminated sediments will be cleaned up to a water depth of six feet (which represents an average of approximately 25% of the total lake area). These water depths represent the highest use feeding areas and, consequently, the areas of greatest exposure to waterfowl and other animals.

- Medicine Lake (198 acres of wetland area and 230 acres of lake area)
- Lane Marsh (213 acres of wetland area)
- Cave Lake (190 acres of wetland area and 746 acres of lake area)
- Anderson Lake (44 acres of wetland area and 505 acres of lake area)

The areas identified for cleanup during the Selected Remedy are shown in Figure 12.2-14. An additional goal of the Selected Remedy is to increase the amount of safe feeding areas by identifying and cleaning up some areas that are currently used for agriculture. These actions would be taken in cooperation with the current owners. It is estimated an additional 1,500 agricultural acres may be cleaned up. In total, about 4,500 acres of safe waterfowl feeding areas could be provided by the cleanup actions taken under the Selected Remedy.

A combination approach is envisioned for these areas, depending on the specific conditions (e.g., depth of contaminated sediments) within a given wetland or lake. Contaminated materials would be excavated from some areas and transported to an upland repository or consolidated within the lateral lake being cleaned up. Other areas would be capped with a layer of clean soil to prevent feeding birds from becoming exposed to metals. Excavation depths and cap thicknesses will be selected to prevent direct exposure of waterfowl, fish, and other animals to contaminated sediments. Excavation depths and cap thicknesses are anticipated to average approximately one foot. If feasible, capping materials could be obtained from clean subsurface sources within the wetland unit, with the possible result of creating deeper ponded areas to increase feeding opportunities for waterfowl and fish. Soil treatment to reduce lead bioavailability may be applied in selected areas if effective treatment technologies are identified in pilot tests underway at this time.

The Selected Remedy focuses on cleaning up sediments in the portions of the lateral lakes where the water depth is six feet or less. These water depths represent the highest use feeding areas and, consequently, the areas of greatest exposure to waterfowl and other animals. Monitoring of the effects of the cleanup would include measuring the concentrations of lead in brown bullhead fish. The brown bullhead has been identified by the USFWS as the best indicator species for the ecological health of the lakes. Should lead concentrations in the brown bullhead remain elevated following completion of cleanup and waterfowl mortalities continue, the need for additional actions would be evaluated. Monitoring of blood lead concentrations in floodplain animals such as migratory birds is also a primary biomonitoring tool that may be used in evaluating cleanup activities.

Although the areas identified for cleanup during the Selected Remedy have relatively low recontamination potential, some recontamination potential does exist. Hydraulic controls (floodgates) and levees could be used to limit recontamination of treated areas. These structures could have effects on the overall hydrology of the river/floodplain system. The need for these types of structures and their effect on the hydrology of the river/floodplain system would be evaluated during remedial design.

During the development of the priority actions included in the Selected Remedy for mitigation of the impacts of lead in floodplain areas, EPA, in consultation with stakeholders, evaluated other potential response actions anticipated in Alternative 3 in light of what they would accomplish over an approximately 30-year time period. Cleanup at additional areas was evaluated, including:

- Harrison Slough
- Blue Lake
- Black Lake
- Swan Lake
- Blessing Slough
- Moffit Slough
- Hidden Marsh
- Campbell Marsh
- Killarney Lake
- Strobl Marsh
- Lane Marsh (only partially addressed in the Selected Remedy)
- Black Rock Slough
- Bull Run
- Porter Slough
- Rose Lake
- Orling Slough
- Cataldo Slough
- Mission Slough

Although cleanup of these wetlands may be needed to protect migratory birds under the MBTA, they were not included in the Selected Remedy because of higher recontamination potential and poorer access. The scope of actions that could be implemented in the approximately 30-year response timeframe was also limited by the need to further develop and verify effective, implementable methods of reducing lead exposure and recontamination. The use of management techniques to discourage waterfowl feeding at contaminated areas also was also considered. These techniques were not included in the Selected Remedy because of concerns about reliability and the limited extent of alternative uncontaminated feeding areas for waterfowl.

The Selected Remedy includes remediation of 4,528 acres of wetland and lateral lakes in the lower basin. Studies conducted during the remedial investigation indicate that over 18,000 acres of waterfowl habitat exceed adverse effect levels and over 15,000 acres exceed lethal thresholds.

Over 13,000 acres that exceed the adverse effect levels are not targeted for cleanup in the Selected Remedy.

The scope of cleanup included in the Selected Remedy reflects a reasonable amount of implementable work, for an approximately 30-year timeframe, toward achieving protection of waterfowl and other animals, as well as a first step toward protection of birds covered under the MBTA. The work will be sequenced to ensure that current land uses (e.g., recreational) will be available throughout the period of cleanup.

It is expected that sediments deposited in these wetlands during future floods would generally decrease in metals content over time as a result of cleanup of the Upper Basin, the river banks of the mainstem Coeur d'Alene River, and, to a lesser extent, the bed of the river. If the metals content of sediments decreases with time, recontamination would be less important for these future wetlands cleanup efforts.

An important goal is full return of cultural resources and recreational uses in the Basin. Remedies that address wetland risks to waterfowl would also address potential human exposures at water potato grounds and recreational beaches. Institutional controls, such as warning signage, will remain in place in the Lower Basin until they are no longer needed to protect human health, but are not preferred as the long-term solution.

Particulate Lead in Surface Water

Lead-bearing sediment in surface water is transported downstream to Coeur d'Alene Lake and the Spokane River, and washes across and contaminates the floodplain in the Lower Basin during flood events. Three sources are suspected to contribute the major particulate lead load in the Lower Basin: sediments derived from the Upper Basin, contaminated river bank sediments in the Lower Basin, and river bed sediments in the Lower Basin. The banks in many areas of the Lower Basin are steep and actively eroding into the river. River bed sediments have become contaminated from materials transported from upstream and from the eroding river banks. A portion of this sediment is entrained during high flow events, transported downstream in the river, and deposited over the floodplain.

One goal of the Selected Remedy is to reduce the lead load in sediment transported and deposited in downstream areas of the lateral lakes, Coeur d'Alene Lake, and Spokane River. Reduction of lead-bearing sediment in surface water is necessary to minimize recontamination of cleaned areas, prevent the occasional exceedances of drinking water standards in Coeur d'Alene Lake, protect wildlife from exposure, and reduce lead concentrations and AWQC exceedances in the Spokane River. During high flow in 1999, the dissolved lead concentration at the outlet from Coeur d'Alene Lake exceeded the chronic AWQC for lead by a factor of approximately two (USEPA 2001b, Table 5.7-8), which suggests a reduction in load of at least 50 percent may be needed during high-flow events to reduce year-round dissolved lead concentrations to below the chronic AWQC in the Spokane River.

Initially during implementation of the Selected Remedy, cleanup actions would focus on areas with the most actively eroding river banks. The reaches for bank stabilization will be prioritized based on the degree of erosion occurring and the concentrations of metals in the riverbank sediments. Remedial actions would include a combination of bioengineering and removals, as appropriate, to allow re-establishment of a sustainable river ecosystem. The extent of removal of contaminated material would be determined by the concentrations of metals in the river bank material, the likelihood that stabilized banks will remain stable in the future, site accessibility, and the presence of infrastructure. A total of about 33 miles of river banks[24] that are highly susceptible to erosion are targeted for stabilization during the Selected Remedy. In addition to reducing particulate lead loading to the river, these actions would increase the area of low-risk riparian area adjacent to the river in these reaches. Potential redeposition of metal-enriched sediment onto remediated river banks after high-flow events would be evaluated as part of the remedial actions.

Cost-effective methods for river-bed sediment removal will also be evaluated and conducted during the Selected Remedy. The natural depositional areas around Dudley and the Cataldo Mission have been identified as the potential sites for sediment removal or management operations. The Dudley area is the location of relatively thick deposits of sediment containing high concentrations of lead and other metals. Fine-grained sediment from the South Fork and North Fork accumulates at this location. Upstream of the Dudley area, the area around the Cataldo Mission acts as a natural trap for coarser-grained sediment, which usually contains less lead, from the North and South Forks. Other sediment management techniques that may be viable alternatives to sediment removals for reducing particulate lead transport and providing long-term protection will also be evaluated during remedial design.

Sediments naturally accumulate in areas where the river leaves its bank during flood events. During implementation of the Selected Remedy, the feasibility of engineering these areas (referred to as “splays”) as natural traps for sediment transported during flood events would be evaluated through pilot studies.

Monitoring and evaluation of the potential improvements resulting from pilot-scale and full-scale remedial actions during the Selected Remedy will be used to help guide the continuing and future implementation of cost-effective remedies for the Lower Basin.

[24] Measured as length of bank on one side of the river, not as river miles.

During the development of the priority actions included in the Selected Remedy for particulate lead in surface water, EPA, in consultation with stakeholders, evaluated other potential response actions anticipated in Alternative 3 in light of what they would accomplish over an approximately 30-year time period. Additional removal or stabilization actions, including banks less susceptible to erosion, was evaluated, but was considered to provide less overall protection of the environment compared to removal or stabilization of banks with high erosion susceptibility. More extensive removal of river-bed sediment was also evaluated, but was not included in the Selected Remedy because of the following considerations:

- Beginning with smaller scale removals to refine cost-effective sediment removal or management techniques
- Confirming that removal can be conducted in a manner that will not exacerbate lead movement downstream
- Limiting uncertainty with respect to repository capacity for disposal of the contaminated sediment removed from the river beds
- Limiting the area of removal work to natural sediment deposition areas, thereby limiting the effects of potential recontamination and effects on boating activities, while enhancing cost-effectiveness
- Insuring that the entire depth of contaminated sediment is excavated at the selected location(s) to eliminate the potential for adverse impacts as a result of exposing deeper, more contaminated sediments than those present on the surface of the river bed

EPA, in consultation with stakeholders, also evaluated a narrower scope of remedies. No action for river-bed sediments was evaluated; however, the bed sediments are a large source of particulate lead, which, when deposited in the lateral lakes during flood events, has had severe effects on wildlife. It was considered necessary to begin removing some of the most highly-contaminated sediments to reduce future downstream effects, as well as to begin developing cost-effective, implementable methods of sediment removal. Removal or stabilization of less length of contaminated river bank was also evaluated; however, removal of banks that are highly susceptible to erosion, as is proposed under the Selected Remedy, would be relatively implementable, could be conducted at a reasonable cost, and would increase protection of birds and animals in riparian areas. In addition, stabilization of a smaller amount of erosion-susceptible bank would likely result in a greater risk of downstream recontamination compared to the Selected Remedy.

12.2.2 Estimated Cost of the Selected Remedy

Detailed cost estimates are presented in the tables listed here.

- Table 12.2-3: Ninemile Creek. Cost estimates were developed both with and without costs for the contingent actions at removal action sites (Interstate, Success, and Rex) and the treatment pond. Assuming none of the contingent actions will be required, the total estimated present worth cost for the Selected Remedy for Ninemile Creek is $13,500,000. The net present worth of 30 years of O&M is $1,500,000. The estimated average annual O&M cost is $120,000. The costs for the contingent actions at removal action sites (Interstate, Success, and Rex) and the treatment pond are:

  - Contingent actions at removal action sites: $16,500,000

  - Treatment pond: $6,000,000

  These actions would be conducted if needed to achieve the benchmarks for Ninemile Creek. Assuming all remedial actions described in the previous section will be necessary to achieve the benchmarks (including contingent actions), the total estimated present worth cost for the Selected Remedy for Ninemile Creek is $36,000,000. The net present worth of 30 years of O&M is $6,000,000. The estimated average annual O&M cost is $480,000.

- Table 12.2-4: Pine Creek. The total estimated present worth cost for the Selected Remedy for Pine Creek is $14,000,000. The net present worth of 30 years of O&M is $2,100,000. The estimated average annual O&M cost is $170,000.

- Table 12.2-5: Canyon Creek. The total estimated present worth cost for the Selected Remedy for Canyon Creek is $35,000,000. The net present worth of 30 years of O&M is $18,000,000. The estimated average annual O&M cost is $1,500,000.

- Table 12.2-6: South Fork. The total estimated present worth cost for the Selected Remedy in the South Fork is $16,000,000. The net present worth of 30 years of O&M is $1,400,000. The estimated average annual O&M cost is $110,000.

- Table 12.2-7: Lead in floodplains. The total estimated present worth cost for the Selected Remedy for lead in the Lower Basin floodplains is $81,000,000. The net present worth of 30 years of O&M is $7,200,000. The estimated average annual O&M cost is $580,000.

- Table 12.2-8: Particulate lead in surface water. The total estimated present worth cost for the Selected Remedy for particulate lead in surface water is $71,000,000. The net present worth of 30 years of O&M is $5,100,000. The estimated average annual O&M cost is $400,000.

The total estimated present worth cost of the Selected Remedy for protection of the environment in the Upper Basin and Lower Basin is $250,000,000, including costs for contingent actions. The total estimated net present worth of 30 years of O&M is $40,000,000. The estimated average annual O&M cost is $3,200,000.

The estimated costs in these detailed cost estimate tables are based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to –30 percent of the actual project cost, consistent with RI/FS guidance.

The costs presented are present worth costs. The present worth cost is the sum of the capital costs and the present value of the O&M costs over the period of performance. Consistent with current CERCLA guidance, estimates of O&M present worth costs assume a discount rate of 7 percent and a 30-year period of performance (USEPA 2000b). O&M costs will vary from year to year. The estimated average annual O&M cost was calculated by dividing the net present worth of O&M by the 30-year present worth factor (12.4).

Because the remedial actions have not been staged or phased over time, all capital costs are considered present worth costs assuming year 2000 dollars.[25] The effect of remedy staging over an approximately 30-year implementation period would be to reduce the present worth cost of both capital and O&M costs.

Some components of the remedy are expected to have O&M requirements that extend beyond the assumed 30-year period of performance. The added incremental cost of O&M in perpetuity compared to 30 years of O&M is 15 percent for a 7 percent discount rate. The potential increase of the present worth cost of the remedy resulting from O&M beyond the 30-year performance period is expected to be less than the potential reduction of the present worth cost of the remedy resulting from remedy staging.

---

[25] The costs in this ROD are based on costs presented in the Feasibility Study (FS), which were developed using year 2000 cost data.

12.2.3 Expected Outcomes of the Selected Remedy

This section describes the expected outcomes of the Selected Remedy in terms of benchmark cleanup criteria, anticipated benefits to human health and the environment, land uses, groundwater uses, and socio-economic and community impacts.

Benchmark Cleanup Criteria

Benchmark cleanup criteria for surface water are based on target levels of fisheries. The benchmark water quality conditions are expressed as multiples of the AWQC, based on the current understanding of the conditions consistent with the targeted fisheries (USEPA 2001d). As fisheries conditions are monitored during and after cleanup, the benchmark cleanup criteria may need to be modified. The benchmark cleanup criteria for dissolved metals in surface water are:

- Tier 1: Migration corridor. Expected to be achieved at dissolved metals[26] concentrations less than 20 times the acute AWQC.

- Tier 2: Resident salmonid fishery of any species. Expected to be achieved at dissolved metals concentrations between 7 times and 10 times the chronic AWQC.

- Tier 3: Resident salmonid fishery with three or more age classes, including young-of-the-year. Expected to be achieved at dissolved metals concentrations between 3 times and 7 times the chronic AWQC.

- Tier 4: Resident salmonid fishery with three or more age classes, including young-of-the-year, and sculpin. Expected to be achieved at dissolved metals concentrations between 1 times and 3 times the chronic AWQC.

- Tier 5: Resident salmonid fishery with five or more age classes, including young-of-the-year, sculpin, and bull trout. Fauna dominated by native species at high densities (0.1 to >0.3 fish per square meter). Least impacted watershed with dissolved metals concentrations less than the chronic AWQC.

The benchmark fisheries tiers are shown in Table 12.2-1.

[26] For the definitions of fisheries tiers, AWQC are equal to the EPA-approved State of Idaho water quality standards for cadmium and zinc (see Tables 8.2-2 and 8.2-3). The concentration ranges are unaffected by the 2001 update to cadmium criteria.

There are no promulgated cleanup criteria or standards that are ARARs for the soil or sediment of the Upper Basin and Lower Basin. Lead is the main risk driver in the soil and sediment and accordingly, EPA has identified lead as the preferred metal to be used as a benchmark. Background lead concentrations in the soil and sediment of the Lower Basin are estimated to be 47.3 mg/kg (see Table 7.2-7), whereas lead concentrations in soil and sediment in the impacted areas are typically 3,500 to 4,000 mg/kg.

To establish a benchmark cleanup criterion for sediment, EPA examined site-specific data and all other available relevant information. For sediment in the wetlands and lateral lakes areas of the Lower Basin, a site-specific lead level of 530 mg/kg has been identified by the USFWS as the LOAEL for waterfowl (Beyer et al. 2000). The USFWS has noted that soil and sediment in 95 percent of the floodplain habitat area the Lower Basin has lead concentrations greater than 530 mg/kg. Using all available lines of evidence, the EcoRA also estimated a range of sediment lead concentrations protective of aquatic birds and mammals. The lead concentrations potentially protective of aquatic birds and mammals include (see also Table 7.2-7):

- 3.65 mg/kg - NOAEL for protection of individuals
- 249 mg/kg - LOAEL for protection of populations
- 718 mg/kg - based on an ED_{20} for populations

Given the absence of promulgated criteria for metals in soil and sediment, EPA made a risk management decision to use the site-specific protective value of 530 mg/kg lead as the benchmark cleanup criterion for the soil and sediment in the Lower Basin. This value is based upon data recently collected in the Coeur d'Alene Basin. It is also within the range of potentially protective values from the literature and other sites. While 530 mg/kg lead in soil/sediment may not be fully protective of aquatic birds and mammals, it will address 95 percent of the habitat area. Only 5 percent of the impacted area in the Lower Basin is estimated to have lead concentrations between 530 mg/kg and background. For these reasons, EPA believes that selection of 530 mg/kg lead as the benchmark cleanup criterion for soil and sediment is technically the best alternative available at this time.

In riparian areas where remedial actions are conducted (e.g., banks and tributaries), risks to riparian receptors will be mitigated using removal and replacement with clean soil or capping with clean soil to isolate contaminants and reduce or eliminate exposure pathways.

It is important to recognize that numerical cleanup criteria for soil and sediment may be revised as additional information becomes available. For example, EPA anticipates conducting studies to evaluate soil and sediment cleanup criteria that are protective of migratory birds in riparian and riverine habitats. As part of this effort, EPA Region 10 and USFWS are currently assessing concentrations in soil and sediment that would be protective of riparian songbirds. Any revisions to criteria would be documented in future decision documents.

A reduction of dissolved metals loads in the Spokane River of approximately 16 percent is estimated to result from implementation of the Selected Remedy. Additional load reductions would result from implementation of remedies in the Box. The estimated reduction needed in high-flow particulate lead load is at least 50 percent to reduce year-round lead concentrations to below chronic AWQC in the Spokane River.

Anticipated Benefits

The remedy selected in this ROD is anticipated to result in significant benefits for protection of the environment, as well as benefits for recreational and subsistence users. Although it would not achieve all long-term goals, it makes a significant step toward achieving those goals. Figure 12.2-15 illustrates the relationship between the Selected Remedy and the long-term remedy that, based on current information, EPA believes is needed for full protection of human health and the environment and compliance with ARARs. Some of the specific benefits anticipated include:

- Providing varying levels of fisheries (adult fisheries, areas capable of supporting spawning and rearing) connected with migratory corridors to allow increased movement between the tributaries and the river. This would include re-establishment of fisheries in Ninemile Creek, improvements of spawning and rearing fisheries in Pine Creek, and improvements in the fisheries, migratory corridors, and water quality in the South Fork and Lower Basin. Figure 12.2-16 shows the benchmarks for improvements in fisheries conditions in the Upper Basin. Table 12.2-2 summarizes the fisheries benchmarks for the Selected Remedy, current water chemistry and physical conditions, and the water chemistry and physical conditions that the Selected Remedy is expected to achieve. The Selected Remedy is not anticipated to provide conditions that would allow re-establishment of the bull trout, which is listed as “threatened” under the ESA.

- A reduction of about 580 pounds per day of dissolved zinc loads from the Upper Basin and Lower Basin (URS 2002b). The reduction in load will result in reduced concentrations of metals in the river system. Figures 12.2-17 and 12.2-18 show the expected values of dissolved zinc concentrations (expressed as multiples of the AWQC) at Pinehurst and Harrison, respectively, after implementation of the Selected Remedy is completed (time = 0 on the graph). A range of concentrations is shown because the effectiveness of remedial actions to be implemented in the Box is not currently known. The expected values of dissolved metals concentrations after implementation of the remedy are consistent with a Tier 1 to Tier 3 fishery in the South Fork at Pinehurst and a Tier 3 fishery in the Coeur d’Alene River at Harrison.

- Additional protection of recreational and subsistence users through cleanup of 31 recreational areas in the Lower Basin.

- An addition of 2,669 acres of safe wetland feeding area and 1,859 acres of safe lake feeding area in the Lower Basin.[27] In these areas soils and sediments with lead exceeding 530 mg/kg would be remediated to provide protection of waterfowl and other birds protected under the MBTA. These actions are expected to result in a reduction in waterfowl mortalities.

- Biostabilization of 33 miles of Coeur d'Alene River bank that is a source of particulate lead to reduce downstream lead loading and recontamination. This action would include cleanup of the adjacent riparian zone, thereby providing additional safe habitat for ecological receptors and additional protection for recreational and subsistence users.

- Cleanup of riparian habitat, including riparian buffer zones along an estimated 33 miles of the Coeur d'Alene River in the Lower Basin; 1.7 miles of East Fork Ninemile Creek, 2.6 miles of East Fork Pine Creek; riparian areas within or adjacent to Thompson Lake, Thompson Marsh, Anderson Lake, Cave Lake, Bare Marsh, Medicine Lake, and Lane Marsh; and oases of riparian habitat at streamside removal areas along the South Fork. The cleanup would provide safe habitat for birds protected under the MBTA and other riparian zone plants and animals.

- Removal of 1,300,000 cy of river bed sediments from natural depositional areas over the duration of the Selected Remedy to reduce downstream lead loading and recontamination. This 1,300,000 cy represents 6 percent of the 20,500,000 cy of contaminated river bed sediments in the Lower Basin.

- Improvements to water quality conditions in the Spokane River. Based on probabilistic modeling and current estimates of remedy effectiveness, the Selected Remedy is anticipated to reduce the dissolved metals load in the Coeur d'Alene River at Harrison by approximately 16 percent. Assuming a consistent rate of dissolved metals retention in Coeur d'Alene Lake, it is anticipated that implementation of the Selected Remedy would result in a reduction of dissolved metals loads in the Spokane River of approximately 16 percent. Additional reductions of dissolved metals load would occur as a result of remedial actions

[27] The acres of lake area shown are the entire areas of the lakes. To develop estimated costs, it is anticipated contaminated sediments will be cleaned up to a water depth of six feet (which represents an average of approximately 25 percent of the total lake area). These water depths represent the highest use feeding areas and, consequently, the areas of greatest exposure to waterfowl and other animals.

that have been implemented within the Box, as well as future Phase 2 remedial actions within the Box.

Available Land Uses

Most of the area addressed by the Selected Remedy consists of riparian, wetland, and lake habitat within the 100-year floodplain in the Lower Basin and remote sites and areas within the 100-year floodplain in the Upper Basin. The anticipated future land uses in these areas are wildlife habitat, recreational use, and subsistence use.

Some former mine and mill sites within the Upper Basin that are not within the 100-year floodplain have the potential for redevelopment for commercial or residential use. At sites where contaminated materials are left on site, institutional controls would be required to manage potential exposures and maintain the integrity of the remedy. Institutional controls to prevent development of groundwater as a drinking water source would be needed at most sites. Institutional controls will be needed in the Upper Basin and Lower Basin to ensure the continued effectiveness of the Selected Remedy and to prevent land uses that are inconsistent with the level of protection achieved by the Selected Remedy. These institutional controls could include:

- Physical measures, such as fences and signs, to limit activities that may interfere with the cleanup action or result in exposure to hazardous substances at the site

- Legal and administrative controls, such as zoning restrictions, environmental protection easements, restrictive covenants, or equitable servitudes used to ensure such measures are maintained

Implementation of the Selected Remedy will require some land for management of waste materials that are generated by the cleanup activities. Management of waste materials is discussed in Section 12.5.

Available Groundwater Uses

The Selected Remedy does not address groundwater use. It is not anticipated that additional available uses of groundwater would result from implementation of the Selected Remedy.

Socio-Economic and Community Impacts

Implementation of the Selected Remedy is expected to improve the socio-economic conditions of the Coeur d'Alene Basin. The elements of the remedy focusing on water quality improvements and the subsequent increase in fish populations and diversity will likely expand the recreational use of this resource. Remediation of the riverbanks will slow erosion and improve the riparian corridor for greater recreational use. Cleanup of easily accessible abandoned mine sites will allow redevelopment of these properties and increase tax revenues. The work associated with implementation of the Selected Remedy may provide additional jobs for the local labor force and contractors. The long duration of the work should encourage investment in training and development of the local labor force to establish the necessary skills and expertise that can pay off for the workers and contractors for many years. This should result in growth of the tax base for local economic benefit. The work may also provide opportunities for local supply contractors. Additionally, remediation dollars spent in the Silver Valley may create other opportunities for local businesses.

12.3 COEUR D'ALENE LAKE

Coeur d'Alene Lake is not included in the Selected Remedy. State, tribal, federal, and local governments are currently in the process of implementing a lake management plan outside of the Superfund process using separate regulatory authorities.

The sediments at the bottom of the lake contain mining contamination, and the rate of release of metals in the sediments into the water column could increase if the lake water quality deteriorates due to nutrient enrichment. Currently, however, more metals enter the lake annually from the Coeur d'Alene River than flow out of the lake into the Spokane River. This and other information indicate that the lake sediments are a smaller source than riverine inputs. Based on currently available information, active remediation (e.g., removal, capping) of lakebed sediments is not warranted.

The lake management plan would focus on reducing riverine inputs of metals and nutrients that continue to contribute to contamination of the lake and the Spokane River. Activities included in the plan are (Coeur d'Alene Tribe, et al. 1996):

- Best management practices to control erosion from littoral areas of the lake and watersheds that feed the lake

- Residential and municipal sewer systems improvements to reduce nutrient loadings entering the lake from these sources

- Where necessary, upgrading of municipal water treatment plants to reduce nutrient contributions to the lake

- Bank stabilization to reduce erosion of river banks. Establishment of "no wake" zones has also been suggested to reduce erosion of river banks

The Coeur d'Alene Tribe, IDEQ, and EPA, along with others, plan to coordinate a comprehensive lake monitoring program to evaluate the effects of upstream cleanup, potential sources of contamination, and potential impacts to the lake and the Spokane River. If conditions change or new information that modifies the current understanding becomes available, additional actions will be evaluated. Evaluation of lake conditions will be included in the five-year review process.

Some questions have been raised regarding the need to further evaluate potential risks to humans who eat whole fish or fillets taken from fish in the lake. Previous fish tissue sampling efforts did not include whole fish from Coeur d'Alene Lake, and only a limited number of fillets were sampled. As a result, some uncertainty remains about the potential risks resulting from eating fish from the lake. Additional fish sampling was conducted in 2002, and results of the sampling should be available in early 2003.

12.4 SPOKANE RIVER

Cleanup of community and residential areas, including the identified recreational areas, to minimize human health exposure is a top priority. For the Spokane River in Idaho, the Selected Remedy does not include any remedial actions. The beaches and wading areas adjacent to the Idaho portion of the Spokane River were sampled in 1998 and were found to be safe; i.e., concentrations of metals did not exceed risk-based levels for recreation.

At present, the risks to persons, including Spokane tribal members, and others who may practice a subsistence lifestyle in the Spokane River area have not been quantified. EPA and the Spokane Tribe are cooperating in planning additional testing and studies that will be implemented to evaluate the potential exposures to subsistence users. The results of those tests and studies will determine appropriate future response actions to be taken, if any.

For the Spokane River in Washington, the Selected Remedy includes all of the remedy for protection of human health upstream of Upriver Dam and protection of the environment between the Washington/Idaho state line and Upriver Dam. The Selected Remedy consists of a combination of access controls, capping, and removals from Spokane River Alternatives 3, 4, and 5. This remedy was also the Preferred Alternative in the Proposed Plan.

The Selected Remedy for the Spokane River is summarized in Table 12.4-1.

12.4.1 Description

For the Washington portion of the Spokane River, a limited number of sediment and soil sites in and adjacent to the Spokane River have been identified for cleanup on the basis of potential human and ecological exposures. The sites are located along a 16-mile reach of the river between the Idaho/Washington state line and Upriver Dam, which is upstream of the city of Spokane. The identified areas include 10 shoreline sites and a subaqueous site where contaminated sediments have accumulated directly behind Upriver Dam. The areas are shown in Figure 12.4-1.

The Selected Remedy to protect human health and the environment at these areas draws from Spokane River Alternatives 3, 4, and 5. The Selected Remedy includes a combination of access controls, capping, and removals for the shoreline sites.

The remedy for the contaminated sediments behind Upriver Dam will be established following further study and engineering evaluation. Dredging or capping are the options anticipated for sediments behind the dam. The sediments behind the dam are contaminated with PCBs, in addition to metals. The PCBs are currently being investigated under the State of Washington MTCA. The Washington State Department of Ecology (Ecology) is working with the responsible parties to conduct a RI/FS of the sediment behind the dam. EPA and Ecology intend to coordinate remediation to minimize unnecessary duplication and cost.

There is some potential for recontamination of the shoreline cleanup sites. Fine-grained, metal-rich sediments coming from the Coeur d’Alene River Basin and metal-rich sediments previously deposited along the upper river may come to rest on remediated locations. Because of this concern, a phased approach may be used. The locations initially remediated can be monitored for recontamination and cleanup work modified as necessary. If recontamination is a problem, the location involved may undergo periodic follow-up contaminant removal or maintenance of the clean-soil cover.

Other actions along the Spokane River include water-quality monitoring, aquatic-life monitoring, remedial-performance monitoring of sediments, and contingencies for additional or follow-up cleanups. Other than the cleanup actions for impacted shorelines and sediments, measurable improvements to water quality in the river must rely primarily on actions performed upstream. Thus, the degree and duration of potential recontamination and the measurement of improvements to ambient surface-water quality will be closely tied to the pace and scope of the cleanup actions in the Lower Basin and Upper Basin, as well as to the long-term retention of metals in Coeur d’Alene Lake sediments. As described in Section 12.2.3 Anticipated Benefits, a reduction of dissolved metals loads of approximately 16 percent is anticipated to result from implementation of the Selected Remedy.

12.4.2 Estimated Remedy Costs

The estimated remedy costs for the Spokane River are summarized in Table 12.4-1. A range of estimated costs was developed. The lower range was developed based on capping of contaminated sediments. The upper range was developed based on excavation and disposal of contaminated sediments. The lower range total estimated present worth cost is $4,500,000 with a net present worth of 30 years of O&M of $1,400,000. The estimated average annual O&M cost is $110,000. The upper range total estimated present worth cost is $11,000,000 with a net present worth of 30 years of O&M of $1,300,000. The estimated average annual O&M cost is $100,000.

The estimated costs in this table are based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to –30 percent of the actual project cost, consistent with RI/FS guidance.

The costs presented are present worth costs. The present worth cost is the sum of the capital costs and the present value of the O&M costs over the period of performance. Consistent with current CERCLA guidance, estimates of O&M present worth costs assume a discount rate of 7 percent and a 30-year period of performance (USEPA 2000b). O&M costs will vary from year to year. The estimated average annual O&M cost was calculated by dividing the net present worth of O&M by the 30-year present worth factor (12.4).

Because the remedial actions have not been staged or phased over time, all capital costs are considered present worth costs assuming year 2000 dollars.[28] The effect of remedy staging over an approximately 30-year implementation period would be to reduce the present worth cost of both capital and O&M costs.

Some components of the remedy may have O&M requirements that extend beyond the assumed 30-year period of performance. The added incremental cost of O&M in perpetuity compared to 30 years of O&M is 15 percent for a 7 percent discount rate. The potential increase of the present worth cost of the remedy resulting from O&M beyond the 30-year performance period is expected to be less than the potential reduction of the present worth cost of the remedy resulting from remedy staging.

12.4.3 Expected Outcomes of Selected Remedy

This section describes the expected outcomes of the Selected Remedy in terms of cleanup levels and residual risks, land uses, groundwater uses, and socio-economic and community impacts.

[28] The costs in this ROD are based on costs presented in the Feasibility Study (FS), which were developed using year 2000 cost data.

Cleanup Levels and Residual Risks

The sediment lead cleanup level is 700 mg/kg for recreational use. For children's exposure to lead, it was assumed that 92 percent of the total exposure occurs at the home and 8 percent occurs during recreation. The total exposure was established such that the probability is 5 percent or less of a typical child having a blood lead level exceeding 10 µg/dL and 1 percent or less of a typical child having a blood lead level exceeding 15 µg/dL. The sediment cleanup level will reduce children's exposure to lead such that the recreational component of the total lead exposure is not exceeded. The 10 shoreline sites shown in Figure 12.4-1 exceed State of Washington regulations for cleanup standards, as defined in WAC 173-340-740, for protection of human health based on lead or arsenic risk-based concentrations. Critical ecological habitat goals will be addressed concurrently with the human health actions in those areas where they are co-located.

Sediments accumulated behind Upriver Dam will be cleaned up to levels that will not pose an unacceptable risk to aquatic organisms and will reduce to acceptable levels the potential for exposure of recreational users to contaminated sediment resulting from mobilization and redeposition of the contaminated sediments in areas downstream of the dam.

Cleanup of critical habitat areas identified by Ecology will reduce risks to waterfowl and other ecological receptors to generally safe levels. The critical habitat areas identified by Ecology are:

- CUA201 (Star Rd)
- DA06/07/08 (Island Complex)
- DA10 (Murray Rd)
- CUA202 (Harvard Rd, N Bank)

Implementation of the Selected Remedy for the Spokane River is not anticipated to result in significant reductions of metals concentrations in surface water, which will be closely tied to the pace and scope of the cleanup actions in the Lower Basin and Upper Basin, as well as the long-term retention of metals in Coeur d'Alene Lake sediments.

Land Uses

The anticipated future land uses of the shoreline and sediment depositional areas addressed by the Selected Remedy are wildlife habitat, recreational use, and subsistence use. Future commercial or residential use is not anticipated.

Groundwater Uses

The Spokane Valley aquifer is a designated “sole source” aquifer. The aquifer is recharged, in part, by surface water from the upper Spokane River; however, use of groundwater is not limited by the presence of metals. Therefore, the remedy does not address potential future groundwater use. The concentrations of metals in Spokane River water are well below drinking water standards. In addition, a surface water groundwater interaction study in the upper Spokane River indicated that dissolved metals entering the aquifer from the river in this area are not migrating far beyond the river bank or are being diluted by aquifer water (Marti and Garrigues 2001).

Socio-Economic and Community Impacts

Implementation of the remedy will reduce the potential for exposure to metals at beach and shoreline recreational areas and may enhance human uses of ecological resources. It is anticipated the Upper Spokane River health advisory regarding ingestion of beach and shoreline sediments could be lifted. There is also a fish consumption health advisory for the Spokane River from the state line to Nine Mile Dam. It is likely that lead concentrations in whole fish will not decline substantially until the amount of lead that reaches the Spokane River from upstream sources in reduced. These reductions will be closely tied to the pace and scope of the cleanup actions in the Lower Basin and Upper Basin, as well as the long-term retention of metals in Coeur d’Alene Lake sediments.

12.5 SITING AND DESIGN OF REPOSITORIES FOR MATERIAL GENERATED BY CLEANUP ACTIVITY

Implementation of the remedy will require construction of repositories for disposal of metals-contaminated soils, sediments, debris, and treatment residuals. All disposal locations will be evaluated using the same process and criteria. All locations will also be subject to long-term institutional controls and monitoring (if necessary) to ensure the integrity of the remedy.

Waste consolidation areas designed and constructed in the Coeur d’Alene Basin pursuant to this ROD will only be able to receive material generated by the cleanup activity associated with the Selected Remedy in this ROD, including material generated through the Basin Institutional Controls Program and related CERCLA removals in the Basin. This material will include soils, house dust, debris, alluvial and fluvial soils, and sediment contaminated by mining extraction and beneficiation waste released from historic mining facilities in the Coeur d’Alene Basin. This material, along with tailings and waste rock that may be consolidated in repositories as well, is exempt from Resource Conservation and Recovery Act (RCRA) Subtitle C hazardous waste management requirements pursuant to the Bevill Amendment (42 U.S.C. §6921(b)(3)(A)(ii). Repositories constructed pursuant to this ROD will be designed to reliably contain waste material and prevent the release of contaminants to surface water, groundwater, or air in concentrations that would exceed state and/or federal standards.

Principal threat wastes (such as metal concentrates) and non-Bevill-exempt hazardous waste will be disposed of at an off-site facility or may be disposed of on-site with additional treatment and/or additional engineering measures. Treatment may consist of stabilization of waste materials. Engineering measures may consist of construction of an enhanced cap to prevent leaching or a lined principal threat materials cell to contain highly concentrated and/or highly mobile material.

A four-step process will generally be used to evaluate potential repository locations and specify design requirements.

1. Site Identification. A list of potential repository sites will be prepared in conjunction with other Basin stakeholders. Additional locations will be identified where local governments and/or property owners have an interest in receiving material generated from cleanup actions.

2. Technical Evaluation. Potential repository sites will be evaluated using site-specific data and the repository location and design guidelines described below.

Repositories will be located and designed to:

- Prevent adverse human health or ecological impacts and result in improvements wherever possible
- Prevent additional groundwater and/or surface water impacts
- Integrate with past or nearby cleanup efforts
- Comply with all ARARs
- Be appropriate for the characteristics of the waste that will be disposed of there
- Be cost-effective
- Minimize long-term operation and maintenance (O&M) costs

Additional considerations include:

- Transportation impacts and costs

- Economic development or future reuse of the site where feasible
- Absence or presence of mining-related contaminants
- Geotechnical stability
- Availability of clean cover material
- Community acceptance

3. Public Input/Notification. Concurrent with the technical evaluation, a public outreach effort will be initiated. Affected citizens and stakeholders will be given an opportunity to comment on the proposed repository location and design.

4. Decision Documentation. Upon completion of the public outreach efforts, remedial design documents will be prepared that include, but are not limited to, the following issues for each repository:

- Rationale for Repository Selection. For example:
  - Evaluation of repository location with respect to surrounding environmental conditions
  - A summary of public outreach efforts
- Design Requirements and Rationale. For example:
  - Description of selected cover system (or systems if multiple cells) and liner/leachate collection requirements, if any
  - Construction configuration and ultimate final grading and geometry of repository including stormwater management and terracing
  - Results of hydrogeologic and hydrologic modeling/characterization of the cover system and repository and surrounding environment
  - Special considerations, if any, due to repository location such as proximity to floodplain or surface water bodies or geotechnical concerns

  - Identification and rationale for compliance with any applicable or relevant and appropriate requirements as well as any other guidance identified as "To Be Considered" as outlined in Section 12 of this ROD

- General Operating Requirements During Remedial Action. For example:

  - Standard operating procedures for site including hours of operation, site access, dust control, decontamination, and record-keeping requirements

  - Waste acceptance criteria including allowable chemical concentrations, moisture content, percent allowable debris, and dimensions of material

  - Sampling requirements for characterization of incoming waste

  - Any pretreatment requirements (e.g., stabilization, de-watering) prior to waste disposal

  - Waste placement requirements including lift thickness and compaction requirements

- Post-Closure O&M Requirements. For example:

  - Post-closure monitoring of groundwater and surface water runoff
  - Institutional controls and limitations on future land use
  - Maintenance plan for the final cover

It is not known, at this point in time, how many repositories will be needed to support the Selected Remedy in this ROD. The estimated volumes of material that may require excavation and disposal are about 500,000 to 900,000 cy in the Upper Basin and about 2,600,000 cy in the Lower Basin (including approximately 1,300,000 cy of river bed sediments, 500,000 cy of river bank and splay material, and 800,000 cy of wetland and lateral lake sediment). By comparison, there are currently about 2,100,000 cy of tailings in the Hecla-Star Tailings Ponds in lower Canyon Creek and about 26,000,000 cy of waste material in the Central Impoundment Area. Exact repository locations and design requirements will be developed, with community input, using the four-step process outlined above.

Where there are two or more noncontiguous contaminated areas that are reasonably related on the basis of geography, or on the basis of the threat, or potential threat, to the public health or welfare or the environment, CERCLA section 104(d)(4) and the preamble to the NCP (40 CFR 8690) allows EPA to treat these related areas as one area of contamination (AOC) for response purposes and, therefore, allows the lead agency to manage waste transferred between such noncontiguous areas without having to obtain a permit.   Within the Coeur d'Alene Basin, the repositories and material generated by the cleanup activity associated with the Selected Remedy in this ROD will be related on both the basis of geography and on the basis of the threat to public health or welfare and the environment. In addition, these wastes will be compatible with the selected disposal approach in the repositories. Thus, consolidation of these wastes in a repository will not require permits even if the waste site and repository location are determined to be noncontiguous.

No lakes will be sacrificed as repositories. However, some cleanup projects may involve consolidation and capping of contaminated materials within a wetland or lake area to reduce ecological impacts (e.g., subaqueous capping). Other projects may involve the consolidation and stabilization of contaminated sediments and river bank material. Remedies that involve consolidation and capping of materials “in place” are not subject to the same siting requirements as remedies that involve removing material from one location and consolidation of that material in a repository.

12.6 MONITORING AND ADDITIONAL DATA NEEDS

EPA is currently working with Coeur d’Alene Basin stakeholders to collaboratively develop a Basin environmental monitoring program. Organizations involved with EPA in development of the monitoring program include IDEQ, Ecology, CDA Tribe, Spokane Tribe, USFWS, USGS, and BLM. The aforementioned parties were involved in the development of the remedy identified in this ROD and are knowledgeable about the remedy, Basin conditions, and monitoring needs. The program will be established as part of the Selected Remedy and is critical to the successful implementation and evaluation of the remedy.

The primary goals of the human health monitoring activities will be to evaluate the effectiveness of remedial actions in the residential and community areas and provide data for EPA to conduct CERCLA-required five-year reviews of the progress made on remedy implementation. For example, soil sampling will be conducted to document post-cleanup concentrations of lead and arsenic, and drinking water monitoring will be conducted for those homes on contaminated private wells that are not connected to public drinking water systems due to annexation and engineering issues (e.g., homes where point-of-use treatment is implemented).

The key goals of the environmental monitoring program will be to evaluate the effectiveness of remedial actions, evaluate progress toward achievement of benchmarks, and gain a better understanding of Basin processes and data variability. The monitoring will also provide data for EPA to conduct future CERCLA-required five-year reviews of progress on remedy implementation. Five-year reviews will need to address the progress toward achieving the ecological focuses for remedial action (e.g., dissolved zinc and cadmium in surface water, particulate lead in surface water, and lead in flood plain soils and sediments) and progress toward the benchmarks (see Table 12.2-1). To the extent feasible, the long-term monitoring is expected to integrate with monitoring conducted by other entities (e.g., IDEQ, Ecology, USGS, etc.) as part of other program requirements. Given the scope of the project, the long time frame, and difficult budget forecasts, every effort will be made to ensure that the monitoring be effective, streamlined and targeted to answer key questions.

The environmental monitoring program is envisioned to have two main components. The first component would provide an overarching status and trends assessment of the surface water, soil, sediment, and biological resources conditions in the Basin. The status and trends monitoring is expected to continue for many years, but would be implemented at a manageable frequency and intensity. Some monitoring parameters may be triggered by events (e.g., high flow events may trigger flood plain sediment monitoring). Other monitoring may occur on a periodic frequency (e.g., quarterly, annually, once every five years, etc.) and at locations which represent key nodes or points of significant chemical or ecological importance. The monitoring is anticipated to have surface water, soil/sediment, and biological aspects. Since groundwater is not addressed in this ROD, groundwater monitoring will likely be limited to the situations in which groundwater data is needed to address specific surface water questions.

The second component of the monitoring program is action-specific monitoring which will be linked with the overarching status and trends monitoring program. The remedial action-specific effectiveness monitoring will be developed as part of the design of each remedial action.

The basin-wide status and trends environmental monitoring program, as well as the remedial action-specific effectiveness monitoring, will be structured to provide data needed to evaluate the following issues:

Trends in dissolved zinc and cadmium concentrations in surface water

- Trends in particulate lead loads and concentrations in surface water
- Trends in lead concentrations in the flood plain soils/sediment, levees, and river bed sediment
- Progress toward achieving the benchmarks of the Selected Remedy
- Potential unwanted impacts to the system (e.g., recontamination, nutrient loading, excess sedimentation, etc.) resulting from implementation of the remedy
- Changes or trends in biotic benchmarks (e.g., population/diversity, chemical exposure, bioavailability, etc.)

- Trends in water quality, sediments, and biological resources in Coeur d'Alene Lake

- Trends in groundwater quality, where appropriate to evaluate impacts to surface water

In addition to monitoring needs, EPA recognizes that some areas of the Basin have not been fully characterized, and additional data collection will be needed. These efforts will include:

- Metals loading sources and pathways in the South Fork from Wallace to Pinehurst, focused on the Bunker Hill Box and Osburn areas, including the contribution of metals sorbed/precipitated within aquifer as a limiting factor to the effectiveness of sediment removals

- The dissolved metals loads originating from the reach from the confluence of the North Fork and South Fork to Cataldo and from the Mission Flats dredge spoils area

- The relative magnitude of lead loads originating from the beds and banks in the Lower Basin

- Recontamination potential of various Lower Basin areas

- Identification of long-term metals flux from Coeur d'Alene Lake

- Identification of cleanup criteria for ecological receptors, including risks to songbirds in riparian habitats

- Characterization of metals loading to groundwater and surface water from the Hecla-Star Tailings Ponds

- Additional testing and studies to evaluate the potential exposures to subsistence users by resources in and along the Spokane River on the Spokane Indian Reservation

12.7 STATE AND TRIBE ACCEPTANCE

This section evaluates state, tribe, and natural resource trustee acceptance of the Selected Remedy based on comments on the Proposed Plan submitted by the States of Idaho and Washington, the Coeur d'Alene and Spokane Tribes, and the Departments of the Interior and Agriculture. The statements included in Sections 12.7.1 through 12.7.6 were compiled by EPA from submittals of the entity referenced in each section heading and reflect the views of the entity. The full comments submitted by these entities, and EPA's responses to these comments, are presented in the Responsiveness Summary (Part 3 of this ROD).

For issuance of this ROD, EPA sought formal concurrence from states and tribes only within their individual jurisdictional boundaries. Because no remedial actions have been selected that would be implemented within the jurisdictional boundaries of the Spokane Tribe, EPA did not seek to obtain formal concurrence from the Spokane Tribe. However, EPA recognizes the concerns of the tribes with respect to contamination within traditional cultural areas that are not within their jurisdictional boundaries. In addition, EPA recognizes the concerns of the State of Washington with respect to contamination entering the state through the Spokane River.

12.7.1 State of Idaho Acceptance

As it pertains to work in Idaho, the State of Idaho generally concurs with the Selected Remedy and agrees with the majority of the final ROD.

Idaho is opposed, however, to *any* identification of the Lake as part of a "Superfund site" and will pursue administrative actions to make clear that the Lake is not presently nor in the future *ever* identified as part of a "CERCLA site." The Sate of Idaho has similar concerns about including the Idaho portion of the Spokane River where no remedial actions are identified. The State believes that the Lake Management Plan process for the Lake and state and local management mechanisms for the Idaho portion of the Spokane River will provide the appropriate level of protection to maintain water quality.

The State of Idaho does not believe it is reasonable to speculate in the ROD about the cleanup work after implementation of the Selected Remedy. Prediction of the environmental situation 30 years into the future is impossible given the unknowns about the effectiveness of remedial actions and natural attenuation. The State believes that, after full implementation of the Selected Remedy, environmental conditions must be evaluated and a determination made as to whether "Applicable or Relevant and Appropriate Requirements" (ARARs) in place at that time have been met or if waivers will be applied.

Idaho supports the continued development and implementation of innovative treatment technologies. Idaho supports the adaptive approach outlined in the ROD to take advantage of new information and technologies.

Idaho insists on and appreciates EPA's support of the Basin Environmental Improvement Commission as the implementing entity for the ROD.

Idaho believes that there is no health emergency of any kind in the Basin, but there are prudent voluntary measures to take to assure that individuals are not exposed to contaminants.

Idaho is concerned that removal actions be accomplished in a manner that does not contribute to additional contamination or disrupt viable ecosystems that currently exist. Idaho's support for the Selected Remedy is conditional upon its implementation not impacting the rapid completion of the Phase I and Phase II actions in the "Box" and subsequent deletion actions.

12.7.2 State of Washington Acceptance

While the State of Washington (the State) believes that the Selected Remedy will make progress towards protection of human health and the environment, the State continues to have concerns about the scope of the Selected Remedy in Idaho. The State believes additional measures should have been identified as part of the remedy.

The State believes that measurable water quality improvements in the Spokane River can be achieved or selected ambient water quality criteria (AWQC) reached if EPA and Idaho were to establish water quality improvements in the river as a primary interim remedial objective. The State sought assurances for a remedy cleanup level that would assure at least a 20 percent reduction in the annual zinc load to the Spokane River, along with achieving total and dissolved lead AWQC during winter melt or spring runoff events. The State believes these goals are feasible and justified and could be achieved under an appropriately scoped interim remedy along with deliberate actions in the Bunker Hill Box. In particular, the State continues to seek additional or enhanced actions to reduce metals loads in the following areas:

- Canyon Creek. The State continues to seek assurances that the anticipated passive treatment systems will not be built unless there is a clear indication they will perform over the long term and represent the best available technology. If the passive systems are not feasible, if system designs cannot be assured to perform in a desired fashion or to meet performance goals, then conventional active treatment system aspects should be incorporated and applied.

- Bunker Hill Box. The State continues to seek commitments from the EPA and Idaho to pursue vigorous remedies in the Bunker Hill Box with the objective of significantly reducing dissolved metals reaching surface water and also to assure the central treatment plant (CTP) is upgraded (avoiding potential catastrophic releases of metals to the South Fork). Thus, treatment or management of groundwater impacting the South Fork should clearly be a basin priority, aspects of which might also potentially be integrated with the CTP reconstruction.

- Mission Flats. The State believes the ROD should clearly include a hydrogeologic evaluation followed by the design and construction of passive or active hydraulic/water quality remedial actions to reduce dissolved metals loading to the Coeur d'Alene River from the dredge spoils at this location.

- Lower Coeur d'Alene River bed sediments. The State concurs that the Dudley reach should be prioritized as part of the first increment of remedial action defined in this remedy. The State strongly supports the increase in riverbed sediment remediation defined in Section 14.0 and appreciates EPA's response to Washington's citizen concerns. However, the State believes the sediment removal actions included in the selected remedy are inadequate to definitely assure long-term, permanent protection of the Spokane River.

- Lake Coeur d'Alene. The State believes EPA should apply all available regulatory and legal authorities to assure implementation of measures to protect water quality in the lake and minimize future releases of metals from the lake. The State believes that for the Lake Management Plan to be successful it must have the long-term financial and regulatory support of the associated local, state, tribal, and federal entities in Idaho.

12.7.3 Coeur d'Alene Tribe Acceptance

The Coeur d'Alene Tribe generally supports the Selected Remedy, but has identified areas of concern.

The tribe does not believe that adequate levels of protectiveness will be achieved once the ROD is implemented. Other concerns identified by the tribe include:

- The Tribe believes the Selected Remedy does not address the risks to recreational and subsistence users in the Upper Basin and Lower Basin.

- The Tribe recognizes that additional cleanup actions will be evaluated during and after implementation of the Selected Remedy, but is concerned that the overall protectiveness and long-term effectiveness of these actions cannot be evaluated.

- The Tribe is also concerned that the Selected Remedy identifies no sources of funding for implementation of the Lake Management Plan. The Tribe believes the Lake Management Plan should be implemented under CERCLA authorities and be fully funded as an institutional control under CERCLA.

- The Tribe expects CERCLA funding to continue monitoring in Coeur d'Alene Lake.

12.7.4 Spokane Tribe Acceptance

- The Spokane Tribe generally supports the cleanup activities included in the Selected Remedy. The Spokane Tribe believes, however, that the Selected Remedy does not maximize the protection of human health and the environment, and that additional measures should be implemented during the term of the remedy's first increment.

- The Tribe believes the Selected Remedy incorporates too many uncertainties and leaves too many things undone for ARARs to be complied with and human health and the environment protected. The Tribe believes the time frame contemplated under the Selected Remedy for achieving ARARs is excessive, and that more cleanup work should be conducted now.

- The Tribe does not believe the Selected Remedy provides adequate protection of current and future subsistence users who reside and/or practice subsistence lifestyles within or near areas scheduled for remediation. Additional testing and studies to evaluate the potential exposures to subsistence users by resources in and along the Spokane River on the Spokane Indian Reservation are necessary. Threats to human health and the environment identified by those tests and studies should be addressed by future response actions.

- The Tribe believes that EPA's future involvement in the management of Lake Coeur d'Alene is legally necessary to ensure the long-term enforceability of the Lake Management Plan.

- The Tribe believes that EPA's approach of employing different remediation goals based on protection of different uses (e.g., beach goers versus subsistence users) within different political boundaries will not result in the necessary reduction of cumulative risk to downstream interests.

- Section 13.2 outlines ARARs and TBCs for this Selected Remedy. Future evaluations may find threats to the environment and the health of subsistence users by resources in and along the Spokane River on the Spokane Indian Reservation, in which case additional ARARs may be identified as appropriate response actions are considered.

12.7.5 Department of Interior

The Department of Interior (DOI) is concerned that species protected under the ESA and MBTA will not be fully addressed once the ROD is implemented. Other concerns identified by the DOI include:

- The DOI would like EPA to select Alternative 3 (at a minimum) and possibly Alternative 4 (for some areas) as the Selected Remedy for this ROD.
- The DOI would like all contaminated wetlands and lakes to be addressed.
- The DOI is concerned that the remedy is not protective of riparian wildlife.
- The ROD should include language recognizing that work by others may be conducted consistent with the long-term goals of the remedy.

12.7.6 Department of Agriculture

The Department of Agriculture generally concurs with the Selected Remedy, but has identified the following areas of concern:

- The interim response action is only a first phase of the necessary actions and as such, USDA would like EPA to continue to pursue Alternative 3 remedial actions as the final remedy for the basin.
- The ROD should include language recognizing that work by others may be conducted consistent with the long-term goals of the remedy.
- Cleanup actions and their effectiveness are iterative processes and, as such, continued coordination with the Natural Resource Trustees and others needs to be maintained.

12.8 COMMUNITY ACCEPTANCE

EPA's work in the Coeur d'Alene Basin has been the subject of considerable controversy and scrutiny. Given the large geographic area encompassed by the study and cleanup activities, community concerns are numerous and wide-ranging. Public opinion has been sharply divided about such overarching issues as whether cleanup is needed in the Basin, how much cleanup is needed, who should be in charge of the cleanup, and the boundaries of the Superfund designation.

EPA led a collaborative process in developing the Proposed Plan and ROD. All of the regulatory and land management agencies with jurisdiction in the Basin have been "at the table" for more than four years and have been directly involved in shaping the cleanup plan. In addition, EPA coordinated an extensive community involvement program that included four public comment periods on draft documents prior to the release of the Proposed Plan, participating in more than 200 meetings in a three-year period, monthly newsletter updates, and hiring a local community liaison (a more detailed description of community involvement activities can be found in Section 3). By engaging the public and regulatory stakeholders early during the RI/FS and providing opportunities for input far beyond those required by CERCLA, EPA has been able to respond to issues and concerns in "real time" as the cleanup plan was being developed.

During the comment period on the Proposed Plan, EPA received more than 1,300 individual submissions that contained a total of more than 3,300 separate comments. EPA has responded to each individual comment and has provided a summary of the major comments and responses. Both the general and detailed comments and responses can be found in Part 3 of this ROD.

As with the four earlier comment periods, a broad range of opinions was represented in the public comments on the Proposed Plan. Many comments were very general and expressed lack of support for EPA and other government agencies or expressed the belief that no cleanup is needed in the Basin. Other comments either generally supported EPA's plan or expressed a desire for a more aggressive cleanup approach. In developing the Selected Remedy, EPA has attempted to strike a balance between addressing community and stakeholder concerns and meeting its legal obligations under CERCLA. Below is a brief summary of the major community concerns expressed during the comment period for the Proposed Plan.

- Some people continued to express concern about the way the State of Idaho and EPA assessed the human health risks in the Basin and believe that the risks have been overestimated. Many of these people therefore believe that residential cleanups in the Upper Basin are not necessary.

- Some people believe that the risks to the environment have been overestimated, or they believe that the Basin environment should be allowed to recover on its own without any active cleanup work.

- Some people expressed concern about the boundaries of the Superfund site and EPA's plan to "expand" the cleanup in the Basin. Many of these people are concerned that the stigma associated with Superfund sites stands in the way of economic progress in the Basin.

- Many people expressed a desire for state and local governments to have a major role in making cleanup decisions.

- Some people were concerned about how long cleanup will take and EPA's proposed "incremental approach." These people were concerned that the incremental approach provides no certainty about when the cleanup will be finished and when the Superfund designation can be removed from the Basin.

- Many people in Washington State and some in Idaho felt that the cleanup plan should be more aggressive in order to be more protective of human health and the environment.

- Some people felt EPA should be in charge of implementing the cleanup because the contamination crosses a state line and affects tribal lands.

EPA has tried to work closely with people in the communities to understand and address these concerns. Some of the things people in the Basin continue to be most concerned about, such as the boundaries of the Superfund site and whether EPA is involved in the cleanup, are outside of the scope of EPA Region 10's decision-making authority. In the case of the boundaries of the Superfund site, EPA has applied the CERCLA definition of a Superfund site, not expanded the boundaries. Because of this, some people feel that EPA has not listened to them, and they are not satisfied that the cleanup plan addresses their concerns.

Despite the fact that on many issues there are widely divergent opinions, there has steadily been a growing recognition in the Basin communities that some cleanup work is needed. People agree that the work should be done as quickly as possible and with as little disruption as possible. People generally agree that the states, tribes, local governments and citizens should be directly involved in planning and implementing the cleanup activities that affect them.

EPA has made no assumptions about specific work beyond this Selected Remedy. The Selected Remedy allows for significant improvements for human health and the environment.

EPA looks forward to working together with all of the people in the Basin to make sure the cleanup plan is carried out in a way that is acceptable to the communities so that, ultimately, both the Basin environment and the local economies are improved for this and future generations.

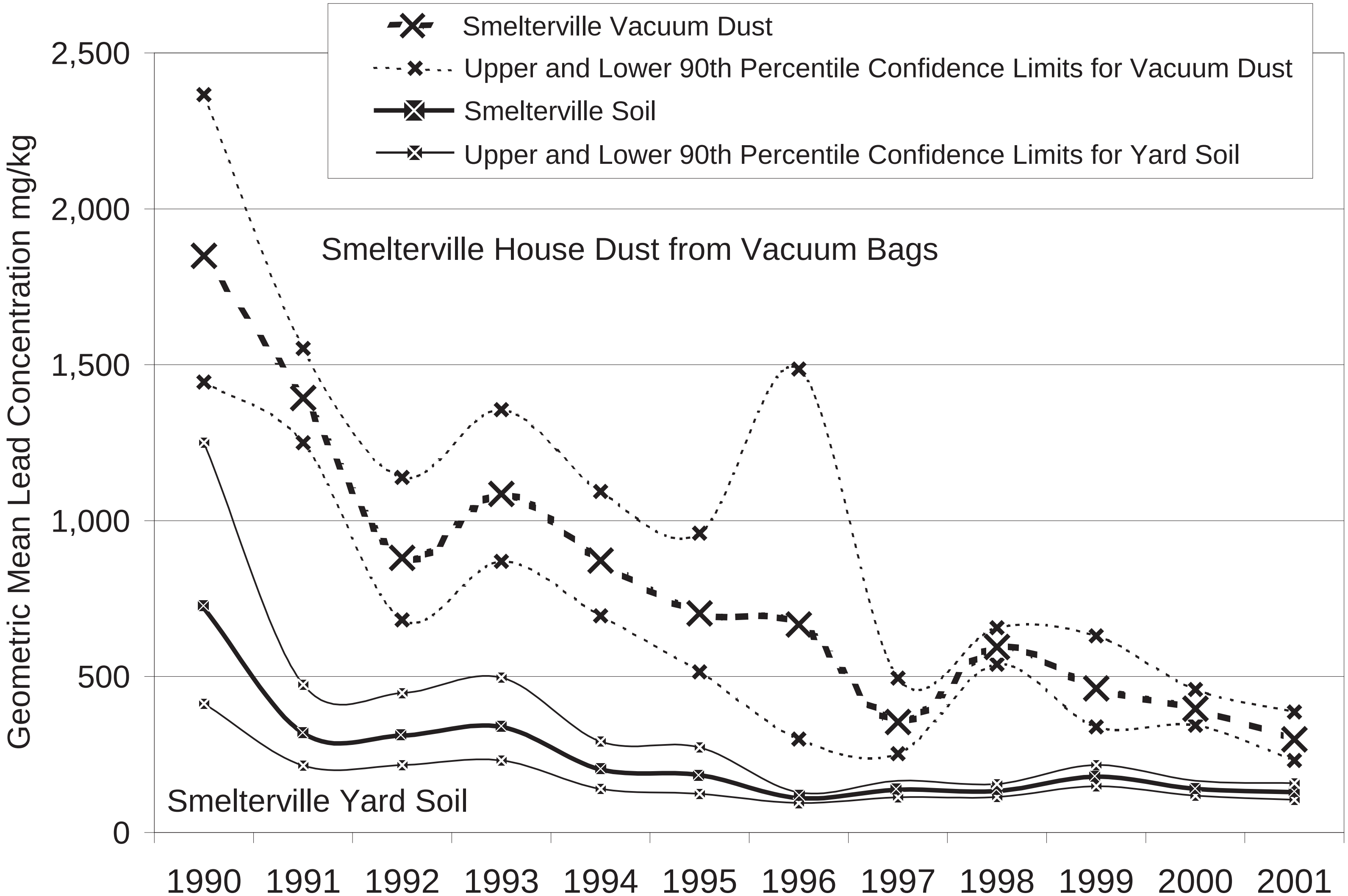
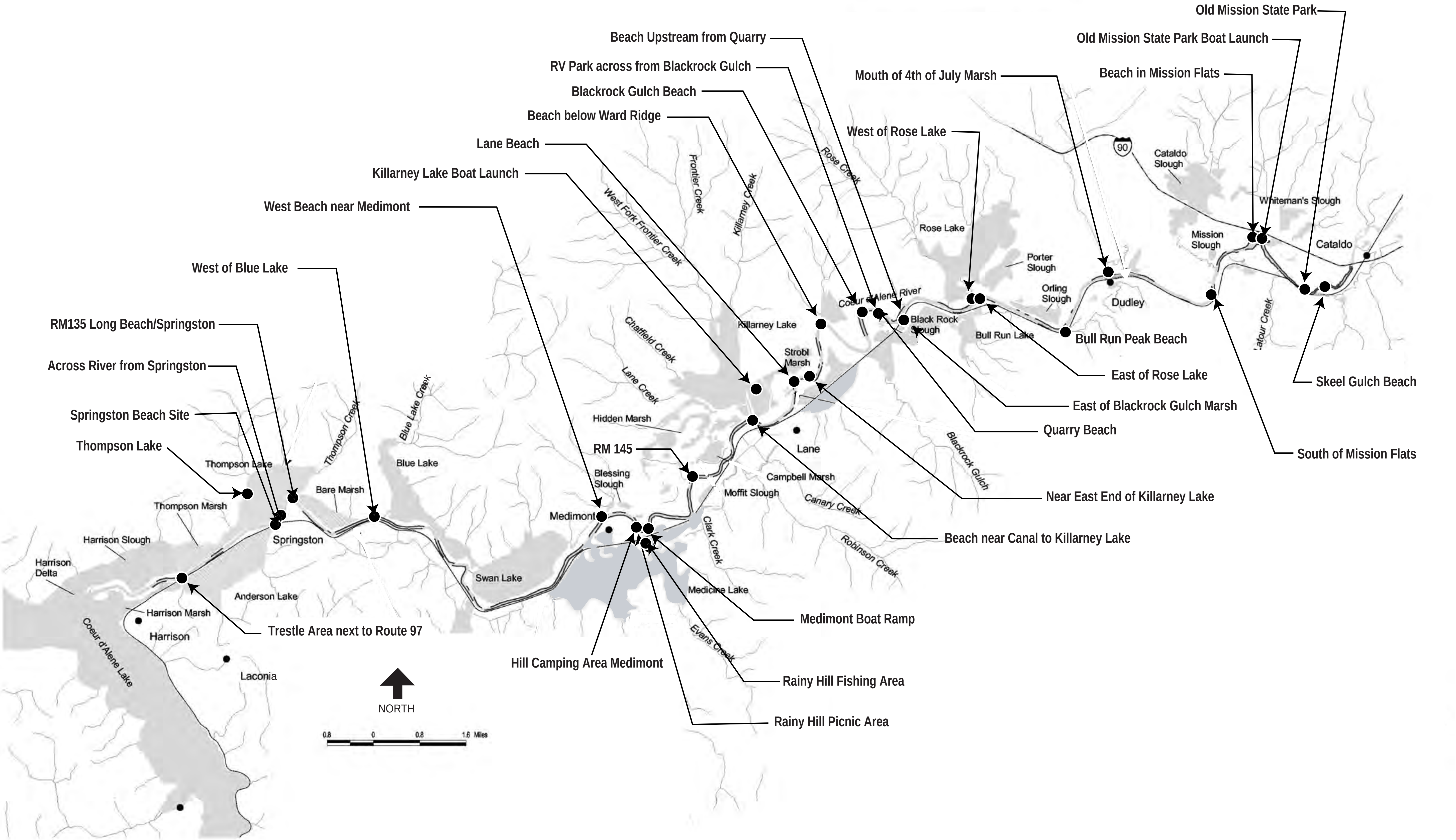


Figure 12.1-1
Smelterville Soil and Dust Lead Geometric Means (1990-2001)
From homes with children participating in the Lead Health Intervention Program

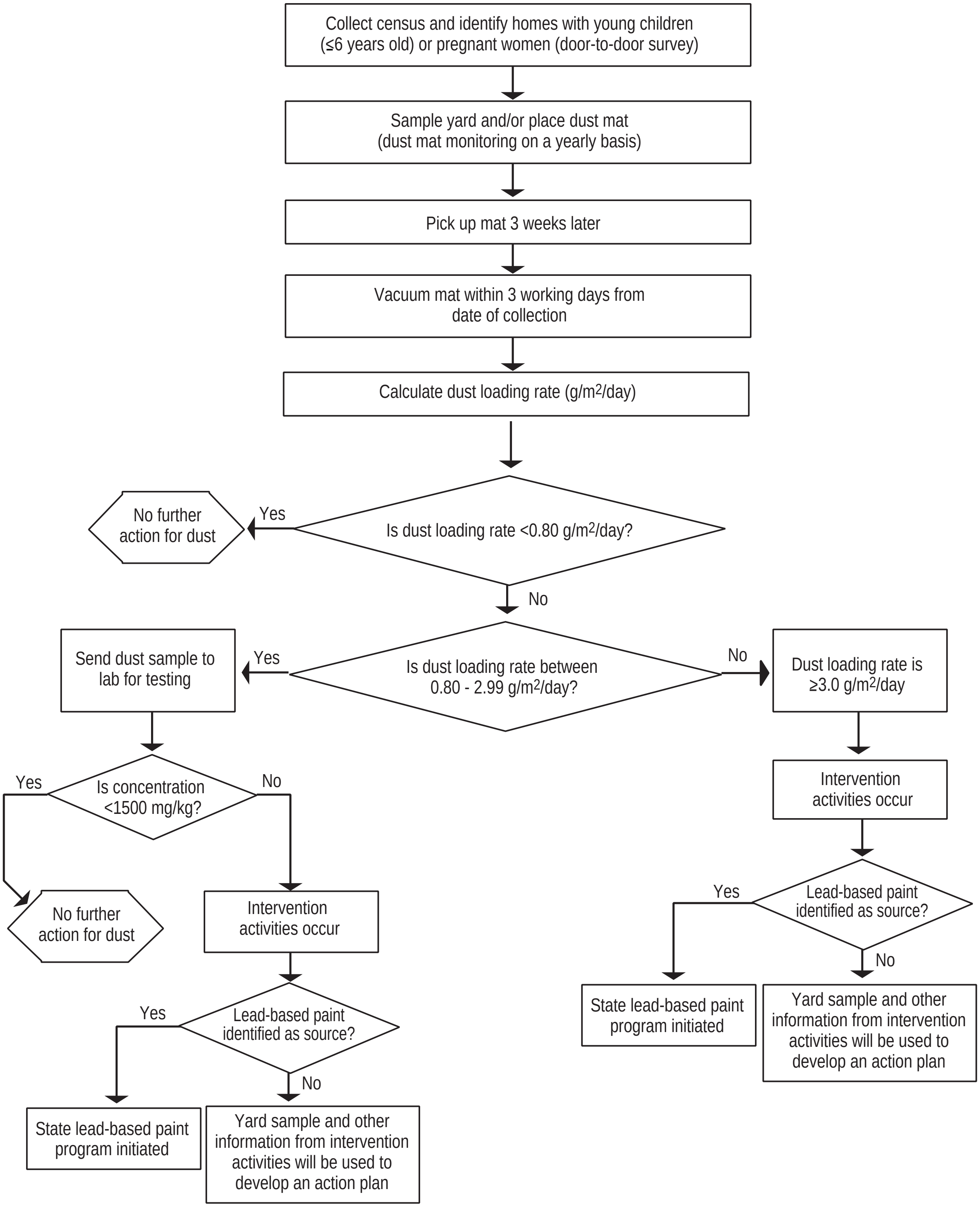


EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

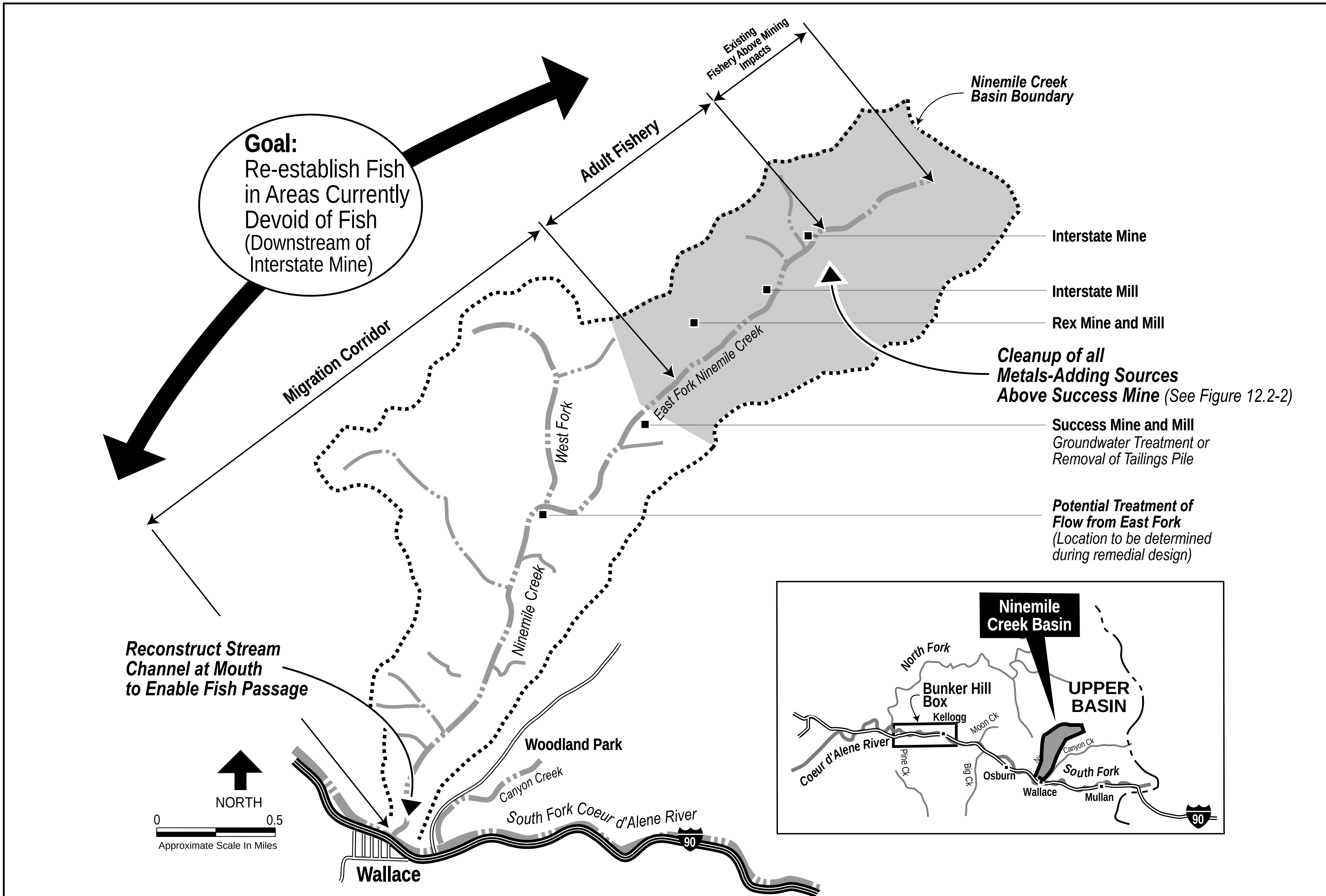
Doc. Control: 4162500.07099.05.a
EPA No. 2.9

Figure 12.1-2
Lower Basin Recreation Areas



Reference: IDIQ (2001)

Figure 12.1-3
Flow Diagram of Dust Intervention Protocol (based on dust mat monitoring)



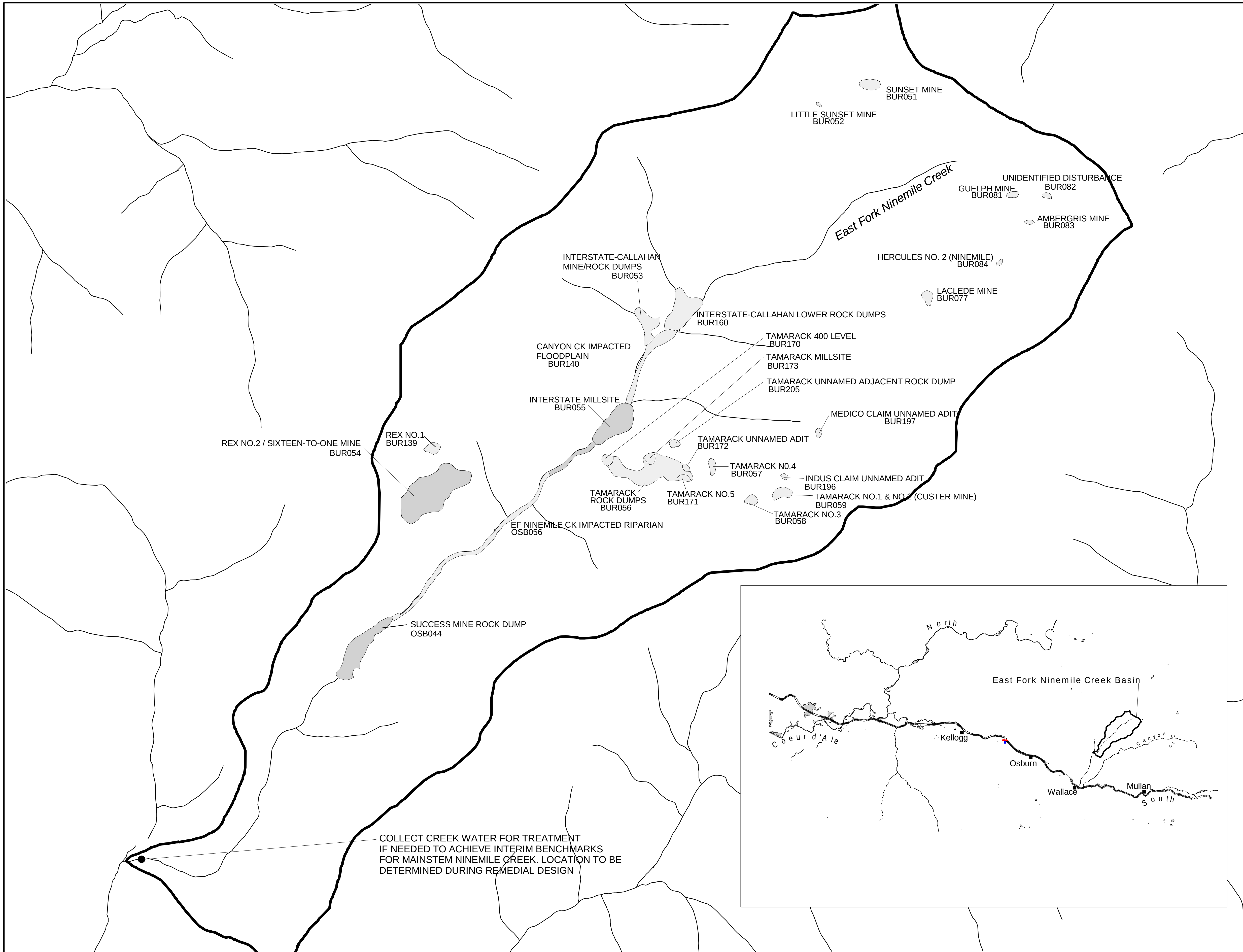
EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

Doc. Control: 4162500.07099.05.a
EPA No. 2.9

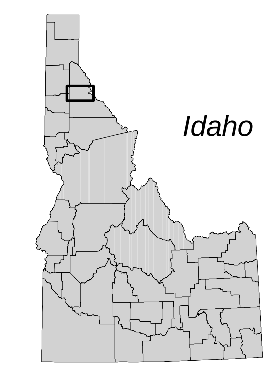
Figure 12.2-1
Ninemile Creek Cleanup Actions and Fisheries Status After Implementation of the Selected Remedy

Figure 12.2-2
East Fork Ninemile Creek Cleanup Locations



LEGEND

- Stream
- City
- Ninemile Creek Watershed Boundary
- Source Area, Name, and Number
- No Action
- Remedial Action Selected in this ROD
- Removal Action by Others



Location Map

NOTE

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:24,000

0 0.5 Miles

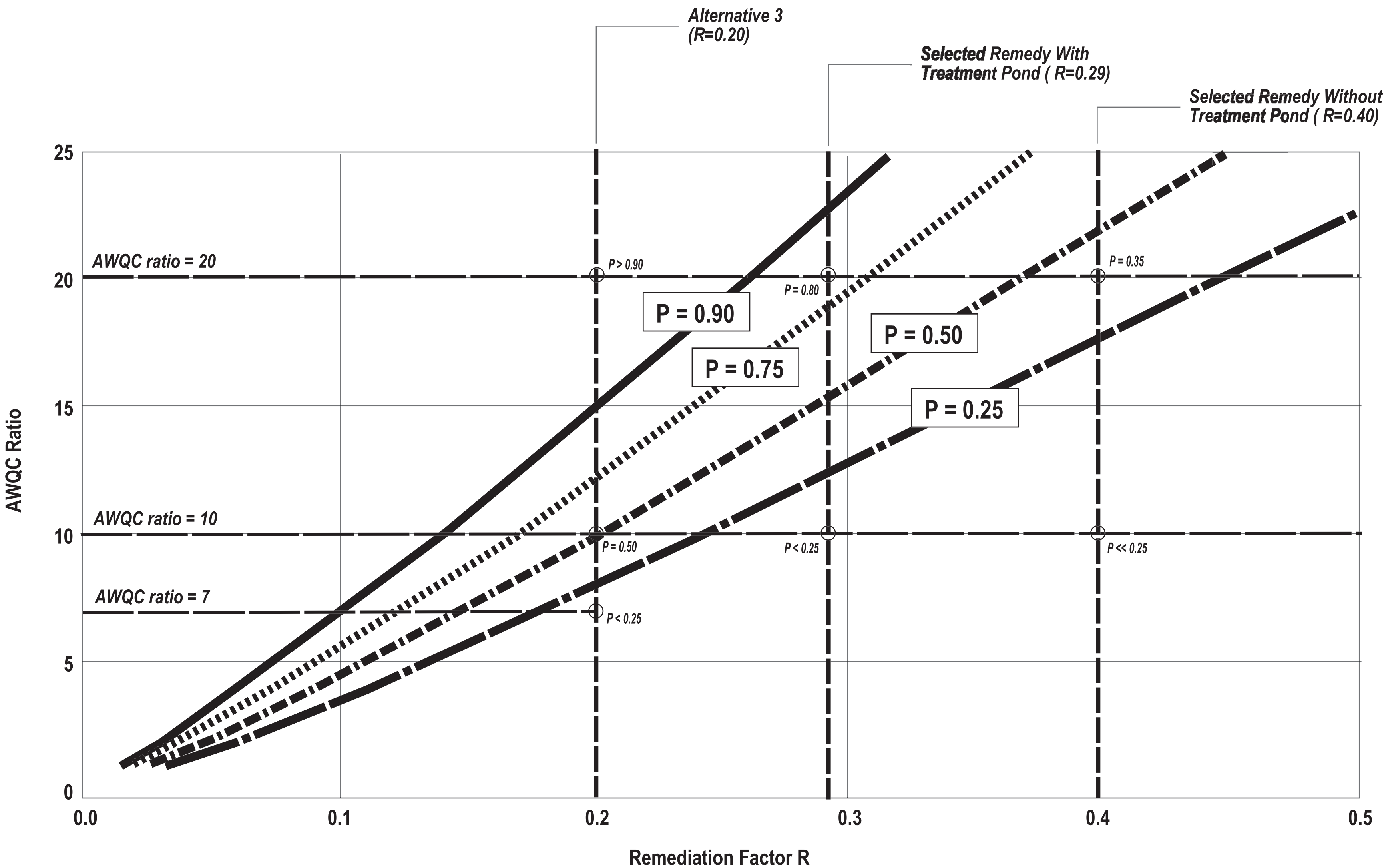
027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

EPA REGION 10

Doc Control : 4162500.07099.05.a
EPA No. 2.9
Generation 1
n:\Projects\Proposed Plan\
PP-NM Source Areas_01.apr
V: NM SEGS1-2 RA
E:SA
L: NM SEGS 1-2
05/01/02

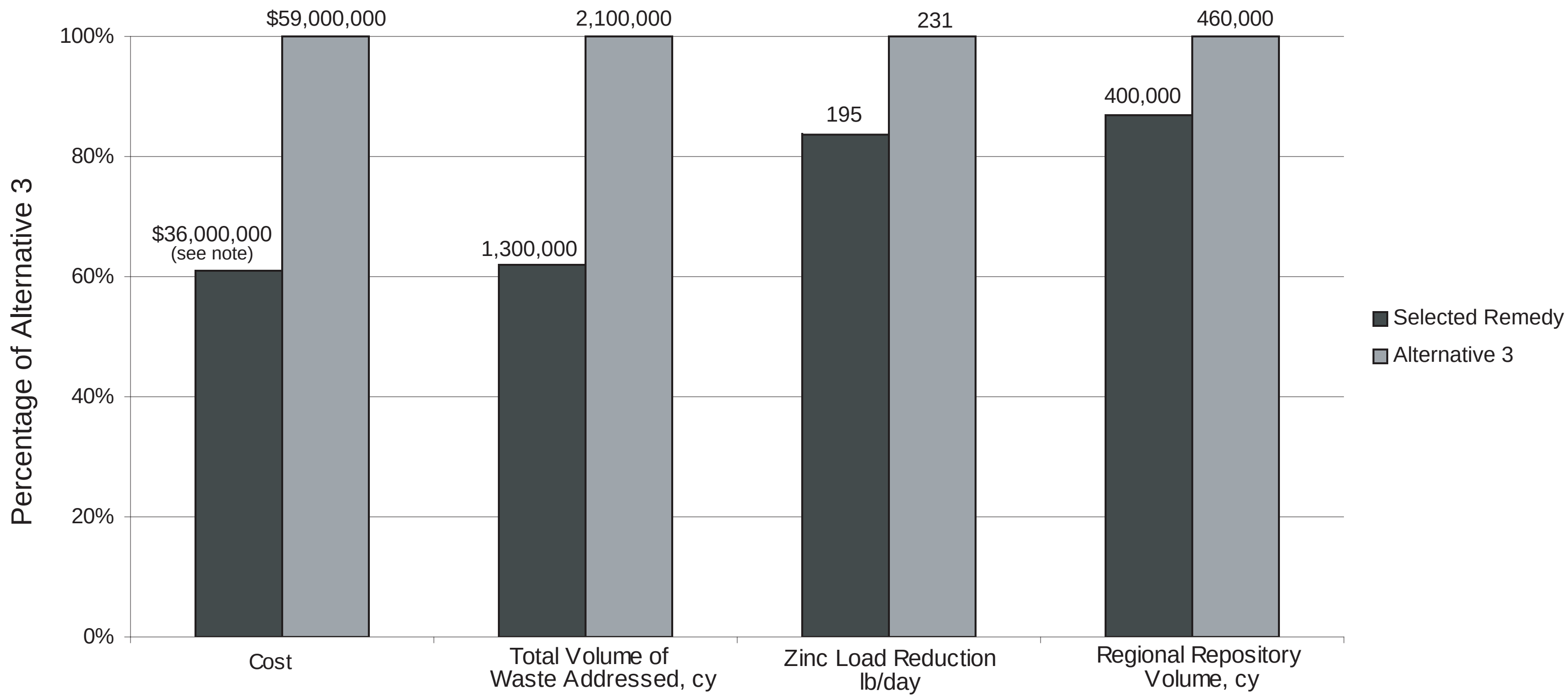
This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: August 14, 2002



NOTES:
P = Estimated probability that AQWC ratio after implementation of remedy will be less than a given AWQC ratio
R = Estimated fraction of current load at NM305 that will remain after implementation of cleanup
AWQC ratio = Concentration divided by AWQC

EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RECORD OF DECISION	Doc. Control: 4162500.07099.05.a EPA No. 2.9	**Figure 12.2-3** **Probability of Achieving Various AWQC Ratios as a Function of the Remediation Factor R - Ninemile Station NM305**



Note:
Cost including all contingent remedies. Estimated cost without contingent remedies = $13,500,000.

EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

Doc. Control: 4162500.07099.05.a
EPA No. 2.9

Figure 12.2-4
Comparison of Selected Remedy to Alternative 3, Ninemile Creek

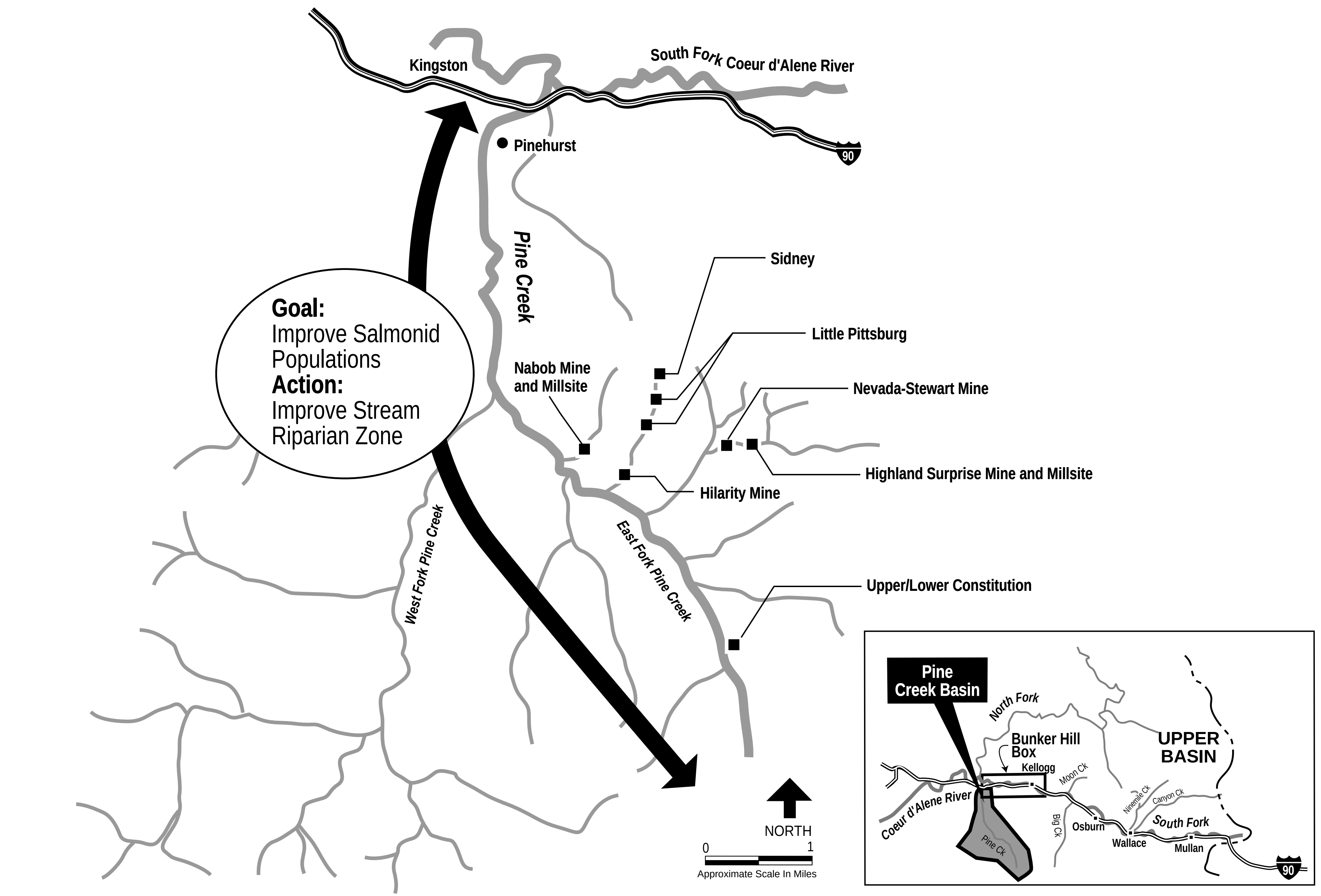


Figure 12.2-5
Pine Creek Cleanup Actions and Fisheries Status After Implementation of Selected Remedy

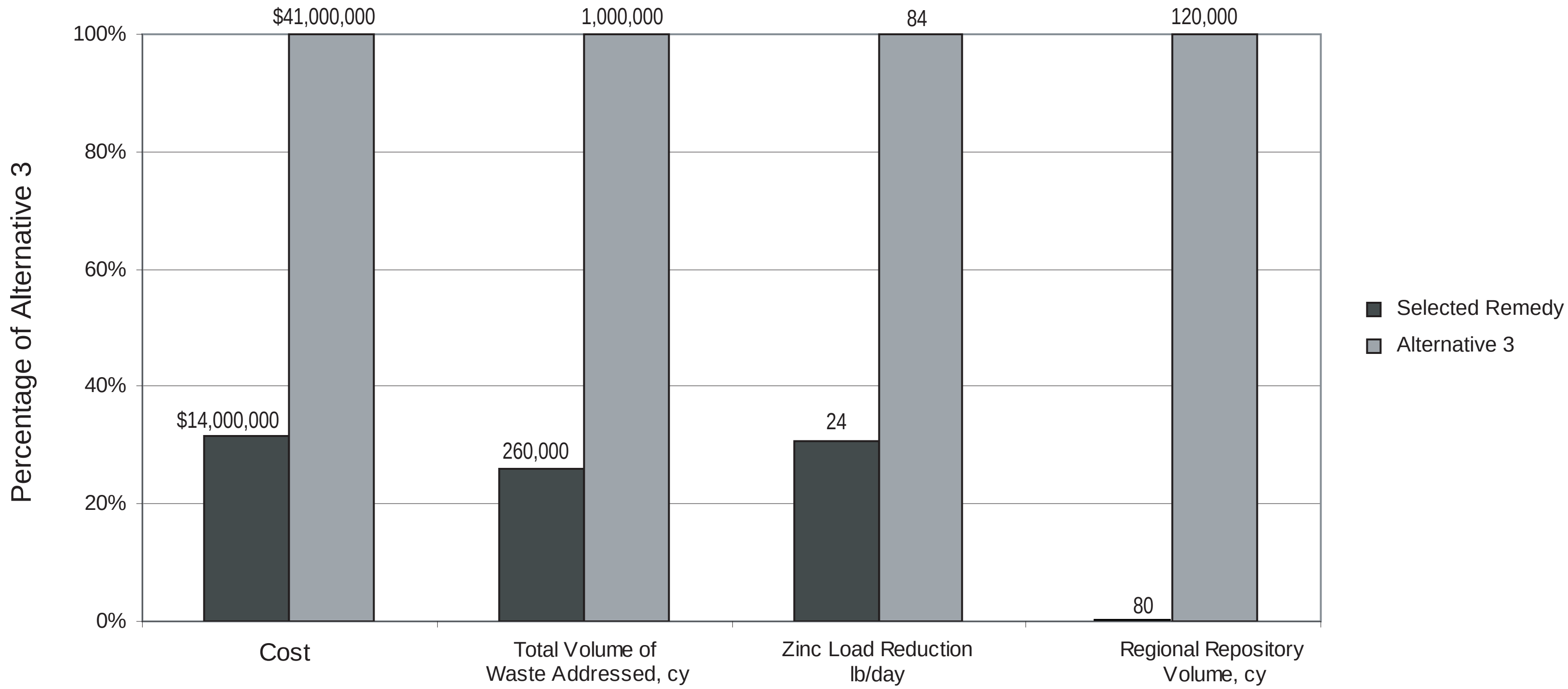
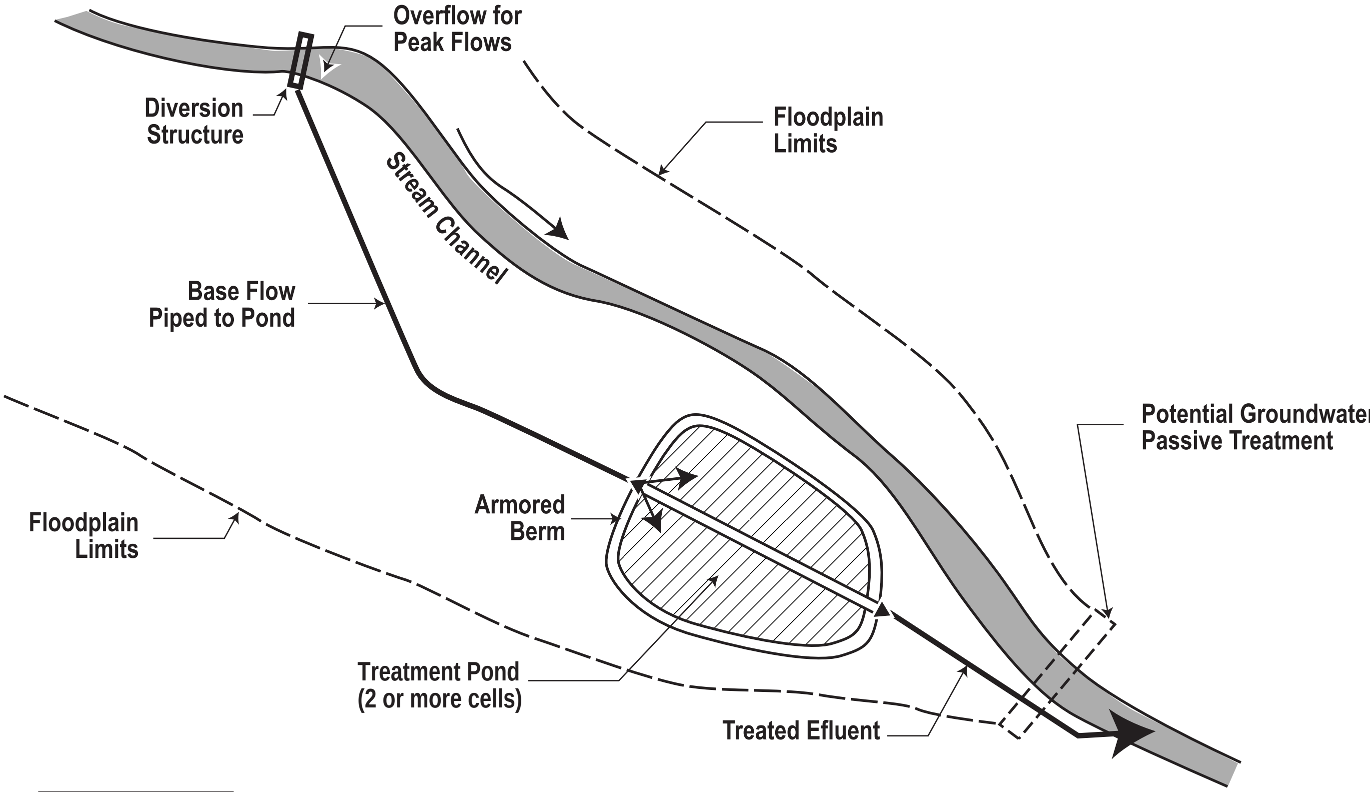
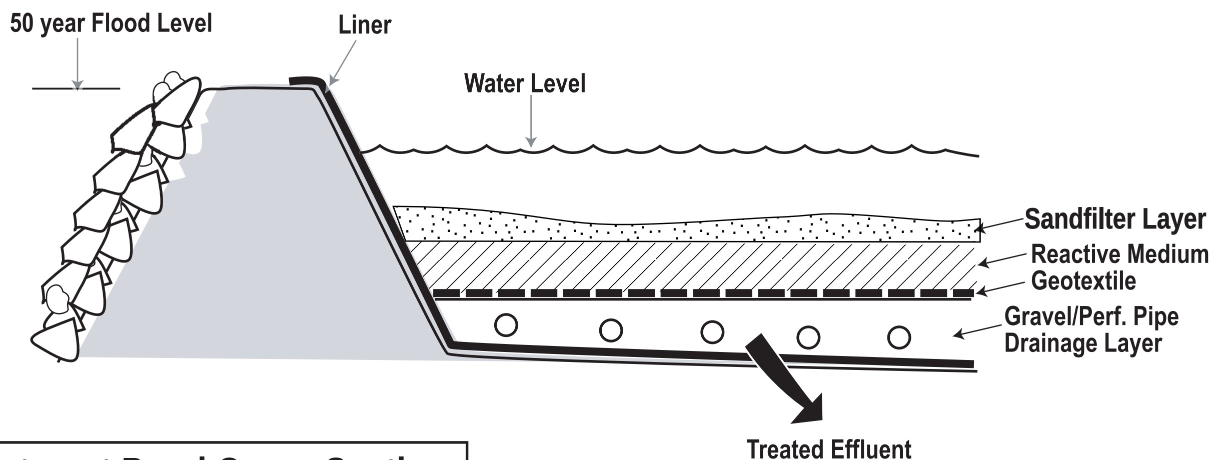


Figure 12.2-6
Comparison of Selected Remedy to Alternative 3, Pine Creek



Plan View



Treatment Pond Cross-Section

Note: This typical conceptual design was developed for feasibility-level analysis of remedial alternatives. Actual designs would be developed during remedial design based on the remedy selected in the ROD and site-specific conditions and requirements.

Figure 12.2-7
Treatment Pond Conceptual Design

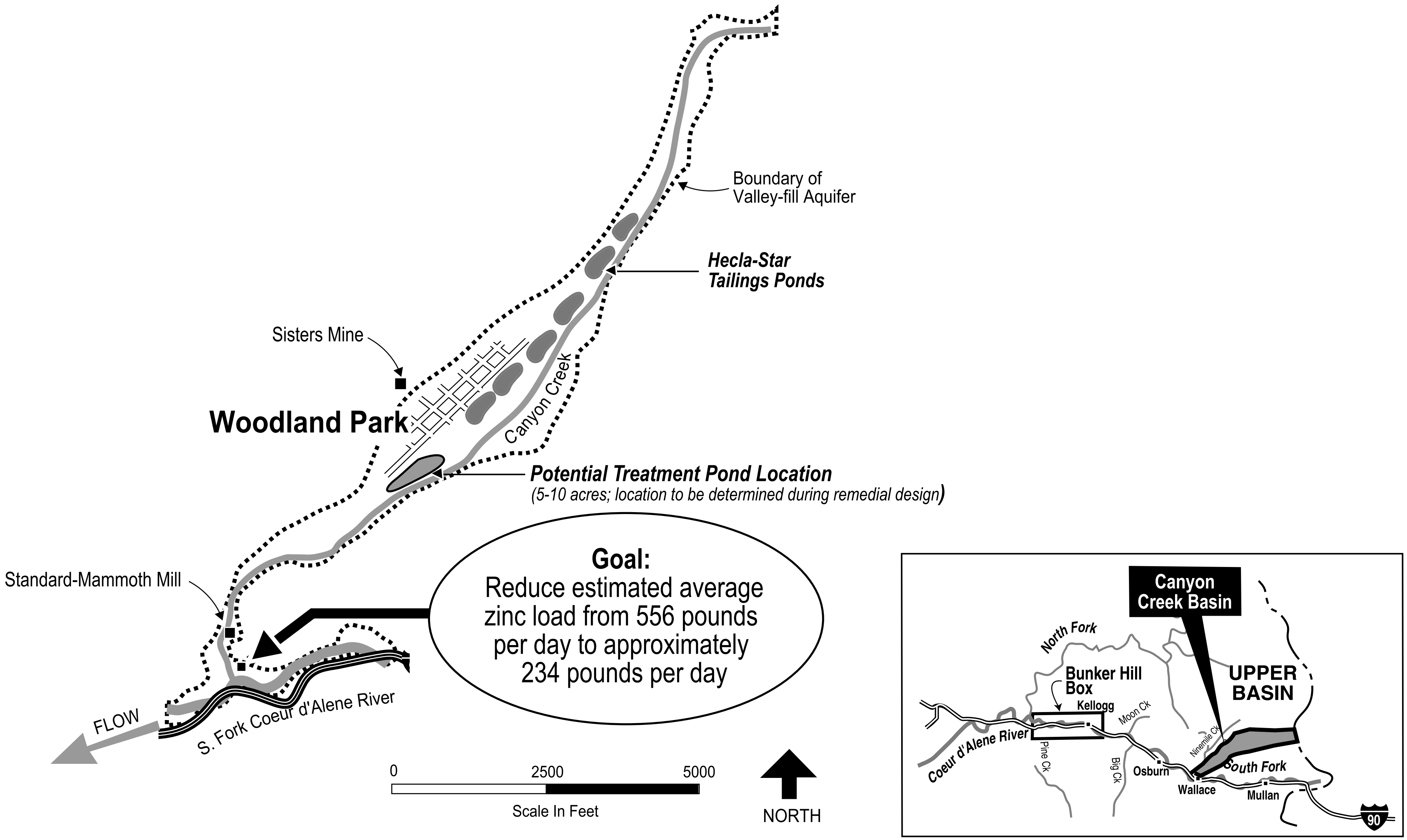
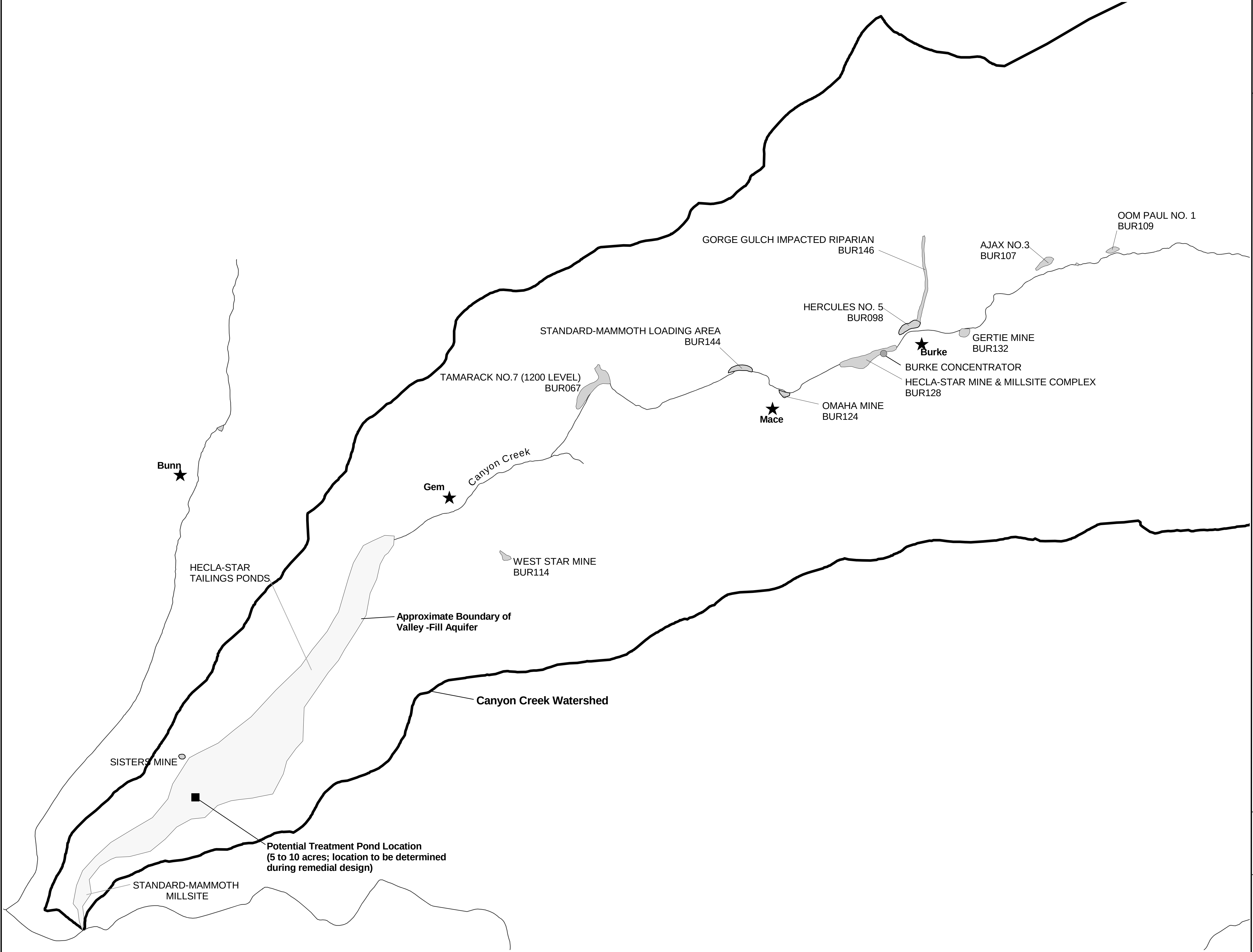


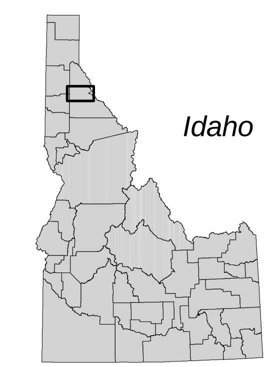
Figure 12-2-8
Lower Canyon Creek Cleanup Actions

Figure 12.2-9
Canyon Creek Cleanup Locations



LEGEND

- Stream
- City
- Canyon Creek Watershed Boundary
- Approximate Location of Valley Fill Aquifer



Location Map

NOTE

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:24,000

0 — 0.5 Miles

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

EPA REGION 10

Doc Control: 4162500.07099.05.a
EPA No. 2.9
Generation 1
n:\Projects\Proposed Plan\
PP-NM Source Areas_01.apr
V: View 2
E:
L: Fig 12.2-4

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: May 01, 2002

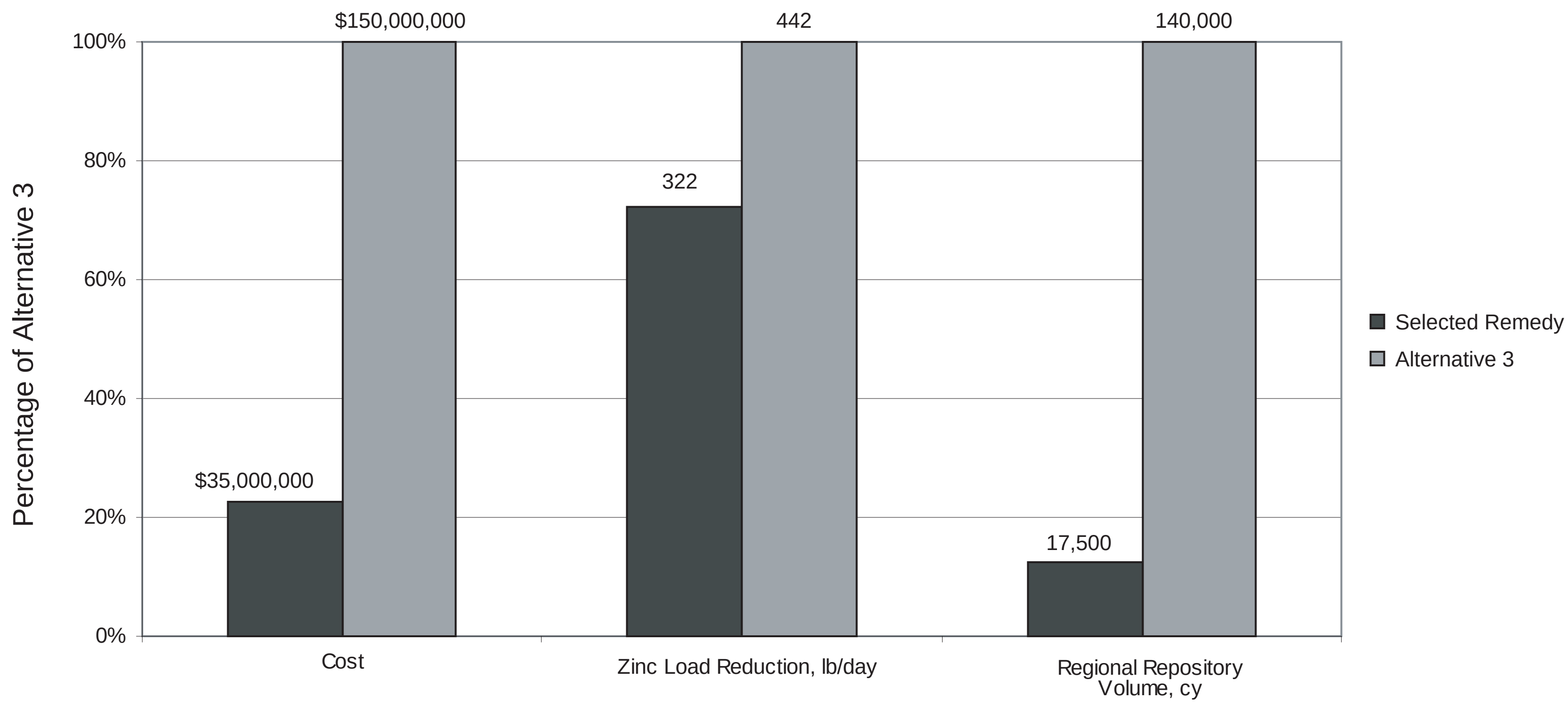


Figure 12.2-10
Comparison of Selected Remedy to Alternative 3, Canyon Creek

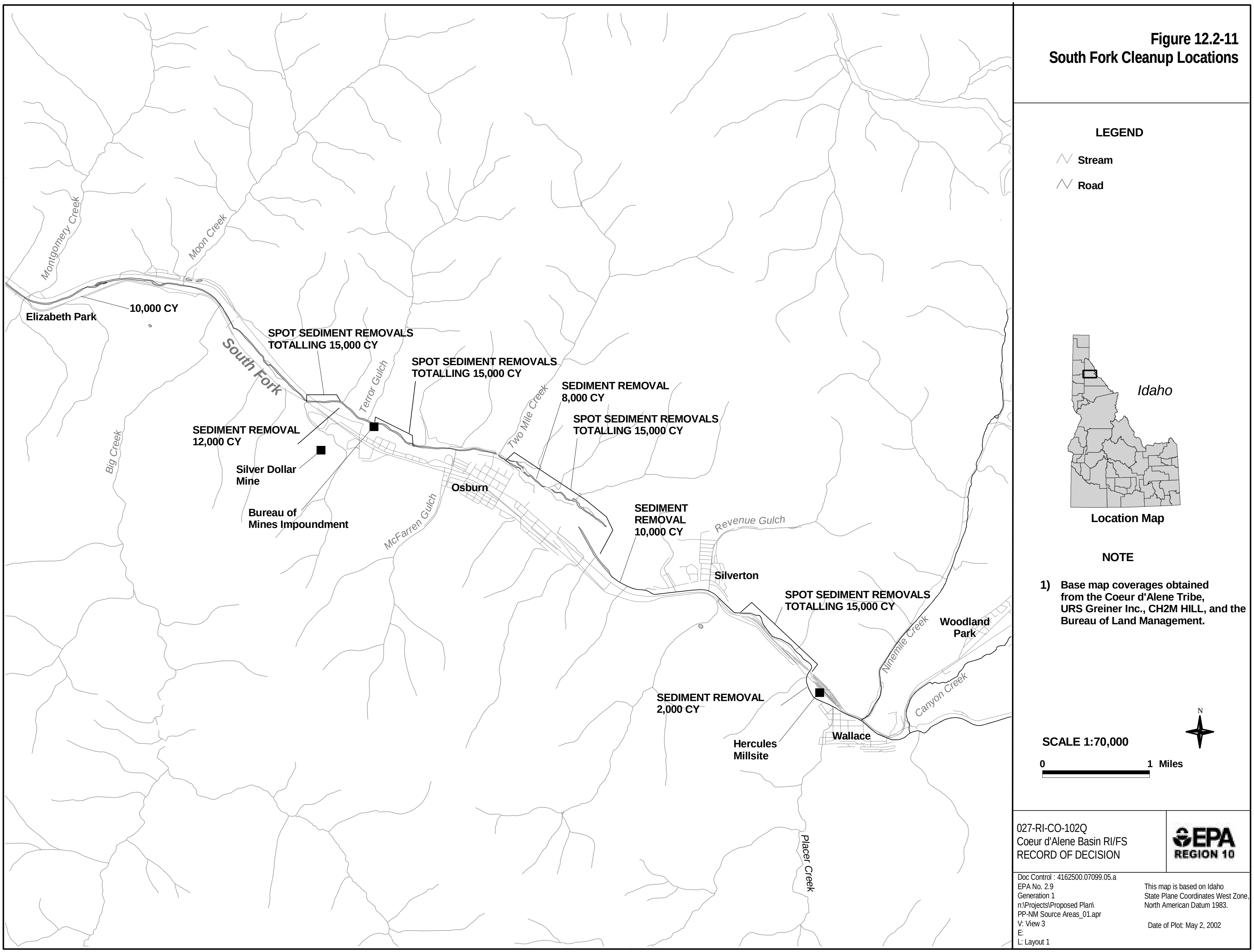


Figure 12.2-11
South Fork Cleanup Locations

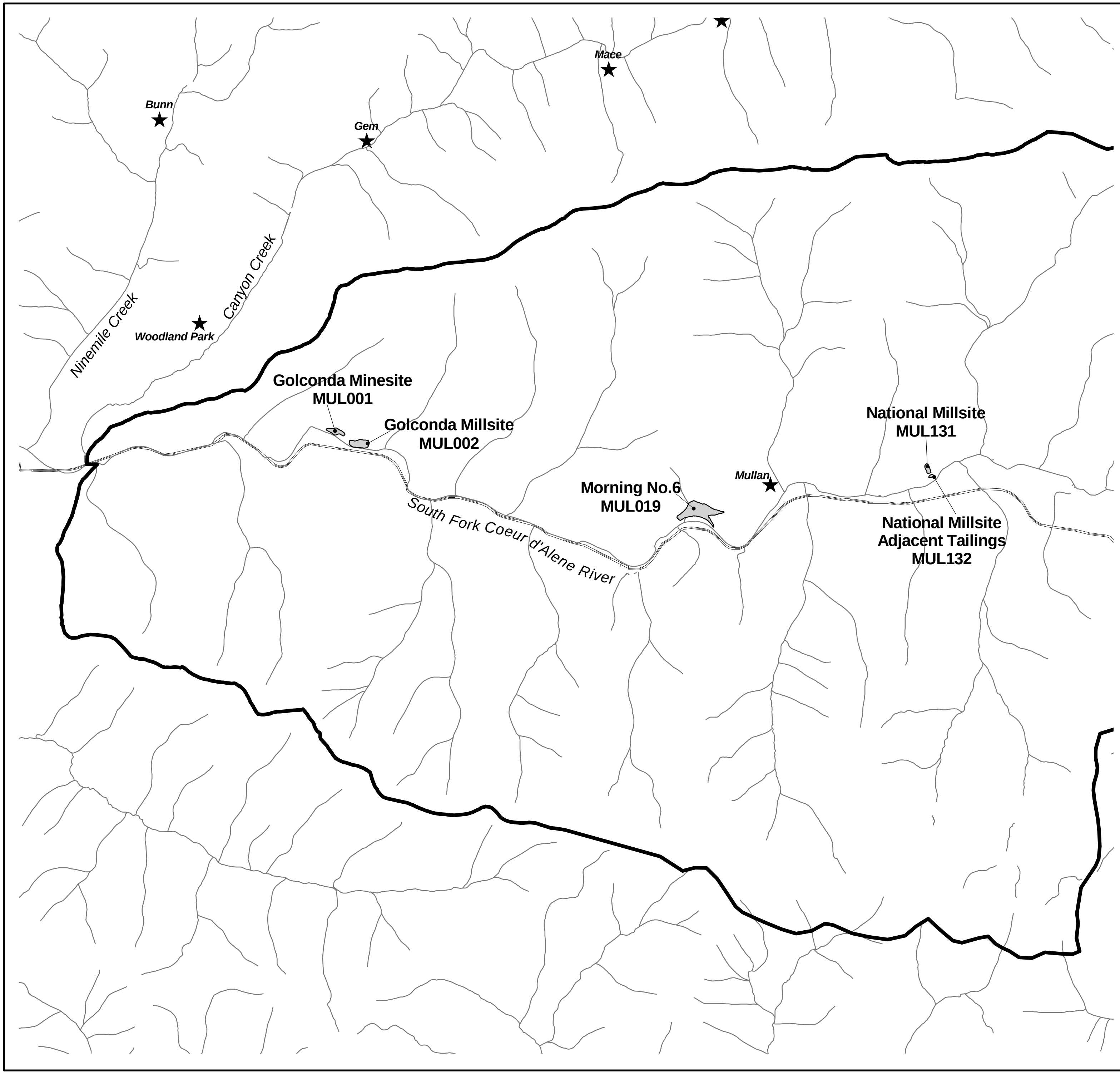


Figure 12.2-12
Upper South Fork Cleanup Locations

LEGEND

- Stream
- I-90
- City
- Source Area, Name, and Number

Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Indian Tribe, URS Greiner, CH2M HIll, and the BLM.

SCALE 1:66,000

2000 0 2000 4000 Feet

N

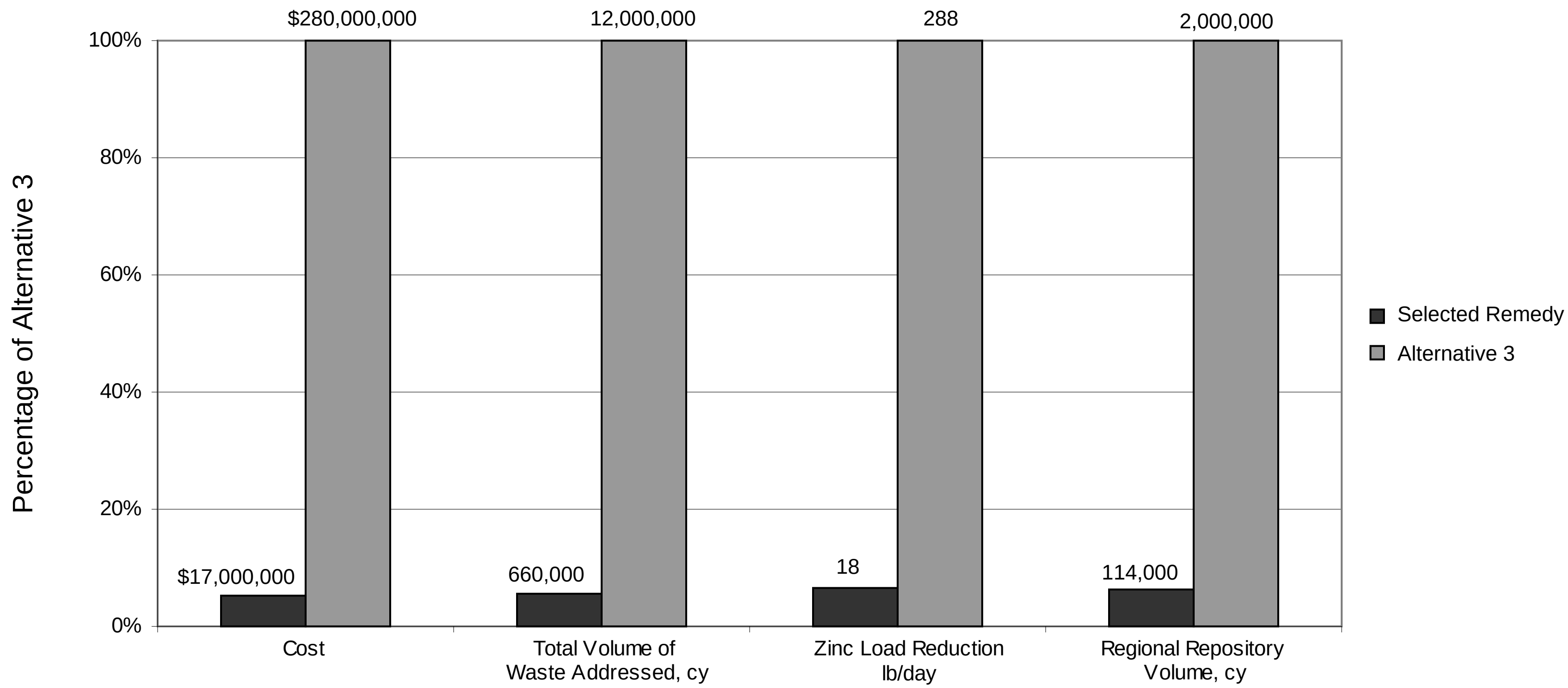
027-RI-CO-102Q
Coeur d' Alene Basin RI/FS
RECORD OF DECISION

EPA
REGION 10

Doc Control 4162500.07099.05.a
EPA No. 2.9
n:\Projects\ROD\
areas_usfcdar.apr
VIEW: USFCDAR Soill
EXTENT:West
LAYOUT: USFCDAR Soil West
05/02/2002

This Map is based on Idaho State Plane West Zone, North American Datum 1983

Date of Plot: August 14, 2002

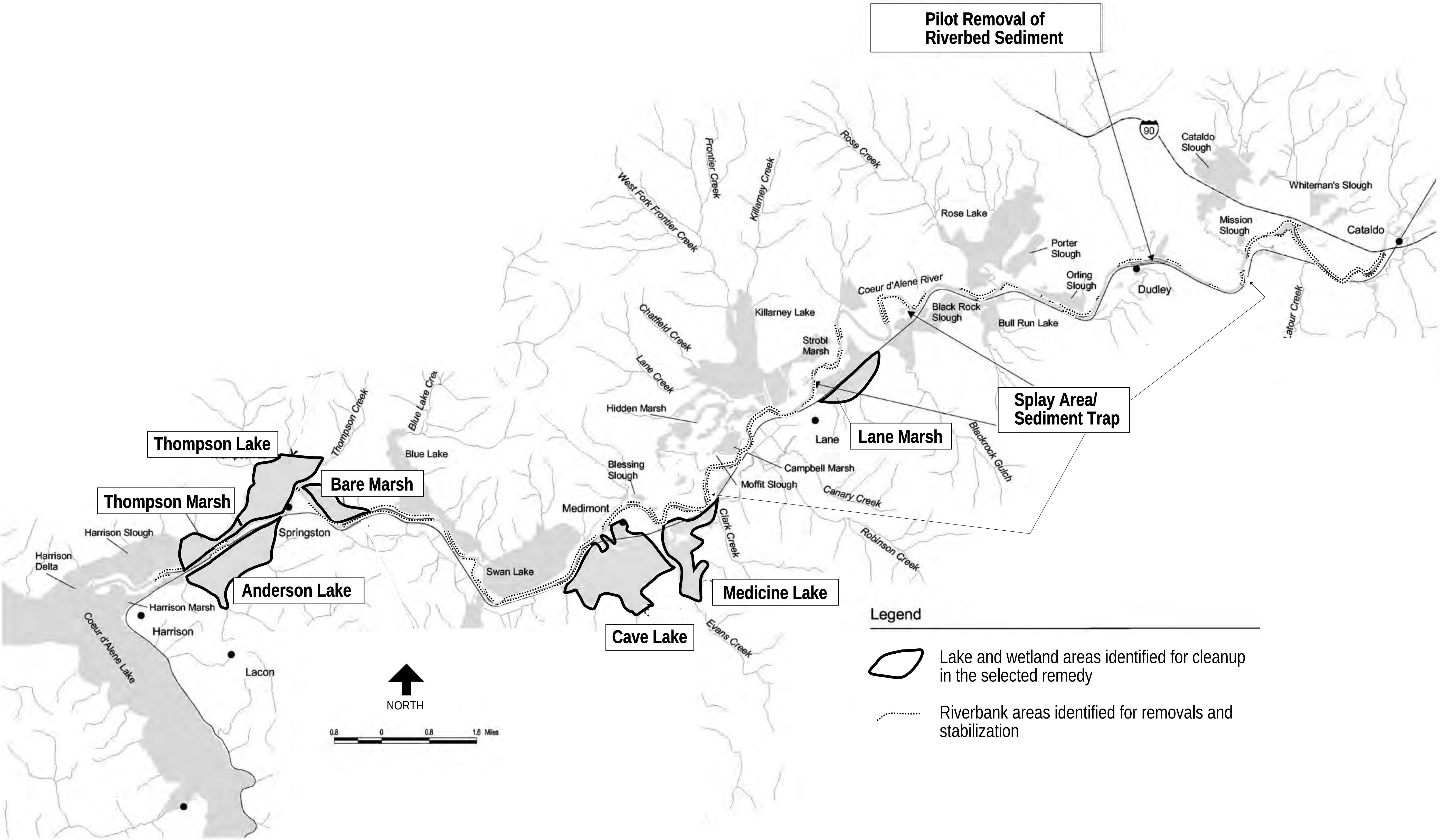


EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

Doc. Control: 4162500.07099.05.a
EPA No. 2.9

Figure 12.2-13
Comparison of Selected Remedy to Alternative 3, South Fork

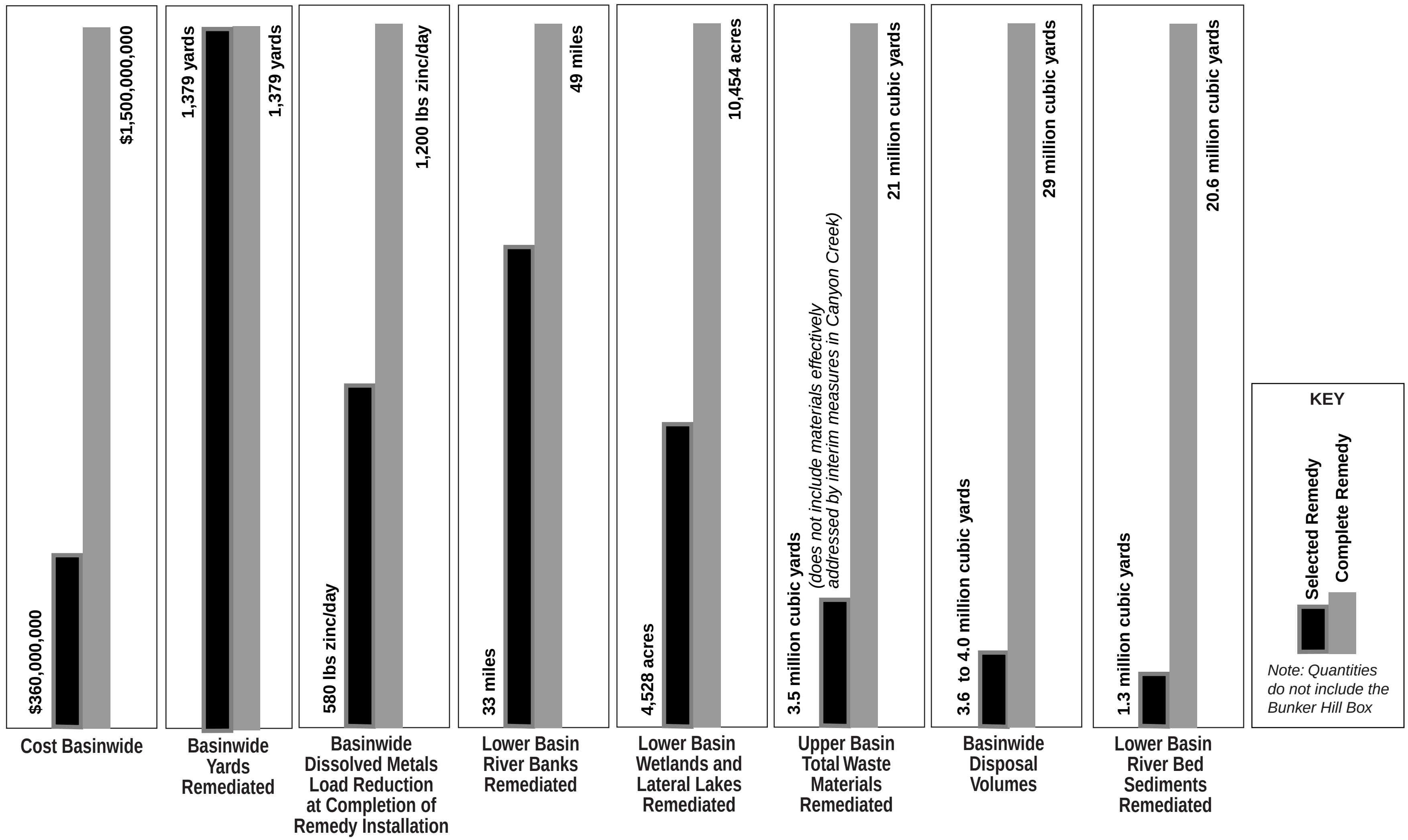


EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

Doc. Control: 4162500.07099.05.a
EPA No. 2.9

Figure 12.2-14
Lower Basin Cleanup Actions

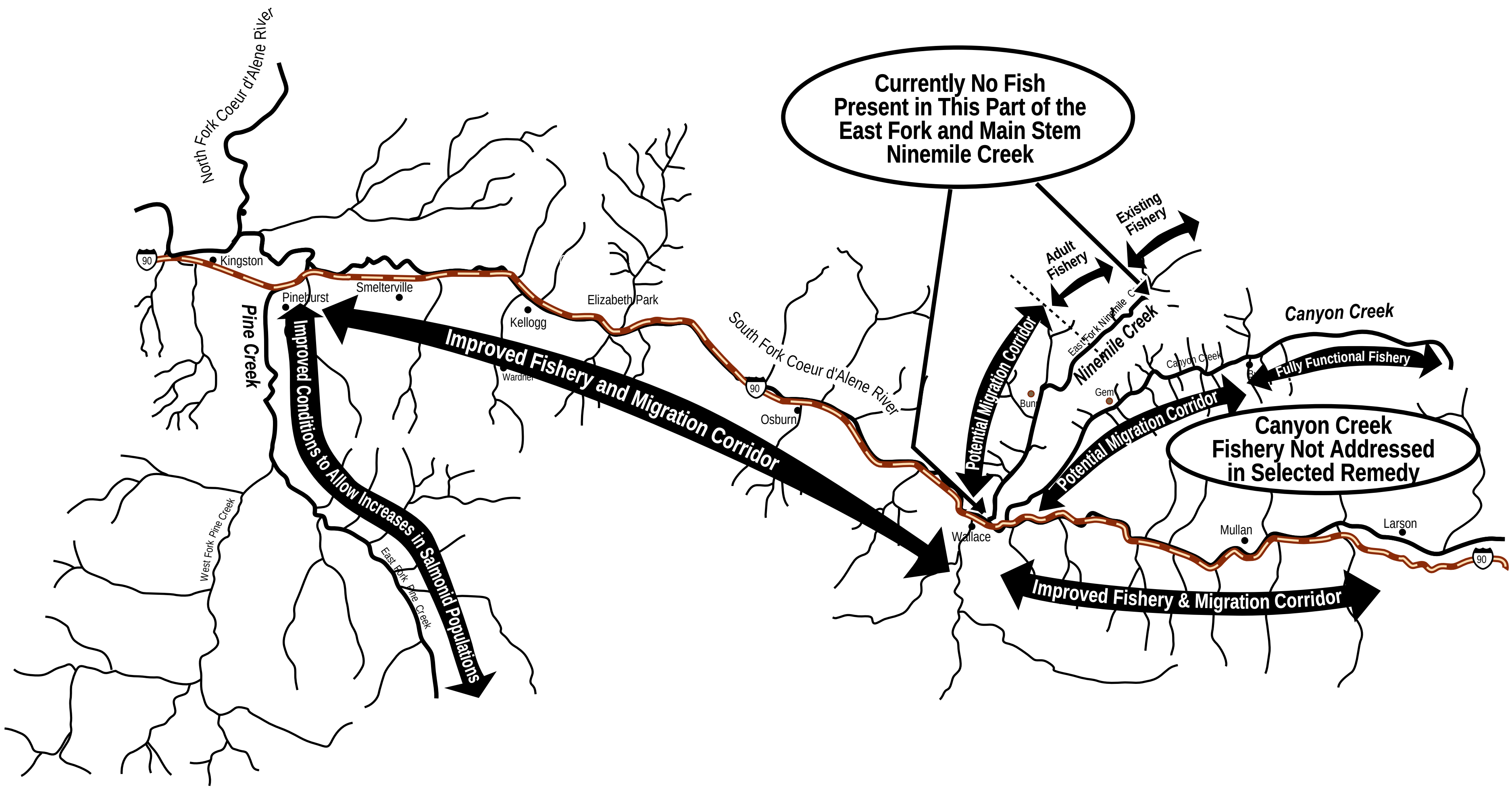


EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

Doc. Control: 4162500.07099.05.a
EPA No. 2.9

Figure 12.2-15
Comparison of Selected Remedy to Complete Remedy

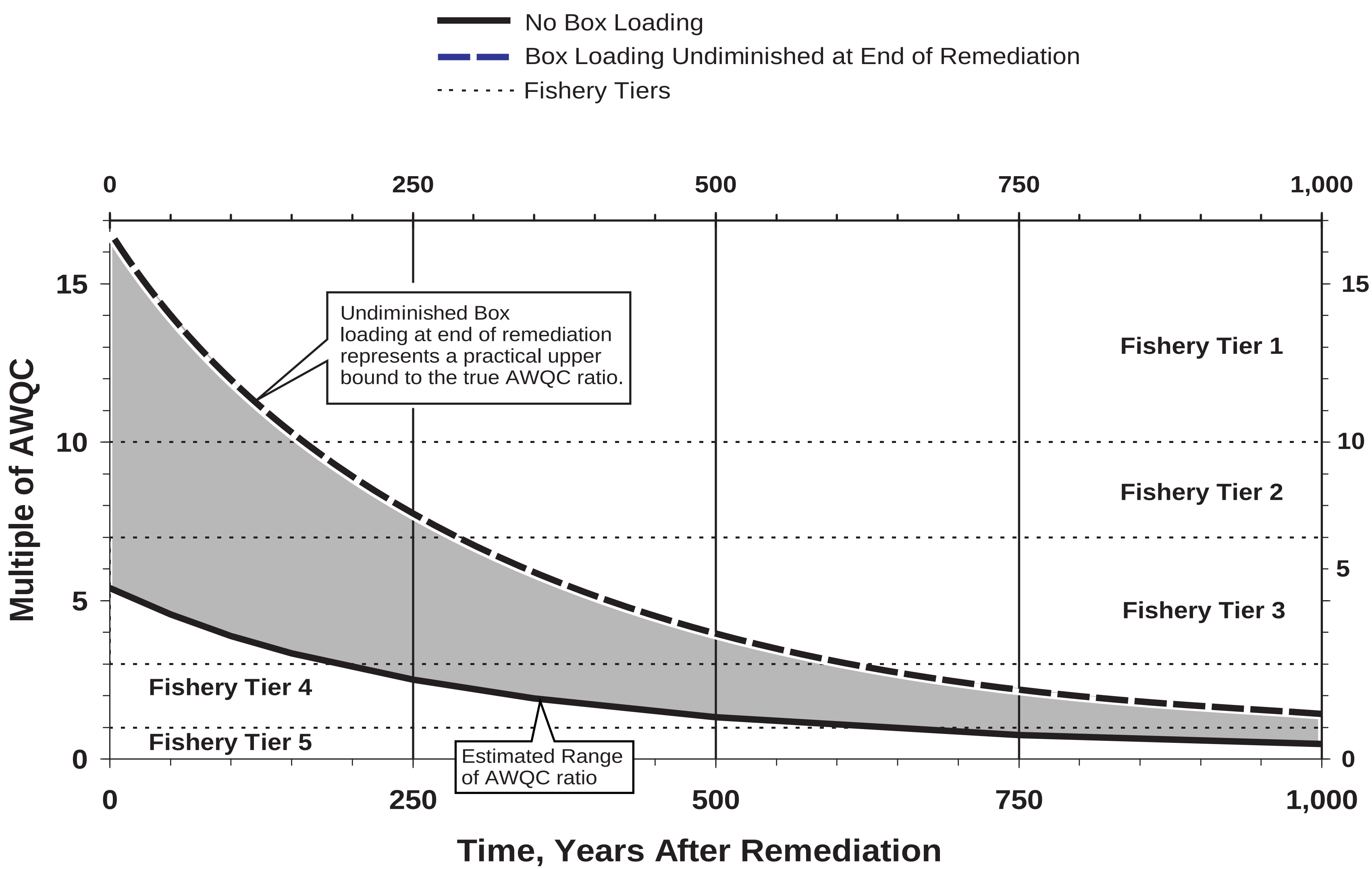


EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

Doc. Control: 4162500.07099.05.a
EPA No. 2.9

Figure 12.2-16
Upper Basin Fisheries Status after Implementation of Selected Remedy



EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

Doc. Control: 4162500.07099.05.a
EPA No. 2.9

Figure 12.2-17
Expected Value of Zinc AWQC Ratio at Pinehurst: Selected Remedy

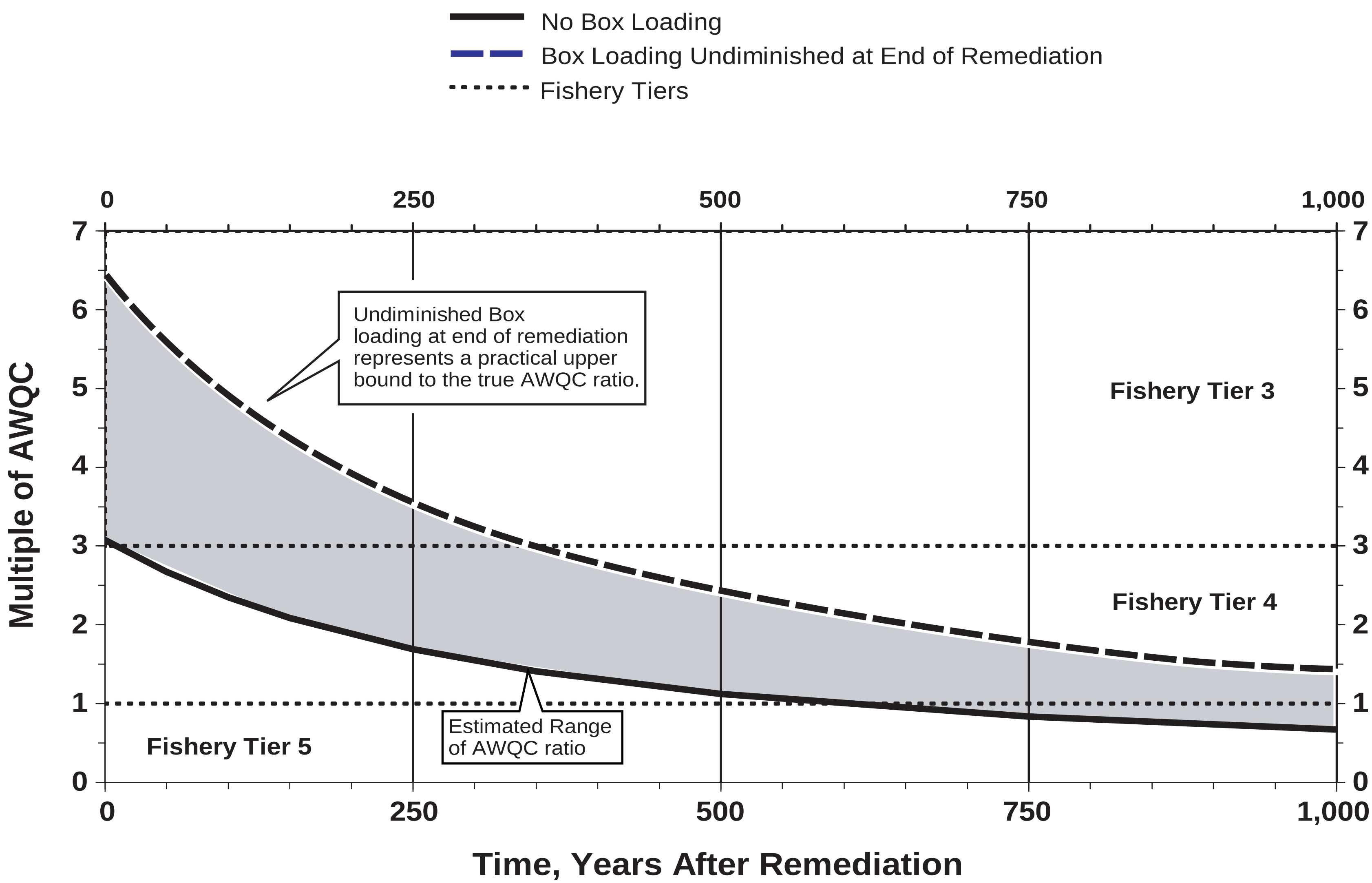
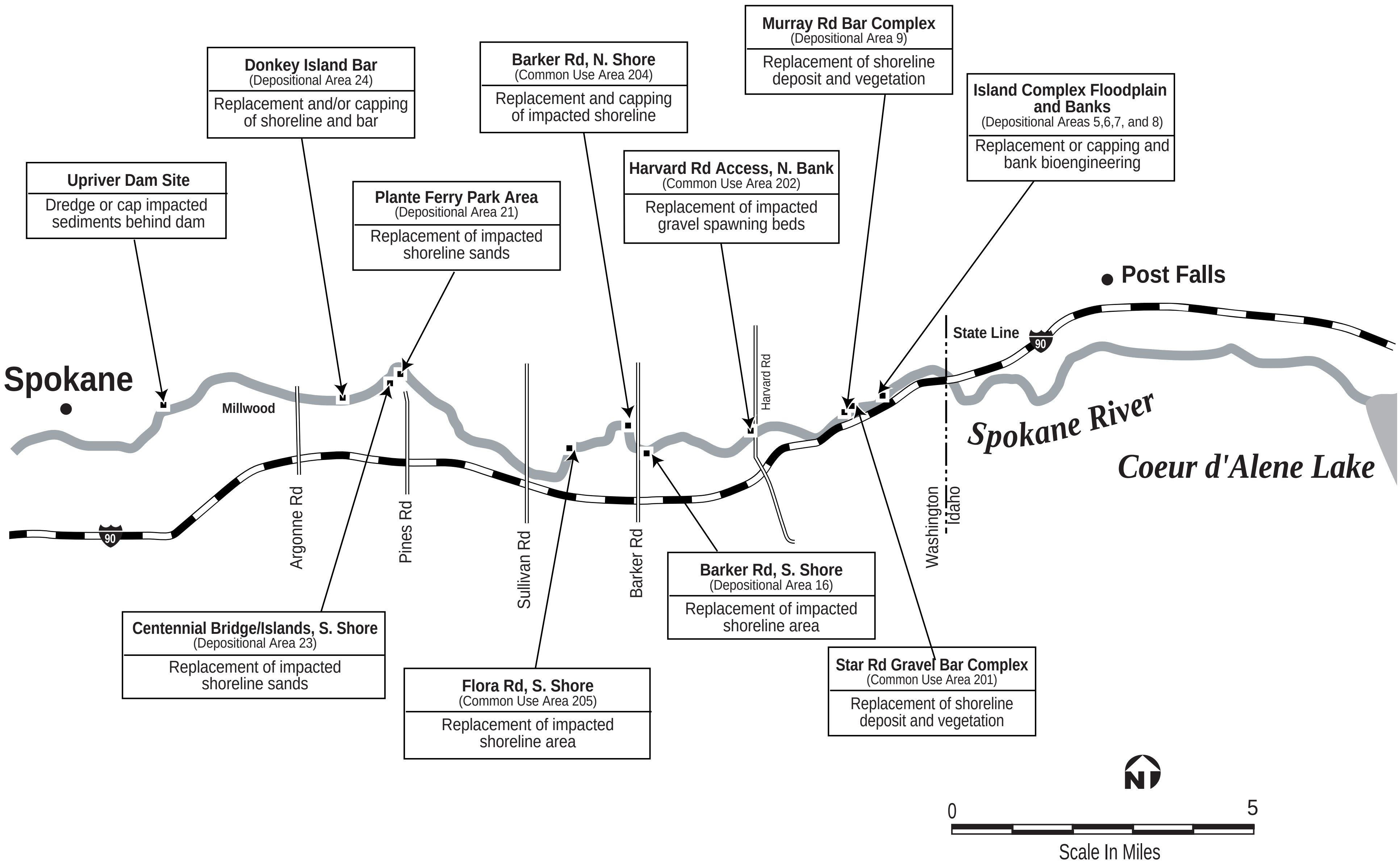


Figure 12.2-18
Expected Value of Zinc AWQC Ratio at Harrison: Selected Remedy



EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RECORD OF DECISION

Doc. Control: 4162500.07099.05.a
EPA No. 2.9

Figure 12.4-1
Spokane River Cleanup Actions

Table 12.0-1
Summary of Feasibility Study Alternatives Used and Estimated Costs of the Selected Remedy

Area	Selected Remedy	Estimated Present Worth Capital Cost	Estimated Present Worth of O&M[a]	Estimated Total Cost
Human health protection in the community and residential areas of the Upper Basin and Lower Basin	Full remedy, including	**$91,000,000**	**$1,000,000**	**$92,000,000** including
	Soil and house dust, including yards, infrastructures, repositories, rights-of-way, commercial properties, and recreation areas. Alternatives S4 (Information and Intervention and Partial Removal and Barriers) and D3: (Information and Intervention, Vacuum Loan Program/Dust Mats, Interior Source Removal, and Capping/More Extensive Cleaning)	$88,000,000	$920,000	$89,000,000[b]
		$2,100,000	$100,000	$2,200,000
	Drinking water: Alternative W6 (Public Information and Multiple Alternative Sources)	$910,000	$0	$910,000
	Aquatic food sources: Alternative F3 (Information and Intervention and Monitoring)			
Ecological protection in the Upper Basin and Lower Basin	Approximately 30 years of prioritized actions	**$210,000,000**	**$39,000,000**	**$250,000,000,** including
	Upper Basin tributaries	$74,000,000	$27,000,000	$100,000,000[c]
	Lower Basin river banks and bed	$66,000,000	$5,300,000	$71,000,000
	Lower Basin floodplains	$74,000,000	$7,200,000	$81,000,000
Coeur d'Alene Lake	Not included in the Selected Remedy			
Spokane River	Combination of elements of Spokane River Alternatives 3, 4, and 5	**$9,300,000**	**$1,300,000**	**$11,000,000[d]**
Monitoring	Basin-wide monitoring	**$0**	**$9,000,000**	**$9,000,000**
Total Cost[e]		**$310,000,000**	**$50,000,000**	**$360,000,000**

Table 12.0-1 (Continued)
Summary of Feasibility Study Alternatives Used and Estimated Costs of the Selected Remedy

Note: Costs are rounded to two significant figures.

[a] O&M = operations and maintenance. Estimated costs are the present worth costs of 30 years of O&M calculated using a discount rate of 7%.
[b] Includes costs for residential soil (Table 12.1-11), street rights of way, commercial properties, and common areas (Table 12.1-12), 31 recreational areas in the Lower Basin (Table 12.1-13), and house dust (Table 12.1-14).
[c] Includes costs for Ninemile Creek (Table 12.2-3), Pine Creek (Table 12.2-4), Canyon Creek (Table 12.2-5), and South Fork (Table 12.2-6). Includes actions at mine and mill sites with human health concerns, as well as ecological concerns. Ninemile Creek costs include contingent actions, which have an estimated total cost of $23,000,000 (including $18,000,000 capital cost and $4,500,000 O&M)
[d] Upper bound estimate for Spokane River. Lower bound total estimated cost = $4,500,000.
[e] Total costs are the sums of the bolded values, rounded to two significant figures.

Table 12.1-1
Estimated Number of Residential Yards Exceeding Lead Cleanup Levels in the Upper Basin and Lower Basin

Area	Estimated Total Residential Yards[a]	Estimated Percentage of Yards Exceeding Cleanup Level[b]		Estimated Number of Yards Exceeding Cleanup Level[c]	
		700 mg/kg	1,000 mg/kg	700 mg/kg	1,000 mg/kg
Upper Basin	3,776	34	21	1,272	800
Lower Basin	821	13	13	107	107
Total	4,597	30	20	1,379	907

[a] Total numbers of yards estimated on the basis of the total yards for investigation areas reported in Table 3-18 of the Human Health Risk Assessment (IDHW 2001a), except for Kingston and the Lower Basin. The total numbers of yards in Kingston and the Lower Basin were reduced by 50 percent to account for upland yards not exposed to potential contamination.
[b] The percentage of yards exceeding 1,000 mg/kg lead concentration was estimated on the basis of the percentage of yards exceeding 1,000 mg/kg lead in Tables 6-11a – 6-11j of the Human Health Risk Assessment; the percentage of yards exceeding 700 mg/kg lead concentration was estimated on the basis of the average of the percentage of homes remediated as listed in Tables 6-61d and 6-61e of the Human Health Risk Assessment.
[c] Estimated by multiplying the estimated total number of yards by the estimated percentage of yards exceeding the corresponding lead concentration.

Table 12.1-2
Summary of the Selected Remedy for Human Health Protection in Community and Residential Areas

Area	Remedial Action Objective	Actions
Soil and House Dust	Reduce mechanical transportation of soil and sediments containing unacceptable levels of contaminants into residential areas and structures. Reduce human exposure to soils, including residential garden soils, and sediments that have concentrations of contaminants of concern greater than selected risk-based levels for soil. (As described in Sections 7 and 12 of this ROD.) Reduce human exposure to lead in house dust via tracking from areas outside the home and air pathways, exceeding health risk goals.	**Alternative S4**: Reduce soil concentrations using information and intervention, community greening, partial removal, and barriers. Includes partial removal and replacement of residential soils with lead concentrations above 1,000 mg/kg (an estimated 907 residences), vegetative barriers to control or limit migration of soils between 700 and 1000 mg/kg (an estimated 472 residences), and a combination of removals, barriers, and access restrictions at commercial and undeveloped properties and recreation areas. **Alternative D3**: Reduce individual house dust lead concentrations and loadings using information and intervention, vacuum loan program/dust mats, interior source removals and controls, if necessary. An estimated maximum of 252 residences would require this additional cleaning. This would be coordinated with paint abatement programs (see Figure 12.1-3). **Institutional Controls** Manage contaminated material by protecting barriers put in place through establishment of an institutional controls program, which would include locally developed and enforced rules and regulations, disposal areas, clean fill sources, control of contaminated source areas and other considerations.
Drinking Water	Reduce ingestion by humans of groundwater or surface water withdrawn or diverted from a private, unregulated source, used as drinking water, and containing contaminants of concern exceeding drinking water standards and risk-based levels for drinking water.	**Alternative W6**: Public information and multiple alternative sources.
Aquatic Food Sources	Reduce human exposure to unacceptable levels of contaminants of concern via ingestion of aquatic food sources (e.g., fish and water potatoes).	**Alternative F3**: Information and intervention and monitoring
Estimated Total Present Worth Cost = $92,000,000		

Table 12.1-3
1996 Blood Lead Levels in 1- to 6-Year-Old Children in the Affected Communities in the Coeur d'Alene Basin, Excluding the Bunker Hill Box

Age (years)	Number of Children Tested	Average Blood Lead μg/dL	Geometric Mean Blood Lead μg/dL	Percent of Children ≥ 10 μg/dL	Percent of Children ≥ 15 μg/dL
1	8	6.6	5.2	25.0	12.5
2	10	5.7	4.6	10.0	10.0
3	8	4.8	3.7	12.5	0.0
4	10	3.4	3.0	0.0	0.0
5	11	6.5	5.5	27.3	9.1
6	11	4.3	3.5	9.1	0.0
All	58	5.2	4.2	13.8	5.2

Table 12.1-4
1997 Blood Lead Levels in 1- to 6-Year-Old Children in the Affected Communities in the Coeur d'Alene Basin, Excluding the Bunker Hill Box

Age (years)	Number of Children Tested	Average Blood Lead µg/dL	Geometric Mean Blood Lead µg/dL	Percent of Children ≥ 10 µg/dL	Percent of Children ≥ 15 µg/dL
1	2	—	—	—	—
2	1	—	—	—	—
3	4	6.8	6.2	25.0	0.0
4	3	—	—	—	—
5	2	—	—	—	—
6	1	—	—	—	—
All	13	6.0	4.9	15.4	7.7

Table 12.1-5
1998 Blood Lead Levels in 1- to 6-Year-Old Children in the Affected Communities in the Coeur d'Alene Basin, Excluding the Bunker Hill Box

Age (years)	Number of Children Tested	Average Blood Lead µg/dL	Geometric Mean Blood Lead µg/dL	Percent of Children ≥ 10 µg/dL	Percent of Children ≥ 15 µg/dL
1	9	8.7	8.0	33.3	11.1
2	9	6.6	5.5	11.1	11.1
3	10	7.1	5.7	20.0	10.0
4	18	5.5	4.8	11.1	0.0
5	13	5.0	4.6	0.0	0.0
6	11	6.3	5.4	7.1	7.1
All	70	6.3	5.4	12.92	5.7

Table 12.1-6
1999 Blood Lead Levels in 1- to 6-Year-Old Children in the Affected Communities in the Coeur d'Alene Basin, Excluding the Bunker Hill Box

Age (years)	Number of Children Tested	Average Blood Lead µg/dL	Geometric Mean Blood Lead µg/dL	Percent of Children ≥ 10 µg/dL	Percent of Children ≥ 15 µg/dL
1	21	6.6	6.0	14.3	0.0
2	26	9.0	7.1	34.6	19.2
3	30	6.8	5.5	20.0	10.0
4	26	6.5	4.8	19.2	11.5
5	36	5.3	4.5	5.6	2.8
6	23	4.5	3.9	4.3	0.0
All	162	6.4	5.2	16.0	7.4

Table 12.1-7
2000 Blood Lead Levels in 1- to 6-Year-Old Children in the Affected Communities in the Coeur d'Alene Basin, Excluding the Bunker Hill Box

Age (years)	Number of Children Tested	Average Blood Lead µg/dL	Geometric Mean Blood Lead µg/dL	Percent of Children ≥ 10 µg/dL	Percent of Children ≥ 15 µg/dL
1	18	6.3	4.5	16.7	11.1
2	13	6.4	5.5	15.4	0
3	18	6.1	5.4	11.1	5.6
4	14	6.6	5.4	21.4	7.1
5	14	5.8	5.1	21.4	0
6	25	4.4	3.8	4.0	0
All	102	5.8	4.8	13.7	3.9

Table 12.1-8
2001 Blood Lead Levels in 1- to 6-Year-Old Children in the Affected Communities in the Coeur d'Alene Basin, Excluding the Bunker Hill Box

Age (years)	Number of Children Tested	Average Blood Lead µg/dL	Geometric Mean Blood Lead µg/dL	Percent of Children ≥ 10 µg/dL	Percent of Children ≥ 15 µg/dL
1	28	3.8	3.2	3.6	0
2	17	4.4	3.7	5.9	0
3	18	5.7	4.7	11.1	5.6
4	19	5.6	4.6	15.8	5.3
5	16	3.5	3.1	0	0
6	19	4.2	3.7	0	0
All	117	4.5	3.7	6.0	1.7

Table 12.1-9
Blood Lead Screening Results for the Basin by Year (Ages 0-6 Only)

Year	Number of Children Tested	Average Blood Lead µg/dL	Percent of Children ≥10 µg/dL	Percent of Children ≥ 15 µg/dL
1996	58	5.2	14	5
1997	13	6.0	15	8
1998	70	6.3	13	6
1999	162	6.4	16	7
2000	102	5.8	14	4
2001	117	4.5	6	2

Table 12.1-10
Estimated Number of Residences With Drinking Water MCL Exceedances in the Upper Basin and Lower Basin

Area	No. of Residences[a]	Assumed Number of Private, Unregulated Sources[b]	Estimated Frequency of MCL Exceedances[c]	Estimated Number of Residences with MCL Exceedances	Availability of Suitable Aquifer
Upper Basin	4,633	1,216	7%	91	None to medium
Lower Basin	1,642	800	10%	80	Medium to high

Notes:
[a] Based on site reconnaissance and demographic data from the human health risk assessment (IDHW 2001a).
[b] Assumes 100 percent of residences outside water district service boundaries have private, unregulated sources.
[c] See Table 4-6 of the FS Part 2 (USEPA 2000c) for actual observed MCL exceedances. Lower Basin value applied to Kingston area because of small Kingston data set.

Table 12.1-11
Estimated Costs for Residential Soil

Area	Total Yards to Remediate	Barriers/ Partial Removals		Mobilization	Contingency[a]	Adminis- tration	Repository Cost	Drainage Upgrades	Recontam- ination	Total Present Worth Cost [b]
		No. of Yards	Estimated Cost							
Upper Basin	1,272	1,233	$18,578,816	$1,857,882	$9,093,509	$2,043,670	$2,031,597	$450,036	$2,552,828	$36,608,338
Lower Basin	107	102	$2,256,100	$225,610	$1,119,513	$248,171	$452,191	$518,903	$648,629	$5,469,116
Totals	**1,379**	**1,335**	**$20,834,916**	**$2,083,492**	**$10,213,022**	**$2,291,841**	**$2,483,788**	**$968,938**	**$3,201,457**	**$42,077,454**
Information and Intervention[c]										$1,358,000
Repository O&M Subtotal[d]										$200,000
Total										**$43,635,454**

[a] Contingency includes costs for potential relocation, which are estimated assuming 5% of homes to be remediated will be relocated at an average cost of $50,000 per residence plus costs for mobilization, contingency, and administration.
[b] Total estimated cost includes costs for 91 residences where soil cleanup has been completed, including 3 in Kingston area, 8 in Mullan, 22 in Osburn, 6 in Silverton, 40 in Wallace, and 12 in Canyon Creek area.
[c] Information and Intervention costs for residential areas are assumed to be equivalent to $1,358,000 of the total available funds for Information and Intervention for the Basin ($3,580,000).
[d] Assumes five Upper Basin and one Lower Basin repositories will be operational for 10 years, with one Upper Basin and one Lower Basin repositories remaining operational for 20 years following completion of cleanup actions. Costs for the repositories remaining operational for 10 years were assumed to be 10% of capital + mobilization costs for year 1, 5% for years 2 - 5, and 2.5% for years 6 - 10. Costs for continued operation were assumed to be 10% per year of the capital + mobilization costs for each of the two repositories for 20 years followed by a 10-year operation and maintenance period with costs estimated as 10% of capital + mobilization costs for year 21, 5% for years 22 - 25, and 2.5% for years 26 - 30.

Table 12.1-12
Estimated Costs for Street Rights of Way, Commercial Properties, and Common Areas

Area	Description	Estimated Present Worth Cost
Street Rights of Way	Assumes 1 foot depth of excavation and soil removal/replacement for $2/SF for approximately 8,000,000 SF of right-of-way (250 miles of road with 3-foot wide rights-of-way on both sides.	$16,000,000
Commercial Properties	Assumes 0.5 foot depth of excavation (1 foot depth next to sensitive receptors) and soil removal/replacement from 150 properties at a cost of $115,000/property.	$17,000,000
Common Areas	Assumes 1 foot depth of excavation and soil removal/replacement from 15 properties at a cost of $100,000/property.	$1,500,000
Information and intervention	Assume 6% of basin-wide Lead Health Intervention Program and 20% of basin-wide institutional controls program.	$310,000
Total Estimated Cost		$35,000,000

Notes:
All costs rounded to two significant figures.
O&M costs are assumed to be minimal for street rights of way, commercial properties, and common areas.

Table 12.1-13
Summary of Estimated Costs for House Dust

Recreation Area	Estimated Present Worth Capital Cost	Estimated Present Worth of O&M	Estimated Total Present Worth Cost
Skeel Gulch Beach	$176,000	$16,500	$192,500
Old Mission State Park	$176,000	$16,500	$192,500
Old Mission State Park Boat Launch	$176,000	$16,500	$192,500
Beach in Mission Flats	$176,000	$16,500	$192,500
South of Mission Flats	$176,000	$16,500	$192,500
Mouth of 4th of July Marsh	$176,000	$16,500	$192,500
Bull Run Peak Beach	$176,000	$16,500	$192,500
Rose Lake Access Area (includes East of Rose Lake and West of Rose Lake)	$254,800	$83,500	$338,300
East of Blackrock Gulch Marsh	$176,000	$16,500	$192,500
Beach Upstream from Quarry	$176,000	$16,500	$192,500
Quarry Beach	$176,000	$16,500	$192,500
RV Park across from Blackrock Gulch	$176,000	$16,500	$192,500
Blackrock Gulch Beach	$176,000	$16,500	$192,500
Beach below Ward Ridge	$176,000	$16,500	$192,500
Near East End of Killarney Lake	$176,000	$16,500	$192,500
Lane Beach	$176,000	$16,500	$192,500
Killarney Lake Boat Launch	$176,000	$16,500	$192,500
Beach near Canal to Killarney Lake	$176,000	$16,500	$192,500
RM 145	$176,000	$16,500	$192,500
Medimont (includes Boat Ramp, West Beach, and Hill Camping Area)	$233,300	$76,000	$309,300
Rainy Hill (includes Fishing Area and Picnic Area)	$233,300	$76,000	$309,300
West of Blue Lake	$176,000	$16,500	$192,500
RM 135 Long Beach/Springston	$176,000	$16,500	$192,500
Across River from Springston	$176,000	$16,500	$192,500
Springston Beach Site	$143,600	$47,000	$190,600
Thompson Lake	$217,300	$72,000	$289,300
Trestle Area next to Route 97	$176,000	$16,500	$192,500
Information and Intervention	$243,000	$0	$243,000
Total Estimated Present Worth Cost for Recreation Areas	**$5,200,000**	**$720,000**	**$5,900,000**

Table 12.1-14
Summary of Estimated Costs for House Dust

Area	Total Residences	Residences Affected	Direct Cost[a,b]	Mobilization 10%	Admin. 10%	Contingency 30%	Total Present Worth Cost[c]
Information and Intervention and Vacuum Loan Program/Dust Mats							
Lower Basin	1,642	575	$ 34,500	$ 3,450	$ 3,795	$11,385	$ 53,130
Upper Basin	4,633	3,180	$190,800	$19,080	$20,988	$62,964	$293,832
Subtotal	6,275	3,755	$225,300	$22,530	$24,783	$74,349	$346,962
Real-Time Monitoring Equipment							$ 7,400
Vacuum Loan Program							$ 16,000
35% of Lead Health Intervention Program costs. NPV@15 years, 7%.							$1,008,000
Subtotal, Information and Intervention and Vacuum Loan Program/Dust Mats							**$1,380,000**
Interior Source Removal/More Extensive Cleaning							
Lower Basin	1,642	39	$ 276,900	$ 27,690	$ 30,459	$ 91,377	$ 426,426
Upper Basin	4,633	227	$1,611,700	$161,170	$177,287	$531,861	$2,482,018
Subtotal	6,275	266	$1,888,600	$188,860	$207,746	$623,238	$2,908,444
Subtotal, Interior Source Removal/More Extensive Cleaning							**$2,908,444**
Total Estimated Cost for House Dust							**$4,288,000**

[a] Direct Cost for Information and Intervention and Vacuum Loan Program/Dust Mats = Number of residences affected times estimated cost for dust mats ($20) and testing ($40) for a total of $60 per residence. Testing costs assume sampling once per year for 5 years, every other year to 10 years, and only 1/5 of the total costs shared with other options.

[b] Direct Cost for Interior Source Removal/More Extensive Cleaning = The average of the average cost per house for HUD cleaning ($9,609) and the average cost per house for commercial cleaning ($4,548) as described in the *Interim Data Summary Report for Pre- and Post-Cleaning Results House Dust Pilot Project 2000*, prepared for the Idaho State Department of Environmental Quality by TerraGraphics Environmental Engineering, Inc., May 2001.

[c] Total Cost = Direct Cost (D) + Mobilization (M) + (D+M) times 10% + (D+M) times 30%.

Table 12.1-15
Summary of Estimated Costs for Drinking Water

Area	Inside or outside water district	Estimated no. of residences	Estimated present worth capital cost	Estimated present worth O&M cost	Estimated total present worth cost
Upper Basin	Inside[a]	3	$22,000	$0	$22,000
	Outside[b]	11	$39,000	$34,000	$73,000
Lower Basin (includes Kingston area)	Inside[a]	78	$580,000	$0	$580,000
	Outside[c]	79	$1,100,000	$70,000	$1,100,000
Information and intervention[d]			$430,000	$0	$430,000
Total		171	$2,100,000	$100,000	$2,200,000

Notes:
All costs rounded to two significant figures.
[a] Estimated costs based on connection to existing public water supply system.
[b] Estimated costs based on point-of-use treatment.
[c] Estimated costs based on installation of new drinking water supply well.
[d] Assumed to be 12% of the basinwide present worth information and intervention costs.

Table 12.1-16
Summary of Estimated Costs for Aquatic Food Sources

Description	Estimated Present Worth Capital Cost	Estimated Present Worth of O&M Costs	Estimated Total Present Worth Cost
Lead Health Intervention Program[a]	$230,000	$0	$230,000
Labor/Equipment/Materials[b]	$310,000	$0	$310,000
Fish Sampling[c]	$370,000	$0	$370,000
TOTAL	$910,000	$0	$910,000

[a] Estimated as 8% of the total present worth cost of the Lead Health Intervention Program ($2,880,000)
[b] Estimated as $25,000 annually for 30 years
[c] Estimated as $250,000 in year 0, $100,000 in year 5, and $100,000 in year 10.

Table 12.2-1
Summary of the Selected Remedy for Ecological Protection in the Upper Basin and Lower Basin

Area	Benchmark	Actions
Upper Basin	Reduce potential for recontamination of downstream remedies and reduce metals load to Coeur d'Alene Lake and the Spokane River **Reduce metals and nutrient loads from groundwater to the South Fork**	Stabilize stream beds and banks and dumps subject to erosion, implement runon/runoff controls, and construct sediment traps. Includes actions in Canyon Creek, Ninemile Creek, Pine Creek, and the South Fork. Construct improvements to sewer and storm drain systems to reduce infiltration of contaminated groundwater.
Estimated costs for stabilization actions are included under the watershed where the action would take place. Costs for sewer and storm drain improvements would not be eligible for funding under CERCLA unless necessary to conduct or maintain remedy (the estimated cost for these improvements = $12,000,000)		
Canyon Creek	Reduce metals toxicity to downstream aquatic receptors Reduce dissolved metals load discharging to the South Fork by at least 50%[a] **Reduce particulate lead and sediment loading during high flows** **Protect recreational users at mine and mill sites**	Pilot and demonstration projects for treatment of creek water and groundwater near the mouth (permeable reactive barrier (PRB) or other technology, potentially including active technology components). Implement water treatment or other technology based on outcome of demonstration project. Conduct stabilization of stream banks and dumps (e.g., Tamarack, Omaha, Standard-Mammoth Loading Area, Hercules No. 5) Address mine/mill sites with human health exposures (Standard-Mammoth Mill, Sisters Mine, and Burke concentrator) using a combination of access controls, capping and removals
Estimated Total Present Worth Cost = $35,000,000		

Table 12.2-1 (Continued)
Summary of the Selected Remedy for Ecological Protection in the Upper Basin and Lower Basin

<table>
<tr><th colspan="2">Area</th><th>Benchmark</th><th>Actions</th></tr>
<tr><td rowspan="2">Ninemile Creek</td><td>East Fork headwaters to above Success</td><td>Improve conditions to allow natural reestablishment of a salmonid fishery
Tier 2 to 3+ fishery (see fishery tier definitions at end of table). Reestablish fishery in 1.7 miles of 13 miles of streams in the Basin that are devoid of fish. Reduce dissolved metals concentrations to less than 7 times chronic AWQC with mitigation of mining impacts on riverine areas. (AWQC are shown in Table 8.2-2)

Protect riverine and riparian receptors
Mitigate mining impacts on riparian areas along 1.7 miles of stream. Risks to riparian receptors will be mitigated using removal and replacement with clean soil or capping with clean soil to isolate contaminants and reduce or eliminate exposure pathways.</td><td>Implementation of a remedy upstream of the Success based on Alternative 3:
• All significant loading sources would be removed, contained, or treated (all <u>except</u> upland waste rock without erosion or leaching potential and adits discharging metals at concentrations <AWQC)
• Impacted sediments and tailings placed in onsite or regional repository
• Tailings impoundments provided with low-permeability cap
• Waste rock subject to erosion or leaching consolidated and contained above the floodplain
• Treatment of water from seeps and five adits
• Hydraulic controls/treatment as needed for loads that are not controlled by removal or containment
• Bioengineering to stabilize stream beds and banks to mitigate mining impacts on riverine and riparian zones
Potential additional actions at the Rex and Interstate mill sites, if needed to achieve benchmarks</td></tr>
<tr><td>East Fork above Success to confluence</td><td>Improve conditions to allow natural reestablishment of a migratory corridor for adult and juvenile fish

Tier 1 fishery. Reduce dissolved metals concentrations to less than 20 times acute AWQC. (AWQC are shown in Table 8.2-2)</td><td>Complete implementation of remedy at Success. Continue monitoring of Success. Based on the results of monitoring, additional actions may be required in this reach, potentially including partial or complete removal of the Success tailings and treatment of creek water near the mouth (permeable reactive barrier (PRB) or other technology, potentially including active treatment components).</td></tr>
</table>

Table 12.2-1 (Continued)
Summary of the Selected Remedy for Ecological Protection in the Upper Basin and Lower Basin

Area		Benchmark	Actions
Ninemile Creek	Mainstem Ninemile Creek.	**Improve conditions to allow natural reestablishment of an adult salmonid fishery** Tier 1 fishery. Reduce dissolved metals concentrations to less than 20 times acute AWQC. (AWQC are shown in Table 8.2-2) **Protect recreational users at mine and mill sites**	Benchmarks would be achieved through actions taken upstream in East Fork. Bioengineering actions may be implemented by other agencies under other programs. Costs for these actions are not included in the estimated costs for Ninemile Creek. Remediate Day Rock mine and mill site using a combination of access controls, capping and removals
Estimated Total Present Worth Cost = $13,500,000 to $36,000,000 (upper range includes additional actions at Success, Rex, and Interstate and treatment of East Fork creek water)			
Pine Creek		**Improve conditions to allow natural increases in salmonid populations and improve spawning and rearing** Tier 3+ fishery. **Protect riverine and riparian receptors** Mitigate mining impacts on riparian areas at locations of hot spot removal/capping. Risks to riparian receptors will be mitigated using removal and replacement with clean soil or capping with clean soil to isolate contaminants and reduce or eliminate exposure pathways. **Protect recreational users at mine and mill sites** including Upper and Lower Constitution Mine and Mill, Highland Surprise Mine and Mill, Nevada Stewart Mine, Hilarity Mine and Mill	Bank and bed stabilization and riparian zone revegetation, with remaining hot spot removals, including Upper and Lower Constitution Mine and Mill, Highland Surprise Mine and Mill, Nevada Stewart Mine, Hilarity Mine and Mill, and Little Pittsburg, Sidney on Denver Creek, and Nabob. Based on results of monitoring, remedy may include treatment of Denver Creek near its mouth to reduce metals load. Improve stream to mitigate environment impacts from mining, including regrading of stream reaches that go dry in the summer months.

Table 12.2-1 (Continued)
Summary of the Selected Remedy for Ecological Protection in the Upper Basin and Lower Basin

Area	Benchmark	Actions
Estimated Total Present Worth Cost = $14,000,000		
South Fork (above Elizabeth Park)	**Improve conditions to support a higher fish density** Tier 2+ to 3+ fishery at >0.1 fish/square meter **Initial protection of riverine and riparian receptors** Mitigate mining impacts on riparian areas at locations of hot spot removal/capping. Risks to riparian receptors will be mitigated using removal and replacement with clean soil or capping with clean soil to isolate contaminants and reduce or eliminate exposure pathways. **Protect recreational users at mine and mill sites**	Stabilize and bioengineer stream channel and banks to protect riverine and riparian receptors, with associated hot-spot removals in upper floodplain. Address mine/mill sites with human health exposures (National Mill, Morning No. 6, Golconda, Hercules Mill, Coeur d'Alene Mill, USBM impoundment, and Silver Dollar Mine) using a combination of access controls, capping, and removals
Estimated Total Present Worth Cost = $16,000,000		
South Fork (Elizabeth Park to confluence including the Bunker Hill Box)	**Reduce metals loading to surface water**	Hydrogeologic investigation: surface water and groundwater monitoring and modeling. Coordination with remedial activities within the Box, which includes actions such as controlling loads to surface water from the CIA area and upgrading the central treatment plant (CTP)[b] Development of groundwater remedy alternatives.
Future actions in the Box are not part of this Selected Remedy.		

[b] Remedial actions for Bunker Hill Box are addressed in the separate Records of Decision (RODs) for this area.

Table 12.2-1 (Continued)
Summary of the Selected Remedy for Ecological Protection in the Upper Basin and Lower Basin

Area	Benchmark	Actions
Lower Basin Stream Banks and Beds, including the Harrison Delta (Riparian and Riverine)	**Reduce particulate lead loading in the river** Reduce lead load entering into Lake Coeur d'Alene and the Spokane River, with emphasis on peak discharge events. Estimated reduction in high-flow load needed is at least 50% to reduce year-round lead concentrations to below chronic AWQC in the Spokane River. **Reduce soil toxicity for songbirds, small mammals, and riparian plants** Mitigate risks to riparian receptors along 33.4 miles of river by removing contaminated bank wedges from a 30-foot wide zone (122 acres). Remove contaminated bank wedges and cap with clean topsoil to enhance vegetation establishment and isolate contaminants from receptors. **Reduce human exposure (recreational and subsistence users)** Same as goals for soil and dust under communities and residential areas	The goal is to implement complete removal of contaminated bank wedges from highly-erosive areas.[c] Where complete removal is not feasible, partial removal may be followed by capping with clean topsoil to enhance vegetation establishment and isolate contaminants from receptors. Stabilize banks and revegetate removal areas to protect riparian zone ecological receptors and humans. Construct and operate sediments traps at four splay areas where the river overflows its banks during high flow conditions (Frutchey's field, Black Rock Slough, Strobl Marsh, and Medicine Lake) after implementing pilot study at one area. Implement periodic removal of river bed sediments in Dudley reach or other natural depositional areas identified during remedial design.[d]
Estimated Total Present Worth Cost = $71,000,000		

[c] Areas identified as requiring aggressive actions. Costs based on 176,383 lf (33.4 miles) with 2.3 cy/lf (approximately 30-feet wide).
[d] Assumes 500,000 cy initial removal and 200,000 cy after 5, 10, 15 and 20 years (total of 1.3 million cubic yards). It is EPA's intent to increase the removal of riverbed sediments in the Dudley reach of the Coeur d'Alene River to up to 1,000,000 cy initial removal and 400,000 cy after 5, 10, 15, and 20 years for a total of up to 2.6 million cubic yards. Based on current unit costs, this would increase the estimated total cost by approximately $26 million.

Table 12.2-1 (Continued)
Summary of the Selected Remedy for Ecological Protection in the Upper Basin and Lower Basin

Area	Benchmark	Actions
Lower Basin Floodplain	**Wetlands: Reduce sediment toxicity and waterfowl mortality** Increase feeding area with lead concentration <530 mg/kg by 1,169 acres (of a total of 5,829 wetland acres with lead exceeding 530 mg/kg). Potentially increase feeding area by an additional 1,500 acres through conversion of agricultural land. **Lakes: Reduce sediment toxicity to diving ducks, dabbling ducks, and warm- and cold-water fishes** Reduce lead concentration in whole brown bullhead fish (as an indicator species) by remediating 1,859 of 5,979 acres of lake with lead exceeding 530 mg/kg. **Riparian: Reduce soil toxicity for riparian receptors** **Reduce human exposure (recreational and subsistence users)** Same as goals for soil and dust under communities and residential areas.	Reduce exposure using a combination of removals, capping, and soil amendments in areas of high waterfowl use, high lead, road access, and relatively low recontamination potential. Human health concerns would also be addressed in identified areas. These areas are: Lane Marsh (south of railroad ROW) (wetland: 213 acres) Medicine Lake (wetland: 198 acres, lake: 230 acres) Cave Lake (wetland: 190 acres, lake: 746 acres) Bare Marsh (wetland: 165 acres) Thompson Lake (wetland: 300 acres, lake: 256 acres); Thompson Marsh (wetland 59 acres, lake: 122 acres) Anderson Lake (wetland 44 acres, lake: 505 acres). Identify agricultural and other areas (subject to landowner approval and further sampling) with lower levels of lead for cleanup to provide additional clean feeding areas (6 areas = 1500 acres).
Estimated Total Present Worth Cost = $81,000,000		

Fishery Tier definitions:
Tier 0: No migrating or resident fish observed.
Tier 1: Presence of migrating fish only, no fish observed during resident fish surveys (expected to be achieved at concentrations below 20x acute AWQC).
Tier 2: Presence of resident salmonids (trout) of any species, sculpin absent (expected to be achieved at concentrations from 7x to 10x chronic AWQC).
Tier 3: Presence of 3 or more year classes of resident salmonids, including young of the year (YOY), sculpin absent (expected to be achieved at concentrations between 3x and 7x chronic AWQC).

Table 12.2-2
Summary of Anticipated Fisheries Status After Implementation of the Selected Remedy

Area	Fishery Benchmark [a]	Current Water Chemistry and Physical Conditions						Water Chemistry and Physical Conditions Necessary to Achieve Benchmark						Notes
		AWQC ratio [b]	Width/ Depth Ratio [c]	Residual Pool Volume [d] (ft^3/mile)	Percent Shade [e]	Large Woody Debris [f] (/100m)	Temperature [g]	AWQC Ratio [b]	Width/ Depth Ratio [c]	Residual Pool Volume [d] (ft^3/mile)	Percent Shade [e]	Large Woody Debris [f] (/100m)	Temperature [g]	
East Fork Ninemile Creek above Success	Improve conditions to allow natural reestablishment of an adult salmonid fishery (Tier 3+)	50x	21 to 35	1,600	35	30 to 50	NR	<7x	10 to 15	>3,500	>60	30 to 50	3	• Rehabilitation of physical features needed to support fishery achieved under the selected remedy. • Marginal evidence for persistence of native trout populations at 10x chronic AWQC. Probability of success increases if concentrations are reduced below 7x chronic AWQC. • Evidence of native trout populations present above the Interstate Mill site as of 1995.
East Fork Ninemile Creek from confluence with mainstem to Success	Improve conditions to allow establishment of a migratory corridor for adult and juvenile fish (Tier 1).	100x	21 to 35	1,600	35	30 to 50	NR	20x	None*	None*	None*	None*	None*	• No physical conditions issues are addressed by the remedy in this area of the watershed. However, minimal improvements are necessary to provide a migratory corridor. • Other agencies may take additional actions under other programs that are consistent with the overall goals of the selected remedy. • Adult fish migration observed at high flow concentrations exceeding 20x acute AWQC in Canyon Creek • High flow bypass of any reactive barrier would need to allow fish passage.
Mainstem Ninemile Crk.	Improve conditions to allow establishment of a migratory corridor (Tier 1)	50x	15	1,600	15	NR	0 to 1	20x	None*	None*	None*	None*	None*	• No physical conditions issues are addressed under remedy. Summer temperatures reduced somewhat by bioengineering actions above Success. • Physical constraints are limiting to establishment of a resident. • Other agencies may take additional actions under other programs that are consistent with the overall goals of the selected remedy.
East Fork Pine Creek below Douglass Creek	• Improve conditions to allow natural increases in salmonid populations (Tier 3+ fishery). • Improve spawning and rearing habitat	10 to 20x	64	2,200	34	42	3*	<7x	18	>6,000	>60	40 to 50	3	• Existing physical conditions issues have been partially addressed by BLM cleanup actions. Additional bioengineering with riparian revegetation should remediate physical conditions • Fishery is currently Tier 2, dominated by introduced brook trout. • Existing densities are generally low (<0.05 fish/m^2).

Table 12.2-2 (Continued)
Summary of Anticipated Fisheries Status After Implementation of the Selected Remedy

Area	Fishery Benchmark [a]	Current Water Chemistry and Physical Conditions						Water Chemistry and Physical Conditions Necessary to Achieve Benchmark						Notes
		AWQC ratio [b]	Width/ Depth Ratio [c]	Residual Pool Volume [d] (ft^3/mile)	Percent Shade [e]	Large Woody Debris [f] (/100m)	Temperature [g]	AWQC Ratio [b]	Width/ Depth Ratio [c]	Residual Pool Volume [d] (ft^3/mile)	Percent Shade [e]	Large Woody Debris [f] (/100m)	Temperature [g]	
Mainstem Pine Creek	Same as above	1x to 3x	42	13,000	16	NR	3	<7x	NR	NR	>33	NR	3	• Floodplain removals include limited bioengineering. Some physical conditions issues may not be fully addressed. • Fishery is currently Tier 3+, dominated by introduced brook trout. • Much of mainstem in Pinehurst is channelized which will limit fishery productivity. • Limiting stream temperatures were not observed during monitoring on mainstem.
South Fork – Wallace to Elizabeth Park	Improve conditions to support a higher fish density (Tier 2+ to 3+ at >0.10 fish/m^2)	10x to 20x	34 to 64	1,500	16	<1	1	<7x	<50	>100,000	>30	>80	2	• Hot-spot removal with associated bank stabilization and riparian planting will address <10% of river length. • Trout are present at Tier 2 to Tier 3 levels in the South Fork, but at low densities (<0.01 fish/m^2). • Physical conditions are limiting to fish populations throughout this area. • AWQC ratio reductions will primarily be achieved by actions in Ninemile and Canyon Creeks.

[a] **Fishery Tier definitions:**
Tier 0: No migrating or resident fish observed.
Tier 1: Presence of migrating fish only, no fish observed during resident fish surveys (concentrations below 20x acute AWQC).
Tier 2: Presence of resident salmonids (trout) of any species sculpin absent (Expected to be achieved of concentrations from 7x to 10x chronic AWQC).
Tier 3: Presence of 3 or more year classes of resident salmonids, including young of the year (YOY), sculpin absent (Expected to be achieved of concentrations between 3x and 7x chronic AWQC).
Tier 4: Presence of 3 or more year classes of resident salmonids, including YOY, and sculpin (Expected to be achieved of concentrations between 1x and 3x chronic AWQC).
Tier 5: Presence of 5 salmonid age classes, including YOY, sculpin, and bull trout. Fauna dominated by native species at high densities (0.1 to >0.3 fish/m^2) (least impacted watersheds with concentrations <1x chronic AWQC).
+ presence of adult trout (>150mm).

[b] AWQC ratios are the measured concentrations of cadmium and zinc rounded to multiples of chronic Ambient Water Quality Criteria (AWQC). Chronic AWQC thresholds are calculated based on a hardness of 70 mg/L as $CaCO_3$. For the definition of fisheries tiers, AWQC are equal to the EPA-approved State of Idaho water quality standards for cadmium and zinc (see Tables 8.2-2 and 8.2-3). The concentration ranges are unaffected by the 2001 update to the cadmium criteria.
[c] Width to depth ratio is the ratio of wetted channel width to wetted channel depth.
[d] Residual pool volume data has not been resolved due to discrepancies in the available data for assessment and reference areas.
[e] Percent shade measured as average percent channel canopy closure (IDEQ 1998).
[f] Large woody debris defined as pieces at least 1 m long and 10cm diameter (IDEQ 1998).

Table 12.2-2 (Continued)
Summary of Anticipated Fisheries Status After Implementation of the Selected Remedy

[g] **Temperature Rating definitions:**
0: Temperatures exceed high adverse effects level threshold.
1: Temperatures exceed moderate adverse effects level threshold.
2: Temperatures exceed low adverse effects level threshold.
3: Temperatures do not exceed adverse level thresholds.

Source: Coeur d'Alene Basinwide Ecological Risk Assessment, Appendix K

Notes:
NR: Indicates data are available but discrepancies have not been resolved.
-: Indicates data are not available.
***: No area-specific actions for this parameter are believed necessary to achieve benchmark.**

Table 12.2-3
Summary of Estimated Costs for Ninemile Creek

Source ID	Site Name	Waste Type	Description	Quantity	Unit	Unit Direct Capital Cost	Direct Capital Cost	Indirect Capital Cost	Net Present Value of O&M
EAST FORK NINEMILE ABOVE SUCCESS									
ACCESSNM01	Access roads Seg01		Temporary Access Road	0.5	MI	$200,000	$100,000	$60,000	$0
ACCESSNM02	Access roads Seg02		Temporary Access Road	1.25	MI	$200,000	$250,000	$150,000	$0
BUR051	Sunset Mine	Adit Drainage	Adit Drainage Collection	1	LS	$6,200	$6,200	$3,720	$1,085
BUR051	Sunset Mine	Adit Drainage	Permeable Reactive Trench	1	LS	$4,400	$4,400	$2,640	$26,400
BUR052	Little Sunset Mine	Waste Rock	Excavation	800	CY	$2.70	$2,160	$1,296	$0
BUR052	Little Sunset Mine	Waste Rock	Low Permeability Cap	0.16	AC	$151,000	$24,160	$14,496	$3,020
BUR053	Interstate Rock Dumps	Waste Rock	Low Permeability Cap	8.45	AC	$170,000	$1,436,500	$861,900	$323,213
BUR053	Interstate Rock Dumps	Waste Rock	Excavation	138,400	CY	$2.70	$373,680	$224,208	$0
BUR054	Rex No. 2	Adit Drainage	Adit Drainage Collection	1	LS	$6,200	$6,200	$3,720	$1.085
BUR054	Rex No. 2	Adit Drainage	Permeable Reactive Trench	1	LS	$4,400	$4,400	$2,640	$26,400
BUR056	Tamarack Rock Dump	Waste Rock	Regrade/Consolidate/Revegetate	13.34	AC	$110,000	$1,467,400	$880,400	$183,425
BUR058	Tamarack No. 3	Adit Drainage	Permeable Reactive Trench	1	LS	$4,400	$4,400	$2,640	$26,400
BUR058	Tamarack No. 3	Adit Drainage	Adit Drainage Collection	1	LS	$6,200	$6,200	$3,720	$1,085
BUR139	Rex No. 1	Waste Rock	Low Permeability Cap	1.31	AC	$151,000	$197,810	$118,686	$24,726
BUR140	Impacted riparian	Floodplain Sediments	Sediment Excavation	10,000	CY	$10	$100,000	$60,000	$0
BUR140	Impacted riparian	Floodplain Sediments	Regional Repository	10,000	CY	$16	$160,000	$96,000	$40,000
BUR160	Interstate Lower Dump	Waste Rock	Low Permeability Cap	4.2	AC	$170,000	$714,000	$428,400	$160,650
BUR170	Tamarack 400 Level	Waste Rock	Low Permeability	0.95	AC	$151,000	$143,450	$86,070	$17,931
BUR170	Tamarack 400 Level	Adit Drainage	Adit Drainage Collection	1	LS	$6,200	$6,200	$3,720	$1,085
BUR170	Tamarack 400 Level	Adit Drainage	Permeable Reactive Trench	1	LS	$4,400	$4,400	$2,640	$26,400
BUR171	Tamarack No. 5	Adit Drainage	Permeable Reactive Trench	1	LS	$4,400	$4,400	$2,640	$26,400
BUR171	Tamarack No. 5	Adit Drainage	Adit Drainage Collection	1	LS	$6,200	$6,200	$3,720	$1,085
BUR171	Tamarack No. 5	Waste Rock	Low Permeability Cap	0.66	AC	$151,000	$99,660	$59,796	$12,458
BUR172	Tamarack Unnamed Adit	Waste Rock	Low Permeability Cap	0.43	AC	$151,000	$64,930	$38,958	$8,116
OSB056	Impacted riparian	Floodplain Sediments	Sediment Excavation	1,600	CY	$10	$16,000	$9,600	
OSB056	Impacted riparian	Floodplain Sediments	Regional Repository	1,600	CY	$16	$25,600	$15,360	$6,400
OSB039	Day Rock	Upland Tailings	Excavation	11,000	CY	$2.70	$29,700	$17,820	$0
OSB039	Day Rock	Floodplain Sediments	Sediment Excavation	11,000	CY	$10	$110,000	$66,000	$0
OSB039	Day Rock	Adit Drainage	Adit Drainage Collection	1	LS	$6,200	$6,200	$3,720	$1,085
OSB039	Day Rock	Adit Drainage	Permeable Reactive Trench	1	LS	$4,400	$4,400	$2,640	$26,400
OSB039	Day Rock	Floodplain Sediments	Regional Repository	11,000	CY	$16	$176,000	$105,600	$44,000

Table 12.2-3 (Continued)
Summary of Estimated Costs for Ninemile Creek

Source ID	Site Name	Waste Type	Description	Quantity	Unit	Unit Direct Capital Cost	Direct Capital Cost	Indirect Capital Cost	Net Present Value of O&M
OSB039	Day Rock	Upland Tailings	Local Repository Above Flood Level	11,000	CY	$9.70	$106,700	$64,020	$24,008
OSB039	Day Rock	Buildings & Structures	Decon Millsite	1	LS	$100,000	$100,000	$60,000	$5,000
LHAULNM02	Haul to local repository, Seg02		Haul to Local Repository	7,000	CY-MI	$0.89	$6,230	$3,738	$0
NM01-1	Headwaters to Interstate millsite reach		Current Deflector Sediment Traps	5	EA	$1,380	$6,900	$4,140	$40,020
NM01-1	Headwaters to Interstate millsite reach		Vegetative Bank Stabilization	4,011	LF	$36	$144,396	$86,638	$43,319
NM01-1	Headwaters to Interstate millsite reach		Bank Stabilization via Revetments	4,011	LF	$83	$332,913	$199,748	$99,874
NM01-1	Headwaters to Interstate millsite reach		Floodplain & Riparian Replanting	200,531	SF	$0.94	$188,499	$113,099	$32,987
NM01-1	Headwaters to Interstate millsite reach		Current Deflector	48	EA	$1,380	$66,240	$39,744	$19,872
NM02-1	Interstate millsite to Success reach		Current Deflector	45	EA	$1,380	$62,100	$37,260	$18,630
NM02-1	Interstate millsite to Success reach		Vegetative Bank Stabilization	3,777	LF	$36	$135,954	$81,572	$40,786
NM02-1	Interstate millsite to Success reach		Bank Stabilization via Revetments	3,777	LF	$83	$313,450	$188,070	$94,035
NM02-1	Interstate millsite to Success reach		Floodplain & Riparian Replanting	188,828	SF	$0.94	$177,498	$106,499	$31,062
NM02-1	Interstate millsite to Success reach		Off-Channel Hydrologic Feature	188,828	SY	$29	$5,032	$3,019	$881
NM02-1	Interstate millsite to Success reach		Current Deflector Sediment Traps	10	EA	1,380	$6,900	$4,100	$40,020
RHAULNMO1	Haul to Regional Repository, Seg01		Haul to Regional Repository	81,200	CY-MI	$0.89	$72,268	$43,361	$0
								Capital Cost	**$ 12,000,000**
								O&M Cost	**$ 1,500,000**
								Total Cost	**$ 13,000,000**
CONTINGENCY COSTS									
Rex									
BUR055	Rex	Waste Rock	Low Permeability Cap	5	AC	$151,000	$755,000	$453,300	$94,375
BUR055	Rex	Upland Tailings	Tailings Impoundment Closure	6.5	AC	$170,000	$1,105,000	$663,000	$221,000
								Capital	$ 2,976,300
								O&M	$ 315,375
								Total	$ 3,291,675
Interstate Millsite									
BUR055	Interstate Millsite	Floodplain Sediments	Regional Repository	5500	CY	$16	$88,000	$52,800	$22,000
BUR055	Interstate Millsite	Upland Tailings	Local Repository Above Flood Level	14000	CY	$9.70	$135,800	$81,400	$30,555
BUR055	Interstate Millsite	Floodplain Sediments	Sediment Excavation	5500	CY	$10	$55,000	$33,000	$0
								Capital	$ 446,080
								O&M	$ 52,555
								Total	$ 498,635

Table 12.2-3 (Continued)
Summary of Estimated Costs for Ninemile Creek

Source ID	Site Name	Waste Type	Description	Quantity	Unit	Unit Direct Capital Cost	Direct Capital Cost	Indirect Capital Cost	Net Present Value of O&M
Success									
OSB044	Success	Floodplain Sediments	Regional Repository	10,000	CY	$16	$160,000	$96,000	$40,000
OSB044	Success	Upland Tailings	Excavation	360,000	CY	$2.70	$972,000	$583,200	$0
OSB044	Success	Waste Rock	Regrade/Consolidate/Revegetate	0.45	AC	$56,000	$25,200	$15,120	$3,150
OSB044	Success	Upland Tailings	Regional Repository	360,000	CY	$16	$5,760,000	$3,456,000	$1,440,000
OSB044	Success	Floodplain Sediments	Sediment Excavation	10,000	CY	$10	$100,000	$60,000	$0
								Capital	$ 11,227,520
								O&M	$ 1,483,150
								Total	$ 12,710,670
East Fork Ninemile Treatment Pond (See Note 1)									
	Ninemile Treatment Pond (10 cfs)		Reagent	1,603	TON	$600	$961,696	$577,018	$1,906,005
	Ninemile Treatment Pond (10 cfs)		Other Construction and Monitoring	1	LS	$1,123,089	$1,123,089	$673,853	$762,402
								Capital	$ 3,335,656
								O&M	$ 2,668,407
								Total	$ 6,004,063
								Total Contingency Capital Cost	**$18,000,000**
								Total Contingency O&M Cost	**$ 4,500,000**
								Total Contingency Cost	**$23,000,000**
								TOTAL CAPITAL COST	**$30,000,000**
								TOTAL O&M COST	**$ 6,000,000**
								TOTAL COST	**$36,000,000**

Note 1: Estimated costs for treatment pond are based on the assumption that 70% of the upstream metal load in Ninemile Creek is removed by source-specific remedial actions.

Table 12.2-4
Summary of Estimated Costs for Pine Creek

Source ID	Site Name	Waste Type	Description	Quantity	Unit	Unit Direct Capital Cost	Direct Capital Cost	Indirect Capital Cost	Net Present Value of O&M
Human Health at Mine and Mill Sites									
MAS027	L. Const. Mine	Floodplain Waste Rock	Low Permeability Cap	2.42	AC	$151,000	$365,420	$219,252	$45,678
MAS027	L. Const. Mine	Floodplain Waste Rock	Excavation	7,000	CY	$2.70	$18,900	$11,340	$0
MAS048	L. Const. Mine	Floodplain Tailings	Excavation	4,950	CY	$2.70	$13,365	$8,019	$0
MAS048	L. Const. Mine	Floodplain Tailings	Local Repository Above Flood Level	4,950	CY	$9.70	$48,015	$28,809	$10,803
MAS048	L. Const. Mine	Upland Tailings	Local Repository Above Flood Level	16,320	CY	$9.70	$158,304	$94,982	$35,618
MAS048	L. Const. Mine	Upland Tailings	Excavation	16,320	CY	$2.70	$44,064	$26,438	$0
MAS049	U. Const. Tailings	Floodplain Tailings	Local Repository Above Flood Level	36,000	CY	$9.70	$349,200	$209,520	$78,570
MAS049	U. Const. Tailings	Floodplain Tailings	Excavation	36,000	CY	$2.70	$97,200	$58,320	$0
MAS050	U. Const. WRP	Floodplain Waste Rock	Excavation	10,500	CY	$2.70	$28,350	$17,010	$0
MAS050	U. Const. WRP	Floodplain Waste Rock	Low Permeability Cap	1.5	AC	$151,000	$226,500	$135,900	$39,638
MAS022	H-S Upper WRP	Floodplain Waste Rock	Excavation	48,000	CY	$2.70	$129,600	$77,760	$0
MAS022	H-S Upper WRP	Floodplain Waste Rock	Local Repository Above Flood Level	48,000	CY	$9.70	$465,600	$279,360	$104,760
MAS078	H-W Mine/mill	Adit Drainage	Permeable Reactive Trench	0.583	LB/DAY	$13,903	$8,109	$4,866	$48,656
MAS078	H-W Mine/mill	Adit Drainage	Adit Drainage Collection	1	LS	$6,200	$6,200	$3,720	$1,085
MAS079	H-S Lower WRP	Floodplain Waste Rock	Excavation	3,300	CY	$2.70	$100,710	$60,426	$0
MAS079	H-S Lower WRP	Floodplain Waste Rock	Low Permeability Cap	1.9	AC	$151,000	$286,900	$172,140	$35,863
MAS021	Nev-Stewart	Adit Drainage	Permeable Reactive Trench	3.888	LB/DAY	$13,903	$54,060	$32,436	$324,359
MAS021	Nev-Stewart	Adit Drainage	Adit Drainage Collection	1	LS	$6,200	$6,200	$3,720	$1,085
MAS021	Nev-Stewart	Upland Waste Rock	Low Permeability Cap	0.63	AC	$170,000	$107,100	$64,260	$24,098
MAS021	Nev-Stewart	Upland Waste Rock	Excavation	200	CY	$2.70	$540	$324	$0
MAS014	Hilarity	Upland Tailings	Excavation	80	CY	$2.70	$216	$130	$0
MAS014	Hilarity	Upland Tailings	Regional Repository	80	CY	$16	$1,280	$768	$320
MAS014	Hilarity	Adit Drainage	Permeable Reactive Trench	1	LS	$4,400	$4,400	$2,640	$26,400
MAS014	Hilarity	Adit Drainage	Adit Drainage Collection	1	LS	$6,200	$6,200	$3,720	$1,085
MAS041	Hilarity	Seep	Permeable Reactive Trench	1	LS	$4,400	$4,400	$2,640	$26,400
MAS007	Nabob Mine	Upland Waste Rock	Excavation	48,000	CY	$2.70	$129,600	$77,760	$0
MAS007	Nabob Mine	Upland Waste Rock	Low Permeability Cap	1.82	AC	$151,000	$274,820	$164,892	$34,353
MAS007	Nabob Mine	Adit Drainage	Adit Drainage Collection	1	LS	$6,200	$6,200	$3,720	$1,085
MAS007	Nabob Mine	Adit Drainage	Permeable Reactive Trench	2.1	LB/DAY	$13,903	$29,412	$17,647	$176,475

Table 12.2-4 (Continued)
Summary of Estimated Costs for Pine Creek

Source ID	Site Name	Waste Type	Description	Quantity	Unit	Unit Direct Capital Cost	Direct Capital Cost	Indirect Capital Cost	Net Present Value of O&M
								Capital	$ 4,800,000
								O&M	$ 1,000,000
								Total	$ 5,800,000
Ecological Protection at Mine and Mill Sites									
MAS015	Little Pittsburg Lower Mine	Upland Waste Rock	Local Repository Above Flood Level	1,000	CY	$9.70	$9,700	$5,820	$2,183
MAS015	Little Pittsburg Lower Mine	Upland Waste Rock	Excavation	1,000	CY	$2.70	$2,700	$1,620	$0
MAS015	Little Pittsburg Lower Mine	Adit Drainage	Permeable Reactive Trench	1	LS	$4,400	$4,400	$2,640	$26,400
MAS015	Little Pittsburg Lower Mine	Adit Drainage	Adit Drainage Collection	1	LS	$6,200	$6,200	$3,720	$1,085
MAS016	Little Pittsburg Lower Mine	Adit Drainage	Permeable Reactive Trench	1	LS	$4,400	$4,400	$2,640	$26,400
MAS016	Little Pittsburg Lower Mine	Adit Drainage	Adit Drainage Collection	1	LS	$6,200	$6,200	$3,720	$1,085
MAS016	Little Pittsburg Lower Mine	Upland Waste Rock	Local Repository Above Flood Level	23,280	CY	$9.70	$225,816	$135,490	$50,809
MAS016	Little Pittsburg Lower Mine	Upland Waste Rock	Excavation	23,280	CY	$2.70	$62,856	$37,714	$0
MAS017	Sidney (Denver)	Upland Waste Rock	Excavation	62,640	CY	$2.70	$169,128	$101,477	$0
MAS017	Sidney (Denver)	Upland Waste Rock	Local Repository Above Flood Level	62,640	CY	$9.70	$607,608	$364,565	$136,712
MAS020	Sidney Mine/Millsite	Adit Drainage	Adit Drainage Collection	1	LS	$6,200	$6,200	$3,720	$1,085
MAS020	Sidney Mine/Millsite	Adit Drainage	Permeable Reactive Trench	4.2	LB/DAY	$13,903	$58,838	$55,421	$147,790
			Haul to Local Repository	96,095	CY-MI	$0.89	$85,525	$51,315	$0
								Capital	$ 2,000,000
								O&M	$ 400,000
								Total	$ 2,400,000
Bioengineering									
PC03-1	E.Fork/W.Fork conf to unnamed		Bank Stabilization via Revetments	2,032	LF	$83	$168,656	$101,194	$50,597
PC03-2	unnamed to unnamed		Bank Stabilization via Revetments	1,649	LF	$83	$136,867	$82,120	$41,060
PC03-3	unnamed to Little Pine Creek		Bank Stabilization via Revetments	1,000	LF	$83	$83,000	$49,800	$24,900
PC03-1	E.Fork/W.Fork conf to unnamed		Floodplain and Riparian Replanting	232,739	SF	$0.94	$218,775	$131,265	$38,286
PC03-2	unnamed to unnamed		Floodplain and Riparian Replanting	181,335	SF	$0.94	$170,455	$102,273	$29,830
PC03-3	unnamed to Little Pine Creek		Floodplain and Riparian Replanting	284,463	SF	$0.94	$267,395	$160,437	$46,794
PC03-1	E.Fork/W.Fork conf to unnamed		Vegetative Bank Stabilization	2,032	LF	$36	$73,152	$43,891	$21,946
PC03-2	unnamed to unnamed		Vegetative Bank Stabilization	1,649	LF	$36	$59,364	$35,618	$17,809
PC03-3	unnamed to Little Pine Creek		Vegetative Bank Stabilization	1,000	LF	$36	$36,000	$21,600	$10,800
PC01-3	Constitution to unnamed		Floodplain and Riparian Replanting	137,280	SF	$0.94	$129,043	$77,426	$22,583
PC01-4	unnamed to Douglas		Floodplain and Riparian Replanting	203,280	SF	$0.94	$191,083	$114,650	$33,440
PC01-5	Douglas to Dry		Floodplain and Riparian Replanting	1,24,080	SF	$0.94	$116,635	$69,981	$20,411

Table 12.2-4 (Continued)
Summary of Estimated Costs for Pine Creek

Source ID	Site Name	Waste Type	Description	Quantity	Unit	Unit Direct Capital Cost	Direct Capital Cost	Indirect Capital Cost	Net Present Value of O&M
PC01-6	Dry to Blue Eagle		Floodplain and Riparian Replanting	47,520	SF	$0.94	$44,669	$26,801	$7,817
PC01-7	Blue Eagle to Highland		Floodplain and Riparian Replanting	126,720	SF	$0.94	$119,117	$71,470	$20,845
PC01-8	Highland to Denver		Floodplain and Riparian Replanting	166,320	SF	$0.94	$156,341	$93,804	$27,360
PC01-9	Denver to Hunter		Floodplain and Riparian Replanting	163,680	SF	$0.94	$153,859	$92,316	$26,925
PC01-10	Hunter to unnamed		Floodplain and Riparian Replanting	36,960	SF	$0.94	$34,742	$20,845	$6,080
PC01-11	unnamed to Nabob		Floodplain and Riparian Replanting	47,520	SF	$0.94	$44,669	$26,801	$7,817
PC01-12	Nabob to West Fork		Floodplain and Riparian Replanting	343,200	SF	$0.94	$322,608	$193,565	$56,456
Bioengineering (Continued)									
PC01-3	Constitution to unnamed		Current Deflector	37	EA	$1,380	$51,060	$30,636	$15,318
PC01-4	unnamed to Douglas		Current Deflector	54	EA	$1,380	$74,520	$44,712	$22,356
PC01-5	Douglas to Dry		Current Deflector	33	EA	$1,380	$45,540	$27,324	$13,662
PC01-6	Dry to Blue Eagle		Current Deflector	13	EA	$1,380	$17,940	$10,764	$5,382
PC01-7	Blue Eagle to Highland		Current Deflector	34	EA	$1,380	$46,920	$28,152	$14,076
PC01-8	Highland to Denver		Current Deflector	44	EA	$1,380	$60,720	$36,432	$18,216
PC01-9	Denver to Hunter		Current Deflector	44	EA	$1,380	$60,720	$36,432	$18,216
PC01-10	Hunter to unnamed		Current Deflector	10	EA	$1,380	$13,800	$8,280	$4,140
PC01-11	unnamed to Nabob		Current Deflector	13	EA	$1,380	$17,940	$10,764	$5,382
PC01-12	Nabob to West Fork		Current Deflector	92	EA	$1,380	$126,960	$76,176	$38,088
								Capital	$ 4,900,000
								O&M	$ 700,000
								Total	$ 5.600,000
								Capital	**$ 12,000,000**
								O&M	**$ 2,100,000**
								Total	**$ 14,100,000**

Table 12.2-5
Summary of Estimated Costs for Canyon Creek

Source ID	Site Name	Waste Type	Description	Quantity	Unit	Unit Direct Capital Cost	Direct Capital Cost	Indirect Capital Cost	Net Present Value of O&M
Human Health at Mine and Mill Sites									
WAL039	SM Mill	Upland Tailings	Excavate/Dispose in Regional Landfill	12,500	CY	$18.50	$231,250	$138,750	$0
WAL039	SM Mill	Upland Tailings	General Grading	10,000	CY	$2	$20,000	$12,000	$2,500
WAL039	SM Mill	Upland Tailings	Cap - General	3,500	CY	$16.50	$57,750	$34,650	$7,219
WAL039	SM Mill	Upland Tailings	Upland Revegetation	2	AC	$5,000	$10,000	$6,000	$1,250
WAL039	SM Mill	Floodplain Sediments	Wetland Vegetation	3	AC	$11,000	$33,000	$19,800	$5,775
WAL039	SM Mill	Floodplain Sediments	Upland Revegetation	1	AC	$5,000	$5,000	$3,000	$625
WAL039	SM Mill	Floodplain Sediments	Bioengineering Streambanks	2,300	LF	$40	$92,000	$55,200	$27,600
WAL008	Sisters	Upland Waste Rock	Excavate/Dispose in Regional Landfill	5,000	CY	$18.50	$92,500	$55,500	$0
WAL008	Sisters	Upland Waste Rock	Upland Revegetation	0.6	AC	$5,000	$3,000	$1,800	$375
WAL008	Sisters	Upland Waste Rock	General Grading	2,000	CY	$2	$4,000	$2,400	$500
BUR128	Burke Concentrator	Buildings & Structures	No Actions identified				$0	$0	$0
								Capital	$ 880,000
								O&M	$ 50,000
								Total	$ 930,000
Dump and Bank Stabilization									
BUR067	Tamarack 7\WRP	Upland Waste Rock	Bioengineering Steambanks	1,000	LF	$40	$40,000	$24,000	$12,000
BUR067	Tamarack 7\WRP	Upland Waste Rock	General Grading	35,000	CY	$2	$70,000	$42,000	$0
BUR067	Tamarack 7\WRP	Upland Waste Rock	Upland Vegetation	14	AC	$5,000	$70,000	$42,000	$8,750
BUR098	Hercules No. 5	Upland Waste Rock	Bioengineering Steambanks	500	LF	$40	$20,000	$12,000	$6,000
BUR098	Hercules No. 5	Upland Waste Rock	General Grading	12,000	CY	$2	$24,000	$14,400	$0
BUR098	Hercules No. 5	Upland Waste Rock	Upland Vegetation	3	AC	$5,000	$15,000	$9,000	$1,875
BUR107	Ajax No. 3 \WRP	Upland Waste Rock	Bioengineering Steambanks	500	LF	$40	$20,000	$12,000	$6,000
BUR107	Ajax No. 3 \WRP	Upland Waste Rock	General Grading	12,000	CY	$2	$24,000	$14,400	$0
BUR107	Ajax No. 3 \WRP	Upland Waste Rock	Upland Vegetation	2.4	AC	$5,000	$12,000	$7,200	$1,500
BUR109	Oom Paul\WRP	Upland Waste Rock	Bioengineering Steambanks	300	LF	$40	$12,000	$7,200	$3,600
BUR109	Oom Paul\WRP	Upland Waste Rock	General Grading	5,000	CY	$2	$10,000	$6,000	$0

Table 12.2-5 (Continued)
Summary of Estimated Costs for Canyon Creek

Source ID	Site Name	Waste Type	Description	Quantity	Unit	Unit Direct Capital Cost	Direct Capital Cost	Indirect Capital Cost	Net Present Value of O&M
Dump and Bank Stabilization (Continued)									
BUR109	Oom Paul\WRP	Upland Waste Rock	Upland Vegetation	1	AC	$5,000	$5,000	$3,000	$625
BUR114	West Star\WRP	Upland Waste Rock	Bioengineering Steambanks	300	LF	$40	$12,000	$7,200	$3,600
BUR114	West Star\WRP	Upland Waste Rock	General Grading	300	CY	$2	$600	$360	$0
BUR114	West Star\WRP	Upland Waste Rock	Upland Vegetation	1	AC	$5,000	$5,000	$3,000	$625
BUR124	Omaha\FP	Floodplain Sediments	Bioengineering Steambanks	1,770	LF	$40	$70,800	$42,480	$21,240
BUR124	Omaha\FP	Floodplain Sediments	General Grading	1,000	CY	$2	$2,000	$1,200	$0
BUR124	Omaha\FP	Floodplain Sediments	Upland Vegetation	0.6	AC	$5,000	$3,000	$1,800	$375
BUR128	Hecla Star	Upland Waste Rock	Bioengineering Steambanks	1,000	LF	$40	$40,000	$24,000	$12,000
BUR128	Hecla Star	Upland Waste Rock	General Grading	1,000	CY	$2	$2,000	$1,200	$0
BUR128	Hecla Star	Upland Waste Rock	Upland Vegetation	1	AC	$5,000	$5,000	$3,000	$625
BUR132	Gertie\WRP	Upland Waste Rock	Bioengineering Steambanks	300	LF	$40	$12,000	$7,200	$3,600
BUR132	Gertie\WRP	Upland Waste Rock	General Grading	8,000	CY	$2	$16,000	$9,600	$0
BUR144	Standard Mammoth\WRP	Upland Waste Rock	Bioengineering Steambanks	300	LF	$40	$12,000	$7,200	$3,600
BUR144	Standard Mammoth\WRP	Upland Waste Rock	General Grading	6,000	CY	$2	$12,000	$7,200	$0
BUR144	Standard Mammoth\WRP	Upland Waste Rock	Upland Vegetation	2.5	AC	$5,000	$12,500	$7,500	$1,563
BUR146	Gorge Gulch/FP	Floodplain Sediments	Bioengineering Steambanks	1,500	LF	$40	$60,000	$36,000	$18,000
BUR146	Gorge Gulch/FP	Floodplain Sediments	General Grading		CY	$2	$0	$0	$0
BUR146	Gorge Gulch/FP	Floodplain Sediments	Upland Vegetation	2	AC	$5,000	$10,000	$6,000	$1,250
WAL039	Strd Mammoth\FP	Floodplain Sediments	Bioengineering Steambanks	2,300	LF	$40	$92,000	$55,200	$27,600
WAL039	Strd Mammoth\FP	Floodplain Sediments	General Grading	1,000	CY	$2	$20,000	$12,000	$0
WAL039	Strd Mammoth\FP	Floodplain Sediments	Upland Vegetation	3	AC	$5,000	$15,000	$9,000	$1,875
								Capital	$ 1,160,000
								O&M	$ 140,000
								Total	$ 1,300,000

Table 12.2-5 (Continued)
Summary of Estimated Costs for Canyon Creek

Source ID	Site Name	Waste Type	Description	Quantity	Unit	Unit Direct Capital Cost	Direct Capital Cost	Indirect Capital Cost	Net Present Value of O&M
Treatment Pond									
	Canyon Creek Treatment Pond (60 cfs)		Reagent	6,411	TON	$600	$3,846,784	$2,308,071	$10,478,910
	Canyon Creek Treatment Pond (60 cfs)		Construction/Monitoring		LS	$5,511,929	$5,511,929	$3,307,157	$7,223,034
								Capital	$15,000,000
								O&M	$18,000,000
								Total	$33,000,000
						TOTAL CAPITAL COST			**$17,000,000**
						TOTAL O&M COST			**$18,000,000**
						TOTAL COST			**$35,000,000**

Table 12.2-6
Summary of Estimated Costs for South Fork

Source ID	Site Name	Waste Type	Description	Quantity	Unit	Unit Direct Capital Cost	Direct Capital Cost	Indirect Capital Cost	Net Present Value of O&M
South Fork Human Health									
WAL037	Hercles	Upland Tailings	Excavation	12,000	CY	$3	$32,400	$19,440	$0
WAL03	Hercles	Upland Tailings	Local Repository Above Flood Level	12,000	CY	$10	$116,400	$69,840	$26,190
KLE062	USBM Imp.	Floodplain Sediments	Sediment Excavation	26,000	CY	$10	$260,000	$156,000	$0
KLE062	USBM Imp	Floodplain Sediments	Regional Repository	26,000	CY	$16	$416,000	$249,600	$104,000
KLE034	Silver Dollar	Floodplain Waste Rock	Excavation	4,400	CY	$2.70	$11,880	$7,128	$0
KLE034	Silver Dollar	Floodplain Waste Rock	Low Permeability Cap	2.29	AC	$151,000	$345,790	$207,474	$43,224
								Capital	$ 1,900,000
								O&M	$ 170,000
								Total	$ 2,070,000
South Fork Hot Spot									
WAL004		Floodplain Sediments	Excavate Sediments	17,000	CY	$10.00	$170,000	$102,000	$0
WAL004		Floodplain Sediments	Regional Repository	17,000	CY	$16.00	$272,000	$163,200	$68,000
WAL004		Floodplain Sediments	Hauling	34,000	CY-MI	$0.89	$30,260	$18,156	$0
OSB120		Floodplain Sediments	Excavate Sediments	33,000	CY	$10.00	$330,000	$198,000	$0
OSB120		Floodplain Sediments	Regional Repository	33,000	CY	$16.00	$528,000	$316,800	$132,000
OSB120		Floodplain Sediments	Hauling	66,000	CY-MI	$0.89	$58,740	$35,244	$0
OSB065		Floodplain Sediments	Excavate Sediments	42,000	CY	$10.00	$420,000	$252,000	$0
OSB065		Floodplain Sediments	Regional Repository	42,000	CY	$16.00	$672,000	$403,200	$168,000
OSB065		Floodplain Sediments	Hauling	84,000	CY-MI	$0.89	$74,760	$44,856	$0
KLE049		Floodplain Sediments	Excavate Sediments	10,000	CY	$10.00	$100,000	$60,000	$0
KLE049		Floodplain Sediments	Regional Repository	10,000	CY	$16.00	$160,000	$96,000	$40,000
KLE049		Floodplain Sediments	Hauling	20,000	CY-MI	$0.89	$17,800	$10,680	$0
								Capital	$ 4,500,000
								O&M	$ 410,000
								Total	$ 4,910,000

Table 12.2-6 (Continued)
Summary of Estimated Costs for South Fork

Source ID	Site Name	Waste Type	Description	Quantity	Unit	Unit Direct Capital Cost	Direct Capital Cost	Indirect Capital Cost	Net Present Value of O&M
Upper South Fork Human Health									
MUL002	Golconda	Upland Tailings	Excavation	23,000	CY	$2.70	$62,100	$37,260	$0
MUL002	Golconda	Upland Tailings	Local Repository Above Flood Level	23,000	CY	$9.70	$223,100	$133,860	$50,198
MUL001	Golconda	Floodplain Waste Rock	Excavation	75,360	CY	$2.70	$203,472	$122,083	$0
MUL001	Golconda	Floodplain Waste Rock	Local Repository Above Flood Level	75,360	CY	$9.70	$730,992	$438,595	$164,473
MUL019	Morning No. 6	Floodplain Tailings	Excavation	85,000	CY	$2.70	$229,500	$137,700	$0
MUL019	Morning No. 6	Floodplain Tailings	Local Repository Above Flood Level	85,000	CY	$9.70	$824,500	$494,700	$185,513
MUL019	Morning No. 6	Floodplain Waste Rock	Excavation	67,260	CY	$2.70	$181,602	$108,961	$0
MUL019	Morning No. 6	Floodplain Waste Rock	Low Permeability Cap	17.65	AC	$151,000	$2,665,150	$1,599,090	$333,144
MUL019	Morning No. 6	Adit Drainage	Permeable Reactive Trench	33.5	CY	$440	$14,740	$8,844	$88,441
MUL019	Morning No. 6	Adit Drainage	Adit Drainage Collection	1	LS	$6,200	$6,200	$3,720	$1,085
MUL019	Morning No. 6	Buildings & Structures	Decon Millsite	1	LS	$100,000	$100,000	$60,000	$5,000
MUL131	National Mill	Upland Tailings	Excavation	6,600	CY	$2.70	$17,820	$10,692	$0
MUL131	National Mill	Upland Tailings	Local Repository Above Flood Level	6,600	CY	$9.70	$64,020	$38,412	$14,405
MUL132	National Mill Adj. Tailings	Upland Tailings	Excavation	1,800	CY	$2.70	$4,860	$2,916	$0
MUL132	National Mill Adj. Tailings	Upland Tailings	Local Repository Above Flood Level	1,800	CY	$9.70	$17,460	$10,476	$3,929
								Capital	$ 8,600,000
								O&M	$ 850,000
								Total	$ 9,450,000
						TOTAL O&M COST			**$1,400,000**
						TOTAL CAPITAL COST			**$15,000,000**
						TOTAL COST			**$16,000,000**

Table 12.2-7
Summary of Estimated Costs for Lead in Floodplains

Site Name	Waste Type	TCD	Description	Quantity	Unit	Unit Direct Capital Cost	Direct Capital Cost	Indirect Capital Cost	Net Present Value of O&M
Lane Marsh (south of UPRR)	Wetland Pond	C01	Excavation	48,000	CY	$2.70	$129,600	$77,760	$0
Lane Marsh (south of UPRR)	Wetland Pond	HAUL-1	Haul 10 miles one-way	48,000	CY	$8.90	$427,200	$256,320	$0
Lane Marsh (south of UPRR)	Wetland Pond	C08	Regional Repository	48,000	CY	$10.31	$494,880	$296,928	$98,976
Lane Marsh (south of UPRR)	Wetland Sediment	LB-06	Hydraulic Controls	3	EA	$57,200	$171,600	$102,960	$34,320
Lane Marsh (south of UPRR)	General	LB-07a	Construct New Levee	14,000	LF	$151	$2,114,000	$1,268,400	$422,800
Lane Marsh (south of UPRR)	Wetland Sediment	LB-08	Place Sand Cap	340,000	CY	$8.02	$2,726,800	$1,636,080	$545,360
Medicine Lake	Wetland Pond	C01	Excavation	32,000	CY	$2.70	$86,400	$51,840	$0
Medicine Lake	Wetland Pond	HAUL-1	Haul 10 miles one-way	32,000	CY	$8.90	$284,800	$170,880	$0
Medicine Lake	Wetland Pond	C08	Regional Repository	32,000	CY	$10.31	$329,920	$197,952	$65,984
Medicine Lake	Wetland Sediment	LB-06	Hydraulic Controls	3	EA	$57,200	$171,600	$102,960	$34,320
Medicine Lake	General	LB-07a	Construct New Levee	9,000	LF	$151	$1,359,000	$815,400	$271,800
Medicine Lake	Wetland Sediment	LB-08	Place Sand Cap	320,000	CY	$8.02	$2,566,400	$1,539,840	$513,280
Medicine Lake	Lake Sediment	LB-04b	Dredge and Pipeline	110,000	CY	$7.59	$834,900	$500,940	$0
Medicine Lake	Lake Sediment	C08	Regional Repository	110,000	CY	$10.31	$1,134,100	$680,460	$226,820
Cave Lake	Wetland Pond	C01	Excavation	32,000	CY	$2.70	$86,400	$51,840	$0
Cave Lake	Wetland Pond	HAUL-1	Haul 10 miles one-way	32,000	CY	$8.90	$284,800	$170,880	$0
Cave Lake	Wetland Pond	C08	Regional Repository	32,000	CY	$10.31	$329,920	$197,952	$65,984
Cave Lake	Wetland Sediment	LB-06	Hydraulic Controls	3	EA	$57,200	$171,600	$102,960	$34,320
Cave Lake	General	LB-07a	Construct New Levee	14,000	LF	$151	$2,114,000	$1,268,400	$422,800
Cave Lake	Wetland Sediment	LB-08	Place Sand Cap	310,000	CY	$8.02	$2,486,200	$1,491,720	$497,240
Cave Lake	Lake Sediment	LB-04b	Dredge and Pipeline	180,000	CY	$7.59	$1,366,200	$819,20	$0
Cave Lake	Lake Sediment	C08	Regional Repository	180,000	CY	$10.31	$1,855,800	$1,113,480	$371,160
Bare Marsh	Wetland Pond	C01	Excavation	32,000	CY	$2.70	$86,400	$51,840	$0
Bare Marsh	Wetland Pond	HAUL-1	Haul 10 miles one-way	32,000	CY	$8.90	$284,800	$170,880	$0
Bare Marsh	Wetland Pond	C08	Regional Repository	32,000	CY	$10.31	$329,920	$197,952	$65,984

Table 12.2-7 (Continued)
Summary of Estimated Costs for Lead in Floodplains

Site Name	Waste Type	TCD	Description	Quantity	Unit	Unit Direct Capital Cost	Direct Capital Cost	Indirect Capital Cost	Net Present Value of O&M
Bare Marsh	Wetland Sediment	LB-06	Hydraulic Controls	3	EA	$57,200	$171,600	$102,960	$34,320
Bare Marsh	General	LB-07a	Construct New Levee	8,000	LF	$151	$1,208,000	$724,800	$241,600
Bare Marsh	Wetland Sediment	LB-08	Place Sand Cap	270,000	CY	$8.02	$2,165,400	$1,299,240	$433,080
Thompson Lake	Wetland Pond	C01	Excavation	48,000	CY	$2.70	$129,600	$77,760	$0
Thompson Lake	Wetland Pond	HAUL-1	Haul 10 miles one-way	48,000	CY	$8.90	$427,200	$256,320	$0
Thompson Lake	Wetland Pond	C08	Regional Repository	48,000	CY	$10.31	$494,880	$296,928	$98,976
Thompson Lake	Wetland Sediment	LB-06	Hydraulic Controls	3	EA	$57,200	$171,600	$102,960	$34,320
Thompson Lake	General	LB-07a	Construct New Levee	8,000	LF	$151	$1,208,000	$724,800	$241,600
Thompson Lake	Wetland Sediment	LB-08	Place Sand Cap	480,000	CY	$8.02	$3,849,600	$2,309,760	$769,920
Thompson Lake	Lake Sediment	LB-04b	Dredge and Pipeline	61,000	CY	$7.59	$462,990	$277,794	$0
Thompson Lake	Lake Sediment	C08	Regional Repository	61,000	CY	$10.31	$628,910	$377,346	$125,782
Thompson Marsh	Wetland Pond	C01	Excavation	16,000	CY	$2.70	$43,200	$25,920	$0
Thompson Marsh	Wetland Pond	HAUL-1	Haul 10 miles one-way	16,000	CY	$8.90	$142,400	$85,440	$0
Thompson Marsh	Wetland Pond	C08	Regional Repository	16,000	CY	$10.31	$164,960	$98,976	$32,992
Thompson Marsh	Wetland Sediment	LB-06	Hydraulic Controls	3	EA	$57,200	$171,600	$102,960	$34,320
Thompson Marsh	General	LB-07a	Construct New Levee	11,000	LF	$151	$1,661,000	$996,600	$332,200
Thompson Marsh	Wetland Sediment	LB-08	Place Sand Cap	95,000	CY	$8.02	$761,900	$457,140	$152,380
Thompson Marsh	Lake Sediment	LB-04b	Dredge and Pipeline	29,000	CY	$7.59	$220,110	$132,066	$0
Thompson Marsh	Lake Sediment	C08	Regional Repository	29,000	CY	$10.31	$298,990	$179,394	$59,798
Anderson Lake	Wetland Pond	C01	Excavation	16,000	CY	$2.70	$43,200	$25,920	$0
Anderson Lake	Wetland Pond	HAUL-1	Haul 10 miles one-way	16,000	CY	$8.90	$142,400	$85,440	$0
Anderson Lake	Wetland Pond	C08	Regional Repository	16,000	CY	$10.31	$164,960	$98,976	$32,992
Anderson Lake	Wetland Sediment	LB-06	Hydraulic Controls	3	EA	$57,200	$171,600	$102,960	$34,320
Anderson Lake	General	LB-07a	Construct New Levee	16,000	LF	$151	$2,416,000	$1,449,600	$483,200
Anderson Lake	Wetland Sediment	LB-08	Place Sand Cap	71,000	CY	$8.02	$569,420	$341,652	$113,884

Table 12.2-7 (Continued)
Summary of Estimated Costs for Lead in Floodplains

Site Name	Waste Type	TCD	Description	Quantity	Unit	Unit Direct Capital Cost	Direct Capital Cost	Indirect Capital Cost	Net Present Value of O&M
Anderson Lake	Lake Sediment	LB-04b	Dredge and Pipeline	120,000	CY	$7.59	$910,800	$546,480	$0
Anderson Lake	Lake Sediment	C08	Regional Repository	120,000	CY	$10.31	$1,237,200	$742,320	$247,440
Other (Ag-lands)	Wetland Sediment	N/A	Allowance for cleanup	6	LS	$1,000,000	$6,000,000	$0	$0
						TOTAL CAPITAL COST			**$74,000,000**
						TOTAL O&M COST			**$ 7,200,000**
						TOTAL COST			**$81,000,000**

Table 12.2-8
Summary of Estimated Costs for Particulate Lead in Surface Water

Source ID	Area	Waste Type	Description	Quantity	Unit	Unit Direct Capital Cost	Direct Capital Cost	Indirect Capital Cost	Net Present Value of O&M
BNKWDG	Lower Coeur d'Alene River	Bank Wedge	Excavate CDR Banks	405,681	CY	$4.92	$1,995,951	$1,197,570	$0
BNKWDG	Lower Coeur d'Alene River	Bank Wedge	Haul 10 miles one-way	405,681	CY	$8.90	$3,610,561	$2,166,337	$0
BNKWDG	Lower Coeur d'Alene River	Bank Wedge	Regional Repository	405,681	CY	$10.36	$4,202,855	$2,521,713	$840,571
BNKWDG	Lower Coeur d'Alene River	Bank Wedge	Vegetative Bank Stabilization	89,383	LF	$36.00	$3,217,788	$1,930,673	$643,558
BNKWDG	Lower Coeur d'Alene River	Bank Wedge	Bank Stabilization via Revetments	87,000	LF	$83.00	$7,221,000	$4,332,600	$1,444,200
BNKWDG	Lower Coeur d'Alene River	Bank Wedge	Floodplain/Riparian Replanting	5,362,980	SF	$0.39	$2,091,562	$1,254,937	$418,312
								Capital	$36,000,000
								O&M	$ 3,300,000
								Total	$39,300,000
Splay Areas									
FPSED	Lower Coeur d'Alene River	Floodplain Sediments	Sediment Trap	4	EA	$270,020	$1,080,080	$648,048	$0
FPSED	Lower Coeur d'Alene River	Floodplain Sediments	Dredge & Pipeline	100,000	CY	$7.59	$759,000	$455,400	$0
FPSED	Lower Coeur d'Alene River	Floodplain Sediments	Regional Repository	100,000	CY	$10.36	$1,036,000	$621,600	$207,200
								Capital	$ 4,600,000
								O&M	$ 210,000
								Total	$ 4,810,000
Dredging									
SED-BED	Lower Coeur d'Alene River near Dudley	Sediment Bed Load	Dredge & Pipeline	500,000	CY	$7.59	$3,795,000	$2,277,000	$0
SED-BED	Lower Coeur d'Alene River near Dudley	Sediment Bed Load	Regional Repository	500,000	CY	$10.36	$5,180,000	$3,108,000	$1,036,000
SED-BED	Lower Coeur d'Alene River near Dudley	Sediment Bed Load	Dredge & Pipeline	200,000	CY	$7.59	$1,082,334	$649,400	$0
SED-BED	Lower Coeur d'Alene River near Dudley	Sediment Bed Load	Regional Repository	200,000	CY	$10.36	$1,477,336	$886,402	$295,467
SED-BED	Lower Coeur d'Alene River near Dudley	Sediment Bed Load	Dredge & Pipeline	200,000	CY	$7.59	$771,599	$462,960	$0
SED-BED	Lower Coeur d'Alene River near Dudley	Sediment Bed Load	Regional Repository	200,000	CY	$10.36	$1,053,198	$631,919	$210,640
SED-BED	Lower Coeur d'Alene River near Dudley	Sediment Bed Load	Dredge & Pipeline	200,000	CY	$7.59	550,123	$330,074	$0
SED-BED	Lower Coeur d'Alene River near Dudley	Sediment Bed Load	Regional Repository	200,000	CY	$10.36	$750,893	$450,536	$150,179

Table 12.2-8 (Continued)
Summary of Estimated Costs for Particulate Lead in Surface Water

Source ID	Area	Waste Type	Description	Quantity	Unit	Unit Direct Capital Cost	Direct Capital Cost	Indirect Capital Cost	Net Present Value of O&M
Dredging (Continued)									
SED-BED	Lower Coeur d'Alene River near Dudley	Sediment Bed Load	Dredge & Pipeline	200,000	CY	$7.59	$392,251	$235,351	$0
SED-BED	Lower Coeur d'Alene River near Dudley	Sediment Bed Load	Regional Repository	200,000	CY	$10.36	$535,405	$321,243	$107,081
Note: 500,000 cy in year 0 and 200,000 cy in years 5, 10, 15, 20.								Capital	$25,000,000
								O&M	$ 1,800,000
								Total	$26,800,000
						TOTAL CAPITAL COST			**$66,000,000**
						TOTAL O&M COST			**$ 5,300,000**
						TOTAL COST			**$71,000,000**

Table 12.4-1
Summary of the Selected Remedy for the Spokane River

Area	Benchmark	Actions
Spokane River upstream of Upriver Dam	**Reduce human health and ecological exposures at selected shoreline sediment depositional areas.** Clean up sediment containing lead at concentrations greater than 700 mg/kg (sites with human health exposure). Clean up sediment resulting in unacceptable risks to ecological receptors (sites with ecological exposure). **Reduce concentrations of metals in surface water, moving toward achievement of AWQC** A reduction of dissolved metals loads of approximately 16% is estimated to result from implementation of the Selected Remedy. Additional load reductions would result from implementation of remedies in the Box. The estimated high flow reduction in particulate lead load needed is at least 50% to reduce year-round lead concentrations to below chronic AWQC in the Spokane River.	**Shoreline sites.** Use a combination of capping, removals, and performance monitoring. **Upriver Dam sediments.** Remediate contaminated sediments stored behind Upriver Dam and conduct performance monitoring. Remedial actions directed at surface water load reductions in the Basin to reduce metals transport. Key remedial actions expected to reduce metals entering the Spokane River include the implementation of a Coeur d'Alene Lake water quality protection program, lower Coeur d'Alene River bed and bank remediation, and South Fork of the Coeur d'Alene River groundwater remediation actions, particularly within the Box near Kellogg.
Estimated Total Present Worth Cost = $4,500,000 to $11,000,000		
Spokane River within reservation	**Reduce concentrations of metals in surface water, moving toward achievement of tribal water quality standards** **Quantify risks to tribal members practicing traditional subsistence lifestyles and to ecological receptors**	Remedial actions directed at surface water load reductions in the Basin to reduce metals transport (see Spokane River actions above). Perform Tribal-Specific Human Health Risk Assessment.
No remedial actions included within the reservation under the Selected Remedy		

Table 12.4-2
Summary of Estimated Cost Range for the Spokane River

Description	Unit	Quantity	Unit Cost	Direct Capital Cost	Indirect Capital Cost[a]	O&M Cost (30 Yr. Present Worth)	Total Cost
UPPER RANGE ESTIMATE							
Shoreline Sites							
Access restrictions (gates)	ea	2	$2,000	$4,000	$2,400	$2,000	$8,400
Granular cap	ac	3.5	$58,080	$203,280	$121,968	$30,492	$355,740
Excavate	cy	8,380	$2.70	$22,626	$13,576	$0	$36,202
Backfill	cy	8,380	$18.00	$150,840	$90,504	$0	$241,344
Consolidate/cap on site	ac	2.0	$28,575	$57,150	$34,290	$8,572	$100,013
Disposal (Subtitle D)	cy	1,980	$36.40	$72,072	$0	$0	$72,072
Haul to landfill	cy-mi	59,400	$0.63	$37,125	$22,275	$0	$59,400
Revegetation	ac	1	$41,000	$41,000	$24,600	$0	$65,600
Bank stabilization	lf	400	$36.41	$14,564	$8,738	$4,369	$27,672
Upriver Dam							
Granular sediment cap	ac	17.0	$82,280.00	$1,398,760	$839,256	$419,628	$2,657,644
Monitoring							
Beach monitoring	ls	1	$0	$0	$0	$420,000	$420,000
Surface water monitoring	ls	1	$0	$0	$0	$470,000	$470,000
TOTAL LOWER RANGE COST ESTIMATE[b]				**$2,000,000**	**$1,200,000**	**$1,400,000**	**$4,500,000**
LOWER RANGE ESTIMATE							
Shoreline Sites							
Excavate	cy	28,000	$2.70	$75,600	$45,360	$0	$120,960
Backfill	cy	28,000	$18.00	$504,000	$302,400	$0	$806,400
Disposal (Subtitle D)	cy	28,000	$36.40	$1,019,200	$0	$0	$1,019,200
Haul to landfill	cy-mi	840,000	$0.63	$525,000	$315,000	$0	$840,000
Revegetation	ac	2	$41,000	$82,000	$49,200	$0	$131,200

Table 12.4-2 (Continued)
Summary of Estimated Cost Range for the Spokane River

Description	Unit	Quantity	Unit Cost	Direct Capital Cost	Indirect Capital Cost[a]	O&M Cost (30 Yr. Present Worth)	Total Cost
Shoreline Sites (continued)							
Beach monitoring	ls	1	$0	$0	$0	$420,000	$420,000
Surface water monitoring	ls	1	$0	$0	$0	$470,000	$470,000
Upriver Dam							
Hydraulic dredge/pipeline/dewater	cy	82,000	$6.59	$540,380	$324,228	$0	$864,608
Disposal (Subtitle D)	cy	82,000	$36.40	$2,984,800	$0	$0	$2,984,800
Haul to landfill	cy-mi	2,460,000	$0.63	$1,537,500	$922,500	$0	$2,460,000
Monitoring	ls	1	$0.00	$0	$0	$400,000	$400,000
TOTAL UPPER RANGE COST ESTIMATE[b]				**$7,300,000**	**$2,000,000**	**$1,300,000**	**$11,000,000**

[a]Assumed at 60% of direct capital cost. No indirect costs assumed for disposal fee.
[b]Total costs rounded to two significant figures.

Notes:
ac - acre
cy - cubic yard
cy-mi - cubic yard-mile
lf - linear foot
ls - lump sum
O&M - operation and maintenance

13.0 STATUTORY DETERMINATIONS

This section describes how the Selected Remedy, which is an interim measure, satisfies the statutory requirements of CERCLA§121 (as required by NCP§300.430(f)(5)(ii)). This section also describes the five-year review requirements for the Selected Remedy. The following is an overview of the five statutory requirements.

- Protection of human health and the environment. This section describes how the Selected Remedy will adequately protect human health and the environment through treatment, engineering controls, and/or institutional controls (NCP§300.430(f)(5)(ii)(A)). Within its scope, the Selected Remedy protects human health and the environment from the exposure pathway or threat it is addressing and the waste material being managed.

- Compliance with ARARs specific to the Selected Remedy. This section describes the federal and state ARARs the Selected Remedy will attain. This section also describes the waiver invoked, if any, and the justification for invoking the waiver (NCP§§300.430(f)(5)(ii)(B) and (C)) for any ARARs the remedy will not attain. This section also describes other available information that does not constitute an ARAR (e.g., advisories, criteria, and guidance that are useful in selecting, designing, and implementing the remedy).

- Cost-effectiveness. This section describes how the Selected Remedy meets the Superfund program definition of a cost-effective remedy as one whose *"costs are proportional to its overall effectiveness"* (NCP§300.430(f)(1)(ii)(D)). The "overall effectiveness" of a remedy is determined by evaluating the following three of the five balancing criteria used in the detailed analysis of alternatives: 1) long-term effectiveness and permanence; 2) Reduction in toxicity, mobility, and volume through treatment; and 3) short-term effectiveness.

- Utilization of permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. This section describes the rationale for the remedy selected, explaining how the remedy provides the best balance of tradeoffs among the alternatives with respect to the balancing criteria set out in NCP§300.430(f)(1)(i)(B), such that it represents the maximum extent to which permanence and treatment can be practicably utilized at this site. The remedy selected is not designed or expected to be final, but represents the best balance of tradeoffs among alternatives with respect to pertinent criteria, given the limited scope of the action.

- Preference for treatment as a principal element. This section describes treatment components that support the statutory preference for treatment. The Selected Remedy satisfies the statutory preference because it contains treatment within its scope.

Within the scope of this remedial action, as is more specifically described in the remainder of this section, the Selected Remedy will: 1) provide an appropriate level of protectiveness of human health and the environment; 2) comply with federal and state requirements that are applicable or relevant and appropriate within its scope; 3) result in a cost-effective action; 4) utilize permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable; and 5) satisfy the statutory preference for treatment as a principal element of the remedy (i.e., reduce the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment).

The remedial actions selected in this ROD are not intended to fully address contamination within the Basin. Thus, achieving certain water quality standards developed under the Clean Water Act and the Safe Drinking Water Act, such as water quality standards and MCLs, are outside of the scope of the remedial action selected in this ROD and are not applicable or relevant and appropriate at this time.[29] Similarly, special status species protection requirements under the MTBA and ESA are only applicable or relevant and appropriate as they apply to the remedial actions included within the scope of the Selected Remedy. Although these requirements are not ARARs throughout the Basin for this Selected Remedy, the priority cleanup actions included in the remedy were selected to progress towards the compliance with surface water quality standards and special status species protection requirements.

At present, the risks to persons, including Spokane tribal members, and others who may practice a subsistence lifestyle in the Spokane River have not been quantified. EPA and the Spokane Tribe are cooperating in planning additional testing and studies that will be implemented to evaluate the potential exposures to subsistence users. The results of those tests and studies will determine appropriate future response actions to be taken, if any.

The Selected Remedy is designed to provide remedial actions toward meeting the statutory requirement of protectiveness of human health and the environment (see 40 CFR 300.430(a)(i)(B) and 40 CFR 300.430 (f)(l)(ii)(c)(l)). Accordingly, such a remedy, by its nature, need not be as protective as the final remedy is required to be under CERCLA. Hence, the Selected Remedy is sufficiently protective in the context of its scope, even though it does not, by itself, meet the statutory protectiveness standard that a final remedy would have to meet. In

[29] The state water quality standards and some federal water quality criteria are applicable or relevant and appropriate to point source discharges to surface water created as a result of implementation of the Selected Remedy. Similarly, maximum contaminant levels are relevant and appropriate at residences where an alternate drinking water supply is provided or drinking water is treated.

addition, because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, statutory reviews will be conducted at least every five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

13.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The Selected Remedy will adequately protect human health and the environment through treatment, engineering controls, and/or institutional controls (NCP§300.430(f)(5)(ii)(A)) within its scope, which includes:

- All of the remedy for protection of human health in the community and residential areas of the Upper Basin and Lower Basin, including identified recreational areas
- Approximately 30 years of prioritized actions for protection of the environment in the Upper Basin and Lower Basin
- All of the Spokane River human health remedy upstream of Upriver Dam and all of the environmental remedy from the Idaho/Washington border to Upriver Dam

13.1.1 Protection of Human Health in the Community and Residential Areas of the Upper Basin and the Lower Basin

The Selected Remedy will be protective of human health. The Selected Remedy will reduce exposure to lead in soil and house dust using a combination of vegetative barriers for soil lead concentrations between 700 mg/kg and 1,000 mg/kg and partial excavation and disposal for soil lead concentrations greater than 1,000 mg/kg such that there is a 5 percent or less probability of a typical child having a blood lead level of greater than 10 µg/dL and a 1 percent or less probability of a typical child having a blood lead level of greater than 15 µg/dL. Actions to reduce exposure to arsenic in soil, which is often co-located with lead, will result in a lifetime RME excess cancer risk for a residential exposure scenario within EPA's target range of to 10^{-6} to 10^{-4}.

The Selected Remedy will achieve compliance with drinking water standards established for protection of human health through a combination of hookups to public water supply systems, installation of new wells in uncontaminated aquifers, and point-of-use treatment. The Selected Remedy does not address potential future use of groundwater as a drinking water supply.

The Selected Remedy will reduce human exposure to lead and other metals in fish and other aquatic food sources. The degree of reduction achieved will depend on the extent individuals voluntarily reduce their consumption of affected food sources. In the long term, protection would be achieved through reductions in the levels of metals in whole fish and other aquatic food sources that would occur through implementation of the ecological cleanup actions over time.

The Selected Remedy for protection of human health in community and residential areas is not expected to fully protect traditional or modern subsistence lifestyles. In the long term, protection for subsistence lifestyles would be achieved through reductions in the levels of metals in surface water, sediment, and aquatic food sources that would occur through implementation of the ecological cleanup actions.

The Selected Remedy will not pose unacceptable short-term risks or cross-media impacts. There is some short-term risk to the community associated with materials hauling; however, these risks are acceptable in relation to the overall long and short-term risk reduction that would result from implementation of the remedy. No significant cross-media impacts are anticipated.

Certain potential exposures outside of the community and residential areas of the Upper Basin and Lower Basin are not addressed by this ROD, and will continue to present risks of human exposure to hazardous substances. These potential exposures impacting human health include:

- Recreational use at areas in the Upper Basin and Lower Basin where cleanup actions are not implemented pursuant to this ROD
- Subsistence lifestyles, such as those traditional to the Coeur d'Alene and Spokane Tribes
- Potential future use of groundwater that is presently contaminated with metals

13.1.2 Protection of the Environment in the Upper Basin and Lower Basin

Within its scope, the Selected Remedy protects human health and the environment in the Upper Basin and Lower Basin from the exposure pathway or threat it is addressing and the waste material being managed.

The Selected Remedy for protection of the environment in the Upper Basin and Lower Basin will result in substantial reductions of exposures of humans and ecological receptors to metals in the areas the Selected Remedy addresses; however, full protection of human health and the environment would not be achieved by the Selected Remedy. The anticipated benefits of the Selected Remedy are listed below.

Risks to aquatic receptors will be reduced through surface and adit water treatment and engineering controls (removal and containment) to reduce metals loads and concentrations. A reduction of about 580 pounds per day of dissolved zinc from the Upper Basin and Lower Basin is anticipated. The dissolved metals reductions, combined with measures to clean up the effects of mining practices on riverine and riparian areas, are expected to result in an overall improvement in the fishery. Reaches that support adult fisheries will be connected with reaches capable of supporting spawning and rearing through migratory corridors to allow increased movement between the tributaries and the river. This would include re-establishment of fisheries in Ninemile Creek, improvements of spawning and rearing fisheries in Pine Creek, and improvements in the fisheries and water quality in the South Fork and Lower Basin.
Risks to waterfowl and other plants and animals in the Lower Basin floodplains would be reduced through sediment removals and capping in wetland and lake feeding areas. Approximately 2,669 acres of wetland feeding area and 1,859 acres of lake feeding area with sediment containing lead at concentrations exceeding 530 mg/kg, the LOAEL for waterfowl, would be cleaned up.[30] The potential for recontamination of these areas during future flood events would be limited through use of hydraulic controls, stabilization of contaminated sediment sources in the Upper Basin, stabilization of 33 miles of contaminated river banks in the Lower Basin, and limited removals of contaminated bed sediments from the lower Coeur d'Alene River.

Risks to riparian and riverine receptors would be reduced through cleanup of 33 miles of contaminated river bank and adjacent riparian zone in the Lower Basin and cleanup of the riverine and riparian zone in Upper Basin areas where cleanup is conducted.

Risks to recreational and subsistence users would be reduced through cleanup of contaminated metals at 33 miles of river bank in the Lower Basin and at recreational use areas of Lane Marsh, Medicine Lake, Cave Lake, Bare Marsh, Thompson Lake, Thompson Marsh, and Anderson Lake.

The risk of recontamination of Lower Basin floodplain areas and Spokane River shoreline areas would be reduced through removal and containment of many of the waste piles that are sediment sources, through bioengineering of unstable stream and bank sediments in the Upper Basin, through stabilization of 33 miles of erodable river bank in the Lower Basin, and through removal of 1.3 million cubic yards of contaminated bed sediments from the lower Coeur d'Alene River.

---

[30] The acres of lake area shown are the entire areas of the lakes. To develop estimated costs, it is anticipated contaminated sediments will be cleaned up to a water depth of six feet (an average of approximately 25% of the total lake area). These water depths represent the highest use feeding areas and, consequently, the areas of greatest exposure to waterfowl and other animals.

The Selected Remedy will not pose unacceptable short-term risks or cross-media impacts. Where the potential exists for unacceptable short-term risks or cross-media impacts, it will be mitigated using engineering controls. Actions included in the Selected Remedy are generally focused on unpopulated areas and use remedial actions that employ limited waste hauling, thereby minimizing the associated short-term risks to the community. Cross-media impacts would be limited to potential short-term increases in sediment levels in surface water resulting from soil or sediment removal actions conducted in or adjacent to streams or lakes. These sediment removals would be conducted in accordance with Clean Water Act requirements. These risks are acceptable in relation to the overall long and short-term risk reduction that would result from implementation of the remedy. The work will be sequenced to ensure that current land uses (e.g., recreational) will be available throughout the period of cleanup.

13.1.3 Spokane River

The Selected Remedy for the Spokane River will protect human health upstream of Upriver Dam and the environment from the Idaho/Washington border to Upriver Dam by reducing exposures to metals, principally lead, arsenic, and zinc, at shoreline sites used for recreation by humans and feeding by wildlife. The Selected Remedy will reduce exposure to lead at shoreline sites with lead concentrations exceeding 700 mg/kg using a combination of removals and capping such that there is a 5 percent or smaller probability of a typical child having a blood lead level exceeding 10 µg/dL and a 1 percent or smaller probability of a typical child having a blood lead level exceeding 15 µg/dL. These same actions would reduce the exposure to arsenic, which is co-located with lead.

The Selected Remedy for the Spokane River will reduce the exposure of waterfowl and other wildlife to sediment contaminated with lead and zinc through a combination of sediment removals and capping in critical habitat areas identified by the Washington Department of Ecology.

The Selected Remedy for the Spokane River will not pose unacceptable short-term risks or cross-media impacts. There is a marginal short-term risk to the community associated with materials hauling. Cross-media impacts would be limited to potential short-term increases in sediment levels in surface water resulting from soil or sediment removal actions conducted in or adjacent to the river. These sediment removals would be conducted in accordance with Clean Water Act requirements. These risks are acceptable in relation to the overall long and short-term risk reduction that would result from implementation of the remedy.

The long-term protectiveness of the remedy will be strongly influenced by remedial activities conducted in the Upper Basin and Lower Basin. These areas are the sources of the metals-impacted sediments that have been deposited within the Spokane River floodway in the past and are potential future sources of recontamination. These areas are also the primary sources of metals in surface water in the Spokane River. Water quality standards for zinc are currently exceeded, and standards for lead are periodically exceeded. These conditions are expected to continue in the future unless sources in the Upper Basin and Lower Basin are remediated.

13.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The Selected Remedy will comply with those federal, state, and tribal requirements that are applicable or relevant and appropriate to the scope of the response action. Background information on these ARARs can be found in Parts 2 and 3 of the Final FS Report. No ARARs waivers are being invoked at this time.

ARARs for the remedy are discussed below under these categories:

- Waste Management and Repository Design
- Air Quality
- Surface Water Quality
- Drinking Water Quality
- Native American Concerns and Cultural Resources Protection
- Special Status Species
- Sensitive Environments
- Other Requirements

Guidance and other nonpromulgated materials to be considered (TBC) are described in the last subsection.

Waste Management and Repository Design

Idaho Solid Waste Management Rules regulations, IDAPA 58.01.05. Idaho regulations define the siting, design, operational, and closure requirements for solid waste management facilities. “Tier II” and “Tier III” facilities include landfills for non-municipal solid wastes, with Tier III facilities generally for management of solid wastes where leachate or gas may be formed. These regulations explicitly do not apply to “waste dumps, . . . tailings and other materials uniquely associated with mineral extraction, beneficiation or processing operation” and thus are not applicable. However, Tier II non-municipal solid waste landfill requirements are relevant and appropriate to the design, operation, and closure of mine waste repositories in the upper and lower Coeur d’Alene Basin. Sections of Tier III non-municipal solid waste landfill requirements may be relevant and appropriate to the design, operation, and closure of some repositories, including repositories that contain principal threat materials (e.g., metal concentrates). The particular provisions of these regulations that are relevant and appropriate for discrete remedial actions will be identified through the remedial design process.

RCRA Subtitle C: Hazardous Waste Management, IDAPA 58.01.05. Pursuant to the RCRA Bevill Amendment, 42 USC§6921(b)(3)(A), solid wastes from the extraction, beneficiation, and some processing of ores and minerals are excluded from the RCRA Subtitle C requirements for managing hazardous wastes. In the Coeur d'Alene Basin, such excluded wastes include waste rock, mill tailings, and metal concentrates. However, elements of Subtitle C may be relevant and appropriate to ensure the safe management of some solid wastes, including principal threat materials (e.g., metal concentrates). RCRA Subtitle C elements that may be relevant and appropriate may include, for example, selected portions of the requirements for design and operation of a hazardous waste landfill, 40 CFR Part 264, Subpart N, IDAPA 58.01.05.009, and selected portions of the requirements for landfill closure and post-closure, 40 CFR Part 264, Subpart G, IDAPA 58.01.06.012-.013. For the management of RCRA hazardous wastes that are not Bevill-exempt, applicability of Subtitle C provisions depend on whether the wastes are managed within the Area of Contamination (AOC). 55 FR 8760 (Mar. 8, 1990). Applicable requirements of RCRA Subtitle C (or the state equivalent) may be satisfied by off-site disposal, consistent with the Off-Site Disposal Rule, 40 CFR 300.440. RCRA Subtitle C also provides treatment standards for debris contaminated with hazardous waste ("hazardous debris"), 40 CFR 268.45, IDAPA 58.01.05.011, although the lead agency may determine that such debris is no longer hazardous, consistent with 40 CFR 261.3(f)(2), IDAPA 52.01.05. These requirements will be applicable for debris contaminated with hazardous waste that will be managed outside the AOC. The particular provisions of Subtitle C that are applicable or relevant and appropriate for discrete remedial actions will be identified through the remedial design process.

RCRA Subtitle D: Criteria for Classification of Solid Waste Disposal Facilities and Practices, 40 CFR Part 257, Subpart A. These regulations are applicable for management and disposal of material generated by cleanup activity pursuant to the Selected Remedy in this ROD. Written for non-municipal non-hazardous waste disposal units, the regulations require that facilities in floodplains not restrict the flow of the base flood, nor reduce the temporary water storage capacity of the floodplain, nor result in washout of solid waste; and not cause or contribute to the taking of any endangered or threatened species. Facilities must not cause a discharge of pollutants into waters of the U.S. that violates the requirements of the National Pollutant Discharge Elimination System and must not contaminate an underground drinking water source beyond the solid waste boundary.

Idaho Land Remediation Rules, IDAPA 58.01.18.027. The Idaho Land Remediation Rules are only applicable to persons who wish to enter voluntary remediation agreements with the State of Idaho. However, EPA has concluded that the Institutional Controls provisions of these regulations are relevant and appropriate for managing waste in locations within the Basin where metals concentrations remain above risk or regulatory levels after remediation. These provisions describe a range of institutional controls, including legal use restrictions, that may be available in certain situations.

Idaho Exploration and Surface Mining regulations, IDAPA 20.03.02. These regulations apply to "surface mining operations," as defined to mean the activities performed in an area where minerals are extracted from the ground. "Minerals" include clay, stone, sand, gravel, "and any other similar, solid material or substance of commercial value to be excavated from natural deposits on or in the earth." IDAPA 20.03.02.010. Substantive requirements of these regulations apply to borrow sources for soil, gravel, and similar clean materials for residential yards, landfill caps, and other areas requiring fill or barriers to underlying contamination. Provisions of IDAPA 20.03.02.140 are not mandatory, but may be relevant and appropriate to the placement and consolidation of contaminated material generated by cleanup activity pursuant to the Selected Remedy. Best management practices are listed for nonpoint source sediment control, clearing and grubbing, placement of topsoil conducive to the growth of vegetation, backfilling and grading, and erosion control.

Washington Hazardous Waste Management Act (Dangerous Waste) regulations, Ch. 173-303 WAC. These regulations are applicable to remedial actions in the State of Washington along the Spokane River. They provide requirements for the identification, accumulation, transport, treatment, and disposal of dangerous (including federally hazardous) wastes. (Note that the Bevill Exemption from RCRA Subtitle C requirements does not apply in the State of Washington.)

Washington Solid Waste Management Act regulations, Ch. 173-304 WAC. These regulations are applicable for the management and disposal of soils and sediments that are not State of Washington dangerous wastes and are excavated from Spokane River beaches within the State of Washington. They provide minimum functional standards for solid waste handling.

Air Quality

Clean Air Act regulations, *National Primary and Secondary Ambient Air Quality Standards (NAAQS)*, 40 CFR Part 50. These regulations are relevant and appropriate to soil removal operations which may generate fugitive emissions. NAAQS have been promulgated for fine and coarse particulates and for lead.

Idaho Rules for Control of Fugitive Dust, IDAPA 58.01.01.650-651. These regulations are applicable to soil removal operations which may generate fugitive emissions. They require that reasonable precautions be taken to prevent particulate matter from becoming airborne, including using water or chemicals to control dust, covering trucks for transporting materials, and promptly removing excavated materials.

Idaho Pollution Control regulations: Toxic Air Pollutants, IDAPA 58.01.01.585-586. These regulations provide screening emission levels and acceptable ambient concentrations (AAC) for designated noncarcinogens and for carcinogens including arsenic. If a remedial action under CERCLA causes an emission exceeding the ACC, Best Available Control Technology (BACT) must be applied until the emission level falls below the AAC. IDAPA 58.01.01.16. These regulations are applicable to elements of the Selected Remedy, such as soil removal, having the potential for creating excessive air emissions. Remedial actions will be carried out to minimize air emissions, and BACT will be applied if necessary to remain below acceptable ambient levels.

Washington Clean Air Act regulations, Ch. 173-400 WAC, Ch. 173-460 WAC. These regulations are relevant and appropriate to remedial activities that could generate fugitive dust containing metals. They require that discharges from treatment units must meet acceptable source impact levels (ASILs) at the property boundary. Generation of fugitive emissions is also regulated.

Surface Water Quality

Clean Water Act Storm Water Multi-Sector General Permit for Industrial Activities. 65 FR 64746-64880 and 40 CFR 122.26. These regulations provide that discharges of storm water associated with "industrial activities" require an NPDES permit. "Industrial activities" include inactive mining facilities, hazardous waste treatment units, and RCRA Subtitle D landfills. The substantive requirements of the Storm Water Multi-Sector General Permit for Industrial Activities (Oct. 30, 2000) apply to elements of the Selected Remedy that result in discharges of storm water, including constructing and operating mine waste repositories. Best management practices (BMPs) must be used, and appropriate monitoring performed, to ensure that storm water runoff does not exceed state water quality standards. It is not an ARAR for seepage or mine drainage.

Clean Water Act Section 304—Federal Ambient Water Quality, 66 FR 18935-18936 (April 12, 2001). Section 304(a)(1) of the Clean Water Act requires EPA to develop, publish, and revise criteria for water quality accurately reflecting the latest scientific knowledge. CERCLA Section 121(d)(2)(B)(i) provides that, "In determining whether or not any water quality criteria under the Clean Water Act is relevant and appropriate under the circumstances of the release or threatened release, the President shall consider the designated or potential use of the surface or groundwater, the environmental media affected, the purposes for which such criteria were developed, and the latest information available." On April 12, 2001, EPA notified the public of revised Ambient Water Quality Aquatic Life Criteria for cadmium. These revised criteria are relevant and appropriate to point source discharges to surface water, where those point sources are established as part of the selected remedial action. These values are relevant and appropriate for the Selected Remedy because they represent the latest scientific knowledge, as determined by EPA's

Health and Ecological Criteria Division, Office of Science and Technology. They are also relevant and appropriate for the Selected Remedy because these criteria were developed to better protect aquatic organisms such as bull trout, a threatened species, that may be found within the Coeur d'Alene Basin. The Selected Remedy will satisfy this ARAR by ensuring that point source discharges established by the remedy do not cause exceedances of the Water Quality Criteria for cadmium in receiving surface waters.

Idaho Water Quality Standards and Wastewater Treatment Requirements, IDAPA 58.01.02. The Idaho water quality standards (WQS) that were submitted to EPA prior to May 30, 2000, and any changes adopted by Idaho and approved by EPA between May 30, 2000 and the date of this ROD are applicable to point source discharges to Idaho surface water, where those point sources are established as part of the selected remedial action. Except as noted above concerning federal AWQC for cadmium, WQS that have been adopted by Idaho but not yet submitted to or approved by EPA, and are more stringent than the standards submitted to EPA prior to May 30, 2000, if any, are relevant and appropriate to point source discharges to Idaho surface water, where those point sources are established as part of the selected remedial action. Idaho WQS for protection of human health and aquatic life incorporate the National Toxics Rule (40 CFR 131.36) by reference for waters designated for aquatic life, recreation, and domestic water supply (Section 210). Turbidity standards for protection of aquatic life (cold water biota) are also applicable (Section 250). Variances can be granted for individual pollutants if the standard is unattainable, based on the criteria in the rule (Section 260). Short-term exemptions allow exceedances of the water quality standards under certain circumstances that are identified in the regulation (e.g., dredge and fill activities) (Section 080). Where Idaho WQS are applicable or relevant and appropriate to the Selected Remedy, point source discharges established by the remedy, such as those from a water treatment plant, must not cause exceedances of WQS in the receiving water body.

Idaho Stream Channel Alteration regulations, IDAPA 37.03.07. These regulations are applicable to any alteration of stream channels. "Alteration" means to change the natural shape of a stream channel, including by removing or placing any material or structures with potential to affect the flow within the channel. The substantive requirements of these regulations are applicable to elements of the Selected Remedy, such as streambank stabilization, with potential to affect stream flows in the upper and lower basins. Substantive requirements include standards for placement of rock riprap and for construction of cofferdams and temporary stream crossings.

Clean Water Act, Section 404—Dredge or Fill Requirements, 33 USC§1344, 33 CFR Parts 320-330; 40 CFR Part 230. These requirements are applicable to work in or near navigable waters. They establish requirements that limit the discharge of dredged or fill material into navigable waters and associated wetlands. EPA guidelines for discharge of dredged or fill materials in 40 CFR Part 230 specify consideration of alternatives that have less adverse impacts and prohibit discharges that would result in exceedance of surface water quality standards, exceedance of toxic effluent standards, and jeopardy of threatened or endangered species. Special consideration is required for "special aquatic sites," which are defined to include wetlands.

Washington Water Quality Standards, Ch. WAC 173-201A. Washington's toxics standards for protection of aquatic life (Section 070), as submitted to EPA by May 30, 2000, and any changes adopted by Washington and approved by EPA between May 30, 2000 and the date of this ROD are applicable to point source discharges to surface water in Washington State (with the exception of tribal lands). These regulations are applicable to the Selected Remedy to the extent the Selected Remedy results in a point source discharge to surface water in Washington State. The Washington State regulations for human health protection incorporate the National Toxics Rule (40 CFR 131.36) by reference. The regulations also provide for short-term modifications of standards for specific water bodies during the performance of essential activities or to otherwise protect the public interest (Section 110). For example, the turbidity criteria established under Section 030 of the regulation can be modified to allow a temporary mixing zone during and immediately after in-water or shoreline construction activities that may result in the disturbance of in-situ sediments.

Washington Hydraulics Project Approval regulations, Ch. 220-110 WAC. Substantive requirements of these regulations are applicable to remedial actions along and within the Spokane River that could affect fish life. They provide actions required for riverbank protection, temporary culvert construction, and dredging, for example.

Drinking Water Quality

Idaho Drinking Water Regulations, IDAPA 58.01.08.050; *Safe Drinking Water Act, National Primary Drinking Water* regulations, 42 USC§300f, 40 CFR Part 141. These regulations are applicable to all public drinking water systems supplying residents of the Coeur d'Alene Basin and are relevant and appropriate to the provision of alternate water supplies, including the installation of new groundwater wells or treatment at the tap. The regulations require that contaminant concentrations in drinking water remain below MCLs and non-zero MCL goals (MCLGs). By final rule effective February 22, 2002, EPA lowered the MCL for arsenic from 0.05 mg/L to 0.01 mg/L (66 FR 7061). While community water systems have until January 2006 to comply with the new MCL for arsenic, EPA has determined that the new MCL is relevant and appropriate presently for ensuring that drinking water as provided by the Selected Remedy is protective of human health.

Native American Concerns and Cultural Resources Protection

Native American Graves Protection and Repatriation Act (NAGPRA), 25 USC§3001 et seq. 43 CFR Part 10. NAGPRA and implementing regulations are intended to protect Native American graves from desecration through the removal and trafficking of human remains and "cultural items" including funerary and sacred objects. To protect Native American burials and cultural items, the regulations require that if such items are inadvertently discovered during excavation, the excavation must cease and the affiliated tribes must be notified and consulted. This program is applicable to ground-disturbing activities such as soil grading and removal.

American Indian Religious Freedom Act, 42 USC§1996 et seq. This statute is applicable to soil excavation in areas of the Coeur d'Alene Basin. It protects religious, ceremonial, and burial sites and the free practice of religions by Native American groups. If sacred sites are discovered in the course of soil disturbances, work will be stopped and the Coeur d'Alene and/or Spokane Tribes will be contacted. The statute has no implementing regulations; following the NAGPRA process should meet with the intent of the law.

National Historic Preservation Act (NHPA), 16 USC§470f, 36 CFR Parts 60, 63, and 800. The NHPA and implementing regulations require agencies to consider the possible effects on historic sites or structures of actions proposed for federal funding or approval. Historic sites or structures are those included on or eligible for the National Register of Historic Places, generally older than 50 years. If an agency finds a potential adverse effect on historic sites or structures, such agency must evaluate alternatives to "avoid, minimize, or mitigate" the impact, in consultation with the State Historic Preservation Office (SHPO). The NHPA and implementing regulations are applicable to selected remedial activities such as mill building, demolition, and soil excavation which could disturb historical sites or structures. In consultation with the SHPO, unavoidable impacts on historic sites or structures may be mitigated through such means as taking photographs and collecting historical records.

Archaeological Resources Protection Act (ARPA), 16 USC§470aa et seq., 43 CFR Part 7. ARPA and implementing regulations prohibit the unauthorized disturbance of archaeological resources on public and Indian lands. Archaeological resources are "any material remains of past human life and activities which are of archaeological interest," including pottery, baskets, tools, and human skeletal remains. The unauthorized removal of archaeological resources from public or Indian lands is prohibited without a permit, and any archaeological investigations at a site must be conducted by a professional archaeologist. ARPA and implementing regulations are applicable for the conduct of any selected remedial actions that may result in ground disturbance.

Special Status Species

Endangered Species Act (ESA), 16 USC 1531 et seq., 50 CFR Parts 17, 402. The ESA and implementing regulations make it unlawful to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any federally-designated threatened or endangered species. The ESA and implementing regulations are applicable to activities of the Selected Remedy (for example, soil removal or repository construction) that could affect federally-designated threatened or endangered species that may be present within the Coeur d'Alene Basin. Such species may include bull trout, bald eagle, lynx, and gray wolf. Consistent with ESA Section 7, if any federally designated threatened or endangered species are identified in the vicinity of remediation work, EPA will consult with the U.S. Fish and Wildlife Service to ensure that remedial actions are conducted in a manner to avoid adverse habitat modification and jeopardy to the continued existence of such species.

Migratory Bird Treaty Act (MBTA), 16 USC 703 et seq. The MBTA makes it unlawful to “hunt, take, capture, kill” or take various other actions adversely affecting a broad range of migratory birds, including tundra swans, hawks, falcons, songbirds, without prior approval by the USFWS. (See 50 CFR 10.13 for the list of birds protected under the MBTA.) Under the MBTA, permits may be issued for take (e.g., for research) or killing of migratory birds (e.g., hunting licenses). The mortality of migratory birds due to ingestion of contaminated sediment is not a permitted take under the MBTA. The MBTA and its implementing regulations are relevant and appropriate for protecting migratory bird species identified within the Coeur d’Alene Basin. The Coeur d’Alene Basin is located within the Pacific migratory flyway and provides important habitat for migratory waterfowl. The selected remedies will be carried out in a manner that avoids the taking or killing of protected migratory bird species, including individual birds or their nests or eggs.

Idaho Classification and Protection of Wildlife regulations, IDAPA 13.01.06. These regulations are relevant and appropriate to remedial activities that could affect wildlife species protected by the State of Idaho, including species listed by state regulation as endangered, threatened, species of special concern, and protected nongame species.

Washington Game Code, Ch. WAC 232-12. These regulations are relevant and appropriate to beach cleanup activities and provide a list of state endangered, threatened, sensitive, and other protected species.

Sensitive Areas

Rivers and Harbors Act, Section 10 regulations, 33 CFR Parts 320 through 330. These regulations are applicable to activities in or near navigable waters. They prohibit unauthorized obstruction or alteration of navigable waters.

Protection of Wetlands, Executive Order 11990; 40 CFR 6.302(a); 40 CFR Part 6, Appendix A. This executive order and regulations apply to remedial activities in wetlands. They require federal agencies to avoid adversely impacting wetlands, minimize wetland destruction, and preserve the value of wetlands.

Protection of Floodplains, Executive Order 11988, 40 CFR 6.302(b) and Appendix A. This executive order and implementing regulations are applicable to the remedial actions within the floodplain of the Coeur d'Alene River and its tributaries. Federal agencies are required to evaluate the potential effects of actions that take place in floodplains and to avoid adverse impacts.

Idaho Lakes Protection Act regulations, IDAPA 20.03.04. These regulations are applicable to remedial work within the beds or waters of navigable lakes of the State of Idaho. They require that the protection of property, navigation, fish and wildlife habitat, aquatic life, recreation, aesthetic beauty and water quality be given due consideration.

Washington Shoreline Management Act and regulations, Ch. 90.58 RCW; Ch.173-18, Ch. 173-22, and Ch.173-27 WAC. This program is applicable to activities within 200 feet of a shoreline of the State of Washington. Applicable activities should be conducted to protect the natural character of the streamway. Shoreline protection measures (such as riprap) should be located, designed, and constructed to avoid the need for channelization of a stream flow, consistent with substantive provisions of the regulations.

Other Requirements

Hazardous Materials Transportation Act regulations, 49 CFR Parts 171-180. These regulations apply to the movement of contaminated soils along public highways and require packaging, documentation, and placarding appropriate to the materials being transported.

Washington Model Toxics Control Act regulations, Ch. 173-340 WAC. These regulations are applicable to the remediation of beach sites between the State line and the Upriver dam. They set soil remediation levels for protection of human health and the environment.

To Be Considered (TBC)

Responsibilities of Federal Agencies to Protect Migratory Birds, Executive Order 13186 (66 FR 3853, Jan. 17, 2001). This executive order encourages federal agencies to integrate migratory bird conservation principles into agency plans and activities. Such efforts may include preventing or abating pollution for the benefit of migratory birds or restoring or designing migratory bird habitat. Substantive elements of this executive order are TBCs for the implementation of the selected remedial actions.

Centers for Disease Control and Prevention (CDC) Statement on Preventing Lead Poisoning in Young Children, 1991. This statement is a TBC providing an intervention level of 10 µg/dL blood lead concentration.

EPA Strategy for Reducing Lead Exposures, 1991. This strategy is a TBC for reducing the amount of lead introduced into the environment and for significantly reducing the blood lead level incidence above 10 µg/dL in children.

Revised Interim Lead Guidance for CERCLA Sites, EPA OSWER Directive 9355.4-12, 1994. This guidance is a TBC that recommends a 400 ppm lead screening level and describes how to develop site-specific remediation goals and a management strategy for lead contamination at sites with multiple lead sources. OSWER Directive 9200.4-27P was issued in 1998 to clarify the 1994 policy of OSWER Directive 9355.4-12.

Integrated Exposure Uptake Biokinetic Model (IEUBK) for Lead in Children, PB 93 9635121.7-15-2. This model was used to develop the 400 ppm lead screening level in OSWER Directive 9355.4-12.

Design and Construction of RCRA/CERCLA Final Covers, EPA/625/4-91/025, May 1991. This publication provides guidelines for the design and construction of these covers.
Guidelines for Mine Tailings Repositories Coeur d'Alene Basin Restoration Project, April 27, 1995. This TBC provides guidelines for location, design, construction, and management of a mine waste repository.

Best Management Practices for Soils Treatment Technologies (EPA OSWER, 1997). This TBC provides technologies for controlling cross-media transfer of contaminants during materials handling activities.

Mine and Mill Waste Remedial Guidelines and Best Management Practices (CDA Basin Restoration Project). Under this TBC, design and implementation of selected response actions should consider a number of factors and techniques for protecting water quality, fish, and wildlife habitat, while minimizing potential for human exposure.

Considering Wetlands at CERCLA Sites, EPA OSWER 9280.03, 1994. This guidance is a TBC that discusses the consideration of potential impacts of response actions on wetlands at CERCLA sites.

Idaho Non-Point Source Management Plan, 1999. This plan is a TBC for remedial activities that disturb soils and sediments. The plan requires activities to be consistent with the state's goal of restoration, maintenance, and protection of the beneficial uses of both surface water and groundwater. Long-term goals include design and implementation of BMPs for surface water and groundwater.

13.3 COST-EFFECTIVENESS

In EPA's judgment, the Selected Remedy is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." (NCP §300.430(f)(1)(ii)(D)). This was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). Overall effectiveness was then compared to costs to determine cost-effectiveness. The overall effectiveness of this remedy was determined to be proportional to its costs and hence the remedy is cost-effective.

To the extent that the costs of the alternatives that comprise the Selected Remedy exceed the costs of other alternatives, the additional cost is proportional to the additional benefits in long-term effectiveness and permanence, reduction in toxicity, mobility, and volume through treatment, and short-term effectiveness.

Long-Term Effectiveness and Permanence. Within its limited scope, the Selected Remedy will achieve overall effectiveness with respect to long-term effectiveness and permanence. The Selected Remedy for protection of human health in the community and residential areas of the Upper Basin and Lower Basin will achieve long-term effectiveness and permanence by reducing residual risks resulting from exposure to lead in soil, house dust, drinking water, and aquatic food sources to acceptable levels. An institutional controls program and follow-up health services would be used to maintain remedy effectiveness over time.

The Selected Remedy for protection of the environment will achieve substantial reductions in residual risks to aquatic receptors resulting from metals in surface water and to waterfowl and other animals resulting from metals in wetland and lateral lake sediments. Overall, the Selected Remedy would be expected to achieve about 50 to 70 percent of the dissolved metals load reduction in the Upper Basin that would be anticipated from full implementation of Ecological Alternative 3 for about 19 percent of the estimated cost of Ecological Alternative 3. The long-term effectiveness and permanence would be enhanced through measures to limit the release of contaminated sediments to surface water that could recontaminate remediated areas.

The Selected Remedy for the Spokane River upstream of the Spokane Indian Reservation will achieve overall effectiveness with respect to long-term effectiveness and permanence. A combination of removals and capping will result in low residual risks. Removals will be used at sites where maintaining the long-term integrity of capping would be difficult. The potential exists for some recontamination of sites from upstream sources. Recontamination would be addressed through monitoring and periodic maintenance.

Reduction in Toxicity, Mobility, or Volume Through Treatment. The Selected Remedy will achieve overall effectiveness with respect to reduction in toxicity, mobility, or volume through treatment. The Selected Remedy includes treatment to reduce the toxicity of drinking water and surface water and, should amendments to limit the bioavailability of metals prove feasible, treatment to reduce the toxicity of soil and sediment.

Short-Term Effectiveness. Within its limited scope, the Selected Remedy will achieve overall effectiveness with respect to short-term effectiveness. Implementation of the Selected Remedy for protection of human health in the community and residential areas of the Upper Basin and Lower Basin is a top priority, and the Selected Remedy will achieve human health RAOs within a relatively short time after completion of the remedial actions.

The Selected Remedy for protection of the environment will provide short-term effectiveness through prioritizing actions and focusing environmental emphasis on the more serious problems, including dissolved metals in rivers and streams, lead in floodplain soil and sediment, and particulate lead in surface water, while limiting adverse impacts on the communities and ecosystems. Examples of the problems the high priority actions will target include the most highly erodable banks, wetlands with high waterfowl mortality, highly contaminated river bed sediments in natural sediment deposition areas, and water with very high loads of dissolved metals in Canyon Creek, where source-by-source removal and containment actions would be costly and take a long time to implement. As construction is completed at individual sites, RAOs for those soils, sediments, and source materials addressed by the Selected Remedy would be achieved. Short-term impacts to the communities will be limited through generally focusing actions in unpopulated areas and through use of remedial actions that employ limited waste hauling.

The Selected Remedy for the Spokane River upstream of the Spokane Indian Reservation will achieve overall effectiveness with respect to short-term effectiveness. RAOs at shoreline and depositional areas would be achieved immediately after implementation of the remedy. Potential short-term impacts to the community from material hauling and to the ecosystem from release of contaminated sediments during construction will be limited.

13.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT (OR RESOURCE RECOVERY) TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

EPA has determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the site. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the Selected Remedy provides the best balance of tradeoffs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and bias against off-site disposal without treatment and considering State and community acceptance. EPA's balancing criteria in selecting a remedy include: 1) long-term effectiveness and permanence; 2) reduction of toxicity, mobility, or volume through treatment; 3) short-term effectiveness; 4) implementability; and 5) cost.

Engineering controls employed in the Selected Remedy, including removal and containment, are appropriate for metals-contaminated soil, sediments, and house dust because these materials can be reliably controlled in place. These engineering controls provide for long-term effectiveness and permanence, achieve short-term effectiveness, and are implementable. As described in Section 13.3, the overall effectiveness of the Selected Remedy was determined to be proportional to its costs and hence the Selected Remedy is cost effective. As described in Section 13.5, the Selected Remedy achieves the statutory preference for treatment as a principal element.

Initially, surface water treatment in Canyon Creek provides a better balance of tradeoffs than more permanent removal and containment actions. Although surface water treatment would not result in ecological improvements within Canyon Creek, it provides a better balance of tradeoffs with respect to short-term effectiveness for the river system as a whole because:

- it can be implemented more rapidly than the comprehensive scope of removal and containment actions that would be required to achieve an equivalent metals load reduction
- it would result in fewer short-term impacts to the community from excavation, hauling, and repositories of contaminated materials
- it would result in fewer short-term impacts to the environment from release of contaminated sediment to surface water during construction

Surface-water treatment is also potentially much less costly than comprehensive removal and treatment actions and achieves a reduction of toxicity through treatment. Surface-water treatment will not result in achieving AWQC within Canyon Creek. Further characterization and source-by-source cleanup would be required to achieve this goal.

13.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (40 CFR 300.430(a)(1)(iii)(A)). EPA has also established an expectation for use of engineering controls, such as containment, for waste that poses a relatively low, long-term threat or where treatment is impracticable (40 CFR 300.430(a)(1)(iii)(B)). Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur. Engineering controls employed in the Selected Remedy, including removal and containment, are appropriate for metals-contaminated soil, sediments, and house dust because these materials can be reliably controlled in place.

Although the Selected Remedy is not intended to fully address the statutory mandate for permanence and treatment to the maximum extent practicable, the Selected Remedy does utilize treatment, and thus supports that statutory mandate. A comprehensive evaluation for preference for treatment will be conducted in subsequent decision documents. Treatment of surface water to reduce toxicity is included in the Selected Remedy for the Upper Basin, as described in Section 12.2. Treatment of drinking water at private wells is included in the Selected Remedy, as described in Section 12.1. Treatment using amendments to reduce the toxicity of soil and sediment will be evaluated as part of remedial design.

13.6 FIVE-YEAR REVIEW REQUIREMENTS

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, statutory reviews will be conducted at least every five years after initiation of remedial action to ensure that the Selected Remedy is, or will be, protective of human health and the environment.

14.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The Selected Remedy contains limited significant changes from the Preferred Alternative identified in the Proposed Plan.

- The fisheries benchmark for the reach of Ninemile Creek identified as "mainstem from East Fork confluence to 0.75 mile downstream of Blackcloud Creek" has been changed from a Tier 2 fishery to a Tier 1 fishery. No changes were made to the cleanup actions included in the Selected Remedy for Ninemile Creek.

- Cleanup of the Nabob Mine site in the East Fork of Pine Creek watershed has been added to the Selected Remedy.

- The Coeur d'Alene Millsite has been cleaned up and has been deleted from the Selected Remedy.

- The estimate of dissolved zinc load reduction in the Coeur d'Alene River at Harrison has been revised from 660 pounds per day to 580 pounds per day, based primarily on revisions to the projected effectiveness of passive treatment in Canyon Creek.

- State legislation under the Basin Environmental Improvement Act established the process for the formation of the Basin Environmental Improvement Project Commission. This commission includes federal, state, tribal, and local governmental involvement. EPA anticipates working as a member of the commission for implementation of the ROD and development of priorities and sequencing of cleanup activities.

It is EPA's intent to increase the removal of riverbed sediments in the Dudley reach of the Coeur d'Alene River from 1.3 million cubic yards to up to 2.6 million cubic yards if the pilot removal project is demonstrated to be compliant with ARARs and cost-effective. This would increase the sediment removal from 6 percent of contaminated riverbed sediments to approximately 12 percent of the total contaminated sediments. The increased volume is intended to further reduce downstream particulate lead movement during high flow events. This change will make additional progress toward reducing potential recontamination and compliance with ARARs in the Spokane River in the State of Washington. Based on current unit cost estimates, the cost of this additional riverbed sediment removal is estimated at $26 million. This change is reflected in Table 12.2-1, but the description of the Selected Remedy in the remaining sections of the ROD has not been changed.

15.0 REFERENCES

Annest, J.L., J.L. Pirkle, D. Makuc, J.W. Neese, D.D. Bayse, and M.G. Kovar. 1983. “Chronological Trend in Blood Lead Levels Between 1976 and 1980.” *New England Journal of Medicine* 308:1373-7.

Barton, G.J. 2000. *Dissolved Cadmium, Zinc, and Lead Loads from Ground-Water Seepage in the South Fork Coeur d’Alene River System*. Provisional U.S. Geological Survey Water-Resources Investigations Report.

Berkovitch, M., D. Matsui, S.H. Lamm, F. Rosa, and G. Koren. 1994. “Recent Increases in Numbers and Risk of Fatalities in Young Children Ingesting Iron Preparations.” *Veterinary and Human Toxicology* 36. February 1994.

Beyer, W.N., D.J. Audet, G.H. Heinz, D.J. Hoffman, and D. Ray. 2000. “Relation of Waterfowl Poisoning to Sediment Lead Concentrations in the Coeur d’Alene River Basin.” *Ecotoxicology* 9:207-218.

Bookstrom, A.A., S.E. Box, J.K. Campbell, K.I. Foster, and B.L. Jackson. 2001. *Lead-Rich Sediments, Coeur d’Alene River Valley, Idaho: Area, Volume, Tonnage, and Lead Content*. U. S. Geological Survey Open-File Report 01-140.

Bornschein, R., P. Succop, K. Deitrich, C. Clark, S. Que Hee, and P. Hammond. 1985. “The Influence of Social and Environmental Factors on Dust Lead, Hand Lead, and Blood Lead Levels in Young Children.” *Environmental Research* 38:108-118.

Brody, D., J.L. Pirkle, R.A. Kramer, K.M. Flegal, T.D. Matte, E.W. Gunter, and D.C. Paschal. 1994. “Blood Lead Levels in the U.S. Population.” Phase 1 of the Third National Health and Nutrition Examination Survey (NHANES III, 1988 to 1991). *Journal of the American Medical Association* 272(4).

Brown, G.E., Jr., A.L. Foster, J.D. Ostergren. 1999. “Mineral Surfaces and Bioavailability of Heavy Metals: a Molecular-Scale Perspective.” *Proceedings of the National Academy of Sciences, USA* 96:3388-95.

Buchman, M.F. 1999. *NOAA Screening Quick Reference Tables*. NOAA HAZMAT Report 99-1. Coastal Protection and Restoration Division, National Oceanic and Atmospheric Administration. Seattle, Washington.

Bureau of Land Management (BLM). 1999. GIS Coverage of Sources in the Coeur d’Alene River Basin.

Casteel, S.W., L.D. Brown, M.E. Dunsmore, C.P. Weis, G.M. Henningsen, E. Hoffman, W.J. Brattin , and T.L. Hammon. 1996a. *Bioavailability of Lead in Slag and Soil Samples from the Murray Smelter Superfund Site*. Prepared for USEPA Region 8. Denver, CO.

———. 1996b. *Bioavailability of Lead in Soil Samples from the New Jersey Zinc NPL Site Palmerton, Pennsylvania*. Prepared for USEPA Region 8. Denver, CO. 04800-030-0178.

Casteel, S.W., L.D. Brown, M.E. Dunsmore, C.P. Weis, G.M. Henningsen, E. Hoffman, W.J. Brattin, and T.L. Hammon. 1998. *Bioavailability of lead in soil and mine waste from the California Gulch NPL Site Leadville, Colorado*. Prepared for USEPA, Region 8. Denver, CO. 04800-030-0178.

Casteel, S.W., R.P. Cowart, C.P. Weis, G.M. Henningsen, E. Hoffman, W.J. Brattin, R.E. Guzman, M.F. Starost, J.T. Payne, S.L. Stockham, S.V.Becker, J.W. Drexler, and J.R. Turk. 1997a. "Bioavailability of Lead to Juvenile Swine Dosed with Soil from the Smuggler Mountain NPL Site of Aspen, Colorado." *Fundamental Applied Toxicology*. 36:177-87.

Casteel, S.W., R. Guzman, M.F. Starost, C.P. Weis, G.M. Henningsen, E. Hoffman, W.J. Brattin, and T.L. Hammon. 1997b. *Bioavailability of Lead in Soil Samples from the Kennecott NPL Site Salt Lake City, Utah*. Prepared for USEPA Region 8. Denver, CO.

Casteel, S.W., C.P. Weis, G.M. Henningsen, E. Hoffman, W.J. Brattin, and T.L. Hammon. 1996d. *Bioavailability of lead in soil samples from the Smuggler Mountain NPL Site Aspen, Colorado*. Prepared for USEPA Region 8. Denver, CO.

Casteel, S.W., C.P. Weis, G.M. Henningsen, E. Hoffman, W.J. Brattin, and T.L. Hammon. 1996c. *Bioavailability of Lead in Soil Samples from the Jasper County, Missouri Superfund Site.* Prepared for USEPA Region 8. Denver, CO.

Casteel, S.W., C.P. Weis, B. Lavelle, W.J. Brattin, and T.L. Hammon. *Relative Bioavailability of Lead in Soils from the VBI70 Site. Final Report*. 2001. Prepared by Syracuse Research Corporation for USEPA Region 8. Denver CO.

Centers for Disease Control and Prevention. 2000. "Blood Lead Levels in Young Children--United States and Selected States, 1996-1999." *Morbidity and Mortality Weekly Review* 49:1133-37.

———. 1991. *Preventing Lead Poisoning in Young Children: A Statement on Preventing Lead Poisoning in Young Children by the Center for Disease Control and Prevention.* Atlanta, GA. <http://aepo-xdv-www.epo.cdc.gov/wonder/prevguid/p0000029/p0000029.asp>

Clark, C., R. Bornschein, P. Succop, S. Que Hee, P. Hammond, and B. Peace. 1985. "Condition and Type of Housing as an Indicator of Potential Environmental Lead Exposure and Pediatric Blood Lead Levels." *Environmental Research* 38:46-53.

Coeur d'Alene Tribe, Clean Lakes Coordinating Council, and Idaho Division of Environmental Quality. 1996. *Coeur d'Alene Lake Management Plan*.

Driver, J.H., J.J. Konz, G.K. Whitmyre. 1989. "Soil Adherence to Human Skin." *Bull Environ Contam Toxicol* 43: 814-20.

Golder Associates. 2001. *Effectiveness Monitoring Results for 10/27/01 Sampling of Success Vault Inlet and Outlet Ports*. Memorandum to Marti Calabretta (Silver Valley Natural Resource Trustees). December 13, 2001.

Gott, G.B. and J.B. Cathrall. 1980. *Geochemical-Exploration Studies in the Coeur d'Alene District, Idaho and Montana*. Geological Survey Professional Paper 1116:63.

Groisbois, C., A. Horowitz, J. Smith, and K. Elrick. 1999. *The Effect of Mining and Related Activities on the Sediment-Trace Element Geochemistry of Lake Coeur d'Alene, Idaho – Part III: Downstream Effects: The Spokane River Basin.*

Harvey, G.W. Undated. Draft Report. Monitoring Results on the Effectiveness of Trace (Heavy) Metals Removal Projects at the Interstate Mill and Canyon Creek Sites. Prepared for the Idaho Department of Environmental Quality.

Idaho Department of Environmental Quality (IDEQ). 2001. *Interim Data Summary Report for Pre- and Post-Cleaning Results, House Dust Pilot Project 2000.* Prepared for the Idaho Department of Environmental Quality by TerraGraphics Environmental Engineering, Inc. May 2001.

———. 1998. Beneficial Use Reconnaissance Project – 1998 Wadeable Streams Workplan. Prepared for the Idaho Division of Environmental Quality by the Beneficial Use Reconnaissance Project Technical Advisory Committee. May 1998.

Idaho Department of Health and Welfare (IDHW). 2001a. *Final Baseline Human Health Risk Assessment for the Coeur d'Alene Basin Extending from Harrison to Mullan on the Coeur d'Alene River and Tributaries, Remedial Investigation/Feasibility Study.* Prepared for the Idaho Department of Health and Welfare, Division of Health, Idaho Department of Environmental Quality, and USEPA Region 10 by TerraGraphics Environmental Engineering, Inc., URS Greiner, Inc., and CH2M Hill. July 2001.

———. 2001b. *1999 Five-Year Review Report Bunker Hill Superfund Site Populated Areas, Addendum and Extended Response to Technical Comments*. Prepared for IDHW by TerraGraphics Environmental Engineering, Inc. April 26, 2001.

———. 2001c. *Human Health Risk Assessment for the Coeur d'Alene Basin Extending from Harrison to Mullan on the Coeur d'Alene River and Tributaries*. Prepared by TerraGraphics Environmental Engineering, Inc. June 2001.

———. 2000a. *Coeur d'Alene River Basin Environmental Health Exposure Assessment.*

———. 2000b. *Final 1999 Five-Year Review Report Bunker Hill Superfund Site*. Prepared for IDHW Division of Environmental Quality by TerraGraphics Environmental Engineering, Inc. April 2000.

Kern, J.W. 1999. *Statistical Model for the Spatial Distribution of Lead Concentration in Surficial Sediments in the Lower Coeur d'Alene River Floodplain with Estimates of Contaminated Soils and Sediments. Draft*. Prepared for the U.S. Fish and Wildlife Service, Spokane, Washington. August 26, 1999.

Kissel, J.C., K.Y. Richter, and R.A. Fenske. 1996. "Factors Affecting Soil Adherence to Skin in Hand-Press Trials." *Bulletin of Environmental Contamination and Toxicology* 56:722-8.

Kneip, T.J., R.P. Mallon, and N.H. Harley. 1983. "Biokinetic Modelling for Mammalian Lead Metabolism." *Neurotoxicology.* 4:189-192. 1983.

Lanphear, B.P., K. Dietrich, P. Auinger, C. Cox. 2000. "Cognitive Deficits Associated with Blood Lead Concentrations Less than 10 µg/dl in U.S. Children and Adolescents." *Public Health Report* 115:521-9.

Lanphear, B.P., T.D. Matte, J. Rogers, R.P Clickner, B. Dietz, et al. 1998. "The Contribution of Lead-Contaminated House Dust and Residential Soil to Children's Blood Lead Levels: A Pooled Analysis of 12 Epidemiologic Studies." *Environmental Research* 79:51-68.

Landrigan, P.J. 1989. "Toxicity of Lead at Low Dose." *British Journal of Industrial Medicine.* 46:593-6. 1989.

Landrigan, P.J. E.L. Baker, Jr., R.G. Feldman. D.H. Cox, K.V. Eden, W.A. Orenstein, J.A. Mather, A.J. Yankel, and I.H. von Lindern. 1976. "Increased Lead Absorption with Anemia and Slowed Nerve Conduction in Children near a Lead Smelter." *Journal of Pediatrics* 89:904-10.

Long, K.R. 1998. *Production and Disposal of Mill Tailings in the Coeur d'Alene Mining Region, Shoshone County, Idaho, Preliminary Estimates.* U.S. Geological Survey Open-File Report 98-595.

Maddaloni, M., N. Lolacono, W. Manton, C. Blum, J. Drexler, and J. Graziano. 1998. "Bioavailability of Soilborne Lead in Adults, by Stable Isotope Dilution." *Environmental Health Perspectives*: 106(Suppl 6):1589-94.

Manton, W.I., C.R. Angle, K.L. Stanek, Y.R. Reese, and T.J. Kuehnemann. 2000. "Acquisition and Retention of Lead by Young Children." *Environmental Research.* 82:60-80.

Marti, P. and R. Garrigues. 2001. *Spokane River/Aquifer Interaction Project Results, May – November 1999.* Washington State Department of Ecology Publication No. 01-03-024. July 2001.

Molenaar, D. 1988. *The Spokane Aquifer, Washington: Its Geologic Origin and Water-Bearing and Water-Quality Characteristics*. U.S. Geological Survey Water Supply Paper 2265.

Morse, S.B., W.E. Hardwick, W.D. King. 1997. "Fatal Iron Intoxication in an Infant." *Southern Medical Journal* 90(10):1043-1047.

Mushak, P. 1998. "Uses and Limits of Empirical Data in Measuring and Modeling Human Lead Exposure." *Environmental Health Perspectives* 106 Suppl 6: 1467-84.

National Academy of Sciences (NAS). 2001. *Arsenic in Drinking Water: 2001 Update*. Washington D.C., National Research Council: 244.

———. 1999. *Arsenic in Drinking Water*. Washington D.C., National Research Council: 330.

———. 1993. *Measuring Lead Exposure in Infants, Children, and other Sensitive Populations*. NAS National Research Council Committee on Measuring Lead in Critical Populations. 16:337. National Academy Press, Washington, D.C. 1993.

Pirkle, J.L., D.J. Brody, E.W. Gunter, R.A. Kramer, D.C. Paschal, K.M. Flegal, and T.D. Matte. 1994. "The Decline in Blood Lead Levels in the United States. The National Health and Nutrition Examination Surveys (NHANES)." *Journal of the American Medical Association* 272:284-291.

Pirkle, J.L., R.B. Kaufmann, D.J. Brody, T. Hickman, E.W. Gunter, and D.C. Paschal. 1998. "Exposure of the U.S. Population to Lead, 1991-1994." *Environmental Health Perspectives.* 106:745-750.

Que Hee, S.S., B. Peace, C.S. Clark, J.R. Boyle, R.L. Bornschein, and P.B. Hammond. 1985. "Evolution of Efficient Methods to Sample Lead Sources, such as House Dust and Hand Dust, in the Homes of Children." *Environmental Research* 38: 77-95.

Rogan, W.J., K.N. Dietrich, J.H. Ware, D.W. Dockery, M. Salganik, J. Radcliffe, R.L. Jones, N.B. Ragan, J.J. Chisolm, Jr., and G.G. Rhoads. 2001. "The Effect of Chelation Therapy with Succimer on Neuropsychological Development in Children Exposed to Lead." *New England Journal of Medicine* 344(19):1421-1426.

Rosen, J.F. and P. Mushak. 2001. "Primary Prevention of Childhood Lead Poisoning -- The Only Solution." *New England Journal of Medicine* 344:1470-1471.

Rothenberg, S.J., L. Schnaas, E. Perroni, R.M. Hernandez, S. Martinez, and C. Hernandez. 1999. "Pre- and Postnatal Lead Effect on Head Circumference: a Case for Critical Periods." *Neurotoxicology and Teratology* 21:1-11.

Roussel, C., C. Neel, and H. Bril. 2000. "Minerals Controlling Arsenic and Lead Solubility in an Abandoned Gold Mine Tailings." *Sci Total Environ* 263:209-19.

Schneider, J.S., M.H. Lee, D.W. Anderson, L. Zuck, and T.I. Lidsky. 2001. "Enriched Environment During Development is Protective Against Lead-Induced Neurotoxicity." *Brain Research* 896(1-2):48-55.

Schwartz, J. 1994. "Low-Level Lead Exposure and Children's IQ: a Meta-Analysis and Search for a Threshold." *Environmental Research* 65:42-55.

Science Applications International Corporation (SAIC). 1993. *Draft Mine Sites Fact Sheets for the Coeur d'Alene River Basin.* Prepared for USEPA Region 10, Seattle, Washington. December 1993.

Succop, P., R. Bornschein, K. Brown, and C.Y. Tseng. 1998. "An Empirical Comparison of Lead Exposure Pathway Models." *Environmental Health Perspectives*. 106 (Suppl. 6):1577-83.

Suter, G.W., R.A. Efroymson, B.E. Sample, and D.S. Jones. 2000. *Ecological Risk Assessment for Contaminated Sites*. Lewis Publishers, Boca Raton.

URS. 2002a. "Dissolved Metal Reduction Ratio RDMR for the Selected Remedy (SR) Relative to Alternative 3 (Alt3)." Memo to Coeur d'Alene project file. URS Document Control No. 4162500.07074.04.z EPA 4.2.5. July 17.

URS. 2002b. "Draft Selected Remedy and Ecological Alternatives 1 through 6; Updated Probability Estimates for the SFCDR at Pinehurst (SF271) and the CDR at Harrison (LC60)." Memo to Coeur d'Alene project file. URS Document Control No. 4162500.06998.04.z. May 29.

U.S. Department of Health and Human Services (DHHS). 1999. *A Toxicological Profile for Lead*. U.S. Department of Health and Human Services. Atlanta, GA. 1999.

U.S. Environmental Protection Agency. *Superfund Community Involvement Handbook*. Office of Solid Waste and Emergency Response. EPA/540-K-01-003. March 2001.

———. 2001a. *Coeur d'Alene Basin RI/FS, Basinwide Ecological Risk Assessment.* May 2001.

———. 2001b. *Coeur d'Alene Basin RI/FS, Remedial Investigation Report, Final.* October 2001.

———. 2001c. *Coeur d'Alene Basin RI/FS, Feasibility Study Report, Final.* October 2001.

———. 2001d. *Technical Memorandum, Interim Fisheries Benchmarks for the Initial Increment of Remediation in the Coeur d'Alene Basin, Final.* September 2001.

———. 2001e. *Coeur d'Alene Basin Proposed Plan.* October 29, 2001.

———. 2001f. *Coeur d'Alene Basin RI/FS Technical Memorandum (Revision 1). Probabilistic Analysis of Post-Remediation Metal Loading.* September 20, 2001.

———. 2001g. *Technical Memorandum: Stream Flow Treatment in Treatment Ponds. Coeur d'Alene Basin RI/FS. Preliminary Draft.* August 2001.

———. 2001h. *Final Technical Memorandum (Rev. 3): Estimation of Background Concentrations in Soil, Sediment, and Surface Water in the Coeur d'Alene and Spokane River Basins*. Prepared by URS Greiner, Seattle, WA, and CH2M HILL, Bellevue, WA, for EPA Region 10. October 5, 2001.

———. 2001i. *Final Field Sampling Plan Addendum No. 18, Fall 2000 Field Screening of Sediment in Spokane River Depositional Areas, Summary of Results.* January 2001.

———. 2000a. *Summer 2000 Drinking Water Standards and Health Advisories*. EPA 822-B-00-001.

———. 2000b. *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*. EPA 540-R-00-002. Prepared by the U.S. Army Corps of Engineers. July 2000.

———. 2000c. *Human Health Alternatives Technical Memorandum, Coeur d'Alene Basin, Idaho, Public Comment Draft.* Prepared for USEPA Region 10 by CH2M HILL, under subcontract to URSG. Work Assignment No. 069-RI-CO-102Q. Bellevue, Washington. October 2000.

———. 2000d. *Draft Final Screening Level Human Health Risk Assessment for Nonresidential Receptors, Revision 2, Spokane River, Washington, Coeur d'Alene Basin RI/FS.* Prepared for USEPA Region 10 by URS Greiner Inc. Seattle, Washington. September 2000.

———. 2000e. *TRW Recommendations for Sampling Soil at Lead (Pb) Sites*. USEPA Technical Review Workgroup for Lead. Washington, D.C.

———. 2000f. *Comments and Responses on the Human Health Risk Assessment for the Coeur d'Alene Basin.* Vols. A and B. Prepared for the Idaho Department of Health and Welfare, Division of Health, Idaho Department of Environmental Quality, and USEPA Region 10 by URS Greiner, Seattle, WA.

———. 1999a. *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents.* EPA 540-R-98-031. OSWER. July 1999.

———. 1999b. *Field Sampling Plan and Quality Assurance Project Plan Addenda for the Bunker Hill Basin-wide RI/FS, Addendum 07, Residential Sampling to Support the Human Health Risk Assessment.* Prepared for USEPA by URS Greiner Inc. Seattle, Washington. September 1999.

———. 1999c. *Field Sampling Plan and Quality Assurance Project Plan Addenda for the Bunker Hill Basin-wide RI/FS, Addendum No. 12*. Prepared for USEPA by URS Greiner Inc. Seattle, Washington. 1999.

———. 1999d. *Field Sampling Plan and Quality Assurance Project Plan Addenda for the Bunker Hill Basin-wide RI/FS, Addendum No. 13, School Yard/Daycare Sampling to Support the Human Health Risk Assessment/Removal Actions.* Prepared for USEPA by URS Greiner Inc. Seattle, Washington. March 25, 1999.

———. 1999e. *Short Sheet: IEUBK Model Bioavailability Variable*. USEPA Technical Review Workgroup for Lead. EPA 540-F-00-006, OSWER No. 9285.7-32. October 1999. http://www.epa.gov/superfund/programs/lead/prods.htm#short

———. 1999f. National Recommended Water Quality Criteria–Correction. EPA 822-Z-99-001. Office of Water. April 1999.

———. 1998a. *Clarification to the 1994 Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities*. EPA 540-F-98/030. OSWER Directive No. 9200.4-2P. August 1998. <http://www.epa.gov/superfund/programs/lead/prods.htm#guidance>

———. 1998b. *Draft Technical Work Plan for the Bunker Hill Basin-Wide RI/FS Panhandle Region of Idaho Including Benewah, Kootenai, and Shoshone Counties*. Prepared for the USEPA Region 10 by URS Greiner, Seattle, WA, and CH2M HILL, Bellevue, WA. June 1998.

———. 1998c. *Risk Assessment Guidance for Superfund: Volume 1 – Human Health Evaluation Manual, Part D: Standardized Planning, Reporting, and Review of Superfund Risk Assessments*. Interim. EPA 540-R-97-033. January 1998.

———. 1998d. *EPA Region 10 Interim Final Guidance: Developing Risk-based Cleanup Levels at Resource Conservation and Recovery Act Sites in Region 10*. EPA 910-R-98-001. January 1998.

———. 1997a. *Generic Field Sampling Plan and Generic Quality Assurance Project Plan for the Bunker Hill Basin-wide RI/FS.* Prepared for USEPA Region 10 by URS Greiner Inc. Seattle, Washington.

———. 1997b. *Exposure Factors Handbook.* Volumes I–III. An Update to Exposure Factors Handbook EPA 600/8-89/043. May 1989. EPA 600-P-95-002Fa. August 1997.

———. 1994a. *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities*. EPA 540/F-94/043. OSWER Directive No. 9355.4-12. Washington DC.

———. 1994b. Guidance for the Data Quality Objectives Process. EPA QA/G-4. September 1994.

———. 1993. *Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors for Central Tendency and Reasonable Maximum Exposure*. Draft.

———. 1992. *Record of Decision (ROD) - Bunker Hill Mining and Metallurgical Complex, Shoshone County, Idaho*. September 1992.

———. 1992. *Community Relations in Superfund: A Handbook.* Office of Emergency and Remedial Response. EPA/540/R-92/009. January 1992.

———. 1991a. *Record of Decision for Bunker Hill Superfund Site Populated Areas*. USEPA Region 10, Kellogg, Idaho.

———. 1991b. *A Guide to Principal Threat and Low Level Threat Wastes*. OSWER 9380.3-06FS.

———. 1990a. *Risk Assessment Data Evaluation Report* (RADER) *for the Populated Areas of the Bunker Hill Superfund Site*. Prepared by TerraGraphics under USEPA Contract No. 68-W9-0008, WA #C10012: for USEPA Region 10 and Idaho Department of Health and Welfare Division of Environmental Quality, Moscow, ID. October 1990.

———. 1990b. *Technical Support Document on Lead. Prepared for Office of Solid Waste and Emergency Response, Final Draft*. Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, Cincinnati, OH. ECAO Cin-747.

———. 1990c. *Air Quality Criteria for Lead: Supplement to the 1986 Addendum*. Office of Health and Environmental Assessment. Washington, DC. EPA 600/8-89/049F.

———. 1989a. *Human Health Risk Assessment: Protocol for the Populated Areas of the Bunker Hill Superfund Site*. Technical Enforcement, Support IV Contract Work Assignment C1,0002. Contract No. 68-01-7351. Prepared by Jacobs Engineering, ICAIR, Life Systems, Inc., and TerraGraphics Environmental Engineering.

———. 1989b. *Guidance Concerning Soil Lead Cleanup Levels at Superfund Sites*. USEPA Office of Solid Waste and Emergency Response. OSWER Directive No. 9355.4-02. Washington, DC.

———. 1989c. *Risk Assessment Guidance for Superfund: Volume 1 -- Human Health Evaluation Manual. Part A. Interim Final*. USEPA Office of Emergency and Remedial Response. Washington, DC. EPA 540/1-89/002.

———. 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA. Interim Final.* EPA 540/G-89/004. October 1988.

———. 1986. *Air Quality Criteria for Lead*. Research Triangle Park, N.C.

U.S. Environmental Protection Agency and Idaho Division of Environmental Quality (USEPA and IDEQ). 2000. *Final Coeur d'Alene Basin Total Maximum Daily Load (TMDL) Package.* August 21, 2000.

———. 1999. *Memorandum of Agreement between the State of Idaho and the Environmental Protection Agency for the Human Health Risk Assessment. Coeur d'Alene Basin Remedial Investigation and Feasibility Study.* Prepared for USEPA Region 10. Seattle, WA.

U.S. Environmental Protection Agency Technical Review Workgroup for Lead. 2000. *Review of Human Health Risk Assessment for the Coeur d'Alene Basin*. Washington, D.C.: USEPA, OSWER, October 2000.

———. 1999. *Short Sheet: IEUBK Model Bioavailability Variable*. EPA No. 540-F-00-006. OSWER No. 9285.7-32.

von Lindern, I.H. 1982. *A Modeling Technique to Simultaneously Evaluate In-Plant and Off-Site Lead Emissions at a Primary Lead Smelter*. National Institute of Occupational Safety and Health, R.A. Contract Document No. 82-20. Taft Laboratory, Cincinnati, Ohio. June 1982.

———. 1980. *An Empirical Air Quality Analysis Utilizing Computer-Assisted Cartographic Modeling Techniques*. Ph.D. Dissertation, Yale University. 1980. Department of Forestry and Environmental Studies. New Haven, CN.

van Winjen, J.H., et al. 1990. "Estimated Soil Ingestion by Children." *Environmental Research* 51:147-162, as cited in USEPA 1997b.

Washington State Department of Ecology Toxics Cleanup Program (Ecology). 1994. *Natural Background Soil Metals Concentrations in Washington State*. Olympia, WA. Publication No. 94-115. October 1994.

Wasserman, G.A., J.H. Graziano, P. Factor-Litvak, D. Popovac, N. Morina, A. Musabegovic, N. Vrenezi, S. Capuni-Paracka, V. Lekic, E. Preteni-Redjepi, et al. 1994. "Consequences of Lead Exposure and Iron Supplementation on Childhood Development at Age 4 Years." *Neurotoxicology and Teratology* 16:233-40.

Wyman, S.A. 1993. *The Potential for Heavy Metal Migration from Sediments of Lake Coeur d'Alene into the Rathdrum Prairie Aquifer Kootenai County, Idaho*. Idaho Department of Health and Welfare, Panhandle Health District, Coeur d'Alene. November 1993.

Yankel, A.J., I.H. von Lindern, and S.O. Walter. 1977. "The Silver Valley Lead Study: The Relationship between Childhood Blood Lead Levels and Environmental Exposure." *Journal of Air Pollution*. Control Association. 27:764-767.

PART 3

RESPONSIVENESS SUMMARY

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLES

TABLE OF CONTENTS (Continued)

1.0 OVERVIEW AND BACKGROUND ON COMMUNITY INVOLVEMENT

On October 29, 2001, EPA released the Coeur d'Alene Basin Proposed Plan for public review. The plan described EPA's Preferred Alternative for cleaning up mine waste contamination in the Basin. The plan described a suite of activities aimed at protecting human health and the environment. The activities in the plan are estimated to take 30 years and cost $359 million. The comment period was extended twice in response to public requests, for a total of 120 days, and officially closed on February 26, 2002. EPA also held four public meetings in the Basin during the comment period to allow people to make oral comments for the record. The meetings were held in Wallace, Idaho on November 13, 2001, Cataldo, Idaho on November 14, 2001, Coeur d'Alene, Idaho on November 15, 2001, and Spokane, Washington on November 19, 2001.

EPA's preparation of the Responsiveness Summary conforms to the intent of EPA guidance, including: OSWER Directive No. 9230.0-06, *Superfund Responsiveness Summaries* and *Community Relations in Superfund: A Handbook*, and the *Superfund Community Involvement Handbook.* The Responsiveness Summary provides information about the views of the public, government agencies, the support agencies, and potentially responsible parties (PRPs) regarding the proposed remedial action and other alternatives. Further, it documents how comments have been considered during the decision-making process and provides answers to all significant comments. Section 1 presents an overview and background on community involvement. Section 2 provides an overview of the general community concerns and themes expressed during the comment period and EPA's responses. Section 3 presents an overview responsiveness summary that addresses the commenters' major issues and concerns, by subject, including those raised by the local communities. Section 4 presents comprehensive responses to each of the individual comments that EPA received on the Proposed Plan.

In total, EPA received more than 3,300 comments on the Proposed Plan from approximately 1,300 commenters. EPA sent copies of all comments received to the states of Idaho and Washington, the Coeur d'Alene and Spokane tribes, and the federal natural resource trustees. EPA reviewed all the comments, in consultation with the regulatory stakeholders, to determine what, if any, changes were appropriate to the Preferred Alternative identified in the Proposed Plan. Based on this evaluation of the comments, both minor changes and significant differences from the Preferred Alternative are reflected in the Selected Remedy of the ROD.

This Responsiveness Summary is a continuation of EPA's extensive efforts to involve stakeholders and community members in the remedy selection process. EPA's community involvement efforts during the remedial investigation/feasibility study (RI/FS) far exceed those required by the National Contingency Plan (NCP). One of the ways EPA worked to ensure early community input was to provide four public review periods at various stages of the Proposed Plan in addition to the required comment period on the Proposed Plan. People in the Basin reviewed and commented on the remedial investigation, the human health risk assessment, the ecological risk assessment, and the feasibility study for the Basin as summarized below.

Document	Public Review	Date of Final Report
Draft Ecological Risk draft Assessment	August 2000 to November 2000	May 2001
Draft Human Health Risk Assessment	July 2000 to October 2000	July 2001
Draft Remedial Investigation	October 2000 to March 2001	October 2001
Draft Feasibility Study	December 2000 to April 2001	October 2001

EPA also prepared written responses to comments on each of these documents. These responses are included in the Administrative Record for the site. Additional information on public involvement in the remedy selection process is presented in Section 3 of Part 2 of this ROD.

Because EPA worked intensively to involve community members and all levels of government affected by the cleanup throughout the RI/FS process and during the development of the Proposed Plan, input from these groups was incorporated into the Preferred Alternative prior to the Proposed Plan being released for public comment. Therefore, the Selected Remedy in this ROD is not substantially different from the Preferred Alternative. Since the release of the Proposed Plan, EPA has been working with the governments and communities to address remaining concerns, but these have been largely related to clarifying the scope and cost of the Selected Remedy, not specific cleanup actions or alternatives.

References used in this Responsiveness Summary are listed in Part 2, Section 15.0 of this ROD. Acronyms and abbreviations are also listed in Part 2 of this ROD.

2.0 GENERAL COMMUNITY CONCERNS AND THEMES

As with the four earlier review periods, a broad range of opinions was represented in the public comments on the Proposed Plan. Many of the more than 3,300 comments on the Proposed Plan were a result of organized efforts by citizen groups, and came in the form of postcards, form letters, a paid newspaper multiple choice survey and e-mail campaigns. A breakdown of the 1,317 individual submissions received follows:

Letter	Email	Newspaper Survey	Postcard	Public Testimony	Total
368	89	221	568	71	1,317

Many of these comments addressed general, overarching concerns about the cleanup and about EPA, though some of the form letters did address specific cleanup alternatives. Most of these general comments were similar to comments EPA received during the four earlier review periods.

Some of the general comments expressed a lack of trust and support for EPA and other government agencies. Other comments generally expressed the belief that cleanup is not needed in the Basin and stated a desire for EPA to stop work and leave the Basin. Other comments generally supported EPA's plan and expressed a desire for an even more aggressive cleanup approach.

EPA worked with community residents, including local elected officials and community leaders, over the last several years to understand and address these overarching concerns during the study and cleanup planning process. However, the things some people are most concerned about, such as the boundaries of the Superfund site and EPA's statutory obligation to protect human health and the environment are outside the scope of EPA Region 10's authority. These issues are matters of statute or regulation and include some that have been the subject of court decisions. Because EPA could not address these issues in the RI/FS or Proposed Plan, some people feel that EPA has not listened to them, and they are not satisfied that the cleanup plan addresses their concerns.

Below is a brief summary of some of these general community concerns and how EPA has tried to address these concerns if possible.

General comment: Concern that the human health risks (particularly in the residential areas of the Upper Basin) have been overestimated and that residential cleanups are not necessary.

Some people expressed concern about the way the State of Idaho and EPA assessed the human health risks in the Basin and believe that the risks have been overestimated. Many of these people believe that because they have not seen children who appear to have lead poisoning, they believe no health emergency exists and therefore cleanup in residential areas is not necessary. However, other people have stated they feel that EPA's cleanup plan doesn't go far enough to protect children and that more should be done.

Response: EPA and the State of Idaho have been working with the communities in the Upper Basin on human health issues for several years. These communities will be the most affected by the cleanups in residential areas. It is understandable that people living in these communities may question the need for cleanup of residential soils containing lead since the effects of lead exposure in children are usually not obvious. People are understandably concerned that their communities may be unfairly stigmatized as unsafe or unhealthy and that people from outside the area will not want to visit or relocate to these communities.

This has been a difficult issue to address. EPA and the State of Idaho have stated that a primary goal for cleanup in the Basin is preventing children from being exposed to lead. This is a fundamentally different approach from treating children and conducting cleanups after children exhibit elevated blood-lead levels or other obvious symptoms of lead exposure. EPA and the State of Idaho followed existing national protocols for conducting risk assessments and establishing soil cleanup standards that are protective of children living in the area now, and those that may live there in the future. The risk assessment clearly indicates that the mining-related waste continues to be a health hazard, especially for young children and pregnant women.

Early on in the RI/FS process, in response to public requests, EPA transferred the lead for conducting the human health risk assessment for the Basin to the State of Idaho. The State followed national guidelines and policies for conducting lead risk assessments and establishing soil cleanup levels. The risk assessment was extensively peer reviewed by national experts. EPA and the State believe the science used in the risk assessment is sound. In April 2001, in response to requests from the communities and in an attempt to address questions and concerns, EPA participated in a "Science Summit" sponsored by the Shoshone Natural Resources Coalition's Science Committee. To support the Science Summit, EPA arranged for local, regional, and national lead remediation experts to attend and present information and respond to questions. The Science Summit helped the agencies understand the communities' questions and concerns.

Recently, the Idaho congressional delegation requested a National Academy of Sciences (NAS) review of the scientific and technical analyses that form the basis of the ROD's Selected Remedy. The NAS agreed to conduct the review if it receives an estimated $840,000 appropriation to do so. If the NAS conducts a review, EPA will evaluate the results of the review and determine if changes to the ROD are needed.

General comment: Concern about government actions on private property and disruption to the communities during cleanup.

Some people expressed concern about government actions on private property and cleanup work.

Response: EPA cannot access or take action on private property without permission from the owner or explicit legal authority to do so. For example, the ROD calls for sampling and cleanup of residential properties in the Upper Basin. Before any work occurs, EPA or the appropriate state or local agency will talk with each property owner and request written permission to sample and/or conduct cleanup work on their property.

In response to concerns about large-scale removal of contaminated material, the ROD calls for more limited removals of "hot spots" of contamination and focuses on treatment technologies that will be less invasive and disruptive to communities. In addition, EPA and other agencies will work closely with individual property owners and local governments to minimize disruption of normal day-to-day activities during cleanup. Whenever possible, work will be scheduled so that it does not interfere with community activities or with an owner's plans for the property. In addition, at residential properties, EPA and the State of Idaho will attempt to protect existing landscaping or will replace trees, shrubs, and plants that may be damaged during cleanup work.

General comment: Concerns about the local economy.

Some people expressed serious concerns about the economic conditions in the Basin and potential negative effects of a Superfund cleanup.

Response: EPA shares the concern for the economy in the Basin. In the long-run, however, EPA and the State of Idaho anticipate that cleanup will improve socioeconomic conditions in the Basin. Basin-wide sampling, analysis, and remediation of soil in residential proprieties will provide property owners the information necessary for lead disclosures required for property transactions. Other aspects of the remedy, such as establishing vegetative cover, remediating schoolyards, rights-of-way and commercial property, and providing drainage improvements to protect the remedy, will be coordinated with paint abatement programs and community redevelopment projects and will have the potential to make the communities more attractive locations for business. The work associated with implementation of the Selected Remedy may provide additional jobs for the local labor force and contractors, including local supply contractors. Additionally, remediation dollars spent in the Silver Valley may create other opportunities for local businesses.

Of $95 million federal contract dollars spent on cleanup in the Bunker Hill Box between 1995 and 2000, $42 million were spent locally. This includes local labor, materials, rentals, taxes and utilities. In addition, EPA has provided $200,000 in grant monies for economic redevelopment in the Silver Valley, and will continue to provide this kind of support when possible. Cleanup work will be coordinated with local land use planning and community infrastructure needs. In addition, the Basin Environmental Improvement Project Commission will work to ensure that as many local people and businesses as possible are involved in the cleanup work within the bounds of federal contracting and procurement rules.

General comment: Concerns about the boundaries of the Superfund site.

Some people expressed concern and confusion about the extent of the boundaries of the Superfund site in the Basin. Some people believe that EPA has illegally expanded the boundaries of the Superfund site. People are also concerned about the possible stigma associated with being part of a Superfund site.

Response: Such issues have been major community concerns in the Basin throughout development of the RI/FS and Proposed Plan. These have been very difficult for EPA to address to some people's satisfaction. The definition of a Superfund site provided by the CERCLA statute includes areas where hazardous substances are found or have come to be located. In conducting its work in the Basin, EPA has complied with this definition.

However, some people in the Basin communities believed that the cleanup work in the Basin would be limited to the area near Kellogg and Smelterville, referred to as the Bunker Hill "Box" (the Box). Given this, it is understandable that people would be concerned when the investigation and cleanup work began in areas outside the Box. Unfortunately, the mine waste contamination in the Basin extends far beyond the boundaries of the Box, both upstream and downstream. The contamination outside the Box continues to pose significant risks to both people and the environment. While the mine waste contamination does exist in areas outside the Bunker Hill Box, the contamination is not present, as some people apparently believe, over the entire 1,500 square-mile watershed. The areas where contamination exists are primarily near historical mining operations; in some of the residential and commercial areas of the Upper Basin; in and near the affected parts of the Coeur d'Alene River system; and other downstream areas where contamination exists. Consequently, areas such as those above the floodplain where contamination does not exist are not included in the site. For example, the residential areas of the cities of Coeur d'Alene, Post Falls, and Harrison are not considered part of the site.

While EPA cannot change the definition of a Superfund site, EPA is trying to address "stigma" concerns in two ways. One way is to better define the areas where cleanup work is needed and where it is not needed. The ROD describes the cleanup actions in each part of the Basin and provides a map showing these areas. In addition, EPA is committed to removing the Superfund designation from clean areas as quickly as possible. Communities will not have to wait until all of the cleanup work in the Basin is complete in order to be removed from the site. Specifically, the goal is to complete cleanup work in the Upper Basin communities first, so that these areas can be removed from the Superfund site as quickly as possible.

The Selected Remedy does not include remedial actions for Coeur d'Alene Lake. State, tribal, federal, and local governments are currently in the process of implementing a Lake Management Plan outside of the Superfund process using separate regulatory authorities.

General comment: State and Local governments should have control of cleanup work.

Some people expressed the desire for the State of Idaho and the new Coeur d'Alene Basin Environmental Improvement Project Commission (the Basin Commission) to have the lead role in implementing the cleanup plan for the Basin. Other commenters felt that because the contamination and cleanup work cross the Washington state line and affect tribal land, the federal government should have the lead role in making sure an effective cleanup is carried out across these jurisdictions.

Response: EPA recognizes that in order to have a successful and sustainable cleanup in the Basin, all the governments affected will need to be directly involved in implementing the cleanup actions outlined in the ROD. Starting early on in the RI/FS process, EPA worked closely with state, tribal and local governments, as well as the other federal agencies with authorities in the Basin. EPA has provided significant funding to many of these governments to allow them to fully participate in the process.

EPA will continue to work in a collaborative way with all levels of government during the next phases of cleanup. State legislation under the Basin Environmental Improvement Act established the process for the formation of the Basin Commission. The Basin Commission includes federal, state, tribal, and local governmental involvement. EPA will participate as a member of the Basin Commission for implementation of the ROD and development of priorities and sequencing of cleanup activities. Although the Commission will have an important role in implementing the cleanup in Idaho, EPA will continue to have overall responsibility to ensure that cleanup meets the requirements of the ROD and of CERCLA. EPA also has a legal obligation to work with the State of Washington to implement the cleanup actions outlined for the Spokane River.

General comment: Concern about contamination migrating downstream and re-contaminating clean areas.

People expressed concern about the continued movement of contamination from the Upper Basin to the Lower Basin and from Idaho into the State of Washington. People were also concerned about the potential for cleanup activities to cause contaminants to move downstream and re-contaminate clean areas.

Response: Much of the work described in the ROD is intended to significantly reduce the amount of contamination moving downstream. When implementing the cleanup, EPA will work with the Commission to evaluate which cleanup work should be done first and how to reduce the possibility of re-contaminating clean areas. The ROD calls for removing up to 12 percent of the total of contaminated riverbed sediments in the Basin. EPA and any other party doing work in the river or lakes must comply with existing environmental laws and minimize downstream movement of contaminants.

General comment: Concern that EPA should select a more aggressive cleanup alternative.

Some people commented that EPA should select a more aggressive cleanup approach which would provide additional protection of human health and the environment.

Response: The Selected Remedy includes prioritized actions to provide significant improvements both for human health and the environment in the Basin. The Selected Remedy will be evaluated for its protectiveness at least every five years as required by CERCLA. If the remedy is not found to be adequately protective, measures will be evaluated and implemented to ensure the remedy is protective, consistent with the ROD.

General comment: Concern about the cost of cleanup and the estimated length of time needed to clean up the Basin.

People were concerned about how long cleanup will take and EPA's proposed "incremental approach." These people were concerned that the incremental approach provides no certainty about when the cleanup will be finished and when the Superfund designation can be removed from the Basin. People were also concerned that the estimated cost for complete cleanup in the Basin, as estimated in the Proposed Plan, was over $1 billion.

Response: It is true that given the amount and extent of mine waste contamination remaining in the Basin, cleanup will be costly and will take many years. The work described in the ROD is estimated to cost $359 million and take approximately 30 years to complete. Cleanup work to protect human health in the communities and residential areas is a top priority for completion. Cleanup of these areas will be conducted concurrently with the ecological remedy. EPA's expectation is that the human health remedy will be completed well before the approximately 30-year timeframe for completing the ecological remedy. EPA is not proposing a cleanup plan that costs in excess of $1 billion. However, EPA has indicated that it is likely that additional work beyond that described in the ROD will be needed.

EPA estimated, based on existing information, that environmental cleanup work under Alternative 3 in the Proposed Plan would cost $1.3 billion. However, no decision has been made regarding specific future work, and any additional work beyond that described in this ROD will have to undergo a public process including another Proposed Plan and a public review and comment period.

2.1 HOW COMMUNITIES AND STAKEHOLDERS HAVE SHAPED THE CLEANUP PLAN

EPA involved all of the various levels of government and the affected communities in the Basin throughout the process. Because of this inclusive and collaborative approach, EPA was able to incorporate the suggestions made in public comments in "real time" as the studies were happening, while documents were being written and as the Preferred Alternative and Selected Remedy were being developed. Below is a list of some of the ways EPA was able to respond to community concerns during the RI/FS, Proposed Plan, and ROD development process.

2.1.1 Pre-Proposed Plan Responses to Community Input

- Expedited sampling of Coeur d'Alene Lake beaches was conducted in 1998 (on request from the mayor of Coeur d'Alene). Result: beaches were declared safe)
- The method for drawing children's blood was changed from venous to finger stick
- Voluntary sampling and cleanups have been conducted since 1998 in the Upper Basin (104 residences and common areas cleaned up, 37 residences provided with clean source of water, and more than 300 residences sampled)
- The list of plants and animals evaluated in the ecological risk assessment was changed based on local landowners input, thus changing the scope of the assessment and making it more site-specific
- EPA provided direct funding to Coeur d'Alene, Post Falls, Harrison, and Kootenai County, as well as Shoshone County so that those localities could hire technical consultants to review EPA's work and provide input prior to the release of the Proposed Plan
- EPA provided direct funding for economic development in the Silver Valley
- EPA gave the State of Idaho the lead role in conducting the human health risk assessment for the Basin
- EPA tailored the screening risk assessment for the Spokane River beaches to the community's specified uses

2.1.2 Some Ways That the Proposed Plan and ROD are Responsive to Community Concerns

- The Proposed Plan actions are closely in line with the recommendations from the State of Idaho's Consensus Building Process

- The cleanup plan will minimize disruption to communities during cleanup by limiting the amount of "digging and hauling" of material in a given year and emphasize treating contamination in place where possible

- EPA is supporting the State of Idaho's YES program for yard cleanups

- EPA has been working with local agricultural landowners on creative wetland cleanup options which will benefit the landowner and assist with the cleanup (Lower Basin)

- No relocation of residents is currently planned for Burke Canyon based on input from local residents

- The cleanup plan includes more flexibility in reaching cleanup standards in residential areas, i.e., "community greening," by using barriers such as vegetation on contaminated yards between 700 and 1,000 parts per million (ppm) lead instead of excavating and replacing soil between 700 and 1,000 ppm lead. This will result in less disruption and fewer yards having soil removed and replaced

- The cleanup plan will include improvements to protect the remedy (e.g., drainage improvements) and cleanup work will be coordinated with local land use planning efforts

- Cleanup in communities will be a top priority so that clean areas can be removed from the Superfund list as quickly as possible

- EPA will participate as a member of the Basin Environmental Improvement Project Commission to implement the ROD

- The Selected Remedy does not include remedial actions in Coeur d'Alene Lake. State, tribal, federal, and local governments are currently in the process of implementing a Lake Management Plan outside of the Superfund process using separate legal authorities

- No wetlands in the Lower Basin will be used as disposal sites

- No disposal of material or dredging in Coeur d'Alene Lake is included in the plan.

- The cleanup plan will be tailored to minimize long-term operations and maintenance costs which will result in less cost to the states

- Local waste repositories have been and will continue to be sited and designed with local community input

- Spokane River cleanup areas are based on input from State of Washington, Spokane Tribe, community, and other interested parties

2.2 COMMUNITY INVOLVEMENT ACTIVITIES CARRIED OUT BY EPA IN RESPONSE TO REQUESTS

Below is a list of community involvement activities carried out by EPA in response to requests:

- Monthly NewsBriefs

- Executive Summaries of documents

- Weekly technical conference calls open to the public

- Four educational workshops on Human Health and Ecological Risk Assessments, Remedial Investigation and Feasibility Study

- Public review periods and comment responses provided on the HHRA, Ecological Risk Assessment, and RI/FS (all review periods were extended upon request)

- Extended Proposed Plan comment period to 120 days on request

- Supported the “Science Summit” by bringing national and regional experts on lead risks and cleanups to the Silver Valley

- Provided support for a “health fair” in the Silver Valley

- Staff support for CAC RI/FS Task Force for two and a half years

- Top regional and national EPA managers have visited the Basin at least 16 times on request

3.0 OVERVIEW RESPONSIVENESS SUMMARY

3.1 COMMUNITY RELATIONS AND COMMUNITY CONCERNS

3.1.1 Community Participation in Remedy Selection Process

Comment Summary:

Some comments questioned whether EPA has done enough to ensure community participation in the technical investigation and remedy selection processes and whether community input was used as opposed to merely being noted.

EPA response:

Community acceptance is one of nine criteria that EPA considers, by regulation, in its remedy selection process. Community acceptance played an early and significant role in selecting the remedy. As described in detail in Section 3.0 of Part 2 of the ROD, EPA has provided a wide range of opportunities for community participation in the investigation and remedy selection processes within the Coeur d'Alene Basin including four additional public review periods. EPA is required by CERCLA to provide opportunities for community participation, and the extensive efforts in the Coeur d'Alene Basin go far beyond the required activities and rival any that have ever been taken in the United States by EPA.

As noted previously, some of the community comments and concerns are outside of EPA's authority. EPA has worked with the communities in the Basin to respond to these concerns, but some people still do not feel EPA has listened or adequately addressed all of their concerns.

Part of the community participation effort in the Basin was the State of Idaho's Basin Consensus Building Process. This effort was initiated in September 2000 and continued until March 2001, with the State of Idaho in the lead role and EPA in a support role. A wide variety of stakeholder entities, both governmental and community, participated. The purpose of the process was to identify "common ground" or points of divergence for EPA to use in developing a cleanup plan. Considerable discussion focused on four prominent issues for cleanup:

- Tailings along the South Fork and its tributaries in the floodplain and on uplands that are major sources of zinc in the water

- Banks and beds of the Coeur d'Alene River that are a major source of lead in the water

- Floodplains along the river from Cataldo to Harrison that are a source of lead exposure to wildlife
- Sources of lead, including soil, indoor dust, and house paint, in communities that may be an exposure source to children

Because this process occurred while EPA was developing remedial alternatives as part of the Feasibility Study, EPA had the benefit of considering and incorporating the outcome of the consensus building process into the development of the Proposed Plan.

3.1.2 Relationship Between Selected Remedy and Basin Environmental Improvement Project Commission

Comment Summary:

Some comments supported the formation of the Basin Environmental Improvement Project Commission or some form of local control over cleanup and recommended EPA turn over control of cleanup to that group.

EPA response:

EPA anticipates working as a member of the new Basin Environmental Improvement Project Commission and looks forward to finding innovative means to cleanup the Basin and create job opportunities, while meeting statutory requirements for cleanup.

3.1.3 Control of Cleanup Work

Comment Summary:

Some comments questioned who would be in control of cleanup, ranging from support for EPA control to turning over control to others, and questioned what EPA's role would be in the cleanup.

EPA response:

EPA recognizes that in order to have a successful and sustainable cleanup in the Basin, all the governments affected will need to be directly involved in implementing the cleanup actions outlined in the ROD. EPA is fully committed to working cooperatively with the States of Idaho and Washington, the Coeur d'Alene and Spokane Tribes, the Federal Natural Resource Trustee Agencies, and the local governments in the Basin to implement the cleanup. In addition, EPA is supportive of the appropriate state, tribal and local entities taking the lead in implementing parts of the ROD in a manner consistent with the statutory obligations EPA has under Superfund.

3.1.4 Role of Ombudsman

Comment Summary:

Several comments expressed the opinion that the Office of the National Superfund Ombudsman should be allowed to complete its work and continue to conduct its duties during the Basin cleanup action.

EPA response:

EPA has cooperated and will continue to cooperate with the Office of the National Superfund Ombudsman in its investigation. In September and October 2001, Region 10 provided written responses to Ombudsman interrogatories related to the Bunker Hill/Coeur d'Alene Basin investigation, and has made sure that the Office of the Ombudsman was aware of the schedule for the Proposed Plan and the ROD. To date, EPA has received no recommendations or reports from the Ombudsman. On December 18, 2001, the Ombudsman office sent a 2-page document entitled "Working Findings for Discussion and Comment" to the "Service List for National Ombudsman Investigation" and the local press. The December 18 memo was not sent to EPA Region 10, nor was a response requested by the Ombudsman. However, EPA has reviewed the memo and has determined that it contains no specific recommendations regarding this Selected Remedy. EPA responded to the working findings in a July 16, 2002 letter to U.S. Senator Mike Crapo. If EPA receives final recommendations from the Office of the Ombudsman, it will evaluate them and take appropriate actions. If EPA determines that substantial changes to the ROD are appropriate based on the Ombudsman recommendations, such changes would be subject to additional public review and comment.

3.1.5 Job Opportunities

Comment Summary:

Many comments questioned what economic impact the Selected Remedy will have on local areas of the Basin and stressed the need for a healthy economy and local hiring in the cleanup.

EPA response:

EPA shares the concern for the economy in the Basin. Of the $95 million in federal contract dollars spent on cleanup in the Bunker Hill Box between 1995 and 2000, $42 million were spent locally. This includes local labor, training materials, rentals, taxes and utilities. To date, EPA has provided $200,000 in grant monies for economic redevelopment in the Silver Valley. EPA will continue to provide this kind of support when possible and will make sure that cleanup work is coordinated with local land-use planning and community infrastructure needs. EPA is required to comply with Federal Acquisitions Requirements, including providing for full and open competition. EPA encourages local businesses to be involved with the cleanup work and believes the cleanup work of the Selected Remedy will provide a significant number of jobs to local residents while benefiting the local economy. EPA is committed to assisting with economic development to the extent possible, and supports local hiring whenever and wherever possible.

3.1.6 Need for Certainty and Closure

Comment Summary:

Many comments stated that "certainty" and/or "closure" related to the cleanup is needed for the economic well-being of the Basin. People were concerned about effects on business development, the ability to complete property transactions, and property values. The comments called for clear identification of the duration of cleanup, of which areas require cleanup and which do not, and of cleanup costs.

EPA response:

The Selected Remedy does include certainty regarding human health protection within community areas and those recreational areas prioritized for cleanup. Cleanup of these areas is a top priority and will be completed well before the 30-years described for the ecological portion of the Selected Remedy. Property owners in the Basin will be able to request soil sampling necessary for lead disclosures required for property transactions, and the results will be made available to them in a timely manner. The length of time required for cleanup in the communities will depend on the availability of funding and the participation of property owners. Although future funding is not a certainty to date, the Bunker Hill/Coeur d'Alene Basin work has been a priority for funding.

As described extensively in the Proposed Plan and the ROD, complete certainty with respect to the environmental cleanup is not possible at this time. Sufficient information exists to support the Selected Remedy. However, insufficient information exists to characterize all the specific sources of metals contamination impacting the streams and floodplains, as well as the anticipated effectiveness of certain remedial actions, in some areas of the Basin. The Selected Remedy includes prioritized cleanup actions that are expected to take approximately 30 years to implement. During the five-year review process and at the end of this approximately 30-year period, EPA will evaluate and decide whether any additional CERCLA remedial actions are necessary to attain ARARs or to provide for the protection of human health and the environment, and whether any ARAR waivers should be applied.

Although complete certainty is not possible at this point for the environmental protection portion of the Selected Remedy, actions taken will be in defined locations and will be designed to achieve specific benchmarks. Areas included in the cleanup are specifically identified in maps included in the ROD. These areas are in and near historical mining operations, the affected parts of the Coeur d'Alene River system, and other downstream areas where contamination has come to be located. Consequently, areas such as those above the floodplain where contamination does not exist, and where most economic development opportunities exist, are not included in the environmental cleanup.

The estimated present worth cost of the Selected Remedy is $359 million. Consistent with EPA RI/FS guidance, the accuracy of this cost estimate is -30 to +50 percent.

3.2 SITE DEFINITION AND FUNDING

3.2.1 Description of the Superfund Site

Comment Summary:

Some comments questioned what the Superfund site is, whether EPA has illegally expanded it, and whether the definition of the site means EPA will be taking actions in all parts of the Basin.

EPA response:

The term "site" is derived from the CERCLA definition of a "facility." Section 101 (9) of CERCLA states that "[T]he term 'facility' means…any site or area where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located." The site was listed on the National Priorities List (NPL) in 1983 and has a CERCLIS identification number IDD048340921. The listing of the site reflected widespread contamination caused by mining and mining-related activity. Consistent with EPA policy, the listing did not set forth any site boundaries. In June 2000, the United States 9th Circuit Court of Appeals vacated a site decision by the U.S. District Court limiting the scope of the NPL facility to the 21-square miles known as the Bunker Hill Box. This decision left standing the EPA position that the NPL facility includes all areas of the Coeur d'Alene Basin where mining contamination has come to be located. Hence, consideration of cleanup actions outside the Box does not constitute expansion of the site. Areas where mining contamination has come to be located, some of which are addressed in this ROD, are primarily near historic mining operations; in some of the residential and commercial areas of the Upper Basin; parts of the Coeur d'Alene River system; and other downstream areas where contamination has come to be located. Consequently, areas such as those above the floodplain which are unaffected by contamination from mining are not included as part of the site.

3.2.2 Funding for Cleanup in the Coeur d'Alene Basin

Comment Summary:

Some comments questioned what source(s) of funding will be available for the cleanup.

EPA response:

The CERCLA statute and the NCP regulations provide EPA with the authority to take actions to protect human health and the environment. EPA's ability to carry out this mandate is subject to the availability of funds. EPA will consider all funding sources available, including the Superfund and judgments against responsible parties to carry out necessary cleanup actions. Currently, EPA's Superfund budget is appropriated annually from Congress.

3.3 REMEDY SELECTION PROCESS

3.3.1 Description of an "Interim Measure"

Comment Summary:

Some comments questioned what an "interim action" (referred to in the ROD as an "interim measure") is in the context of CERCLA.

EPA response:

EPA implements CERCLA cleanups (response actions) through removal and remedial actions. The regulation that governs the implementation of CERCLA is the National Contingency Plan (NCP). The Selected Remedy in this ROD for the Coeur d'Alene Basin is a "remedial" action. The "threshold criteria" set forth in the NCP at Sec.300.430(f)(1)(i)(A) for selection of remedies are "overall protection of human health and the environment and compliance with ARARs (unless a specific ARAR is waived)." A remedial action, such as the one selected in this ROD, which does not meet ARARs, but will become part of a total remedial action that will attain ARARs, is defined as an "interim measure" by the NCP (Sec. 300.430(f)(1)(ii)(C)(1)). Because EPA cleanups are termed "response actions" by the NCP, EPA often uses the term "interim action," such as it did in the Proposed Plan and as the NCP does, to refer to an interim measure such as the Selected Remedy.

3.3.2 Length of Time, Size, and Complexity of an Interim Measure

Comment Summary:

Some comments questioned whether it was appropriate for EPA to use an interim measure approach to cleanup, considering the lengthy estimated time for cleanup, the size of the site, and its complexity.

EPA response:

CERCLA does not place restrictions on the use of interim measures based on the time necessary to remediate a site or its size or complexity. Instead, the NCP provides discretion to EPA to determine where interim measures are appropriate. As described in the ROD, an adaptive management strategy or incremental approach using interim measures makes sense for cleanup of the Coeur d'Alene Basin. Although overall cleanup times are estimated to be lengthy, the Selected Remedy will produce ongoing incremental human health and environmental improvements over the estimated 30 years. Cleanup work to protect human health in the communities and residential areas is a top priority. Cleanup of these areas will be conducted concurrently with the ecological remedy. EPA's expectation is that the human health remedy will be completed well before the approximately 30-year timeframe of the ecological remedy. Conversely, reduction of dissolved metals until Ambient Water Quality Criteria (AWQC) are met, will occur over long periods of time. The geographic extent of areas requiring cleanup and the complexity of the sources of contamination support the use of an adaptive management approach to cleanup. By using information from CERCLA-required five-year reviews and other processes, the effectiveness of any future increments of cleanup can be optimized.

3.3.3 Relationship Between Remedy Selection Requirements and EPA Guidance Documents

Comment Summary:

Some comments questioned whether EPA strictly adhered to its guidance document in developing the Proposed Plan and selecting a remedy.

EPA response:

EPA's selection of remedies is governed by the requirements of CERCLA and the NCP regulations that implement CERCLA. EPA complied with these requirements in selecting a remedy in this ROD. EPA's guidance document for preparing remedy selection decision documents is "A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents" which was published in July 1999. The "Notice" on the first page of this document states: "This document provides guidance to EPA and State staff…" The document does not, however, substitute for statutes EPA administers nor their implementing regulations, nor is it a regulation itself. Thus it does not impose legally-binding requirements on EPA, States, or the regulated community, and may not apply to a particular situation based upon the specific circumstances." EPA used the guidance, as appropriate, to assist it in preparing the Proposed Plan and the ROD.

3.3.4 The Selected Remedy in Relationship to Ecological Alternative 3

Comment Summary:

Some comments questioned whether EPA is selecting Ecological Alternative 3 as the remedy in this ROD.

EPA response:

The Selected Remedy in this ROD is not Ecological Alternative 3. EPA is using an adaptive management strategy to implement cleanup. The Selected Remedy includes the complete remedy needed to protect people from exposure to contamination that currently occurs in the community and residential areas and identified recreational areas of the Upper Basin and Lower Basin, as well as at Spokane River recreational sites upstream of Upriver Dam. For environmental protection, the Selected Remedy includes approximately 30 years of prioritized actions from Ecological Alternative 3 in areas of the Basin upstream of Coeur d'Alene Lake. It also includes cleanup of Spokane River sites between the Washington/Idaho border and Upriver Dam.

3.3.5 The Selected Remedy in Relationship to a Natural Resource Damages Restoration Plan

Comment Summary:

Some comments questioned the relationship of the Selected Remedy to actions taken by the natural resource trustees and whether development of the Selected Remedy was motivated by a desire to assist the natural resource trustees in their natural resource damage litigation.

EPA response:

EPA initiated the RI/FS for Operable Unit 3 because of the threats to human health and the environment created by releases of hazardous substances, not to assist other agencies in litigation. EPA's selection of remedies is governed by the requirements of CERCLA and the NCP. EPA complied with these requirements in selecting a remedy in this ROD. The Selected Remedy is not a restoration plan in support of a natural resource damages lawsuit. While the CERCLA remedial process has certain similarities to the NRDA process in that both address the environmental effects of mining pollution, the two processes are distinct and do not necessarily have the same environmental objectives.

However, EPA does have, and has met, regulatory obligations regarding coordination with natural resource trustees. For example, NCP Section 300.430(b)(7) states that the lead agency shall: . . . "[I]f natural resources are or may be injured by the release, ensure that state and federal trustees of the affected natural resources have been notified in order that the trustees may initiate appropriate actions, including those identified in Subpart G of this Part. The lead agency shall seek to coordinate necessary assessments, evaluations, investigations, and planning with such state and federal trustees." EPA, the lead agency here, has satisfied this coordination responsibility during the conduct of the RI/FS and the selection of the remedy. As discussed previously, EPA worked with a wide spectrum of entities including local governments, federal agencies, state agencies, and Indian tribes in developing the Selected Remedy.

3.4 BACKGROUND METALS CONCENTRATIONS

3.4.1 Background Metal Concentrations Absent Mining Effects

Comment Summary:

Various comments questioned EPA's estimates of background concentrations for metals (i.e., metal concentrations absent mining effects) and asserted that metals concentrations in the Basin are naturally elevated because of geologic conditions in the Basin.

EPA response:

EPA conducted extensive analyses and evaluations of background conditions as part of the RI/FS. These analyses and evaluations conclusively demonstrated that the dominant source of metals is from mining-related activities, not natural sources.

A comprehensive analysis of background concentrations, representing more than 10,000 samples, can be found in the RI/FS Technical Memorandum (Revision 3): "Estimation of Background Concentrations in Soils, Sediments, and Surface Water in the Coeur d'Alene and Spokane River Basins," USEPA 2001. Because metal concentrations are naturally variable, the analysis quantified the range of background concentrations for each metal and selected the 90th percentile for soils and sediments and the 95th percentile for surface water as the representative background concentrations. The background concentrations identified for the Upper Basin represent the most mineralized conditions and are different from background sediment concentrations for the Lower Basin, Coeur d'Alene Lake, and Spokane River. The background soil/sediment and surface water metal concentrations are far below, indeed are small fractions of the existing concentrations in the mining-impacted media targeted for cleanup by the Selected Remedy. Furthermore, the background soil and sediment lead levels are far below the soil/sediment benchmark (530 milligrams/kilogram) reflected in the Selected Remedy. As described in the ROD, the numerical cleanup criteria for soil and sediment may be revised as additional information becomes available.

3.4.2 Mining-Related Sources of Metals

Comment Summary:

Several comments questioned EPA's conclusion that the overwhelming sources of metals that create environmental and human health risks in the Basin are from historic mining-related practices and, in particular, that tailings-impacted sediments are the primary source of metal loadings to Basin streams.

EPA response:

EPA's analyses and the historic record make clear that mining-related practices in general and tailings-impacted sediment in particular are the dominant sources of metals in the Basin. The historic record has been analyzed in USGS Open-File Report 98-595 "Production and Disposal of Mill Tailings in the Coeur d'Alene Mining Region, Shoshone County, Idaho; Preliminary Estimates." The USGS estimates indicate that 62 million tons of tailings containing 880,000 tons of lead and more than 720,000 tons of zinc were discharged to streams prior to 1968. As documented in the FS, these historic releases of metal-rich tailings have mixed with Basin sediments to create a present condition with hundreds of millions of tons of tailings-impacted, metal-rich sediments in the floodplains (including wetlands and lakes) of the Basin and Coeur d'Alene Lake. The 2001 USGS Open-File Report 01-140 "Lead-Rich Sediments, Coeur d'Alene River Valley Idaho: Area, Volume, Tonnage, and Lead Content," provides detailed estimates for lead. EPA's RI/FS Technical Memorandum (Revision 3) "Estimation of Background Concentrations in Soils, Sediments, and Surface Water in the Coeur d'Alene and Spokane River Basins" makes clear that metal concentrations from natural sources are small fractions of the existing concentrations in mining-impacted soils, sediments, and surface water.

3.5 REMEDIAL INVESTIGATION/FEASIBILITY STUDY

3.5.1 Scientific Adequacy of RI/FS, Including Risk Assessments, Versus Need for Independent Study

Comment Summary:

Some comments questioned the scientific adequacy of the RI/FS, including the risk assessments, and called for an independent study of the Basin to determine what remedy is warranted.

EPA response:

EPA's conduct of the Basin-wide RI/FS is governed by and was consistent with CERCLA and the NCP. The findings are based on accepted scientific and engineering principles. The RI/FS was reviewed by a wide variety of stakeholders, including federal, state, tribal, local, and community entities. As described in detail in Section 3.0 of Part 2 of the ROD, EPA has provided a wide range of opportunities for community participation in the investigation and remedy selection processes within the Coeur d'Alene Basin. The RI/FS had a "full, scientific review" and EPA is confident that it is scientifically defensible.

The Idaho congressional delegation has requested that the National Academy of Sciences (NAS) review the scientific and technical analyses that form the basis of the Selected Remedy. EPA will cooperate fully with any NAS review and will seriously consider new information or recommendations resulting from a review. If EPA determines that substantial changes to the ROD are appropriate based on the NAS recommendations, such changes would be subject to additional public review and comment.

3.5.2 Adequacy of Data Collected During RI/FS to Select and Design Remedy

Comment Summary:

Some comments questioned whether sufficient data were available to select a remedy.

EPA response:

More than 10,000 samples were collected to support the RI/FS. These samples, combined with the 7,000 additional samples collected by IDEQ, USGS, the mining companies, EPA under other regulatory programs (e.g., the National Pollutant Discharge Elimination System), and others, provide a solid basis to support informed risk management decisions for Coeur d'Alene Basin mining waste contamination. EPA has made data available to the public through its website, reports, public repositories, meetings, and specific requests.

Section 300.430 of the NCP sets out the process that EPA follows when conducting a remedial investigation and feasibility study and selecting remedies. Section 300.430(d) provides that "[T]he purpose of the remedial investigation (RI) is to collect data necessary to adequately characterize the site for the purpose of developing and evaluating effective remedial alternatives." Section 300.430(e) provides that "[T]he primary objective of the feasibility study (FS) is to ensure that appropriate remedial alternatives are developed and evaluated such that relevant information concerning the remedial action options can be presented to a decision-maker and an appropriate remedy selected."

Once a remedy is selected in a ROD, the process moves into the Remedial Design phase, followed by implementation in the Remedial Action phase. Where necessary, additional data are collected to support design of the remedy. Data collected during the RI/FS are not intended to be sufficient to provide all necessary data to fully design the Selected Remedy. This principle is recognized in the NCP and in EPA guidance, and is common in implementing CERCLA remedies nationwide. Hence, the anticipated need for additional design data to implement the Selected Remedy is not unique to the Coeur d'Alene Basin.

3.6 REMEDY EFFECTIVENESS AND IMPLEMENTATION ISSUES

3.6.1 Remedy Effectiveness Estimates for Surface Water Quality

Comment Summary:

Some comments questioned EPA's estimates of post-remediation metal loadings and concentrations in Basin surface water and raised specific questions regarding the effect of possible metal loading to surface water from precipitated zinc in aquifers or from deep groundwater not associated with identified mining sources.

EPA response:

Quantitative estimates of post-remediation dissolved metal (zinc) loadings and concentrations in Basin surface waters upstream of Coeur d'Alene Lake are the subject of EPA's RI/FS Technical Memorandum "Probabilistic Analysis of Post-Remediation Metal Loading." Recognizing the inherent uncertainty in post-remediation conditions, these estimates were based on a rigorous probabilistic approach that quantified the uncertainty consistent with available information. In particular, the potential loadings from precipitated zinc in deep aquifer material and from deep groundwater not associated with identified mining sources were quantified, to the extent practical, and conservatively assumed to be unreduced by remedial action.

The probabilistic approach was used to predict aggregate effects associated with the Preferred Alternative upstream of the lake, as presented in EPA's RI/FS Technical Memorandum "Interim Fishery Benchmarks for Initial Increment of Remediation in the Coeur d'Alene River Basin." The ROD discusses how these probabilistic results were used to support the Selected Remedy. The probabilistic analysis provides one sound technical basis to support the Selected Remedy that is consistent with the CERCLA statute and the NCP.

To date, the probabilistic analysis has not considered the interactive effects of relevant processes in Coeur d'Alene Lake or effects of flooding events, and so is not applicable to conditions along the Spokane River. Enough information regarding the Spokane River does exist, however, to develop and support the Selected Remedy.

3.6.2 Remedy Performance for Ecological Protection

Comment Summary:

Many comments expressed concern regarding the ecological protectiveness of the Selected Remedy, including questions of long-term performance, recontamination, and the role of potential new technology.

EPA response:

As explained in the ROD, within its scope, the Selected Remedy protects human health and the environment from the exposure pathway or threat it is addressing and the waste material being managed. The effectiveness of the Selected Remedy in improving surface water quality has been estimated to the extent practical given existing information. EPA recognizes that after the selected remedial actions are implemented, conditions in the Upper Basin and Lower Basin may differ substantially from EPA's current forecast of those future conditions, which is solely based on present knowledge. Although no ARAR waivers are being invoked at this time, the additional knowledge that will be gained by the end of this period through long-term monitoring and five-year review processes may provide a basis for ARAR waivers in the future. In addition, this new information and advances in science and technology may allow for additional actions to achieve ARARs and fully protect human health and the environment in a more cost-effective manner.

EPA also recognizes that recontamination is a major factor affecting ecological protectiveness, particularly in the Lower Basin. The Selected Remedy was developed recognizing that a majority of Lower Basin sediments contain lead concentrations posing a risk to ecological receptors. One of the criteria used to select wetland areas for remediation was relatively low potential for recontamination during flood events. Remedies implemented in the Upper Basin and beds and banks in the Lower Basin are expected to reduce lead in sediments that may be deposited in wetland units during future floods. Additionally, ongoing performance evaluation of remedial efforts will provide useful data for refining remedies. EPA will review this information during implementation of the Selected Remedy, including during five-year review cycles, to determine the need for and the priority of remedies, not currently described in the ROD, that may be appropriate in the future.

EPA also recognizes that development of new remedial technologies that are potentially more cost-effective and have fewer short-term impacts than conventional technologies is an important potential benefit of the adaptive management approach. Examples of efforts to develop new technologies include ongoing pilot studies of chemical treatment of soil in the Lower Basin and planned studies of passive treatment of surface water in Canyon Creek.

3.6.3 Estimated Times to Achieve AWQC and the Role of Natural Recovery

Comment Summary:

Some comments questioned EPA's estimated time period to achieve water quality standards, with some believing this supports doing more now and some believing this supports doing much less and relying on natural recovery.

EPA response:

The Selected Remedy for protection of the environment in the Upper Basin and Lower Basin will result in substantial reductions of exposures of humans and ecological receptors to metals in the areas the remedy addresses. Full protection of human health and the environment will not be achieved until the final remedy is implemented. The anticipated benefits of the Selected Remedy are described in Sections 12.1.3, 12.2.3 and 12.4.3 of the ROD.

The time needed to achieve overall cleanup goals, including AWQC and risk-based sediment cleanup goals, will be lengthy and require a period of natural recovery for all alternatives. The probable time period decreases with the aggressiveness and completeness of the alternative. These differences in time to achieve water quality standards are described in Section 10.2 of the ROD.

In EPA's experience at complex sites such as in the Coeur d'Alene Basin, the expectation that considerable time will be necessary to achieve cleanup is not uncommon. For such complex sites, EPA typically examines the magnitude and extent of contamination, selects and implements remedies, and then collects empirical data over time to examine the efficacy of the remedies. Once sufficient data are available, an analysis is conducted to determine if ARAR waivers are appropriate. Although it is possible that such future data may indicate that ARAR waivers are appropriate in the Coeur d'Alene Basin, it is not appropriate to attempt to invoke them now.

Benefits to aquatic life begin much sooner than when AWQC are finally met. As remedies are implemented, resulting in reduced metals concentrations, aquatic conditions begin to improve and benefits accrue as concentrations drop further over time. Such benefits will occur much sooner with the more aggressive alternatives (i.e., Ecological Alternatives 3 and 4). As graphed on Figures 10.2-3 and 10.2-4 of the ROD, water quality conditions at completion of remediation (Time 0 on the graphs), as represented by multiples of AWQC, will be considerably better under Ecological Alternatives 3 and 4 than the other alternatives. Although the resulting conditions will not be fully supportive of aquatic life, the reduced dissolved metals concentrations will allow a substantial improvement to the fisheries and ecosystem, as described in more detail in Section 12 of the ROD and the "Interim Fishery Benchmarks Technical Memorandum" (URS 2001d). The population and species diversity of fish and aquatic organisms will continue to improve as cleanup progresses in the Basin.

Differences between the alternatives in anticipated benefits are not restricted to time to achieve water quality standards. Section 10.2 of the ROD also describes the differences between the alternatives in their anticipated effects on impacted sediments in the Basin, and presents a comparative analysis which supports Ecological Alternative 3 as the best balance of tradeoffs for a long-term cleanup approach in the Upper Basin and Lower Basin.

Overall, the Selected Remedy would be expected to achieve about 50 to 70 percent of the dissolved metals load reduction in the Upper Basin (above Pinehurst) that would be anticipated from full implementation of Ecological Alternative 3 for about 19 percent of the estimated cost of Ecological Alternative 3.

3.6.4 Idaho TMDL for the Coeur d'Alene Basin

Comment Summary:

Some comments questioned the relationship of Idaho total maximum daily loads (TMDLs) to the Selected Remedy.

EPA response:

The TMDL establishes waste load allocations for discrete point sources and load allocations for non-discrete sources. It has long been recognized that non-discrete sources are the primary sources of metals in surface water in the Basin. The CERCLA remedial process was identified as the most effective tool for addressing these non-discrete sources. In September 1996, the United States District Court for the Western District of Washington ordered EPA and the State of Idaho to develop a schedule for completion of TMDLs for all water quality impaired streams identified by the State, including the Coeur d'Alene River Basin. TMDL development was initiated in 1998. In August 2000, a TMDL for dissolved cadmium, lead, and zinc in surface waters of the Basin was jointly released by EPA and the State of Idaho. On September 4, 2001, a state court judge for the State of Idaho invalidated the TMDL on the procedural grounds that the IDEQ had not engaged in formal rulemaking when adopting the Basin TMDL. The impact of this court decision on TMDL implementation is currently unclear, and the final status of the TMDL has not yet been determined.

3.6.5 Relationship of Forest Management Practices to Recontamination and Water Quality

Comment Summary:

A number of comments noted the relationship between forest management practices on national forest land in the North Fork Coeur d'Alene River watershed and the magnitude of flood events, particularly those caused by rain-on-snow events. These comments stated that large flood events result in erosion of large amounts of lead-contaminated sediment from the beds, banks, and floodplains, particularly in the Lower Basin. The large lead loads carried by the river during these events can result in recontamination of floodplain areas and have resulted in temporary exceedances of the lead drinking water standard in Coeur d'Alene Lake.

EPA response:

Remedial actions for effects unrelated to releases of hazardous substances, such as deforestation effects associated with logging practices or development, are not addressed by CERCLA unless such effects contribute to a release of hazardous substances or potentially compromise the effectiveness of an implemented response action.

EPA evaluated the Basin on a watershed level, therefore, the potential effects of sediment movement associated with North Fork discharges (and other sources) were considered in developing the RI/FS and the Selected Remedy. The available database used to develop the Selected Remedy includes loadings in the Coeur d'Alene River, including loadings to Coeur d'Alene Lake, during high flow events (including rain-on-snow events) that reflect large discharges from both the North Fork and the South Fork. To increase the available database, further field data are being collected on extreme flow events (including rain-on-snow events) by USGS as part of ongoing monitoring for the Coeur d'Alene Basin cleanup. Additional data will likely be collected as part of (post-ROD) remedial design. The collective data—including data from the USGS, COE/FEMA, and USFS—will be analyzed and interpreted during remedial design to implement the remedy selected in the ROD.

EPA anticipates that the Lake Management Plan will include measures intended to reduce sediment loading resulting from timber harvesting. EPA will consult with state and federal agencies on timber harvest activities in the North Fork to reduce the likelihood of adverse effects on proposed cleanup activities.

3.6.6 Long-Term Protectiveness and Permanence of the Remedy

Comment Summary:

A number of comments expressed a concern over the long-term protectiveness of the remedy and a preference for more permanent solutions, such as removals. A few comments questioned the long-term reliability of synthetic liners used in waste containment systems.

EPA response:

The long-term effectiveness and permanence of remedial actions is one of the criteria EPA weighs when selecting remedial actions. Using permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable is a statutory requirement for remedies selected under CERCLA. When weighing capping of contaminated materials in place against a potentially more permanent remedy, such as disposal in an engineered repository, EPA considers several factors, including the long-term maintenance requirements of capping, the potential for recontamination, and cost. In some cases, the long-term maintenance requirements of capping can be reduced by consolidating the material above the flood elevation. The decision to cap or remove waste materials will be made during remedial design on a site-by-site basis.

The synthetic liners available today are highly effective at isolating contaminated waste, if installed properly. The remedial design will include development of quality assurance requirements for proper installation of liners and other remedy components.

3.6.7 Scope of Lower Basin Sediment Removal

Comment Summary:

A number of comments called for increased removal of impacted sediments in the Lower Basin. Some of these comments cited the potential for adverse effects to waterfowl and the potential for recontamination of downstream areas from these sediments.

EPA response:

The Selected Remedy is focused on cleaning up the highest priority upstream sources. The remedy includes removal of up to 2.6 million cubic yards of some of the most highly contaminated riverbed sediments. These sediments are located in the area around Dudley, where the gradient of the main stem of the Coeur d'Alene River flattens and fine-grained sediments containing relatively high concentrations of metals are deposited. EPA and stakeholders elected not to include more extensive riverbed removal because of the following considerations:

- Beginning with smaller scale removals to refine cost-effective sediment removal or management techniques

- Confirming that removal can be conducted in a manner that is compliant with ARARs and will not exacerbate lead movement downstream

- Uncertainty regarding repository capacity for disposal of the contaminated sediment removed from the river beds

- Limiting the area of removal work to natural sediment deposition areas, thereby limiting the effects of potential recontamination and the effects on boating activities, while enhancing cost-effectiveness

- Insuring that the entire depth of contaminated sediment is excavated at the selected location(s) to eliminate the potential for adverse impacts as a result of exposing deeper, more contaminated sediments than those present on the surface of the river bed

Implementation of the Selected Remedy will provide additional safe feeding area for waterfowl and other animals through a combination of removals and capping in Lower Basin wetlands and lateral lakes. Cleanup of some areas currently used for agriculture is also anticipated to provide additional safe feeding area. In total, about 4,500 acres of safe waterfowl feeding areas could be provided by the cleanup actions taken under the Selected Remedy. Implementation of the Selected Remedy will help determine what additional actions are warranted.

3.6.8 Scope of Remedies for Water Quality and Fish Habitat

Comment Summary:

A number of comments expressed the concern that EPA could be doing more to restore water quality and fish habitat in the watershed.

EPA response:

The Selected Remedy contains actions to reduce the concentrations of dissolved metals, particularly zinc and cadmium, that adversely affect fish. It is estimated that the amount of dissolved zinc entering the river system will be reduced by 580 pounds per day. This represents 26 percent of the zinc load from Basin sources outside of the Bunker Hill Box. Monitoring of the Selected Remedy will help determine what additional actions are necessary to further reduce zinc loadings. Additional improvements will result from remedial actions implemented within the Bunker Hill Box.

The Selected Remedy will result in improvements to fish habitat. In areas where stream and bank cleanups are conducted, stream and bank stabilization will also be conducted. Where feasible, bioengineering stabilization techniques will be used. Bioengineering techniques use natural materials such as large woody debris, native vegetation, and biodegradable materials to protect riverine and riparian areas from flood damage and erosion. Use of these techniques is anticipated to result in improved fish habitat. Areas where cleanup and stabilization will occur under the Selected Remedy include the East Fork of Ninemile Creek, Pine Creek, the South Fork, 33 miles of banks along the lower Coeur d'Alene River, and the Spokane River, including critical habitat areas.

3.6.9 Siting and Design of Repositories for Material Generated by Cleanup Activities

Comment Summary:

Some comments questioned how many repositories will be required as a result of this ROD.

EPA response:

EPA anticipates that the implementation of the remedy will require the construction of several mine-waste repositories for the disposal of metals-contaminated soils, sediments, source materials, and treatment residuals. The estimated volumes of material that may require excavation and disposal are about 500,000 to 900,000 cubic yards in the Upper Basin and about 3,900,000 cubic yards in the Lower Basin (including up to 2,600,000 cubic yards of river bed sediments, approximately 500,000 cubic yards of river bank and splay material, and approximately 800,000 cubic yards of wetland and lateral lake sediment).

The number and size of repositories to accommodate the estimated volumes will be determined during the Remedial Design Phase. It is anticipated that some of the repositories will be small and some will be larger. Some will be used to service nearby cleanup projects (i.e., local repositories) and some will be able to service area-wide cleanup efforts (i.e., regional repositories). All disposal locations will be evaluated using the same process and criteria identified in Section 12.5 of the ROD. All locations will also be subject to long-term institutional controls and monitoring, if necessary, to ensure the integrity of the remedy.

Comment Summary:

Some comments questioned how repositories would be sited and designed.

EPA response:

EPA anticipates that a four-step process will generally be used to evaluate potential repository locations and specify design requirements. (1) A list of potential repository sites for further evaluation will be prepared in conjunction with local governments, property owners, and other Basin stakeholders; (2) A technical evaluation for each specific site will be performed to assess basic environmental and engineering issues; (3) Concurrent with the technical evaluation, a public outreach effort will be initiated so that affected citizens are given an opportunity to comment on the proposed repository location and design; (4) Finally, a remedial design document for each specific site will be prepared that summarizes design requirements, waste acceptance criteria, and other key information associated with the short-term and long-term management of the repository. Repositories constructed pursuant to this ROD will be designed to reliably contain waste material and prevent the release of contaminants to surface water, groundwater, or air in concentrations that would exceed state and/or federal standards.

3.6.10 Treatment of Surface Water from Canyon Creek

Comment Summary:

Some comments questioned the feasibility or potential effectiveness of passive treatment of surface water from Canyon Creek, citing concerns about the availability of suitable sites with adequate size, the feasibility of treating relatively large flows (up to 60 cubic feet per second), the volume of treatment residuals that would be produced, the loads of metals in water that would bypass the treatment system during high flow periods, and the potential for recontamination of treated water after it is discharged into the South Fork Coeur d'Alene River. Other comments sought assurances that a conventional active treatment system would be constructed if the passive treatment system did not achieve metals removal goals. Finally, one comment questioned whether the levels of metals in the treatment system discharge would meet typical permit limits.

EPA response:

Each of the issues raised will be addressed during remedial design, which will include pilot testing to evaluate the effectiveness of passive water treatment. Passive treatment would only be implemented if the pilot testing demonstrates it will effectively remove metals from Canyon Creek water. Responses to the individual issues raised in the comments are presented in the following paragraphs.

Availability of suitable sites. Siting of the treatment facility or facilities will be accomplished during the remedial design phase and will consider public input. The land area required is anticipated to be about 5 to 10 acres. The facility or facilities would be located in areas of flat ground in the Woodland Park area or near the South Fork in the Wallace area. The facility would not be located immediately adjacent to the mouth of Canyon Creek.

One comment suggested the area needed would be about 4,000 acres, based on the size of a passive wetlands treatment system. Some passive wetlands treatment systems can require long retention periods to accomplish metals removal and hence require a relatively large area to treat a given flow. Passive treatment with reactive media typically does not require long retention periods, and hence a larger flow can be treated within a given footprint. Treatability testing will further evaluate the required retention times for the various passive treatment methods.

Feasibility of treating relatively large flows. The feasibility of treating relatively large flows (60 cfs) will be evaluated during remedial design using pilot studies. As stated in the ROD, "if passive treatment does not prove effective, alternative treatment and control systems to achieve the benchmark of at least a 50-percent reduction of dissolved metals loads would be evaluated. Alternative actions may be used based on an evaluation against CERCLA remedy selection criteria."

Volume of treatment residuals. The passive treatment would use a reactive medium, such as apatite, that does not generate the large amounts of sludge that are associated with conventional hydroxide precipitation-based treatment systems.

Loads of metals in water that would bypass the treatment system during high flow periods. The expected (estimated average) value of the dissolved zinc load in Canyon Creek after remedy implementation is estimated to be 234 pounds per day, a reduction of 322 pounds per day compared to the expected value calculated from surface water data collected from 1991 to 1999. The estimated load reduction is based on a design flow of 60 cfs and has taken into account the untreated peak flows and associated loads.

Potential for recontamination of treated water. It is recognized that additional metals are added to the South Fork as a result of surface water/groundwater interactions (i.e., river water infiltrates into the aquifer, dissolves metals associated with the solid phase of the aquifer, and returns to the river containing metals at higher concentrations). However, the re-dissolution of metals by treated water is not anticipated to negate the load reductions resulting from treatment. Geochemical modeling does not suggest that solid-phase zinc and cadmium control the concentrations of the metals in groundwater. Hence, there is no evidence that treated water in the South Fork that enters the groundwater system (which would be a fraction of the total treated water) would subsequently be discharged to the South Fork at the same concentration as it would had it not been treated.

Alternative treatment and control (including active treatment) systems. The benchmark for Canyon Creek is to reduce dissolved metals loads discharging from the creek into the South Fork by at least 50 percent. If passive treatment does not prove effective, alternative treatment and control systems to achieve the benchmark of at least a 50 percent reduction of dissolved metals loads would be evaluated. Alternative actions may be used based on an evaluation against CERCLA remedy selection criteria**.** At this time, it is noted that active treatment could potentially cost more than the $150 million estimated for source removals in Canyon Creek, and thus active treatment is not anticipated to be cost-effective for treating large surface water flows such as in Canyon Creek.

Levels of metals in the treatment system discharge. The expected (estimated average) value of the dissolved zinc load in Canyon Creek after remedy implementation is discussed above. The majority of the untreated load would not be in the treatment system discharge, but rather is associated with two other factors. First, peak flows of Canyon Creek (e.g., flows greater than a design flow of 60 cubic feet per second) would not be treated, and hence daily loads would be higher than average during peak flow periods. Second, depending on the siting of the treatment facility, a significant load associated with groundwater may not be intercepted or treated by the treatment system. The discharge requirements for the treated effluent are defined by the ARARs as outlined in Section 13 of the ROD for this point-source discharge.

3.6.11 Effects of Nonmining Impacts on the Environment

Comment Summary:

Some comments suggested that non-mining impacts (e.g. urbanization, transportation corridors, introduction of non-native fish species) have adversely affected the Basin environment and have not been taken into account by EPA.

EPA response:

The ROD is focused on the effects of historic mining activities on the environment of the Basin. These mining effects, which are substantial, are documented in the RI/FS (and supporting human health and ecological risk assessment reports) and summarized in the Proposed Plan and ROD. EPA acknowledged in its supporting technical documents that physical habitat conditions are limiting to fish and wildlife populations, and that non-mining related modifications of habitats for these species have had a significant effect. However, it is also apparent that secondary effects from mining-related metals contamination have also contributed to the degradation of physical habitat conditions in the Basin (e.g. metals can damage or eliminate vegetation, which promotes erosion and destroys habitat). Such degradation falls under the purview of CERCLA and was considered in the Selected Remedy.

3.7 SELECTED REMEDY FOR HUMAN HEALTH

3.7.1 Development of the Human Health Selected Remedy and EPA National Guidance

Comment Summary:

Some comments, many from the areas where residential cleanups may be conducted, questioned the basis for the selected human health remedy and EPA's determination that human health cleanup activities should be initiated in the Basin. These comments included questions about the use and effectiveness of the model EPA uses to determine site-appropriate soil cleanup levels for residential areas (the IEUBK model).

EPA response:

The Selected Remedy for human health was developed in a manner consistent with EPA's *1994 Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities* and the 1998 clarification to the 1994 Guidance (USEPA 1994a, 1998a). These documents describe a strategy for managing lead contamination at CERCLA sites that have multiple sources of lead. The guidance also recommends use of the Integrated Exposure Uptake Biokinetic (IEUBK) model and blood lead studies and ways to determine appropriate response actions at residential lead sites.

Using the IEUBK model. The IEUBK model is the best available tool for predicting blood lead levels in children exposed to lead in the environment. EPA's guidance also recommends the "evaluation of blood lead data, where available," but suggests that "blood lead data not be used *alone* to assess risk from lead exposure or to develop soil lead cleanup levels," recognizing that blood lead levels below 10 µg/dL are not "necessarily evidence that a potential for significant lead exposure does not exist or that such potential could not occur in the future." The guidance indicates that cleanup actions should be designed to address both current and potential future risk, and that actions should be taken to limit exposure to soil lead levels such that a typical child or group of similarly exposed children would have an estimated risk of no more than 5 percent of exceeding a 10 µg/dL blood lead level. Under a Memorandum of Agreement, the State of Idaho took the lead in preparing the Basin Human Health Risk Assessment (HHRA) and developed the HHRA in a manner consistent with these EPA guidance documents (USEPA 1999a).

While EPA guidance documents are not binding and do not represent final agency action, national guidance is generally followed unless facts or circumstances related to a particular matter indicate compliance with the guidance is inappropriate. EPA guidance documents provide a recommended decision framework for EPA staff and consistent application of these recommendations helps provide greater certainty to the EPA and its stakeholders, including the regulated community. Based on the totality of circumstances, EPA believed it was appropriate to follow national guidance in developing the Basin HHRA.

EPA and IDEQ used the IEUBK model to assist in evaluating human health risks in the Basin for several reasons. Because EPA focuses on preventing elevated blood lead levels in children, EPA believes it is necessary to use a tool that predicts blood lead levels in children exposed to lead in the environment. The IEUBK model is the best tool currently available for this purpose and it has been peer reviewed by the EPA Science Advisory Board (SAB), an independent panel of scientific experts. The SAB concluded that the model approach is sound. EPA is not currently aware of an alternative tool that can be used for a similar purpose, and during the course of the RI/FS, the HHRA, and the remedy selection process (including the associated public comment periods) no alternative was identified. In addition, exposure conditions in the Box and Basin are similar and a substantial database on lead exposure and its subsequent effects in children is available from many years of cleanup in the Bunker Hill Box. The amount of data related to lead exposure and its subsequent effect in children is unique to the Bunker Hill site. Therefore, the Box database was used to calibrate the IEUBK Model, and the calibrated model (referred to as the Box Model) was used in the Basin HHRA. The Bunker Hill Box database is large enough and sufficiently representative of environmental conditions and characteristics of the exposed population to provide a sound basis for the Box Model.

Basin Selected Remedy Compared to Box Record of Decision. The recommendations in the 1994 and 1998 EPA guidance were used to develop the Selected Remedy in this ROD, as compared to the Selected Remedy in the 1991 residential soils ROD for the Bunker Hill Box (USEPA 1991a). The Selected Remedy in the 1991 ROD included a community blood lead goal of no more than 5 percent of children in each community exhibiting a blood lead level greater than 10 µg/dL and less than 1 percent exhibiting a blood lead of 15 µg/dL or greater. This approach was consistent with EPA national policy at that time (USEPA 1989b). In more recent guidance, EPA recommends that risks be assessed at lead-contaminated residential sites using an exposure unit defined as the individual residence and other areas where routine exposures are occurring. Accordingly, the Selected Remedy focuses the response actions on the individual property level to reduce lead exposure pathways, such as soil and dust, and ensure that a typical child has no more than a 5 percent risk of exceeding a 10 µg/dL blood lead level. This approach, by targeting cleanup actions at the individual property level, ensures cleanup of all contaminated residential properties in a community, thereby protecting current as well as future residents.

This difference in approach does not substantially change the soil cleanup strategy (both remedies include partial soil removal for lead soil concentrations above 1,000 mg/kg); however, it does affect the way that annual blood lead screening results are evaluated. While the 1991 ROD includes a community-level blood lead goal for children, the Selected Remedy in the Basin ROD is based on reducing lead exposure pathways to reduce risks to children at the individual property level.

3.7.2 Use of Blood Lead Observations in the HHRA and Development of the Proposed Plan

Comment Summary:

Several comments refer to the use of blood lead screening results from the Panhandle Health District's Lead Health Intervention Program to assess or characterize lead health hazards in the Basin. Most of the comments refer to the nonrepresentative nature of the blood lead screenings with respect to the overall population of the Basin, and question the appropriateness of using blood lead observations in the site-specific analysis.

EPA response:

The HHRA takes great care to discuss the limitations of the blood lead observations in the Basin for uses in the risk assessment, including representativeness of the results, sampling bias, and the potential effect of intervention on blood lead levels. Blood lead observations from the Basin were used in the HHRA (1) to characterize age-related and geographic patterns of blood lead concentrations among the population sampled, (2) to compare IEUBK Model predictions to observed blood lead concentrations, and (3) in site-specific quantitative analysis to evaluate relationships between environmental lead levels and blood lead levels. These uses do not depend on the blood lead concentrations being statistically representative of the Basin population as a whole.

National EPA guidance, issued in 1994 and 1998, recommends evaluation of blood lead data but does not recommend that these data be used alone when assessing risk from lead exposure or developing soil lead cleanup levels. The guidance recognizes that blood lead levels below 10 µg/dL are not necessarily evidence that a potential for significant lead exposure does not exist or that such potential could not occur in the future. The HHRA, consistent with national guidance, evaluated the blood lead screening results in conjunction with environmental sampling data, and follow-up investigations performed under the Lead Health and Intervention Program (LHIP) by the Panhandle Health District (PHD).

Observed blood lead levels used in the HHRA were obtained from the PHD annual screening program, which is conducted as a public health service to Basin residents. PHD uses the annual screening results to provide advice and assistance to families with children exhibiting elevated blood lead levels. These screening efforts are not intended as a research investigation. Individuals were not randomly selected nor were they compelled to participate in a study. It has been State policy for the last three decades to conduct blood lead screenings to identify individual children with elevated blood levels and to provide follow-up intervention services to identify and reduce lead exposure pathways. The Idaho Department of Health and Welfare has not supported blood lead studies for the purpose of acquiring population-based data for academic or experimental purposes. Instead, the State prefers to offer the voluntary program as a service to families with young children. In the past, research studies met with resistance from local families, which reduced participation in screening and cooperation in follow-up programs. As a result, risk assessment and health assessment analysis is limited to the screening results of the voluntary participants and must operate within the constraints of the overriding health response priorities. Nevertheless, used within these limitations, these data have been useful in characterizing lead exposure pathways and developing the Selected Remedy described in the ROD.

Information from the Bunker Hill Box also was used in the HHRA. Paired environmental and blood lead observations collected from the Bunker Hill Box were analyzed to calibrate the IEUBK Model. The calibrated model, referred to as the Box Model, was subsequently used in the Basin HHRA to assess lead risks and to develop the lead soil action levels described in the ROD. The Bunker Hill Box data spanned 11 years, included more than 4,000 pairs of blood and environmental results, and have represented more than 50 percent of all children residing in the Box during every year, since 1988. The Bunker Hill Box database is large enough and sufficiently representative of environmental conditions and characteristics of the exposed population to provide a sound basis for the Box Model.

Participation rates in the Basin annual blood lead screening have not been as high as those in the Box. This may be due to a number of factors, including the absence of door-to-door solicitations in the Basin. It is estimated that there are between 1,000 and 1,100 children from 9 months to 9 years of age in the Basin area. In 1999, the most successful year for participation, 272 children or approximately 25 percent of eligible children participated with a $40 dollar payment ($20 each from the state and local mining companies). In other years, with payments limited to $20, fewer than 20 percent of eligible children participated.

Different opinions have been expressed regarding potential selection bias in the annual screening results. One argument suggests the incidence of elevated blood lead levels is biased low because families who participated were more likely to be attentive to lead health concerns and were more likely to have benefited from the LHIP's assistance in helping parents reduce exposures in the home. A counter argument suggests the incidence of elevated blood lead levels is biased high because the financial incentives for participation favored economically-disadvantaged families, and poverty is generally associated with higher than average blood lead levels. Others requested that the socio-economic co-factors and environmental exposures describing the sampled population be compared to the overall population. The environmental data were compared in Table 3.7-1 and results indicate that the environmental lead concentrations for participants in the 1996 to 1999 blood lead screenings are similar to those of the general population. There is not, however, a complete socio-economic database for Basin children that would allow for a comparison of risk co-factors. An additional consideration is the geographic representation of participants in the blood lead screening program. In recent years, areas with higher lead health risks have been under-represented in the screenings. Whether biased high or low, selection bias relates to behavior of the participants and not the environmental conditions in which they reside.

The HHRA did not draw a conclusion relative to these different viewpoints, as there are not sufficient data to test the competing hypotheses. These issues are discussed in Sections 6.2.2 and 7.4.1, 8.8, and 8.11.2 of the HHRA. As a result, the screening results must primarily be interpreted as information regarding the children and families who desired screening and it may, or may not, be representative of the majority of children who did not participate in the screening programs. In any case, questions of the representativeness of the blood lead screening observations to blood lead concentrations in the population as a whole are largely irrelevant since the data demonstrates that there is a serious risk to the health of the people who exhibit elevated blood lead levels and a clear need to address excessive lead exposure pathways.

Several individuals also questioned the use of repeat blood lead measures in the batch mode runs for the paired data. That is, blood lead levels from the same child in successive years were included. All available observations were utilized in the model runs presented in the HHRA, as was used in the site-specific quantitative analysis. Similar runs also were accomplished using only the initial observation for each child. Both runs, with and without repeat observations, are summarized in Tables 3.7-2a and 3.7-2b (children ages 9 to 84 months), 3.7-3a and -3b (children ages 9 to 60 months), and 3.7-4a and -4b (children ages 9 to 24 months). The analysis showed similar results regardless of whether the repeat observations were included.

3.7.3 The 2000-2001 Lead Health Intervention Program Blood Lead Screening Results

Comment Summary:

Several comments questioned the absence of a discussion of the 2001 annual blood lead screening results in the Proposed Plan, noting that the data indicate a substantial reduction when compared to the blood lead data from 1996 to 1999, which were used in the HHRA. These individuals also state that these apparent declines in blood lead levels call into question EPA's need to initiate human health cleanup activities in the Basin.

EPA response:

The 2001 annual Basin blood lead screening results were made available to EPA after it had issued the Proposed Plan in October 2001. EPA has included the 2000 and 2001 blood lead results in the ROD, and both EPA and the State of Idaho are encouraged by the improvements. However, as noted in Sections 3.7.1 and 3.7.2, data on blood lead levels do not demonstrate that a potential for significant lead exposure does not exist. Because of the limitations of the blood lead data (see response to 3.7.2 above), EPA considered several environmental factors and did not use blood lead data alone to develop the Selected Remedy for human health.

The apparent improvement in blood lead levels may be due to a number of factors including: intervention services to families with children identified as having elevated blood lead levels; cleanup actions at daycares, school, and homes occupied by young children; and the reduced participation in blood lead screening by families from areas with higher environmental lead exposures areas. There is no reason to believe that the reduction in blood lead is the result of any natural attenuation of the risks presented by lead contamination in the environment. The apparent success of previous efforts argues for continued intervention and cleanup efforts to further reduce the risks of lead in the environment.

The 1996 to 1999 blood lead results indicated that about 15 percent of children 6 months to six years of age tested had blood lead levels of 10 µg/dL or greater and 7 percent were greater than or equal to 15 µg/dL. In 2000 and 2001, 13 percent and 6 percent, respectively, of children had blood levels 10 µg/dL or more and 4 percent and 2 percent, respectively, had levels of 15 µg/dL or more. Annual screening results indicate that blood lead levels differ by age and geographic area, as shown in Tables 12.1-3 through 12.1-8 of the ROD and described in the HHRA.

The difficulties of extending the 2000-2001 results to the overall population remain the same as with previous years (discussed in Section 7.2), with some additional complications. These complications include less specific information regarding environmental exposures for these participants and significantly reduced participation by families from some geographic areas. For example, there has been a notable decline in participation among residents of the more contaminated residential areas east of Osburn, where mean blood lead levels remain higher than in the remainder of the Basin. Prior to 1999, 39 children were tested in the Burke/Ninemile area and 23 percent showed blood levels greater than 10 µg/dL and 15 percent were greater than 15 µg/dL. Since 1999, parents of only 3 children from these areas have availed themselves of testing. Another important factor that may affect blood lead screening results are the intervention activities and cleanup actions that have been undertaken in the Basin since 1996. Through 2001, the LHIP has provided follow-up investigations and consultation to families of 72 Basin children identified with elevated blood lead levels. As the total number of participants in the intervention program increases, more families will benefit from home visits that provide information to reduce exposures to lead. The continuing intervention efforts, through annual blood lead screenings, follow-up health programs, and public and school education efforts, have increased general community knowledge. Awareness of lead health issues also has increased since the release of the HHRA and the RI/FS, and residents may be exercising more care in their activities.

In addition to intervention activities, cleanup actions in Basin communities and residential areas have been conducted since 1997. Yard soils from ninety-one homes, resident to an estimated 150 to 200 children, have been remediated as part of EPA's high-risk removal program. Seven schools and six recreation areas have also been remediated as part of the removal program. As a result, nearly 20 percent of all children in the Basin and, at least the 5 percent at greatest risk of exposure, have received direct remediation and/or intervention. Twenty percent is a significant fraction of the children at risk, considering that only about 25 percent of the Basin residential yards are estimated to require remediation. The precise degree of exposure reductions or decrease in lead intake rates associated with these efforts have not been quantified, but experience in the Bunker Hill Box indicates that marked decreases in the percent of children with elevated blood lead levels followed introduction of the aggressive intervention program, common areas cleanup, and high-risk yard remediation programs. For example, in the first two years of the high-risk yard cleanup in the Box (from 1989 to 1991), the incidence of children with blood lead levels greater than 10 µg/dL was reduced from 52 percent to 20 percent in Kellogg and from 78 percent to 23 percent in Smelterville. However, while early intervention and removal actions contribute to reductions in blood lead levels, remediation of all contaminated properties is needed to ensure that children are protected from excessive exposures both now and in the future.

3.7.4 Lead Based Paint and the Relationship to House Dust and Blood Lead

Comment Summary:

Several comments raised concerns about the effect of interior lead-based paint on children's blood lead levels and stated that lead-based paint, not mine waste, is the primary source of lead in house dust.

EPA response:

The site-specific analysis in the HHRA found correlations between paint condition, paint lead content, soil lead, and dust lead with elevated blood lead levels in children (see HHRA Section 6.4.1). The HHRA analyzed the prevalence of elevated blood lead levels among children who were, or were not, exposed to a paint lead hazard (in the analysis, a hazard is defined as paint in poor condition with an X-Ray Fluorescence (XRF) loading of at least 1.0 mg of lead/cm^2). Of the 524 blood lead observations in children, 58 (11 percent) had blood lead levels greater than or equal to 10 µg/dL and 20 of these observations were associated with an XRF paint measurement. Analysis of these 20 observations revealed that 70 percent (14/20) of the children with elevated blood lead levels were not associated with an interior lead paint hazard and the remaining 30 percent (6/20) of the children were associated with an interior lead paint hazard. Thus, the majority of children with elevated blood lead levels (who resided in homes where paint was measured) were from homes without a lead paint hazard.

It is clear that children who live in the Basin and who have elevated blood lead levels tend to be exposed to significantly higher soil and dust lead concentrations and dust lead loading rates than children with blood lead levels less than 10 µg/dL. Measurements of lead loading rates have been obtained by placing a floor mat in the home's main entrance, retrieving the mat after a prescribed period of time, measuring how much dust and lead has accumulated, and adjusting the lead mass to a per area per day rate (mg of lead per m^2 of mat per day). The HHRA supports the conclusion that both lead paint sources and soils from the yard and community contribute to house dust lead and blood lead levels. However, lead in paint affects fewer children than lead in soil based on available data.

These findings are consistent with the follow-up reports from PHD nurses investigating children with elevated blood lead levels and results from other areas, including the Bunker Hill Box. Exposures were characterized in nearly all of the children identified with elevated blood lead levels during follow-up activities by the PHD. Potential paint exposures were noted for a few children, and housing renovation was recommended in a small number of cases. However, follow-up reports of children identified as having elevated blood lead levels continue to indicate that contaminated soils and dusts are the most significant sources for the majority of children.

Some commenters have criticized the use of repeat observations for the same children in successive years in the database used to assess the paint lead contribution. In developing the paint analysis protocol, EPA, IDEQ, and technical representatives to the mining companies agreed to maximize the number of observations in the analysis. Dr. Robert Bornschein, the consultant to the mining companies, recommended that a minimum of 150 observations be included in the analysis. Several potential combinations of exposure and response variables were considered. The largest available database was found to have 126 observations relating blood lead to select environmental variables. It was agreed to use this database, which included the repeat measurements of individuals to maximize the number of observations. Tables 3.7-5a and 3.7-5b show the analysis conducted with and without the repeat observations included. The analysis showed similar results regardless of whether the repeat observations were included.

3.7.5 Comparison of National Declines in Blood Lead Levels and Site-Specific Conditions

Comment Summary:

Several comments suggest that the declines in children's blood lead levels in the Silver Valley are the same as the national declines in blood lead levels and that, therefore, local declines cannot be attributed to the aggressive cleanup of contaminated residential areas.

EPA response:

The State of Idaho compared blood lead levels collected in the Bunker Hill Box since 1974 with the results of the National Health and Nutrition Evaluation Surveys (NHANES) for the periods 1976 to 1994 (Pirkle et al. 1994; Pirkle et al. 1998; IDHW 2000b, 2001b). Because the NHANES studies were conducted over several years, the midpoint of each study period was used to compare results with the Bunker Hill Box and to compute the time elapsed between consecutive studies. Declines in blood lead levels from the Silver Valley have been substantially greater than declines in national averages. The national reduction in overall blood lead levels (i.e., geometric mean) was approximately 13 µg/dL from 1976 to 1999; the Bunker Hill Box data show a reduction of more than 30 µg/dL during the same period of time, as seen in Table 3.7-6.

3.7.6 Soil Lead Sampling and Particle Size

Comment Summary:

Some comments questioned the sampling method used to measure lead in soil for the HHRA. Specifically, some comments were critical of the use of soil samples sieved to 175 micrometer (80 mesh) and recommended the use of the larger 250 micrometer sieve (60 mesh) particle size, which has been recommended in recent EPA guidance, and other comments suggested a finer sieve used for sediment characterization by the U.S. Geological Survey in ecological/transport evaluations. Other comments suggested that the whole soil fraction should be used without sieving.

EPA response:

The 175 micrometer (μm) soil sampling technique used in the Bunker Hill Box and Basin was adopted in 1974 during the original lead health studies and has been used for all residential soil and dust samples collected in the Basin RI/FS. The procedure was developed to represent the size range of particles most likely to adhere to children's hands and be ingested during normal hand-to-mouth activities. The selection of this standard pre-dates recent recommendations from EPA. However, subsequent research has shown that this size-range represents inadvertent soil ingestion of particles most likely to adhere to skin (Driver et al. 1989; Kissel et al. 1996; Que Hee et al. 1985; U.S. Environmental Protection Agency Technical Review Workgroup for Lead, 2000). While some questions remain as to the precise size fraction to use in risk assessment protocols, the studies support an upper size-range limit between 150 and 250 μm. EPA recommendations currently identify 250 μm as a maximum particle size to standardize sieving techniques, but acknowledge that site-specific differences may exist (USEPA 2000e). In the absence of compelling evidence to support modifying the existing protocol, the State of Idaho has decided to continue using the under 175 μm size fraction to maintain consistency in risk characterization for the Bunker Hill Box and Coeur d'Alene Basin. EPA has concurred with the State's approach.

Evidence from other sites suggests that larger particle size fractions are likely to exhibit lower concentrations of lead and other metals (USEPA 1999e, 2000e). The HHRA analysis derived a site-specific dose-response by relating observed blood lead levels to paired soil and dust lead concentrations. This site-specific relationship was used to determine the proposed soil action levels. Assuming that any concentration effect due to sieving is proportional, use of a larger particle size (resulting in a lower soil or dust concentration) would have been compensated with an increased dose-response coefficient in the Basin analysis. That is, the per unit effect of soil or dust lead concentration on blood lead levels would have been greater. The reduced concentration of lead would have been interpreted as a higher bioavailability of soil and dust or a higher ingestion rate of soil and dust. EPA and the State believe that the same sieving methodology used historically to characterize soil and dust exposure and to develop the action levels should be used to implement the cleanup.

3.7.7 Bioavailability, Speciation, and the HHRA

Comment Summary:

Several comments refer to the chemical species of lead in Basin soils and suggest that the relationship between blood lead and lead in soils and dusts observed in the Bunker Hill Box is not applicable to the Basin. Some also suggest that Bunker Hill Box soil and dust contamination is predominantly lead oxide due to the smelter, that there was limited impact of smelter emissions "outside the Box," and that soil contamination in the Basin is lead sulfide due to mine-related activities releasing lead as native galena ore. Because lead sulfide has low solubility, these comments suggest that this lead cannot be dissolved in the digestive tract and is not absorbed by children. In addition, some commenters stated that EPA and the State of Idaho should have conducted site-specific swine studies and speciation analyses to support the Basin HHRA.

EPA response:

The State of Idaho and EPA have found no compelling reason to conduct swine studies and speciation analyses for the Basin HHRA due to the vast amount of site-specific historical emissions research and analyses relating environmental lead exposures to blood lead levels in the Silver Valley. Extensive review and analysis of information on historic emissions from the smelter and mining operations in the Silver Valley, including the smelter owners' own analyses, suggest that exposures in both the Bunker Hill Box and in the Basin are likely to be a mixture of lead oxides and lead sulfides. Analysis of airborne particulate in the 1970s indicate the ratio of lead oxides and sulfides in Basin and Box soils are of a similar average magnitude (von Lindern 1980; von Lindern 1982). It is unlikely that all smelter-related soil and dust lead is in an oxide form and equally unlikely that the soil and dust particles ingested by children, that originated as mining releases, are purely a sulfide form. This conclusion is consistent with the results of the mineralogical investigations conducted in EPA Region 8 (Casteel et al. 1996a, 1996b, 1996c, 1997a, 1997b, 1998, and 2001).

Results Summary of Swine Soil Bioavailability Studies Conducted at Other Lead Sites

The EPA Region 8 investigations concluded that samples from tailings, sulfide ore wastes, and surface soils had relative bioavailabilities (compared to lead acetate) ranging from 1 percent (un-weathered galena) to 90 percent for soil with iron manganese lead oxides (Casteel et al. 1996a, 1996b, 1996c, 1997a, 1997c, 1998, and 2001). The average relative bioavailability of all soils tested (15 samples from 9 sites) was approximately 60 percent (USEPA 1999e).

The bioavailability results were reported as relative to a lead acetate control standard. Relative bioavailabilities are computed as the ratio of soil bioavailability to lead acetate bioavailability. Standardizing results to lead acetate facilitates comparisons of study results from different sites. A relative bioavailability of 60 percent equates to the default bioavailability values used by the IEUBK for soil and dust; this is equivalent to an absolute bioavailability of 30 percent (USEPA 1999e). For simplicity, bioavailability values discussed in the following paragraph refer to absolute bioavailability (e.g. the ratio of the mass of lead absorbed divided by mass of lead administered).

Derivation of Bioavailability at the Bunker Hill Box for the Basin Human Health Risk Assessment

In the Bunker Hill Box, studies have evaluated concentrations of lead in soils and house dust and subsequent effects on children's blood lead levels for more than 20 years (Landrigan et al. 1976;

Yankel et al. 1977). The vast amount of data on children's blood lead levels in the Bunker Hill Box has provided valuable information about how exposure to lead in the environment is absorbed by children, as measured in their blood. This data includes more than 4,000 blood lead measurements taken every year (since 1988) for more than a decade from the majority of children living in the communities within the Bunker Hill Box. Each blood lead measurement was paired with available soil and house dust lead measurements from the homes of the children who participated in the annual blood lead screening. The availability of such a large number of blood lead measurements, combined with a large number of environmental samples, provides a complete picture of lead exposure and its impact on children. The amount of lead exposure data and its subsequent effect in children is unique to the Bunker Hill site. Typically, when the site-specific impact of lead on children is unknown, default average values for bioavailability are used in the IEUBK Model or bioavailability is estimated by feeding soil to juvenile swine and measuring its absorption into the blood (USEPA 1999e). Juvenile swine are believed to represent lead absorption in children better than other species or adult animals, but there is some uncertainty associated with using animal models for human inference (Mushak 1998; USEPA 1999e).

Extensive review and analysis of historic emissions data provided substantial information about lead speciation in the Silver Valley. Bioavailability is affected by the chemistry and physical state of lead that is being analyzed, and by the person (or animal) exposed. For example, lead sulfide is dissolved slowly by the digestive tract, which makes it difficult to be absorbed by the human body. In contrast, lead oxides are more readily absorbed by the human body and are, therefore, more bioavailable. Additionally, particles with more exposed lead at the surface are more bioavailable than particles with lead inclusions occurring beneath the surface (Brown et al. 1999). Children absorb lead more readily than adults and people who have fasted absorb more lead than people who have recently eaten (Maddaloni et al. 1998). Extensive analysis of dose-response relationships between soils/dust lead content and blood lead levels were conducted in the late 1980s, prior to the initiation of the soils cleanup in the Bunker Hill Box. These studies suggest that both the bioavailability of lead and the contribution to blood lead levels per unit of soil/dust lead concentration (i.e., dose-response) have been remarkably consistent throughout the last 25 years, both before and after the smelter closure (in 1980) and during remedial activities. No compelling evidence exists to indicate that these conclusions are not applicable to the Basin (USEPA 1989a; USEPA 1990a).

The studies of dose-response relationships observed in the Bunker Hill Box assumed a typical daily soil/dust ingestion rate of 100 mg and the estimated lead intake included air, diet, and drinking water. An absorbed dose (i.e., lead uptake rate, μg/day) was calculated that yielded the observed blood lead levels, assuming the biokinetic parameters estimated by Kneip (Kneip et al. 1983). The parameters estimated by Kneip are used in the IEUBK Model. The result was a coefficient relating the estimated lead intake and uptake that represents the lead bioavailability from soil/dust. By solving for bioavailability in this way, any errors in the estimates of soil/dust lead concentration or soil/dust ingestion rates would proportionally change the bioavailability estimate because the mass of absorbed lead is the product of the lead concentration in soil/dust, the ingestion rate of soil/dust, and bioavailability.

Therefore, if the lead concentration or ingestion rate is overestimated, then this calculation would underestimate bioavailability proportionally.

This approach was applied to the exposure and blood lead data collected in the Bunker Hill Box from 1974 to 1989, which yielded estimates of lead bioavailability that ranged from 14 percent to 18 percent. These estimates formed the basis for using a value of 14 percent for bioavailability in developing the 1,000 mg/kg individual yard and 350 mg/kg community geometric mean threshold cleanup criteria for residential soils in the Bunker Hill Box (USEPA 1991a). This analysis was updated with an estimate of the geometric mean bioavailability (18 percent) for the data collected from 1988 to 1998. This value was used in the Five-Year Review of the Bunker Hill Box, and was the basis for the 18 percent value in the Box Model used in the Basin HHRA (IDHW 2000b, 2001a). The bioavailability of soil and dust are discussed at length in the HHRA, HHRA Response to Comments, Appendix Q to the HHRA, the 1999 Five-Year Review for the Populated Areas of the Box, and the Extended Response to Comments for the Five-Year Review (IDHW 2000b, 2001a, 2001b; USEPA 2000f).

Distribution of Lead Minerals Based on Historic Smelter Emissions Data

The meteorological effects on the dispersion of smelter emissions were extensively studied by the smelter owners in their development of the supplemental control system (SCS) for the complex. The difference between upwind and downwind impacts in the Silver Valley was small and the impacted area extended beyond the Bunker Hill Box in both directions. In addition to smelter emissions, other significant sources of airborne lead included transport of ore, concentrates, and tailings and use of large-scale mechanized materials handling equipment. Passive fugitive dust sources included windblown dust from exposed surfaces and inactive storage piles. Geographic and terrain-related phenomena had important effects on the source strength and the dispersion and deposition of particulate lead. Estimates of various source impacts also were developed to assess potential compliance strategies for the smelter prior to the time of closure. These analyses showed that different sources were dominant at different locations. Combining the estimated relative impacts with the oxide/sulfide content of the sources results in an estimate of the relative constituency at various locations. Airborne lead levels were estimated to range from 57 percent to 72 percent oxides and 28 percent to 43 percent sulfides between Cataldo and Wallace (IDHW 2001a; von Lindern 1980; and 1982). The data indicate that the ratio of lead oxides and sulfides in historic airborne particulate matter was comparable among the Bunker Hill Box and Basin communities.

Processes Affecting Speciation of Tailings-Derived Lead Minerals

Other contaminant migration processes were operating to mix, redistribute, and abrade lead particulate in soils and dusts throughout the valley, including releases of mine and mill tailings.

Prior to 1968, large masses of mine-related releases were discharged to local streams or flood plain locations in predominantly lead sulfide form. However, oxidized ores were also likely released because milling and extraction practices were primarily designed to capture galena from sulfide ore. Oxidized lead minerals present in the original ores also were likely discharged to tributaries of the Coeur d'Alene River. These waste materials were redistributed by the river, flood events, construction activities, or mineral recovery operations. During movement and weathering, the lead in mill tailings was subject to physical and chemical transformation through abrasion, pH changes, and exposure to the atmosphere and aerobic hydrologic environments. These conditions promoted decreased particle size and increased surface area, and enhanced oxidation and the transition from lead sulfide to oxidized species. As an example of the large quantity of lead released into the environment, between 48,000 and 90,000 tons of lead were removed from the 300-acre Smelterville Flats area in 1998 and 1999 (IDHW 2001b).

These transformation processes are important for lead sources of greatest concern to children's exposure. The soil and dust particles that adhere to skin are generally small, in the <150 micron range, and more available for ingestion because of frequent hand-to-mouth activity (Driver et al. 1989; Kissel et al. 1996). That is, smaller particles adhere to hands and are more likely to be ingested. Lead in mine tailings can occur as complexes adsorbed on particle surfaces, which are potentially more bioavailable than the underlying lead bearing minerals which may be otherwise poorly soluble (Brown et al. 1999). Common oxidation products of galena (lead sulfide PbS) include cerussite (lead carbonate $PbCO_3$), hydrocerussite ($Pb_3(CO_3)_2(OH)_2$), anglesite (lead sulfate $PbSO_4$), lead-bearing jarosites (iron hydroxy sulfates), and lead-bearing iron oxyhydroxides (Roussel et al. 2000). Weathering, which increases with surface area, favors oxidation products which can become more bioavailable over time compared to galena (Roussel et al. 2000).

In summary, the ratio of lead oxides and sulfides in Basin and Box soils are likely similar. It is unlikely that all smelter-related soil and dust lead is in an oxide form and equally unlikely that the soil and dust particles ingested by children, that originated as mining releases, are purely a sulfide form (Brown et al. 1999; von Lindern 1980; and 1982). This conclusion is consistent with the results of micro-probe analyses studies conducted in EPA Region 8 (Casteel et al. 1996a, 1996b, 1996c, 1996d, 1997a, 1997c, 1998, and 2001). Several tailings and sulfide ore wastes were found to be bioavailable. The results of the investigations suggest that the average (absolute) bioavailability ranged from 1 percent to 45 percent with the average of all wastes and soils tested being consistent with the 30 percent bioavailability default value used by EPA (USEPA 1999e). The 18 percent used in the Basin HHRA is on the low side of bioavailability observed across the range of potential sources and should be regarded as a minimum. The true value could be higher if ingestion rates are less than the IEUBK default or if lead concentrations in the 175 μm size fraction are biased high relative to the 250 μm size fraction.

3.7.8 Subtle Health Effects of Lead Exposure

Comment Summary:

Several comments expressed the opinion that there have been no observed cases of lead poisoning in the Basin since the Bunker Hill Smelter closed in 1981 and consequently that no public health emergency exists in the Basin.

EPA response:

EPA and IDEQ agree that lead exposures in the Basin are not a public health emergency. The health effect of greatest concern at blood lead levels observed in the Basin is lead's potential to cause subtle neurologic developmental effects in children. These effects are based on systematic observations of groups of children and would not be visibly apparent in any individual child.

Lead induced neurological effects and decreases in intelligence quotient (IQ) have been affirmed by multiple consensus reviews undertaken by the EPA, the NAS, the Centers for Disease Control and Prevention (CDC), and the Agency for Toxic Substances Disease Registry (CDC 1991; NAS 1993; DHHS 1999; USEPA 1986). The 1993 NAS committee report states:

> *The toxic effects of lead range from recently revealed subtle, subclinical responses to overt serious intoxication. It is the array of chronic effects of low-dose exposure that is of current public-health concern and that is the subject of this chapter. Overt, clinical poisoning still occurs, however, and is also discussed here. We have several reasons for emphasizing low-dose exposure. As recently noted by (Landrigan, 1989), the subtle effects of lead are bona fide impairments, not just inconsequential physiologic perturbations or slight decreases in reserve capacity.*

Recognition of low-dose health effects of lead and the need for primary prevention is accepted among mainstream medical groups (see the American Academy of Pediatrics Statement at: <http://www.aap.org/policy/re9815.html> or the CDC Lead Prevention Fact Sheet <http://www.cdc.gov/nceh/lead/factsheets/leadfcts.htm>). Recent studies have suggested that clinical treatment (chelation therapy), which effectively lowers blood lead levels in treated children, is unable to prevent subtle neurological health effects (Rogan et al. 2001). Furthermore, subtle health effects may occur at blood lead levels below 10 µg/dL. Correlation and regression analyses of data on blood lead levels and various health outcomes point to a spectrum of undesirable effects that become apparent in populations having a range of blood lead levels extending upward from 10 – 15 µg/dL. These include effects on heme metabolism and erythrocyte pyrimidine nucleotide metabolism, serum vitamin D levels, mental and physical development of infants and children, and blood pressure in adults (Rothenberg et al. 1999; USEPA 1990a, 1990b; Wasserman et al. 1994). Although correlations between blood lead levels and various health outcomes persist when examined across a range of blood lead levels extending below 10 µg/dL, the risks associated with blood lead levels below 10 µg/dL are less certain (Schwartz 1994). More recent literature lends further support to the possibility of adverse consequence of exposures that result from blood lead levels below 10 µg/dL (Lanphear et al. 2000). Although excessive lead exposure has been shown to adversely affect neurological development, lead is not the only determinant of IQ. Research has suggested that a developmentally enriched environment can combat lead-induced deficits (Schneider et al. 2001).

3.7.9 Community Support for the Selected Human Health Remedy

Comment Summary:

Several comments suggested that there is widespread community opposition to the human health remedy.

EPA response:

A wide range of community leaders and local citizens have participated in the various public forums throughout the development of the Basin RI/FS and Proposed Plan and submitted comments during the extended public comment period. While some local citizens, including some elected officials and community leaders, have expressed their opposition to the cleanup plan for residential areas in public forums, others have expressed their support and, in some cases, have requested a more aggressive cleanup plan. EPA and the State of Idaho have found that many Basin homeowners, when presented with specific information about residential cleanup, are receptive to participating in cleanup programs.

For example, since 1997, EPA has been conducting removal actions to address lead exposures to young children and pregnant women in the Basin. The removal program is voluntary and EPA notified community residents about the soil and drinking water sampling that was available through the program. From 1997 to 2001, approximately 275 Basin residents contacted EPA to have their homes sampled for potential cleanup. Those homeowners who met the removal program criteria were sampled, and those homes that exceeded the lead soil action level and drinking water action levels (for homes on private wells) were remediated. From 1997 to 2001, soil at approximately 223 residential properties was tested and cleanup actions were conducted at 91 residential yards, 7 schools and daycares, and 6 recreational areas. Drinking water treatment, municipal hook-up, or bottled water has been provided to approximately 28 residences. These yard removals represent approximately 10 percent of the estimated total number of yards with lead concentrations greater than 1,000 mg/kg in the Basin. In addition, the high-risk yard removals have reduced exposures to a significant percentage of Basin children because this program was focused primarily on homes where children or pregnant women reside.

Similarly, in the fall of 2000, IDEQ commissioned a telephone survey of residents in Kootenai and Shoshone counties that found that 51 percent of those surveyed agreed that lead contamination in residential yards is a serious health problem, 29 percent disagreed, and 20 percent were undecided.

A total of 488 residents were interviewed. More recently, during the Spring of 2002, a door-to-door survey conducted by IDEQ in the towns of Osburn and Wallace found that approximately 66 percent of the residents surveyed (176 out of 266) wanted their yards sampled to provide information regarding potential cleanup.

3.8 ECOLOGICAL ISSUES

3.8.1 Cleanup Criteria

Comment Summary:

Some comments questioned the basis at the 530 mg/kg lead benchmark for cleanup of Lower Basin soils/sediments.

EPA response:

There are no promulgated cleanup criteria or standards that are ARARs for the soil or sediment of the Upper Basin or Lower Basin. Lead is the main risk driver in the soil and sediment and accordingly, EPA has identified lead as the preferred metal to be used as a benchmark. Background lead concentrations in the soil and sediment of the Lower Basin are estimated to be 47.3 mg/kg while the mean concentrations of lead in soil and sediment in the impacted area of the Lower Basin are approximately 3500 to 4000 mg/kg.

To establish a benchmark cleanup criterion for sediment, EPA examined site-specific data and all other available relevant information. For sediment in the wetlands and lateral lakes areas of the Lower Basin, a site-specific lead level of 530 mg/kg has been identified by the United States Fish and Wildlife Service (USFWS) as the lowest observed adverse effects level (LOAEL) for waterfowl (Beyer, et al. 2000). The USFWS has noted that soil and sediment in 95 percent of the floodplain habitat area of the Lower Basin have lead concentrations greater than 530 mg/kg. Using all available lines of evidence, the EcoRA also estimated a range of sediment lead concentrations protective of aquatic birds and mammals. The lead concentrations potentially protective of aquatic birds and mammals include:

- 3.65 mg/kg - no observed adverse effects level (NOAEL) for protection of individuals
- 249 mg/kg - LOAEL for protection of populations
- 718 mg/kg - based on an ED_{20} for populations

Given the absence of promulgated criteria for metals in soil and sediment, EPA made a risk management decision to use the site-specific protective value of 530 mg/kg lead as the benchmark cleanup criterion for the soil and sediment in the Upper Basin and Lower Basin. This value is based upon recent data collected in the Coeur d’Alene Basin. It is also within the range of potentially protective values from the literature and other sites. While 530 mg/kg lead in soil/sediment may not be fully protective of all aquatic birds and mammals, it will address 95 percent of the habitat area. Only 5 percent of the impacted area in the Lower Basin is estimated to have lead concentrations between 530 mg/kg and background. For these reasons, EPA believes that selection of 530 mg/kg lead as the benchmark cleanup criterion for soil and sediment is technically the best alternative available at this time.

It is important to recognize that numerical cleanup criteria for soil and sediment may be revised as additional information becomes available. For example, EPA anticipates conducting studies to evaluate soil and sediment cleanup criteria that are protective of migratory birds in riparian and riverine habitats. As part of this effort, EPA Region 10 and USFWS are currently assessing concentrations in soil and sediment that would be protective of riparian songbirds. Any revisions to criteria would be documented in future decision documents.

3.8.2 Waterfowl Issues

Comment Summary:

Some comments expressed the belief that waterfowl populations in the Basin are increasing and questioned the need to take actions to protect waterfowl.

EPA response:

Waterfowl mortality in the Lower Basin due to ingestion of contaminated soil/sediment remains a concern, despite fluctuations in regional population size, because EPA is responsible under CERCLA for protecting the environment and because waterfowl mortality represents unacceptable "take" under terms of the Migratory Bird Treaty Act (MBTA). The MBTA is an ARAR for the Basin cleanup and requires EPA to consider both individuals and populations of waterfowl and other migratory birds.

There are many causes of mortality in animal populations, and population numbers vary from year to year due to many factors in addition to poisoning of adult animals. The Ecological Risk Assessment (EcoRA) and ROD (Section 7.2 of Part 2) focus on observed and expected effects of mining-related hazardous substances on health or reproduction of waterfowl and other ecological receptors. Waterfowl mortalities associated with the ingestion of contaminated sediments have been reported for decades. Nearly 80 percent of all waterfowl (including many swans) found dead or dying in the Coeur d'Alene River Basin were affected by lead poisoning due to the ingestion of lead-contaminated soil/sediment. While it is difficult to precisely count the number of impacted waterfowl because these birds are often scavenged by predators or hidden by vegetative cover, there were 13 times more tundra swans found sick or dead in the Coeur d'Alene Basin than in an adjacent reference area. Wildlife mortality information is presented in the report by Audet et al. (1999 [cited as 1999a in the EcoRA; the report was considered a "working draft" at the time it was referenced, but it is now available as a final report]), and in the Report of Injury Assessment and Injury Determination: Coeur d'Alene Basin

Natural Resource Damage Assessment, prepared for USFWS, USFS, and the Coeur d'Alene Tribe by Stratus Consulting (2000). Species in which lead poisoning has been documented in the Basin include mallard, wood duck, northern pintail, American wigeon, tundra swan, trumpeter swan, Canada goose, canvasback, redhead, common goldeneye, common merganser, and meadow vole. Chemical of concern (COC) concentrations protective for waterfowl are presented in Section 7.2 of Part 2 of the ROD.

Waterfowl species are at greater risk than many other kinds of wildlife because they obtain much of their food from among the contaminated sediments in the Basin, and they continue to die as a result of their exposure, especially to lead, as summarized in Section 7.2 of Part 2 of the ROD. The modeling done for the EcoRA estimated risks in various portions of the Basin and then provided estimates for soil/sediment concentrations that represented NOAEL-, LOAEL-, and ED20-based preliminary remedial goals (PRGs). These endpoints represent both individual- and population-based protective concentrations of metals. The estimates were based on multiple lines of evidence, including extensive field data (especially for waterfowl) and laboratory studies. Bioavailability of lead from sediment to waterfowl was measured in the laboratory study and was factored into the EcoRA exposure estimates.

Although remediation of contaminated areas in the Lower Basin will cause short-term disruption of the ecosystem, the long-term benefits of reducing waterfowl and other wildlife mortality due to lead poisoning support the decision to remediate the floodplain soil/sediment in some areas. Among the goals of remediation are the reduction of waterfowl exposures to contaminated sediments in the Lower Basin and the minimization of recontamination of those areas after they are remediated. Thus, actions are proposed for both the Lower Basin and upstream source areas.

3.8.3 Fish Issues

Comment Summary:

A number of comments expressed the opinion that fish populations were increasing and questioned the need to do additional cleanup work to protect fish.

EPA response:

While there are indications of slow recovery in some portions of the Coeur d'Alene Basin, other areas are still severely affected and recovery is not expected to occur within many years. Fish populations at various locations in the South Fork Coeur d'Alene River and its tributaries have been observed over a limited period of time. This information is documented in the EcoRA and the Technical Memorandum: Interim Fishery Benchmarks for the Initial Increment of Remediation in the Coeur d'Alene Basin (Final) (USEPA 2001d), and it is summarized in Section 7.2 of Part 2 of the ROD.

During the period for which data are available, fish population abundance and composition fluctuated due to the influence of natural and human-related influences. Nevertheless, fish population data for the South Fork and its tributaries show a clear abundance gradient between contaminated and uncontaminated areas. For example, fish populations on the South Fork are much lower below the confluence with Canyon Creek, where concentrations of hazardous substances are much higher than in the South Fork above the confluence. Similarly, fish populations in Canyon Creek above Burke are much higher than below Burke, where metal concentrations are higher. Exposure of aquatic organisms to metals was confirmed by the presence of elevated concentrations of metals in the tissues of fish and invertebrates in many portions of the Basin. Some species expected to be present (e.g., sculpin) are absent from areas of high metals contamination. In general, areas supporting the healthiest fish populations tended to have the highest abundance even in years when numbers on the whole were depressed. Conversely, areas with depressed fish populations continued to support very low numbers during years of both low and high abundance. Several available sources of invertebrate index data used in the EcoRA indicate that macroinvertebrate diversity is depressed in areas of the Coeur d'Alene Basin affected by mining contamination. For example, as many as 50 species of invertebrates were observed in surveys of the non-contaminated headwaters areas, whereas only 9 or 10 metals-tolerant species were observed in downstream areas. Long-term monitoring of aquatic populations will be required to identify trends in fish and invertebrate abundance in response to remediation, and is proposed in association with the ROD.

3.8.4 Special-Status Species

Comment Summary:

Several comments questioned the identification of certain special-status species.

EPA response:

In accordance with the Endangered Specifies Act (ESA), special-status species have been identified by USFWS. Risks to special status species (including federally listed endangered or threatened species, those identified by the USFWS as species of concern, state-listed sensitive plant species, and culturally significant plant species) were evaluated at the individual level as well as the population level, because these species are to be more stringently protected under the ESA or some other statute/policy guidance. Briefly, the EcoRA indicated no significant risks to several of these species (including the bald eagle, fisher, wolverine, gray wolf, or lynx), but some level of risk was determined to exist for several other wildlife species in at least one portion of the Basin (as summarized in Section 7.2 of Part 2 of the ROD).

3.8.5 Bull Trout

Comment Summary:

Several comments questioned whether bull trout are present in the Basin and suggested that it is, therefore, inappropriate to use bull trout as a species of concern.

EPA response:

Under the ESA, the USFWS has identified bull trout as a listed threatened species and the westslope cutthroat trout as a species of concern in the entire project area (as described in Section 7.2 of Part 2 of the ROD). Although bull trout are rare, they have been identified in parts of the Coeur d'Alene Basin. The affected area falls within the historic range of this species and remains accessible to existing populations. Bull trout populations are known to exist in the St. Joe River and Coeur d'Alene Lake, and bull trout have been observed in the North Fork Coeur d'Alene River. These fish have access to the South Fork Coeur d'Alene River and its tributaries, and could potentially re-colonize these habitats if limiting habitat and water chemistry conditions are addressed. Therefore, it was appropriate to examine risks to bull trout in the Basin from this perspective. Although the AWQC are generally protective for surface-water biota, in areas of low hardness (e.g., 10 mg/L as $CaCO_3$) the AWQC may not be fully protective of individuals of special-status species such as bull trout and cutthroat trout. EPA published an update to the AWQC for cadmium (66 FR 18935; April 12, 2001) at about the same time as final changes were being incorporated into the EcoRA, and it was not feasible to re-analyze risks to aquatic organisms in time to make corresponding changes in the final EcoRA. Revised protective concentrations for cadmium are, however, shown in Section 7.2 of Part 2 and in later sections of the ROD. In relatively soft waters of the Basin, the updated cadmium AWQC is lower than the 1998 cadmium AWQC used in the EcoRA, and use of the 2001 criterion would result in larger estimated cadmium risks to aquatic biota than the risks identified in the EcoRA if the risks were recalculated.

3.9 COEUR D'ALENE LAKE

3.9.1 Relationship Between Selected Remedy and Coeur d'Alene Lake

Comment Summary:

Some comments questioned why Coeur d'Alene Lake is not included in the Selected Remedy or mistakenly assumed it is.

EPA response:

The selected remedy does not include remedial actions for Coeur d'Alene Lake. State, tribal, federal, and local governments are currently in the process of implementing a Lake Management Plan outside of the Superfund process using separate regulatory authorities.

3.9.2 Lake Management Plan

Comment Summary:

A number of comments questioned whether the Lake Management Plan will be an enforceable and effective tool for maintaining and improving water quality in the lake. A number of comments expressed support for implementation of the Lake Management Plan, but questioned whether adequate funding would be available. Some viewed the lake management plan as an unfunded institutional control.

EPA response:

EPA is looking toward implementation of the Lake Management Plan by state, tribal, and local agencies under separate legal authorities outside of the Superfund process to reduce the probability of additional metals movement from the sediments at the lake bottom into the lake water. The Lake Management Plan was developed by the Coeur d'Alene Tribe, the State of Idaho Department of Environmental Quality, and the Clean Lakes Coordinating Council, the commissions of Kootenai, Benewah, and Shoshone Counties, Idaho, the U.S. Geological Survey, the Coeur d'Alene Basin Restoration Project, and the Panhandle Health District to protect the water quality of the lake.

The mechanism for funding of the Lake Management Plan is still under development. EPA will support the efforts of state, tribal, and local agencies to obtain funding for implementation of the plan. Funding will likely come from several sources, including the states, tribe, local agencies, and the federal government. The Lake Management Plan, however, is not an unfunded institutional control under Superfund because no Superfund action is being taken at this point (see response to comment 9.1 in Table 4-1).

3.9.3 Potential for Release of Metals from Coeur d'Alene Lake Bottom Sediments

Comment Summary:

A number of comments questioned whether the chemical processes controlling metals movement in the lake were fully understood and raised questions regarding what process(es) would lead to increased metals mobility in lake bed sediments.

EPA response:

The geochemistry within Coeur d'Alene Lake is complicated. The basin-wide monitoring plan will be used as a tool to evaluate conditions in the lake and elsewhere over time.

Based on available information, the association of heavy metals (e.g., cadmium, lead, and zinc) with metal (e.g., iron) oxides within the hypolimnion and shallow sediments is a very important process controlling metals movement in the lake. If oxygen within the lake becomes depleted, the metal oxides may be reduced (i.e., transformed into non-oxide forms), and the heavy metals associated with the oxides could be released into the water column. Nutrient enrichment would be the process most likely to cause oxygen depletion in the lake.

3.10 BUNKER HILL BOX

3.10.1 Bunker Hill Box as Source of Metal Contamination

Comment Summary:

A number of comments supported removal of dissolved metals to protect fish and identified the Bunker Hill Box as a major source that requires cleanup.

EPA response:

The Selected Remedy contains actions to reduce the concentrations of dissolved metals, particularly zinc and cadmium, that adversely affect fish. It is estimated the load of dissolved zinc entering the river system will be reduced by 580 pounds per day. This represents 26 percent of the zinc load entering Coeur d'Alene Lake from Basin sources outside of the Box. Monitoring of the Selected Remedy will help determine what additional actions are necessary to further reduce zinc loads. The Bunker Hill Box is a major source of dissolved metals; it represents about half the dissolved metals load in the South Fork at its confluence with the North Fork. Extensive remedial actions have been conducted within the Bunker Hill Box beginning in 1995 and are ongoing.

As discussed under 3.11.2 below, the Bunker Hill Box is not part of the Selected Remedy for Operable Unit 3.

3.10.2 Relationship Between the Bunker Hill Box and the Selected Remedy

Comment Summary:

Some comments questioned whether the Bunker Hill Box would be cleaned up as part of this ROD.

EPA response:

Although the Bunker Hill Box is part of the Basin and, as discussed in Section 10.2 of Part 2, is a major source of dissolved metals, the Box is not part of the Selected Remedy because it is already the subject of ongoing remedial actions selected in existing RODs for this area. EPA is approaching cleanup of the non-populated areas in the Bunker Hill Box in two phases. Phase 1 is focused on cleaning up known source areas. Phase 2, which is underway, includes evaluating the efficacy of Phase 1 and determining what additional remedies, including, for example, potential groundwater collection and treatment, are necessary. EPA will integrate actions in the Bunker Hill Box with those described in the Selected Remedy to effectively clean up the Coeur d'Alene Basin.

3.11 UNION PACIFIC RAILROAD

3.11.1 UPRR Cleanup in Relationship to the Selected Remedy

Comment Summary:

Some comments questioned whether the UPRR cleanup was intended to address all potential problems within the railroad right-of-way (ROW), and, if not, what will be done to address these problems.

EPA response:

As discussed in Section 2.3.1 of the Part 2 of the ROD, UPRR cleanup activities are continuing as mandated by the 2000 consent decree between the United States, the Coeur d'Alene Tribe, the State of Idaho and the Union Pacific Railroad (UPRR). This consent decree resulted from the engineering evaluation/cost analysis (EE/CA) conducted under CERCLA removal authority. UPRR has substantial obligations, including long-term obligations that extend in perpetuity. Furthermore, the United States has reserved its rights against UPRR in the event that previously unknown conditions or information arise.

The cleanup uses combinations of removal and disposal/consolidation of hazardous substances, placing protective barriers over hazardous substances, and institutional controls. Oversight of the UPRR cleanup is carried out by representatives of EPA, the Coeur d'Alene Tribe, and the State of Idaho.

The UPRR cleanup was intended to protect human health. In particular, the cleanup was intended to protect users of the recreational trail being constructed along the ROW, as well as protect trail maintenance workers and residents in proximity to the ROW. The UPRR cleanup was not intended to and does not cleanup all portions of the ROW. Additional actions may be warranted in portions of the ROW, particularly in floodplain areas that are susceptible to recontamination. As cleanup is implemented under the UPRR consent decree, the Selected Remedy of this ROD for the Coeur d'Alene Basin and any subsequent actions, results may indicate additional actions may be warranted in the ROW to protect against risks to human health and the environment. Such actions will be taken with the appropriate regulatory authority which, depending on the circumstances, may include the UPRR consent decree, another removal action, a remedial action, or some other action.

3.12 SPOKANE RIVER

3.12.1 Anticipated Water Quality Conditions in the Spokane River

Comment Summary:

Some comments questioned what degree of cleanup will be accomplished in the Spokane River and why more actions are not included for the Spokane River.

EPA response:

The long-term goal is to achieve AWQC in the Spokane River. Improvements to ambient surface-water quality will be closely tied to the pace and scope of the cleanup actions in the Lower Basin and Upper Basin as well as the long-term retention of metals in Coeur d'Alene Lake sediments. Although the remedial actions of the Selected Remedy will result in improved conditions in the Spokane River, the reality is there is some uncertainty in predicting exact cause and effect relationships for water quality improvements in the Spokane River. This argues for the adaptive management approach to cleanup under the Selected Remedy.

3.12.2 Sole-Source Spokane Valley-Rathdrum Aquifer

Comment Summary:

A number of comments were received expressing concern about potential contamination of the sole-source Spokane Valley-Rathdrum Prairie Aquifer (which has been designated as a sole-source aquifer) by metals. The comments noted that this aquifer is recharged by Coeur d'Alene Lake and parts of the upper Spokane River. Many of the comments requested monitoring of the recharge areas and plans to mitigate potential impacts, including those that might occur from sediment-rich floodwaters.

EPA response:

EPA recognizes the tremendous importance of the Spokane Valley-Rathdrum Prairie Aquifer to eastern Washington. EPA is developing a long-term monitoring plan that will include monitoring of Coeur d'Alene Lake and the Spokane River and their potential effects on the aquifer.

The Spokane Valley-Rathdrum Prairie Aquifer is recharged, in part, by infiltration from Coeur d'Alene Lake and the upper Spokane River. According to a study by Wyman (1993), about 30 percent of the recharge to the aquifer is from the lake and the river; although not quantified, the lake contributes most of the recharge via underflow.

While Coeur d'Alene Lake and the Spokane River contain levels of some metals that are potentially harmful to sensitive fish and aquatic organisms, the levels are well below the drinking water standards established under the Safe Drinking Water Act for protection of human health.

Metal	Drinking water standard, µg/L	Range of dissolved metals concentrations, µg/L	
		Spokane River	Coeur d'Alene Lake
Lead	15	0.3 to 1.2	0.2 to 4
Zinc	5,000	30 to 90	40 to 100
Cadmium	5	0.1 to 1	0.22 to 0.34
Arsenic	10	0.4 to 1.1	No data

The Lake Management Plan that will be pursued for Coeur d'Alene Lake is in part predicated on actions that are designed to minimize remobilization of metals from the bottom of the lake into the overlying water. Successful implementation of this plan will reduce the possibility that metals from the bottom of the lake will adversely affect downstream areas.

A surface water/groundwater interaction study in the upper Spokane River indicated that dissolved metals entering the aquifer from the river in this area are not migrating far beyond the river bank or are being quickly diluted by aquifer water (Marti and Garrigues, 2001). Concentrations of metals in the aquifer are substantially lower than the concentrations in the water of the lake and the river.

Floodwaters can transport relatively large amounts of sediment from the Coeur d'Alene River to the Spokane River. This sediment contains elevated levels of metals, such as lead, that bind to sediments, and some of the sediment typically is deposited in slack water areas along the Spokane River. Because the sediment-associated lead is relatively insoluble, it is not expected to pose a threat of contaminating the aquifer at levels of concern. As a part of remedy monitoring, EPA anticipates sampling depositional areas along the Spokane River after floods.

3.12.3 Cleanup Method for Sediments Behind the Upriver Dam

Comment Summary:

Comments were received from local government and utility representatives and the public expressing concern about the possible impacts of excavating sediments that have accumulated behind Upriver Dam. The comments postulated that existing sediments may limit infiltration of river water at this location. Possible adverse effects of sediment excavation, and the resulting potentially increased river water infiltration and short-term sediment mobilization, included:

- Impacts on dam integrity
- Impacts on nearby water supply wells

EPA response:

The ROD selects a combination of access controls, capping and sediment removals for this area; however, it does not specify the exact cleanup methods that will be used. These will be established following further study and engineering evaluation. The Washington Department of Ecology (Ecology) also has concerns about PCBs in the sediments behind Upriver Dam. EPA will coordinate with Ecology in the cleanup of the sediments. The engineering evaluation of sediment cleanup will include consideration of the potential effects of cleanup actions on dam stability and nearby water supply wells.

3.12.4 Remedies for Contaminated Sediments in Shoreline and Depositional Areas

Comment Summary:

A number of comments expressed concern about the remedies for contaminated sediments in shoreline and depositional areas of the Spokane River and indicated a preference for maximum removal of contaminated sediments.

EPA response:

The Selected Remedy identifies a combination of removals and capping of contaminated sediments on Spokane River beaches and accumulated behind Upriver Dam. Each of these areas will be the subject of a remedial design prior to implementation of the remedial action. The details of the remedial action will be determined during remedial design. In making that determination, a number of factors will be considered, including:

- the long-term maintenance requirements of capping
- the potential for recontamination
- cost

3.12.5 Protectiveness of Shoreline Remedies

Comment Summary:

A number of comments stated that the cleanup of the impacted shoreline areas in Washington needs to fully protect the public health and environmental health. Many of these comments further stated that, in case of recontamination, remedial action should be triggered by the same criteria triggering the initial cleanup. Many of the comments also expressed that cleanup of the Spokane River beaches should be a priority.

EPA response:

The Selected Remedy includes cleanup of beach areas upstream of Upriver Dam where lead is present in soil or sediment at a concentration exceeding 700 mg/kg. Based on the Spokane River screening-level risk assessment, this cleanup level, and therefore the remedy, will be protective of public health. The Selected Remedy also will achieve protection of environmental health through cleanup of shoreline areas that have been identified by the Washington State Department of Ecology as critical habitat areas and include sediments that contain metals at concentrations exceeding risk-based levels.

Cleanup of areas for protection of human health have been identified by EPA and stakeholders as a top priority for implementation of the Selected Remedy. Should shoreline areas in Washington become recontaminated, these areas would be addressed to ensure that human health continues to be protected.

3.12.6 PCBs in Sediments

Comment Summary:

A number of comments identified human health and environmental concerns related to the presence of PCBs in Spokane River sediments. Some comments suggested that risks related to PCBs were as great as or greater than those related to metals. Some comments called for EPA to coordinate cleanup for metals with any cleanup conducted for PCBs.

EPA response:

The RI/FS (including supporting risk assessments and technical memoranda) and Proposed Plan addressed mining contamination in the Coeur d’Alene Basin and Spokane River. The PCB contamination in the Spokane River sediments is not mining related and thus not part of the Proposed Plan or ROD.

Ecology is evaluating options for cleanup of PCBs. EPA will work with Ecology as practicable to ensure a coordinated cleanup of the Spokane River sediments that jointly addresses the PCB and mining-related metals contamination.

3.13 MONITORING

3.13.1 Monitoring as Part of the Selected Remedy for Ecological Improvement

Comment Summary:

A number of comments emphasized the importance of monitoring in the Basin and requested clarification of the role of monitoring in the Selected Remedy. The focus of these comments appeared to be on the ecological portions of the remedy.

EPA response:

Monitoring is a key part of the Selected Remedy for ecological improvement in the Basin. EPA, with stakeholder input, is in the process of developing the scope and details of a long-term monitoring program, which will be finalized after the ROD and coordinated with remedial design. As part of this process, EPA intends to balance the wide range of viewpoints on monitoring while meeting the legal requirements of CERCLA. Goals of the Basin-wide monitoring are to ensure that adequate data are collected to evaluate the effectiveness of remedial actions, progress towards the benchmarks and areas for improvement, and gain a better understanding of Basin processes and data variability. Some of this monitoring will be conducted routinely to examine the efficacy of the remedies over time; other portions will be tailored to specific parts of the remedies. The monitoring will provide data for EPA to conduct the CERCLA-required five-year reviews of the progress of remedy implementation.

3.13.2 Monitoring of Fish in Coeur d'Alene Lake and the Spokane River

Comment Summary:

A number of comments called for monitoring of fish in Coeur d'Alene Lake and the Spokane River. Many of these comments emphasized potential risks to persons, particularly low-income and subsistence users, that consume relatively large quantities of fish caught in these water bodies.

EPA response:

EPA agrees that further study is needed to evaluate potential risks to persons that consume large amounts of fish caught in the Spokane River or the Lake. EPA and the Spokane and Coeur d'Alene Tribes are cooperating in planning additional testing and studies to evaluate these exposures. Sampling of fish in Coeur d'Alene Lake was conducted in the spring and summer of 2002, and it is anticipated the results of testing will be available in early 2003.

Table 3.7-1
Summary Statistics for Environmental Variables for Two Data Sets
(all environmental data versus the subset of environmental data paired with blood lead measurements)

Area	Stat	Mat Lead (mg/kg)		Lead Loading (µg/m2/day)		Soil Lead (mg/kg)		Vacuum Lead (mg/kg)		Interior Mean Paint Lead (mg/cm2)		Exterior Mean Paint Lead (mg/cm2)	
		All Homes	All Children	All Homes	All Children	All Homes	All Children	All Homes	All Children	All Homes	All Children	All Homes	All Children
KINGSTON	N	48	14	42	10	99	44	30	25	37	7	40	10
	MIN	63	145	0.06	0.19	22	57	102	102	0.00	0.00	0.00	0.00
	MAX	15500	3505	6.31	3.78	9228	753	1750	1750	0.57	0.06	8.60	1.65
	GEOMEAN	610	660	0.74	0.96	257	207	466	326	0.02	0.02	0.03	0.18
	GSD	2.69	2.96	3.26	3.32	3.34	2.35	2.07	1.81	7.23	5.15	15.65	12.07
LOWER BASIN	N	110	18	109	18	160	38	31	15	104	23	102	22
	MIN	22	55	0.02	0.04	15	15	49	68	0.00	0.00	0.00	0.00
	MAX	4805	4805	29.75	22.52	7350	7350	3140	3140	7.85	0.12	0.93	0.21
	GEOMEAN	318	263	0.48	0.56	110	104	301	221	0.01	0.01	0.04	0.03
	GSD	3.26	3.24	4.41	6.47	4.29	6.04	2.81	3.59	6.28	3.29	5.12	4.99
MULLAN	N	47	10	40	9	105	27	32	14	43	13	43	13
	MIN	278	892	0.43	0.66	40	215	429	557	0.00	0.00	0.00	0.00
	MAX	4460	2800	10.47	4.79	20217	5620	4060	4060	0.72	0.27	2.83	2.83
	GEOMEAN	1242	1301	1.52	1.34	628	930	985	1385	0.03	0.03	0.10	0.04
	GSD	1.78	1.45	2.04	2.13	2.91	2.49	1.70	2.03	6.69	5.58	7.03	11.71
BURKE/ NINE MILE	N	54	33	37	27	88	70	35	33	38	38	39	38
	MIN	173	691	0.30	0.96	32	37	83	83	0.00	0.00	0.00	0.00
	MAX	59498	27601	87.17	45.70	5410	5410	5800	5800	2.14	2.14	4.70	4.70
	GEOMEAN	1781	2044	4.28	6.07	679	628	879	906	0.02	0.04	0.05	0.22
	GSD	2.86	2.60	4.43	3.81	3.25	4.01	2.63	2.72	10.15	11.87	12.92	11.67
OSBURN	N	98	35	73	27	262	95	84	48	81	46	79	45
	MIN	202	517	0.19	0.35	33	76	23	82	0.00	0.00	0.00	0.00
	MAX	42045	6020	66.16	3.91	12883	4251	2192	1340	0.35	0.28	4.28	0.51
	GEOMEAN	882	990	0.88	1.06	419	532	493	328	0.02	0.02	0.06	0.05
	GSD	1.94	1.81	2.49	1.91	2.45	2.34	2.17	2.26	6.38	6.51	8.87	6.45
SIDE GULCHES	N	53	19	47	16	100	45	26	14	52	28	53	28
	MIN	167	281	0.17	0.17	25	31	116	162	0.00	0.00	0.00	0.00
	MAX	8840	2103	21.37	5.73	3356	1200	3929	1646	0.34	0.25	1.67	1.67
	GEOMEAN	842	651	1.13	1.18	368	197	695	493	0.02	0.03	0.04	0.03
	GSD	2.11	1.78	2.55	4.06	2.38	2.65	2.21	1.78	7.83	7.67	7.19	8.08
SILVERTON	N	22	28	19	27	70	69	26	37	23	35	24	35
	MIN	326	374	0.28	0.42	94	94	75	75	0.00	0.00	0.00	0.00
	MAX	3658	1458	9.45	2.69	6098	1690	3390	3390	0.57	0.28	1.83	1.58
	GEOMEAN	863	859	1.10	1.21	352	356	557	660	0.05	0.11	0.08	0.16
	GSD	1.93	1.58	2.42	1.95	2.25	2.24	2.52	2.23	6.56	3.76	8.24	4.75
WALLACE	N	42	12	33	6	110	56	35	19	37	26	37	26
	MIN	604	716	0.35	1.17	54	65	259	681	0.00	0.01	0.01	0.01
	MAX	47624	3440	158.27	4.78	16027	3020	29724	3300	1.23	1.20	9.90	3.40
	GEOMEAN	1774	1404	2.63	2.31	771	866	1004	1059	0.08	0.08	0.22	0.12
	GSD	2.54	1.69	3.14	1.60	2.47	2.10	2.33	1.48	5.26	3.64	7.89	4.20

Table 3.7-2a

IEUBK Batch Mode Overall Observed vs. Predicted Blood Lead by Geographic Area, Ages 9-84 Months: Default and 40:30:30 - with repeat observations

	Mullan			Burke/Nine Mile			Wallace			Silverton		
	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)
N	15	15	15	46	46	46	39	39	39	55	55	55
Minimum (µg/dl)	2	5	4	1	4	3	1	6	4	2	2	2
Maximum (µg/dl)	12	16	9	21	27	17	19	21	13	23	19	11
Arithmetic Mean (µg/dl)	5.5	10.2	6.4	7.8	10.2	6.6	6.1	10.0	6.5	5.5	7.3	4.7
Geometric Mean (µg/dl)	4.7	9.7	6.1	6.3	9.2	6.1	5.2	9.6	6.3	4.6	6.7	4.5
Geometric Standard Deviation	1.75	2.08	1.73	1.98	1.76	1.78	1.82	1.64	1.70	1.81	1.86	1.79
% ≥ 10 µg/dl	13%	48%	19%	22%	44%	20%	13%	47%	19%	11%	26%	8%
% ≥ 15 µg/dl	0%	22%	5%	15%	22%	7%	5%	20%	5%	5%	10%	2%

IEUBK Batch Mode Overall Observed vs. Predicted Blood Lead by Geographic Area, Ages 9-84 Months: Default and 40:30:30 (continued)

	Osburn			Side Gulches			Kingston			Lower Basin			Total		
	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)
N	62	62	62	30	30	30	36	36	36	28	28	28	311	311	311
Minimum (µg/dl)	1	3	2	1	2	2	1	2	2	1	2	2	1	2	2
Maximum (µg/dl)	11	14	8	9	14	8	16	9	5	18	28	16	23	28	17
Arithmetic Mean (µg/dl)	4.6	6.2	4.2	4.0	6.1	4.2	5.7	5.0	3.4	6.9	7.0	4.5	5.7	7.6	5.0
Geometric Mean (µg/dl)	4.0	5.7	4.0	3.6	5.7	4.0	4.3	4.7	3.3	4.9	4.5	3.2	4.6	6.6	4.5
Geometric Standard Deviation	1.77	1.86	1.74	1.64	1.79	1.73	2.17	1.83	1.72	2.40	2.68	2.81	1.93	2.02	1.90
% ≥ 10 µg/dl	5%	19%	5%	0%	17%	5%	17%	11%	2%	32%	21%	14%	13%	28%	11%
% ≥ 15 µg/dl	0%	6%	1%	0%	5%	1%	17%	2%	0%	11%	16%	7%	7%	12%	3%

Note: observed levels are for children 9-84 months or 0-7 years old as opposed to community mode showing observed levels for 0-9 year olds.

Table 3.7-2b
IEUBK Batch Mode Overall Observed vs. Predicted Blood Lead by Geographic Area, Ages 9-84 Months: Default and 40:30:30 - without repeat observations

NO REPEATS

	Mullan			Burke/Nine Mile			Wallace			Silverton		
	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)
N	15	15	15	37	37	37	35	35	35	36	36	36
Minimum (µg/dl)	2	5	4	1	4	3	1	6	4	2	3	2
Maximum (µg/dl)	12	16	9	20	27	17	19	21	13	23	17	10
Arithmetic Mean (µg/dl)	5.5	10.2	6.4	7.4	10.5	6.7	6.1	10.2	6.6	6.1	7.4	4.8
Geometric Mean (µg/dl)	4.7	9.7	6.1	6.1	9.5	6.2	5.1	9.8	6.4	5.1	6.8	4.6
Geometric Standard Deviation	1.75	2.08	1.73	1.90	1.72	1.80	1.85	1.60	1.70	1.81	1.87	1.77
% ≥ 10 µg/dl	13%	48%	19%	19%	46%	21%	14%	48%	20%	14%	27%	8%
% ≥ 15 µg/dl	0%	22%	5%	11%	24%	8%	6%	22%	6%	8%	10%	2%

IEUBK Batch Mode Overall Observed vs. Predicted Blood Lead by Geographic Area, Ages 9-84 Months: Default and 40:30:30 (continued)

	Osburn			Side Gulches			Kingston			Lower Basin			Total		
	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)
N	52	52	52	23	23	23	32	32	32	26	26	26	256	256	256
Minimum (µg/dl)	1	3	2	1	2	2	1	2	2	1	2	2	1	2	2
Maximum (µg/dl)	11	14	8	9	14	8	16	9	5	18	28	16	23	28	17
Arithmetic Mean (µg/dl)	4.7	6.4	4.3	4.2	6.2	4.3	5.9	4.9	3.4	6.6	6.0	3.9	5.8	7.6	5.0
Geometric Mean (µg/dl)	4.1	5.9	4.1	3.7	5.8	4.1	4.4	4.6	3.3	4.7	3.98	2.9	4.7	6.6	4.5
Geometric Standard Deviation	1.75	1.88	1.75	1.75	1.81	1.73	2.24	1.83	1.71	2.42	2.45	2.62	1.94	2.06	1.91
% ≥ 10 µg/dl	6%	20%	5%	0%	18%	5%	19%	10%	2%	31%	15%	10%	14%	28%	11%
% ≥ 15 µg/dl	0%	7%	1%	0%	5%	1%	13%	2%	0%	12%	12%	6%	6%	12%	3%

Note: observed levels are for children 9-84 months or 0-7 years old as opposed to community mode showing observed levels for 0-9 year olds.

Table 3.7-3a
IEUBK Batch Mode Observed vs. Predicted Blood Lead by Geographic Area, Ages 9-60 Months: Default and 40:30:30 - with repeat observations

	Mullan			Burke/Nine Mile			Wallace			Silverton		
	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)
N	8	8	8	31	31	31	26	26	26	46	46	46
Minimum (µg/dl)	2	8	5	2	4	4	2	7	5	2	3	2
Maximum (µg/dl)	12	13	8	21	27	17	19	21	13	23	19	11
Arithmetic Mean (µg/dl)	6.8	10.9	6.9	7.9	11.1	7.2	7.0	10.9	7.2	6.0	7.8	5.0
Geometric Mean (µg/dl)	5.8	10.7	6.8	6.3	10.0	6.7	6.0	10.6	7.1	5.0	7.2	4.8
Geometric Standard Deviation	1.87	1.64	1.65	1.98	0.98	1.77	1.79	1.79	1.66	1.78	1.81	1.75
% ≥ 10 µg/dl	25%	56%	22%	23%	48%	24%	19%	54%	25%	13%	29%	10%
% ≥ 15 µg/dl	0%	25%	6%	16%	26%	9%	8%	25%	7%	7%	12%	2%

IEUBK Batch Mode Observed vs. Predicted Blood Lead by Geographic Area, Ages 9-60 Months: Default and 40:30:30 (continued)

	Osburn			Side Gulches			Kingston			Lower Basin			Total		
	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)
N	43	43	43	23	23	23	27	27	27	18	18	18	222	222	222
Minimum (µg/dl)	1	3	3	1	3	2	1	3	2	1	2	2	1	2	2
Maximum (µg/dl)	11	14	8	9	14	8	16	9	5	18	28	16	23	28	17
Arithmetic Mean (µg/dl)	5.0	6.5	4.4	4.2	6.6	4.5	6.7	5.6	3.8	8.2	9.3	5.7	6.3	8.2	5.4
Geometric Mean (µg/dl)	4.3	6.1	4.3	3.8	6.3	4.4	5.4	5.3	3.7	6.2	5.7	4.1	5.1	7.2	4.9
Geometric Standard Deviation	1.80	1.83	1.71	1.61	1.75	1.69	2.03	1.79	1.68	2.31	3.27	3.11	1.90	1.96	1.86
% ≥ 10 µg/dl	7%	20%	6%	0%	20%	6%	22%	14%	3%	39%	32%	21%	16%	31%	13%
% ≥ 15 µg/dl	0%	7%	1%	0%	6%	1%	15%	3%	0%	17%	25%	11%	8%	14%	4%

Note: observed levels are for children 9-60 months or 0-5 years old.

Table 3.7-3b
IEUBK Batch Mode Observed vs. Predicted Blood Lead by Geographic Area, Ages 9-60 Months: Default and 40:30:30 - without repeat observations

NO REPEATS

	Mullan			Burke/Nine Mile			Wallace			Silverton		
	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)
N	8	8	8	24	24	24	23	23	23	31	31	31
Minimum (µg/dl)	2	8	5	2	4	4	2	8	6	2	3	2
Maximum (µg/dl)	12	13	8	20	27	17	19	21	13	23	17	10
Arithmetic Mean (µg/dl)	6.8	10.9	6.9	7.1	11.6	7.5	7.0	11.2	7.4	6.5	7.9	5.1
Geometric Mean (µg/dl)	5.8	10.7	6.8	6.0	10.4	6.9	5.9	10.9	7.3	5.4	7.4	4.9
Geometric Standard Deviation	1.87	1.64	1.65	1.81	1.88	1.79	1.83	1.75	1.65	1.80	1.82	1.73
% ≥ 10 µg/dl	25%	56%	22%	17%	51%	26%	22%	56%	26%	16%	31%	10%
% ≥ 15 µg/dl	0%	25%	6%	8%	28%	11%	9%	27%	8%	10%	12%	2%

IEUBK Batch Mode Observed vs. Predicted Blood Lead by Geographic Area, Ages 9-60 Months: Default and 40:30:30 (continued)

	Osburn			Side Gulches			Kingston			Lower Basin			Total		
	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)
N	38	38	38	19	19	19	25	25	25	16	16	16	184	184	184
Minimum (µg/dl)	1	3	3	1	3	2	1	3	2	1	2	2	1	2	2
Maximum (µg/dl)	11	14	8	9	14	8	16	9	5	18	28	16	23	28	17
Arithmetic Mean (µg/dl)	5.1	6.7	4.5	4.4	6.6	4.6	6.9	5.4	3.7	7.9	7.9	5.0	6.3	8.2	5.4
Geometric Mean (µg/dl)	4.4	6.2	4.4	3.9	6.3	4.4	5.5	5.1	3.6	5.8	4.9	3.6	5.2	7.2	4.9
Geometric Standard Deviation	1.74	1.85	1.72	1.68	1.77	1.70	2.07	1.78	1.68	2.38	2.79	2.88	1.88	2.01	1.88
% ≥ 10 µg/dl	8%	22%	6%	0%	21%	6%	24%	12%	2%	38%	24%	17%	17%	32%	13%
% ≥ 15 µg/dl	0%	7%	1%	0%	6%	1%	16%	3%	0%	19%	19%	9%	8%	14%	4%

Note: observed levels are for children 9-60 months or 0-5 years old.

Table 3.7-4a
IEUBK Batch Mode Observed vs. Predicted Blood Lead by Geographic Area, Ages 9-24 Months: Default and 40:30:30 - with repeat observations

	Mullan			Burke/Nine Mile			Wallace			Silverton		
	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)
N	4	4	4	10	10	10	8	8	8	16	16	16
Minimum (µg/dl)	5	10	7	2	8	6	3	8	6	3	4	3
Maximum (µg/dl)	11	13	8	20	27	17	16	15	9	23	17	10
Arithmetic Mean (µg/dl)	7.8	12.1	7.8	9.1	15.0	9.6	8.1	11.4	7.7	7.5	8.5	5.5
Geometric Mean (µg/dl)	7.4	12.1	7.8	6.6	13.7	9.0	7.0	11.2	7.6	6.1	7.9	5.3
Geometric Standard Deviation	1.44	1.61	1.61	2.39	2.00	1.70	1.83	1.64	1.64	1.86	1.85	1.74
% ≥ 10 µg/dl	25%	65%	30%	30%	67%	42%	38%	59%	29%	19%	35%	13%
% ≥ 15 µg/dl	0%	33%	8%	30%	44%	20%	13%	28%	8%	19%	15%	3%

IEUBK Batch Mode Observed vs. Predicted Blood Lead by Geographic Area, Ages 9-24 Months: Default and 40:30:30 (continued)

	Osburn			Side Gulches			Kingston			Lower Basin			Total		
	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)
N	14	14	14	9	9	9	7	7	7	7	7	7	75	75	75
Minimum (µg/dl)	2	3	3	2	5	4	2	3	2	3	2	2	2	2	2
Maximum (µg/dl)	11	12	8	9	14	8	15	9	5	18	25	15	23	27	17
Arithmetic Mean (µg/dl)	6.5	6.2	4.5	5.2	7.4	5.0	7.7	6.5	4.3	8.7	8.9	5.6	7.5	9.2	6.1
Geometric Mean (µg/dl)	6.0	5.7	4.3	4.8	7.0	4.9	6.3	6.1	4.2	7.1	5.5	4.0	6.2	7.9	5.5
Geometric Standard Deviation	1.55	1.87	1.73	1.55	1.72	1.69	2.03	1.82	1.67	2.04	2.88	3.07	1.82	2.08	1.91
% ≥ 10 µg/dl	14%	18%	6%	0%	26%	9%	29%	20%	4%	43%	29%	21%	23%	37%	17%
% ≥ 15 µg/dl	0%	6%	1%	0%	9%	2%	14%	5%	1%	14%	23%	12%	12%	19%	6%

Note: observed levels are for children 9-24 months or 0-2 years old.

Table 3.7-4b
IEUBK Batch Mode Observed vs. Predicted Blood Lead by Geographic Area, Ages 9-24 Months: Default and 40:30:30 - without repeat observations

NO REPEATS

	Mullan			Burke/Nine Mile			Wallace			Silverton		
	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)
N	4	4	4	9	9	9	8	8	8	15	15	15
Minimum (μg/dl)	5	10	7	2	8	6	3	8	6	3	4	3
Maximum (μg/dl)	11	13	8	20	27	17	16	15	9	23	17	10
Arithmetic Mean (μg/dl)	7.8	12.1	7.8	8.0	14.9	9.6	8.1	11.4	7.7	7.8	8.7	5.6
Geometric Mean (μg/dl)	7.4	12.1	7.8	5.9	13.4	8.9	7.0	11.2	7.6	6.4	8.1	5.4
Geometric Standard Deviation	1.44	1.61	1.61	2.31	2.09	1.70	1.83	1.64	1.64	1.84	1.88	1.75
% $\geq$ 10 μg/dl	25%	65%	30%	22%	66%	41%	38%	59%	29%	20%	37%	13%
% $\geq$ 15 μg/dl	0%	33%	8%	22%	42%	20%	13%	28%	8%	20%	16%	3%

IEUBK Batch Mode Observed vs. Predicted Blood Lead by Geographic Area, Ages 9-24 Months: Default and 40:30:30 (continued)

	Osburn			Side Gulches			Kingston			Lower Basin			Total		
	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)	Observed	Predicted (Default)	Predicted (40:30:30)
N	13	13	13	9	9	9	7	7	7	7	7	7	72	72	72
Minimum (μg/dl)	2	3	3	2	5	4	2	3	2	3	2	2	2	2	2
Maximum (μg/dl)	11	12	8	9	14	8	15	9	5	18	25	15	23	27	17
Arithmetic Mean (μg/dl)	6.5	6.3	4.5	5.2	7.4	5.0	7.7	6.5	4.3	8.7	8.9	5.6	7.4	9.2	6.1
Geometric Mean (μg/dl)	5.9	5.8	4.4	4.8	7.0	4.9	6.3	6.1	4.2	7.1	5.5	4.0	6.2	7.9	5.5
Geometric Standard Deviation	1.57	1.88	1.73	1.55	1.72	1.69	2.03	1.82	1.67	2.04	2.88	3.07	1.81	2.08	1.90
% $\geq$ 10 μg/dl	15%	19%	7%	0%	26%	9%	29%	20%	4%	43%	29%	21%	22%	38%	17%
% $\geq$ 15 μg/dl	0%	7%	1%	0%	9%	2%	14%	5%	1%	14%	23%	12%	11%	19%	6%

Note: observed levels are for children 9-24 months or 0-2 years old.

Table 3.7-5a
General Linear Model and Regression Coefficients for Blood Lead and Environmental Sources - with repeat observations

Dependent Variable: BLPB
R-Square=0.597 (P<0.0001)
N=126

Variable	Estimate	Pr>F	Standardized Estimate
Intercept	2.8644	0.0032	0.0000
AGE	-0.3351	0.0007	-0.2056
SOILPB	0.0007	0.0012	0.2249
LEADLD	0.1638	0.0006	0.3212
EXTMED	0.5176	0.0005	0.2742
INTCCMIN	1.9230	0.0008	0.2313

Table 3.7-5b
General Linear Model and Regression Coefficients for Blood Lead and Environmental Sources - without repeat observations

Dependent Variable: BLPB
R-Square=0.598 (P<0.0001)
N=97

Variable	Estimate	Pr>F	Standardized Estimate
Intercept	3.0020	0.0072	0.0000
AGE	-0.3261	0.0056	-0.1907
SOILPB	0.0005	0.0435	0.1635
LEADLD	0.1895	0.0006	0.3803
EXTMED	0.4572	0.0083	0.2365
INTCCMIN	2.0071	0.0023	0.2401

Table 3.7-6
Blood Lead Declines in National Surveys, Smelterville, and Kellogg

Time Period	Geometric mean μg/dL	Annualized Decline using mid-points of study periods μg/dL per year
National Blood Lead Levels		
1976-80	15.0	--
1988-91	3.6	1.0 (Annest et al. 1983)
1991-94	2.7	0.3 (Brody et al. 1994)
1999	2.0	0.1 (Pirkle et al. 1998)
1978-99		0.6 (CDC 2000)
Smelterville Blood Lead Levels		
1975	44.8	--
1989-90 midpoint	11	2.3 (IDHW 2000b)
1992-93 midpoint	6.6	1.5 (IDHW 2000b)
1999	3.6	0.5 (IDHW 2000b)
1975-99		1.7 (IDHW 2000b)
Kellogg Blood Lead Levels		
1975	37.4	--
1989-90 midpoint	8.8	2.0 (IDHW 2000b)
1992-93 midpoint	6.1	0.9 (IDHW 2000b)
1999	3.7	0.4 (IDHW 2000b)
1975-99		1.4 (IDHW 2000b)

4.0 RESPONSES TO INDIVIDUAL COMMENTS

In Section 4.0 of the Responsiveness Summary, EPA's responses to individual comments are presented. The comments and responses are organized alphabetically by the last name of the person providing the comment in Table 4-1. Each comment was assigned a unique comment number. Many commenters submitted more than one comment, and an individual comment number was assigned to each of these comments.

Many comments addressed similar issues. In this case, the response for a given issue is provided once, and additional comments addressing the same issue are referenced to the comment number where this response is provided. These referenced responses are organized in numerical order by comment number in Table 4-2. When using Table 4-2, the user should be aware that in some cases the reference responses may address more issues than those raised in the user's comment. In these cases, it is expected that the user will be able to identify those parts of the referenced response applicable to his or her comment. In other cases, a comment may raise multiple issues. In such a case, a user may be referred to multiple reference responses for a complete response to all issues raised. An overview of issues raised and EPA's responses is provided in Section 3.0.

A small number of written comments were illegible and some oral comments were inaudible. EPA has included these comments in this section and has attempted to respond to such comments where possible. As provided in the CERCLA statute, Section 117(b), EPA is only responsible for providing responses to each of the "significant" comments, criticisms, and new data. Comments not meeting this statutory criterion have nonetheless been recorded in this section.

Following Table 4-2 is a list of references used in the responses to comments related to the human health remedy.