

1.0 INTRODUCTION

In September 2002, the U.S. Environmental Protection Agency (EPA) issued its interim plan to clean up mining contamination in the Bunker Hill Mining and Metallurgical Complex Superfund Site Operable Unit 3 ("the Coeur d'Alene Basin") (EPA 2002). The plan, or interim Record of Decision (ROD), came after several years of intensive studies to determine the extent of the contamination and the associated risks to people and the environment. The ROD describes the specific cleanup work that will be conducted in the Basin over the next 30 years at a cost of about \$360 million.

The Basin is a large and diverse geographic area. Given the size and complexity of the Basin and the amount of historical mine waste present, it is clear that the cleanup will take many years. For environmental protection, an adaptive management approach has been adopted. The remedy selected in the ROD consists of approximately 30 years of prioritized actions designed to achieve tangible and measurable human health and environmental benefits. A key component of the adaptive management approach to cleanup of the Basin is the environmental monitoring program. Monitoring of the river system and Basin will provide data to help evaluate cleanup efforts and to make adjustments and modifications where needed.

The ROD, and consequently the Basin-wide environmental monitoring plan, is focused on the mining-related contamination in the river corridor and floodplain of the Basin. The Basin includes the South Fork of the Coeur d'Alene River and its tributaries (Upper Basin), the lower Coeur d'Alene River (Lower Basin), Coeur d'Alene Lake, and depositional areas of the Spokane River (Figure 1-1). Coeur d'Alene Lake is not included in the interim action and will be addressed in a future ROD. Under separate regulatory authorities, state, tribal, federal, and local governments are developing a lake management plan outside of Superfund focusing on nutrient management.

Establishment of a long-term Basin-wide environmental monitoring program is required under the ROD. We anticipate that the Basin environmental monitoring program will have two main components to address the various data needs, which include data needed to fulfill the five-year review requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). The first component, which is the subject of this document, is a long-term status and trends assessment of surface water, soil, sediment, and biological resource conditions in the Basin. The second component is remedial action-specific effectiveness monitoring, which will be developed as part of the design of each remedial action conducted under the Operable Unit (OU) 3 ROD. While this monitoring plan will provide guidance regarding development of remedial action-specific effectiveness monitoring, the details for such monitoring will be addressed in the planning, design and implementation of each remedial action.

1.1 COLLABORATIVE DEVELOPMENT OF BASIN ENVIRONMENTAL MONITORING PLAN

Since January 2002, EPA has been working with Basin regulatory stakeholders to collaboratively develop a long-term Basin Environmental Monitoring Plan (BEMP). Organizations initially involved with EPA in development of the monitoring program include the Idaho Department of Environmental Quality (IDEQ), Washington Department of Ecology (Ecology), Coeur d'Alene Tribe, Spokane Tribe, U.S. Fish and Wildlife Service (USFWS), U.S. Geological Survey (USGS), and the Bureau of Land Management (BLM). Media-specific workgroups were established to focus on specific Basin needs regarding surface water, soil/sediment, biological resources and Coeur d'Alene Lake. The larger group and the smaller working groups have had numerous discussions, teleconferences and meetings to discuss the formulation of the environmental monitoring program.

The Coeur d'Alene Basin Environmental Improvement Project Commission (Basin Commission) was established in August 2002 by the Idaho legislature to implement the Basin ROD and the Coeur d'Alene Lake Management Plan (LMP). Since establishment of the Basin Commission, EPA has been working with parties in the Commission and its support teams to develop this draft monitoring plan. The Basin Commission established a Technical Leadership Group (TLG) and Citizens Coordinating Council (CCC) to provide the Basin Commissioners with recommendations regarding implementation of the ROD and LMP. Within the TLG, project-focused workgroups formed to tackle specific implementation issues. Among many workgroups formed, a Monitoring Project Focus Team was established to focus on monitoring issues. Members were self-selected but included nearly all of the parties involved in the initial monitoring workgroup established in January 2002, as well as additional participants from the TLG. Members of the Citizens Coordinating Council were invited to attend meetings to stay informed and provide input. Several CCC members indicated particular interest in the monitoring issues and in turn received all subsequent informational emails and conference call/meeting announcements.

1.2 GOAL AND OBJECTIVES

The environmental monitoring program is established as part of the selected remedy and will be critical to the successful implementation and evaluation of the remedy. The goal of the BEMP is to evaluate the success of the 2002 Coeur d'Alene Basin ROD in remediating the historic mining waste contamination and improving ecosystem conditions. The BEMP does not, however, conduct basic research to investigate fundamental phenomena or develop mechanistic (physico-chemical process-based) spatial-temporal performance models of the selected remedy.

The monitoring program provides data relative to the following Basin-wide monitoring objectives:

- Assess long-term status and trends of surface water, soil, sediment, and biological resource conditions in the Basin
- Evaluate the effectiveness of the selected remedy
- Evaluate progress toward cleanup benchmarks
- Provide data for CERCLA-required five-year reviews of the progress on remedy implementation
- Improve understanding of Basin processes and variability to in turn improve the effectiveness and efficiency of subsequent remedial action implementation

Basin monitoring data will be integrated with effectiveness monitoring data collected in the Basin to gain a better understanding of Basin conditions and how to improve the cleanup effort.

Effectiveness monitoring data will include, at a minimum, data collected at specific remedial actions implemented under the OU 3 ROD as well as data collected within Coeur d'Alene Lake under the LMP and the Bunker Hill Box OUs 1 and 2, a 21-square-mile area surrounding the smelting operations (Figure 1-1). All data that may help understand Basin processes and provide information to guide effective implementation of the selected remedy will be included in the future data analyses.

1.3 SCOPE OF BASIN-WIDE MONITORING PROGRAM

1.3.1 Media Addressed

The scope of the environmental monitoring program includes three primary media:

- Surface water
- Soil and sediment
- Biological resources

The OU 3 selected remedy for environmental protection consists of interim measures and does not include remediation of Basin-wide groundwater contamination. However, groundwater monitoring will also be conducted to the extent necessary to address surface water issues and gain a better understanding of Basin-wide issues. The importance of the inter-relationship between groundwater and surface water is recognized and it is expected that the remedial action-specific effectiveness monitoring often will include a groundwater monitoring component.

1.3.2 Geographic Scope

The geographic area covered by the monitoring plan includes the area addressed in the OU 3 ROD. Specifically, the plan includes the Upper Basin (the South Fork and its tributaries, with monitoring of the North Fork limited to surface water samples collected near its confluence with the South Fork), the lower Coeur d'Alene River and Lateral Lakes area (Lower Basin), and the Spokane River. Since the OU 3 ROD does not cover Coeur d'Alene Lake, lake monitoring is not part of the monitoring plan.

Coeur d'Alene Lake surface water, sediment, and biological resources are addressed in a separate Lake Monitoring Plan, which is a component of the Coeur d'Alene Lake Management Plan (LMP) (see Section 1.7 of this plan). The Lake Monitoring Plan is intended to provide data and information to assess the effectiveness of the LMP. Accordingly, monitoring of the lake conducted under the Basin-wide monitoring program is limited to the inflow and outflow of the lake. The data collected via the Lake Monitoring Plan will be integrated as appropriate into the analysis of Basin conditions, as will other effectiveness monitoring conducted in the Basin.

1.4 SITE BACKGROUND

To provide a context for the BEMP, this section briefly describes the history of the site. There is substantial detailed information regarding site background in many documents including the Basin RI/FS (EPA 2001a; EPA 2001b) and Basin Ecological Risk Assessment (EPA 2001c).

The historic mining and processing of metal-rich ores within North Idaho's Coeur d'Alene Basin began more than 100 years ago and has produced widespread metal contamination of soil, sediment, water, and biota within the Basin. The Basin has been one of the leading silver, lead, and zinc-producing areas in the world. The BLM has identified nearly 900 mining or milling-related features in the region surrounding the South Fork Coeur d'Alene River. Mining-related activities generated tailings, waste rock, concentrates, and smelter emissions. In addition, the water that drains from many abandoned adits contains elevated levels of metals. Mining, milling, and smelting practices resulted in substantial portions of the Basin containing elevated concentrations of metals that are potentially hazardous to humans and to plants and animals. The primary metals of concern include lead and arsenic for human health and cadmium, lead, and zinc for ecological receptors.

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 beds, banks, floodplains and lateral lakes of the Upper/Lower Basin and Coeur d'Alene Lake. Some fine-grained material washed through Coeur d'Alene Lake and was deposited as sediment within the Spokane River flood channel. The estimated total mass and extent of the impacted materials (primarily sediments) exceeds 100 million tons dispersed over thousands of acres.

The EPA has identified three operable units within the Bunker Hill Facility: 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). While this monitoring plan focuses on environmental monitoring in OU 3, the data gathered from monitoring programs within the Bunker Hill Box and Coeur d'Alene Lake will contribute to the understanding of the Basin as a whole. Monitoring associated with human health remedies, as well as other monitoring programs within the Basin, will be addressed during the five-year review of remedy implementation.

1.4.1 Bunker Hill Box

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

The populated areas of the Bunker Hill Box (OU 1) includes the residential and commercial properties, rights-of way (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. The 1991 ROD addressed the residential soils component of OU 1 and other aspects were covered as part of a ROD issued in 1992, primarily for OU 2. Much of the focus of activities in OU 1 has been to remediate residential yards, schools, daycares, commercial properties and ROWs with contaminated soil. A five-year review of OU 1 was completed in 2000 and further describes OU 1 cleanup activities (EPA 2000a).

1.4.1.2 Operable Unit 2 (Non-populated Areas of the Bunker Hill Box)

Operable Unit 2 comprises the non-populated areas of the Box and includes the former industrial complex and mine operations area, river floodplain, hillsides, various creeks and gulches, surface water and groundwater, the Central Impoundment Area, and the Bunker Hill Mine and associated acid mine drainage (AMD). Site potentially responsible parties performed various removal activities pursuant to orders prior to a 1992 ROD, including smelter stabilization efforts, hillsides revegetation, and fugitive dust control. There have been two amendments to the 1992 ROD (1996 and 2001). A five-year review of OU 2 was completed in 2000 (EPA 2000b).

Much of the Bunker Hill Box is underlain by mine tailings, and substantial metal loads enter the South Fork Coeur d'Alene River as it passes through the Box. Based on estimated average values, about 1,550 pounds per day of dissolved zinc (about 53 percent of the total Upper Basin load) comes from sources inside the Bunker Hill Box. As noted above, OU 2 includes the Bunker Hill Mine and associated AMD, which contains very large loads of metals. The Central Treatment Plant (CTP) has not been significantly upgraded since it was built in 1974. The 2001 ROD amendment addressed issues concerning the CTP.

Due to the location and impacts of OU 2, integration of the OU 2 environmental monitoring data with the Basin-wide data will be critical to understanding the Basin-wide environmental monitoring.

1.4.2 Operable Unit 3 (Coeur d'Alene Basin)

The risks posed to human and environmental health by historic mining contamination prompted the EPA to conduct a Remedial Investigation/Feasibility Study (RI/FS) of the Coeur d'Alene Basin (EPA 2001a, EPA 2001b). The RI/FS began in 1998 and resulted in the Coeur d'Alene Basin ROD, which was issued in September 2002. The remedial actions selected in the ROD for OU 3 focus largely on mining-related contamination within the floodplains and river corridors of the Basin, exclusive of the populated (OU 1) and unpopulated areas (OU 2) within the Bunker Hill Box.

A selected remedy for Lake Coeur d'Alene is not included in the interim ROD (see Section 12.3 of the ROD). As an alternative to remedial action, the Idaho DEQ and Coeur d'Alene Tribe are formulating a revised nutrient-control Lake Management Plan, or LMP, outside of Superfund and having the objective of using separate state, tribal and local regulatory authorities to protect lake quality and control metals mobility. The revised LMP is expected to improve upon an LMP first developed in 1995, prior to the Basin-wide Superfund Remedial Investigation efforts, and assure effective implementation. A draft of revisions underwent public review and comment in April 2003. The final revised plan is pending. One important component of the LMP revision effort is the inclusion of an environmental monitoring program to assess effectiveness. A nutrient-driven monitoring plan for the lake is expected to be incorporated within the LMP revisions.

1.5 LEGAL REQUIREMENTS FOR MONITORING

The remedy selected by the interim action ROD is not the final remedy and recognizes that some contamination will remain on site into perpetuity. Under Section 121(c) of CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and under the Superfund implementation regulations, if contamination remains on site then post-response reviews are required every five years in perpetuity to ensure protection of human health and the environment. The EPA further interpreted this requirement in the National Contingency Plan (NCP) (40 CFR 300.430(f)(4)(ii)), which states that if contaminants remain on site above levels that allow for unlimited use and unrestricted exposure, then the lead agency must review the action at least every five years. The preamble to the National Contingency Plan (NCP) states that the focus of the five-year review should be an assessment of monitoring data to evaluate whether the remedy continues to provide for adequate, risk-based protection of human health and the environment (55 FR 8730, March 8, 1990). Additional authority regarding monitoring gives the EPA authority to undertake monitoring to identify threats (42 U.S.C. 9604(b)) and defines

remedial actions as inclusive of any monitoring reasonably required to ensure that such actions protect the public health, welfare, and the environment.

1.6 FIVE-YEAR REVIEWS AND ADAPTIVE MANAGEMENT

An important objective of the monitoring program is to provide data for five-year reviews, including evaluation of progress toward the benchmarks of the selected remedy. The five-year review process under CERCLA focuses on answering the following three questions (EPA 2001d):

- Is the remedy functioning as intended by the decision documents?
- Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection still valid?
- Has any other information come to light that could call into question the protectiveness of the remedy?

Five-year reviews for all site operable units are conducted on a unified schedule to present a comprehensive picture of site status. The next five-year review is due in September 2005 and subsequent reviews will be due every five years thereafter for the foreseeable future.

Remedial action performance will be evaluated, in part, by comparing the long-term monitoring data to the benchmarks of the selected remedy. The monitoring hypotheses for this monitoring program have been developed to answer questions relating to progress toward benchmarks of the selected remedy, where possible, and the timing of monitoring events will be selected with consideration of five-year review data needs. Effectiveness monitoring data will be used to complement the long-term monitoring data during five-year review evaluations.

The ROD calls for an adaptive management framework to remedy implementation, and a component of the five-year review is anticipated to be an adaptive management review. Under the adaptive management process, which is described in Section 6 of this document, the BEMP data will be analyzed and interpreted in order to evaluate remedy performance against the ROD benchmarks, which are the expectations of remedy performance. These evaluations and the experience gained from remedy implementation may help identify and guide "course corrections" that improve remedy performance or cost-effectiveness. Specific efforts include detecting trends or major trend discontinuities, which may signal a need to update critical assumptions or change management practices, potentially including the BEMP itself.

1.7 OTHER MONITORING ACTIVITIES

1.7.1 Bunker Hill Box

In the Bunker Hill Box, a water quality assessment (WQA) program and biological resources monitoring are being implemented under the OU 2 ROD. The primary goal of the WQA program is to determine the effect that remedial actions have had on water quality in the Box and to aid future remedial action decisions, in particular the control of dissolved metals reaching the South Fork Coeur d'Alene River. In order to achieve this with any degree of certainty, a better understanding of metal concentrations and loads entering, moving within, and exiting the Box is needed. Two parallel objectives include better defining the overall Box contribution to the Basin metal loads and better defining where the load is originating from within the Box. The latter objective is necessary to help determine what effect, if any, individual remedial actions have had on water quality, and where additional remedial activities may be needed in the future to reduce metals loading from the Box.

There are currently 80 wells in the Box monitoring network, including 23 that were installed in 2003. Until recently, there were not enough data points to effectively evaluate trends or even patterns within the data. When combined with water level measurements, patterns are now appearing. Work is underway to evaluate the historical data on each well to see if and where these patterns hold. This evaluation also should lead to the reduction of monitoring frequency where results are consistent (such as the deeper aquifer), and the deletion of some wells altogether where information is duplicated. One question that will be much harder to answer is how any trends observed using recent data (past 8 years) might be influenced by other significant site activities, such as the treatment plant going online in the early 1970s. It may be too early to notice trends due to specific remedial actions due to the "noise" caused by the treatment plant both prior to, and after, going online.

Surface water sampling is being conducted at the mouths of tributaries throughout the Box. Metals loading from surface water sources is calculated at 13 different stations and, as of this year, will be coordinated with USGS sampling data collected along several points of the South Fork of the Coeur d'Alene River in the Box. Gaining and losing reaches of the river add to the complexity of surface water/groundwater evaluations. The WQA team is scheduled to complete additional measurements of low-flow groundwater seepage along the South Fork of the Coeur d'Alene River in 2004 to help better understand this relationship. The impact of the Central Impoundment Area (CIA) cap on the reach where the CIA seeps have historically been located is of primary interest. The USGS completed these measurements in 1999 prior to installation of the cap. A comparison with 2004 measurements, after five years of CIA dewatering has taken place, will aid in the effectiveness evaluation of that particular remedial activity.

Biological monitoring of the non-populated areas of the Bunker Hill Box is being conducted to assess the effectiveness of the remedies as they relate to biological resources (wildlife, fish and

other aquatic resources, plants, and associated habitats) and to provide data to inform future remedial actions. All studies are currently implemented by the USFWS under an inter-agency agreement with EPA (USFWS 2001, 2002). The investigations include:

- Songbird and waterfowl surveys
- Songbird and waterfowl blood collection
- Small mammal population surveys and metals evaluation
- Amphibian/reptile surveys
- Fish population surveys and metals evaluation
- Aquatic and riparian habitat evaluation
- Wetland vegetation mapping
- Floodplain and riparian community sampling
- Riparian vegetation community sampling
- Wildlife fecal evaluation

The biological resources monitoring is being conducted at several locations within the Box, including Smelterville Flats, hillsides, gulches, and the South Fork Coeur d'Alene River.

1.7.2 Coeur d'Alene Lake

As noted above, Coeur d'Alene Lake is not included in the OU 3 ROD. The Idaho DEQ and Coeur d'Alene Tribe are working with local, state, and federal parties to develop a lake monitoring plan as part of a revised Lake Management Plan (LMP) (CLCC 1996). The Basin-wide monitoring plan described herein includes stations relative to the lake as needed to characterize the mass balance of metals and nutrients in the lake for long-term status and trends. The BEMP includes surface water monitoring stations at the mouths of the major tributaries and the outflow from the Lake. Additional monitoring designed to assess the effectiveness of the LMP is expected to be included within the LMP monitoring program. Results from the LMP effectiveness monitoring will be incorporated into evaluations of Basin conditions.

1.7.3 Human Health

The focus of this plan is environmental monitoring. The monitoring conducted under this plan will provide data that can be used for assessing progress toward protecting human health, particularly for exposures related to recreational and subsistence uses. The plan, however, is not designed to monitor protection of human health in the community and residential areas of the Basin upstream of Coeur d'Alene Lake. The selected remedy includes a lead health intervention program that will provide for monitoring of human health in the community and residential areas.

The selected remedy also includes monitoring of aquatic food sources, such as fish and water potatoes, for protection of human health. The Basin-wide environmental monitoring program

will draw on these monitoring results as part of the evaluation of biological resource conditions in the Basin.

1.7.4 Remedial Action Effectiveness Monitoring

Action-specific effectiveness monitoring will focus on specific areas (tributaries, river reaches, etc.) that have been addressed by remedial actions. By comparison, the long-term status and trends monitoring program will address basin-wide conditions by monitoring a limited number of strategic locations. The long-term monitoring plan was designed to integrate effectiveness monitoring with status and trends monitoring results. The effectiveness and long-term monitoring plans will be integrated by coordinating monitoring to generate comparable data (same timeframe or synoptic) and using common sampling locations, where possible. Effectiveness monitoring, while not detailed in this plan, will incorporate similar monitoring hypotheses as those presented in this plan. The adaptive management approach will maximize the utility of effectiveness monitoring data through comparison of results to expectations. The BEMP relies on and anticipates the systematic performance of action-specific effectiveness monitoring across the Basin.

1.7.5 Monitoring Activities Under Other Programs

In addition to the monitoring related to the Superfund activities noted above, a variety of non-CERCLA monitoring efforts, either on-going or in the process of being developed, are occurring in the Coeur d'Alene Basin. To the extent possible, the monitoring conducted under the BEMP will be coordinated and linked with the other monitoring efforts to ensure as much commonality as practical, given potentially different authorities, management goals, and jurisdictions. Examples of other monitoring efforts include, but are not limited to, monitoring that the state water quality program does for 303(d) listing of impaired water bodies, IDEQ's Beneficial Use Reconnaissance Program (BURP), and IDEQ and U.S. Forest Service effectiveness monitoring programs.

1.8 DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) are qualitative and quantitative statements that:

- Clarify the study objective
- Define the most appropriate type of data to collect
- Determine the most appropriate conditions from which to collect the data
- Specify tolerable limits on decision errors that will be used as the basis for establishing the quantity and quality of data needed to support the decision

The Basin environmental monitoring program uses the DQO process, which is a strategic planning approach based on the scientific method to prepare for a data collection activity (EPA 1994, EPA 2000c). The DQO process provides a systematic procedure for defining the criteria that a data collection design should satisfy, including when to collect samples, where to collect samples, the tolerable level of decision error for the study, and how many samples to collect, while balancing risk and cost in an acceptable manner. The data quality assessment process is a comparison of the implemented sampling approach and resulting analytical data against the sampling and data quality requirements specified by the DQOs. The results are meant to determine whether the data are of adequate quality and quantity to support the decision-making process.

The DQO process will assure that the type, quantity, and quality of environmental data used in decision-making will be appropriate for the intended application, resulting in environmental decisions that are technically and scientifically sound and legally defensible. In addition, the DQO process will guard against committing resources to data collection efforts that do not support a defensible decision. To this end, DQOs will be evaluated as part of the adaptive management process as part of the five-year process.

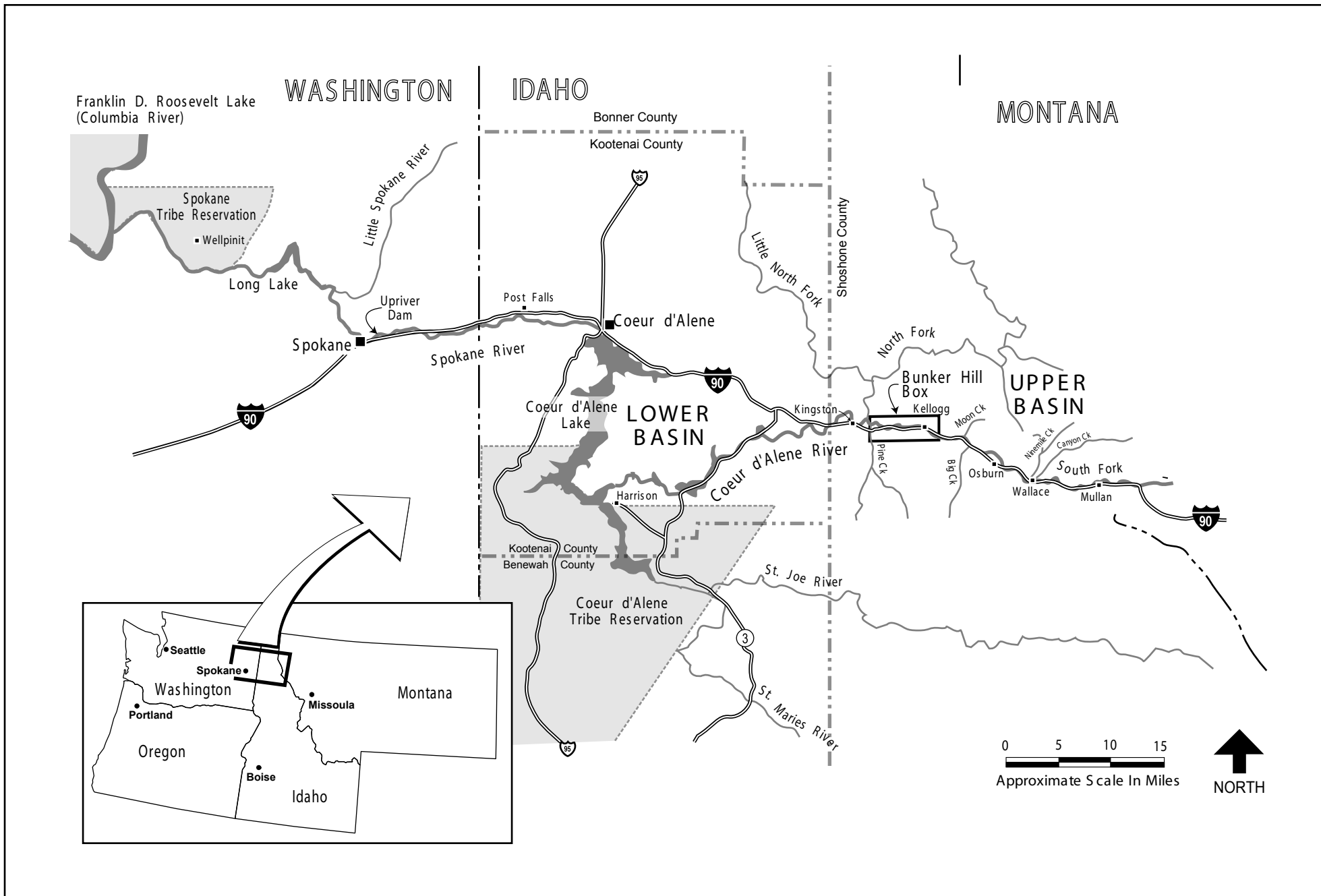
A detailed description of the DQO process is presented in Appendix B.

1.9 REPORT ORGANIZATION

The BEMP is presented in the following sections.

- Section 2.0 **Summary of Basin Model and Processes** describes the conceptual model used in the Basin RI/FS, ecological exposure pathways and receptors, and baseline (pre-remediation) conditions in surface water, groundwater, soil and sediment, and biological resources.
- Section 3.0 **Monitoring Assumptions, Approach, Hypotheses, and Benchmarks** describes the framework for development of the media-specific monitoring plans, which includes the working assumptions of Basin processes, the monitoring approach, specific monitoring hypotheses, and the ecological benchmarks identified in the ROD.
- Section 4.0 **Basin-Wide Environmental Monitoring Program** describes the media-specific monitoring plans for surface water, soil and sediment, and biological resources.
- Section 5.0 **Data Collection Methods** provides a general description of field sample and data collection methods and laboratory analysis methods.

- Section 6.0 **Evaluation and Interpretation of Sampling Results** describes the range of techniques that may be used to evaluate and interpret the media-specific monitoring data.
- Section 7.0 **Data Management and Reporting** describes the methods used to manage the monitoring data and present the monitoring results.
- Section 8.0 **References** provides citations for references used in this report.



Coeur d'Alene Basin
ENVIRONMENTAL
MONITORING PLAN

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Figure 1-1
Basin Study Area