
Final

Environmental Monitoring Plan
Operable Unit 2
Bunker Hill Mining and Metallurgical
Complex Superfund Site



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Executive Summary

Introduction

This document presents the Operable Unit 2 Environmental Monitoring Plan (OU2 EMP). The OU2 EMP has been developed to guide the collection, analysis, and interpretation of water quality and biological resources data to assess the effectiveness of the overall Phase I remedy for OU2 of the Bunker Hill Mining and Metallurgical Complex Superfund Site based on goals and objectives identified in the 1992 Record of Decision (ROD) (EPA, 1992), ROD Amendments (EPA 1996a and 2001a), and explanations of significant differences (ESDs) (EPA 1996b and 1998).

Operable Unit 2 of the Bunker Hill Mining and Metallurgical Complex Superfund Site (Figure ES-1) has been the focus of remedial activities since 1983 when it was placed on the National Priorities List (NPL). The remedy for OU2 was selected in the 1992 OU2 ROD and amended in 1996 and 2001. In 1994, responsibility for the implementation of the selected remedy was passed from the potentially responsible parties (PRPs) to the U.S. Environmental Protection Agency (EPA). In 1995, the EPA and State of Idaho entered into a State Superfund Contract (SSC) (IDHW, 1995) to provide a framework for collaborative decision-making and site cleanup. As part of the SSC a Comprehensive Cleanup Plan (CCP) was developed to define a path forward for remedy implementation within OU2 that focused on a phased approach to remedy implementation. It is important to note that the South Fork of the Coeur d'Alene River (SFCDR) and the Pine Creek drainage are part of Operable Unit 3 (OU3) even though they are located within the Bunker Hill Box. Given this, the OU2 EMP has been developed and is intended to coordinate with the OU3 Basin Environmental Monitoring Plan (BEMP) (EPA, 2004).

Under Phase I of the CCP, remedial actions were focused on human health-related remedial actions and enhanced source removal and capping. Phase I also includes the evaluation of initial remedial actions on water quality and ecological conditions within OU2. Phase II is intended to focus on remaining water quality, ecological, and management issues remaining after Phase I activities, including implementation of additional remedial actions that may be necessary.

OU2 EMP Goals and Objectives

The OU2 EMP presents the environmental monitoring program for the overall Phase I remedy implemented for OU2. The major goal of the OU2 EMP is to monitor and evaluate the Phase I remedy with respect to the 1992 OU2 ROD goals and objectives. Consistent with that goal, the OU2 EMP will provide data relative to the following OU2-wide monitoring objectives:

- Evaluate tributaries to the SFCDR within OU2 with respect to compliance with ambient water quality criteria (AWQC)

- Evaluate groundwater within OU2 with respect to compliance with maximum contaminant levels (MCLs)
- Evaluate potential impacts to SFCDR water quality from tributaries and groundwater within OU2
- Evaluate the cumulative effect of Phase I remedial actions with respect to surface water, groundwater, and ecological conditions
- Provide data for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) required five-year reviews
- Improve understanding of processes and variability within OU2 to assist in Phase I remedial action evaluations and Phase II remedial action design and implementation.

OU2 EMP Design

The OU2 EMP design is founded on several primary principles that are intended to enhance practicality, robustness, and cost-effectiveness of data collection and analysis while maintaining adequate technical rigor and effectiveness. First, the OU2 EMP focuses on the goals for the OU2 remedy identified in the 1992 OU2 ROD. The 1992 OU2 ROD identifies goals with respect to water quality and ecological conditions.

The following key indicators of change are the focus of the OU2 EMP:

- Dissolved and total metals in surface water
- Dissolved metals in groundwater
- Fish, macroinvertebrates, and aquatic habitat in riverine environments
- Songbirds, vegetation, and invertebrates in riparian and upland environments
- Waterfowl in palustrine environments

Second, the monitoring program uses parameters and sampling frequencies that are intended to be sensitive and responsive to the potential rates of relevant environmental changes in OU2 over the monitoring period. The monitoring program includes parameters monitored at relatively long intervals (e.g., 5 years) and parameters measured at more frequent intervals (e.g., semi-annually). It is expected that this approach will reduce sample collection and analysis costs, while maintaining adequate monitoring effectiveness in terms of sensitivity and responsiveness.

OU2 EMP Activities

The environmental monitoring identified in the OU2 EMP includes sampling, testing, and evaluation of three primary media: surface water, groundwater, and biological resources. The specific monitoring activities, sampling locations, and schedules for the OU2 EMP are summarized in the tables at the end of this section.

Relationship to Other Bunker Hill Superfund Site Monitoring

The OU2 EMP data will be integrated with data from the OU3 BEMP (EPA, 2004), Phase I remedial action-specific effectiveness monitoring plans (Appendix C), and other monitoring programs conducted within OU2. This approach is anticipated to reduce monitoring redundancy and enhance cost-effectiveness. The monitoring conducted under the OU2 EMP will be coordinated with monitoring efforts in OU3 to maximize commonality and compatibility to the extent practical, given the different authorities, management goals, and jurisdictions.

Adaptive Management

It is anticipated that the OU2 EMP will evolve over time. The monitoring program assumes that an adaptive management approach will be used to guide appropriate revisions to the monitoring requirements, while maintaining a sound scientific and technical basis. The adaptive management approach emphasizes “learning from experience” and is tied to the statutory five-year review process.

TABLE ES-1
Surface Water Monitoring Program
OU2 Environmental Monitoring Plan
Bunker Hill Superfund Site OU2

Location	Station ID	Historic Name	OU2 EMP	BEMP ^a	RA Effectiveness	Rationale
SFCDR at Elizabeth Park	SF-268	USGS 12413210 SF-2	X	X		SFCDR water quality entering OU2 at the eastern boundary under base-flow and high-flow conditions. Contaminant metal concentrations in the SFCDR entering OU2 typically exceed AWQC. Data from this location will be used to determine SFCDR background conditions prior to flowing through OU2.
Old Milo Creek Outfall	BH-MC-0001	MC-0	X			Monitoring location at the old Milo Creek outfall to the SFCDR. Monitoring data collected from this location represent Milo Creek surface water and groundwater that is not captured and conveyed by the new Milo Creek pipeline.
New Milo Creek Outfall	BH-MC-0002	MC-2	X			Monitoring location at the new Milo Creek outfall to the SFCDR. Monitoring data collected from this location represent Milo Creek surface water and groundwater that is captured and conveyed by the new Milo Creek pipeline. Data from this location will be used to evaluate tributary impacts to SFCDR water quality.
Italian Gulch	BH-IG-0001	IG-1, IG-3	X			Monitoring location on Italian Creek prior to discharge to the SFCDR. Contaminant metal concentrations measured at this location have generally been below AWQC. However, minimal data is available for this location and additional data will be required to compute discharge and mass balances for evaluation of OU2 tributary contributions to the SFCDR.
Jackass Creek	BH-JC-0001	JC-1, JC-3	X			Monitoring location on Jackass Creek prior to discharge to the SFCDR. Contaminant metal concentrations measured at this location have generally been below AWQC. However, minimal data is available for this location and additional data will be required to compute discharge and mass balances for evaluation of OU2 tributary contributions to the SFCDR.
SFCDR at Kellogg	SF-269	USGS 1241320 SF-4	X	X	CIA	SFCDR water quality and discharge upstream of the CIA. Monitoring data from this location will provide information regarding SFCDR water quality as it flows through OU2 and will provide SFCDR water quality upstream of the CIA in an area where the SFCDR transitions from a losing to a gaining reach. Colocated with groundwater monitoring Transect 2.
Seeps North of CIA	BH-CS-0001	CIA Seeps	X			Discrete groundwater seep located in the south bank of the SFCDR north of the CIA. Contaminant metal concentrations measured at this location are similar to groundwater quality measured in nearby monitoring wells. This location is recommended for continued sampling in the near term. However, pending the results of OU2 EMP and CIA RA effectiveness monitoring, it may be more beneficial to focus resources on surrounding groundwater monitoring and/or groundwater/surface water interaction monitoring in this area.
Bunker Creek Headwaters	BH-BC-0003	BC-HW			Bunker Creek	Monitoring location at the headwaters of Bunker Creek. It is important to note that Bunker Creek is a man-made conveyance ditch and that the headwaters normally only have discharge under high-flow conditions as a result of stormwater runoff from the City of Kellogg. This monitoring location will provide discharge and quality data for Bunker Creek prior to inputs from tributaries and the CTP.
Portal Gulch	BH-PG-0001	BC-2D, PG-1	X		Bunker Creek	Monitoring location at the discharge of Portal Gulch to Bunker Creek. Portal Gulch is the location of the Kellogg Tunnel and Bunker Hill Mine yard. Portal Gulch typically only exhibits discharge under high-flow conditions. Data from this location will be used to evaluate Portal Gulch water quality impacts on Bunker Creek.
Bunker Hill Mine Yard	BH-MY-0001	MY-1	X		Bunker Creek	Stormwater discharge to Bunker Creek from the Bunker Hill Mine yard. Discharge at this location only occurs under high flow conditions. Data from this location will be used to evaluate impacts on Bunker Creek water quality.
Bunker Creek after CTP	BH-BC-0004	New location			Bunker Creek	Bunker Creek water quality, colocated with groundwater monitoring well BH-SF-E-0320-U. Data collected at this location will be used to evaluate groundwater/surface water interaction between Bunker Creek and the underlying upper aquifer and to evaluate the performance of the Bunker Creek remedial action with respect to remedial action objectives.
Railroad Gulch	BH-RR-0001	RR-1	X		Bunker Creek	Monitoring location at the discharge of Railroad Gulch to Bunker Creek. Railroad Gulch typically only exhibits discharge under high-flow conditions. Data from this location will be used to evaluate Railroad Gulch water quality impacts on Bunker Creek.
Deadwood Gulch	BH-DW-0001	BC-2B, DW-3	X		Bunker Creek	Monitoring location at the discharge of Deadwood Creek to Bunker Creek. Data from this location will be used to evaluate Deadwood Creek water quality impacts on Bunker Creek.
Bunker Creek between Deadwood and Magnet creeks	BH-BC-0005	New location			Bunker Creek	Bunker Creek water quality, colocated with groundwater monitoring well BH-SF-E-0410-U. Data collected at this location will be used to evaluate groundwater/surface water interaction between Bunker Creek and the underlying upper aquifer and to evaluate the performance of the Bunker Creek remedial action with respect to remedial action objectives.
Magnet Gulch	BH-MG-0001	BC-2C, MG-3	X		Bunker Creek	Monitoring location at the discharge of Magnet Creek to Bunker Creek. Data from this location will be used to evaluate Magnet Creek water quality impacts on Bunker Creek.
Bunker Creek	BH-BC-0001	BC-2	X		Bunker Creek	Monitoring location at the discharge of Bunker Creek to the SFCDR. Data from this location will be used to evaluate tributary impacts on SFCDR water quality and to evaluate the effectiveness of the Bunker Creek Phase I remedial action with respect to remedial action objectives.

TABLE ES-1
 Surface Water Monitoring Program
 OU2 Environmental Monitoring Plan
 Bunker Hill Superfund Site OU2

Location	Station ID	Historic Name	OU2 EMP	BEMP ^a	RA Effectiveness	Rationale
Government Creek above Zinc Plant	BH-GG-0002	GG-2			Government Gulch	Government Creek water quality, collocated with groundwater monitoring well BH-GG-GW-0002. Data collected at this location will be used to evaluate groundwater/surface water interaction between Government Creek and its tributary aquifer and to evaluate the performance of the Government Gulch remedial action with respect to remedial action objectives.
Government Creek in Zinc Plant Area	BH-GG-0005	New location			Government Gulch	Government Creek water quality, collocated with proposed new groundwater monitoring well BH-GG-GW-0009 in an area where source removals did not occur. Data collected at this location will be used to evaluate groundwater/surface water interaction between Government Creek and its tributary aquifer and to evaluate the performance of the Government Gulch remedial action with respect to remedial action objectives.
Government Creek downgradient of Zinc Plant	BH-GG-0006	New location			Government Gulch	Government Creek water quality, collocated with proposed new groundwater monitoring well BH-GG-GW-0010. Data collected at this location will be used to evaluate groundwater/surface water interaction between Government Creek and its tributary aquifer and to evaluate the performance of the Government Gulch remedial action with respect to remedial action objectives.
Government Creek upgradient of Phosphoric Acid Plant	BH-GG-0007	New location			Government Gulch	Government Creek water quality, collocated with groundwater monitoring well BH-GG-GW-0003. Data collected at this location will be used to evaluate groundwater/surface water interaction between Government Creek and its tributary aquifer and to evaluate the performance of the Government Gulch remedial action with respect to remedial action objectives.
Government Creek downgradient of Phosphoric Acid Plant	BH-GG-0008	New location			Government Gulch	Government Creek water quality, collocated with groundwater monitoring well BH-GG-GW-0004. Data collected at this location will be used to evaluate groundwater/surface water interaction between Government Creek and its tributary aquifer and to evaluate the performance of the Government Gulch remedial action with respect to remedial action objectives.
Government Creek at Gulch Mouth	BH-GG-0001	GG-3	X		Government Gulch	Monitoring location at the mouth of Government Gulch. Water quality and discharge data collected from this location will be representative of conditions in Government Creek prior to flowing across the main valley floor. Data collected at this location will be used to evaluate groundwater/surface water interaction between Government Creek and its tributary aquifer and the main SFCDR valley upper aquifer and to evaluate the performance of the Government Gulch remedial action with respect to remedial action objectives.
Government Creek at SFCDR	BH-GG-0004	New location	X		Government Gulch	Monitoring location at the discharge of Government Creek to the SFCDR. Data from this location will be used to evaluate tributary impacts on SFCDR water quality and to evaluate the effectiveness of the Government Gulch Phase I remedial action with respect to remedial action objectives.
SFCDR at Smeltonville	SF-270	USGS 12413300 SF-5	X	X	CIA/Smeltonville Flats	SFCDR water quality and discharge downstream of the CIA. Monitoring data from this location will provide information regarding SFCDR water quality as it flows through OU2 and will provide SFCDR water quality upstream of the CIA in an area where the SFCDR transitions from a gaining to a losing reach. Collocated with groundwater monitoring Transect 5.
Grouse Creek	BH-GC-0001	GC-3, GC-1A	X			Monitoring location at the mouth of Grouse Gulch prior to the East Swamp. Water quality and discharge data collected from this location will be used to evaluate compliance with AWQC and to evaluate contributions to the Page Swamps which discharge to the SFCDR.
Humboldt Creek	BH-HC-0001	HC-1, HC-3	X			Monitoring location at the mouth of Humboldt Gulch prior to the West Swamp. Water quality and discharge data collected from this location will be used to evaluate compliance with AWQC and to evaluate contributions to the Page Swamps which discharge to the SFCDR.
West Page Swamp Outfall	BH-WP-0001	WP-1, WPS-1, OPS-1	X			Monitoring location at the outfall of the West Page Swamp prior to discharge to the SFCDR. Data from this location will be used to evaluate tributary impacts on SFCDR water quality.
Pine Creek below Amy Gulch	PC-339	USGS 12413445 PC-2	X	X		Monitoring location in the upgradient portion of the Pine Creek drainage. Data from this location will be used in the evaluation of Pine Creek discharge and quality on SFCDR water quality.
Pine Creek at SFCDR	BH-PC-0001	New location	X			Monitoring location at the discharge of Pine Creek to the SFCDR. Data from this location will be used to evaluate tributary impacts on SFCDR water quality.
SFCDR at Pinehurst	SF-271	USGS 12413470 SF-8	X			SFCDR discharge and water quality at the western boundary of OU2. Data from this location will be used to evaluate OU2 impacts on SFCDR water quality as it passes through OU2.

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Location	Station ID	Historic Name	OU2 EMP	BEMP ^a	RA Effectiveness	Rationale
Central Treatment Plant	BH-CTP-0001 ^b	BC-CTP	X		Bunker Creek	Discharge input to Bunker Creek
Page Wastewater Treatment Plant	BH-PTP-0001 ^b	PTP-1	X			Wastewater treatment plant discharge to the SFCDR. Monitoring conducted as part of an NPDES permit. Data will be gathered and used for evaluation of SFCDR water quality as it flows through OU2.
Smeltonville Wastewater Treatment Plant	BH-STP-0001 ^b	STP-1	X			Wastewater treatment plant discharge to the SFCDR. Monitoring conducted as part of an NPDES permit. Data will be gathered and used for evaluation of SFCDR water quality as it flows through OU2.

Notes:

All monitoring locations sampled under base-flow and high-flow conditions.

^a Monitoring locations sampled 8 times per year as part of the OU3 BEMP.

^b Treatment plant outfall monitoring performed by operations staff.

TABLE ES-2
Groundwater Monitoring Locations
OU2 Environmental Monitoring Plan
Bunker Hill Superfund Site OU2

Location	Historic Name	Hydrogeologic Unit	Frequency	OU2 EMP	RA Effectiveness Monitoring	Rationale
Transect 1						
BH-SF-E-0001	MW-01	Single Unconfined Aquifer	Semi-annual	X		Monitoring well located on Transect 1. Provides groundwater quality information for the upper portion of the single unconfined aquifer at the upgradient boundary of OU2. Contaminant metal concentrations at this location are generally below the MCL. This monitoring well has been selected for semi-annual sampling to fill data gaps associated with groundwater elevation data for the eastern portion of OU2 and to provide synoptic data with other Transect monitoring wells.
BH-SF-E-0002	MW-02	Single Unconfined Aquifer	Semi-annual	X		Monitoring well located on Transect 1. Provides groundwater quality information for the lower portion of the single unconfined aquifer at the upgradient boundary of OU2. Contaminant metal concentrations at this location are generally below the MCL. This monitoring well has been selected for semi-annual sampling to fill data gaps associated with groundwater elevation data for the eastern portion of OU2 and to provide synoptic data with other Transect monitoring wells.
BH-SF-E-0003	MW-03	Single Unconfined Aquifer	Semi-annual	X		Monitoring well located on Transect 1. Provides groundwater quality information for the upper portion of the single unconfined aquifer at the upgradient boundary of OU2. Contaminant metal concentrations at this location are generally below the MCL. This monitoring well has been selected for semi-annual sampling to fill data gaps associated with groundwater elevation data for the eastern portion of OU2 and to provide synoptic data with other Transect monitoring wells.
Transect 1 to Transect 2						
BH-SF-E-0101	GR-44UD	Single Unconfined Aquifer	Semi-annual	X		Monitoring location in the upper portion of the single unconfined aquifer near the mouth of Milo Gulch. Monitoring well is located in an area with relatively little data coverage. Monitoring data will be used to evaluate groundwater quality impacts from surface water infiltration through contaminated materials in a losing reach of the SFCDR and potential groundwater impacts on the upper portion of the single unconfined aquifer from the Milo Gulch tributary groundwater system.
BH-SF-E-0104	New Location	Single Unconfined Aquifer	Quarterly	X		Monitoring location near the SFCDR in an area with relatively little data coverage. Monitoring data will be used to evaluate groundwater quality impacts from surface water infiltration through contaminated materials in a losing reach of the SFCDR. Quarterly sampling of this monitoring well for 2 years is recommended to evaluate variability and build statistical data set.
BH-SF-E-0201	UMG-D	Single Unconfined Aquifer	Semi-annual	X		Monitoring location in the lower portion of the single unconfined aquifer prior to the eastern extent of the confining unit. Monitoring well is in an area with relatively little data coverage. Monitoring data will be used to evaluate groundwater quality impacts from surface water infiltration through contaminated materials in a losing reach of the SFCDR. Provides groundwater quality information for the lower portion of the single unconfined aquifer upgradient of the confining unit.
BH-SF-E-0202-U	New Location	Upper Aquifer	Quarterly	X		Monitoring location near the SFCDR in the upper aquifer in an area with relatively little data coverage. Monitoring well will be located downgradient of the eastern extent of the confining unit. Monitoring data will be used to evaluate groundwater quality impacts from surface water infiltration through contaminated material in a losing reach of the SFCDR. Quarterly sampling of this monitoring well for 2 years is recommended to evaluate variability and build statistical data set.
Transect 2						
BH-SF-E-0301-U	GR-52U	Upper Aquifer	Semi-annual	X	Bunker Creek/CIA	Monitoring location on groundwater monitoring Transect 2. Monitoring well is located in the upper aquifer near the pre-1900s SFCDR channel. Data from this monitoring well will be used to evaluate groundwater quality along Transect 2 in tandem with other transect monitoring wells, groundwater quality impacts resulting from infiltration of Bunker Creek surface water through contaminated materials, and groundwater quality data upgradient of the CIA.
BH-SF-E-0302-L	GR-52L	Lower Aquifer	Annual	X		Monitoring location on groundwater monitoring Transect 2. Monitoring well is located in the lower aquifer and data from this location will be used to evaluate groundwater quality along Transect 2 and in the lower aquifer.
BH-SF-E-0305-U	MW-04	Upper Aquifer	Semi-annual	X	CIA	Monitoring location on groundwater monitoring Transect 2. Monitoring well is located in the upper aquifer on the upgradient edge of the CIA. Data from this monitoring well will be used to evaluate groundwater quality along Transect 2 and water quality conditions upgradient of the CIA.
BH-SF-E-0306-L	MW-05	Lower Aquifer	Annual	X		Monitoring location on groundwater monitoring Transect 2. Monitoring well is located in the lower aquifer. Monitoring data from this location will be used to evaluate groundwater quality along Transect 2 and in the lower aquifer.
BH-SF-E-0309-U	MW-06	Upper Aquifer	Semi-annual	X	CIA	Monitoring well located on groundwater monitoring Transect 2. Monitoring well is located near the SFCDR in the upper aquifer on the upgradient edge of the CIA. Monitoring data from this location will be used to evaluate groundwater quality along Transect 2, groundwater/surface water interaction between the SFCDR and the upper aquifer, and groundwater quality upgradient of the CIA.
BH-SF-E-0310-L	MW-07	Lower Aquifer	Annual	X		Monitoring well located on groundwater monitoring Transect 2. Monitoring well is located in the lower aquifer. Monitoring data from this location will be used to evaluate groundwater quality along Transect 2 and in the lower aquifer.
BH-SF-E-0311-U	MW-09	Upper Aquifer	Semi-annual	X		Monitoring location on groundwater monitoring Transect 2. Monitoring well is located in the upper aquifer on the north side of the SFCDR. Monitoring data from this location will be used to evaluate groundwater quality along Transect 2 and groundwater/surface water interaction with the SFCDR.
Within the CIA						
BH-SF-E-0316-U	GWM-9	Upper Aquifer	Semi-annual		CIA	Monitoring location in the upper aquifer beneath the CIA. Monitoring data from this location will be used to evaluate upper aquifer water quality and groundwater elevations beneath the CIA.
BH-SF-E-0318-U	GWM-7	Upper Aquifer	Semi-annual		CIA	Monitoring location in the upper aquifer beneath the CIA. Monitoring data from this location will be used to evaluate upper aquifer water quality and groundwater elevations beneath the CIA.
BH-SF-E-0322-U	GWM-5	Upper Aquifer	Semi-annual		CIA	Monitoring location in the upper aquifer beneath the CIA. Monitoring data from this location will be used to evaluate upper aquifer water quality and groundwater elevations beneath the CIA.
BH-SF-E-0323-U	GWM-4	CIA Materials	Semi-annual		CIA	Monitoring well completed in CIA materials above the upper aquifer. This monitoring well has consistently been dry since installation. Groundwater elevation monitoring will be continued at this location to assess dewatering of CIA materials.
BH-SF-E-0407-U	GWM-2	Upper Aquifer	Semi-annual		CIA	Monitoring location in the upper aquifer beneath the CIA. Monitoring data from this location will be used to evaluate upper aquifer water quality and groundwater elevations beneath the CIA.
BH-SF-E-0408-U	GWM-1	Confining Unit				Monitoring well completed in the confining unit. Not selected for inclusion in OU2 EMP or RA Effectiveness monitoring.

TABLE ES-2
Groundwater Monitoring Locations
OU2 Environmental Monitoring Plan
Bunker Hill Superfund Site OU2

Location	Historic Name	Hydrogeologic Unit	Frequency	OU2 EMP	RA Effectiveness Monitoring	Rationale
BH-SF-E-0409-U	GWM-8	Upper Aquifer	Semi-annual		CIA	Monitoring location in the upper aquifer beneath the CIA. Monitoring data from this location will be used to evaluate upper aquifer water quality and groundwater elevations beneath the CIA.
BH-SF-E-0415-U	GWM-3	CIA Materials	Semi-annual		CIA	Monitoring location in the upper aquifer beneath the CIA. Monitoring data from this location will be used to evaluate upper aquifer water quality and groundwater elevations beneath the CIA.
Between CIA and SFCDR						
BH-SF-E-0314-U	00-MW-05	Upper Aquifer	Semi-annual	X	CIA	Monitoring well in the upper aquifer between the CIA and SFCDR. Data from this location will be used to evaluate CIA effectiveness and groundwater/surface water interaction.
BH-SF-E-0315-U	00-MW-06	Upper Aquifer	Semi-annual	X	CIA	Monitoring well in the upper aquifer between the CIA and SFCDR. Data from this location will be used to evaluate CIA effectiveness and groundwater/surface water interaction.
BH-SF-E-0317-U	GR-46	Upper Aquifer	Semi-annual	X	CIA	Monitoring well in the upper aquifer between the CIA and SFCDR. Data from this location will be used to evaluate CIA effectiveness and groundwater/surface water interaction.
BH-SF-E-0321-U	GR-57	Upper Aquifer	Semi-annual	X	CIA	Monitoring well in the upper aquifer between the CIA and SFCDR. Data from this location will be used to evaluate CIA effectiveness and groundwater/surface water interaction.
BH-SF-E-0402-U	GR-58S	Upper Aquifer	Semi-annual	X	CIA	Monitoring well in the upper aquifer between the CIA and SFCDR. Data from this location will be used to evaluate CIA effectiveness and groundwater/surface water interaction.
BH-SF-E-0403-U	GR-58D	Upper Aquifer	Semi-annual	X	CIA	Monitoring well in the upper aquifer between the CIA and SFCDR. Data from this location will be used to evaluate CIA effectiveness and groundwater/surface water interaction.
Between CIA and Bunker Creek						
BH-SF-E-0320-U	GR-50	Upper Aquifer	Semi-annual		Bunker Creek/CIA	Upper aquifer monitoring well located between Bunker Creek and the CIA. Data will be used to evaluate CIA effectiveness and groundwater/surface water interaction between Bunker Creek and the upper aquifer.
BH-SF-E-0410-U	GR-60	Upper Aquifer	Semi-annual		Bunker Creek/CIA	Upper aquifer monitoring well located between Bunker Creek and the CIA. Data will be used to evaluate CIA effectiveness and groundwater/surface water interaction between Bunker Creek and the upper aquifer.
Deadwood Gulch						
BH-DW-GW-0001	GR-40	Upland Tributary	Semi-annual	X		Monitoring well located at the mouth of Deadwood Gulch prior to the main SFCDR aquifer. Monitoring data from this location will be used to evaluate Deadwood Gulch tributary water quality and potential impacts on the main SFCDR valley upper aquifer.
Transect 3						
BH-SF-E-0423-U	GR-59	Upper Aquifer	Semi-annual	X	CIA	Monitoring location on groundwater monitoring Transect 3. Monitoring well is located on the downgradient edge of the CIA and near the SFCDR. Data from this monitoring well will be used to evaluate groundwater quality at Transect 3, CIA effectiveness, and groundwater/surface water interaction.
BH-SF-E-0424-L	MW-13	Lower Aquifer	Annual	X		Monitoring location on groundwater monitoring Transect 3. Monitoring well is located in the lower aquifer. Monitoring data from this location will be used to evaluate groundwater quality along Transect 3 and in the lower aquifer.
BH-SF-E-0425-U	MW-11	Upper Aquifer	Semi-annual	X	CIA	Monitoring location on groundwater monitoring Transect 3. Monitoring well is located in the upper aquifer on the downgradient edge of the CIA. Data from this monitoring well will be used to evaluate groundwater quality along Transect 3 and CIA remedial action effectiveness.
BH-SF-E-0426-L	MW-12	Lower Aquifer	Annual	X		Monitoring location on groundwater monitoring Transect 3. Monitoring well is located in the lower aquifer. Monitoring data from this location will be used to evaluate groundwater quality along Transect 3 and in the lower aquifer.
BH-SF-E-0427-U	GR-8	Upper Aquifer	Semi-annual	X	Bunker Creek/CIA	Monitoring location on groundwater monitoring Transect 3. Monitoring well is located in the upper aquifer on the downgradient edge of the CIA near Bunker Creek and the pre-1900s SFCDR channel. Monitoring data collected at this location will be used to evaluate groundwater quality along Transect 3, CIA and Bunker Creek remedial action effectiveness and groundwater/surface water interaction.
BH-SF-E-0428-L	MW-10	Lower Aquifer	Annual	X		Monitoring location on groundwater monitoring Transect 3. Monitoring well is located in the lower aquifer. Monitoring data from this location will be used to evaluate groundwater quality along Transect 3 and in the lower aquifer.
Slag Pile Area						
BH-SF-E-0429-U	GR-3	Upper Aquifer	Semi-annual	X	CIA	Monitoring well located downgradient of the CIA in the upper aquifer. Monitoring well is located near the SFCDR and will provide groundwater/surface water interaction information.
North of SFCDR						
BH-SF-E-0502-U	GR-4	Upper Aquifer	Semi-annual	X		Monitoring well located in the upper aquifer on the north side of the SFCDR. Data from this monitoring location will be used to evaluate groundwater/surface water interaction.
Between Bunker Creek and Government Creek						
BH-SF-E-0503-U	00-MW-03	Upper Aquifer	Semi-annual		Bunker Creek	Monitoring well located in the upper aquifer downgradient of Bunker Creek. Data from this monitoring location will be used to evaluate groundwater/surface water interaction between Bunker Creek and the upper aquifer.
BH-SF-E-0504-U	00-MW-04	Upper Aquifer	Semi-annual		Bunker Creek	Monitoring well located in the upper aquifer downgradient of Bunker Creek. Data from this monitoring location will be used to evaluate groundwater/surface water interaction between Bunker Creek and the upper aquifer.
Transect 5						
BH-SF-W-0001-U	MW-19	Upper Aquifer	Semi-annual	X	Smeltonville Flats	Monitoring location on groundwater monitoring Transect 5. Monitoring well is located in the upper aquifer on the north side of the SFCDR. Data from this monitoring location will be used to evaluate groundwater quality along Transect 5 and groundwater/surface water interaction and to provide upgradient water quality and elevation data for Smeltonville Flats remedial action effectiveness.
BH-SF-W-0002-L	MW-20	Lower Aquifer	Annual	X		Monitoring location on groundwater monitoring Transect 5. Monitoring well is located in the lower aquifer. Monitoring data from this location will be used to evaluate groundwater quality along Transect 5 and in the lower aquifer.
BH-SF-W-0003-U	MW-17	Upper Aquifer	Semi-annual	X	Smeltonville Flats	Monitoring location on groundwater monitoring Transect 5. Monitoring well is located in the upper aquifer on the south side of the SFCDR. Data from this location will be used to evaluate groundwater quality along Transect 5 and groundwater/surface interaction and to provide upgradient water quality and elevation data for Smeltonville Flats remedial action effectiveness.
BH-SF-W-0004-L	MW-18	Lower Aquifer	Annual	X		Monitoring location on groundwater monitoring Transect 5. Monitoring well is located in the lower aquifer. Monitoring data from this location will be used to evaluate groundwater quality along Transect 5 and in the lower aquifer.

TABLE ES-2
Groundwater Monitoring Locations
OU2 Environmental Monitoring Plan
Bunker Hill Superfund Site OU2

Location	Historic Name	Hydrogeologic Unit	Frequency	OU2 EMP	RA Effectiveness Monitoring	Rationale
BH-SF-W-0005-U	MWC-U	Upper Aquifer	Semi-annual	X	Smeltonville Flats	Monitoring location on groundwater monitoring Transect 5. Monitoring well is located in the upper aquifer. Data from this location will be used to evaluate groundwater quality along Transect 5 and to provide upgradient water quality and elevation data for Smeltonville Flats remedial action effectiveness.
BH-SF-W-0006-L	MW-16	Lower Aquifer	Annual	X		Monitoring location on groundwater monitoring Transect 5. Monitoring well is located in the lower aquifer. Monitoring data from this location will be used to evaluate groundwater quality along Transect 5 and in the lower aquifer.
BH-SF-W-0007-U	MWC-L	Upper Aquifer	Semi-annual	X	Smeltonville Flats	Monitoring location on groundwater monitoring Transect 5. Monitoring well is located in the upper aquifer. Data from this location will be used to evaluate groundwater quality along Transect 5 and to provide upgradient water quality and elevation data for Smeltonville Flats remedial action effectiveness.
Smeltonville Flats North of I-90						
BH-SF-W-0008-U	GR-31	Upper Aquifer	Semi-annual	X	Smeltonville Flats	Monitoring well in the upper aquifer near the SFCDR. Monitoring location will be used to evaluate groundwater/surface water interaction and Smeltonville Flats remedial action effectiveness.
BH-SF-W-0009-U	GR-102	Upper Aquifer	Semi-annual		Smeltonville Flats	Monitoring well in the upper aquifer in Smeltonville Flats will be used to evaluate Smeltonville Flats remedial action effectiveness.
BH-SF-W-0018-U	P-101	Upper Aquifer	Semi-annual	X	Smeltonville Flats	Monitoring well in the upper aquifer near the SFCDR. Monitoring location will be used to evaluate groundwater/surface water interaction and Smeltonville Flats remedial action effectiveness.
BH-SF-W-0104-U	GR-27	Upper Aquifer	Semi-annual	X	Smeltonville Flats	Monitoring well in the upper aquifer near the SFCDR. Monitoring location will be used to evaluate groundwater/surface water interaction and Smeltonville Flats remedial action effectiveness.
BH-SF-W-0021-U	New Location	Upper Aquifer	Quarterly		Smeltonville Flats	Monitoring well in the upper aquifer near the SFCDR. Monitoring location will be used to evaluate groundwater/surface water interaction and Smeltonville Flats remedial action effectiveness. Quarterly monitoring of this location is recommended to evaluate variability and to build statistical data set.
BH-SF-W-0022-U	New Location	Upper Aquifer	Quarterly		Smeltonville Flats	Monitoring well in the upper aquifer near the SFCDR. Monitoring location will be used to evaluate groundwater/surface water interaction and Smeltonville Flats remedial action effectiveness. Quarterly monitoring of this location is recommended to evaluate variability and to build statistical data set.
Smeltonville						
BH-SF-W-0010-U	MWA-U	Upper Aquifer	Semi-annual	X		Monitoring well in the upper aquifer in Smeltonville. Data will be used to evaluate groundwater conditions in the upper aquifer.
BH-SF-W-0011-L	MWA-L	Lower Aquifer	Annual	X		Monitoring well in the lower aquifer. Data will be used to evaluate groundwater conditions in the lower aquifer.
BH-SF-W-0019-U	MWB-U	Upper Aquifer	Semi-annual	X		Monitoring well in the upper aquifer in Smeltonville. Data will be used to evaluate groundwater conditions in the upper aquifer.
BH-SF-W-0020-U	MWB-L	Upper Aquifer	Semi-annual	X		Monitoring well in the upper aquifer in Smeltonville. Data will be used to evaluate groundwater conditions in the upper aquifer.
Page Ponds						
BH-SF-W-0111-U	GR-18	Upper Aquifer			Smeltonville Flats	Monitoring well located near the Page and Smeltonville WWTPs. Monitoring data from this location appears to be compromised as a result of remedial actions nearby. This monitoring well has been recommended for deletion from the monitoring program.
BH-SF-W-0118-U	00-MW-01	Upper Aquifer	Semi-annual		Smeltonville Flats	Monitoring well in the upper aquifer near Page Ponds. Data will be used to evaluate Smeltonville Flats remedial action effectiveness.
BH-SF-W-0119-U	00-MW-02	Upper Aquifer	Semi-annual	X		Monitoring location in the upper aquifer near Page Ponds. Data will be used to evaluate upper aquifer groundwater conditions near the west end of OU2.
BH-SF-W-0121-U	GR-26UD	Upper Aquifer	Semi-annual	X	Smeltonville Flats	Monitoring well in the upper aquifer near Page Ponds. Data will be used to evaluate Smeltonville Flats remedial action effectiveness.
BH-SF-W-0122-L	GR-26L	Lower Aquifer	Annual	X		Monitoring location in the lower aquifer near the west end of OU2. Monitoring data will be used to evaluate lower aquifer groundwater conditions.
BH-SF-W-0023-U	New Location	Upper Aquifer	Quarterly		Smeltonville Flats	Monitoring well in the upper aquifer near Page Ponds will be used to evaluate Smeltonville Flats remedial action effectiveness. Quarterly monitoring of this location is recommended to evaluate variability and to build statistical data set.
Transect 6						
BH-SF-W-0201-U	MW-21	Upper Aquifer	Semi-annual	X	Smeltonville Flats	Monitoring location on groundwater monitoring Transect 6. Monitoring well is located in the upper aquifer near the SFCDR at Pinehurst Narrows. Data from this location will be used to evaluate groundwater along Transect 6, groundwater/surface water interaction, and provide downgradient information for Smeltonville Flats remedial action effectiveness.
BH-SF-W-0202-L	MW-22	Lower Aquifer	Annual	X		Monitoring location on groundwater monitoring Transect 6. Monitoring well is located in the lower aquifer and will be used to evaluate groundwater along Transect 6 and in the lower aquifer.
Between Transect 6 and 7						
BH-SF-W-0203-U	GR-25	Upper Aquifer	Semi-annual	X		Monitoring well located in the upper aquifer near the mouth of Pine Creek.
Transect 7						
BH-SF-W-0204-U	MW-23	Upper Aquifer	Semi-annual	X		Monitoring well located on Transect 7. Monitoring data will be used to evaluate groundwater conditions at the downgradient boundary of OU2 and groundwater/surface water interaction.
BH-SF-W-0205-L	MW-24	Lower Aquifer	Annual	X		Monitoring well located on Transect 7 in the lower aquifer.
BH-SF-W-0206-U	New Location	Upper Aquifer	Semi-annual	X		Monitoring well located on Transect 7. Monitoring data will be used to evaluate groundwater conditions at the downgradient boundary of OU2 and groundwater/surface water interaction.
BH-SF-W-0207-U	New Location	Lower Aquifer	Annual	X		Monitoring well located on Transect 7 in the lower aquifer.

TABLE ES-2
Groundwater Monitoring Locations
OU2 Environmental Monitoring Plan
Bunker Hill Superfund Site OU2

Location	Historic Name	Hydrogeologic Unit	Frequency	OU2 EMP	RA Effectiveness Monitoring	Rationale
Government Gulch						
BH-GG-GW-0001	GR-37	Upland Tributary	5-years	X		Government Gulch background monitoring well. Historically low contaminant metal concentrations. Sampling every 5 years prior to 5-year remedy reviews is recommended.
BH-GG-GW-0002	GR-36	Upland Tributary	Semi-annual		Government Gulch	Government Gulch monitoring well located above the Zinc Plant and majority of Government Gulch remedial actions.
BH-GG-GW-0003	GR-47	Upland Tributary	Quarterly		Government Gulch	Government Gulch monitoring well located downgradient of Zinc Plant area.
BH-GG-GW-0004	GR-48	Upland Tributary	Semi-annual		Government Gulch	Government Gulch monitoring well located downgradient of the majority of source removal areas within Government Gulch.
BH-GG-GW-0005	GR-32S	Upland Tributary	Semi-annual	X	Government Gulch	Monitoring well located on Transect 4 in the upper portion of the Government Gulch tributary aquifer.
BH-GG-GW-0006	GR-32D	Upland Tributary	Semi-annual	X	Government Gulch	Monitoring well located on Transect 4 in the lower portion of the Government Gulch tributary aquifer.
BH-GG-GW-0007	MW-14	Upland Tributary	Semi-annual	X	Government Gulch	Monitoring well located on Transect 4 in the upper portion of the Government Gulch tributary aquifer.
BH-GG-GW-0008	MW-15	Upland Tributary	Semi-annual	X	Government Gulch	Monitoring well located on Transect 4 in the lower portion of the Government Gulch tributary aquifer.
BH-GG-GW-0009	New Location	Upland Tributary	Quarterly		Government Gulch	Government gulch monitoring well located near the area of the Zinc Plant where minimal source removals occurred.
BH-GG-GW-0010	New Location	Upland Tributary	Quarterly		Government Gulch	Government Gulch monitoring well located downgradient of Zinc Plant area.
Smelter Closure Area						
BH-SCA-GW-0001	BG-1	Upland	Annual		Smelter Closure Area	SCA background monitoring well.
BH-SCA-GW-0002	WC-1	Upland	Semi-annual		Smelter Closure Area	SCA monitoring well used to evaluate the effectiveness of the West Canyon surface water diversion. Groundwater elevation will be collected monthly from this location to correlate with monthly groundwater elevation measurements collected in the proposed temporary piezometer on the upgradient edge of the SCA.
BH-SCA-GW-0003	BAL-1	Upland	Semi-annual		Smelter Closure Area	Monitoring well located on the upgradient edge of the PTM monocell.
BH-SCA-GW-0004	BAL-2	Upland	Semi-annual		Smelter Closure Area	Monitoring well located on the upgradient edge of the PTM monocell.
BH-SCA-GW-0005	OM-2	Upland	Semi-annual		Smelter Closure Area	Monitoring well on the downgradient edge of the SCA.
BH-SCA-GW-0006	OM-3	Upland	Semi-annual		Smelter Closure Area	Monitoring well on the downgradient edge of the SCA.
BH-SCA-GW-0007	OM-4	Upland	Semi-annual		Smelter Closure Area	Monitoring well on the downgradient edge of the SCA.
BH-SF-E-0501-U	GR-33	Upper Aquifer	Semi-annual		Smelter Closure Area	Monitoring well located in the upper aquifer downgradient of the SCA.
West Canyon Piezometer	New Location	Upland	Monthly		Smelter Closure Area	Temporary piezometer located on the upgradient edge of the SCA downgradient of the West Canyon. Groundwater elevations measured at this location will be correlated with groundwater elevations measured at BH-SCA-GW-0002 to evaluate the effectiveness of the West Canyon surface water diversion.

Notes:

All monitoring data will be used in OU2 EMP data evaluations regardless of the monitoring program identified. Monitoring wells identified as OU2 EMP monitoring wells are the minimum number of monitoring wells required to evaluate groundwater conditions and groundwater/surface water interaction.

TABLE ES-3

Groundwater/Surface Water Interaction Monitoring Program
 OU2 Environmental Monitoring Plan
Bunker Hill Superfund Site OU2

Location	Surface Water	Groundwater
BH-SF-LF001	X	X
BH-SF-LF002	X	X
BH-SF-LF003	X	X
BH-SF-LF004	X	X
BH-SF-LF005	X	X
BH-SF-LF006	X	X
BH-SF-LF007	X	X
BH-SF-LF008	X	X
BH-SF-LF009	X	X
BH-SF-LF010	X	X
BH-SF-LF011	X	X
BH-MC-0002	X	^a
BH-BC-0001	X	^a
BH-GG-0004	X	X
BH-PC-0001	X	X

Notes:

Groundwater quality monitored using temporary piezometers.

^a Channel conditions at Milo and Bunker Creeks preclude installation of temporary piezometers.

TABLE ES-4
 Biological Resource Monitoring Program
 OU2 Environmental Monitoring Plan
 Bunker Hill Superfund Site OU2

Parameter	Locations	Frequency
Soil/ Sediment		
	Smeltonville Flats Government Gulch Magnet Gulch Deadwood Gulch Page Ponds	5-year
Riverine		
Fish diversity/abundance	SFCDR	5-year
Fish tissue metal levels	SFCDR	5-year
Macroinvertebrate diversity/abundance	SFCDR	5-year
Macroinvertebrate tissue metal levels	SFCDR	5-year
Amphibian population survey	TBD	5-year
Palustrine		
Waterfowl blood lead	Page Ponds	5-year
Waterfowl fecal sampling	Page Ponds	5-year
Waterfowl use areas/diversity survey	Page Ponds	3 consecutive years at 5-year intervals
Riparian/Upland		
Songbird productivity and survivorship (MAPS) ^a	TBD	5 consecutive years at 10-year intervals
Songbird blood lead	Smeltonville Flats Government Gulch Magnet Gulch Deadwood Gulch	5-year
Songbird population surveys	Bunker Hill Breeding Bird Survey Route CIA	1-year
Small Mammal population diversity/abundance	Smeltonville Flats Government Gulch Magnet Gulch Deadwood Gulch	5-year
Small Mammal tissue residues	Smeltonville Flats Government Gulch Magnet Gulch Deadwood Gulch CIA	5-year
Large mammal fecal sampling	Smeltonville Flats Government Gulch Magnet Gulch Deadwood Gulch CIA	5-year
Terrestrial invertebrates abundance	Smeltonville Flats Government Gulch Magnet Gulch Deadwood Gulch	5-year

Notes:

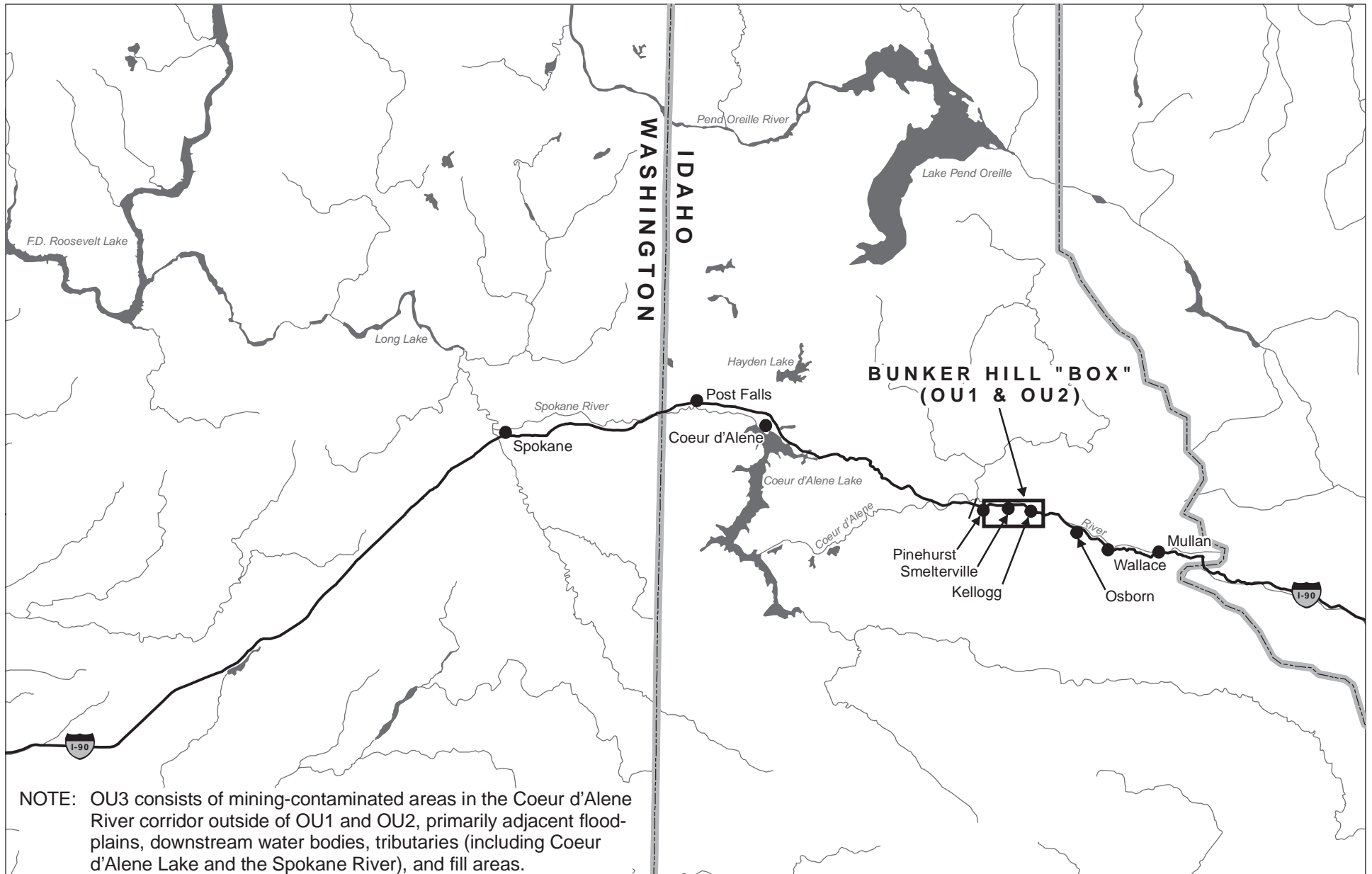
^a Monitoring Avian Productivity and Survivorship Program

TABLE ES-5
 OU2 EMP Summary
 OU2 Environmental Monitoring Plan
 Bunker Hill Superfund Site OU2

Media/Organism	2005*	2006	2007	2008	2009	2010*	2011	2012	2013	2014	2015*	2016	2017	2018	2019	2020*	2021	2022	2023	2024	
	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	
Surface water monitoring	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Groundwater monitoring	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Groundwater/surface water interaction	X	X	X	X					X					X					X		
Soil/sediment			X					X					X					X			
Biological Resources																					
Waterfowl blood lead				X					X					X					X		
Waterfowl fecal sampling				X					X					X					X		
Waterfowl diversity/abundance	X	X	X			X	X	X			X	X	X			X	X	X		X	
Songbird blood lead			X					X					X					X			
Songbird population survey	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Songbird MAPS					X	X	X	X	X						X	X	X	X	X	X	
Small mammal tissue residues				X					X					X					X		
Small mammal diversity/abundance				X					X					X					X		
Large mammal fecal sampling			X					X					X					X			
Terrestrial invertebrates abundance			X					X					X					X			
Macroinvertebrates diversity/abundance		X				X					X					X					
Macroinvertebrates tissue residues		X				X		X			X		X		X			X			
Fish diversity abundance								X					X					X			
Fish tissue residues								X					X					X			
Amphibian population survey								X					X					X			

Notes:

* = Five-year review years.



NOTE: OU3 consists of mining-contaminated areas in the Coeur d'Alene River corridor outside of OU1 and OU2, primarily adjacent floodplains, downstream water bodies, tributaries (including Coeur d'Alene Lake and the Spokane River), and fill areas.

Legend

- Operable Units
- Cities
- State Boundaries
- Water Features

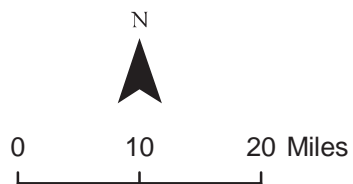


FIGURE ES-1
BUNKER HILL SUPERFUND SITE MAP
OU2 ENVIRONMENTAL MONITORING PLAN
 BUNKER HILL SUPERFUND SITE OU2

