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Final

**Work Plan for
Ecological Investigations in the North Branch Potomac River
Site 1
Baseline Ecological Risk Assessment - Step 4**

**Allegheny Ballistics Laboratory
Rocket Center, West Virginia**

Contract Task Order 0102

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Acronyms and Abbreviations

ABL	Allegany Ballistics Laboratory
AVS/SEM	Acid Volatile Sulfide/Simultaneously Extracted Metals
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Chemical of Concern
DQO	Data Quality Objective
ERA	Ecological Risk Assessment
FSP	Field Sampling Plan
GPS	Global Positioning System
HASP	Health and Safety Plan
IDW	Investigation-Derived Waste
IDWMP	Investigation-Derived Waste Management Plan
LANTDIV	Atlantic Division, Naval Facilities Engineering Command
LOAEL	Lowest Observed Adverse Effect Level
LTM	Long-Term Monitoring
NOAEL	No Observed Adverse Effect Level
PAH	Polycyclic Aromatic Hydrocarbon
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
TOC	Total Organic Carbon
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound

SECTION 1

Introduction

This work plan describes additional ecological risk investigations of Site 1 sediment in the North Branch Potomac River at Allegany Ballistics Laboratory (ABL), Rocket Center, West Virginia (Figure 1-1). The primary purpose of this investigation is to provide additional data to refine the Site 1 ecological risk assessment (ERA) for the river that was presented in the *Focused Remedial Investigation for Site 1 Soil, Operable Unit 4* (CH2M HILL 2006a). These data will also be used to reduce the uncertainties associated with these risk estimates.

This work plan, which constitutes Step 4 of the ERA process for river sediment, will be coordinated with the Site 1 Long Term Monitoring (LTM) sampling event (surface water, sediment, and biological sampling) currently scheduled for Summer 2006. Once the data outlined in this work plan are collected (Steps 5 and 6 of the ERA process), they will be evaluated, along with previously collected data, in order to develop final ecological risk estimates for sediments in the North Branch Potomac River adjacent to Site 1 (Step 7).

1.1 Objectives

The general objective of this investigation is to provide additional data with which to refine previous estimates of ecological risk (CH2M HILL 2006a) from potential exposures to river sediments adjacent to Site 1. The specific objectives of this investigation are to:

- Collect additional data, as recommended in Step 3 of the ERA (CH2M HILL 2006a), to refine ecological exposure and risk estimates for the exposure pathways, receptors, areas, and chemicals of concern, as well as to reduce uncertainties associated with these risk estimates.
- Collect data to directly assess potential toxicity of river sediment adjacent to Site 1 to ecological receptors.
- Collect data to directly assess potential impacts to river biota (e.g., fish, and aquatic and benthic invertebrate communities) in areas adjacent to Site 1.

1.2 Work Plan Organization

This remainder of this work plan is divided into the following sections:

Section 2 - Rationale for the Investigation. Provides a summary of the results of the Step 3 ERA, identifies data needs, and outlines the ERA approach.

Section 3 - Sampling and Analysis Plan. Describes the major components of the SAP (Field Sampling Plan, Quality Assurance Project Plan, Health and Safety Plan, and Investigation-Derived Waste Management Plan) as well as the sampling approach and methodology.

Section 4 - Project Reporting. Describes how the results of the work plan components will be used and reported.

Section 5 - Project Schedule. Provides the estimated schedule for sampling and reporting.

Section 6 - References. Lists references cited in this work plan.

As applicable, this work plan references previous regulatory-approved work plans and related documents, and uses addenda to describe variations or additions to the information presented therein. Addenda to referenced documents, including Standard Operating Procedures (SOPs), are included as appendices to this work plan. This sampling program will build upon the results of previous sampling that has been conducted as part of the evaluation of Site 1.

SECTION 2

Rationale for the Investigation

The rationale for this investigation is based upon the results of the ERA presented in the *Focused Remedial Investigation for Site 1 Soil, Operable Unit 4* (CH2M HILL 2006a), which covered Steps 1 through 3 of the ERA process for the portion of the North Branch Potomac River adjacent to Site 1. Potential ecological risks were identified in the river that may be attributable to transport from source areas within the Site 1 floodplain. The ERA did not identify any Chemicals of Concern (COCs) for surface water exposures in the portions of the river adjacent to Site 1. Copper, mercury, nickel, silver, zinc, and total polycyclic aromatic hydrocarbons (PAHs) were identified as COCs in river sediment and mercury was identified as a COC for river food web exposures to piscivorous birds. The data from the river in support of the previous ERA were collected along a series of transects that extended from Site 1 across the river (Figure 2-1). The highest sediment concentrations of copper occurred at Transects 2 and 3, of mercury occurred at Transects 2 and 6, of nickel occurred at Transects 3, 7, and 8, and of silver, zinc, and total PAHs occurred at Transect 2. Transect 2, where the maximum concentrations of the COCs (except for nickel) occurred, is situated where the Western Drainage Ditch enters the river.

Biomonitoring data from the Site 1 LTM program (using benthic macroinvertebrates) in the river indicate slight to moderate impairment of the invertebrate community at some of the stations located adjacent to, or downstream of, Site 1 relative to an upstream reference station (Figure 2-2). However, data from the most recent survey (2004) indicates an improvement in bioassessment scores relative to 2000 and 2002 surveys, with bioscores exceeding, equaling, or approaching baseline (1998) levels. Analytical results do not indicate a clear correlation with constituent concentrations in sediment, although the biological and sediment sampling stations are not optimally located for such a comparison and these two sampling programs measure different time scales of exposure.

Site 1 is an aggregate of a number of potential source areas from often unrelated activities that occurred within the same general geographic area. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-related potential source areas associated with Site 1 are shown on Figure 2-1, as are the locations of historic surface water and sediment samples used to assess potential ecological risk. A description of these source areas and the historic surface water and sediment data is contained in the *Focused Remedial Investigation for Site 1 Soil, Operable Unit 4* (CH2M HILL 2006a).

Based upon the results of the Step 3 ERA for the river (CH2M HILL 2006a), the following complete exposure pathways were identified in riverine habitats:

- Direct exposure of benthic invertebrates and fish to copper, mercury, nickel, silver, and zinc in river sediments located adjacent to Site 1. In localized areas, PAHs may also pose a potential risk to these receptors.
- Exposures via food webs for piscivorous birds to mercury.

Based upon the results of the Step 3 ERA and the refined ERA conceptual model, the following data needs were identified for river sediments adjacent to Site 1:

- Direct measures of biological effects (toxicity testing) for lower trophic level aquatic organisms (benthic invertebrates).
- Direct measures of biological effects (biological surveys) for lower trophic level aquatic organisms (fish and benthic invertebrates).
- Direct measures of biological effects (tissue residues) of metals in fish.
- Direct measures of tissue residues of mercury in prey items (fish) of piscivorous birds.

To fill these identified data needs, the following sampling is proposed:

- 42-day laboratory toxicity testing using amphipods and field-collected sediment samples.
- Semi-quantitative biological surveys of fish and benthic invertebrate communities.
- Tissue residue analysis (metals) of field-collected whole-body fish from portions of the river adjacent to, and upstream of, Site 1.

Assessment endpoints associated with the refined conceptual model for the river are listed in Table 2-1. Measurement endpoints are measures of biological effects (e.g., laboratory toxicity test results) that are related to each respective assessment endpoint. Measurement endpoints for this investigation are also listed in Table 2-1.

2.1 Ecological Risk Assessment Approach

Following the field investigation (Steps 5 and 6 of the ERA process), the collected data will be used, along with historical data and data from LTM sampling, to evaluate the potential ecological risks associated with exposure to river surface water and sediment adjacent to Site 1. This evaluation will occur as part of a revision to the existing ERA report for the river (Step 7).

SECTION 3

Sampling and Analysis Plan

The Sampling and Analysis Plan (SAP) consists of four individual plans: (1) the Field Sampling Plan (FSP), (2) the Quality Assurance Project Plan (QAPP), (3) the Health and Safety Plan (HASP), and (4) the Investigation-Derived Waste Management Plan (IDWMP). Rather than reproducing these individual plans, existing regulatory-approved plans from previous investigations at ABL are referenced herein, and addenda to these plans are attached as appendices. To facilitate review, the addenda contain only those modifications and/or activities that are specific to this investigation. Field activities will also be conducted in accordance with the general procedures described in the *Work Plan for the Supplemental Investigation of Site 1 Surface and Subsurface Soil, Surface Water, and Sediment and Site 2 and 3 Soil in Support of Human and Ecological Risk Assessments* (CH2M HILL 2001), hereafter referred to as the Supplemental Investigation Work Plan, and the *Draft Long-Term Monitoring Plan for Sites 1, 5, and 10* (CH2M HILL 2006b), hereafter referred to as the LTM Work Plan.

3.1 Field Sampling Plan

This subsection describes the components of, and methodologies to be used for, the field sampling program. Appendix A is the FSP addendum for this investigation. It contains those procedures that are specific to this investigation that differ from those contained in the Supplemental Investigation and LTM FSPs.

3.1.1 Overview of Proposed Sampling

The components of the Step 4 river sampling are outlined in the following subsections. These components are in addition to the components associated with the LTM program sampling.

Compile and Evaluate Available Fish and Macroinvertebrate Community Data

The State of Maryland collects fish and macroinvertebrate community data from the North Branch Potomac River on a regular basis (e.g., as part of the Maryland Biological Stream Survey). Available fish data will be obtained for the river reach that includes ABL Site 1 (Station 6, Pinto), as well as for the river reaches upstream (Station 5) and downstream (Station 7) of the site. These data, once obtained, will be qualitatively evaluated to determine if the structure of the fish community adjacent to Site 1 differs from that at upstream and downstream reaches and from what would be expected based upon habitat and river characteristics (e.g., flow rate). Available macroinvertebrate data will also be compiled for the reach of the river near ABL to supplement the data collected as part of this work plan (see Section 3.1.1.2).

Field Data

The following field data will be collected as part of this program:

- **Fish Tissue** - Whole-body fish tissue samples will be collected at five of the LTM biota locations (Biota 1, 2, 3, 4, and 4B; Figure 3-1). These whole-body fish tissue samples will be collected, if possible, during the LTM sampling. If this is not feasible, logistically, or if the needed samples cannot be collected during the LTM sampling, fish will be collected during a separate sampling event using methods appropriate to the habitat conditions present (e.g., seines, electroshockers, or traps). All collected fish will be weighed, their total length measured, and subjected to a gross external examination for lesions and other abnormalities.

Analytes will include Target Analyte List (TAL) metals, percent lipid, and percent moisture. The compositing of samples may be necessary to achieve the required tissue mass for analysis (150 g). If compositing is necessary, composite samples will be composed of the same species, gender, and age group whenever possible and will be consistent among locations, whenever possible. All samples will be analyzed as whole-body samples. Species will be selected based upon relative abundance and trophic level, with predators (e.g., bass) or bottom-feeders (e.g., suckers) emphasized. Size classes will be targeted to those most likely to be consumed by representative upper trophic level receptors, generally 4 to 10 cm. Fish tissue samples will be put in plastic bags, labeled, and placed on ice for shipment.

- **Sediment** - Surface (0 to 4 inches) sediment samples specific to this investigation will be collected in three areas as shown on Figure 3-1: (1) two locations (near bank and center) at the existing LTM upstream biological sampling reference location (Biota 1); (2) at 2001 sampling locations SD-9 and SD-9A (Transect 9), which are located near Biota 4B; and (3) at 2001 sampling locations SD-6 and SD-7 (Transects 6 and 7). Sediment sampling will occur concurrent with LTM surface water and sediment sampling and will use the same sampling methods (as outlined in the LTM Work Plan and associated SOPs). Analytes will include TAL metals, Target Compound List (TCL) semivolatile organic compounds (SVOCs), TCL volatile organic compounds (VOCs), sieve grain size, total organic carbon (TOC), pH, and Acid-Volatile Sulfide/Simultaneously Extracted Metals (AVS/SEM). In addition, sieve grain size, TOC, pH, and AVS/SEM will be added to the parameter list for LTM stations 1, 1A, 2, 2A, 3, and 3A. Thus, six new sediment locations will be sampled in addition to the 10 LTM stations and data from 6 of the 10 LTM stations will be used in this study.
- **Toxicity Testing** - Splits of the sediment samples collected at the two upstream reference locations (0 and 0A), as well as from locations 1, 1A, 2, 2A, 3, 3A, 6, 7, 9, and 9A, will be used for laboratory-based toxicity testing (total of 12 samples). *Hyalella azteca* (amphipod) will be used for the sediment toxicity tests. Test duration will be 42 days and the methodology will follow USEPA protocols (e.g., USEPA 2000), as modified by the specific toxicology laboratory (see Appendix D).
- **Benthic Community Structure** - The benthic invertebrate community will be sampled at five (5) of the LTM biota locations (Biota 1, 2, 3, 4, and 4B; Figure 3-1) using additional methodologies to the Hester-Dendy samplers currently employed as part of the LTM program. These methodologies will include kick-net sampling in riffle areas and 20 jabs with a D-frame net in pool areas in proportion to the available in-pool habitats. If both pool and riffle habitat types are present at a location, separate samples will be collected

using each of the different methodologies. Kick-net samples are considered semi-quantitative in nature, that is, the sample area is well defined (one square meter). The method of using 20 jabs with a D-frame net is considered qualitative in nature because the area sampled is not well defined and is based solely upon proportion of available habitat present.

Riffle habitat will be sampled with a composite of two kick-net samples, one in a faster flowing area and one from a slower flowing area. Where pools are the more dominant physical characteristic, an area of 100 meters will be selected for 20 jab samples. The available habitat types (i.e., banks, snags, sediment deposits) will be identified in the 100 meter reach and the percentage of each habitat determined. The number of jabs will then be allocated to each habitat type based upon the determined percentages. Sampling in pool areas will be confined to the ABL side of the river and will not extend beyond the center of the stream reach.

Each sample type will be consolidated, placed in bottles or plastic bags, labeled, preserved as appropriate, and sent to the laboratory (along with the LTM Hester-Dendy samplers) for taxonomic identification to the lowest practical taxon.

Kick-net and dip net data will be evaluated using suitable metrics selected from Blocksom and Flotemersch (2005). Hester-Dendy data will be evaluated using the metrics described in the LTM Work Plan.

3.1.2 Sampling Locations

Approximate sampling locations are shown on Figure 3-1. The sampling locations may be moved slightly from the locations shown on Figure 3-1 based upon the physical conditions encountered in the field. The coordinates of all sampling locations will be documented using a Global Positioning System (GPS) receiver to approximately 1-meter resolution.

The rationale for sampling location placement was as follows:

- Sampling an area not directly impacted by Site 1 activities (upstream reference area). The area selected was near Biota 1, the LTM biological reference station located upstream of all known ABL source areas.
- Toxicity testing/biological sampling in areas identified in the ERA as posing a potential risk (based upon the refined conceptual model) from exposure to metals and PAHs in sediments, particularly the area between Transects 2 and 3 (Figure 3-1), as well as in upstream (Transect 1) and downstream areas (Transect 9).
- Tissue residue sampling in areas identified as having the highest concentrations of metals in sediment (near Transects 2 and 3), as well as areas with detected (but lower) concentrations of metals in sediments located both upstream and downstream of the Transect 2/3 area.

3.2 Quality Assurance Project Plan

Appendix B is the QAPP addendum for this investigation. It contains those procedures that are specific to this investigation that differ from those contained in the Supplemental Investigation and LTM QAPPs.

Data will be collected to meet high-level data quality objectives (DQOs) as described in the QAPP. Sediment and fish tissue samples will be analyzed for the analytes listed in Table 3-1 using the methods specified in Table 3-2. Quality assurance procedures for the sediment toxicity tests are described in the SOP for the toxicity test protocol (Appendix D).

Field QC samples will be collected as listed in Table 3-3. Laboratory-grade deionized water will be provided by the laboratory for equipment blanks. Samples will be shipped to the laboratory daily for analysis. A standard 28-day turnaround time will be used for all analytical samples. No field QC samples will be collected for the toxicity tests or benthic invertebrate samples.

3.3 Health and Safety Plan

This sampling event will be conducted concurrently with the LTM sampling and will encompass similar activities. Thus, the HASP from the LTM Work Plan applies to this sampling event.

3.4 Investigation-Derived Waste Management

Appendix C is the IDWMP addendum for this investigation. It contains those procedures that are specific to this investigation that differ from those contained in the Supplemental Investigation and LTM IDWMPs.

SECTION 4

Project Reporting

This work plan constitutes Step 4 of the ERA process. Once the data outlined in this work plan are collected (Steps 5 and 6 of the ERA process), they will be used, along with the previously collected river data and the data from LTM sampling, to revise the existing ERA for the river (Step 7). This revision will consist of a stand-alone report.

The draft versions of the ERA report will be posted to the " Document Review" page of the ABL web site. The final report will be posted to the "Library" page of the ABL web site and will be provided in hardcopy format and electronically on a CD-ROM.

SECTION 5

Project Schedule

Total estimated project duration is approximately nine months following work plan approval (assumed to be 4 August 2006), as shown in the following table.

Proposed Project Milestones and Schedule

Key Project Milestones	Start Date	End Date	Interval (Days)
Work Plan Approval	08/04/2006	08/04/2006	1
Mobilization	07/31/2006	08/04/2006	5
Sample Collection	08/07/2006	08/11/2006	5
Laboratory Analysis/Toxicity Testing	08/11/2006	09/20/2006	40
Data Validation	09/20/2006	10/05/2006	15
Data Management	10/05/2006	10/19/2006	14
Draft ERA Report (Step 7)	10/19/2006	12/08/2006	50
Document Review	12/08/2006	01/05/2007	28
Final ERA Report (Step 7)	01/05/2007	02/02/2007	29

SECTION 6

References

- Blocksom, K.A. and J.E. Flotemersch. 2005. Comparison of macroinvertebrate sampling methods for nonwadeable streams. *Environmental Monitoring and Assessment*. 102:243-262.
- CH2M HILL, Inc. 2006a. *Focused Remedial Investigation for Site 1 Soil, Operable Unit 4, Allegany Ballistics Laboratory Superfund Site, Rocket Center, West Virginia*. Draft.
- CH2M HILL, Inc. 2006b. *Long-Term Monitoring Plan for Sites 1, 5, and 10, Allegany Ballistics Laboratory,, Rocket Center, West Virginia*. Draft.
- CH2M HILL, Inc. 2001. *Work Plan for the Supplemental Investigation of Site 1 Surface and Subsurface Soil, Surface Water, and Sediment and Site 2 and 3 Soil in Support of Human and Ecological Risk Assessments, Allegany Ballistics Laboratory Superfund Site, Rocket Center, West Virginia*. October.
- U.S. Environmental Protection Agency (USEPA). 2000. *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates*. Second edition. EPA/600/R-99/064. March.

TABLE 2-1
 Endpoints for the Step 4 Investigation – Site 1 River Sediments
Allegheny Ballistics Laboratory, Rocket Center, WV

Assessment Endpoint	Measurement Endpoint
Survival, growth, and reproduction of benthic invertebrate communities	Comparison of results of 42-day sediment laboratory toxicity tests (survival, growth, and reproduction) with the amphipod, <i>Hyaella azteca</i> , using site and reference (upstream) sediment. Existence of significant correlations between laboratory toxicity test results and concentrations of chemical constituents or other chemical/physical characteristics of the sediment.
	Comparison of results of benthic invertebrate field surveys in areas adjacent to and downstream of Site 1 source areas with upstream areas.
Survival, growth, and reproduction of fish communities	Comparison of results of state field surveys in areas adjacent to and downstream of Site 1 source areas with upstream areas.
	Comparison of results of fish tissue residue analyses with literature-based tissue screening values and with concentrations from the upstream reference location.
Survival, growth, and reproduction of piscivorous bird populations	Comparison of modeled dietary intakes using field-collected fish (tissue residues) with literature-based ingestion screening values; ratios >1 based upon the NOAEL-LOAEL range indicate an effect.

TABLE 3-1
 Samples and Analytical Parameters
Allegany Ballistics Laboratory, Rocket Center, WV

Station ID	Station Type	Medium	Sample ID	Toxicity Testing	Metals	SVOCs	VOCs	AVS/SEM	pH	TOC	Grain Size	Percent Moisture	Percent Lipids	Duplicates	MS/MSD*
1SD-0	SD	Sediment	AS01-SD00	X	X	X	X	X	X	X	X				
1SD-0A	SD	Sediment	AS01-SD00A	X	X	X	X	X	X	X	X				
1SD-1/1SW-1	SD	Sediment	AS01-SD01-R12	X	L	L	L	X	X	X	X				
1SD-1A/1SW-1A	SD	Sediment	AS01-SD01A-R12	X	L	L	L	X	X	X	X				
1SD-2/1SW-2	SD	Sediment	AS01-SD02-R12	X	L	L	L	X	X	X	X			L / X	
1SD-2A/1SW-2A	SD	Sediment	AS01-SD02A-R12	X	L	L	L	X	X	X	X				
1SD-3/1SW-3	SD	Sediment	AS01-SD03-R12	X	L	L	L	X	X	X	X				
1SD-3A/1SW-3A	SD	Sediment	AS01-SD03A-R12	X	L	L	L	X	X	X	X				
1SD-6/1SW-6	SD	Sediment	AS01-SD06-02	X	X	X	X	X	X	X	X			X	
1SD-7/1SW-7	SD	Sediment	AS01-SD07-02	X	X	X	X	X	X	X	X				
1SD-9/1SW-9	SD	Sediment	AS01-SD09-02	X	X	X	X	X	X	X	X				
1SD-9A	SD	Sediment	AS01-SD09A-02	X	X	X	X	X	X	X	X				
AS01-BIKN01	BI	Benthic Invertebrate	AS01-BI-KN01	Benthic Invertebrate Sample (Taxonomy) – Kick-Net											
AS01-BIDN01	BI	Benthic Invertebrate	AS01-BI-DN01	Benthic Invertebrate Sample (Taxonomy) – Dip Net											
AS01-BIKN02	BI	Benthic Invertebrate	AS01-BI-KN02	Benthic Invertebrate Sample (Taxonomy) – Kick-Net											
AS01-BIDN02	BI	Benthic Invertebrate	AS01-BI-DN02	Benthic Invertebrate Sample (Taxonomy) – Dip Net											
AS01-BIKN03	BI	Benthic Invertebrate	AS01-BI-KN03	Benthic Invertebrate Sample (Taxonomy) – Kick-Net											
AS01-BIDN03	BI	Benthic Invertebrate	AS01-BI-DN03	Benthic Invertebrate Sample (Taxonomy) – Dip Net											
AS01-BIKN04	BI	Benthic Invertebrate	AS01-BI-KN04	Benthic Invertebrate Sample (Taxonomy) – Kick-Net											

TABLE 3-1
 Samples and Analytical Parameters
Allegheny Ballistics Laboratory, Rocket Center, WV

Station ID	Station Type	Medium	Sample ID	Toxicity Testing	Metals	SVOCs	VOCs	AVS/ SEM	pH	TOC	Grain Size	Percent Moisture	Percent Lipids	Duplicates	MS/MSD*
AS01-BIDN04	BI	Benthic Invertebrate	AS01-BI-DN04	Benthic Invertebrate Sample (Taxonomy) – Dip Net											
AS01-BIKN05	BI	Benthic Invertebrate	AS01-BI-KN05	Benthic Invertebrate Sample (Taxonomy) – Kick-Net											
AS01-BIDN05	BI	Benthic Invertebrate	AS01-BI-DN05	Benthic Invertebrate Sample (Taxonomy) – Dip Net											
AS01-FWB01	TI	Tissue	AS01-TI-FWB01		X							X	X		X
AS01-FWB02	TI	Tissue	AS01-TI-FWB02		X							X	X		
AS01-FWB03	TI	Tissue	AS01-TI-FWB03		X							X	X	X	
AS01-FWB04	TI	Tissue	AS01-TI-FWB04		X							X	X		
AS01-FWB05	TI	Tissue	AS01-TI-FWB05		X							X	X		

The collection of the remaining field duplicates and MS/MSD samples for sediment will be done as part of the concurrent LTM sampling

X – Collected as part of this sampling; L – Collected as part of concurrent LTM sampling

* Collect two volumes for MS/MSD (3 including sample)

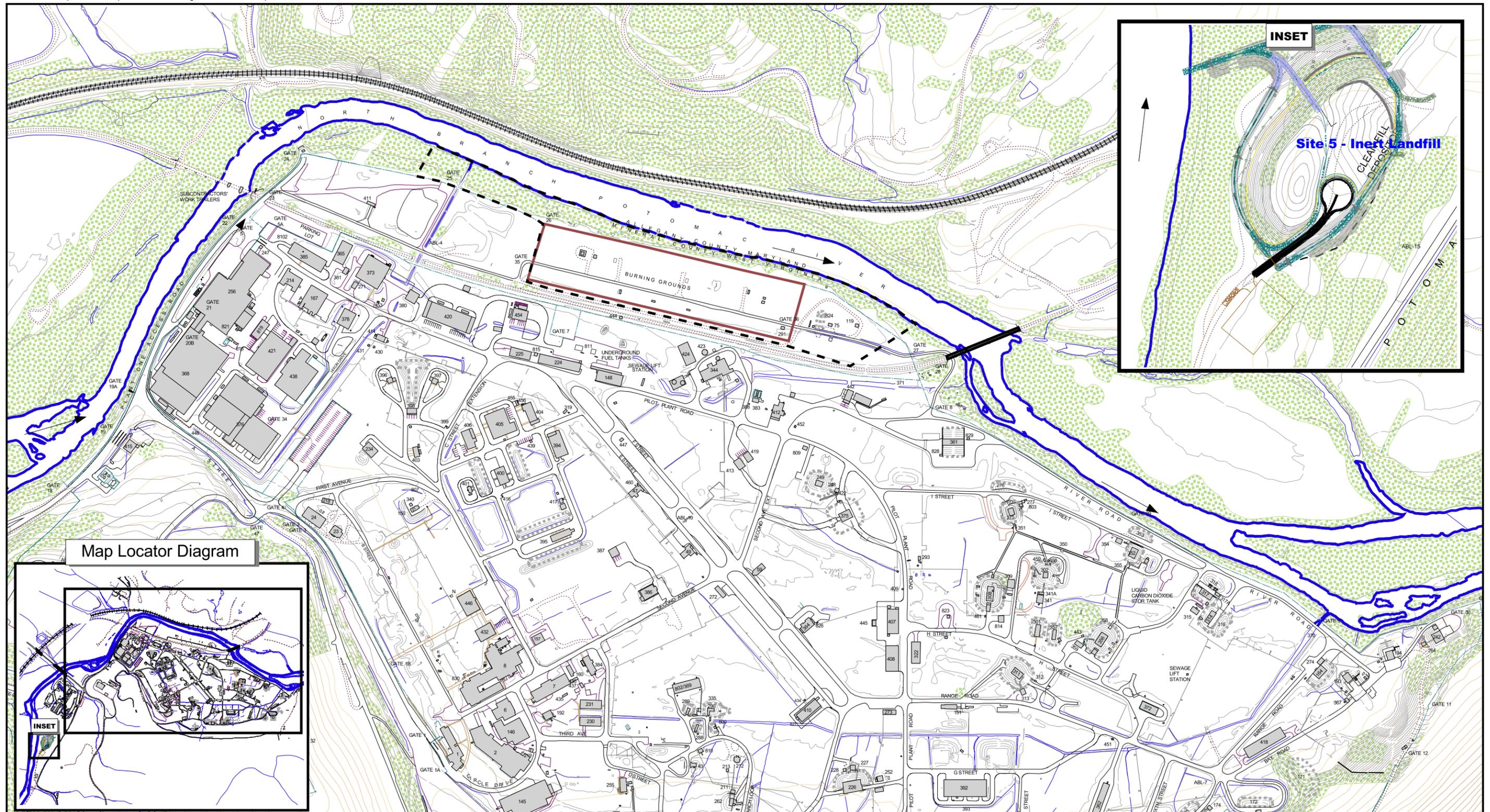
TABLE 3-2

Analytical Methods and Required Containers, Preservatives, and Holding Times For Samples
Allegheny Ballistics Laboratory, Rocket Center, WV

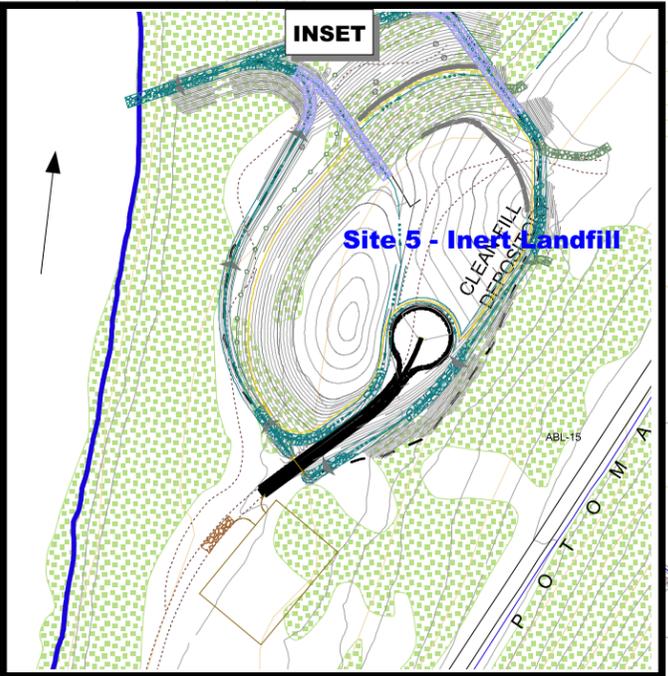
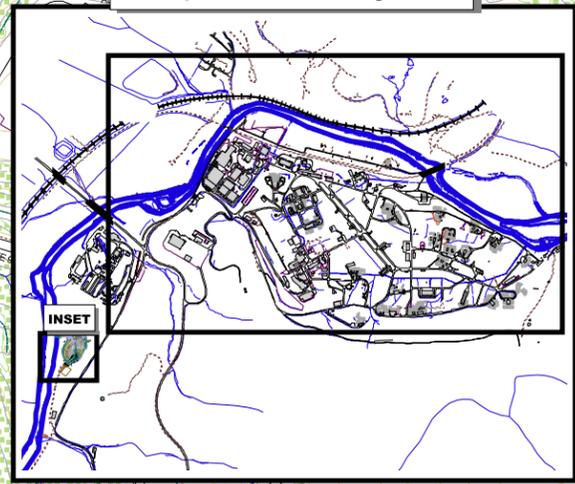
Analysis	Method	Sample Container	Preservative	Holding Time
Sediment Samples				
TAL Metals	CLP ILM04	One 8-oz glass bottle with Teflon-lined cap	Cool to 4°C	6 months; 28 days for mercury
TCL SVOCs	CLP OLM04	One 8-oz glass bottle with Teflon-lined cap	Cool to 4°C	7 days (extract); 40 days (analysis)
TCL VOCs	CLP OLM04	One 4-oz glass bottle with Teflon-lined cap	Cool to 4°C	2 days
TOC	Lloyd Kahn	One 8-oz glass bottle with Teflon-lined cap	Cool to 4°C	28 days
AVS/SEM	USEPA	One 4-oz glass bottle with Teflon-lined cap	Cool to 4°C	14 days
pH	9045C	One 8-oz glass bottle with Teflon-lined cap	Cool to 4°C	ASAP
Grain size	ASTM D422	One 8-oz glass bottle with Teflon-lined cap	None	Not applicable
Tissue Samples				
TAL Metals	CLP ILM04	Double freezer bag or as provided by laboratory	Cool to 4°C	6 months; 28 days for mercury
Percent Moisture	ASTM D2216	Double freezer bag or as provided by laboratory	Cool to 4°C	7 days (extract); 30 days (analysis)
Percent Lipids	Lab SOP	Double freezer bag or as provided by laboratory	Cool to 4°C	7 days (extract); 30 days (analysis)

TABLE 3-3
 General Requirements for QC Sample Collection
Allegheny Ballistics Laboratory, Rocket Center, WV

QC Samples	QC Specified Collection Frequency
Field Duplicate	One per 10 samples per matrix or one duplicate per day, matrix, and site, whichever is more frequent
Trip Blank	One per cooler containing samples collected for VOC analysis
Equipment (Rinsate) Blank	One per day per matrix per site
Field Blank	One per site per sampling event
Temperature Blank	One per cooler
Matrix Spike/Matrix Spike Duplicate	One per matrix for each group of up to 20 samples sent to a single laboratory
Collection of QC samples will take into account the concurrently-collected LTM samples	



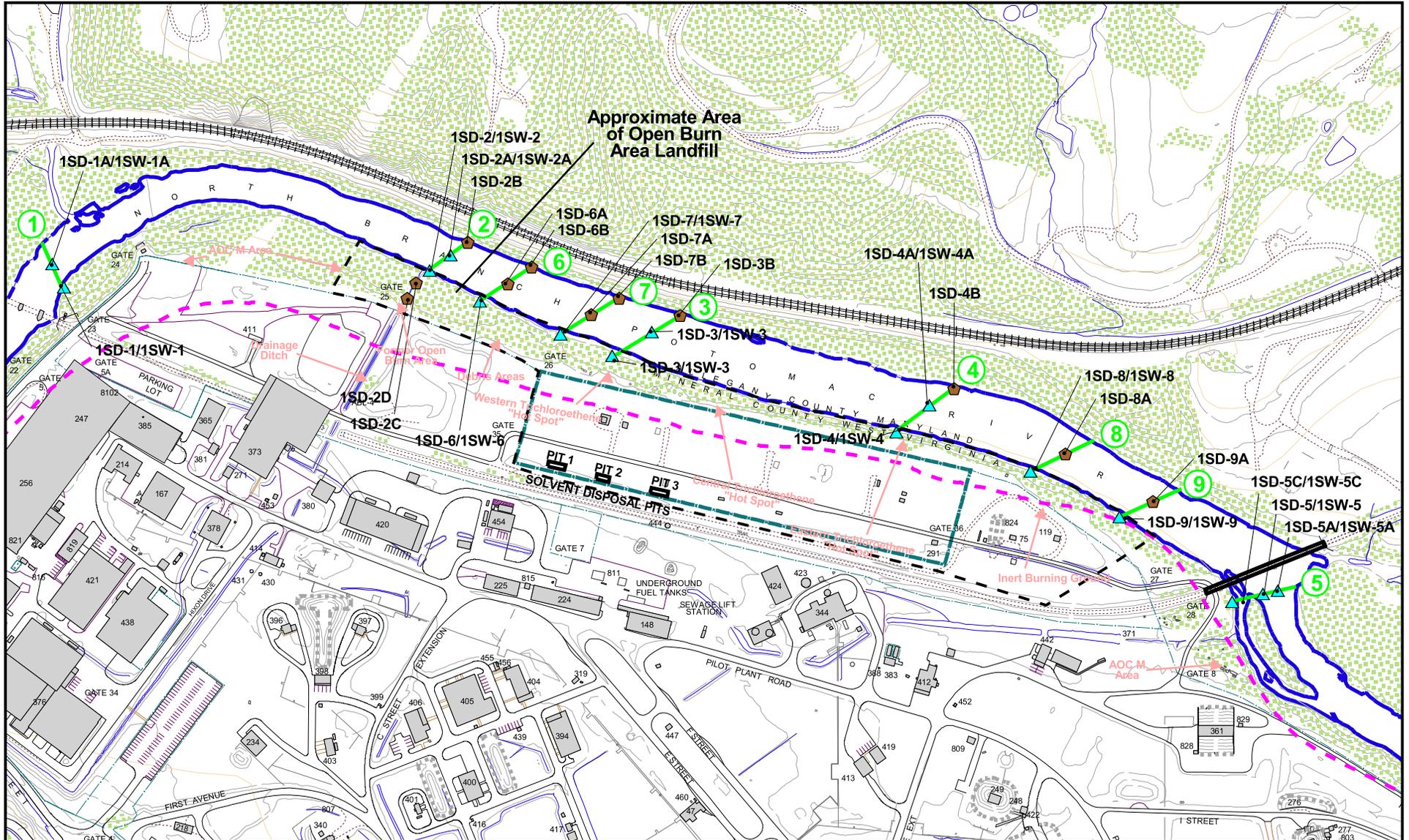
Map Locator Diagram



- LEGEND**
- Boundary of Burning Grounds
 - - Boundary of IR Site 1
 - Flow Direction



Figure 1-1
Location of Site 1
Step 4 ERA Work Plan
Allegany Ballistics Laboratory



- LEGEND**
- ▲ Surface Water and Sediment Sample Location
 - ▭ Sediment Sample Location
 - Vegetation
 - Buildings
 - ▬ Boundary of IR Site 1
 - ▬ 100-Year Flood Plain
 - ▬ Transects
 - ▬ Water Bodies
 - ▬ Roads

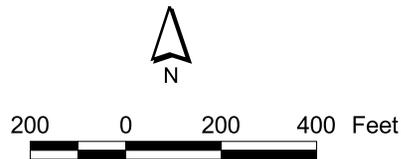
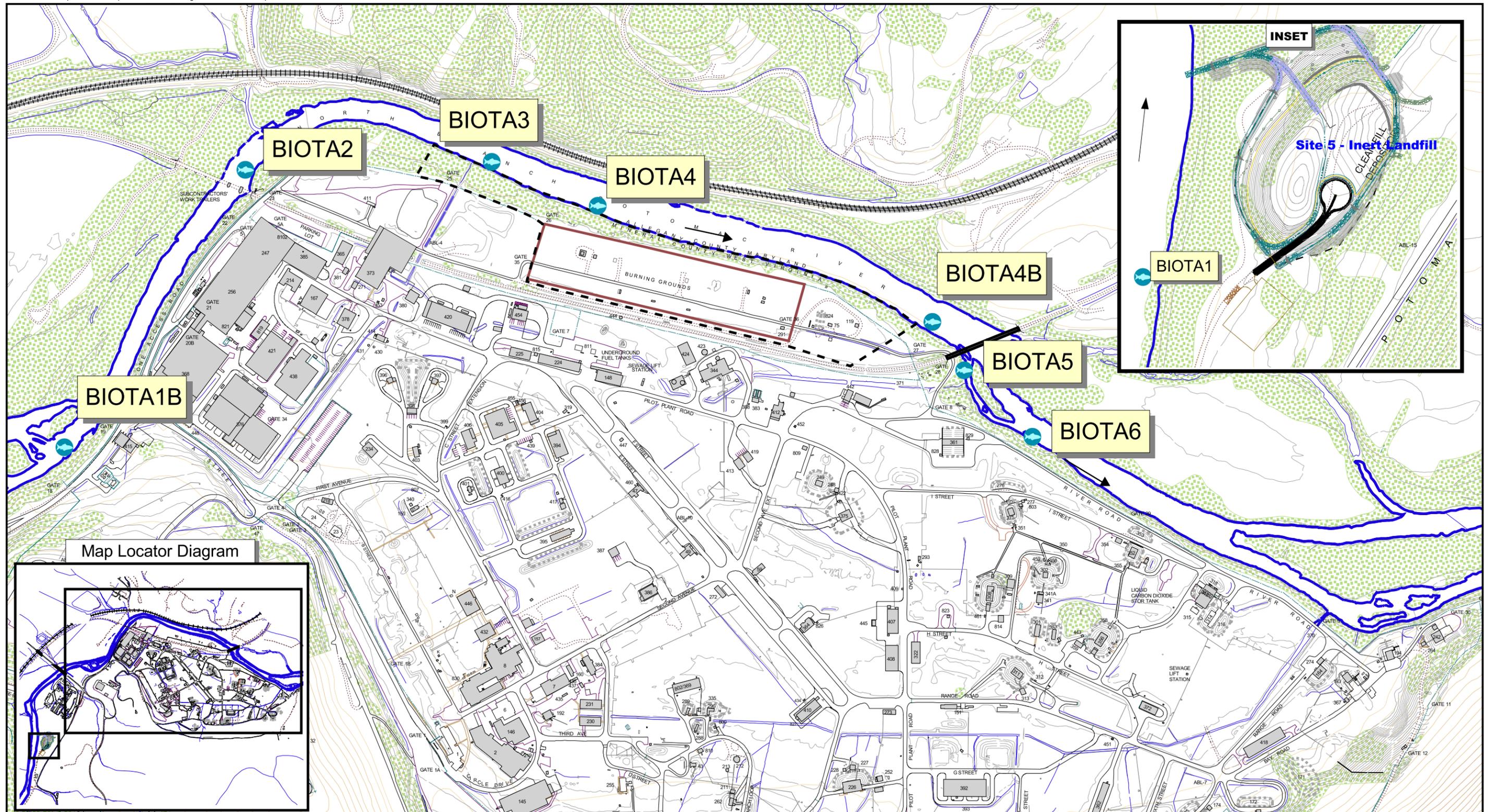
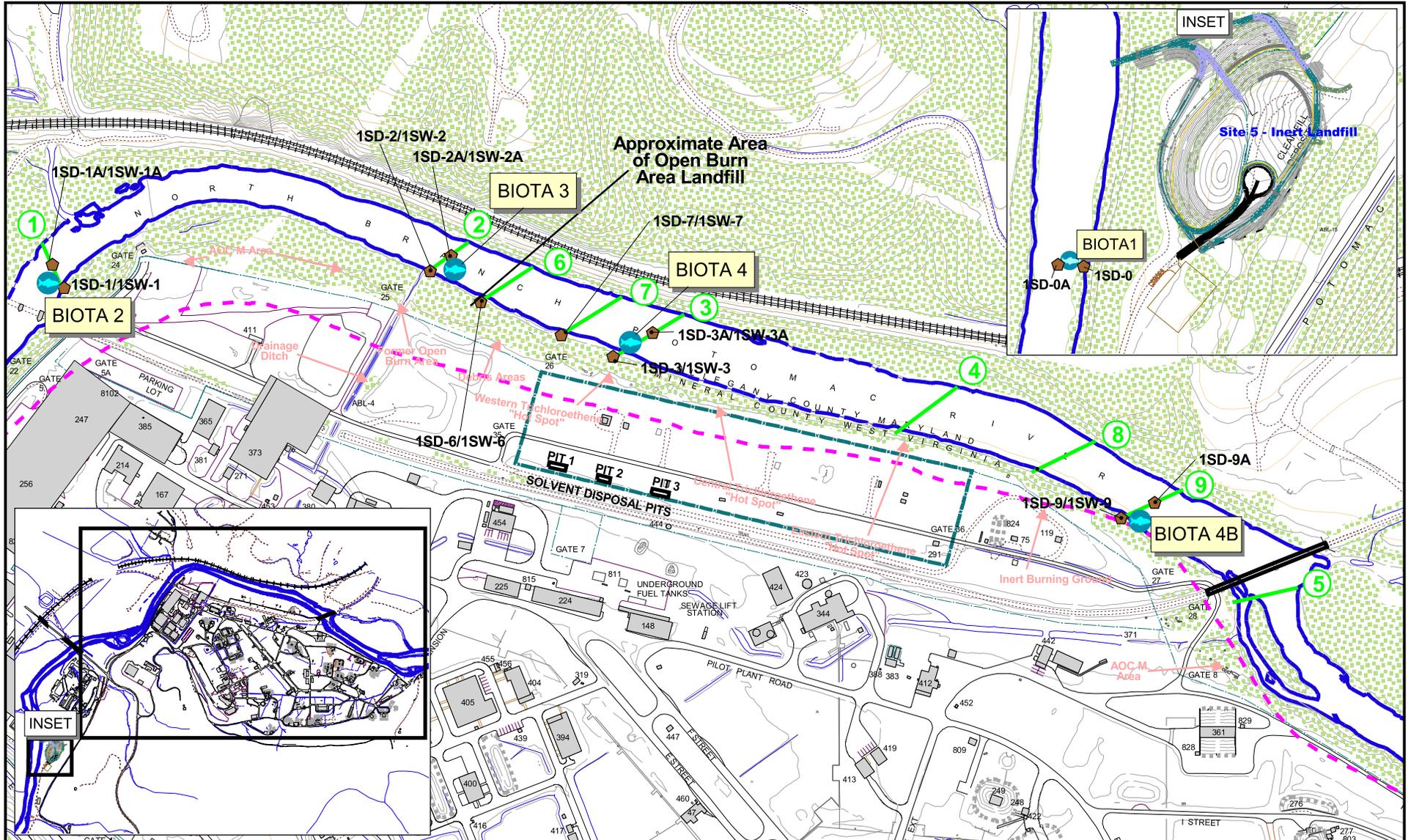


Figure 2-1
 Previous Surface Water and
 Sediment Sampling Locations - Site 1
 Step 4 ERA Work Plan
 Allegheny Ballistics Laboratory
 Rocket Center, West Virginia
CH2MHILL



- LEGEND**
- Long-term Monitoring Biota Sampling Locations
 - Boundary of Burning Grounds
 - Boundary of IR Site 1
 - Flow Direction

Figure 2-2
Biological Sampling Locations - Site 1
Step 4 ERA Work Plan
Allegany Ballistics Laboratory
Rocket Center, West Virginia



LEGEND

- Sediment Sample Location
- Biota Sample Location
- Vegetation
- Buildings
- 100-Year Flood Plain
- Transects
- Water Bodies
- Roads

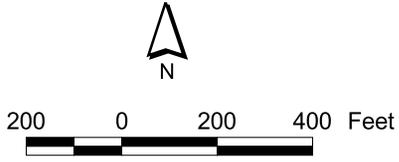


Figure 3-1
 Proposed Sediment and Biota
 Sampling Locations - Site 1
 Step 4 ERA Work Plan
 Allegheny Ballistics Laboratory
 Rocket Center, West Virginia

Appendix A
Field Sampling Plan Addendum

Field Sampling Plan Addendum

This addendum describes the additions or changes to Supplemental Investigation and LTM FSPs referenced in this work plan. The changes contained herein supersede all other documentation.

A.1 General Procedures

All sampling will take place in the area outlined on Figure 3-1.

Table 3-1 lists the specific samples that are to be collected, sample names, and analytical parameters. Table 3-2 lists the sample container requirements, preservatives, and holding times.

A.2 Toxicity Testing

Splits of the sediment samples will be used for laboratory-based toxicity testing and samples will be thoroughly homogenized (following the collection of VOC and AVS/SEM samples) prior to splitting. Toxicity tests will be 42 days in duration and use the amphipod *Hyalella azteca*. Test endpoints will include survival, growth, and reproduction. Toxicity testing procedures will follow those outlined in the SOP provided in Appendix D.

A.3 Biological Surveys

The benthic invertebrate community will be sampled at five (5) of the LTM biota locations (Biota 1, 2, 3, 4, and 4B; Figure 3-1) using additional methodologies to the Hester-Dendy samplers currently employed as part of the LTM program. These methodologies will include kick-net sampling in riffle areas and 20 jabs with a D-frame net in pool areas in proportion to the available in-pool habitats. If both pool and riffle habitat types are present at a location, separate samples will be collected using each of the different methodologies. Kick-net samples are considered semi-quantitative in nature, that is, the sample area is well defined (one square meter). The method of using 20 jabs with a D-frame net is considered qualitative in nature because the area sampled is not well defined and is based solely upon proportion of available habitat present.

Riffle habitat will be sampled with a composite of two kick-net samples, one in a faster flowing area and one from a slower flowing area. Where pools are the more dominant physical characteristic, an area of 100 meters will be selected for 20 jab samples. The available habitat types (i.e., banks, snags, sediment deposits) will be identified in the 100 meter reach and the percentage of each habitat determined. The number of jabs will then be allocated to each habitat type based upon the determined percentages. Sampling in pool areas will be confined to the ABL side of the river and will not extend beyond the center of the stream reach.

Each sample type will be consolidated, placed in bottles or plastic bags, labeled, preserved as appropriate, and sent to the laboratory (along with the LTM Hester-Dendy samplers) for taxonomic identification to the lowest practical taxon.

Kick-net and dip net data will be evaluated using suitable metrics selected from Blocksom and Flotemersch (2005). Hester-Dendy data will be evaluated using the metrics described in the LTM Work Plan.

A.4 Fish Tissue Sampling

Whole-body fish tissue samples will be collected at the same five locations used for benthic invertebrate surveys (LTM locations Biota 1, 2, 3, 4, and 4B; Figure 3-1). These whole-body fish tissue samples will be collected, if possible, during the LTM sampling. If this is not feasible, logistically, or if the needed samples cannot be collected during the LTM sampling, fish will be collected during a separate sampling event using methods appropriate to the habitat conditions present (e.g., seines, electroshockers, or traps). All collected fish will be weighed, their total length measured, and subjected to a gross external examination for lesions and other abnormalities.

Analytes will include TAL metals, percent lipid, and percent moisture. The compositing of samples may be necessary to achieve the required tissue mass for analysis (150 g). If compositing is necessary, composite samples will be composed of the same species, gender, and age group whenever possible and will be consistent among locations, whenever possible. All samples will be analyzed as whole-body samples. Species will be selected based upon relative abundance and trophic level, with predators (e.g., bass) or bottom feeders (e.g., suckers) emphasized. Size classes will be targeted to those most likely to be consumed by representative upper trophic level receptors, generally 4 to 10 cm.

A.5 Sample Processing and Shipping

Fish tissue samples will be put in plastic bags, labeled, and placed on ice for shipment.

For benthic invertebrate samples, each sample type (kick-net and dip net) at each location will be consolidated, placed in bottles or plastic bags, labeled, and preserved as appropriate using formalin or alcohol.

Appendix B
Quality Assurance Project Plan Addendum

Quality Assurance Project Plan Addendum

This addendum describes the additions or changes to the Supplemental Investigation and LTM QAPPs referenced in this work plan. The changes contained herein supercede all other documentation.

The analytes for this QAPP are detailed in Tables 3-1 and 3-2.

Refer to Table B-1 for the laboratory procedures, precision, accuracy, and completeness objectives for AVS/SEM, pH, TOC, and grain size.

Refer to Table 3-2 for containers, preservatives, and holding times for all samples.

Refer to Table 3-3 for collection frequency of field QC samples.

TABLE B-1
Precision, Accuracy, and Completeness Objectives
Allegany Ballistics Laboratory, Rocket Center, WV

Parameter	Method	Precision (Relative Percent Difference)	Accuracy (% Spike Recovery)	Intended Data Use
AVS/SEM	USEPA	Not applicable	85 - 105	Refine ERA risk estimates
pH	9045C	Not applicable	Not applicable	Refine ERA risk estimates
TOC	Lloyd-Kahn	<±35	70 - 130	Refine ERA risk estimates
Grain Size	ASTM D422	Not applicable	Not applicable	Refine ERA risk estimates

Appendix C
Investigation-Derived Waste Management Plan
Addendum

APPENDIX C

Investigation-Derived Waste Management Plan Addendum

This addendum describes the additions or changes to the Supplemental Investigation and LTM IDWMPs referenced in this work plan. The changes contained herein supercede all other documentation.

The only IDW anticipated to be generated during this investigation will be decontamination fluids and personal protective equipment. This activity is not expected to generate more than about 2 gallons of liquid decontamination fluid which will be disposed of at the Site 1 groundwater treatment plant.

No additional changes to the IDWMP are noted.

Appendix D
Standard Operating Procedure for Toxicity
Testing

APPENDIX D

Standard Operating Procedure for Toxicity Testing

This appendix provides the laboratory-specific SOP for sediment toxicity testing, which is based upon U.S. Environmental Protection Agency (USEPA) protocols.

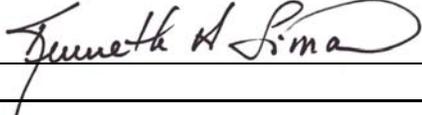
ENVIROSYSTEMS, INCORPORATED
STANDARD OPERATION PROCEDURE

SOP Number: QA-1466
 Issued: 6/00
 Revision Number: 6.1
 Page: 1 of 11

TITLE: Assessment Toxicity (42-Day) of Sediments To The Amphipod, *Hyaella azteca*
 based on Survival and Growth - CH2M Hill Contract N62470-02-D-3052, CTO-0102

Approved By:

QA Officer: _____ Date: _____

President:  _____ Date: July 31, 2006

Revision History:

Revision Number	Changes	Revised By	Date
0	Preparation of SOP	K. A. Simon	06/00
1	Review and Update	K. A. Simon	02/01
2	Review and Update, definitions added	K.A. Simon	05/01
3	Review and Update, Addition of NELAC Requirements	K.A. Simon	07/01
4	Revision	S. Dionne	01/03
5	Revision	A. Planz	06/03
6	Review and Update	K. A. Simon	06/06
6.1	Client Specific requirements	K. A. Simon	07/31/06

TITLE: Assessment Toxicity (42-Day) of Sediments To The Amphipod, *Hyaella azteca* based on Survival and Growth - CH2M Hill Contract N62470-02-D-3052, CTO-0102

1.0 Purpose and Applicability

The purpose of this Standard Operating Procedure is to determine the impact, based on survival and growth, of sediments to amphipods exposed under static renewal conditions. The assay involves a 28-day sediment exposure, followed by a 14-day water-only exposure period. The assay is conducted using guidelines developed by ASTM and is provided in *Standard Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates*.

The assay involves exposing juvenile amphipods to sediment samples for a period of 28 days. At the end of the 28 day exposure period, the amphipods in a portion of the replicates are recovered, enumerated, sexed and dried to establish survival and growth. Amphipods in the remaining replicates are recovered and transferred to clean test chambers, containing only water and an inert substrate (Nitex screen), for an additional 14 days. During this period the number of juvenile amphipods produced are recorded.

Hyaella azteca (Saussure), Amphipoda, have many desirable characteristics of an ideal sediment toxicity testing organism including: relative sensitivity to contaminants associated with sediment, short generation time, contact with sediment, ease of culture in the laboratory, and tolerance to varying physio-chemical characteristics of sediment.

This SOP has been modified to meet Sample Analysis Plan (SAP) specific criteria for the analysis of samples associated with CH2M Hill Contract N-62470-02-D-3052, CTO-0102 for Ecological Investigations in the North Branch Potomac River - Site 1 Baseline Ecological Risk Assessment - Step 4. Allegany Ballistics Laboratory, Rocket Center, West Virginia.

2.0 Definitions

Overlying Water: the water placed over sediment in a test chamber during a test.

Reference Sediment: a whole sediment near an area of concern used to assess sediment conditions exclusive of material(s) of interest. The reference sediment may be used as an indicator of localized sediment conditions exclusive of the specific pollutant input of concern. Such sediment would be collected near the site of concern and would represent the background conditions resulting from any localized pollutant inputs as well as global pollutant input. This is the manner in which reference sediment is used in dredge material evaluations.

Reference-Toxicity Test: a test conducted with reagent-grade reference chemical to assess the sensitivity of the test organisms. Deviations outside an established normal range may indicate a change in the sensitivity of the test organism population. Reference-toxicity tests are most often performed in the absence of sediment.

Pore water: water located in spaces between grains of sediment.

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Sediment: particulate material that usually lies below water; formulated particulate material that is intended to lie below water in a test.

Whole Sediment: sediment and associated pore water which have had minimal manipulation. The term bulk sediment has been used synonymously with whole sediment.

3.0 Applicable Documents/References

ASTM. 1999. Vol. 11.05. *Standard Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates*. E 1706-95b, Philadelphia. Revision #4.

U.S. EPA, U.S. Army Corps of Engineers. 1998. *Great Lakes Dredged Material Testing and Evaluation Manual. Appendix G. Biological Effects Testing Procedures*. September 1998.

U.S. EPA. 2000. *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates*. Second Edition. EPA/R-99/064. March 2000.

ESI SOP QA-1203 - "Preparation of Daphnia Food (YCT)"
ESI SOP QA-1118 - "Corrective Action Reports"

4.0 Materials and Apparatus

Test organisms - juvenile *Hyaella azteca*
Beakers, 400 mL, drilled and screened to facilitate water exchanges
Incubator/waterbath capable of maintaining 23 ±1°C
DO Meter, pH meter, conductivity meter, temperature logger
Analytical Balance, 0.01 mg
Drying Oven, 60°C
Components for artificial sediment - sand, clay, peat moss/laboratory organic component
0.5, 6.0 mm Screens
YCT (See SOP QA - 1203)

5.0 Methods/Procedures

5.1 Test Material

5.1.1 Sediment samples will be clearly identified as to source and collection date. This information will be provided to the testing facility by the client, unless arranged otherwise. Upon receipt, the laboratory will assign a unique sample number to each container. The laboratory will maintain receipt, storage, and disposition records.

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5.2 Test Organisms

- 5.2.1 Healthy amphipods from the same source and age are used in the test. Amphipods will be between 7 and 8 days old at the start of the assay.
- 5.2.2 Confirmation of species is provided by the supplier. If not provided, the species will be verified using appropriate taxonomic keys. Organisms maintained by ESI will be from cultures of the confirmed species.
- 5.2.3 Pretest observation data concerning the source, handling procedures, disease treatment (if any), health, feeding and mortality of test organisms will be recorded and reported.
- 5.2.4 Amphipods will be maintained under static renewal or flow-through conditions, from hatch until use, in dilution water. The dilution water should have approximately the same hardness and temperature as will be used during testing.
- 5.2.5 Prior to the start of the assay, mean weights will be determined on a portion of the test population. Organisms will be weighed in groups of 10. If length is a required endpoint, group of 20 amphipods will be photographed and measurements made from the photographs to determine start lengths,.

5.3 Exposure Conditions

Sediment and water will be added to the test chambers on day -1. Test organisms will be added 24 hours later on day 0.

- 5.3.1 Assays are conducted in a static renewal mode. Overlying water is renewed on a daily basis, at the rate of (minimum) two (2) volume additions per day.
- 5.3.2 Water temperature is $23 \pm 1^{\circ}\text{C}$. Maximum temperature deviation should not exceed $\pm 3^{\circ}\text{C}$ of the specified value at any time.
- 5.3.3 The photoperiod is set to 16 hours light : 8 hours dark. Light intensity is 100 to 1000 lux from wide spectrum fluorescent fixtures.
- 5.3.4 The test vessels are 400 mL beakers, minimum, containing 100 mL of sediment and 175 to 225 mL of water.
- 5.3.5 Sediment for the laboratory control treatment may be natural sediments obtained from uncontaminated areas, or formulated sediments prepared, by weight, as follows:

No. 18 silica sand (fine sand)	-	69%
Clay	-	20%
Organic matter (peat moss)	-	10%
Calcium Carbonate	-	1%

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The preferred source for organic matter in the artificial sediment is the organic matter recovered from either midge larvae or amphipod cultures. The material is screened to remove large matter and then autoclaved for a half hour to insure sterility. If peat moss is to be used as a source of organic matter it is sieved through a 2 mm mesh screen to remove large debris. (Care should be taken to prevent the peat moss from drying out. Once dried, peat moss will separate from the sand and float in the test chambers.) The mixture is blended in a lined mixer for 1 hour to insure homogeneity. The formulated sediment may be autoclaved and stored in an air-tight container until needed.

5.4 Study Conduct

- 5.4.1 The amphipods are exposed for 28 days to the test sediment and to the untreated control sediment, under static renewal conditions. Overlying water renewal is equal to two (2) volume additions per day. After the initial 28-day exposure period, the organisms are recovered from the sediment and transferred to clean test chambers for an additional 14-day period to monitor reproduction.
- 5.4.2 A representative sample is obtained from sediment provided. Test sediments are homogenized and 100 mL placed in each test chamber. Sediments may be screened through a 3 mm screen to remove debris. Between 175 and 225 mL of water is added to the test chamber and allowed to stand overnight with gentle aeration. Aeration is provided to each test chamber to provide approximately 1 bubble/second and to not disturb the sediment surface. Prior to the addition of the test organisms, any floating detritus is removed from the surface of the water using a piece of Nytex[®] screen.
- 5.4.3 As recommended by the EPA protocol, overlying water will be mix of equal parts of natural surface water and reconstituted water. Use of straight reconstituted laboratory water is not recommended (EPA, ASTM). Hardness, alkalinity, ammonia, pH, conductivity and total organic carbon content will be determined prior to the start of the assay.
- 5.4.4 Amphipods will be acclimated to the overlying water: 2 hours in a 50:50 mixture of culture water to overlying water followed by 2 hours in a 25:75 mix, then transferred to 100% overlying water.
- 5.4.5 Test organisms will be 7 - 8 days old at the start of the assay. Amphipods are added below the surface of overlying water. Any observed amphipods trapped in the surface tension should be removed and replaced. Amphipods that come in contact with any other surface are not used in the assay.
- 5.4.6 Each treatment group will consist of 15 replicates with 10 organisms per test vessel. The organisms are randomly assigned to the test vessels one day after the addition of the test sediment and water. Five (5) of the replicates

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are assigned to the 28-day survival portion of the assay and ten (10) are assigned to the 42-day reproduction evaluation.

5.4.7 Measurement of Water Characteristics

5.4.7.1 Dissolved oxygen, specific conductance and pH are measured daily during the test, in at least one replicate, prior to renewal. In cases where the dissolved oxygen falls below 2.5 mg/L, oxygen levels will be checked in all replicates for that treatment.

5.4.7.2 Temperature is recorded daily during the test in one replicate, and hourly in a separate test vessel by a data-logger.

5.4.7.3 Alkalinity, hardness, ammonia and TOC levels of the overlying water are measured in one replicate of each treatment at the start of the assay, and weekly thereafter during the first four weeks.

5.4.8 Amphipods are fed 1.0 mL of YCT food per vessel per day (solids content 1800 mg/L). Feeding will be suspended if fungus is noted forming on the sediment surface. ESI SOP QA-1203 - "Preparation of Daphnia Food (YCT)" provides instructions for the production of YCT.

5.4.9 The initial phase of the assay is terminated on day 28. Amphipods swimming in the overlying water are siphoned into a screen and counted. Sediments are placed on a #35 (0.5 mm) screen and gently washed with fresh water to remove sediment. Material remaining on the screen is examined to recover remaining amphipods. Any amphipod that shows signs of movement is considered alive, and counted.

5.4.10 Surviving amphipods from 5 replicates are rinsed with lab water to remove any detritus, then placed on tared pan and dried at 60°C for 24 hours. Pans are allowed to cool to room temperature in a desiccator and weighed to the nearest 0.01 mg. The process is repeated until a constant weight is achieved. If requested by the client, lengths may be determined on the surviving amphipods.

5.4.11 Amphipods from the remaining 10 replicates are transferred to clean test chambers containing the same overlying water as used in the initial 28-day exposure period. A piece of Nytex[®] screen is added to each test vessel to provide support for the amphipods. During the next 14 days, the test vessels are maintained on the same schedule as used during the initial 28-days. Reproduction is measured on days 35 and 42. On day 35, the adults are carefully removed from the test chamber and the number of juveniles recorded and removed. The adults are returned to the test chamber until day 42. On day 42, the adults are removed from the chambers and preserved in formalin, the number of juveniles present is determined. Preserved adults are examined and the numbers of males and females

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recorded. The number of females is used to determine juvenile production rates.

5.4.12 If requested by the client, additional endpoints may be achieved; survival may be recorded at days 35 and 42, and final growth may be determined at day 42.

6.0 Quality Control Requirements

6.1 Reference Toxicant Evaluation

A reference toxicant evaluation should be conducted with each series of assays. The reference toxicant shall be a 96-hour 'water-only' test conducted with either sodium dodecyl sulfate or copper. A reference toxicant assay must be conducted when test species are obtained from a source other than normally used by the laboratory or if a reference toxicant assay has not been conducted during the preceding month.

6.2 Interferences

Living organisms present in the sample may compete with the amphipods or may be predators, reducing overall survival. This impact may be mitigated by sieving samples prior to testing.

6.3 Detection Limits - Not Applicable

7.0 Calculations/Reporting

7.1 Data Analysis

Survival and growth data from each treatment will be subjected to analysis of variance (ANOVA) to determine if significant differences exist between treatments and the control. Statistical evaluations will be made CETIS® software using appropriate standard statistical models.

7.1.1 Prior to statistical analysis, the survival, growth and reproduction data will be reviewed to determine the presence of outliers. If outliers are found, an explanation must be sought. If a reasonable source for the deviation is found, the value may be excluded from further analysis. If no explanation is found, the analysis should be performed both with and without the questionable data point and both sets of results reported. All data sets are evaluated to determine sample variance homogeneity and normality. Those data sets meeting the criteria for normality and homogeneity are evaluated

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with parametric statistical models, while those that do not meet both criteria are evaluated using non-parametric models.

7.1.2 Endpoints evaluated are: survival at days 28 and 42, growth (dry weight) at days 28 and 42, numbers of juveniles produced by days 35 and 42, number of juveniles per female on day 42.

7.1.3 Statistical comparisons for each sample site will be made against the laboratory control treatment plus each project reference site. Project reference sites will also be compared to one another.

7.2 Reporting

7.2.1 Reports generated from this study will include: summarization of collection and transportation information (as provided), methods and materials, test organism history, test conditions, documentation of variations from the proposed work scope, results and data analysis. Copies of all statistical printouts and raw data are attached as appendices to the report.

8.0 Corrective Actions

8.1.1 The amphipod assay is considered acceptable if environmental parameters (temperature, dissolved oxygen, salinity, pH, alkalinity and hardness) fall within the ranges specified. Survival in the control sediments after 28 days exposure will be $\geq 80\%$ and there is evidence of juvenile reproduction in the control treatment.

8.1.2 Criteria specified in Section 11 will be met.

8.2 If survival fails to meet the minimum value specified by the protocol, the client will be notified and the test restarted. Water quality data is reviewed when collected and all necessary steps taken to insure that values which are approaching limits or are outside study limits, are documented and corrected.

8.3 If water quality values fall outside study limits the Project Manager or other authority, using sound scientific practice, will determine if the study requires repeating or the data is allowed to be accepted. The client will be notified, the results reviewed and a final determination made as to the acceptability of the data.

8.4 Corrective Actions

8.4.1 In the event that an element of the assay falls outside acceptable limits, or there is a change in the protocol, a Corrective Action Report must be initiated and completed; see ESI SOP QA-1118 - "Corrective Action Reports"

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9.0 Health and Safety

- 9.1 As with all samples, gloves and safety glasses should be worn when handling sediment samples and chemicals. It is advisable to wear a lab coat to protect clothing.
 - 9.2 At the end of an assay excess sample material and material used in the assay will be disposed of appropriately. Material may be returned to the client, or air dried and placed in an appropriate container for disposal at an approved disposal facility. If the material is classified as non- hazardous, the material may be disposed in an appropriate waste container.
 - 9.3 Assays and sample disposal will be conducted using procedures to minimize potential pollution of surface and ground waters, soils and sediments.
-

10.0 Responsibilities

- 10.1 It is the Lab Manager's responsibility to ensure analysts performing this procedure are properly trained and the training is documented in their training file. The analyst is responsible for following the procedures outlined in this SOP.
 - 10.2 Prior to any staff member working unsupervised on a testing procedure, they must be certified by the Laboratory Manager. Certification will include reading this and associated SOPs, review of the primary literature and participation in similar procedures under the direct supervision of a trained staff member. Certification will be based upon a review of the persons' demonstrated abilities.
-

TITLE: Assessment Toxicity (42-Day) of Sediments To The Amphipod, *Hyaella azteca* based on Survival and Growth - CH2M Hill Contract N62470-02-D-3052, CTO-0102

11.0 Summary of Test Conditions

1. Test Type: Static renewal
2. Temperature: 23 ±1°C with no values exceeding limits of ±3°C
3. Light Source: Wide-spectrum fluorescent
4. Light Intensity: 100 to 1000 Lux
5. Photoperiod: 16 hr light:8 hr dark
6. Test Chamber: 400 mL beakers (minimum)
7. Sediment Volume: 100 mL
8. Overlying water volume: 175-225 mL in the sediment exposure from day 0 to day 28; 175 to 275 mL in the water-only exposure from day 28 to day 42.
9. Overlying Water Renewal: 2 Volume additions per day
10. Age of organisms: 7 to 8 days old at the start of the assay
11. Organisms per Replicate: 10
12. Number of replicates: 15, 5 for 28-day survival and growth, 10 for 35 and 42 day survival, growth and reproduction
13. Feeding: YTC mix, fed 1.0 mL daily to each test chamber (1800 mg/L solids)
14. Aeration: None, unless dissolved oxygen in overlying water drops below 2.5 mg/L
15. Overlying water: Culture water, well water, surface water or site water. Use of reconstituted water is not recommended (EPA, ASTM).
16. Test chamber cleaning: If screens become clogged during a test; gently brush the outside of the screen
17. Overlying water quality: Hardness, alkalinity, ammonia and TOC levels at the beginning and weekly thereafter during the sediment exposure. Dissolved oxygen, pH, conductivity, and temperature daily in one replicate of each treatment. Hourly measurement of temperature in a separate test vessel.
18. Test duration: 42 days

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19. Endpoints: Day 28 survival and growth; Day 35 survival and reproduction; Day 42 survival, growth and reproduction.
20. Test Acceptability: Minimum mean control survival of 80% on day 28 and measurable growth, dry weight >0.15 mg/individual, in the laboratory control treatment. Mean reproduction from Day 28 to Day 42 should be ≥ 2 juveniles/female.