4.0 FIELD ACTIVITIES

In order to organize and track sampling efforts for the Phase I RI at the NACA Test Area, the AOC has been separated into six sub-areas based on operational data, available maps, and historical aerial photographs. These sub-areas and a summary of the environmental matrices that will be sampled within each are listed in Table 4-1. Areas 1 through 3 lie within the NACA Test Area and will be sampled to evaluate potential contaminant sources within the AOC. Areas 4 through 7 lie adjacent to or outside of the NACA Test Area and will be sampled to evaluate off-AOC contaminant migration. The selection of these sub-areas for biased or random sampling is based on the project DQOs and conceptual site model described in Section 3.2.

4.1 SUBSURFACE SOILS

4.1.1 Rationales

Subsurface soil samples will be collected during the Phase I RI at the NACA Test Area to investigate (1) potential subsurface contamination occurring as a result of dispersal of aircraft fuel during crash-test activities, (2) potential subsurface contamination occurring as a result of surface thermal destruction of explosives and other munitions wastes related to the adjacent Demolition Area 1 site, and (3) transport pathways to deeper soil horizons for such contaminants as those described in the DQOs (Section 3.2). Table 4-2 summarizes the planned subsurface soil sampling activities for the NACA Test Area Phase I RI.

4.1.1.1 Soil boring locations

As denoted in Table 4-1, subsurface soil samples are planned at 14 locations in the plane burial area and 4 locations in the refueling/catapult area (Figure 4-1). The proposed locations were selected on the basis of DQOs and the conceptual site model developed from operational information and analytical results from previous sampling events (see Sections 1.0 and 3.2).

A total of 18 subsurface soil stations will be sampled from the 0.3- to 0.9-meter (1- to 3-foot) interval. Table 4-3 describes the rationale for the placement of individual soil borings. Two additional subsurface contingency samples are planned and will be collected from areas that exhibit visual evidence or indications of surface soil contamination. These subsurface contingency samples will be located in the field during the sampling effort. Specific sample locations may be moved within the general grid pattern to any obviously disturbed or bare nearby areas.

Geotechnical samples from 0.3 to 0.9 meters (1 to 3 feet) bgs will be collected using a geoprobe rig and Shelby tube at 3 of the 18 stations (NTA-038, -057, and -059). One sample location, NTA-038, will be advanced to a depth of approximately 30 feet for lithologic logging. If refusal occurs at a depth of less than 6.1 meters (20 feet), one additional geoprobe boring will be attempted adjacent to the original location. Using a geoprobe rig equipped with macro-core samplers. At this location, a Shelby tube sampler will first be collected from the 0.3- to 0.9-meter (1- to 3-foot) bgs interval for geotechnical analysis (see Section 4.1.2.3). Macro-core samplers will then be collected continuously to the total depth probed for field lithologic description. Upon reaching total depth, a retractable screen, attached to the probe rods will be exposed allowing for groundwater sample collection. The retractable screen will be set at the shallowest depth at which sufficient inflow exists for sampling. A groundwater sample will be collected using a mini-bailer. The groundwater sample will be sent for laboratory analyses of VOCs,

Table 4-1. Phase I RI Sub-areas at the NACA Test Area

Area No.	Description	Sample Matrix
1	Crash Area	Surface soil/sediment/surface water/ groundwater (1 location)
2	Plane Burial Area	Surface soil/subsurface soil
3	Plane Fueling/ Catapult Area	Surface soil/subsurface soil (4 locations)
4	Ditches Flowing from Crash Area	Surface soil/sediment/surface water
5	Drainageways Upstream of NACA	Sediment/surface water
6	Main Ditch from NACA Test Area Adjacent to Hinkley Creek	Sediment/surface water

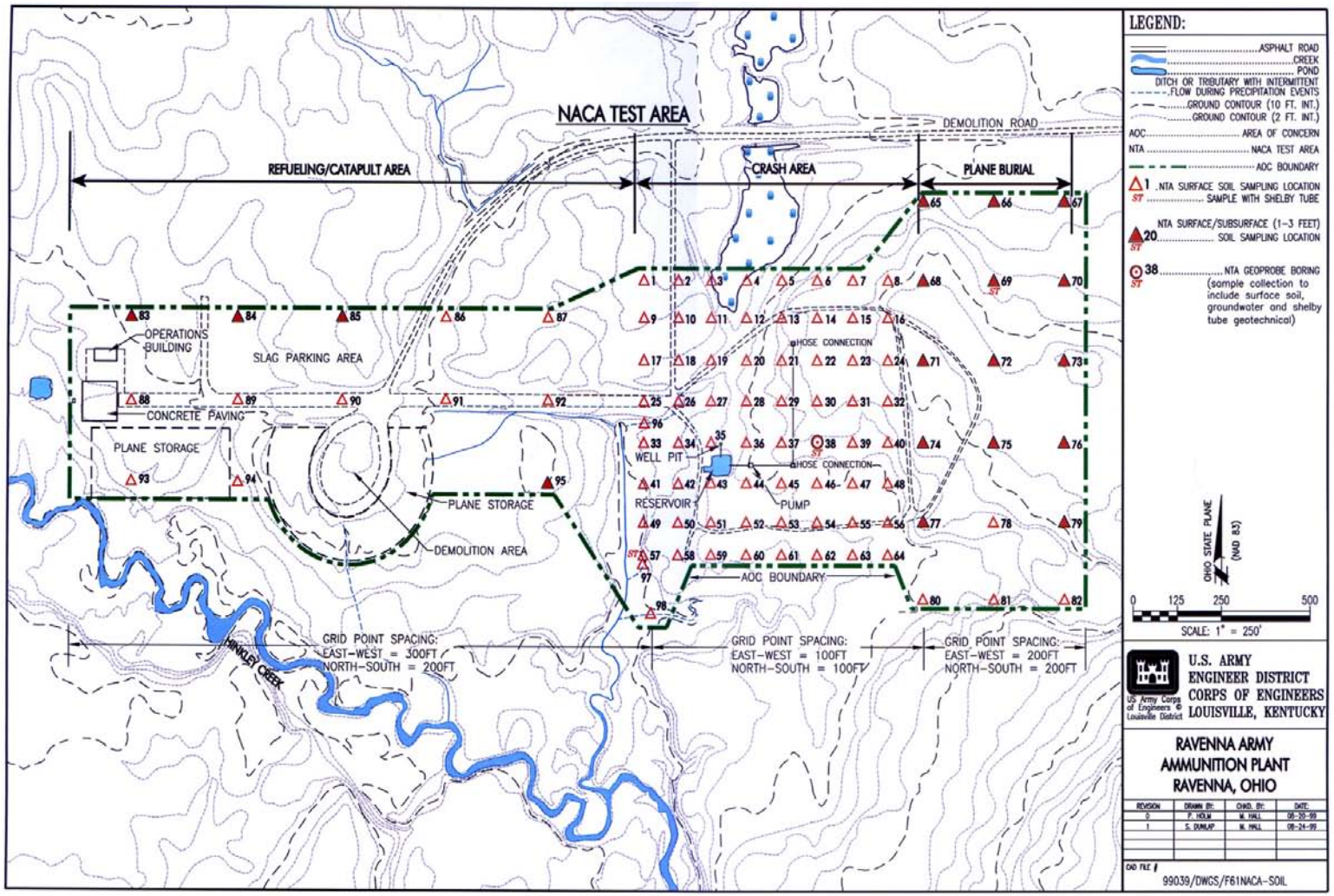

Figure 4-1. Surface Soil and Subsurface Soil Sampling Locations

Table 4-2. Summary of Phase I RI Sampling at the NACA Test Area

Sample Media	Sample Stations	Sampling Method	Depth (feet)	Samples/Station	Total No. of Samples	Explosives (8330)	Propellants (8330/352.2)	TAL Metals (6010/7000/7841/7470/7471)	Cyanide (9012)	VOCs (8260B)	SVOCs (8270C)	PCBs (8082)	Grain Size (ASTM D422)	Atterberg Limits (ASTM D4318)	Unified Soil Classification	Total Organic Carbon (9060)	Shelby Tube Geotechnical[a]
Planned Samples																	
Surface soils	11	Composite	0 to 1	1	11	11	11										
Surface soils	98	Discrete	0 to 1	1	98			98	98	98	98	11		6	6		
Soils	3	Discrete	1 to 3	1	3												3
Subsurface soils	18	Discrete	1 to 3	1	18	2	2	18	18	18	18	2		1	1		
Sediment	6	Discrete	0 to 0.5	1	6	6	6	6	6	6	6	6	6			6	
Surface water	6	Grab	--	1	6	6	6	6	6	6	6	6					
Groundwater	1	Grab	Water table	1	1	1	1	1	1	1	1						
Total Planned	139				140	26	26	129	128	129	129	25	6	7	7	6	3
Contingency Samples																	
Surface soils	2	Discrete	0 to 1	1	2			2	2	2	2	1					
Subsurface soils	2	Discrete	1 to 3	1	2			2	2	2	2						
Total Contingency	4				4			4	4	4	4	1					
QC Samples (A&E)																	
Surface soils	1	Composite	0 to 1	1	1	2	2										
Surface soils	9	Discrete	0 to 1	1	9			10	10	10	10	2					
Subsurface soils	2	Discrete	1 to 3	1	2			2	2	2	2						
Sediment	1	Discrete	0 to 0.5	1	1	1	1	1	1	1	1	1					
Surface water	1	Grab	--	1	1	1	1	1	1	1	1	1					
Total QC Samples	14				14	4	3	14	14	14	14	4					
QA Samples (USACE)																	
Surface soils	1	Composite	0 to 1	1	1	2	2										
Surface soils	9	Discrete	0 to 1	1	9			9	9	9	9	2					
Subsurface soils	2	Discrete	1 to 3	1	2			2	2	2	2						
Sediment	1	Discrete	0 to 0.5	1	1	1	1	1	1	1	1	1					
Surface water	1	Grab	--	1	1	1	1	1	1	1	1	1					
Total QA Samples	14				14	4	4	13	13	13	13	4					

A&E = Architect and Engineer.

ASTM = American Society for Testing and Materials.

QA = Quality assurance.

TAL = Target analyte list.

[a] Shelby tube geotechnical = grain size (ASTM D422), bulk density (internal lab method), pH (ASTM D4972) Redox potential (SM2580), organic carbon content (9060), soil permeability (D5084), specific gravity (ASTM D854), moisture content (ASTM D2216), and Atterberg Limits (ASTM D4318).

Table 4-3. Phase I RI Sampling Locations and Rationale

Site Location	No. Sample Stations	Sample Station IDs	Location Description	Sample Station Rationale
Soil Samples (see Figure 4-1)				
Crash Area	64	NTA-001	Crash area (area of tank rupture and impact) at the east end of catapult area.	Possible contaminant source due to dispersal of petroleum fuel and other fluids during crash tests.
		NTA-002	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-003	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-004	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-005	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-006	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-007	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-008	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-009	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-010	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-011	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-012	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-013	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-014	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-015	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-016	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-017	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-018	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-019	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-020	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-021	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-022	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-023	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-024	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-025	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-026	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-027	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-028	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-029	Crash area (area of tank rupture and impact) at the east end of catapult area.	

Table 4-3 (continued)

Site Location	No. Sample Stations	Sample Station IDs	Location Description	Sample Station Rationale
		NTA-030	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-031	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-032	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-033	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-034	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-035	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-036	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-037	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-038	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-039	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-040	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-041	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-042	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-043	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-044	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-045	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-046	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-047	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-048	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-049	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-050	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-051	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-052	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-053	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-054	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-055	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-056	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-057	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-058	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-059	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-060	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-061	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-062	Crash area (area of tank rupture and impact) at the east end of catapult area.	

Table 4-3 (continued)

Site Location	No. Sample Stations	Sample Station IDs	Location Description	Sample Station Rationale
		NTA-063	Crash area (area of tank rupture and impact) at the east end of catapult area.	
		NTA-064	Crash area (area of tank rupture and impact) at the east end of catapult area.	
Plane Burial Area	18	NTA-065	Area east of crash area.	Possible contaminant source due to leakage of petroleum fuel and other fluids as a result of plane burial activities.
		NTA-066	Area east of crash area.	
		NTA-067	Area east of crash area.	
		NTA-068	Area east of crash area.	
		NTA-069	Area east of crash area.	
		NTA-070	Area east of crash area.	
		NTA-071	Area east of crash area.	
		NTA-072	Area east of crash area.	
		NTA-073	Area east of crash area.	
		NTA-074	Area east of crash area.	
		NTA-075	Area east of crash area.	
		NTA-076	Area east of crash area.	
		NTA-077	Area east of crash area.	
		NTA-078	Area east of crash area.	
		NTA-079	Area east of crash area.	
		NTA-080	Area east of crash area.	
		NTA-081	Area east of crash area.	
		NTA-082	Area east of crash area.	
Plane Fueling / Catapult Area	13	NTA-083	Area west of crash area.	Possible contaminant source due to spillage of petroleum hydrocarbons and other fluids during fueling activities and catapult launching of aircraft during crash tests.
		NTA-084	Area west of crash area.	
		NTA-085	Area west of crash area.	
		NTA-086	Area west of crash area.	
		NTA-087	Area west of crash area.	
		NTA-088	Area west of crash area.	
		NTA-089	Area west of crash area.	
		NTA-090	Area west of crash area.	
		NTA-091	Area west of crash area.	

Table 4-3 (continued)

Site Location	No. Sample Stations	Sample Station IDs	Location Description	Sample Station Rationale
		NTA-092	Area west of crash area.	
		NTA-093	Area west of crash area.	
		NTA-094	Area west of crash area.	
		NTA-095	Area west of crash area.	
Ditches flowing from the NACA Test Area	3	NTA-096	Dry portions of ditches flowing toward the west from the site.	Possible contaminant accumulation point due to runoff from elevated source area.
		NTA-097	Dry portions of ditches flowing toward the west from the site.	
		NTA-098	Dry portions of ditches flowing toward the west from the site.	
Contingency	2	NTA-099	Location to be determined. Surface and subsurface soil samples.	Additional sample coverage based on field observations.
		NTA-100	Location to be determined. Surface and subsurface soil samples.	
Total Soil Locations	**100**			
Sediment Samples (see Figure 4-2)				
Crash Area - Well Pit	1	NTA-101	Subaqueous sediment.	Possible contaminant accumulation point for soil contaminated with petroleum hydrocarbons as a result of crash tests.
Crash Area - Reservoir	1	NTA-102	Subaqueous sediment.	Possible contaminant accumulation point for soil contaminated with petroleum hydrocarbons as a result of crash tests.
Ditches Flowing from the NACA Test Area	1	NTA-103	Subaqueous sediment.	Possible contaminant accumulation point due to runoff from elevated source area.
Drainageways Upstream of NACA on North	2	NTA-104	Subaqueous sediment.	Characterization of ambient conditions upstream of Demolition Area 1.
		NTA-105	Subaqueous sediment.	
Main Ditch from NACA Test Area Adjacent to Hinkley Creek	1	NTA-106	Subaqueous sediment.	Possible contaminant accumulation point due to runoff from elevated source area.
Total Sediment Locations	**6**			

Table 4-3 (continued)

Site Location	No. Sample Stations	Sample Station IDs	Location Description	Sample Station Rationale
Surface Water Samples (see Figure 4-2)				
Crash Area - Well Pit	1	NTA-101	Co-located with sediment location to be determined in the field based on flow conditions.	Possible contaminant accumulation point for soil contaminated with petroleum hydrocarbons as a result of crash tests.
Crash Area - Reservoir	1	NTA-102	Co-located with sediment location to be determined in the field based on flow conditions.	Possible contaminant accumulation point for soil contaminated with petroleum hydrocarbons as a result of crash tests.
Ditches Flowing from the NACA Test Area	1	NTA-103	Co-located with sediment location to be determined in the field based on flow conditions.	Possible contaminant accumulation point due to runoff from elevated source area.
Drainage Ways Upstream of NACA on North	2	NTA-104	Co-located with sediment location to be determined in the field based on flow conditions.	Characterization of ambient conditions upstream of the NACA Test Area.
		NTA-105	Co-located with sediment location to be determined in the field based on flow conditions.	
Main Ditch from NACA Test Area Adjacent to Hinkley Creek	1	NTA-106	Co-located with sediment location to be determined in the field based on flow conditions.	Possible contaminant accumulation point due to runoff from elevated source area.
Total Surface Water Locations	**6**			

SVOCs, explosives, propellants, filtered Target Analyte List (TAL) metals, and cyanide. The TAL metals sample fraction will be filtered in the field, immediately after collection using a hand-held vacuum type mechanism equipped with a 0.45 micron filter. Filtration will be performed in accordance with Section 4.3.5 of the facility-wide SAP. Following groundwater sample collection, the boring will be abandoned in accordance with Section 4.3.2.5 of the facility-wide SAP.

4.1.1.2 Discrete/composite soil sampling requirements

The eighteen subsurface soil samples collected during the NACA Test Area Phase I RI will be collected from the 0.3- to 0.9-meter (1- to 3-foot) depth interval only. The subsurface sample location will be in the approximate center of the three surface soil composite samples collected solely for explosives and propellant analyses (see Section 4.2). All VOC samples will be collected as discrete aliquots from the middle of the interval without homogenization. All remaining samples will be collected from homogenized soil collected using a bucket hand auger over the depth interval. Soil will be collected over the depth interval, placed into a stainless steel pan or bowl and homogenized, and representative aliquots will be placed into sample containers in accordance with Section 4.4.2.5.2 of the facility-wide SAP.

4.1.1.3 Sample collection for laboratory analysis

All subsurface samples will be submitted for off-site laboratory analysis of TAL metals, cyanide, VOCs, and SVOCs. Two samples will be selected for explosives, propellants, and PCB analyses.

One disturbed geotechnical sample will be collected at a representative location in the plane burial area and will be analyzed for Atterberg limits and Unified Soil Classification System (USCS) classification. Undisturbed geotechnical samples will be collected at crash area sample locations NTA-038 and NTA-057 and plane burial location NTA-069 and analyzed for particle size, dry weight, pH, redox potential, organic carbon content, bulk density, permeability, moisture content, and Atterberg Limits. All subsurface contingency samples will be submitted for laboratory analysis of TAL metals, cyanide, VOCs, and SVOCs (see Table 4-2). Geotechnical logging of all samples will be conducted including visual estimates of USCS classification and moisture content. Table 4-2 summarizes the analytical parameters and methods that will be used during the NACA Test Area Phase I RI. Analytical laboratory methods, analytes, and procedures are further discussed in the NACA Test Area Phase I RI Quality Assurance Project Plan (QAPP) Addendum.

4.1.1.3.1 Organic vapor screening

All soil borings will be field screened for VOCs using a hand-held photoionization detector (PID) or flame ionization detector organic vapor analyzer (OVA) during sample collection. All OVA readings will be recorded in the field boring logs. No samples will be collected for headspace analysis of VOCs.

4.1.1.4 Field quality control sampling procedures

Subsurface soil quality assurance (QA)/ QC samples will be collected during the Phase I RI (Table 4-2). Duplicate and split samples will be selected on a random statistical basis and submitted for the same analyses as the environmental samples. Chapter 8.0 of the NACA Test Area Phase I RI QAPP Addendum summarizes QA/QC sampling.

Duplicate soil samples will be collected at a frequency of 10 percent (1 per 10 environmental samples). Split samples will also be collected at a frequency of 10 percent. No field or rinsate blanks will be collected for subsurface soils. Split samples will be submitted to the following USACE contract

laboratory for independent analysis: GP Environmental, Inc., 202 Perry Parkway, Gaithersburg, MD 20877, (301) 926-6802.

4.1.2 Procedures

4.1.2.1 Drilling methods

A hand-operated power auger will be used in conjunction with bucket hand augers to create the subsurface borings. The power auger will be used to advance the soil boring to the target depth intervals if necessary, as discussed in Sections 4.4.2.4.2 and 4.4.2.5.2 of the facility-wide SAP (USACE 1996a). Once the boring has been advanced to the top of the 0.3- to 0.9-meter (1- to 3-foot) interval with the power auger, a bucket hand auger will be used for the collection of the soil sample.

As described in Section 4.1.1.1, a geoprobe rig will be used to collect Shelby tube samples and soil cores for lithologic sampling at location NTA-038. The rig will first be used to collect a Shelby tube from the 0.3- to 0.9-meter (1- to 3-foot) interval. The boring will then be advanced to the total depth using macro-core samplers.

4.1.2.1.1 Equipment condition and cleaning

Requirements for the condition and cleaning of equipment used for well installation are described in Section 4.3.2.1.1 of the facility-wide SAP. These requirements, as applicable, will be employed for equipment used to drill soil borings during the Phase I RI of the NACA Test Area.

4.1.2.2 Field measurement procedures and criteria

All field measurement procedures and criteria will be in accordance with Section 4.4.2.3 of the facility-wide SAP, with the following exception. Headspace gases will not be screened in the field for organic vapors.

4.1.2.3 Sampling for geotechnical analysis

Subsurface soil samples collected using the hand-auger method are classified as disturbed samples; therefore, geotechnical analysis of the samples collected using these methods will be limited to Atterberg limits and USCS. Undisturbed geotechnical samples, collected with Shelby tubes will be analyzed for particle size, pH, redox potential, organic carbon content, bulk density, soil permeability, moisture content, specific gravity, and Atterberg Limits. Each soil sample collected will be visually classified in the field according to the USCS. Procedures for sampling for geotechnical analysis using the Shelby tube and bucket hand-auger methods are presented in Sections 4.4.2.4.1 and 4.4.2.4.2, respectively, of the facility-wide SAP.

4.1.2.4 Sampling for chemical analysis

Procedures for sampling of subsurface soils for chemical analysis using the bucket hand-auger method are presented in Section 4.4.2.5.2 of the facility-wide SAP.

4.1.2.5 Sample containers and preservation

Requirements for sample containers and preservation techniques for subsurface soil samples are presented in Section 4.4.2.6 of the facility-wide SAP and in Chapter 4.0 the NACA Test Area Phase I RI QAPP Addendum.

4.1.2.6 Decontamination procedures

The decontamination procedure for subsurface soil sampling activities presented in Section 4.4.2.8 of the facility-wide SAP will be followed, except that a 2 percent hydrochloric acid rinse will be used instead of a 10 percent solution.

4.1.2.7 OE screening

OE support staff will be present during sampling of the plane fueling/catapult sub-area at the NACA Test Area. The OE Team Leader will train all field personnel to recognize and stay away from propellants and OE. Safety briefings for OE will also be provided to all site personnel and site visitors. All sample locations and access routes into the locations will be cleared for potential OE prior to entry. The OE Team Leader will clearly mark the boundaries of the cleared soil sampling locations and access routes. If surface OE is encountered, the approach path will be diverted away from the OE, the area will be clearly marked, and the OE Team Leader will be notified immediately. In any area in which surface metallic OE is encountered, a magnetometer will be used to ensure that no subsurface OE exists within the approach path. Prior to collection of the surface soil sample (0 to 1 foot bgs), the OE team will verify that the location is anomaly free using a magnetometer. Should special circumstances dictate that the borehole be deepened beyond 1 foot bgs, a magnetometer reading will be taken at the top of each subsequent 2-foot interval prior to augering.

4.2 SURFACE SOIL AND SEDIMENT

4.2.1 Rationales

Surface soil samples will be collected during the Phase I RI at the NACA Test Area to identify impacted areas within the NACA Test Area resulting from spillage and dispersal of petroleum hydrocarbons and to identify the potential for contaminant migration via leaching or erosional processes from surface soil sources to receptor media, such as sediment and surface water (see Section 3.2). Table 4-2 summarizes the planned NACA Test Area surface soil and sediment sampling activities for the Phase I RI.

4.2.1.1 Surface soil sampling locations

As denoted in Table 4-1, surface soil samples are planned at locations within four sub-areas: (1) the crash area, (2) the plane burial area, (3) the plane fueling/catapult area, and (4) in ditches flowing from the NACA Test Area. As discussed in Section 4.1, subsurface soil samples will also be collected at the plane burial area. The proposed locations were selected on the basis of DQOs and the conceptual site model developed from operational information and analytical results from previous sampling events (see Sections 1.0 and 3.2). Proposed sampling locations are shown in Figure 4-1.

A total of 98 surface soil samples will be collected from the 0- to 0.3-meter (0- to 1-foot) interval. In addition, two sample locations are planned as a contingency; the locations will be determined in the field during the sampling effort. Contingency surface soil samples will be used to characterize any identified areas exhibiting obvious visual evidence of contamination. The rationale for locating contingency surface soil samples is to target areas of obvious staining or discoloration, stressed vegetation, evidence of OE, or areas in which additional samples may be deemed necessary based on field observations. Table 4-3 describes the rationale for the placement of individual soil sampling locations.

Sixty-four surface soil sample locations are planned within the crash area. Eighteen surface sample locations are planned for the plane burial area. Thirteen surface soil samples will be collected from the plane fueling/catapult area, and three surface soil samples are planned for ditches (dry portions) flowing from the NACA Test Area. The ditches are possible contaminant accumulation points due to intermittent overland flow from the adjacent NACA Test Area. Eighteen of the surface soil sample locations correspond to the subsurface soil locations discussed in Section 4.1.1.1.

4.2.1.2 Sediment sampling locations from drainage channels and surface water basins

Sediment samples will be collected from two locations inside of the NACA Test Area and four locations (three sub-areas) outside of the NACA Test Area during the Phase I RI (Table 4-1). The locations within the NACA Test Area will identify whether contaminants from source areas are migrating via surface water dissolution and erosional processes and accumulating within sediment. Drainageways entering the NACA Test Area or upstream of the AOC provide data on baseline conditions and potential water quality impacts from other sources. Locations outside and downstream of the NACA Test Area will provide data on potential contaminants exiting the site and accumulating within surface water drainage system sediments. Figure 4-2 illustrates sediment sampling locations. Table 4-3 provides a description and rationale for each location. Sediment sampling locations inside the NACA Test Area include:

- the reservoir located in the crash area and
- the well pit located inside the crash area.

During collection of the sediment sample from the well pit inside the crash area, notation of the condition of the production well will be made. Casing type and estimated diameter and presence and type of pump and well head will be made. If the well is accessible, a measurement of the water surface and sounding of the total depth of the well will be performed.

Sediment sampling locations outside the NACA Test Area include:

- drainageways upstream of the NACA Test Area to the north (to evaluate ambient conditions),
- middle of ditches flowing from the NACA Test Area (accumulation point due to runoff from source area), and
- main ditch from the NACA Test Area adjacent to Hinkley Creek (accumulation point due to runoff from source area).

Additional locations, sampled as part of the concurrent Phase I RI at Demolition Area 1, will be used to evaluate ambient conditions upstream of the NACA Test Area site and will provide data on potential contaminants exiting the site. These include:

- Hinkley Creek upstream of convergence of ditches exiting the NACA Test Area and Hinkley Creek (to evaluate ambient conditions) and
- Station HC-2 on Hinkley Creek at the RVAAP boundary (surface water exit pathway).

4.2.1.3 Discrete/composite soil and sediment sampling requirements

All surface soil [0- to 0.3-meter (0- to 1-foot)] samples collected for explosives and propellants analyses will be composited and homogenized from three subsamples collected about 0.9 meter (3 feet) from one another in a roughly equilateral triangle pattern. Equal portions of soil from each of the subsamples will be homogenized in a stainless steel bowl following protocols in Section 4.5.2.5 of the facility-wide SAP. Once the subsamples are homogenized, a composite sample will be sent for laboratory analysis as

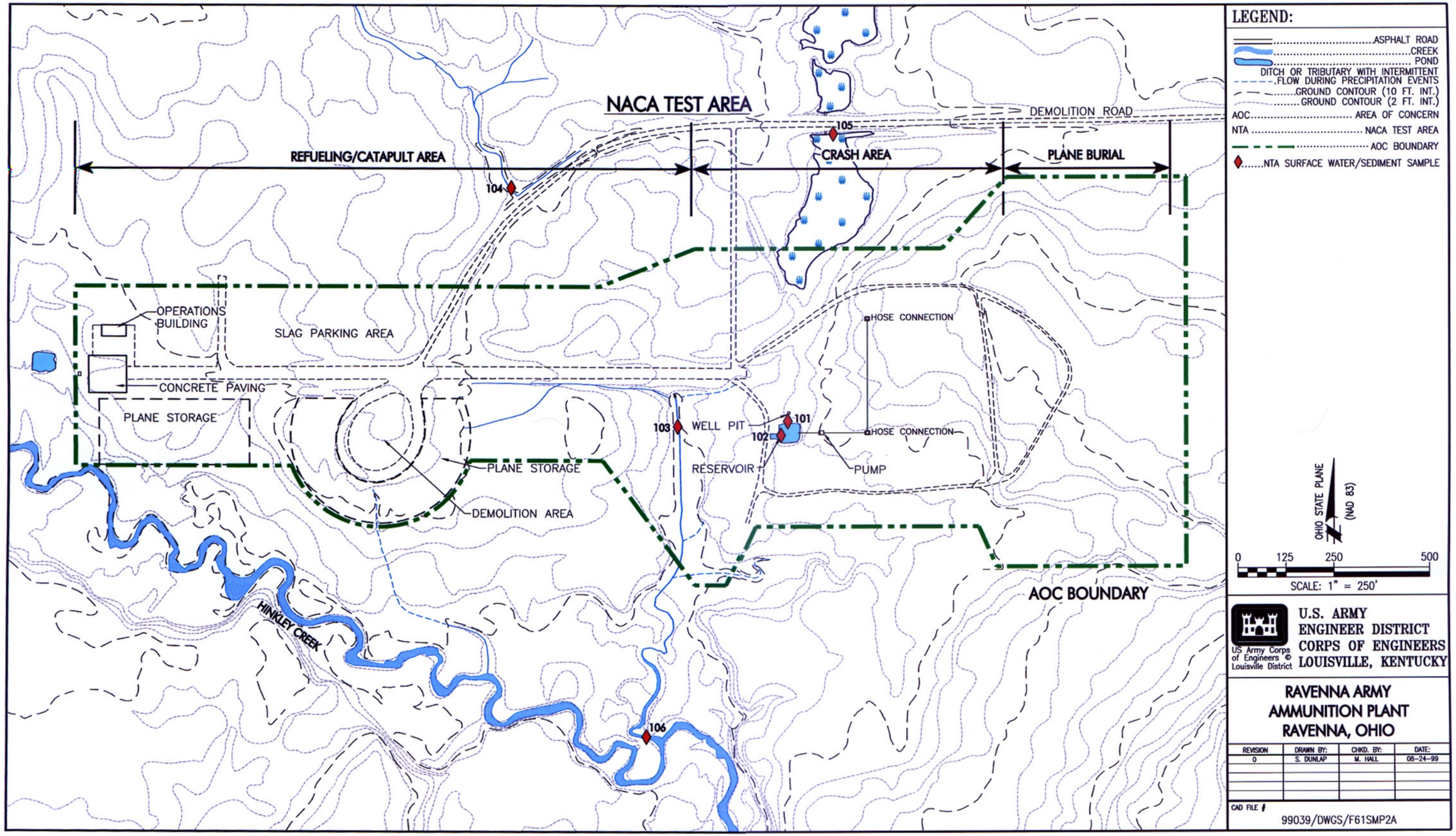

Figure 4-2. Surface Water/Sediment Sampling Locations

described in Section 4.2.1.4. Remaining surface soil samples (and subsurface soil samples) will be collected from a point located in the approximate center of the triangle. Surface soil sample material will be extracted from the center location and placed into a stainless steel bowl. Discrete samples for VOC analysis will be taken from the middle of the sample interval. The remaining portion of the soil interval will be homogenized, and nonvolatile fractions will be collected for analyses.

All sediment samples will be discrete samples. Sediment from the surface water basins will be collected using a stainless steel trowel or spoon, hand auger, or sediment coring device, where necessary. Sediment samples will be collected from downstream locations first and moving upstream relative to overall flow patterns within a sub-area. Sediment samples will not be collected from areas exhibiting turbid or rapid flow. Where sediment and surface water stations are co-located, surface water samples will be collected first.

4.2.1.4 Sample collection for field and laboratory analyses

All surface soil samples will be submitted for laboratory analysis of TAL metals, cyanide, VOCs, and SVOCs. Eleven samples from identified sample stations within sub-areas will be selected for explosives, propellants, and PCB analyses as denoted below; the reduced number of these samples reflect the fact these classes of contaminants are not thought to be prevalent based on operational history of the site. Selection of these samples will be based, whenever possible, on visual evidence of contamination, such as stained soil. These samples are as follows:

- seven samples from the crash area at the NACA Test Area,
- two samples from the plane burial area,
- one sample from the plane fueling/catapult area, and
- one sample from one of the ditches (to the south) flowing from the NACA Test Area.

Geotechnical samples will be collected at six surface soil sample locations and analyzed for Atterberg limits and USCS classification. The six surface soil samples that will be selected for geotechnical analyses area as follows:

- three samples from the crash area,
- two samples from the plane burial area, and
- one sample from the plane fueling/catapult area.

Geotechnical logging will be performed for all samples, including estimations of USCS classification and visual moisture content.

All surface soil samples will be field screened for VOCs using a hand-held PID during collection. Field screening readings will be recorded in the field boring logs. No samples will be collected for headspace analysis of VOCs.

All sediment samples collected at the NACA Test Area will be analyzed for explosives, propellants, TAL metals, cyanide, VOCs, SVOCs, and PCBs. In addition, six samples will be collected for the determination of grain-size distribution total organic carbon (TOC) analysis as follows:

- one sample from crash area well pit,
- one sample from crash area reservoir,
- one sample from the middle of one of the ditches flowing from the NACA Test Area,

- two samples from the drainageways north (upstream) of the NACA Test Area, and
- one sample from main ditch adjacent to Hinkley Creek.

Visual classification of soil types according to the USCS shall be noted in the field. Moisture content will also be estimated and noted in the field logs.

All sediment samples will be field screened for VOCs using a hand-held PID during collection. Field screening readings will be recorded in the field boring logs. No samples will be collected for headspace analysis of VOCs.

4.2.1.5 Field quality control sampling procedures

Surface soil and sediment QA/QC samples will be collected during the Phase I RI (see Table 4-2). Duplicate and split samples will be selected on a random statistical basis and submitted for the same analyses as the environmental samples. Chapter 8.0 of the NACA Test Area Phase I RI QAPP Addendum summarizes QA/QC sampling.

Duplicate surface soil and sediment samples will be collected at a frequency of 10 percent (1 per 10 environmental samples). Split samples will also be collected at a frequency of 10 percent. No field or rinsate blanks will be collected for surface soil or sediment. Split samples will be submitted to the following USACE contract laboratory for independent analysis: GP Environmental, Inc., 202 Perry Parkway, Gaithersburg, MD 20877, (301) 926-6802.

4.2.2 Procedures

4.2.2.1 Sampling methods for soil/dry sediments

4.2.2.1.1 Bucket hand auger method

Surface soil and dry sediment samples will be collected with a bucket hand auger in accordance with Section 4.5.2.5 of the facility-wide SAP. In this investigation, auger buckets 15.24 centimeters (6.0 inches) in length and 7.62 centimeters (3.0 inches) in diameter will be used. At each location, an auger will be advanced in 15.24-centimeter (6.0-inch) increments.

For surface soil samples, as noted in Section 4.2.1.3, composite soil samples for explosives and propellant analyses will be created from three subsamples collected in a roughly equilateral-triangle pattern with the subsamples positioned about 0.9 meters (3 feet) apart from each other. Each subsample point will be augered to a depth of 30.48 centimeters (1.0 foot). The content of each subsample will be added to a stainless-steel bowl and thoroughly homogenized. Aliquots for analyses will be extracted for the homogenized mixture. A point located at the approximate center of the triangle will be selected for collection of the remaining samples. The hand auger will be advanced to a depth of 30.48 centimeters (1.0 foot), and the contents will be placed into a stainless steel bowl. Aliquots for VOC analyses will be collected at the center of the interval [15.24 centimeters (0.5 foot)] immediately upon extraction from the boring. No VOC sample will be collected from homogenized or composited sample volumes. If field observations indicate evidence of contamination, the collection depth for the VOC sample will be adjusted to contain the observed contamination. The remainder of the soil interval will be homogenized, and samples for nonvolatile analyses will be collected.

4.2.2.1.2 Trowel/scoop method

A stainless steel trowel or scoop may be used to collect surface soil samples in soft, loose soil, if feasible. The protocol for compositing, homogenization, and discrete VOC sample collection will follow that described in Section 4.2.2.1.1 for bucket hand augers.

Loose material, debris, and dry sediment may also be collected using the trowel method as presented in Section 4.5.2.1.2 of the facility-wide SAP. The trowel will be used to manually obtain sediment to a depth of 15.24 centimeters (0.5 foot) bgs. Extracted material will be placed into a stainless steel bowl. At sample locations where VOC fractions are to be collected, the VOC containers will immediately be filled with the first materials obtained.

4.2.2.2 Sampling methods for subaqueous sediments from streams and surface water basins

4.2.2.2.1 Trowel/scoop method

Sediment samples in locations where water depth does not exceed 15.24 centimeters (0.5 foot) will be collected with a stainless steel trowel or scoop. The trowel will be used to manually obtain sediment to a depth of 15.2 centimeters (0.5 foot) below the sediment surface. Sediment will be placed into a stainless steel bowl as it is collected. At sample locations where VOC fractions are to be collected, the VOC containers will immediately be filled with the first sediment obtained. Sample containers for the remaining nonvolatile analytes will be filled as described in Section 4.5.2.5 of the facility-wide SAP.

4.2.2.2.2 Hand core sampler method

A sludge sampler will be used to collect sediment at locations where the depth of the surface water exceeds 15.24 centimeters (0.5 foot). Samples will be collected following the guidelines presented in Section 4.5.2.5 of the facility-wide SAP.

The sludge sampler consists of a stainless steel, 8.26-centimeter (3.25-inch) outside diameter, 30.48-centimeter (12-inch) long capped tube that can be fitted with either an auger- or core-type sampler end. Each sampler end is equipped with a butterfly valve to prevent loss of sample upon retrieval. In this investigation the core-type end will preferentially be used. The auger-type sampler end will be used only in the event that the sediment becomes too gravelly or consolidated for the efficient use of the core-type end. The sludge sampler will be extended to the sampling depth by connecting 60.96-, 91.44-, 121.92-, or 152.40-centimeter (2-, 3-, 4-, or 5-foot) stainless steel extension rods to the sampler. The extension rods will be attached to a cross handle and will be pushed or augered by hand.

Sediment will be placed into a stainless steel bowl as it is collected. At sample locations where VOC fractions are to be collected, the VOC containers will immediately be filled with the first sediment obtained. Sample containers for the remaining nonvolatile analytes will be filled as described in Section 4.5.2.5 of the facility-wide SAP.

4.2.2.3 Field measurement procedures and Criteria

4.2.2.3.1 Organic vapor screening

All field measurement procedures and criteria will be in accordance with Section 4.4.2.3 of the facility-wide SAP, with the following exception. Headspace gases will not be screened in the field for organic vapors. All organic vapor readings will be noted in the field boring logs.

4.2.2.4 Sampling for geotechnical analysis

Surface soil samples collected using the hand auger, scoop, or sediment corer methods are classified as disturbed samples. Therefore, geotechnical analysis of samples collected using these methods will be limited to Atterberg limits and USCS classification. Sediment samples shall be submitted for geotechnical analysis for grain size and TOC only. Procedures for sampling for geotechnical analysis using the sampling methods above are presented in Section 4.5.2.4 of the facility-wide SAP.

4.2.2.5 Sampling for chemical analysis

Procedures for sampling of surface soils and sediment for chemical analysis using the bucket hand-auger/ trowel and hand-core sampler methods are presented in Sections 4.5.2.1.1, 4.5.2.1.2, and 4.5.2.2.2 of the facility-wide SAP.

4.2.2.6 Sample containers and preservation

Requirements for sample containers and preservation techniques for surface soil and sediment samples are presented in Section 4.4.2.6 of the facility-wide SAP and Chapter 4.0 of the NACA Test Area Phase I RI QAPP Addendum.

4.2.2.7 Decontamination procedures

The decontamination procedure for surface soil and sediment sampling activities is presented in Section 4.4.2.8 of the facility-wide SAP, except that a 2-percent hydrochloric acid rinse will be used instead of at 10-percent solution.

4.2.2.8 OE screening

OE support staff will be present during sampling of the plane fueling/catapult sub-area at the NACA Test Area. The OE Team Leader will train all field personnel to recognize and stay away from propellants and OE. Safety briefings for OE will also be provided to all site personnel and site visitors. All sample locations and access routes into the locations will be cleared for potential OE prior to entry. The OE Team Leader will clearly mark the boundaries of the cleared soil sampling locations and access routes. If surface OE is encountered, the approach path will be diverted away from the OE, the area will be clearly marked, and the OE Team Leader will be notified immediately. In any area where surface metallic OE is encountered, a magnetometer will be used to ensure that no subsurface OE exists within the approach path. Prior to collection of the surface soil sample (0 to 1 foot bgs), the OE team will verify that the location is anomaly free using a magnetometer. Should special circumstances dictate that the borehole be deepened beyond 1 foot bgs, then a magnetometer reading will be taken at the top of each subsequent 2-foot interval prior to augering.

4.3 SURFACE WATER

Surface water samples will be co-located with all of the six sediment samples. Evaluation of surface water is a critical element of the Phase I RI because this medium represents the primary contaminant transport pathway off of the AOC (either as dissolved phase or adsorbed to particulates/sediment mobilized by flow).

4.3.1 Rationales

The rationale for surface water sampling at the NACA Test Area is to characterize surface water quality in accumulation areas, such as Hinkley Creek and the ditches south of the NACA Test Area. In addition, the RI will obtain data on ambient water quality entering the AOC.

4.3.1.1 Locations

Surface water sampling locations are shown on Figure 4-2. Six surface water sampling locations are planned. The samples are to be distributed in the following manner:

- one in the crash area well pit,
- one in the crash area reservoir,
- one in ditches flowing from the NACA Test Area,
- two samples from drainageways north (upstream) of the NACA Test Area, and
- one in main ditch adjacent to Hinkley Creek.

4.3.2 Procedures–General

All surface water sampling will be conducted as described in Section 4.6.2.1.1 of the facility-wide SAP. The hand-held bottle method will be used to sample water in ditches where water is flowing. The sample container will be submerged, with the cap in place, into the surface water flow. The container will then be slowly and continuously filled using the cap to regulate the rate of sample entry into the container. The sample container will be removed from the flow with minimal disturbance to the sample. Immediately after collection of the sample and proper labeling, the container will be placed into a sealable plastic bag and placed into an ice-filled cooler to ensure preservation.

All surface water sample collection will begin at the sampling point farthest downstream in the channel and proceed upstream to minimize the effects of sediment turbidity on surface water quality. Surface water samples will be collected prior to sediment samples at co-located sites.

4.3.2.1 Sampling methods for surface water–filtration

Surface water collected during the NACA Test Area Phase I RI will not be filtered prior to analysis.

4.3.2.2 Field measurement procedures and criteria

Surface water field measurements to be performed during the NACA Test Area Phase I RI will include determination of pH, conductivity, dissolved oxygen content, and temperature. These measurements will be performed in the same manner as described in Section 4.3.3 of the facility-wide SAP. All field measurements will be recorded in the sampling logbooks.

4.3.2.3 Sampling for chemical analysis

All unfiltered surface water samples will be submitted to the analytical laboratory for analysis of explosives, propellants, TAL metals, cyanide, VOCs, SVOCs, and PCBs, as shown in Table 4-1.

4.3.2.4 Sample containers and preservation techniques

Information regarding sample containers and preservation techniques for surface water samples collected for chemical analysis during the NACA Test Area Phase I RI is presented in Chapter 4.0 of the NACA Test Area Phase I RI QAPP Addendum. All sample containers will be provided by the contracted laboratory, including pre-preserved containers for VOC samples.

4.3.2.5 Field quality control sampling procedures

Surface water QA/QC samples will be collected during the Phase I RI (see Table 4-2). Duplicate and split samples will be selected on a random statistical basis and submitted for the same analyses as the environmental samples. Chapter 8.0 of the NACA Test Area Phase I RI QAPP Addendum summarizes QA/QC sampling.

Duplicate surface water samples will be collected at a frequency of 10 percent (1 per 10 environmental samples). One field blank or rinsate for surface water will be collected (frequency of 5 percent). Split samples will also be collected at a frequency of 10 percent. Split samples will be submitted to the following USACE contract laboratory for independent analysis: GP Environmental, Inc., 202 Perry Parkway, Gaithersburg, MD 20877, (301) 926-6802.

4.3.2.6 Decontamination procedures

Decontamination of any equipment used for collection of surface water samples during the NACA Test Area Phase I RI will be conducted in the same manner as described for nondedicated sampling equipment in Section 4.3.8 of the facility-wide SAP, except that a 2-percent hydrochloric acid rinse will be used instead of a 10-percent solution.

In addition to the surface water sampling equipment, field measurement instruments will also be decontaminated between sampling locations. Only those portions of each instrument that come into contact with potentially contaminated surface water will be decontaminated. This decontamination will be accomplished with a deionized-water rinse of the measurement probe and collection cup.

4.4 SITE SURVEY

The horizontal coordinates of all sampling stations will be determined to within 1 foot. The surface elevations will be determined to within 0.2 foot. For soil sampling stations, the ground elevations will be determined at the point of collection. For tributary surface water locations and sediment sampling stations that are not underwater (i.e., adjacent to the water edge), the ground elevation at the water's edge at the collection point will be determined. For surface water locations within the surface water basins and for sediment sampling stations underwater, the elevation of the water surface, depth to bottom, and elevation of the bottom will be determined.

All locations will be conveyed in Ohio State Plane Coordinates (NAD83). The vertical datum for all elevations will be 1929 National Geodetic Vertical Datum. All coordinates and elevations will be recorded on the boring logs upon receipt of quality-assured survey results. In addition, electronic results will be provided to USACE and RVAAP in ASCII format.