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Sampling and Analysis Plan for Pre-Characterization of the A-Area Ash Pile (788-0A), F-Area Ash Landfill (288-0F), H-Area Ash Basin (288-0H), L-Area Ash Basin (188-0L), K-Area Ash Basin (188-0K), and D Ash Overflow (NBN) (U)

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LIST OF ABBREVIATIONS AND ACRONYMS

~	approximate, approximately
<	less than
≥	greater than or equal to
%	percent
AAP	A-Area Ash Pile
ac	acres
ACP	Area Completion Projects
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
cm	centimeter
COC	constituents of concern
COPC	constituents of potential concern
CPRB	Coal Pile Runoff Basin
DAOU	D-Area Operable Unit
DAO	D Ash Overflow
DQD	Decision Quality Data
DQO	Data Quality Objectives
ECODS	Early Construction and Operational Disposal Site
EP	Extraction Procedure
ERDMS	Environment Restoration Data Management System
FAL	F-Area Ash Landfill
FFA	Federal Facility Agency
ft	feet
GIS	Geographic Information System
ha	hectare
HAB	H-Area Ash Basin
IDW	investigation derived waste
in.	inch, inches
IWT	Industrial Wastewater Treatment
KAB	K-Area Ash Basin
km	kilometer
km^2	square kilometers
LAB	L-Area Ash Basin
LANG	L-Area Northern Groundwater
LAZ	Lower Aquifer Zone
LiDAR	light detection and ranging
LUC	land use control
LUCIP	Land Use Control Implementation Plan
µg/L	microgram per liter
m	meters
m^2	square meters
m^3	cubic meters

LIST OF ABBREVIATIONS AND ACRONYMS *(Continued)*

MCL	maximum contaminant level
mi	mile
mi^2	square miles
MS	Matrix Spike
MSD	Matrix Spike Duplicate
msl	mean sea level
NBN	No Building Number
NPDES	National Pollutant Discharge Elimination System
OU	Operable Unit
pCi/g	picocuries per gram
pCi/L	picocuries per liter
PQO	Project Quality Objective
PRG	Preliminary Remediation Goal
QA/QC	Quality Assurance and Quality Control
QAPP	Quality Assurance Program Plan
QC	Quality Control
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RI	Remedial Investigation
ROD	Record of Decision
RPD	relative percent difference
RSL	regional screening level
SAP	Sampling Analysis Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SD	screening level data
SEA	Site Evaluation Area
SEMS	Superfund Enterprise Management System
SOP	Standard Operating Procedure
SRNS	Savannah River Nuclear Site, LLC
SRS	Savannah River Site
ssEQL	Sample Specific Estimated Quantitation Limit
SVOC	Semi-volatile Organic Compound
SWL	Solid Waste Landfill
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
UAZ	Upper Aquifer Zone
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency

LIST OF ABBREVIATIONS AND ACRONYMS *(Continued/End)*

VOC	Volatile Organic Compound
VV	Verified and Validated
WSRC	Westinghouse Savannah River Company
yd^2	square yards
yd^3	cubic yards

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1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) was prepared in accordance with the United States Environmental Protection Agency (USEPA) *Uniform Federal Policy for Quality Assurance Project Plans* (USEPA, et. al, 2005) and the *Area Completion Projects Programmatic Quality Assurance Project Plan for Environmental Data Collection and Management* (SRNS 2012a). Project or task specific information for the waste units is documented in the SAP and refers to the program level Quality Assurance Program Plan (QAPP) (SRNS 2012a) for the program level quality objectives, standard operating procedures (SOPs), and quality assurance/quality control (QA/QC) procedures.

1.1 Purpose of Sampling

This SAP was prepared to direct additional sampling, analysis, and/or ash delineation at the following ash units: A-Area Ash Pile (AAP) (788-0A), F-Area Ash Landfill (FAL) (288-0F), H-Area Ash Basin (HAB) (288-0H), L-Area Ash Basin (LAB) (188-0L), K-Area Ash Basin (KAB) (188-0K), and the D Ash Overflow area (DAO) [No Building Number (NBN)]. The DAO is referred to in the Federal Facility Agreement (FFA) as the "Easterly of D-Area Ash Basins 488-1D and 488-2D" area which is part of the Savannah River and Floodplain Swamp Integrator Operable Unit, NBN (Including Beaver Dam Creek, D-Area Effluent Discharge Canal, and Ash Area Adjacent to and Easterly of D-Area Ash Basins 488-1D and 488-2D) (FFA 1993).

The overall objective of this sampling effort is to generate sufficient representative data to support development of a comprehensive remedial strategy for the ash units at the Savannah River Site (SRS). The SAP is being developed to determine the nature of contamination and extent of ash resulting from past facility operations.

The location of the units is shown in Figure 1. Individual unit discussions are provided in the following sections.

1.2 Sampling Unit Locations

The SRS occupies an area of approximately (~) 800 square kilometers (km^2 [310 square miles {mi^2}]) adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina. The ash units associated with this SAP include AAP, FAL, HAB, KAB, LAB, and DAO. Figure 1 shows the location of the units within the SRS boundary.

1.3 Statement of Broad Objectives for the Sampling

There are two primary objectives of this sampling plan: (1) collect soil/ash samples from four of the ash units where existing data are insufficient (HAB, LAB, KAB, and the DAO and (2) determine the extent of ash outside all five units (AAP [788-A], FAL [288-0F), HAB, KAB, and LAB to help determine the appropriate action for a consolidated remedial approach for all ash units. Additionally, to further assess beneficiation of SRS coal ash, bulk samples will be taken for geotechnical analyses. Individual units are show in Figures 2 through 6 and are discussed further below.

2.0 SAMPLING UNIT BACKGROUND

2.1 Sampling Area Physical and Geographical Description

A-Area Ash Pile

The AAP (788-A) is located in A-Area, which is part of the larger A/M Area in the northwest portion of SRS within the Upper Three Runs watershed (Figure 3). The AAP is an inactive unit and is listed as a Resource Conservation and Recovery Act (RCRA)/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit within the FFA (FFA 1993). The AAP is as part of the A-Area Ash Pile (788-A), A-Area Coal Pile Runoff Basin (CPRB) (788-3A), and Stormwater Outfall A-013 Operable Unit (OU). The FFA states these units will be addressed through one set of FFA documentation due to their proximity to one another. Revision 0, Interim Record of Decision Remedial Alternative Selection Submittal is scheduled for 03/09/2021 (FFA 1993). The AAP is ~1.1 hectare (ha [2.6 acres {ac}]) in size and has an estimated ash volume of 38,227.7 cubic meter (m^3 [50,000 cubic yards {yd^3}]).

F-Area Ash Landfill

The FAL is an active Class 2 Landfill (South Carolina Department of Health and Environmental Control [SCDHEC] Permit #025800-1601). The landfill is ~305 by 91 m (1,000 by 300 ft), encompassing ~2.8 ha (7 ac). Approximately 5.3 ha (13 ac) of the land surrounding the landfill has surficial ash deposits. Figure 3 presents a light detection and ranging (LiDAR) image of the area, and the ash deposits surrounding the landfill are evident. The LiDAR technology measures subtle changes in elevation, which is shown on the figure as lighter shades of gray (for higher surface elevations). The west portion of the FAL has been planted with grass, and the east portion contains an engineered storm water retention pond. Based on a review of aerial photographs, the area south and east of the landfill was logged at some point after 2015. The previously logged areas are currently in the process of regeneration and contain a mixture of small trees, shrubs, and grasses.

The FAL is situated in a relatively flat area that slopes gradually to the north and northeast. Ground surface elevation is ~95-m (312-ft) mean sea level (msl). The base of the ash layer within the landfill is ~89-m (293-ft) msl (SRNS 2013). Thus, the ash layer within the landfill is currently ~6-m (20-ft) thick. Runoff from the landfill is collected in an engineered retention pond that has an administrative outfall (F-07), which would discharge north to an engineered, rip-rap lined drainage ditch. However, the retention basin was designed to accept a 100-year rainfall event (SRNS 2013) and no discharges from the retention basin have occurred. The nearest perennial stream is an unnamed tributary of Upper Three Runs ~1,000 m (3,300 ft) to the north from the FAL. The unnamed tributary flows north for 701 m (2,300 ft) before discharging into Upper Three Runs. As a permitted landfill, the FAL has existing wells that are monitored on a semi-annual basis. Based on the Annual Groundwater Report for 2018 (SRNS 2019a), depth-to-water is generally 21 to 24 m (70 to 80 ft).

H-Area Ash Basin

The HAB (288-0H) is shown in Figure 4. This unit is listed as a Site Evaluation Area (SEA) unit with a Site Evaluation Report submittal date of December 2034 (FFA 1993). This unit is considered active and receives discharge from an above ground pipeline to the basin of rain water

that accumulates in Abatement Pumps located behind 284-H. All operating systems in 284-H have been shut down.

The HAB is ~5.3 ha (13 ac) with an estimated ash volume of 114,683.2 m^3 (150,000 yd^3). Based on available Geographic Information System (GIS) coverages, the HAB likely includes wetlands within and beyond the boundary of the unit. A known/suspected Carolina bay is partially located within the southeastern boundary of the HAB.

K-Area Ash Basin

The KAB (188-0K) is listed as a RCRA/CERCLA unit with an FFA Field Start date of September 2024, a Record of Decision (ROD) issuance date of September 2027, and an remedial action (RA) date of December 2028 (FFA 1993). Located immediately southwest of the K-Area industrial complex, the KAB is outside the facility fence in a vegetated and undeveloped area (Figure 5).

The KAB, which slopes to the southwest, is located in the Pen Branch watershed. The KAB is ~4.6 ha (11.16 ac) in size. The ground surface elevation is ~78-m (255-ft) above msl. A natural drainage feature crosses the unit and merges with an intermittent stream that flows to the southwest. Ultimately this intermittent stream joins Indian Grave Branch and discharges to Pen Branch ~2-km (1.3-mi) southwest from the unit. Drainage from the subunit discharges to the National Pollutant Discharge Elimination System (NPDES) Industrial wastewater outfall (K-06), which is covered under NDPES Permit SC0000175. Monthly monitoring reports noted that the K-06 outfall had no flow from 2004 through 2018.

The OU is located 160 m (525 ft) from the inner fence of the K-Reactor Building (105-K). The ash basin is irregularly shaped and of earthen dike construction. The basin is not full and has an estimated depth of 4.3 to 4.9 m (14 to 16 ft) from the top of the berms to the bottom of the basin. The basin has a designed storage volume of ~218,000 m^3 (285,000 yd^3). The estimated volume of ash currently in the basin is 35,705 m^3 (46,700 yd^3). The berm walls vary in height and width because the top elevation of the berm was maintained over uneven terrain. The ash is unevenly distributed across the entire basin and could range up to 4.9-m (1- ft) thick. Vegetation consisting of grass, shrubs, and trees cover most of the ash basin.

The KAB currently receives process blowdown water from the Ameresco Biomass Steam Plant during the winter months. There is a potential reclassification of this outfall to a surface water outfall when the new Industrial Waste Water permit is issued. The K-06 outfall discharges to a tributary that leads to Indian Grave Branch which flows into Pen Branch.

L-Area Ash Basin

The LAB is an inactive ash basin that covers ~7.5 ha (18 ac) (Figure 6). The LAB is located 595-m (1,950-ft) northwest from the inner fence of the L-Reactor Building (105-L). The basin is not full and has a depth of 3.7 to 4.6 m (12 to 15 ft) from the top of the berm walls to basin bottom with a designed storage volume of 297,326 m^3 (388,887 yd^3). Ash is unevenly distributed across the entire basin, and the ash thickness could range up to 4.3 m (14 ft). The estimated volume of ash currently in the basin is 113,689 m^3 (148,700 yd^3).

The LAB (188-0L) is listed in the FFA as a combined unit OU consisting of Early Construction and Operational Disposal Site (ECODS) L-3 (East of L Area) (no building number [NBN]), L-Area Rubble Pit (131-1L), L-Area Rubble Pit (131-4L), and the L-Area Ash Basin (188-0L). The Field Start is schedule for September 2022 with an August 2025 ROD issuance, and a RA start date scheduled for November 2026. The LAB is shown in Figure 6. The LAB is ~7.3 ha (18 ac) with an estimated 113,230.6 m^3 (148,100 yd^3) of ash. The L-14 Outfall was associated with the basin and is no longer in use. Inlet lines to the basin have been removed.

The LAB, which slopes to the west-southwest, is located in the Pen Branch watershed. The ground surface elevation at the LAB is ~78-m (255-ft) above msl. A natural drainage feature crosses the unit on the north-northwest side of the basin. An unnamed tributary is located on the southwest corner of the LAB. This tributary joins Pen Branch ~1.5 m (0.9 mi) to the west. Drainage from the subunit does not discharge to an NPDES or stormwater permitted outfall and is in an area not served by storm sewers (WSRC 2003). The water table at the LAB is estimated to be ~7.6- to 12.2-m (25- to 40-ft) below ground surface (bgs) (SRNS 2012b).

D Ash Overflow

The D Ash Overflow area is located between three closed ash-related units in D-Area (D-Area Ash Landfill [488-4D], D-Area Ash Basin [488-2D]), and the D-Area Effluent Discharge Canal). The DAO, as shown in Figure 7, represents an area ~ 100,000 m^2. There are Land Use Controls in place for several of the units surrounding the DAO.

2.2 Operational History

This section presents any operational knowledge about each sampling unit, including the history of contamination, type of contaminants, nature of contamination, and any details concerning process knowledge.

A-Area Ash Pile

The AAP is a stockpile of fly ash and bottom ash located southeast of A-Area. The stockpile was in operation from 1952 to 1978. During operation of the AAP, the pile was graded, the top leveled, and the north side (stream side) benched. Grade level at the AAP is 99- to 101-m (325- to 330-ft) msl, and the elevation of the top of the pile is about 105-m (345-ft) msl. The base of the streambed adjacent to the AAP is about 90 m (295 ft). The north side of the AAP is located immediately south of an unnamed tributary to Tim's Branch. The stream channel has been significantly eroded due to other operational discharges. In the late 1990s, erosion control measures (e.g. sheet piles) were installed in the tributary to Tim's Branch to prevent further erosion of the stream banks.

The AAP has been out of operation for almost 40 years. The side slopes of the ash pile are vegetated with pine trees and underbrush and show no visible signs of ash migration or erosion. The top of the ash pile is heavily vegetated with brush and grass. The stabilizing effects of the vegetative cover are qualitatively considered in this assessment of the slope stability. The vegetation and tree canopy help protect the side slopes against erosion and migration of the ash. The initial stability assessment inspection was performed (SRNS 2016). No evidence of slope failure or ash migration was observed in those inspections. In September 2015, USEPA and SCDHEC requested, and United States Department of Energy (USDOE) agreed, to perform annual inspections at the AAP. A checklist is used to document the annual inspections.

F-Area Ash Landfill

The FAL (288-0F) (Figure 3) is an active Class 2 Landfill with a SCDHEC Permit #025800-1601. The F-Area Ash Landfill was constructed in 1951 and began operations in 1954. The ash basin received coal ash in sluice water from the F-Area powerhouse from the mid-1950s until the early 1980s. Ash was sluiced in and periodically removed after it dried. The removed ash was placed around the basin to make room for more wet ash. Active operations at the landfill ceased in 1985; however, coal ash from the 288-H ash basin was later transferred and consolidated at the landfill in 1991. In 1986, Westinghouse Savannah River Company (WSRC) conceptually agreed to permit the ash basin under the South Carolina soil waste regulations. On April 22, 2004, SCDHEC issued Class I Permit # 025800-1601 for the SRS 288-0F Industrial Waste Landfill. Between April 2004 and September 2008, the landfill received coal ash from the 784-A powerhouse. In February 2014, SCDHEC issued an approved modified landfill permit for vertical expansion of the FAL (SCDHEC 2014) to allow the movement of ash from deposits surrounding the landfill to areas inside the permitted landfill boundary. The vertical expansion plan was developed to occur in phases over many years, allowing the gradual movement of ancillary ash deposits into the permitted landfill. Phase I activities were conducted in 2014 (1,980.2 m^3 [2,590 yd^3]) of ash moved to the landfill) and 2015 (1,496.2 m^3 [1,957 yd^3]) of ash moved to the landfill). Phase II activities were conducted in 2016 (474 m^3 [620 yd^3] of ash moved), 2017 (649.9 m^3 [850 yd^3] of ash moved), 2018 (1,984.8 m^3 [2,596 yd^3] of ash moved), and 2019 (1,549.8 m^3 [2,027 yd^3] of ash moved). Phases of ash movement are planned to continue over the next several years based on available funding and resources. Landfill closure activities will commence once all the ancillary deposits of ash have been moved into the permitted landfill.

H-Area Ash Basin

The HAB is an unlined earthen basin that received ash from the H-Area powerhouse. Ash from the powerhouse was delivered to the basin via a sluicing system through elevated pipelines. Ash from the sluicing line settled within the basin. There are no records of unplanned releases from the basin.

K-Area Ash Basin

The KAB is an unlined earthen containment basin that received ash from the K-Area powerhouse from 1951 to 1990. Ash from the powerhouse was delivered to the basins via a sluicing system through elevated pipelines. Ash from the sluicing line settled within the basin and sluice water was drained by an overflow line installed through one of the berm walls at the lowest elevation. The berm walls have not been disturbed and there are no records of unplanned releases from the basin (SRNS 2012b). The KAB currently receives process blowdown water from the Ameresco Biomass Steam Plant during the winter months.

Review of aerial photographs and visual inspection of the area outside the berm walls and drainages downgradient (southwest) of the KAB indicates that ash, coal rejects, and boiler bottom slag are present (SRNS 2012b).

L-Area Ash Basin

The LAB is an unlined earthen containment basin that received ash from the L-area powerhouse (184-L) from 1951 to 1968. Ash from the L-Area powerhouse was delivered to the basin via a sluicing system through elevated pipelines. Ash from the sluicing line settled within the basin, and sluice water was drained from the basin by an overflow line installed through one of the berm walls at the lowest elevation. The berm walls have not been disturbed and there are no records of unplanned releases from the basin (SRNS 2012b).

Review of aerial photographs and visual inspection of the area outside the berm walls and drainage areas downgradient (i.e., northwest, west, and southwest) of the basin indicate that ash, coal rejects, and boiler bottom slag are present (SRNS 2012b).

D Ash Overflow

Extensive investigation and remediation have occurred around the DAO area defining the nature and extent of ash deposits within permitted ash basins, inlet basins, the Coal Pile Runoff Basin, and other ash depositional areas associated with the D-Area Operable Unit (DAOU) and D-Area Expanded Operable Unit. The DAO has not undergone extensive investigation other than walk-downs to visually identify ash within and adjacent to the area.

2.3 Previous Investigations/Regulatory Actions

A-Area Ash Pile

The RCRA Facility Investigation/Remedial Investigation (RFI/RI) characterization of the AAP was conducted in August 2009 and included ash and soil samples from five borehole locations. A total of four ash samples and four soil samples per borehole were planned; however, due to poor core recovery, the number of samples and the associated sample intervals were altered slightly. In general, ash samples were collected from 0- to 0.3-m (0- to 1-ft), 0.3- to 1.2-m (1- to 4-ft), and 2.4- to 3.0-m (8- to 10-ft) bgs and directly above the ash/soil contact. The soil sample intervals (native material below the ash) were collected from 0- to 0.3-m (0- to 1-ft), 0.3- to 1.2-m (1- to 4-ft), 1.8- to 2.4-m (6- to 8-ft), and 3.0- to 3.7-m (10- to 12-ft) below the ash/soil contact. The total depth of each boring ranged from 10- to 12-m (33- to 40-ft) bgs. In total, 21 ash and 18 soil samples were collected from the AAP. Results of the *RCRA RFI/RI Work Plan and RFI/RI Report with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for the A-Area Ash Pile (788-A), A-Area Coal Pile Runoff Basin (788-3A), and Stormwater Outfall (NBN) Operable Unit (U)* identified Arsenic, Potassium-40, Radium-226 and Uranium-238 as human health Refined Contaminants of Concern (RCOCs) (SRNS 2012c).

Initial toxicity characteristic leaching procedure (TCLP) sampling results for the AAP are also described in the *Work Plan and RFI/RI Report with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for the A-Area Ash Pile Operable Unit* (SRNS 2012). On April 5, 2011, one composite sample from five locations representing the ash media in the AAP were collected to determine if this material would be considered a characteristic hazardous waste under the RCRA.

A RCRA characteristic hazardous waste is a solid waste that exhibits one of four characteristics as defined in 40 Code of Federal Regulations Part 261 Subpart C. In the case of toxicity characteristic waste, TCLP (Method 1311) is used to identify wastes likely to leach concentrations of contaminants that may be harmful to human health or the environment. Samples collected at the AAP and A-Area CPRB were analyzed by the TCLP for metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, and herbicides. The AAP 2011

TCLP results showed that barium was the only detected constituent and had a concentration of 336 µg/L. All other constituents were non-detected (U-qualified). On October 22, 2012, SRS received feedback via e-mail from the SCDHEC Solid Waste Department regarding additional requirements for waste classification determination at the AAP and A-Area CPRB (SCDHEC 2012). In March 2013, SRS performed additional sampling and analysis to address the data gaps identified by SCDHEC. A total of six samples from six locations were collected and analyzed for metals (identified in Section IV) via the TCLP. At each borehole, ash from the 0- to 1.2-m (0- to 4-ft) interval was composited to obtain a representative sample. A total of five composite samples were collected. In addition, a single grab sample was collected at the 0.9-m (3-ft) interval to identify any sampling variability.

F-Area Ash Landfill

The FAL has an existing well network that is monitored semi-annually as required by the SCDHEC landfill permit. In February 2014, SCDHEC issued a modified landfill permit for vertical expansion to facilitate plans to move ancillary ash deposits from surrounding areas to the landfill proper. In 2014, SRS commenced activities in connection with the placement of additional reclaimed ash into the landfill. The movement of ash is planned to occur in phases over the next several years. Appendix G.1 of the FFA lists this OU as a SEA to be investigated. Appendix E lists the site evaluation report date for the FAL as December 2024 (FFA 1993). The FAL is ~2.8 ha (7 ac) with an estimated ash volume of 152,911 m^3 (200,000 yd^3).

Seventeen soil samples were collected in 2002 for analysis of naturally occurring radionuclides and metals via TCLP. The resulting TCLP data showed the only constituent that exceeded an maximum contaminant level (MCL) was thallium.

In 2012, as part of the landfill permit modification, seven samples were collected from the ash deposits surrounding the landfill. The samples were analyzed for TCLP RCRA metals plus boron and thallium. The ash was also analyzed for total metals (i.e., arsenic, cadmium, chromium, selenium, barium, lead, silver, mercury, and hexavalent chromium). Approximate sample locations are provided on Figure 9. None of the TCLP results exceeded MCLs. Because the 2012

soil samples were collected for purposes of waste characterization and landfill permitting, they were not compared to human or ecological risk-based standards at the time.

The 288-0F Class 2 Landfill Permit mandates semi-annual groundwater sampling of eight monitoring wells (SCDHEC 2004). Six of these wells were installed in 2004 to characterize groundwater downgradient (as interpreted at the time) of the landfill: FAB 5C, FAB 5D, FAB 6C, FAB 6D, FAB 7C, and FAB 7D (Figure 9). The six wells are grouped into three clusters of two wells each with the shallower "D" wells screened in the Upper Aquifer Zone (UAZ) of the Upper Three Runs Aquifer just above the Tan Clay Confining Zone; the deeper "C" wells are screened in the Lower Aquifer Zone (LAZ) of the Upper Three Runs Aquifer just below the Tan Clay Confining Zone. Two previously installed upgradient UAZ wells, FAB 2 and BGO 13DR, are used as background monitoring wells for comparison purposes. Two upgradient LAZ wells, BGO 43C and NWP202C, are not part of the monitoring network but are sampled for water level measurements. To better delineate groundwater flow direction and to ensure that the water table aquifer is monitored on the downgradient side, SRS installed three new UAZ monitoring wells at the unit in June 2015, one each on the west, south, and east sides of 288-0F. These wells are labelled FAB008D, FAB009D, and FAB010D.

The landfill permit requires monitoring of barium, chromium, copper, lead, nickel, zinc, nitrate, sulfate, pH, specific conductivity, and the water level. The semi-annual monitoring program has been ongoing since 2004. In the most recent annual monitoring event (SRNS 2019a), nitrate was the only constituent that exceeded MCLs. Based on historic process knowledge and prior investigations, nitrate has been determined to be associated with historic F-Area operations unrelated to the FAL.

A plan has been drafted to guide characterization of the FAL, the *Sampling and Analysis Plan for Pre-Work Plan Characterization of the ECODS L-3, Rubble Pit 131-1L, Rubble Pit 131-4L, L-Area Ash Basin (188-0L), K-Area Ash Basin (188-0K), and F-Area Ash Landfill (288-0F)*, drafted in August 2019 (SRNS 2019b). The sampling presented herein is in partial fulfillment of the sampling proposed in that comprehensive SAP.

H-Area Ash Basin

There has been limited assessment and regulatory activity at the HAB. Extraction Procedure (EP) Toxicity Testing of HAB was conducted in Augusta 1983 and found no constituents exceeding threshold limits. The HAB was tested for EP Toxicity, PAH, and VOC contaminants in June of 1989. Results of this testing indicated elevated levels of benzene, however subsequent testing in July indicated no elevated levels benzene which are uncharacteristic for ash (WSRC 1989).

K-Area Ash Basin

EP Toxicity Testing of KAB was conducted in Augusts 1983. This testing found no constituents exceeded test limits (WSRC 1989).

In 2012, a Scoping Summary for the KAB and LAB was developed and reviewed with the SCDHEC and USEPA (SRNS 2012b). The negotiated scope for the KAB was used to develop the sampling plan presented SAP drafted in August 2019 (SRNS 2019b) to address the KAB. The sampling presented herein is in partial fulfillment of the sampling proposed in that comprehensive SAP (SRNS 2019b).

L-Area Ash Basin

There has been limited assessment and regulatory activity at the LAB OU. Groundwater at the LAB is included in the L-Area Northern Groundwater (LANG) OU. The 2011 ROD for the LANG OU establishes that the approved remedy for groundwater is “no action” (SRNS 2011). Given this ROD is the official end point of the RCRA/CERCLA process, no additional sampling or investigation of the groundwater medium will be pursued.

One surface water/sediment sampling location (PBIOU-4) is located just downgradient from the LAB. This location was sampled in 2002 and 2003 as part of the Pen Branch Integrator OU evaluation.

The LAB was also addressed in the 2012 Scoping Summary for the KAB and LAB that was scoped with the SCDHEC and USEPA (SRNS 2012b) and is addressed in the 2019 SAP (SRNS 2019b).

As with the KAB, sampling herein associated with the LAB is in partial fulfillment of the sampling proposed in that comprehensive SAP (SRNS 2019b).

D Ash Overflow

The DAO is shown in Figure 7 and is associated with the DAOU. In 2013, the USDOE, USEPA, and SCDHEC agreed to add the 488-1D Ash Basin, 488-2D Ash Basin, and the 488-4D Ash Landfill as subunits of the DAOU. The ash basins were permitted under the SCDHEC Industrial Wastewater Treatment (IWT) regulations (Permit #7295), and the ash landfill was permitted under a Class Two Solid Waste Landfill (SWL) (Permit #025800-1602).

Because of the extensive scope, cost, and duration, removal actions were divided into two major phases. Phase 1 included the 488-2D Ash Basin and the 488-4D Ash Landfill; Phase 2 included the 488-1D Ash Basin and the 489-D CPRB (Southern 75 percent [%]).

Extensive investigation and remedial actions have been implemented at the ash-related units surrounding/near the DAO (488-1D Ash Basin, 488-2D Ash Basin and 488-4D Ash Landfill) because of coal-related contaminants. The applicable IWT operating permits have been closed upon the completion of the removal actions. The SWL permit has been terminated and is to be managed in accordance with the post-closure requirements specified in the Second Early Action ROD.

The unit-specific Land Use Control Implementation Plan (LUCIP) for the 488-1D Ash Basin, 488-2D Ash Basin and the 488-4D Ash Landfill subunits will be the Second Early Action LUCIP for the DAOU and will provide details and specific measures required for the LUCs selected as part of the preferred remedy.

2.4 Summary of Existing Data

There are two primary goals of the SAP: (1) collect representative soil/ash data from four of the ash units (HAB, KAB, LAB, and DAO), those lacking adequate analytical data to date, to determine if contaminants are present; and (2) better define the extent of ash outside the unit boundary for five of the ash units addressed in this SAP (AAP, FAL, HAB, LAB, and KAB). The

sampling results generated from this limited characterization will be used to assess potential contaminants to support a comprehensive consolidated strategy for ash units outlining future remedial decision-making for these units. Data associated with the FAL, HAB, and LAB are also being collected as partial fulfillment of the SAP drafted for the comprehensive characterization of these specific units (SRNS 2019b).

A-Area Ash Pile

The AAP was included in *A Preliminary Report of Coal Pile, Coal Pile Runoff Basins and Ash Basins* drafted in 1998 focusing on potential effects to groundwater. At that time, only two ash basins at SRS had monitoring wells (D- and K-Area). Recommendations within the report were to install monitor wells at the other three "active" ash basins and piles (at that time) which included A-, H-, and P-Area.

The *RCRA Facility Investigation/Remedial Investigation (RFI/RI) Work Plan and RFI/RI Report with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for the A-Area Ash Pile (788-A), A-Area Coal Pile Runoff Basin (788-3A), and Stormwater Outfall (NBN) Operable Unit (U)* revealed arsenic, potassium-40, radium-226(+D), and uranium-238(+D) were identified as human health RCOCs in the 0 to 0.3-m (0 to 1-ft) surface ash interval because they pose an exposure risk to a future resident and a future industrial. For the future resident scenario, surface ash is impacted by arsenic (risk 5.4E-05), potassium-40 (risk 1.3E-04), radium-226(+D) (risk 1.8E-04), and uranium-238(+D) (risk 2.8E-06) and poses a total cumulative risk of 3.7E-04. For the future industrial worker scenario, surface ash is impacted with arsenic (risk 1.3E-05), potassium-40 (risk 7.3E-04), radium-226(+D) (risk 1.0E-04), and uranium-238(+D) (risk 1.4E-06) and poses a total cumulative risk of 1.9E-04. There is no threat to ecological receptors in the ash based on the quantitative ecological risk assessment (ERA) performed on the 0 to 0.3-m (0 to 1-ft) and 0.3- to 1.2-m (1- to 4-ft) bgs intervals (SRNS 2012c).

Initial TCLP sampling results were also described in the *RFI/RI Work Plan and RFI/RI Report with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for the A-Area Ash Pile (788-A), A-Area Coal Pile Runoff Basin (788-3A), and Stormwater Outfall (NBN) Operable Unit (U)* (SRNS 2012c). On April 5, 2011, one composite sample from five locations

representing the ash media in the AAP and one composite sample from three locations representing the coal fines media in the CPRB were collected to determine if this material would be considered a characteristic hazardous waste under RCRA. Samples collected at the were analyzed by the TCLP for metals, VOCs, SVOCs, pesticides, and herbicides.

Barium was detected in six of six samples at a maximum concentration of 441 µg/L, and boron was detected in six of six samples at a maximum concentration of 222 µg/L. All other constituents were non-detected. The results confirm the materials at the AAP do not exceed the RCRA characteristically hazardous waste limits and therefore, are not RCRA characteristically hazardous wastes. In addition, no constituents exceed a TCLP leachate concentration greater than ten times (10x) the MCL which is the standard for Class 2 material under South Carolina Regulation 61- 107.19.

The primary data needs for the AAP include (Figure 2):

- Visual inspection of soil samples will be used to define the lateral extent of ash in areas outside the pile.

F-Area Ash Landfill

The FAL had limited soil data collected in 2012 as part of the landfill permit modification. Seven samples of surficial ash were collected from areas surrounding the landfill. All samples were analyzed for RCRA metals and hexavalent chromium.

The primary data need for the FAL include (Figure 3):

- Visual inspection of soil samples will be used to define the lateral extent of ash in areas outside the landfill.

The data collected above with be in partial fulfillment of the recently drafted SAP that includes the FAL (SRNS 2019b).

H-Area Ash Basin

The HAB has minimal data to date. *A Preliminary Report of Coal Pile, Coal Pile Runoff Basins and Ash Basis* was drafted in 1998 focusing on potential effects on groundwater. At that time, only two ash basins at SRS had monitoring wells (D- and K-Area). Recommendations within the report were to install monitor wells at the other three "active" ash basins and piles, at that time, at A-, H-, and P-Area.

EP Toxicity testing of H Area ash in August 1983 found no constituents exceeding the test limits. H- Area ash was tested for EP Toxicity, PAH, and VOC in June 1989. Results of this testing indicated elevated levels of benzene. However, subsequent testing in July 1989 indicated no elevated level of benzene. Elevated levels of benzene are uncharacteristic for ash and it was felt that the samples were contaminated by sampling equipment or in the laboratory (memo: D.R. Earnhart to E.A. Campbell, August 1, 1989, EPD-PED-890695).

The primary data needs for the HAB include (Figure 4):

- Surface samples will be collected from inside the basin to confirm contaminants, if any, and to assess the physical parameters of the ash.
- Visual inspection of soil samples will be used to define the lateral extent of ash in areas outside the basin.

K-Area Ash Basin

There were no existing soil/ash data for the KAB.

The primary data needs for the KAB include (Figure 5):

- Surface samples will be collected from inside the landfill to confirm contaminants, if any, and to assess the physical parameters of the ash.
- Visual inspection of soil samples will be used to define the lateral extent of ash in areas outside the basin.

The data collected above with be in partial fulfillment of the SAP, drafted in 2019, that includes the KAB (SRNS 2019b).

L-Area Ash Basin

There were no existing soil data for the LAB.

The primary data needs for the LAB include (Figure 6):

- Surface samples will be collected from inside the landfill to confirm contaminants, if any, and to assess the physical parameters of the ash.
- Visual inspection of soil samples will be used to define the lateral extent of ash in areas outside the basin.

The data collected above with be in partial fulfillment of the SAP drafted in August 2019 that includes characterization of the LAB (SRNS 2019b).

D Ash Overflow

The primary information available on the DAO area is based on walk-downs to visually identify ash and estimate ash volume. The surrounding area includes several closed units including ash basins (488-D, 488-4D, 488-2D, 488-1D) that required extensive remediation, the Inlet Basins, and D-Area Coal Pile Runoff Basin.

The primary data needs for the DAO include (Figure 7):

- Surface samples will be collected from the area adjacent to the D-Area Effluent Discharge Canal to confirm contaminants, if any, and to assess the physical parameters of the ash.

3.0 PROJECT DATA QUALITY OBJECTIVES

The Data Quality Objectives (DQO) process is a series of logical steps that guides managers or staff to a plan for the resource-effective acquisition of environmental data. It is both flexible and iterative, and applies to both decision-making (e.g., compliance/non-compliance with a standard) and estimation (e.g., ascertaining the mean concentration level of a contaminant). The DQO process is used to establish performance and acceptance criteria, which serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support the goals of the study. Use of the DQO process leads to efficient and effective expenditure of resources; consensus on the type and quantity of data needed to meet the project goal; and the full documentation of

actions taken during the development of the project. The DQO process, which is detailed in USEPA Guidance (USEPA 2006), is a series of seven planning steps based on the scientific method. The seven planning steps, discussed in more detail in Sections 3.1 to 3.7 below) are as follows:

1. State the Problem,
2. Identify the Goals of the Study,
3. Identify Information Inputs,
4. Define the Boundaries of the Study,
5. Develop the Analytical Approach,
6. Specify Performance or Acceptance Criteria, and
7. Develop the Plan for Obtaining the Data.

3.1 State the Problem

The following units have, or may have, contaminants that exceed the human health risk thresholds:

- A-Area Ash Pile (188-0A),
- F-Area Ash Landfill (288-0F),
- H-Area Ash Basin (188-0H),
- K-Area Ash Basin (188-0K),
- L-Area Ash Basin (188-0L), and
- D Ash Overflow area (NBN).

3.2 Identify Goals of the Study

The objective of this sampling plan is to collect representative data of sufficient quality that will be used to justify a comprehensive remedial decision strategy. The ash basins have had various, limited assessment to date. Since ash is a uniform waste material, the available assessment data from these ash units was used to tailor the analytical suites and sampling design of this SAP. Data associated with these units have been compiled, reviewed, and plotted in ArcGIS to assist in sampling design.

3.3 Identify Information Inputs

Historical soil data collected for three of the units has been reviewed and summarized in Section 2.4 of this document. The data for each unit may not be of sufficient quality to make final remedial decisions, therefore additional data are required for three of the units. Also, data is not sufficient to develop adequate estimates of ash volume; therefore, a new sampling event is required to fill gaps in the existing data set.

3.4 Define the Boundaries of the Study

The administrative boundaries of each unit are delineated in Figures 2 through 7. Samples will be collected at planned locations as shown in these figures. These locations will be subject to adjustment in the field based on potential interferences. The locations reflect the likely extent, or location of potential contamination, based on historical process history and field walk downs.

3.5 Develop the Analytical Approach

Samples will be analyzed by a laboratory that has passed the USDOE Consolidated Audit Program qualification audit and using USEPA SW846 methods, or approved equivalents, that have been certified by SCDHEC. Radiological analyses are performance based and evaluated by the USDOE Mixed Analyte Performance Evaluation Program. Laboratory developed radionuclide methods are typically based on USEPA or USDOE methods.

The constituents of concern (COCs) for the units will be identified by comparing the analytical results to the USEPA regional screening levels (RSLs), radiological Preliminary Remediation Goals (PRGs), and regional screening values (RSVs) for soil samples. Soil data exceeding RSL values, or radiological PRG values, will be screened against SRS background soil values (WSRC 2006) to determine if inorganic or radionuclide concentrations are within ranges for SRS soil. In most cases, indicator analyses (i.e., gross alpha and nonvolatile beta) will be used to identify if a given sample requires more extensive radiological analyses. If the gross alpha result exceeds 20 picocuries per gram (pCi/g) for a soil, then the Alpha spectroscopy radionuclides in Table 4 will also be analyzed for that sample. If the nonvolatile beta result exceeds 50 pCi/g for a soil or sediment sample, then the gamma spectroscopy radionuclides and individual beta analyses in Table 4 will also be analyzed for that sample.

3.6 Specify Performance or Acceptance Criteria

According to USEPA guidance (USEPA 2006), the USEPA has developed the DQO process as the agency's recommended planning process when environmental data are used to select between two or more alternatives or to derive an estimate of contamination. The DQO process is a seven-

step method designed to ensure that the appropriate type, quantity, and quality of environmental data are collected for the intended application.

Table 1 presents the DQO worksheet developed for each unit. The DQO worksheet specifies the quantity, type, and quality of data. Table 2 specifies the minimum project QA/QC criteria. USEPA SW846 methods are analytical specifications for the Target Compound List/Toxicity Characteristic Leaching Procedure (TAL/TCL) constituents (Table 3), while radiological methods are generally performance based by each laboratory (Table 4). Table 5 provides sample preservation and handling requirements. Additional analytical details are presented in the Analytical Plan discussed in Section 5.0.

Total study error is the additive impact of two main sources of error: 1) sampling error and 2) measurement error, with sampling error being responsible for the vast majority of the total error. "As much as 90% or more of the uncertainty in environmental data sets is due to sampling variability as a direct consequence of the heterogeneity of the environmental matrices" (Crumbling et al. 2001). The method best suited to reduce sampling error is to gather representative samples (Crumbling et al. 2001).

It is incorrect to assume that randomly collected, non-representative samples plus perfect analytical chemistry will always lead risk managers to correct risk management decisions. To avoid incorrect risk management decisions, it is more important to develop Decision Quality Data (DQD). DQD is defined as "Data of known quality that can logically be demonstrated to be effective for making the specified decision because both the sampling and analytical uncertainties are managed to the degree necessary to meet clearly defined and stated data needs" (Crumbling et al. 2001). Therefore, it is more important for the risk managers to use DQD, emphasizing representative sampling with a specified percentage of definitive data, in order to make a correct decision and to not be confused by emphasizing analytical data quality, which does not necessarily equate to a correct risk management decision.

Because the SRS possesses significant process and historical knowledge, and in most instances has preliminary or survey data results for the majority of its waste units, this sampling plan will largely control sampling error (the cause of greatest total error) and set tolerable limits on decision

errors by gathering data by judgmental, judgmental-stratified, and systematic sampling designs based on process knowledge, existing data, historical information/data, survey data, and institutional knowledge to generate DQD. This is the method SRS will use to control decision errors since sample collection will be focused in areas of known contamination rather than using a sampling design intended to randomly search for contamination. Judgment-based sampling provides a very conservative and certain method for collecting data with a high likelihood for detecting worst-case contaminant concentrations while reducing total study error. Project Quality Objectives (PQOs) are qualitative and quantitative statements derived from the DQO process that clarify study objectives for the measurement performance criteria, which define the appropriate types of data and acceptance limits for data. PQOs are used as the basis for establishing the quality and quantity of data needed to support decisions. The PQOs include the following:

- Relative percent difference (RPD) <50% between the regular soil sample and field duplicate when the result ≥ Sample Specific Estimated Quantitation Limit (ssEQL) for the precision data quality indicator.
- RPD <200% when the soil or sediment sample result ≥ Method Detection Limit but < ssEQL for accuracy/bias for the precision data quality indicator.
- Percent recovery from the Matrix Spike (MS) and Matrix Spike Duplicates (MSDs) are generally ≥ 135% or < 30% for the accuracy/bias data quality indicator. MS recovery windows may be tighter than those listed. Refer to the Measurement Performance Criteria Tables in the QAPP for analyte and media-specific recovery percentages (SRNS 2012a).
- No target compound ≥ ssEQL for the equipment blank, field blanks, method blanks, or instrument blanks for the accuracy data quality indicator.
- ssEQL < MCL, RSL, or PRG for the sensitivity data quality indicator.
- 95% of samples sent to the laboratory have useable (i.e., non-rejected) results for the completeness data quality indicator.
- 90% of the planned samples are collected and their data are useable for the completeness data quality indicator.

The objective for the representativeness data quality indicator is qualitative and will be met by properly documenting field and analytical protocols. In the event these procedures and methods are not able to be implemented, the appropriate corrective action documentation should encompass the impact on the representativeness of the information. When review of the data and documentation determines the data to be nonrepresentative, the information is qualified for use or is not used by the project.

3.7 Develop the Plan for Obtaining the Data

In general, shallow soil samples will be collected by hand auger will be analyzed for the TAL/TCL constituents (Table 3). Additionally, radiological indicator analyses will be performed for all samples (Table 6). Those samples with radiological indictor analyses exceeding the trigger limits will receive the appropriate radionuclide-specific analyses for alpha-, beta-, and/or gamma emitting radionuclides (Table 4).

4.0 SAMPLE DESIGN AND RATIONALE

Implementation of the SAP to obtain DQD for each OU/subunit/media is documented in the remaining sections of this document. The following sections describe how the plan is implemented to collect the physical data to meet the criteria developed during the DQO process.

Given the results of evaluations at other SRS ash basins, the ash is expected to have a uniform consistency and chemical composition, with metals, naturally occurring radionuclides, and SVOCs as the primary constituents of concern. Therefore, each sample will be analyzed for pH, TCL SVOCs, TAL metals, hexavalent chromium, and radiological indicator parameters (gross alpha and nonvolatile beta). Any samples that exceed the radiological triggers for gross alpha (20 pCi/g) or nonvolatile beta (50 pCi/g) will be further analyzed for the radionuclide specific analyses listed in Table 4.

The objective for the sampling transects shown in Figures 2 through 7 is to laterally delineate the extent of ash using visual inspection. All borings be advanced vertically up to a maximum depth of 30.5 cm (12 in.). All transects will begin with a boring at a specified distance from the existing

landfill boundary. A limited number of specific boring locations will be followed, as needed, by additional 3-m (10-ft) step outs to confirm the ash extent. Longer transects, may generally be needed, and will result in a step-out at 30-m (100-ft) intervals until an ash-free location is located. Subsequent to finding an ash-free location, two additional step borings will be installed, with each step being one-half the length of the prior step. The step direction will be inbound (i.e., toward the basin/landfill) if ash is absent and outbound if ash is present. For example, stepping outbound at a 30.5-m (100-ft) interval and discovering a clean location, the sampling team then would step back one-half the distance of the last step (i.e., in this case, 30.5 m [100 ft] divided by 2, or 15.2 m [50 ft]) to install the next boring. At this location, if ash is present, the second step would be 7.6-m (25-ft) outbound or, if ash is absent, the next step would be 7.62-m (25-ft) inbound toward the landfill. Using this procedure will result in defining the lateral extent of ash to within a distance of 7.6 m (25 ft). It is likely the edge of ash is not vertically discrete but rather is tapering with decreasing thickness towards the outbound edges, so defining the lateral extent to within 7.6 m (25 ft) is expected to be sufficient to capture the majority of the ash volume.

Some transects will require greater sample densities to investigate and define mounds, holes, or other anomalies. Also, transects that cross a "drainage swale" may be free of ash deposits due to soil movement or from recent construction activities (e.g., the ash may have been completely removed). Transects in this vicinity must continue beyond the area to confirm the lateral extent of

No groundwater or surface water sampling is proposed for this SAP.

5.0 ANALYTICAL PLAN

This section describes the data quality levels for each type of data being collected. All data collected under this SAP will follow the Area Completion Projects (ACP) QAPP for Environmental Data Collection and Management (SRNS 2012a). The data quality level is determined by the intended use of the data.

5.1 Subunit Analytical Plans

Table 1 presents the DQOs developed for each of the units. The specific analytes and analytical methods and detection limits for the sampling project for TAL/TCL constituents for soil/ash samples are listed in Table 3. The radiological constituents for soil/ash samples are listed in Table 4. Table 5 lists the hold times, preservatives, and sample containers for all analyses. The specific samples and analyses planned at each OU/subunit are provided in Table 6.

5.2 Indicator Analyses

At SRS, radiological indicators (gross alpha and nonvolatile beta) area commonly used to identify soils with concentrations of alpha- and beta-emitting radionuclides that may not be within the range of values expected in nature. If soil sample analytical results exceed predetermined trigger levels for gross alpha emitters (20 pCi/g) or nonvolatile beta emitters (50 pCi/g), radionuclide-specific analysis will be performed on the sample. For example, if the sample exceeds the trigger for the 20 pCi/g alpha radiation screen level, the sample will undergo radionuclide-specific analyses for alpha emitters. Use of gross alpha and nonvolatile beta trigger level is consistent with the known occurrence of natural isotopes as well as recognized characterization and investigation derived waste (IDW) management methods at SRS. The trigger levels for soil samples are based upon the maximum activities of naturally occurring isotopes in unimpacted SRS soils (WSRC 2006).

5.3 Field Analytical Sampling Quality Assurance/ Quality Control

QC samples can consist of field duplicates, rinsate/equipment blanks, trip blanks, and split samples. For this SAP, field duplicates will be utilized. Field QA/QC will be maintained through the use of QA/QC samples and methods, as described below:

- Field Duplicate (co-located) Samples: Two or more independent samples collected from side-by-side locations at the same point in time and space. These separate samples are intended to represent the same population and are carried through all steps of the sampling and analytical procedures in an identical manner. These samples are used to assess precision of the total method, including sampling, analysis, and site heterogeneity. Field duplicate samples are planned at a combined minimum rate of 5% according to ER-SOP-043

(or typically 1 per 20 samples) and analyzed for the same parameters as the associated samples.

5.4 Data Quality Levels

The characterization samples will be screening level data (SD). This is verified and validated (VV) data (SRNS 2012c, 2012d). SD data are verified data that meet the following selected aspects of USEPA Functional Guideline criteria:

- Quantitation Limits,
- Surrogate or Tracer Recoveries,
- Laboratory Control Spike Recoveries,
- MS Recoveries/MSDs,
- Lab Replicates,
- Field Replicates,
- Cooler Temperatures,
- Chemical Preservation, and
- Holding Times.

Requirements for SD data are listed in Table 2. Site data can undergo additional validation to meet definitive data requirements at a later date, if needed.

5.5 Sample Matrix Table

Sampling matrix tables that include the detailed information for all samples planned to be collected are provided for each unit in Table 6. The exact number of samples may change based on field conditions.

5.6 Sample Location Map

Figures 2 through 7 illustrates the proposed locations of samples to be collected.

6.0 FIELD IMPLEMENTATION

The following sections outline the field implementation procedures for the sampling effort. Additional implementing documents, such as the environmental evaluation checklist, automated hazard analysis, radiological work instructions, and site-specific health and safety plan, are internal to SRS and detail day-to-day sampling operations and safety requirements.

6.1 Sample Collection Procedures and Processes

The sampling effort will include soil/ash sampling. The following specific procedures will be followed:

- *Sampling Surface and Sub-Surface Soils for Analytical Purposes*, SRNS Manual 3Q1, Section 9016.
- *Soil and Sediment Sampling*, SRNS Manual 3Q1, Section 3005.
- *Soil Boring Investigations*, SRNS Manual 3Q1, Section 9006.

These procedures are consistent with the USEPA Region 4 Field Branches Quality System and Technical Procedures sampling procedures. Prior to beginning all field activities, all field crews will be required to read the procedures listed above and the field Technical Oversight will have had experience with that activity.

6.2 Equipment and Decontamination Procedures

In addition, as stated in the SAP, the following sampling equipment will be required:

- Camera for photograph documentation;
- Field logbook and/or field data recorder with backup batteries;
- Global positioning system unit and backup batteries;
- Personal protective equipment;
- Hand auger system with bucket and extension rods;
- Stainless steel scoops
- Two forms of communication (KIJ5 radio, cell phone, and/or pager);
- All sample bottles with appropriate preservatives; and
- Cooler and frozen blue ice or equivalent for packing samples in the field.

Equipment needs will vary from day-to-day based on sampling requirements and field conditions. Specific needs will be addressed at plan of the day meetings by the industrial hygiene personnel, radiological controls inspector, and safety personnel. Decontamination of field sampling

equipment will be performed in accordance to the 3Q1 Manual Procedure 9016, Section 5.4. Disposal of IDW will follow the job specific waste management plan.

6.3 Sample Documentation

Overall documentation will be completed in accordance with the QAPP (SRNS 2012a). Sample documentation will be conducted according to Manual C3, ER-SOP-043, *Obtaining and Managing Environmental Data for Environmental Compliance & Area Completion Projects*, which provides the general requirements and guidelines that are necessary for the documentation, record keeping, mobilization, collection, processing, reporting, and storage of environmental data. Data Management Plan Q-DMP-B-00001, *Environmental Restoration Data Management System*, requires sampling information (i.e., bar- coded dates, times, sample identifications, weather, etc.) to be recorded and maintained in logbooks, and Chain-of-Custody documents included in the sampling package delivered to the project. Sampling documentation is tracked through a series of documents, including:

- Mobilization Report;
- Chain-of-Custody Forms;
- Field Logbooks;
- Analytical Data Packages; and
- SCDHEC and SRS required logs and forms.

A logbook for recording sample collection activities will be kept for this project. The subcontractor will ensure the logbook is correctly filled out and returned within two weeks after completion of sampling. Essential field information includes sample name, date of collection, time of collection, depth of sample, and sampler's name. Space should be provided for any field observations or comments relating to the quality or representativeness of the sample. If the actual sample location differs from the planned sample location specified by the Chain-of-Custody, the revised sample location should be indicated in the sample logbook. Information on the parent sample of each field duplicate should be recorded.

6.4 Chain-of-Custody

Chain-of-Custody procedures establish requirements for sample custody and documenting custody from the time of collection through laboratory analysis. Chain-of-Custody demonstrates that

samples obtained in the field have been securely collected and transported and have reached the analytical laboratory without alteration. Chain-of-Custody requirements are established by SRNS Manual 3Q1, Procedure 1001, *Chain-of-Custody Procedure*. At a minimum, Chain-of-Custody documents will include the following information, which is compliant with USEPA requirements:

- Project name (i.e., monitoring well name, stream name, RFI/RI project name, etc.);
- Sample identification;
- Number of sample containers/bottles;
- Sampler's signature for each sample;
- Date of sample collection;
- Time of sample collection;
- Sample identifiers (bar-coded labels);
- Sample description;
- Whether a sample is persevered or unpreserved; and
- Analyses to be performed.

A Chain-of-Custody record is used as physical and legal evidence of sample custody to trace the sample from collection through delivery to the analyzing laboratory and where the samples were stored. The Chain-of-Custody record must originate with the responsible organization or the person collecting the sample. Every sample is assigned a unique identification number that is entered on the Chain-of-Custody document. The Chain-of-Custody records each transfer of custody of the samples by a relinquishing party to a receiving organization whose name and identifying contact information is located on the form.

6.5 Sample Management and Shipping

Soil/ash samples will be collected in accordance with SRNS Manual 3Q1, Section 9000, *Hydrogeologic Data Collection Procedures and Specifications* (SRNS 2010). Sample management for analytical laboratories and intra-SRS facilities is primarily controlled by SRNS Quality Assurance Manual 1Q, Procedure 13-1, *Packaging, Handling, Shipping, Storage and Receiving*. The purpose of this procedure is to define the requirements and specify the responsible parties and their roles for the packaging, handling, shipping, storage, and receiving of items to ensure that they are properly controlled to prevent damage or loss and to minimize their deterioration. Sample shipment is also regulated by SRNS Manual 19Q, Procedure 1.02, *General Transportation Requirements for Radioactive and Non-Radioactive Hazardous Materials.* These manuals provide specific requirements to sampler personnel for the safe off-site shipment or

on-site transfer of radioactive and non-radioactive hazardous materials and hazardous substances, mixed waste (i.e., radiological/nonradiological hazardous materials), and empty packaging that have previously contained mixed waste. It specifies the required packaging, labeling, record-keeping, selection of appropriate transportation carrier, and appropriate transport container based on the analytically pre-tested nature of a sample. Radiological samples must also meet United States Department of Transportation shipping regulations. Samples associated with this SAP are expected to be non-hazardous and non-radiological, as they represent environmental media rather that waste materials.

Soil samples will be stored in coolers with blue ice, as applicable, in the custody of the sampler, or designee, until delivered to the ACP Sample Packaging personnel in B-Area. If samples need to be stored overnight prior to delivery to the B-Area sample-packaging group, then they will be stored in a locked facility with the Chain of Custody, and in a refrigerator (4°C +/- 2°C) if required for sample preservation. ACP Sample Packaging personnel in B-Area will manage, package, and ship samples to the laboratories in accordance with Manual C3, Volume IX, Procedure ER-SOP-803B, *Packaging of Non-Department of Transportation (DOT) Samples for On-Site Transfers/Off-Site Shipments*. Table 5 lists proper preservatives, holding times, and sample containers for samples collected in the field, stored, and transported to the analytical laboratories.

6.6 Data Validation and Data Management

Requirements for data validation/verification and data management procedures are found in SRNS Procedures and SOPs, the USEPA Functional Guidelines, and two USDOE National Policies and Procedures, as identified below:

- SRNS Manual C1, ER-AP-305 – *Use of Field-Generated Blanks* (SRNS 2012c);
- SRNS Manual C1, ER-AP-306 – *Laboratory Data Records Review* (SRNS 2012d);
- SRNS Manual C3, Volume X, ER-SOP-033 – *Analytical Data Qualification* (SRNS 2015);
- SRNS Manual C3, Volume X, ER-SOP-043 – *Obtaining and Managing Environmental Data for Environmental Compliance & Area Completion Projects* (SRNS 2014b);

- Data Management Plan, Q-DMP-B-00001, *Environmental Restoration Data Management System* (WSRC 2002);
- Department of Energy Consolidated Audit Program, Policies and Practices, Procedure AD-1, Revision 2, November 10, 2009; and
- Quality Systems for Analytical Services, Revision 2.5, Department of Energy, November 9, 2009.

In addition, SRS procedures incorporate the criteria found in the USEPA National Functional Guidelines to verify, validate, and qualify analytical data to assess its usability for risk and remedial management decisions. Adherence to this complex list of procedures and guidelines establishes: a) if data meet the specific technical and QC criteria established by the DQOs and laboratory QAPPs; and b) the usability of any data not meeting the specific technical and QC criteria. All data are qualified for usability using USEPA Functional Guidelines. Adherence to the guideline requirements and the USDOE Audit Program for analytical laboratories allows the data to be qualified based upon a set of nationally established functional guideline qualifiers for uniformity.

Depending upon the PQOs, data will be verified and/or validated according to the following criteria:

- Verification – Confirmation by examination and provision of objective evidence that the specified analytical requirements have been met. This is to be an electronic data deliverable completeness check for all required fields. Data verification consists of a completeness check to confirm that all sampling data and data fields requested from the laboratory have been received and comply with specified requirements.
- Validation – Confirmation by manual examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled. Data validation consists of any analyte and sample specific process for evaluating compliance of the laboratory data received with methods, procedures, or contract requirements.

The ACP Data Management group will enter sample collection and laboratory data into the Environment Restoration Data Management System (ERDMS) in accordance with Procedure

ER-SOP-43. Properly completed and qualified data are entered into the ERDMS Database. Data records are updated, re-qualified, and continuously corrected for usability based on the results of electronic verification and manual validation evaluations as corrective actions are resolved with the analytical laboratories.

6.7 Investigation Derived Waste

IDW will be managed according to the site IDW management plan.

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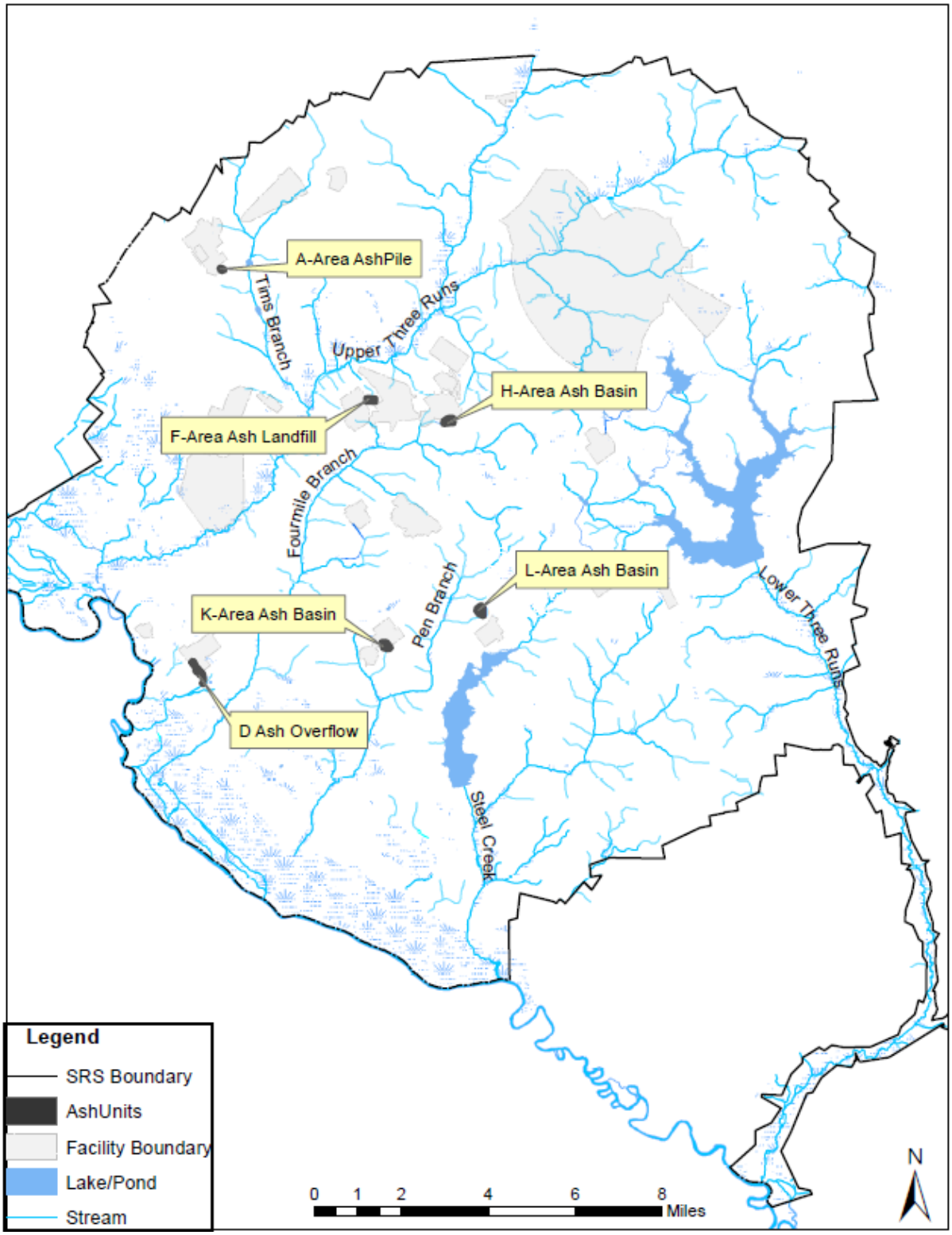


Figure 1. Location of Ash Units



Figure 2. Location of A-Area Ash Pile (788-0A)

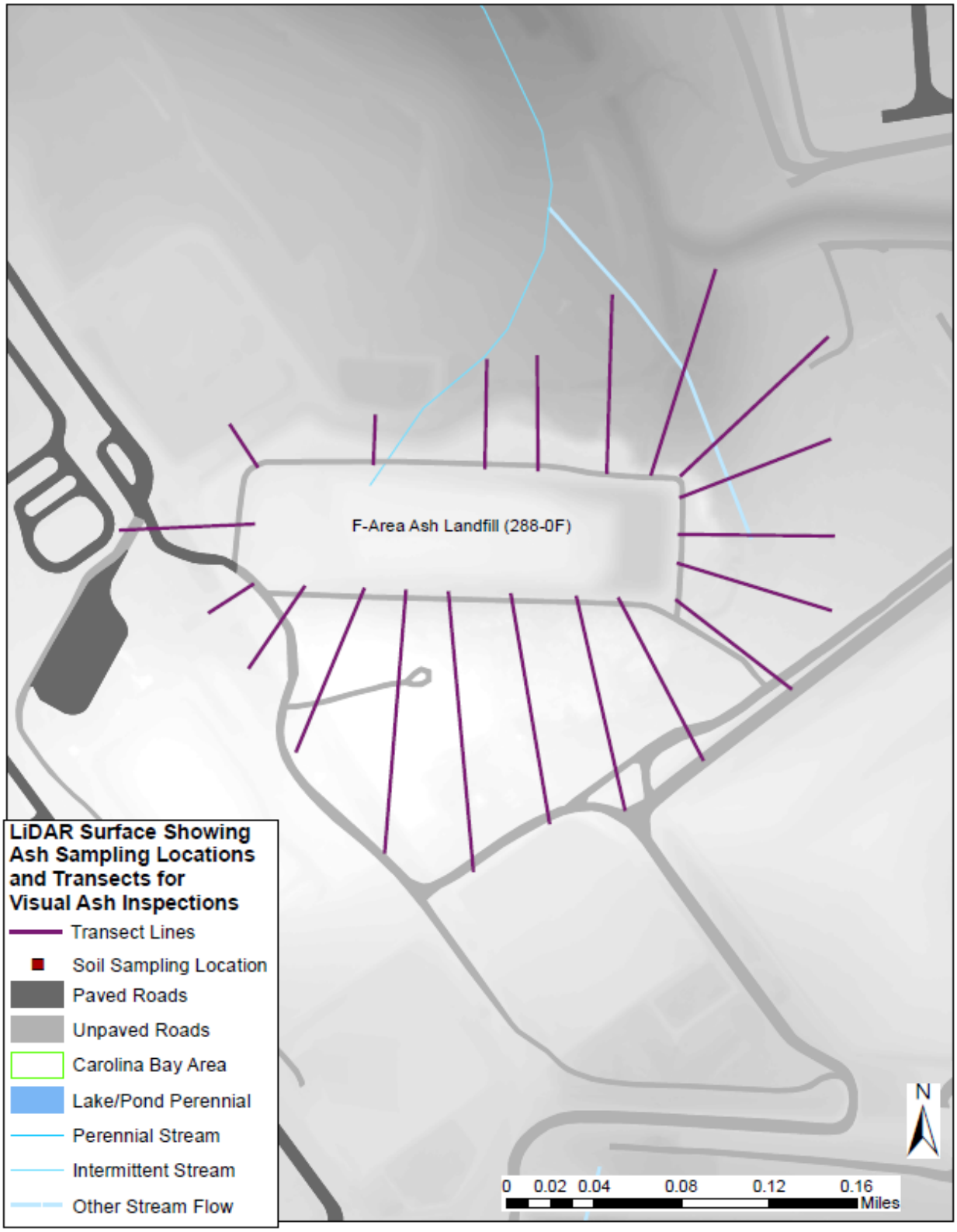


Figure 3. Location of F-Area Ash Landfill (288-0F)

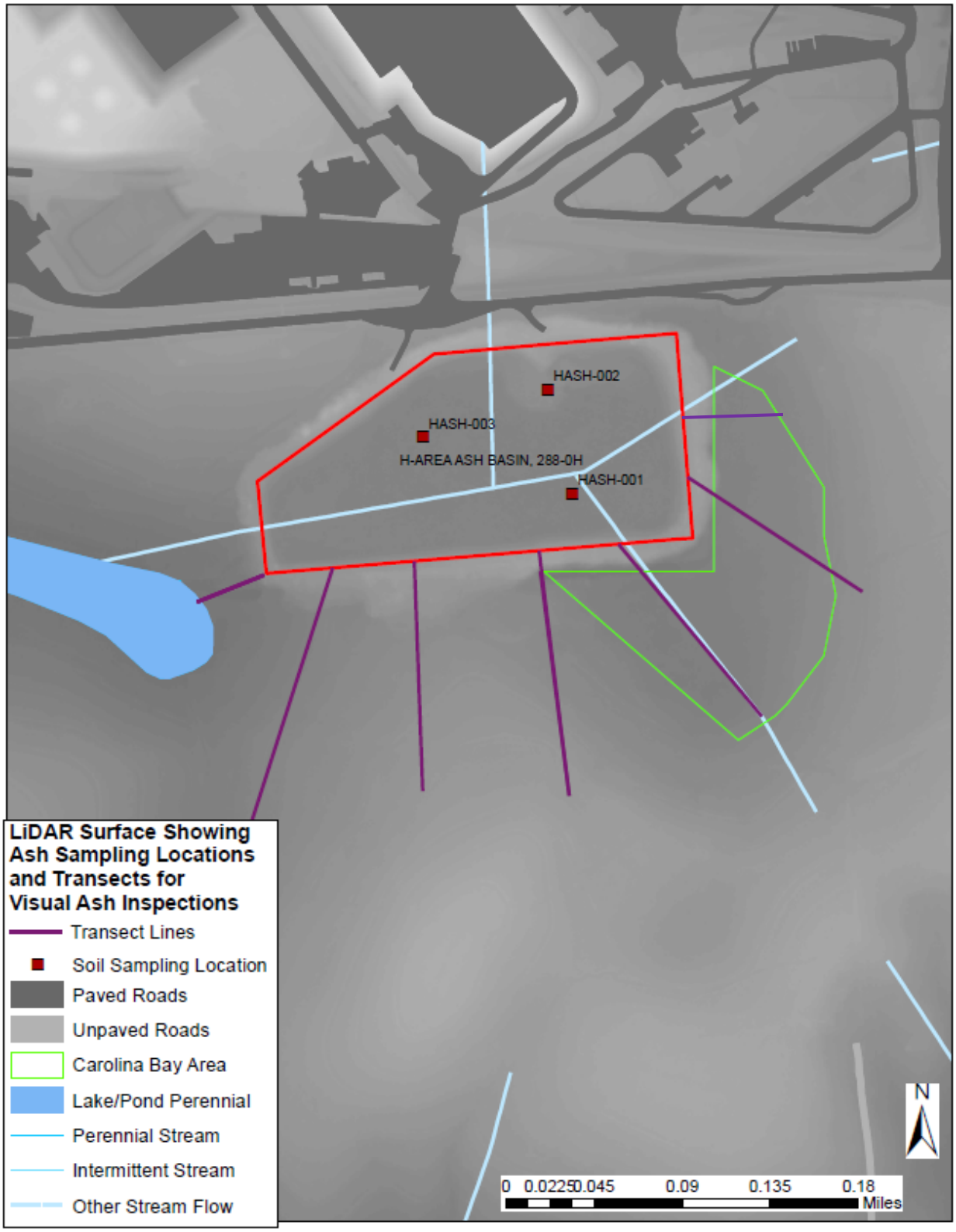


Figure 4. Location of H-Area Ash Basin (288-0H)

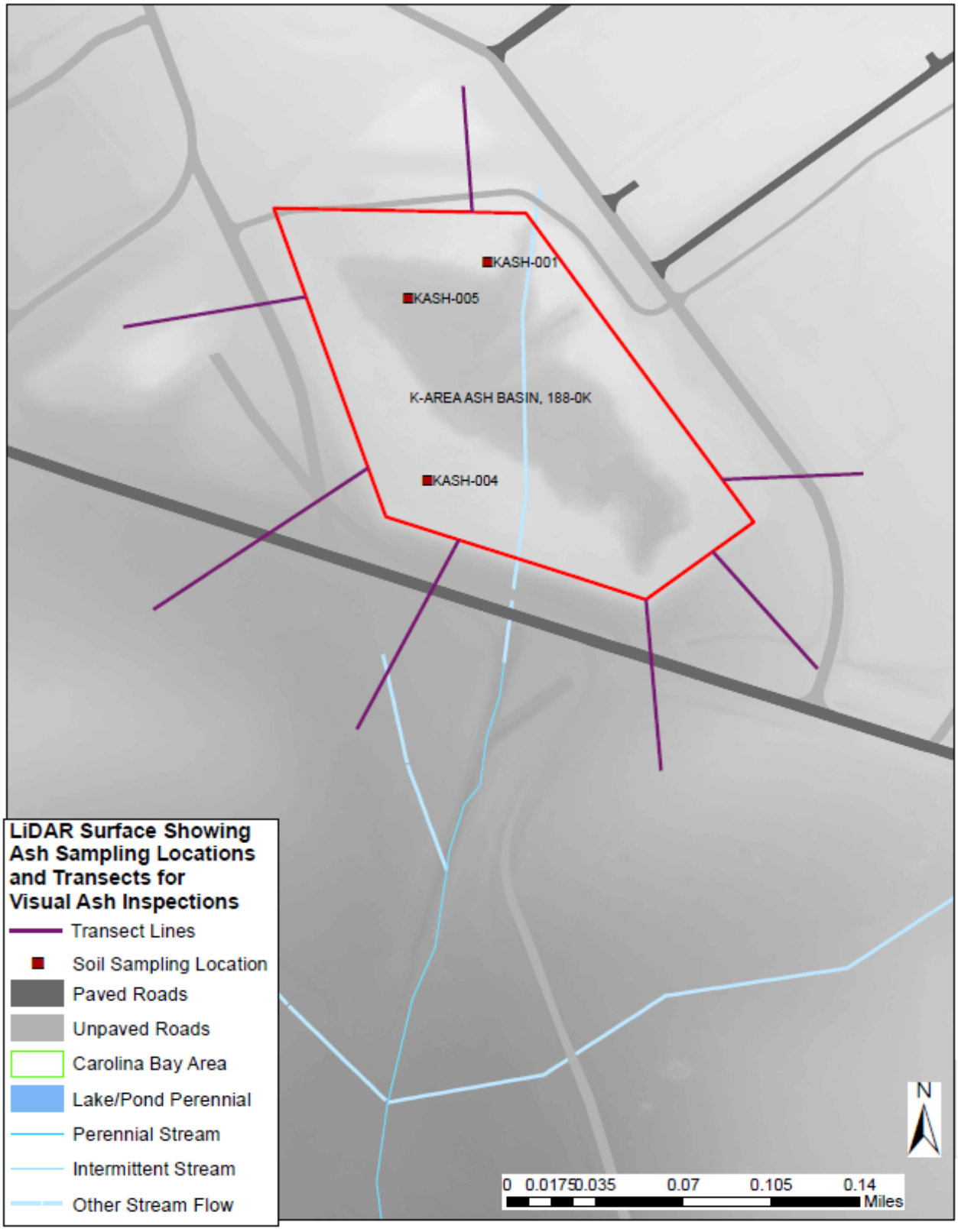


Figure 5. Location of K-Area Ash Basin (188-0K)

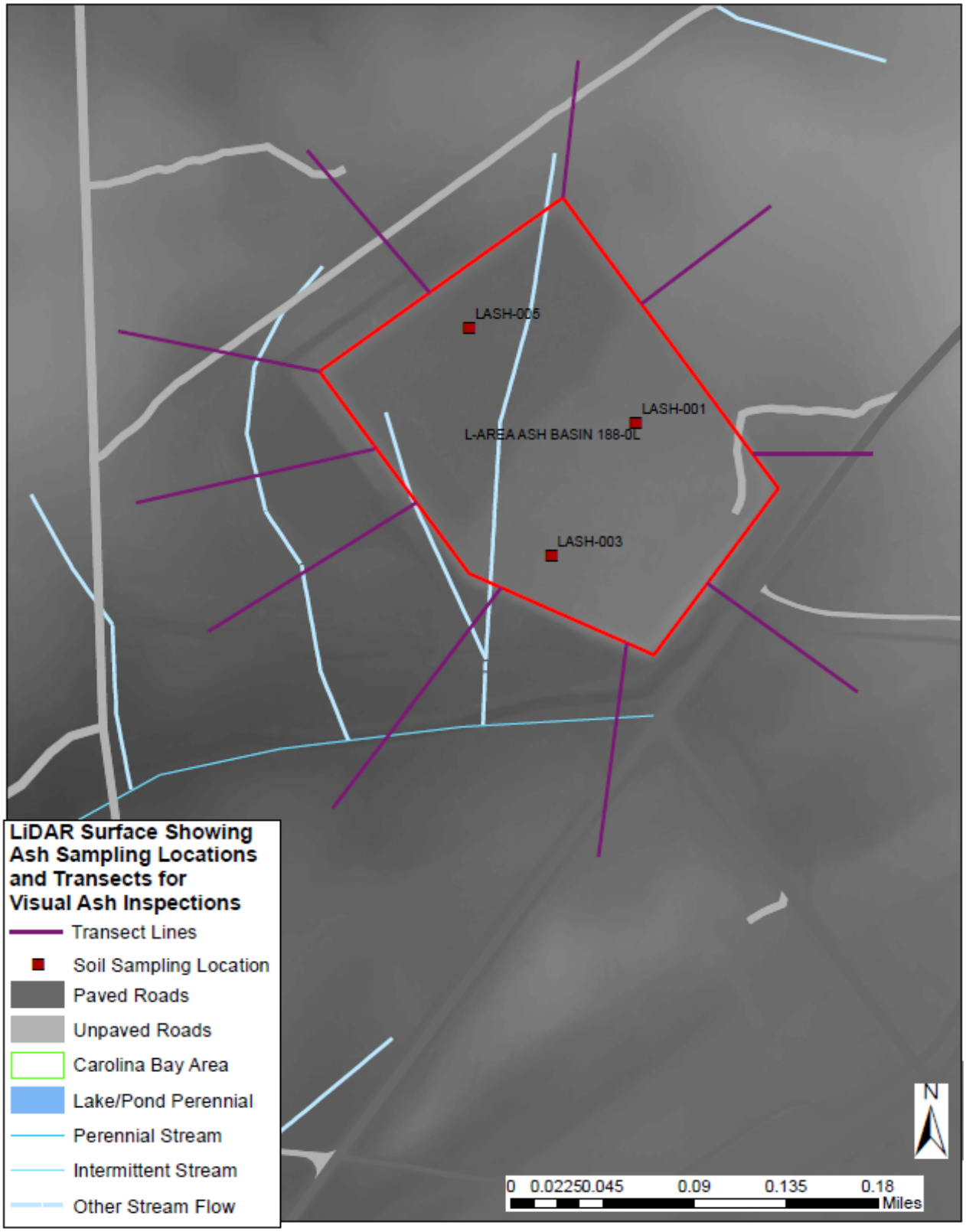


Figure 6. Location of L-Area Ash Basin (188-0L)

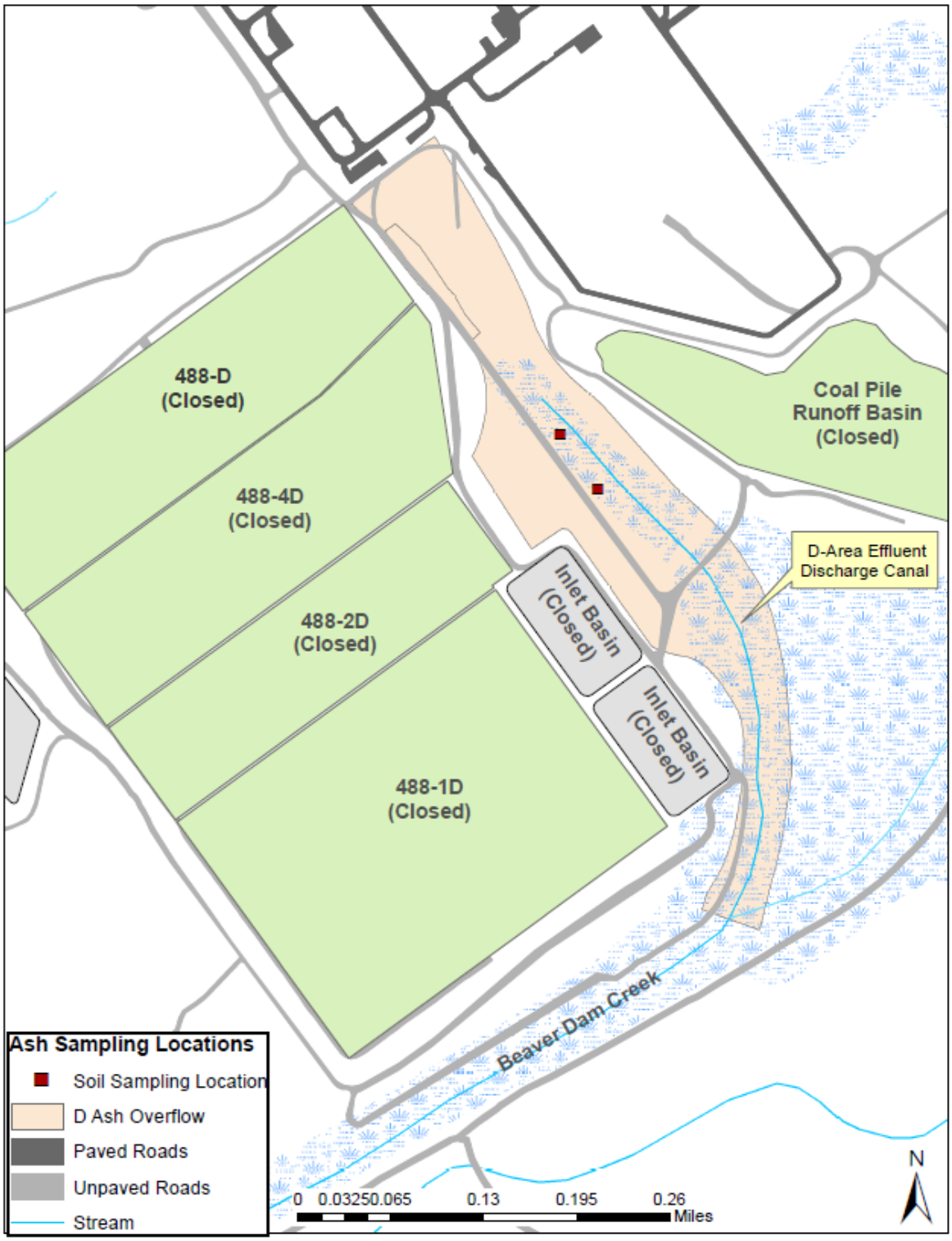


Figure 7. D Ash Overflow (NBN)

Table 1. Data Quality Objectives for Soil/Ash Media

Pathway (Media)	Probable Conditions	Exposure Pathway and/or Release Mechanisms	Data Needs and DQOs Including Engineering / Physical Processes	Field Activities Including Removal and Characterization	Parameters	Potential Remedial Action Alternatives
Surface soil	Contamination of surface soil from ash material in basin	Ingestion, inhalation, dermal absorption and/or direct exposure with soils/ash	Determine the nature and extent of ash contamination Determine surficial risk due to direct exposure with contaminated soils	Inside Basin: Collection of surface soil/ash; collection of bulk samples of coal ash Outside Basin: Vertical extent of ash is defined. Step-outs will be conducted until lateral extent of ash is defined	Data validated to SRS electronic V&V level pH, TAL metals, TCL SVOCs, Cr6, GA and NVB. Uranium, Thorium, and Radium isotopes and gamma spectroscopy for selected intervals and in any sample where triggers are exceeded, or visible ash is present.	No Action Land Use Controls Excavation and consolidation of ash/contaminated soils Cover System Beneficial re-use

Table 2. Minimum Field Quality Control/Quality Assurance Sampling Requirement

Data Quality Level	Field Quality Control/Quality Assurance Samples	Frequency of Field Quality Control/ Quality Assurance Sample
UU	None	
VU	None	
VV	Co-located Field Duplicate	Minimum 5%[2]
	Trip Blank	Minimum 1 per cooler
	Equipment Blank	1 per 40 samples[3]
	Field Blank	Optional; 1 per 40 samples[4]
	Split Sample	Minimum 5%
[1]SD	Co-located Field Duplicate	Minimum 5%[2]
	Trip Blank	1 per cooler
	Equipment Blank	1 per 40 samples[3]
	Field Blank	Optional; 1 per 40 samples[4]
	Split Sample	Minimum 5%
D	Co-located Field Duplicate	Minimum 5%[2]
	Trip Blank	1 per cooler
	Equipment Blank	1 per 40 samples[3]
	Field Blank	Optional; 1 per 40 samples[4]
	Split Sample	Minimum 5%

Data Quality Levels
UU Data Unverified and Invalidated Data (no errors from ERDMS database loading screens)
VU Data Verified and Invalidated Data (includes missing data checks)
VV Data Verified and Validated Data (validated to automated criteria; equivalent to USEPA Screening Level Data)
SD Data USEPA Screening Level Data with 10% Definitive Confirmation D Data USEPA Definitive Level Data

Footnotes:
1. Level of data quality used in this SAP.
2. Minimum frequency established per ER-SOP-043.
3. Typical frequency.
4. Recommended based on project needs; typical frequency.

Table 3. Laboratory Analytical Specifications Table TAL/TCL Analytes for Soil and Sediment Media

Analyte	Analyte ID	Preparation[B] Method	USEPA[B] Method	CRDL[A] *(µg/kg)*
Target Analyte List				
Metals				
Aluminum	7429-90-5	3051A,3052	EPA6010C	1,900
Antimony	7440-36-0	3051A,3052	EPA6010C	350
Arsenic	7440-38-2	3051A,3052	EPA6010C	312
Barium	7440-39-3	3051A,3052	EPA6010C	21
Beryllium	7440-41-7	3051A,3052	EPA6010C	31.1
Cadmium	7440-43-9	3051A,3052	EPA6010C	40
Calcium	7440-70-2	3051A,3052	EPA6010C	69
Chromium	7440-47-3	3051A,3052	EPA6010C	90
Cobalt	7440-48-4	3051A,3052	EPA6010C	80
Copper	7440-50-8	3051A,3052	EPA6010C	100
Iron	7439-89-6	3051A,3052	EPA6010C	2,190
Lead	7439-92-1	3051A,3052	EPA6010C	590
Magnesium	7439-95-4	3051A,3052	EPA6010C	14.1
Manganese	7439-96-5	3051A,3052	EPA6010C	88.5
Mercury	7439-97-6	3051A,3052	EPA7471B	15.2
Nickel	7440-02-0	3051A,3052	EPA6010C	88
Potassium	7440-09-7	3051A,3052	EPA6010C	80
Selenium	7782-49-2	3051A,3052	EPA6010C	5.7
Silver	7440-22-4	3051A,3052	EPA6010C	101
Sodium	7440-23-5	3051A,3052	EPA6010C	298
Thallium	7440-28-0	3051A,3052	EPA6010C	160
Vanadium	7440-62-2	3051A,3052	EPA6010C	74
Zinc	7440-66-6	3051A,3052	EPA6010C	4.3
Specific Analysis				
Cyanide	57-12-5		EP 9012B	3.0
Hexavalent Chromium			7196A	
Target Compound List				
PCBs				
Aroclor 1016	12674-11-2	3540C,3541,3545A	EPA8082A	3.2
Aroclor 1221	11104-28-2	3540C,3541,3545A	EPA8082A	0.22
Aroclor 1232	11141-16-5	3540C,3541,3545A	EPA8082A	0.22
Aroclor 1242	53469-21-9	3540C,3541,3545A	EPA8082A	0.22
Aroclor 1248	12672-29-6	3540C,3541,3545A	EPA8082A	0.22
Aroclor 1254	11097-69-1	3540C,3541,3545A	EPA8082A	0.22
Aroclor 1260	11096-82-5	3540C,3541,3545A	EPA8082A	0.22
Pesticides				
Aldrin	309-00-2	3540C,3541,3545A,3550C	EPA8081B	0.029
alpha-Benzene hexachloride	319-84-6	3540C,3541,3545A,3550C	EPA8081B	0.066
alpha-Chlordane	5103-71-9	3540C,3541,3545A,3550C	EPA8081B	0.021
beta-Benzene hexachloride	319-85-7	3540C,3541,3545A,3550C	EPA8081B	0.32
DDD	72-54-8	3540C,3541,3545A,3550C	EPA8081B	2.4
DDE	72-55-9	3540C,3541,3545A,3550C	EPA8081B	1.7
DDT	50-29-3	3540C,3541,3545A,3550C	EPA8081B	1.01
delta-Benzene hexachloride	319-86-8	3540C,3541,3545A,3550C	EPA8081B	0.066
Dieldrin	60-57-1	3540C,3541,3545A,3550C	EPA8081B	0.03
Endosulfan I	959-98-8	3540C,3541,3545A,3550C	EPA8081B	0.066
Endosulfan II	33213-65-9	3540C,3541,3545A,3550C	EPA8081B	0.13
Endosulfan sulfate	1031-07-8	3540C,3541,3545A,3550C	EPA8081B	0.13
Endrin	72-20-8	3540C,3541,3545A,3550C	EPA8081B	0.13

Table 3. Laboratory Analytical Specifications Table TAL/TCL Analytes for Soil and Sediment Media *(Continued)*

Analyte	Analyte ID	Preparation[B] Method	USEPA[B] Method	CRDL[A] *(µg/kg)*
Target Compound List *(continued)*				
Pesticides *(continued)*				
Endrin aldehyde	7421-93-4	3540C,3541,3545A,3550C	EPA8081B	0.13
Endrin ketone	53494-70-5	3540C,3541,3545A,3550C	EPA8081B	0.34
gamma-Chlordane	5103-74-2	3540C,3541,3545A,3550C	EPA8081B	C
Heptachlor	76-44-8	3540C,3541,3545A,3550C	EPA8081B	0.44
Heptachlor epoxide	1024-57-3	3540C,3541,3545A,3550C	EPA8081B	0.59
Lindane	58-89-9	3540C,3541,3545A,3550C	EPA8081B	0.066
Methoxychlor	72-43-5	3540C,3541,3545A,3550C	EPA8081B	1.13
Toxaphene	8001-35-2	3540C,3541,3545A,3550C	EPA8081B	18.7
Semi-volatiles				
2,4,5-Trichlorophenol	95-95-4	3540C,3541,3545A,3550C	EPA8270D	7.4
2,4,6-Trichlorophenol	88-06-2	3540C,3541,3545A,3550C	EPA8270D	7.4
2,4-Dichlorophenol	120-83-2	3540C,3541,3545A,3550C	EPA8270D	14
2,4-Dimethylphenol	105-67-9	3540C,3541,3545A,3550C	EPA8270D	14
2,4-Dinitrophenol	51-28-5	3540C,3541,3545A,3550C	EPA8270D	120
2-Chlorophenol	95-57-8	3540C,3541,3545A,3550C	EPA8270D	5.7
2-Methyl-4,6-dinitrophenol	534-52-1	3540C,3541,3545A,3550C	EPA8270D	7.8
2-Nitrophenol	88-75-5	3540C,3541,3545A,3550C	EPA8270D	13
4-Chloro-m-cresol	59-50-7	3540C,3541,3545A,3550C	EPA8270D	55.5
4-Nitrophenol	100-02-7	3540C,3541,3545A,3550C	EPA8270D	156
m/p-Cresol	1319-77-3	3540C,3541,3545A,3550C	EPA8270D	96
o-Cresol (2-Methylphenol)	95-48-7	3540C,3541,3545A,3550C	EPA8270D	5.6
Pentachlorophenol	87-86-5	3540C,3541,3545A,3550C	EPA8270D	3
Phenol	108-95-2	3540C,3541,3545A,3550C	EPA8270D	6.2
1,2,4,5-Tetrachlorobenzene	95-94-3	3540C,3541,3545A,3550C	EPA8270D	170
2,3,4,6-Tetrachlorophenol	58-90-2	3540C,3541,3545A,3550C	EPA8270D	170
1,1'-Biphenyl	92-52-4	3540C,3541,3545A,3550C	EPA8270D	350
2,4-Dinitrotoluene	121-14-2	3540C,3541,3545A,3550C	EPA8270D	44.6
2,6-Dinitrotoluene	606-20-2	3540C,3541,3545A,3550C	EPA8270D	28
2-Chloronaphthalene	91-58-7	3540C,3541,3545A,3550C	EPA8270D	5.6
2-Methylnaphthalene	91-57-6	3540C,3541,3545A,3550C	EPA8270D	50
2-Nitroaniline	88-74-4	3540C,3541,3545A,3550C	EPA8270D	3.5
3,3'-Dichlorobenzidine	91-94-1	3540C,3541,3545A,3550C	EPA8270D	143
4-Bromophenyl phenyl ether	101-55-3	3540C,3541,3545A,3550C	EPA8270D	15
4-Chloroaniline	106-47-8	3540C,3541,3545A,3550C	EPA8270D	16
4-Chlorophenyl phenyl ether	7005-72-3	3540C,3541,3545A,3550C	EPA8270D	40.9
Acenaphthene	83-32-9	3540C,3541,3545A,3550C	EPA8270D	35.2
Acenaphthylene	208-96-8	3540C,3541,3545A,3550C	EPA8270D	35
Acetophenone	98-86-2	3540C,3541,3545A,3550C	EPA8270D	0.49
Anthracene	120-12-7	3540C,3541,3545A,3550C	EPA8270D	44.5
Atrazine	1912-24-9	3540C,3541,3545A,3550C	EPA8270D	2.2
Benzaldehyde	100-52-7	3540C,3541,3545A,3550C	EPA8270D	6100
Benzo[a]anthracene	56-55-3	3540C,3541,3545A,3550C	EPA8270D	29.4
Benzo[a]pyrene	50-32-8	3540C,3541,3545A,3550C	EPA8270D	25.5
Benzo[b]fluoranthene	205-99-2	3540C,3541,3545A,3550C	EPA8270D	55.3
Benzo[g,h,i]perylene	191-24-2	3540C,3541,3545A,3550C	EPA8270D	29.6
Benzo[k]fluoranthene	207-08-9	3540C,3541,3545A,3550C	EPA8270D	58.8

Table 3. Laboratory Analytical Specifications Table TAL/TCL Analytes for Soil and Sediment Media *(Continued)*

Analyte	Analyte ID	Preparation[B] Method	USEPA[B] Method	CRDL[A] *(µg/kg)*
Target Compound List *(continued)*				
Semi-volatiles *(continued)*				
Bis(2-chloro-1-methylethyl)ether	108-60-1	3540C,3541,3545A,3550C	EPA8270D	54.1
Bis(2-chloroethoxy) methane	111-91-1	3540C,3541,3545A,3550C	EPA8270D	7.2
Bis(2-chloroethyl) ether	111-44-4	3540C,3541,3545A,3550C	EPA8270D	69.5
Bis(2-ethylhexyl) phthalate	117-81-7	3540C,3541,3545A,3550C	EPA8270D	35
Butylbenzyl phthalate	85-68-7	3540C,3541,3545A,3550C	EPA8270D	28
Caprolactam	105-60-2	3540C,3541,3545A,3550C	EPA8270D	46.3
Carbazole	86-74-8	3540C,3541,3545A,3550C	EPA8270D	24
Chrysene	218-01-9	3540C,3541,3545A,3550C	EPA8270D	32.9
Dibenz[a,h]anthracene	53-70-3	3540C,3541,3545A,3550C	EPA8270D	33.2
Dibenzofuran	132-64-9	3540C,3541,3545A,3550C	EPA8270D	38.9
Dibutyl phthalate	84-74-2	3540C,3541,3545A,3550C	EPA8270D	28
Diethyl phthalate	84-66-2	3540C,3541,3545A,3550C	EPA8270D	28
Dimethyl phthalate	131-11-3	3540C,3541,3545A,3550C	EPA8270D	28
Di-n-octyl phthalate	117-84-0	3540C,3541,3545A,3550C	EPA8270D	28
Fluoranthene	206-44-0	3540C,3541,3545A,3550C	EPA8270D	3.4
Fluorene	86-73-7	3540C,3541,3545A,3550C	EPA8270D	37.9
Hexachlorobenzene	118-74-1	3540C,3541,3545A,3550C	EPA8270D	32.2
Hexachlorobutadiene	87-68-3	3540C,3541,3545A,3550C	EPA8270D	5.6
Hexachlorocyclopentadiene	77-47-4	3540C,3541,3545A,3550C	EPA8270D	2.4
Hexachloroethane	67-72-1	3540C,3541,3545A,3550C	EPA8270D	30
Indeno[1,2,3-c,d]pyrene	193-39-5	3540C,3541,3545A,3550C	EPA8270D	30
Isophorone	78-59-1	3540C,3541,3545A,3550C	EPA8270D	44
m-Nitroaniline	99-09-2	3540C,3541,3545A,3550C	EPA8270D	164
Naphthalene	91-20-3	3540C,3541,3545A,3550C	EPA8270D	5.6
Nitrobenzene	98-95-3	3540C,3541,3545A,3550C	EPA8270D	14
N-Nitrosodiphenylamine	86-30-6	3540C,3541,3545A,3550C	EPA8270D	13
N-Nitrosodipropylamine	621-64-7	3540C,3541,3545A,3550C	EPA8270D	55.9
Phenanthrene	85-01-8	3540C,3541,3545A,3550C	EPA8270D	33.5
p-Nitroaniline	100-01-6	3540C,3541,3545A,3550C	EPA8270D	28
Pyrene	129-00-0	3540C,3541,3545A,3550C	EPA8270D	8.2
Volatiles				
1,1,1-Trichloroethane	71-55-6	5035A	EPA8260B	1.18
1,1,2,2-Tetrachloroethane	79-34-5	5035A	EPA8260B	1.33
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	5035A	EPA8260B	C
1,1,2-Trichloroethane	79-00-5	5035A	EPA8260B	0.85
1,1-Dichloroethane	75-34-3	5035A	EPA8260B	1.15
1,1-Dichloroethylene	75-35-4	5035A	EPA8260B	0.054
1,2,4-Trichlorobenzene	120-82-1	5035A	EPA8260B	0.423
1,2-Dibromo-3-chloropropane	96-12-8	5035A	EPA8260B	0.45
1,2-Dibromoethane	106-93-4	5035A	EPA8260B	0.0069
1,2-Dichlorobenzene	95-50-1	5035A	EPA8260B	C
1,2-Dichloroethane (EDC)	107-06-2	5035A	EPA8260B	0.35
1,2-Dichloropropane	78-87-5	5035A	EPA8260B	0.35
1,3-Dichlorobenzene	541-73-1	5035A	EPA8260B	C
1,4-Dichlorobenzene	106-46-7	5035A	EPA8260B	C
2-Hexanone	591-78-6	5035A	EPA8260B	2.86

Table 3. Laboratory Analytical Specifications Table TAL/TCL Analytes for Soil and Sediment Media *(Continued/End)*

Analyte	Analyte ID	Preparation[B] Method	USEPA[B] Method	CRDL[A] *(µg/kg)*
Target Compound List *(continued)*				
Volatiles *(continued)*				
Acetone	67-64-1	5035A	EPA8260B	7.03
Benzene	71-43-2	5035A	EPA8260B	0.823
Bromodichloromethane	75-27-4	5035A	EPA8260B	1
Bromoform (Tribromomethane)	75-25-2	5035A	EPA8260B	1.15
Bromomethane (Methyl bromide)	74-83-9	5035A	EPA8260B	2.56
Carbon disulfide	75-15-0	5035A	EPA8260B	0.988
Carbon tetrachloride	56-23-5	5035A	EPA8260B	1.22
Chlorobenzene	108-90-7	5035A	EPA8260B	0.987
Chloroethane	75-00-3	5035A	EPA8260B	2.69
Chloroethene (Vinyl chloride)	75-01-4	5035A	EPA8260B	0.15
Chloroform	67-66-3	5035A	EPA8260B	1.42
Chloromethane (Methyl chloride)	74-87-3	5035A	EPA8260B	1.2
cis-1,2-Dichloroethylene	156-59-2	5035A	EPA8260B	C
cis-1,3-Dichloropropene	10061-01-5	5035A	EPA8260B	1.31
Cyclohexane	110-82-7	5035A	EPA8260B	0.08
Dibromochloromethane	124-48-1	5035A	EPA8260B	1.03
Dichlorodifluoromethane	75-71-8	5035A	EPA8260B	4
Dichloromethane (Methylene chloride)	75-09-2	5035A	EPA8260B	1.65
Ethylbenzene	100-41-4	5035A	EPA8260B	1.07
Cumene (Isopropylbenzene)	98-82-8	5035A	EPA8260B	0.254
Methyl acetate	79-20-9	5035A	EPA8260B	22,000
Methyl ethyl ketone	78-93-3	5035A	EPA8260B	4.68
Methyl isobutyl ketone	108-10-1	5035A	EPA8260B	2.62
Methyl tertiary butyl ether (MTBE)	1634-04-4	5035A	EPA8260B	0.107
Methylcyclohexane	108-87-2	5035A	EPA8260B	2,600
Styrene	100-42-5	5035A	EPA8260B	0.72
Tetrachloroethylene (PCE)	127-18-4	5035A	EPA8260B	1.42
Toluene	108-88-3	5035A	EPA8260B	1.07
trans-1,2-Dichloroethylene	156-60-5	5035A	EPA8260B	2
trans-1,3-Dichloropropene	10061-02-6	5035A	EPA8260B	1.13
Trichloroethylene (TCE)	79-01-6	5035A	EPA8260B	1.37
Trichlorofluoromethane	75-69-4	5035A	EPA8260B	2
o-Xylene	95-47-6	5035A	EPA8260B	3.11
m,p-Xylene	MPXYL	5035A	EPA8260B	5
Bromochloromethane	74-97-5	5035A	EPA8260B	5
1,4-Dioxane	123-91-1	5035A	EPA8260B	100
1,2-Dichlorobenzene	95-50-1	5035A	EPA8260B	5
1,2,3-Trichlorobenzene	87-61-6	5035A	EPA8260B	5

A. CRDL is the Contract Required Detection Limit and is not always attainable.
B. Extraction and preparation methods differ depending upon media, concentration, instrument, laboratory, and analytical method. Preparation methods will also influence detection limits.
C. Laboratory instructed to obtain the lowest possible method detection limit.

Table 4. Laboratory Analytical Specification Table for Radiological Analytes in Soil, Sediment, Surface, and Groundwater Media

Radionuclides	Typical Soil MDAs[A] *(pCi/g)*	Typical Water MDAs[A] *(pCi/L)*	Analytical Method[B]
Alpha Spectroscopy			
Americium-241	0.50	0.40	NNS
Americium-243	0.50	0.462	NNS
Curium-243/244	0.351	0.503	NNS
Curium-245/246	0.416	0.458	NNS
Neptunium-237	0.07	0.771	NNS
Plutonium-238	0.50	0.35	NNS
Plutonium-239/240	0.50	0.353	NNS
Plutonium-242	0.50	0.372	NNS
Radium-226	0.895	0.30	EPA903.0MOD
Thorium-228	0.50	0.445	NNS
Thorium-230	0.50	0.523	NNS
Thorium-232	0.50	0.45	NNS
Uranium-233/234	0.50	0.663	NNS
Uranium-235	0.206	0.684	NNS
Uranium 238	0.50	0.744	NNS
Gamma Spectroscopy Analyses			
Actinium-228	0.30	25.00	NNS
Bismuth-212	0.25	20.00	NNS
Bismuth-214	0.25	20.00	NNS
Cesium-137	0.15	5.0	NNS
Cobalt-60	0.03	10.00	NNS
Europium-154	0.25	25.0	NNS
Lead-212	0.25	20.00	NNS
Lead-214	0.25	20.00	NNS
Potassium-40	1.00	75.00	NNS
Radionuclide Indicators			
Gross Alpha	3.000	3.00	EPA900.0MOD
Nonvolatile beta	4.000	4.00	EPA900.0MOD
Individual Beta Analyses			
Carbon-14	2.00	10.00	NNS
Iodine-129	2.00	1.00	NNS
Nickel-59	3.38	20.00	NNS
Nickel-63	4.00	10.00	NNS
Promethium-147	10.00	10.00	NNS
Radium-228	1.29	0.50	EPA903.0MOD
Strontium-90	2.00	0.852	NNS
Technetium-99	5.00	17.3	NNS
Tritium	6.00	0.50	EPA906.0MOD

NNS - No National Standard

A. All MDAs are sample-specific. The MDAs represented above are typical MDAs as reported by the subcontract laboratories but are not always achievable.

B. Extraction and preparation methods differ depending upon media, concentration, instrument, laboratory, and analytical method. Preparation methods will also influence detection limits. Laboratory instructed to obtain the lowest possible method detection limit.

Table 5. Preservatives, Holding Times, and Sample Containers

Parameter	Preservatives		Holding Time		Containers	
	Aqueous	Solid	Aqueous	Solid	Aqueous	Solid
Volatile Organic Compounds (VOCs) Including: 8260 – VOCs	No Residual Chlorine Adjust pH to <2 with H2SO4, HCL, or solid sodium bisulfate (NaHSO4). Cool to 4°C	Low-level soil Add ~5 g soil to 40 mL VOA vial Preserved with 1 g of NaHSO4/5 mL water	14 days	Low/High Level 14 days	3x40 mL glass VOC vial, PTFE septa cap	3x40 (or 60) mL glass VOA vial (with stir bar for low-level soil), PTFE septa cap
Extractable Organics Including: 8270 – Semivolatile Organics	No Residual Chlorine Cool to 4°C	Cool to 4°C	7 days until extraction/ analyzed within 40 days after extraction	14 days until extraction/ analyzed within 40 days after extraction	2 x 1 L amber glass bottle per chemical parameter	250 mL CWM
8081 – Organochlorine Pesticides 8082 – Polychlorinated Biphenyls 8310 – Polycyclic Aromatic Hydrocarbons	Extracts must be stored at 4°C and in the dark until analysis Extracts must be stored at 4°C and in the dark until analysis	Cool to 4°C	7 days until extraction/ analyzed within 40 days after extraction	14 days until extraction/ analyzed within 40 days after extraction	2 x 1 L amber glass bottle per chemical parameter	250 mL CWM
Metals (except Chromium (VI) & Mercury)	HNO3 to pH <2	Cool to 4°C	6 months	6 months	1 L HDPE	250 mL CWM (metals and cyanide may be collected in the same container for soils)
Mercury	HNO3 to pH <2	Cool to 4°C	28 days	28 days	250 mL HDPE or glass	250 mL CWM
Chromium (VI)	Cool to 4°C	Cool to 4°C	24 hours	24 hours	250 mL HDPE	250 mL CWM
Miscellaneous Radiological Test Gross Alpha	HNO3 to pH <2	Cool to 4°C	6 months	6 months	2 L HDPE	250 mL HDPE
Radiological Test Nonvolatile Beta	HNO3 to pH <2	Cool to 4°C	6 months	6 months	2 L HDPE	250 mL HDPE
Tritium	None Cool 0 to 6°C	None Cool 0 to 6°C	180 days	180 days	250 Amber Glass	250 HDPE or 4 oz Amber Glass

Abbreviations used in Table:

g = gram
L = liter
mL = milliliter
VOA = volatile organic analysis
H2SO4 = Sulfuric acid
Na2S2O3 = Sodium Thiosulfate
CWM = Clear Wide-Mouth Glass Jar
AG = Amber Glass Jar
HDPE = High-Density Polyethylene plastic bottle
HNO3 = Nitric acid
BR = Boston Round bottle
HCL = Hydrochloric acid
NaHSO4 = Sodium bisulfate
PTFE = Teflon lined seals

Table 6. Sampling Matrix

Sample Type	Subunit	Station	Top Depth	Bottom Depth	Media	Sample Method	Analyses	Lat	Long
REG	188-K	KASH-001	0	1	Soil	Hand Auger	1, 2, 3	3674527.522	438129.5261
REG	188-K	KASH-004	0	1	Soil	Hand Auger	1, 2, 3	3674385.647	438091.208
REG	188-K	KASH-005	0	1	Soil	Hand Auger	1, 2, 3	3674503.573	438078.8738
REG	188-L	LASH-001	0	1	Soil	Hand Auger	1, 2, 3	3675738.909	441726.6692
REG	188-L	LASH-003	0	1	Soil	Hand Auger	1, 2, 3	3675632.616	441660.2695
REG	188-L	LASH-005	0	1	Soil	Hand Auger	1, 2, 3	3675815.546	441595.3292
DUP	188-L	LASH-005	0	1	Soil	Hand Auger	1, 2, 3	3675815.546	441595.3292
REG	188-H	HASH-001	0	1	Soil	Hand Auger	1, 2, 3	3675738.909	441726.6692
REG	188-H	HASH-002	0	1	Soil	Hand Auger	1, 2, 3	3675632.616	441660.2695
REG	188-H	HASH-003	0	1	Soil	Hand Auger	1, 2, 3	3675815.546	441595.3292
REG	DAO	DASH-001	0	1	Soil	Hand Auger	1, 2, 3	3675632.616	441660.2695
REG	DAO	DASH-002	0	1	Soil	Hand Auger	1, 2, 3	3675738.909	441726.6692

Note: If no ash is visually identified at the 0-1' interval, a 1-4ft sample will be taken.
Analyses
1) pH, TAL metals, and hexavalent chromium
2) TCL SVOCs
3) Gross Alpha / Nonvolatile Beta. Radionuclide specific analyses if gross alpha / nonvolatile beta trigger levels are exceeded.
Field parameter: moisture content

Other required analyses (collection of bulk samples, 5-gallon bucket, from 188-K and 188-L)
A) Geotechnical: sieve analysis, standard proctor, specific gravity
B) Mineralogical/Elemental: XSRD (X ray diffraction), XRF (X ray fluorescence)
C) Carbon content

Notes: Sample Count 12
Total Number of Samples: 12
Field Duplications: 1
Regular Samples: 11