

FINAL

**3 SITE GROUP (SITES 118 [PICA-097], 131
[PICA-131] and 149 [PICA-149])
SOIL SAMPLING WORK PLAN**

**PICATINNY ARSENAL CLEANUP CONTRACT
PICATINNY ARSENAL, NEW JERSEY**

December 2015

Prepared for:



Contract No.: W91ZLK-13-D-0014, Delivery Order 0007

This page intentionally left blank

FINAL
3 SITE GROUP (SITES 118 [PICA-097], 131 [PICA-131] and 149 [PICA-149])
SOIL SAMPLING WORK PLAN

PICATINNY ARSENAL CLEANUP CONTRACT
PICATINNY ARSENAL, NEW JERSEY

December 2015

Prepared for:



Prepared by:



ECC
33 Boston Post Road West, Suite 420
Marlborough, MA01752

Contract No.: W91ZLK-13-D-0014, Delivery Order 0007

This page intentionally left blank

TABLE OF CONTENTS

	<u>Page</u>
LIST OF TABLES	ii
LIST OF FIGURES	iii
ACRONYMS AND ABBREVIATIONS	iv
1. INTRODUCTION	1
1.1 REPORT ORGANIZATION	1
1.2 BACKGROUND	1
1.3 OBJECTIVES AND APPROACH	2
1.4 ACTIVITIES	3
1.5 COMMUNICATIONS PLAN	4
2. UFP-QAPP WORKSHEETS	7
QAPP WORKSHEETS #1 AND #2	9
QAPP WORKSHEET #10	11
QAPP WORKSHEET #11	19
QAPP WORKSHEET #13	23
QAPP WORKSHEETS #14 AND #16	25
QAPP WORKSHEET #15	27
QAPP WORKSHEET #17	29
QAPP WORKSHEET #18	33
QAPP WORKSHEETS #19 AND #30	35
QAPP WORKSHEET #20	39
3. REFERENCES	41

LIST OF TABLES

<u>Number</u>	<u>Title</u>
1	Potential Site-Specific Logistics And Communications Checklist
2	Uniform Federal Policy Worksheets
1-1	Previously Prepared Documents Relevant to Environmental Investigation at 3 Site Group
10-1	Site Specific Cleanup Goals for the 3 Site Group
15-1	Reference Limits For Soil
17-1	Proposed Soil Samples and Associated Coordinates
19-1	Sample Containers, Preservation, And Hold Times
20-1	Field QC Summary

LIST OF FIGURES

<u>Number</u>	<u>Title</u>
1-1	Location of Picatinny Arsenal
10-1	Layout of Site 118/PICA-097, Building 41
10-2	Historical Soil Sample Exceedances of Cleanup Goals at Site 118/PICA-097
10-3	Layout of Site 131/PICA-131, Building 266
10-4	Historical Soil Sample Exceedances of Cleanup Goals at Site 131/PICA-131
10-5	Layout of Site 149/PICA-149, Propellant Plant
10-6	Historical Soil Sample Exceedances of Cleanup Goals at Site 149/PICA-149
10-7	Site 118/PICA-097 Proposed Soil Sampling Locations
10-8	Site 131/PICA-131 Proposed Soil Sampling Locations
10-9	Site 149/PICA-149 Proposed Soil Sampling Locations

ACRONYMS AND ABBREVIATIONS

°C	degree(s) Celsius
mg/kg	milligrams per kilogram
AAP	Anomaly Avoidance Plan
APP	Accident Prevention Plan
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Contaminants of Concern
COR	Contracting Officer's Representative
CSM	Conceptual Site Model
DOD	Department of Defense
DQO	Data Quality Objective
EA	EA Engineering, Science, and Technology, Inc., PBC
ECC	Environmental Chemical Corporation
ERA	Ecological Risk Assessment
ERIS	Environmental Restoration Information System
FFA	Federal Facility Agreement
FS	Feasibility Study
ft	foot/feet
HHRA	Human Health Risk Assessment
HI	Hazard Index
IRSL	Industrial Regional Screening Level
LOC	Level of Concern
MEC	Munitions and Explosives of Concern
NRSRS	Non-Residential Soil Remediation Standards
NJDEP	New Jersey Department of Environmental Protection
PBA	Performance-Based Acquisition
PCB	Polychlorinated Biphenyl
PICA	Picatinny Arsenal
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control

RI	Remedial Investigation
ROD	Record of Decision
SOP	Standard Operating Procedure
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TPH	Total Petroleum Hydrocarbon
UFP	Uniform Federal Policy
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command
USAEHA	United States Army Environmental Health Agency
USEPA	United States Environmental Protection Agency
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound

This page intentionally left blank

1. INTRODUCTION

The United States Army has contracted Environmental Chemical Corporation (ECC) to perform environmental remediation services at Picatinny Arsenal (PICA), New Jersey, under performance-based acquisition (PBA) Contract No. W91ZLK-13-D-0014, Task Order 0007. This Site-Specific Work Plan (Work Plan) was prepared to refine delineations of contaminants of concern (COCs) in surface and subsurface soil at the 3 Site Group in order to achieve a Record of Decision (ROD). The three sites included within the 3 Site Group are PICA-097 (Site 118), PICA-131 (Site 131), and PICA-149 (Site 149).

1.1 REPORT ORGANIZATION

This Work Plan outlines policies, organization, and specific quality assurance (QA)/quality control (QC) measures associated with collecting, analyzing, and reporting data in order to achieve the data quality goals. This Work Plan will be used in conjunction with the Site-Wide Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP) (ECC 2015b), the Accident Prevention Plan (APP) (ECC 2015c), and the Anomaly Avoidance Plan (AAP) (ECC 2015d) to address all elements of the work to be performed. The Site-Wide UFP-QAPP has been prepared to consistently address information applicable to multiple sites at PICA that are being addressed under this PBA and eliminate replication of common information. Therefore, only the worksheets that required updating due to information specific to the subject Sites and field investigation are presented herein. Table 1 details information related to logistics and communications for the work planned for these Sites. Table 2 lists the combined 37 QAPP worksheets and whether or not they are included in this Work Plan or the Site-Wide UFP-QAPP. References are provided in Section 3.0.

1.2 BACKGROUND

PICA is located in Morris County, New Jersey and comprises approximately 5,900 acres (Figure 1-1). The arsenal was a major source of munitions for World War I, World War II, the Korean War, and the Vietnam War. During these periods, PICA was involved in the production of explosives, rocket and munitions propellants, pyrotechnic signals and flares, fuzes, and metal components. Currently, PICA's mission is research, development, and engineering of munitions and weapons.

PICA was added to the National Priority List in March 1990 and assigned a Comprehensive Environmental Response, Compensation, and Liability Information System number. A Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 120 Federal Facility Agreement (FFA) was signed by the United States Environmental Protection Agency (USEPA) Region 2 and the Army in 1991 to integrate the Army's CERCLA response and Resource Conservation and Recovery Act corrective action obligations into a comprehensive agreement.

Subsequently, the Army prepared a Remedial Investigation (RI)/Feasibility Study (FS) Concept Plan, which identified 156 potentially contaminated sites at PICA. The investigative approach suggested by the Concept Plan was to consolidate the "Concept Sites" into "Areas" (i.e., Areas

A-P). PICA Concept Sites were additionally consolidated into “Groups” of sites as a result of agreements made at a series of meetings held in 2003 with USEPA Region 2, New Jersey Department of Environmental Protection (NJDEP), and United States Army Corps of Engineers (USACE) program managers. The consolidation of Concept Sites into Groups was based on geographic attributes, similar schedules, and similar remedies.

This work plan was prepared for surface and subsurface soil delineation at three PICA sites (known as the 3 Site Group). The three sites are (Figure 1-1):

- Building 41, Pesticide Storage Facility (PICA-097/Site 118)
- Building 266, Former Ordnance Manufacturing Facility (PICA-131/Site 131)
- Propellant Plant, Former Building 541 (PICA-149/Site 149).

These sites were previously evaluated during environmental remediation efforts conducted at PICA in accordance with CERCLA, the National Oil and Hazardous Substances Pollution Contingency Plan, and the FFA. The FS for the 3 Site Group was finalized in June 2014 (ARCADIS 2014), and the preferred alternative identified in the Final Proposed Plan (U.S. Army 2014) was removal and off-site disposal of contaminated soil, installation of soil covers over the excavated areas, and Land Use Controls to restrict future land use in the areas of the soil covers.

The only media of concern for the 3 Site Group is surface and subsurface soil. Groundwater at PICA-097 and PICA-131 has been addressed by the Area D and Mid-Valley Records of Decision (RODs), respectively. Groundwater is not a media of concern for PICA-149 because analytes detected in groundwater samples were not found at concentrations above levels of concern (LOCs) during the RIs (Final Proposed Plan, U.S. Army 2014). Surface water and sediment are not present at any of the three Sites.

1.3 OBJECTIVES AND APPROACH

The first performance objective for the 3 Site Group under the PBA contract is to achieve a Final ROD. The Army has determined that refinement of the horizontal and vertical delineation of COCs in soil within the areas of attainment is needed prior to finalization of the ROD document to determine the vertical extent of soil requiring remediation. While prior sampling generally identified the horizontal extent of soil contamination at each of the sites (defined in Worksheet #10), additional surface and subsurface soil sampling also needs to be conducted to tighten the horizontal boundaries of areas of excavation within the areas of attainment. The objective of this Work Plan is to present the rationale, methodologies, and QA/QC procedures for soil delineation at each of the three Sites.

The data gaps, objectives, deliverables, and rationale for this Work Plan are covered in Worksheets #10, #11, #14 and 16, and #17, respectively. Potential data gaps are summarized as follows:

Data Gaps: (Worksheet #10 – Conceptual Site Model)

- While prior sampling generally identified the horizontal extent of soil contamination (defined in Worksheet #10), additional surface and subsurface soil sampling needs to be conducted to tighten the horizontal boundaries of areas of excavation and also further define the vertical extent of COC-impacted soils at PICA-097 (Site 118), PICA-131 (Site 131), and PICA-149 (Site 149). Vertical extents of COCs in soil with concentrations greater than cleanup goals within the areas of attainment identified in the Final FS (see Worksheet #10) at the three Sites have been partially bounded; however, soil sampling is needed to more precisely determine the vertical limits of remediation. These additional data are needed to ensure the full extent of soil with concentrations of COCs greater than cleanup goals (to a maximum depth of 10 feet [pathways including soil deeper than 10 ft are considered incomplete for risk assessment]) are identified.

Objective: (Worksheet #11 – Project/Data Quality Objectives)

- To tighten the horizontal extent and determine the vertical extent of remediation within the areas of attainment at each of the three sites.

Deliverables: (Worksheets #14 and #16 – Project Tasks and Schedule)

- An Internal Draft ROD that includes the results of the soil sampling described in this work plan to refine remediation areas will be submitted to the Army for review. Responses to Army comments will be incorporated into the Draft ROD and submitted to regulators for review and comment (after receiving Army concurrence). The Final ROD will document responses to stakeholder comments on the Draft document. Achievement of a final ROD is a required performance objective of this PBA.
- An Environmental Restoration Information System (ERIS) submittal containing all analytical and geospatial (e.g., sample coordinates) data generated for this project will be prepared and provided to the Army.

Rationale: (Worksheet #17 – Sampling Design and Rationale)

- As part of developing this Work Plan, the current Conceptual Site Model (CSM), FS (ARCADIS 2014), Proposed Plan (U.S. Army 2014), and site data were reviewed. Based on these information inputs, additional sample locations were identified and are proposed in Worksheet #17 of this work plan.

1.4 ACTIVITIES

The scope and sequence of activities to be conducted under this Work Plan are identified in Worksheets #14 and #16 and are summarized below:

- Pre-investigation Activities
 - Work Plan approval
 - Acquire sampling materials
 - Coordinate site access
 - Obtain necessary permits and perform notifications (as needed).

- Mobilization, site access coordination, unexploded ordnance (UXO) avoidance support coordination, and utility clearance.
- Perform soil sampling, decontamination, and management of investigation-derived waste.
- Demobilization.
- Data management, review, and evaluation.
- Reporting
 - Internal Draft ROD
 - Draft ROD
 - Response to Comments on Draft ROD
 - Final ROD incorporating response to comments on Draft ROD
 - ERIS deliverable.

1.5 COMMUNICATIONS PLAN

The communications plan for the activities outlined in this Work Plan is straightforward. Field activities within PICA will be coordinated with the PICA Environmental Restoration Branch, Range Control Office, and Installation Safety Office prior to initiation of fieldwork. In addition, site access and field activities will be coordinated with area building managers and exclusion zones will be established as needed. The procedures provided in the AAP (ECC 2015d) will be followed for munitions and explosives of concern (MEC) avoidance/discovery. The ECC Team will notify USACE and PICA a minimum of 10 days in advance of fieldwork initiation; for activities that might impact installation personnel, ECC will conduct a coordination meeting at least 1 month in advance of fieldwork. All communication with USEPA Region 2 and NJDEP representatives will be coordinated through the PICA Project Manager for Environmental Restoration, Mr. Ted Gabel. The ECC team will take the lead coordinating and communicating with PICA, wherever possible, for issues such as permitting, escorts, waste management, etc., required to proceed with the field activities described in this Work Plan.

Table 1
Potential Site-Specific Logistics and Communications Checklist
 3 Site Group Soil Sampling Work Plan, PICA New Jersey

Logistics Consideration	Applicable?	Type	General Comments
Base Access and Access Passes	Yes	Weekly	Weekly accesses passes will be requested at the Main Gate (truck gate). Ted Gabel is the contact.
Communications Plan	Yes	---	Site-Wide UFP-QAPP, Worksheet #6 contains contact information, as does the Project Management Plan (ECC 2015a).
Coordination with Building Manager(s)	Yes	Buildings 41 and 266	Linda Speth for Buildings 41 and 266, 973-724-9510.

Table 2
Uniform Federal Policy Worksheets
 3 Site Group Soil Sampling Work Plan, PICA New Jersey

Worksheet #	Worksheet Title	Worksheet Types, Generic versus Site-Specific	Location
1 and 2	Title and Approval Page; Project Identifying Information	Generic and site specific	Work Plan
3 and 5	Distribution List; Project Organizational Chart	Generic	Site-Wide UFP-QAPP
4, 7, and 8	Project Personnel Sign-off Sheet; Personnel Responsibilities and Qualification Table; Special Training Requirements Table	Generic	Site-Wide UFP-QAPP
6	Communication Pathways	Generic	Site-Wide UFP-QAPP
9	Project Scoping Session Participants Sheet	Generic	Site-Wide UFP-QAPP
10	Problem Definition/Conceptual Site Model	Site-Specific	Work Plan
11	Project Quality Objectives/Systematic Planning Process Statements	Site-Specific	Work Plan
12	Measurement Performance Criteria	Generic	Site-Wide UFP-QAPP
13	Secondary Data Criteria and Limitations	Site-Specific	Work Plan
14 and 16	Summary of Project Tasks; Project Schedule Timeline	Generic and Site-Specific	Work Plan (Project Tasks) Site-Wide UFP-QAPP (Schedule)
15	Reference Limits and Evaluation Tables	Site-Specific	Work Plan
17	Sampling Design and Rationale	Site-Specific	Work Plan
18	Sampling Locations and Methods/ Standard Operating Procedure Requirements	Site-Specific	Work Plan
19 and 30	Analytical Standard Operating Procedure Requirements Table; Analytical Services Table	Generic and Site-Specific	Work Plan
20	Field Quality Control Summary Table	Site-Specific	Work Plan
21	Project Sampling SOP Reference Table	Generic	Site-Wide UFP-QAPP
22	Field Equipment Calibration, Maintenance, Testing, and Inspection	Generic	Site-Wide UFP-QAPP
23	Analytical Standard Operating Procedures References	Generic	Site-Wide UFP-QAPP
24	Analytical Instrument Calibration	Generic	Site-Wide UFP-QAPP
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection	Generic	Site-Wide UFP-QAPP
26 and 27	Sample Handling System; Sample Custody Requirements	Generic	Site-Wide UFP-QAPP
28	Quality Control Samples	Generic	Site-Wide UFP-QAPP
29	Project Documents and Records	Generic	Site-Wide UFP-QAPP
31, 32, and 33	Planned Project Assessments Table; Assessment Findings and Corrective Action Responses; Quality Assurance Management Reports Table	Generic	Site-Wide UFP-QAPP
34	Verification (Step I) Process Table	Generic	Site-Wide UFP-QAPP
35	Validation (Steps IIa and IIb) Process Table	Generic	Site-Wide UFP-QAPP
36	Analytical Data Validation (Step IIa and IIb) Summary Table	Generic	Site-Wide UFP-QAPP
37	Usability Assessment	Generic	Site-Wide UFP-QAPP

NOTE: Only worksheets with site-specific information are included in this Work Plan.

2. UFP-QAPP WORKSHEETS

This section documents the project organization, specific procedures for execution of the work, QC protocols, and the assessment and oversight planning that will help ensure the quality of the soil sampling. The worksheets follow the UFP Guidance for QAPPs (EPA 2005) and optimized worksheets (EPA 2012). As noted in Section 1.0 and Table 2, this Work Plan includes QAPP worksheets that contain site-specific information that is either not included in the Site-Wide UFP-QAPP or in need of revision.

This page intentionally left blank

QAPP WORKSHEETS #1 AND #2

Title and Approval Pages

Site Name/Project Name: 3 Site Group, New Jersey/Picatinny Arsenal Cleanup Contract

Site Location/Number: PICA, New Jersey/PICA-097 (Site 118), PICA-131 (Site 131), and PICA-149 (Site 149)

Contract/Work Assignment: W91ZLK-13-D-0014, Delivery Order-0007

Document Title: 3 Site Group Soil Sampling Work Plan

Lead Organization: Picatinny Arsenal, USACE and US Army Environmental Command (USAEC)

Preparation Date (Month/Year): December 2015

Lead Organization's Contact: Ted Gabel/PICA Environmental Restoration Project Manager
 Emily Schiffmacher, P.E./USACE Contracting Officer's Representative (COR); Russell Marsh, USACE Project Manager
 Mary Ellen Maly, USAEC Program Manager

Federal Regulatory Agency: William Roach/EPA Region 2 Remedial Project Manager

State Regulatory Agency: Anne Pavelka/NJDEP Case Manager

The QAPP is (select one): Generic Site-Specific

List dates and titles of any documents written for previous site work, that are relevant to the current investigation:

Table 1-1
Previously Prepared Documents Relevant to Environmental Investigation at the 3 Site Group
3 Site Group Soil Sampling Work Plan, PICA New Jersey

Title	Author	Approval Date
<i>Site Investigation of Picatinny Arsenal, New Jersey, Volumes I and II</i>	Dames and Moore	1998

Title	Author	Approval Date
<i>Phase I Remedial Investigation Report Volume 7, Ecological Assessment</i>	Dames and Moore	1998
<i>Phase II Remedial Investigation Report, Round 1, Volume 3, Area 1, 2A/3A-Site Recommended for Additional Investigation, Picatinny Arsenal Task Order 05</i>	ICF Kaiser	1998
<i>Phase II Remedial Investigation Report, Round 1, Volume 3, Area 1 – No Further Action Sites, Picatinny Arsenal Task Order 05</i>	ICF Kaiser	1998
<i>Phase II Remedial Investigation Report, Round 1, Volume 3, Area 1 – Specific Appendices, Picatinny Arsenal Task Order 05</i>	ICF Kaiser	1999
<i>Phase II Ecological Risk Assessment Remedial Investigation/Feasibility Study, Picatinny Arsenal, New Jersey, Volume 1</i>	IT	2000
<i>Final Record of Decision, Green Pond Brook/Bear Swamp Brook</i>	U.S. Army	2004
<i>Phase II Remedial Investigation Report, Rounds 1 and 2</i>	Shaw Environmental	2005
<i>Phase II Remedial Investigation Report, Rounds 1 and 2, Volume 2 – Area H Sites. Prepared for USACE</i>	Shaw Environmental	2005
<i>Picatinny Task Order 17 Phase I 2A/3A Sites Remedial Investigation Report</i>	Shaw Environmental	2005
<i>Phase III and Phase I 2A/3A Sites Screening Level Ecological Risk Assessment</i>	Shaw Environmental	2005
<i>Final Feasibility Study, PICAs 097, 131, and 149. U.S. Army Garrison Picatinny Arsenal, New Jersey. Prepared for U.S. Army</i>	ARCADIS	2014
<i>Final Proposed Plan, PICA-097,-131, and -149 (Sites 118, 131, and 149)</i>	U.S. Army	2014
<i>Draft Site-Wide Uniform Federal Policy Quality Assurance Project Plan.</i>	ECC	2015

QAPP WORKSHEET #10

Conceptual Site Model

This worksheet presents the site-specific CSM for the 3 Site Group. The CSM describes the site background, site geology and hydrogeology, nature and extent of contamination in soil as presently understood based on available site data, potential receptors and exposure pathways, and current land uses.

For purposes of the nature and extent discussions presented below, the LOCs are the NJDEP non-residential soil remediation standards (NRSRS) or, in the absence of state criteria, the USEPA Industrial Regional Screening Levels (IRSLs). It should be noted that the cleanup goals identified for COCs in the Final FS were equal to the NJDEP NRSRS values unless the value was an inhalation-based value (relates to manganese at PICA-097 only, as described below). In the case of manganese, the USEPA IRSL value was used as the cleanup goal. Therefore, for all COCs except for manganese, the LOC is the same as the cleanup goal.

PICA-097 (SITE 118), PESTICIDE STORAGE FACILITY

Site Background (PICA-097)

PICA-097 (Site 118) is approximately 0.1 acres in size and includes Building 41, which is located near the 14th hole tee box of the golf course. Figure 10-1 presents the Site layout. Building 41 was constructed in 1956 and prior to 1964 was used for storage; however, the nature of stored items was not documented. In 1964 the building was re-assigned and used for storage of pesticides and herbicides that were applied to the golf course. In the past, the roof of Building 41 leaked during rainfall events, and the water contacted open bags of pesticides and herbicides; subsequently causing pesticides and herbicides to spill onto the concrete floor. Building 41 currently does not contain any pesticides or herbicides, and is used for the storage of golf course maintenance equipment.

Previous Investigations (PICA-097)

As shown above in Table 1-1, several investigations have been conducted that included evaluation of PICA-097 (Site 118). In 1986 the United States Geological Survey (USGS) performed a base-wide geophysical survey. This survey found elevated conductivity readings throughout the area adjacent to Building 41. It was concluded that these data suggested groundwater contamination in the area. From 1982 through 1990, two wells on the north side of Building 41 were included in a groundwater monitoring program performed for the Area D trichloroethylene plume.

Because Building 41 was originally used for pesticide storage, a number of investigations focusing on pesticides and herbicides have been completed at PICA-097 (Site 118). These investigations involved soil sampling as part of a 1988 United States Army Environmental Health Agency (USAEHA) pesticide risk management study, a 1990 supplemental soil study, and a 1997 USAEHA pesticide evaluation of the golf course.

PICA-097 (Site 118) has also been evaluated in two RIs. Dames and Moore completed a Phase I RI in 1998. This RI evaluated surface soil, subsurface soil, and groundwater. An additional RI (Phase I 2A/3A Sites) was completed in 2005 (Shaw 2005). This RI involved the collection of surface soil samples that were analyzed for a limited list of metals.

Nature and Extent of Contamination, Risk Assessment Summary (PICA-097)

In surface and subsurface soils, there were no detections of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), or explosives at concentrations greater than LOCs. The pesticides dieldrin and heptachlor epoxide were detected in a few surface soil samples at concentrations greater than LOCs, as were arsenic, manganese, and thallium (ARCADIS 2014).

A human health risk assessment (HHRA) was completed as part of the Phase I 2A/3A RI. The HHRA evaluated the industrial/research worker, outdoor maintenance worker, and construction/excavation worker. The total carcinogenic risk from exposure to soil for all receptors was within the USEPA acceptable risk range of 1×10^{-4} to 1×10^{-6} . The total non-carcinogenic hazard was below the threshold of 1 for the outdoor maintenance worker but was greater than 1 for the industrial/ research worker and construction/excavation worker. The constituents driving the hazard for these two scenarios were thallium and manganese. The lead blood model results concluded that lead is not a concern at Site 118 (ARCADIS 2014).

A preliminary ecological risk assessment (ERA) was completed as part of the 1998 RI. This ERA indicated that there was a potential for risks to avian species from metals and 4,4'-dichlorodiphenyltrichloroethane in soil. Concentrations of metals reported during subsequent investigations were greater than wildlife screening concentrations; however, given the size of the site (0.1 acre), the fact that the vegetation is primarily mowed and maintained (providing little habitat for ecological receptors), and the site's location in the middle of the golf course, the potential for significant exposure was determined to be limited. In addition, golf courses are routinely treated with fertilizers and pesticides, which could confound the results of any risk evaluation. For these reasons a baseline ERA was deemed unnecessary (Final Proposed Plan, U.S. Army 2014).

Identification of Contaminants of Concern Considered in the Feasibility Study (PICA-097)

As part of the Final FS (ARCADIS 2014), the RI and risk assessment results were reviewed and specific COCs in soil requiring consideration in the remedial alternatives evaluation were identified. The COCs identified for PICA-097 (Site 118) were thallium, arsenic, manganese, lead, dieldrin, and heptachlor epoxide. The likely source of these COCs were items historically stored and used in the building, such as pesticides and other golf course maintenance equipment/items, that may have spilled and caused a release to the environment.

Cleanup goals were then established for the COCs. In accordance with USEPA policy, the cleanup goals were equal to the NJDEP NRSRS unless the NRSRS value was an inhalation-based value. In that case, the USEPA IRSL value was used as the cleanup goal. Cleanup goals are presented in Table 10-1.

The NJDEP NRSRS value for manganese is an inhalation-based value. Therefore, the USEPA IRSL was identified as the cleanup-goal rather than the NRSRS. The USEPA IRSL for

manganese is higher than the NJDEP NRSRS, and the maximum concentration of manganese detected at PICA-097 (13,000 milligrams per kilogram [mg/kg]), while greater than the NRSRS (5,900 mg/kg), was less than the IRSL (23,000 mg/kg). For this reason manganese is not retained as a COC for PICA-097 and is not presented in Table 10-1. However, there was a typographical error in the Proposed Plan (U.S. Army 2014), and manganese was listed as a COC at this Site. Because the maximum concentration of manganese detected at PICA-097 is less than the USEPA IRSL, manganese will not be identified as a COC in the ROD and samples collected as part of this Work Plan, and soil samples will not be analyzed for manganese.

Figure 10-2 presents the historical sample locations and identifies those locations where FS COCs have been found at concentrations greater than cleanup goals.

Table 10-1. Site-Specific Cleanup Goals for the 3 Site Group
 3 Site Group Soil Sampling Work Plan, PICA New Jersey

Contaminant of Concern	Cleanup Goal (mg/kg) ¹
Site 118/PICA-097	
Arsenic	19
Dieldrin	0.2
Heptachlor epoxide	0.3
Lead	800
Thallium	79
Site 131/PICA-131	
Arsenic	19
Benzo(a)anthracene	2
Benzo(a)pyrene	0.2
Benzo(b)fluoranthene	2
Site 149/PICA-149	
2,4-Dinitrotoluene	3
Benzo(a)anthracene	2
Benzo(a)pyrene	0.2
Benzo(b)fluoranthene	2
Dibenz(a,h)anthracene	0.2
Indeno(1,2,3-c,d)pyrene	2

¹Cleanup goals are the NJDEP NRDCSRS values.

PICA-131 (SITE 131), FORMER ORDNANCE MANUFACTURING FACILITY

Site Background (PICA-131)

PICA-131 (Site 131) is approximately 1.2 acres and includes Building 266 (Figure 10-3). Building 266 was constructed in 1903 and served as an explosives production facility from 1903 to 1953, when it was converted to its current use as a wind tunnel research facility. During use as an explosives production facility, the material used and/or wastes generated are not clearly documented; however, based on documentation for explosives operations in Area H, materials used and/or derivative wastes generated in appreciable quantities would likely have included scrap explosives wastes and possibly pyrotechnics and explosive-contaminated wastewater, which were generally placed in red cans and disposed of at the PICA Burning Ground. Wastewater from Building 266 presently discharges to a sanitary sewer; however, oil-contaminated wastewater generated by the wind tunnel was previously conveyed to an oil-water

separator that discharged to Bear Swamp Brook. Mercury condensate in and around the wind tunnel exhaust area was subject to a 1992 investigation and removal, with historical soil confirmation data reporting concentrations of mercury that were lower than the NJDEP cleanup criterion at that time. Several non-polychlorinated biphenyl (PCB) transformers also were removed from PICA-131 in the 1990s (ARCADIS 2014a).

Previous Investigations (PICA-131)

As indicated in Table 1-1, several investigations have been conducted that included evaluation of PICA-131 (Site 131).

An internal investigation and several isolated sampling events were conducted prior to the RI at PICA-131. These investigations included sampling in 1988 of stained soil from a leaky air compressor, a 1991 soil sampling event around Building 266, a 1991 Armament Research, Development, and Engineering Center (ARDEC) Discharge Investigation, a 1992 Internal Investigation for an accidental mercury spill, and a radiation survey of Building 226.

PICA-131 (Site 131) has also been evaluated in two RIs. Dames and Moore completed a Phase I RI in 1998. This RI evaluated surface soil, subsurface soil, and groundwater. A Phase II RI was completed in 2005 (Shaw 2005b), which also involved the collection of surface soil, subsurface soil, and groundwater samples that were analyzed for a limited list of analytes, including explosives, SVOCs, VOCs, pesticides/PCBs and total petroleum hydrocarbons (TPH).

Nature and Extent of Contamination, Risk Assessment Summary (PICA-131)

The results of the 1988 sampling of stained soil indicated that PCB concentrations were below detectable limits and that TPH levels were less than the NJDEP cleanup criterion. Results of the other soil investigations indicated that base neutral/acid extractables and metals were present but that remaining mercury concentrations were below the NJDEP mercury cleanup criterion. VOCs and explosives were also not detected at concentrations above cleanup criterion in any of the soil samples that indicated a release of those compounds at the site. PAHs were detected at concentrations greater than LOCs in a few soil samples, as was arsenic. The potential source for the elevated PAH detections may be the adjacent paved parking area and associated roadway, and the elevated arsenic detections are likely a result of wind tunnel operations and the potential release of compressor and lubricating oils.

An HHRA was completed as part of the Phase I 2A/3A RI. The HHRA evaluated the exposure for the industrial/research worker and the construction/excavation worker receptors for soil. The total non-carcinogenic hazard was below the threshold of 1 for both receptors. The total carcinogenic risk from exposure to soil for the construction/excavation worker was within the USEPA acceptable risk range of 1×10^{-4} to 1×10^{-6} , while the total carcinogenic risk for the industrial/research worker (2×10^{-4}) was above the acceptable risk range. The constituent driving the risk for this scenario was arsenic (ARCADIS 2014). Lead was not a COPC at this site and the Lead Blood Model was not evaluated.

PICA-131 (Site 131) was included in the ERA completed as part of the Phase II RI (Shaw 2005b). The ERA identified a potential for risks to small mammals from arsenic in soil (Final Proposed Plan, U.S. Army 2014).

Identification of Contaminants of Concern Considered in the Feasibility Study (PICA-131)

As part of the Final FS (ARCADIS 2014), the RI and risk assessment results were reviewed and specific COCs requiring consideration in the remedial alternatives evaluation were identified. The COCs identified for PICA-131 (Site 131) were arsenic, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene. Cleanup goals were then established for the COCs. The cleanup goals were equal to the NJDEP NRSRS values unless the NRSRS value was an inhalation-based value. In that case, the USEPA IRSL value was used as the cleanup goal. Cleanup goals are presented in Table 10-1.

Figure 10-4 presents the historical sample locations and identifies those locations where FS COCs have been found at concentrations greater than cleanup goals.

PICA-149 (Site 149), PROPELLANT PLANT

Site Background

PICA-149 covers 0.8 acre of forested habitat, located along Picatinny Lake, and included former Building 541 (Figure 10-5). Former Building 541 was constructed in 1943 and demolished in 1983. Former Building 541 was used from 1943 to the mid-1950s for the water drying process to harden explosive powder grains. At some point during this period, a cypress drying vat in the building ruptured, releasing a solution of single base propellant grains dissolved in solvents onto the building floor and to the outside area. The energetic compounds were nitrocellulose and/or nitroglycerine. The solvents were ether, alcohol, and/or acetone. In the 1960s the building was used to house two Plymouth gas locomotives. Building 541 was demolished in 1983.

Previous Investigations (PICA-149)

PICA-149 was first investigated as part of the Phase II RI (Shaw 2005b). Surface soil, subsurface soil, and groundwater samples were collected at this site during that RI. Samples were analyzed for VOCs, SVOCs, explosives, metals, pesticides/PCBs, and anions.

Nature and Extent of Contamination, Risk Assessment Summary (PICA-149)

The results of the RI sampling indicated that PAHs and explosives were present in surface and subsurface soil at concentrations greater than LOCs. The potential source for these compounds was the historic release of energetic compounds and associated solvents from the ruptured cypress vat. PAH detections are also observed adjacent to paved roadways and possibly in natural drainages from the roadways, which could be a source for those compounds. No metals, pesticides, PCBs, cyanide, or anions were detected at concentrations greater than their respective LOCs in surface or subsurface soils.

A HHRA was completed as part of the Phase II RI. The HHRA evaluated the industrial/research worker and construction/excavation worker. The total non-carcinogenic hazard was below the threshold of 1 for the construction/excavation worker and was equal to 1 for the industrial/research worker. The total carcinogenic risk from exposure to soil for the construction/excavation worker was within the USEPA acceptable risk range of 1×10^{-4} to 1×10^{-6} , while the total carcinogenic risk for the industrial/research worker (2×10^{-4}) was above the acceptable risk range. The constituent driving the risk for this scenario was 2,4-dinitrotoluene (ARCADIS 2014). Lead was not a COPC at this site and the Lead Blood Model was not evaluated.

PICA-149 (Site 149) was not included in the ERA completed as part of the Phase II RI. The FS indicates that the risk analyses performed for neighboring sites with similar habitat suggest that the potential for risks to populations of ecological receptors at PICA-149 is minimal (ARCADIS 2014).

Identification of Contaminants of Concern Considered in the Feasibility Study (PICA-149)

As part of the Final FS (ARCADIS 2014), the RI and risk assessment results were reviewed and specific COCs requiring consideration in the remedial alternatives evaluation were identified. The COCs identified for PICA-149 (Site 149) were 2,4-dinitrotoluene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene. Cleanup goals were then established for the COCs. The cleanup goals for these COCs were equal to the NJDEP NRSRS values. Cleanup goals are presented in Table 10-1.

Figure 10-6 presents the historical sample locations and identifies those locations where FS COCs have been found at concentrations greater than cleanup goals.

SITE GEOLOGY, HYDROGEOLOGY, and TOPOGRAPHY

PICA lies within Green Pond Valley, a glaciated river valley bounded by Green Pond Mountain on the west, Green Pond and Copperas Mountains on the northwest, and an unnamed hill on the southeast. Elevations at PICA range from approximately 1,000 feet (ft) above mean sea level to 700 ft above mean sea level at Green Pond Brook at the southern installation boundary. Green Pond Valley is filled with glacially-derived sediments surrounded and underlain by bedrock. The basement rocks are faulted by a series of northeast/southwest trending faults.

The principal source of groundwater in the Green Pond Valley is found in the stratified drift deposits filling the valley floor. The low-permeability and the steep slopes of Green Pond Mountain and Copperas Mountain restrict infiltration of precipitation in these mountains. As a result, most precipitation flows overland and into the highly permeable stratified drift deposits in the valley center. The small amount of precipitation that enters Green Pond and Copperas Mountains flows down through shallow fractures to the glacial sediments in the valley. The principal aquifers in the PICA region are located in stratified drift deposits found in the valley areas. The bedrock aquifer is infrequently used for production wells because of limited fracture occurrence and generally low hydraulic conductivity.

Area D, in which PICA-097 (Site 118) is located, is generally flat with elevations ranging from approximately 695 to 715 ft above msl. Surface water runoff is minimal, as precipitation on the golf course and other undeveloped, grassy portions of Area D infiltrates into the ground. Storm drains leading to Bear Swamp Brook control surface water runoff. PICA-097 (Site 118) is located in the middle of the golf course (Figure 1-1). Area H, in which PICA-131 (Site 131) is located, is situated in a small valley bounded on the west by Green Pond Mountain and to the east-southeast by a slightly elevated hill. PICA-131 (Site-131) is located in a moderately developed area. There is no surface water or wetlands at Site 118 or Site 131, and the Sites are located outside of the 100 year floodplain.

PICA-149 is located near the edge of Picatinny Lake, in Area I (Figure 1-1). Picatinny Lake is a groundwater discharge area and drains the installation via Green Pond Brook. PICA-149 is not located in a wetland specified by the National Wetland Inventory or in the 100-year floodplain specified by the Federal Emergency Management Agency (ARCADIS 2014).

CONTAMINANT FATE AND TRANSPORT

The COCs identified in the soil at PICA-097, PICA-131, and PICA-149 (based on the findings of previous CERCLA investigations) are metals, PAH, explosives, and pesticides (Table 10-1). In the context of this work plan, these are the target COCs for this work. Soil samples will be submitted for laboratory analyses of only these defined COCs.

The metals identified as COCs will adsorb to soil and are persistent in the environment. Metals cannot be degraded, but some can be transformed among various oxidation states, which alters their mobility and toxicity. Metals can also be immobilized by the natural processes of adsorption, ion exchange, complexation, and precipitation. These metals can bioaccumulate, but not all biomagnify in the foodchain.

Organic compounds present in the environment will, in the long-term, reduce to elemental forms (e.g., carbon, hydrogen, and oxygen) with exposure to water, air, bacteria, sunlight, or combinations thereof. Persistence of organic constituents in the environment is related to resistance to degradation. Biodegradation of PAHs in soil is expected to be a slow fate process, and adsorption to soil is expected to inhibit biodegradation. Both dieldrin and heptachlor epoxide are highly persistent in soil (i.e., they degrade slowly) and are expected to have low to no mobility in soil. These pesticides bioconcentrate in the foodchain.

REFINEMENT OF AREAS OF ATTAINMENT

As presented in Figures 10-7 through 10-9, soil sampling will be conducted to tighten the horizontal extent and further determine the vertical extent of COC-contaminated soils within the areas of attainment at each of the three sites (as presented in the FS [ARCADIS 2014] and Proposed Plan [U.S. Army 2014]). Upon completion of soil sampling, the soil remediation estimates and associated cost will be revised and presented in the ROD.

This page intentionally left blank

QAPP WORKSHEET #11

Project/Data Quality Objectives

This worksheet is used to develop and document project data quality objectives (DQOs) using a systematic planning process that follows the USEPA DQO process (USEPA 2006) and documents the necessary environmental decisions and the level of data quality. The seven steps of the DQO process are: (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 Analytic Approach, (6) Specify Performance or Acceptance Criteria, and (7) Develop the Detailed Plan for Data Collection.

STATE THE PROBLEM

While prior sampling generally identified the horizontal extent of soil contamination (defined in Worksheet #10), additional surface and subsurface soil sampling needs to be conducted to tighten the horizontal boundaries of areas of excavation and also further define the vertical extent of COC-impacted soils at PICA-097 (Site 118), PICA-131 (Site 131), and PICA-149 (Site 149).

IDENTIFY THE GOALS OF THE STUDY

The data collected from this investigation will be used to achieve the following goals:

- Tighten the horizontal extent and determine the vertical extent of COCs present in soils at concentrations above cleanup goals within the areas of attainment, to a maximum depth of 10 ft.
 - Delineation beyond 10 ft below ground surface (bgs) is not proposed because exposure pathways including soil deeper than 10 ft are considered incomplete for the construction worker receptor for risk assessment for soil. Further, the average depth to groundwater at each of the sites (based on existing monitoring wells at the site) is 9 to 11-ft bgs, and groundwater COCs at PICA-097 and PICA-131 have been addressed by the Area D and Mid-Valley RODs, respectively. Groundwater is not a media of concern for PICA-149 because analytes detected in groundwater samples were not found at concentrations above LOCs during the RIs (Final Proposed Plan, U.S. Army 2014).
- Use results from the additional soil sampling at each of the three sites to refine the size and volume of excavation areas and revise the associated cost estimates in the ROD. Note that additional soil samples will be collected during and/or following soil excavation activities, which will be discussed in the Remedial Design.
- Resultant data will also be used to perform risk assessment evaluations to ensure that the previously completed risk assessments are representative of the new data set, and if necessary the new data will be used to revise the risk assessments.

IDENTIFY INFORMATION INPUTS

The following existing information was used to construct the CSM and to identify the areas requiring refined delineation:

- Historical soil sampling data
- Areas of excavation identified in the Final FS and PP
- Cleanup goals identified in the Final FS and PP.

Soil data collected from the sampling locations and intervals listed in Worksheet 18 and analyzed for the site COCs by the analytical methods specified in Worksheet 15. Data collected will consist of validated laboratory analytical data from soil samples analyzed for the COCs specified in the Final FS and PP, and Worksheet #10.

DEFINE THE BOUNDARIES OF THE STUDY

Areas of attainment identifying horizontal extent of where COCs are above cleanup goals at each of the three Sites are presented on Figures 10-7 through 10-9. As discussed in Worksheet #10, horizontal and vertical extents of soil contamination need to be further refined within the areas of attainment at the three sites; which will be accomplished through the collection of soil samples using a step-down approach. Proposed sampling locations are presented in Figures 10-7 through 10-9, and additional details are provided in Worksheet #14.

DEVELOP THE ANALYTICAL APPROACH

Soil data are required to tighten horizontal extent and determine vertical extent of COC-impact soils above cleanup goals within the areas of attainment at each of the three Sites. Soil sampling and analysis will follow the methods presented in the Site-Wide UFP-QAPP and Worksheets #17 and #18 of this Work Plan.

SPECIFY PERFORMANCE OR ACCEPTANCE CRITERIA

Definitive quality data will be used to tighten the horizontal extent and determine the vertical extent of soil contamination exceeding cleanup goals within the areas of attainment at each of the 3 sites (Figures 10-7 through 10-9). Data obtained during the sampling effort will be used to update the CSM. Data will be generated using standard and accepted analytical methods (see Worksheet #15). The use of these data is not restricted unless there is a quality problem associated with them.

The derivation of project action levels is detailed in Worksheet #15. The action levels consist of the cleanup goals identified in the Final FS (ARCADIS 2014) and Final Proposed Plan (U.S. Army 2014).

DEVELOP THE DETAILED PLAN FOR DATA COLLECTION

The scope and sequence of activities to be conducted under this Work Plan are detailed in Worksheets #14, #15, #17, and #18 and are summarized below:

- Pre-investigation activities
- Mobilization and performance of soil sampling
- Demobilization
- Data management, review, and evaluation
- Reporting.

This page intentionally left blank

QAPP WORKSHEET #13

Secondary Data Uses and Limitations

The term secondary data includes data collected from previous investigations, as well as regional, local, and arsenal-wide reference materials that may be used to increase the understanding of current site conditions. The following table identifies the limitations of previously collected data.

Secondary Data	Data Source ¹	Data Uses Relative to Current Project	Factors Affecting the Reliability of Data and Limitations on Data Use
Chemical laboratory data	Previous site reports	Validated data will be used for applicable DQO purposes, including nature and extent determinations and risk assessment evaluations.	Changes in site conditions since data were generated. Changes in analytical methods. Analyte detection limits appropriate to meet project goals.
Geographic information system mapping layers and coordinates	Previous site reports and PICA geodatabase	Data will be used to determine sample and site feature locations to support CSMs and delineation evaluations.	Review of data and professional judgment will be required to determine applicability and usability of data.

¹ Data sources relevant to environmental investigation at the 3 Site Group are presented in Table 1-1.

This page intentionally left blank

QAPP WORKSHEETS #14 AND #16

Project Tasks/Project Schedule

Tasks to be completed during the soil delineation effort are listed below. All work will be coordinated with USACE and appropriate PICA points-of-contact. The project schedule is presented in the Project Management Plan (ECC 2015).

- Pre-investigation Activities
 - Work Plan approval
 - Acquire sampling materials
 - Coordinate site access
 - Obtain necessary permits and perform notifications (as needed).
- Mobilization and Soil Sampling
 - UXO avoidance—avoidance procedures will be followed according to the AAP (ECC 2015d)
 - Soil sampling and collection of sample location coordinates.
- Demobilization
 - Equipment (e.g., geoprobe rigs) will be demobilized following completion of the field activities.
- Data management, review, and evaluation
 - Maintenance of a field log book and/or standard field forms
 - Identification of samples requiring analysis based on initial laboratory results for samples located closest to past sampling locations
 - Validation of analytical data (see Worksheet #36 of the Site-Wide UFP-QAPP).
- Reporting
 - Letter-style data report (including data table and figures)
 - Internal Draft, Draft, and Final ROD
 - Electronic data deliverable
 - Incorporation into geographic information system
 - ERIS deliverable (analytical data).

A detailed description of the sampling process and rationale for the project tasks is presented in Worksheet #17. Refer to Worksheet #21 of the Site-Wide UFP-QAPP for the list of field Standard Operating Procedures (SOPs).

QAPP WORKSHEET #15

Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

The previously-defined target analytes for the 3 Site Group soil sampling activities are arsenic, lead, thallium, dieldrin, heptachlor epoxide, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, 2,4-dinitrotoluene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene. These analytes will be measured via the methods identified in Table 15-1.

Table 15-1
Reference Limits For Soil
 3 Site Group Soil Sampling Work Plan, PICA New Jersey

Analyte	Analytical Method	CASRN	Units	Project Action Limit ¹	Site Cleanup Goal ²	Achievable Laboratory Limits			Laboratory
						LOQ	LOD	DL	
Metals									
Arsenic	SW846 6010C	7440-38-2	mg/kg	19	19	2	1.2	0.6	Empirical
Lead	SW846 6010C	7439-92-1	mg/kg	800	800	1	0.6	0.3	Empirical
Thallium	SW846 6010C	7440-28-0	mg/kg	79	79	1.6	0.8	0.6	Empirical
Explosives									
2,4-Dinitrotoluene	SW846 8330B	121-14-2	mg/kg	3	3	0.08	0.04	0.02	Empirical
PAHs									
Benzo(a)anthracene	SW846 8270 SIM	56-55-3	mg/kg	2	2	0.00667	0.00333	0.00167	Empirical
Benzo(a)pyrene	SW846 8270 SIM	50-32-8	mg/kg	0.2	0.2	0.00667	0.00333	0.00167	Empirical
Benzo(b)fluoranthene	SW846 8270 SIM	205-99-2	mg/kg	2	2	0.00667	0.00333	0.00167	Empirical
Dibenz(a,h)anthracene	SW846 8270 SIM	53-70-3	mg/kg	0.2	0.2	0.00667	0.00333	0.00167	Empirical
Indeno(1,2,3-c,d)pyrene	SW846 8270 SIM	193-39-5	mg/kg	2	2	0.00667	0.00333	0.00167	Empirical
Pesticides									
Dieldrin	SW846 8081	60-57-1	mg/kg	0.2	0.2	0.000667	0.00034	0.00017	Empirical
Heptachlor epoxide	SW846 8081	1024-57-3	mg/kg	0.3	0.3	0.000667	0.00034	0.00017	Empirical

NOTES:

¹ Project Action Limits are the cleanup goals used in the Final FS.

² Site Cleanup Goals are equal to the NJDEP Non-Residential Direct Contact Soil Remediation Standard (NRDCSRS) values.

CASRN = Chemical Abstracts Service Registry Number.

DL = detection limit.

LOD = limit of detection.

LOQ = limit of quantitation.

mg/kg = milligram(s) per kilogram.

QAPP WORKSHEET #17

Sampling Design and Rationale

This worksheet describes the sampling design and rationale for completing the refinement the horizontal and vertical extent of COC-impacted soils within the areas of attainment at the three Sites. Surface soil samples (0-0.5 ft bgs) will be collected from each of the three Sites. Up to three subsurface soil samples will also be collected from each sample location using direct push technology (DPT). Each DPT boring will be advanced up to 10 ft bgs to facilitate the evaluation for potential risk for any future construction at the sites. Soil deeper than 10 ft bgs will not be sampled because exposure pathways for soil deeper than 10 ft are considered incomplete for the construction worker receptor for risk assessment. Further, the average depth to groundwater at the sites is 9 to 11-ft bgs (based on existing monitoring wells at the sites) and COCs identified for groundwater for PICA-097 and -131 are being addressed under separate RODs (there were no COCs identified in groundwater at PICA-149). Thus, sample collection will be performed above the water table and to the extent of potential risk exposure to construction workers, which is 10-ft bgs.

Soil Sampling

Surface and subsurface soil samples will be collected from each boring location using DPT. This consists of driving a 2-inch outside diameter, 48-inch long piston-type sampler containing a clean, dedicated non-reactive plastic liner to the top of the desired sample interval. The piston within the sampler is released and the pipe is advanced through the target interval to obtain a soil core. After removing the drive rod from the soil, the liner containing the soil sample is removed and split longitudinally for sampling. Upon splitting the soil sample, all changes in the lithology will be recorded.

Surface soil samples will be collected from the 0 to 0.5-ft depth interval from each DPT core at every location. For subsurface samples, each DPT soil core will be visually inspected for signs of any potential impact (e.g., soil staining). If signs of impact are observed, a subsurface soil sample will be collected from that portion of the core. If no sign of impact is observed, then subsurface soil samples will be obtained from the following depth intervals: 1-2 ft bgs; 4-5 ft bgs; and 9-10 ft bgs. The 1-2 ft bgs soil samples will be analyzed on a 24-hour turnaround time from the laboratory, and the deeper interval samples will be held by the laboratory. If concentrations of COCs exceed cleanup goals in the 1-2 ft sample, then the laboratory analysis will be conducted on each successive depth interval until results are below cleanup goals or until the last sample has been analyzed.

Proposed soil sample locations for each site are discussed below, and a summary of the locations and associated coordinates are presented in Table 17-1. Sample identification numbers have been developed in accordance with the method described in Worksheet 27 of the Site-Wide UFP-QAPP. Proposed sample identification numbers are presented in Table 17-1.

Table 17-1
 Proposed Soil Samples and Associated Coordinates
 3 Site Group Soil Sampling Work Plan, PICA New Jersey

Site ID	Proposed Sampling Location Identification Number ¹	X-Coordinate ²	Y-Coordinate ²
PICA-097 (Site 118)	D-118-SS-020	472652.651	766251.1211
PICA-097 (Site 118)	D-118-SS-021	472661.6319	766296.6118
PICA-097 (Site 118)	D-118-SS-022	472671.765456	766281.409584
PICA-097 (Site 118)	D-118-SS-023	472673.7957	766309.4619
PICA-097 (Site 118)	D-118-SS-024	472700.0869	766308.8377
PICA-097 (Site 118)	D-118-SS-025	472744.3135	766370.265
PICA-097 (Site 118)	D-118-SS-026	472735.8261	766368.9916
PICA-097 (Site 118)	D-118-SS-027	472788.5943	766343.8341
PICA-097 (Site 118)	D-118-SS-028	472780.669	766342.2756
PICA-131 (Site 131)	H-131-SS-014	473811.3698	769494.5471
PICA-131 (Site 131)	H-131-SS-015	473820.8225	769533.448
PICA-131 (Site 131)	H-131-SS-016	473849.7986	769510.2256
PICA-131 (Site 131)	H-131-SS-017	473879.2253	769554.1677
PICA-131 (Site 131)	H-131-SS-018	473972.599367	769493.20121
PICA-131 (Site 131)	H-131-SS-019	473963.0158	769478.9116
PICA-131 (Site 131)	H-131-SS-020	473942.498364	769468.49333
PICA-149 (Site 149)	I-149-SS-009	478812.782056	771604.642467
PICA-149 (Site 149)	I-149-SS-010	478818.79448	771587.845896
PICA-149 (Site 149)	I-149-SS-011	478829.059978	771579.776305
PICA-149 (Site 149)	I-149-SS-012	478851.374856	771578.000807
PICA-149 (Site 149)	I-149-SS-013	478812.5887	771549.0681
PICA-149 (Site 149)	I-149-SS-014	478856.9061	771554.8928
PICA-149 (Site 149)	I-149-SS-015	478868.5088	771533.9868
PICA-149 (Site 149)	I-149-SS-016	478806.5128	771473.5594

NOTES:

¹ A unique sampling location identification number is designated for each sampled location (i.e., set of coordinates) that consists of Site Number, media, and location number. The sample collection depth and date will be appended to the sampling location identification number.

² Coordinate System: NAD83 New Jersey State Plane U.S.-Foot

QA/QC samples will be collected as described in Worksheet 20 of the Site-Wide UFP-QAPP.

PICA-097 (Site 118)

As discussed in Worksheet #10, concentrations of arsenic, lead, thallium, dieldrin, and heptachlor epoxide were detected at concentrations greater than cleanup goals at multiple sample locations at PICA-097 up to 2-ft bgs. Sampling will be biased around these areas to refine impacted soil dimensions above CUGs within the areas of attainment. Surface and subsurface soil samples will be collected as described above and will be analyzed for arsenic, lead, thallium, dieldrin, and heptachlor epoxide. Proposed sample locations are presented in Figure 10-7.

PICA-131

As discussed in Worksheet #10, concentrations of arsenic, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene were detected at concentrations greater than cleanup goals down to 2-

ft bgs in soil samples at PICA-131. Areas of attainment to the west and east of Building 266, along with a smaller area to the north, will be horizontally and vertically refined based on samples proposed for these areas. Surface and subsurface soil samples will be collected as described above and will be analyzed for arsenic, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene. Proposed sample locations are presented in Figure 10-8.

PICA-149

As discussed in Worksheet #10, 2,4-dinitrotoluene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene were detected at concentrations greater than cleanup goals down to 2-ft bgs at PICA-149. Five areas of attainment were identified at this Site in the Final FS (ARCADIS 2014). Surface and subsurface soil samples will be collected as described above and will be analyzed for 2,4-Dinitrotoluene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene. Proposed sample locations are presented in Figure 10-9.

Post-ROD Sampling

The results from the soil sampling at each of the three sites, as presented in this Work Plan, will be used to refine the size and volume of excavation areas and revise the associated cost estimates in the ROD. However, following this sampling event additional soil samples will be collected during and/or following soil excavation activities, which will be discussed in the Remedial Design.

This page intentionally left blank

QAPP WORKSHEET #18

Sampling Locations and Methods

Table 17-1 and Figures 10-7 through 10-9 identify the proposed sampling locations. Sample analyses will vary by site. The analyses are based on COCs historically present at concentrations greater than the cleanup goals identified in the Final FS, which are being used as project action limits for this Work Plan. The target COCs and analytical methods are (see also Worksheet #15):

- PICA-097 (Site 118): arsenic, lead, and thallium by SW846 6010C; dieldrin and heptachlor epoxide by SW846 8081.
- PICA-131 (Site 131): arsenic by SW846 6010C; benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene by SW846 8270 SIM.
- PICA-149 (Site 149): 2,4-dinitrotoluene by SW846 8330B; benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene by SW846 8270 SIM.

Sampling SOPs are identified in Worksheet 21 of the Site-Wide UFP-QAPP. The specific SOP for soil sampling is ENV-801. Soil samples will be collected from the surface (0-0.5 ft) and at three depth intervals from the subsurface, to a maximum depth of 10 ft bgs. Soil samples will be collected via DPT. DPT is typically used to characterize soil vertically and obtain discrete interval soil samples with minimal soil loss or slough. A truck or track-mounted Geoprobe® is commonly used for DPT.

All DPT equipment must be thoroughly cleaned before and after each use to allow retrieval of representative soil samples. Decontamination procedures specific in SOP SE-302 (provided in the Site Wide UFP-QAPP) will be followed.

This page intentionally left blank

QAPP WORKSHEETS #19 AND #30

Sample Containers, Preservation, and Hold Times

Table 19-1 is found on the following page.

Laboratory:	See Worksheet 30 of the Site-Wide UFP-QAPP
List any required accreditations/certifications:	DoD Environmental Laboratory Approval Program and DoD Quality Systems Manual (Version 5.0), State of New Jersey TN473. Documentation of accreditations and certifications are provided in Appendix D of the Site-Wide UFP-QAPP.
Back-up Laboratory:	See Worksheet 30 of the Site-Wide UFP-QAPP
Sample Delivery Method:	Expedited courier service

This page intentionally left blank

Table 19-1
Sample Containers, Preservation, and Hold Times

3 Site Group Soil Sampling Work Plan, PICA New Jersey

Analyte/ Analytical Group	Matrix	Method/ SOP	Accreditation Expiration Date	Container Size/Type	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround
Metals	Soil	6010C/ Lab SOPs 100 and 105	DOD 20151130 NJ 20160630	4-ounce glass jar	Cool 0-6°C	180 days from sampling	180 days from sampling	7 days
Explosives	Soil	8330B/Lab SOP 327	DOD 20151130 NJ 20160630	4-ounce glass jar	Cool 0-6°C	14 days from sampling	40 days from preparation	7 days
PAHs	Soil	8270 SIM/SOP 201	DOD 20151130 NJ 20160630	4-ounce glass jar	Cool 0-6°C	14 days from sampling	40 days from preparation	7 days
Pesticides	Soil	8081/SOP 211	DOD 20151130 NJ 20160630	4-ounce glass jar	Cool 0-6°C	14 days from sampling	40 days from preparation	7 days

NOTES:

°C = Degree(s) Celsius.

Laboratory SOPs are provided in Appendix C of the Site-Wide UFP-QAPP.

This page intentionally left blank

QAPP WORKSHEET #20

Field QC Summary

The anticipated number of QC samples is determined based on the number of samples collected and analyzed. In accordance with Worksheet #20 of the Site-Wide UFP-QAPP, one field duplicate will be collected for every 20 normal samples and one equipment blank will be collected at a minimum of one per sampling mobilization for non-dedicated equipment (only one mobilization expected for this sampling event). Matrix spike and matrix spike duplicates will be run/reported with laboratory batch samples.

Table 20-1
Field QC Summary
 3 Site Group Soil Sampling Work Plan, PICA New Jersey

Matrix	Analyte	Method	Number of Samples ¹	Field Duplicates	Equip. Blanks ²	Total
General Samples						
Aqueous	Metals	6010C	0	0	1	1
	Explosives	8330B	0	0	1	1
	Pesticides	8081	0	0	1	1
	PAH	8270 SIM	0	0	1	1
Site 118/PICA-097 – 9 Locations						
Soil	Metals	6010C	36	1	0	37
	Pesticides	8081	36	1	0	37
Site 131/PICA-131 – 7 Locations						
Soil	Metals	6010C	28	1	0	29
	PAH	8270 SIM	28	1	0	29
Site 149/PICA-149 – 8 Locations						
Soil	Explosives	8330B	32	1	0	33
	PAH	8270 SIM	32	1	0	33
¹ This is the maximum number of soil samples expected to be collected. All soil samples may not be analyzed as discussed in Worksheet#17. ² Equipment blanks will be collected at a minimum of one per sampling mobilization for non-dedicated equipment; however, only one mobilization is anticipated for completion of this sampling event.						

This page intentionally left blank

3. REFERENCES

- ARCADIS. 2014a. Final Feasibility Study, PICA-097, -131, and -149 (Sites 118, 131, and 149). June.
- . 2014b. Final Proposed Plan, PICA-097, -131, and -149 (Sites 118, 131, and 149). August.
- Dames and Moore. 1998. *Picatinny Arsenal Phase I Remedial Investigation Report*. Prepared for USAEC, Aberdeen Proving Ground, Maryland.
- Department of Defense (DoD). 2013. *Quality Systems Manual*, Version 5.
- ECC. 2015a. Project Management Plan for Picatinny Arsenal. October.
- . 2015b. Internal Draft Site-Wide Uniform Federal Policy Quality Assurance Project Plan. October.
- . 2015c. Internal Draft Accident Prevention Plan. October.
- . 2015d. Internal Draft Anomaly Avoidance Plan. November.
- IT Corporation (IT). 2000. Phase II Ecological Risk Assessment Remedial Investigation/Feasibility Study, Picatinny Arsenal, New Jersey, Volumes I, II, and III. February.
- Shaw Environmental. 2005a. *Phase I 2A/3A Sites Remedial Investigation Report*. Prepared for U.S. Army Corps of Engineers, Baltimore District. Contract No. DACA-31-95-D-0083. January 2005. Final.
- . 2005b. *Phase II Remedial Investigation Report, Rounds 1 and 2*. Final. Prepared for U.S. Army Corps of Engineers. November.
- USEPA. 2012. Intergovernmental Data Quality Task Force Uniform Federal Policy for Quality Assurance Project Plans, Optimized UFP-QAPP Worksheets. March.
- . 2012. Intergovernmental Data Quality Task Force Uniform Federal Policy for Quality Assurance Project Plans, Part 2A: Uniform Federal Policy-Quality Assurance Project Plan Workbook. Revision 1. March.
- . 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA/240/B-06/001). February.
- U.S. Army. 2004. *Record of Decision, Green Pond Brook/Bear Swamp Brook, Picatinny, New Jersey*. December.

———. 2014. *Final Proposed Plan, PICA-097, -131, and -149 (Sites 118, 131, and 149)*.
August.

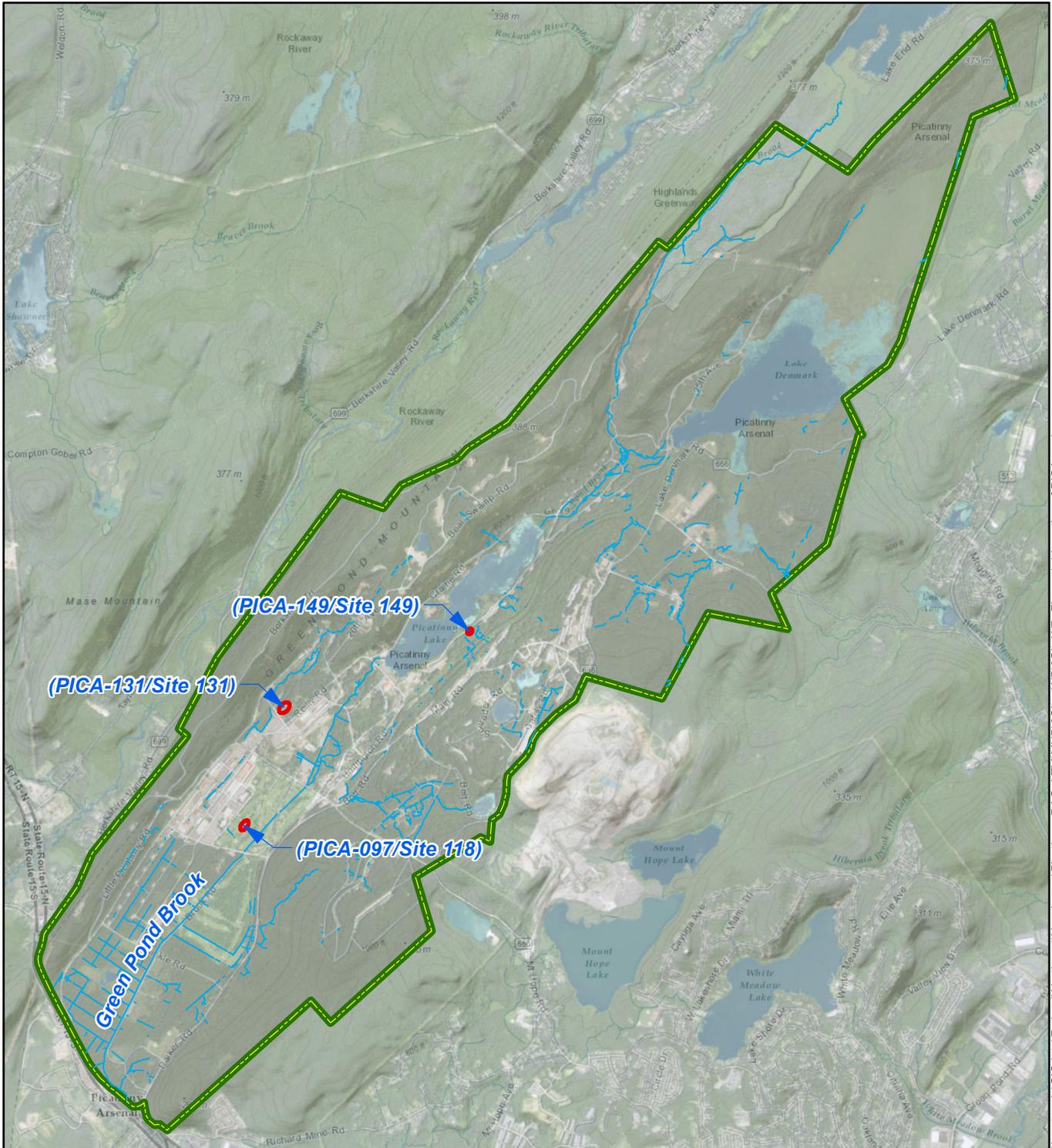
Figures

This page intentionally left blank

LIST OF FIGURES

<u>Number</u>	<u>Title</u>
1-1	Location of Picatinny Arsenal
10-1	Layout of Site 118/PICA-097, Building 41
10-2	Layout of Site 131/PICA-131, Building 266
10-3	Layout of Site 149/PICA-149, Propellant Plant
10-4	Historical Soil Sample Exceedances of Cleanup Goals at Site 118/PICA-097
10-5	Historical Soil Sample Exceedances of Cleanup Goals at Site 131/PICA-131
10-6	Historical Soil Sample Exceedances of Cleanup Goals at Site 149/PICA-149
11-1	Site 118/PICA-097 Proposed Soil Sampling Locations
11-2	Site 131/PICA-131 Proposed Soil Sampling Locations
11-3	Site 149/PICA-149 Proposed Soil Sampling Locations

This page intentionally left blank



\\ovetongis\GISdata\Federal\NewJersey\Picatinny_RAO_L1TMMXD\3Site_WP\3SiteWP_Figure 1-1 Location of PICA.mxd



Legend

-  Installation Boundary
-  River/Stream
-  Sites

A north arrow pointing upwards, with cardinal directions N, S, E, and W labeled. Below the arrow is a scale bar in feet, with markings at 0, 1,250, 2,500, and 5,000 feet.



PICATINNY ARSENAL
 3 SITE GROUP SOIL SAMPLING WORK PLAN
 PICATINNY, NEW JERSEY
 MORRIS COUNTY

Figure 1-1
 Location of Picatinny Arsenal



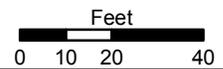
Aerial Source: Google Earth

\\ovetongis\GISdata\Federal\NewJersey\Picatinny_RAO_L\TMMXD\3Site_WP\3SiteWP_Figure 10-1 Site 118 PICA-097 Bldg 41 Site Layout.mxd



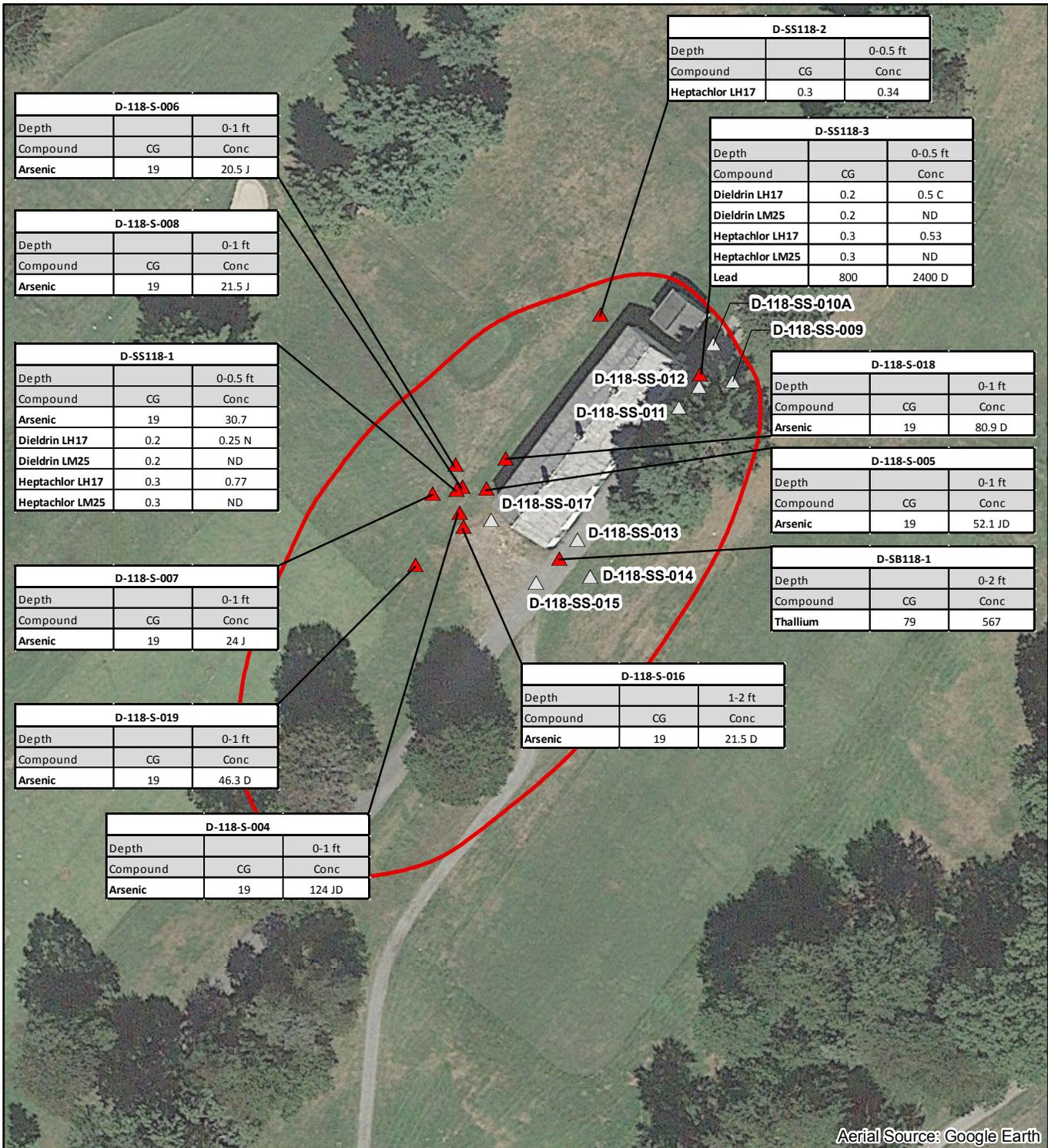
Legend

-  Installation Boundary
-  PICA Site



PICATINNY ARSENAL
 3 SITE GROUP SOIL SAMPLING WORK PLAN
 PICATINNY, NEW JERSEY
 MORRIS COUNTY

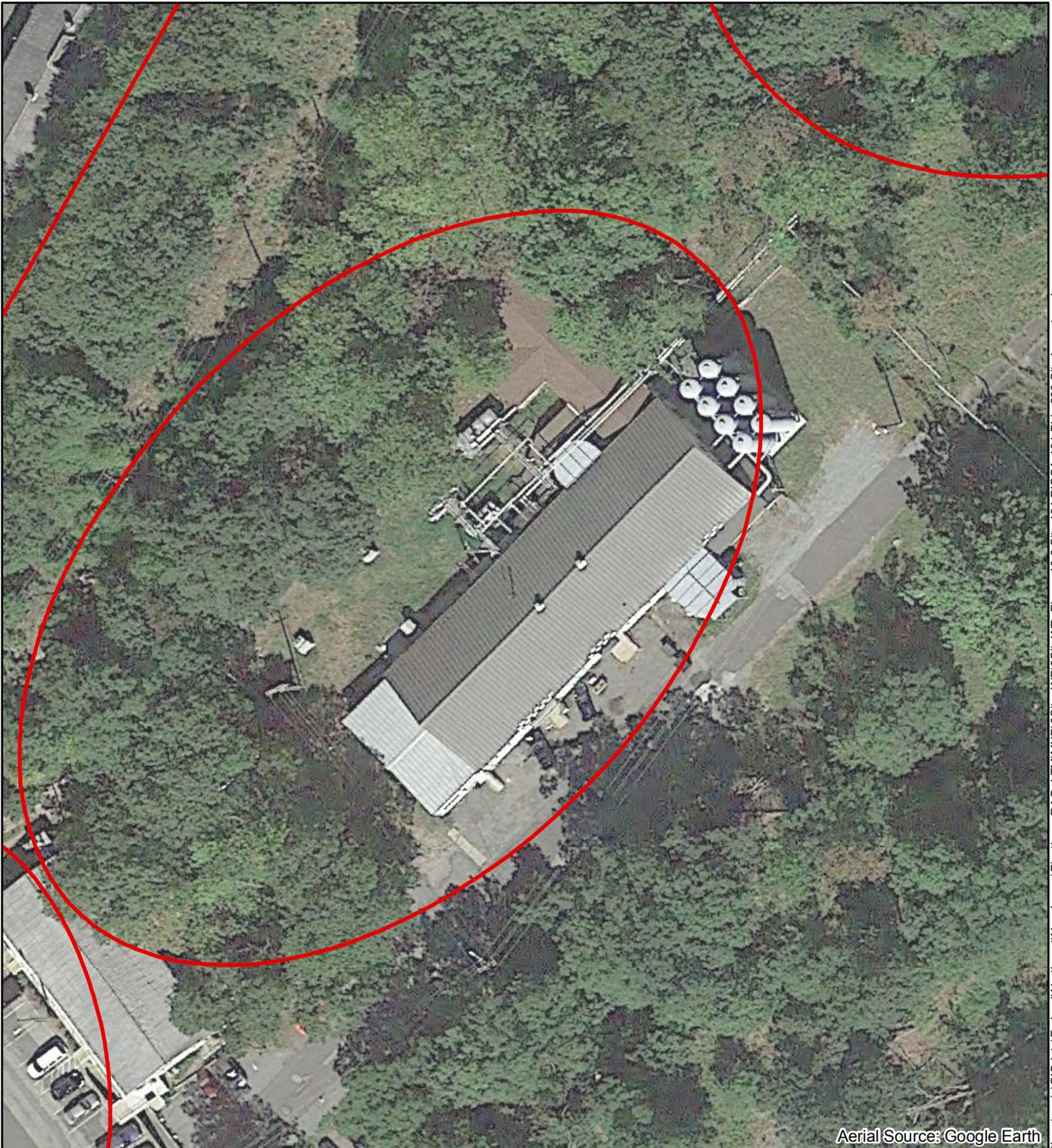
Figure 10-1
 Layout of Site 118/PICA-097,
 Building 41



Aerial Source: Google Earth

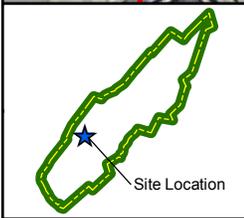
\\lovetongis\GIS\data\Federal\NewJersey\Picatinny_RAO_LTM\XDG\Site_WP\3SiteWP_Figure 10-4 Site 118/PICA-097 Historical Soil Sample Exceedances.mxd

<p>Site Location</p>	<p>Legend</p> <ul style="list-style-type: none"> Installation Boundary PICA Site Contaminant Concentrations Exceed Cleanup Goal Contaminant Concentrations less than Cleanup Goal 	<p>NOTE: All analyte results in mg/kg CG - Cleanup Goal</p> <p>Feet 0 10 20 40</p>
	<p>PICATINNY ARSENAL 3 SITE GROUP SOIL SAMPLING WORK PLAN PICATINNY, NEW JERSEY MORRIS COUNTY</p> <p>Figure 10-2 Historical Soil Sample Exceedances of Cleanup Goals at Site 118/PICA-097</p>	



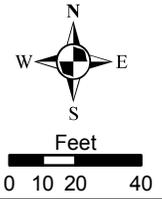
Aerial Source: Google Earth

\\ovetongis\GISdata\Federal\NewJersey\Picatinny_RAO_LTM\XID\3Site_WP\3SiteWP_Figure 10-2 Site 131 PICCA-131 Bldg 266 Site Layout.mxd



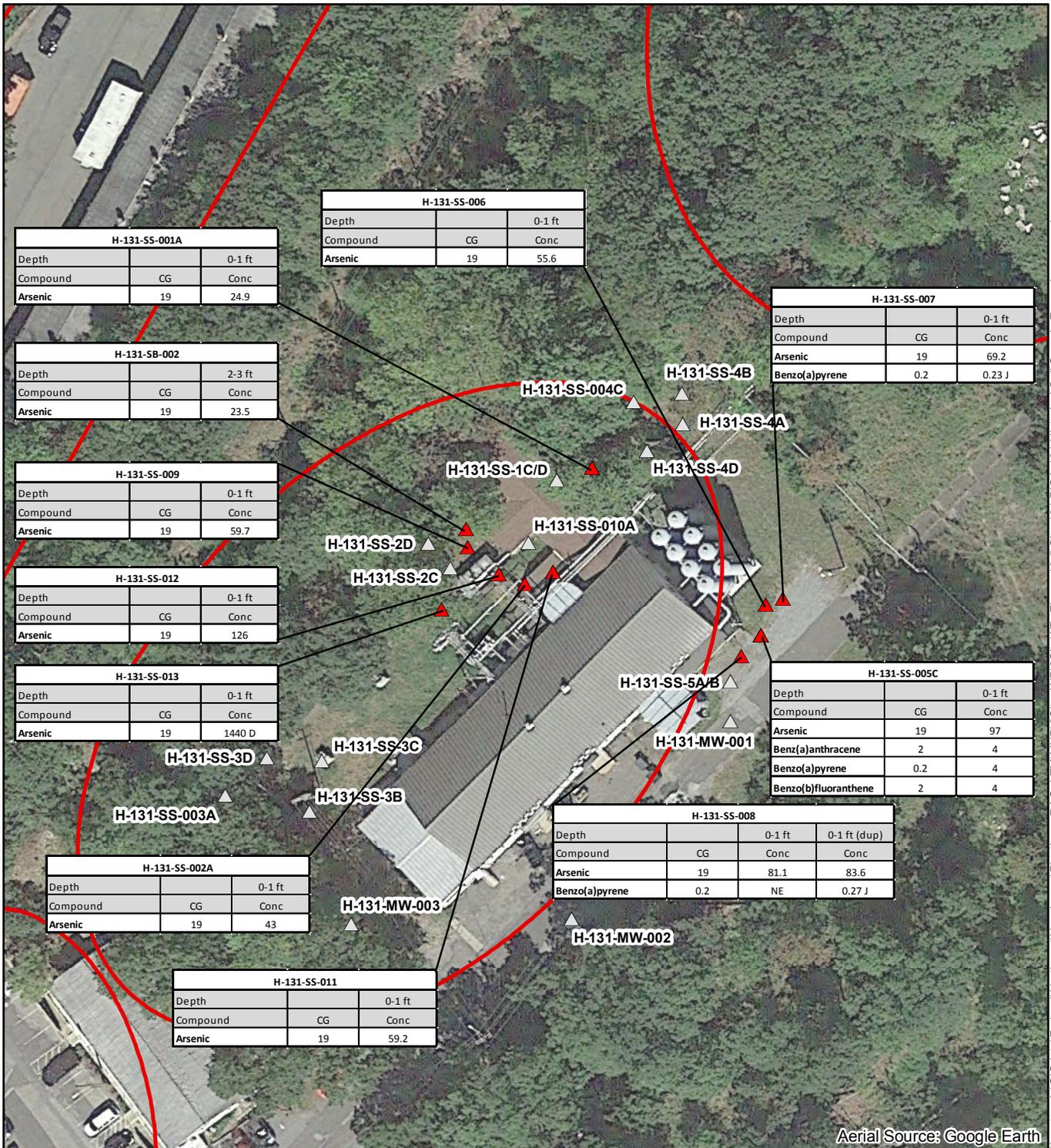
Site Location

- Legend**
-  Installation Boundary
 -  PICA Site



PICATINNY ARSENAL
 3 SITE GROUP SOIL SAMPLING WORK PLAN
 PICATINNY, NEW JERSEY
 MORRIS COUNTY

Figure 10-3
 Layout of Site 131/PICA-131,
 Building 266

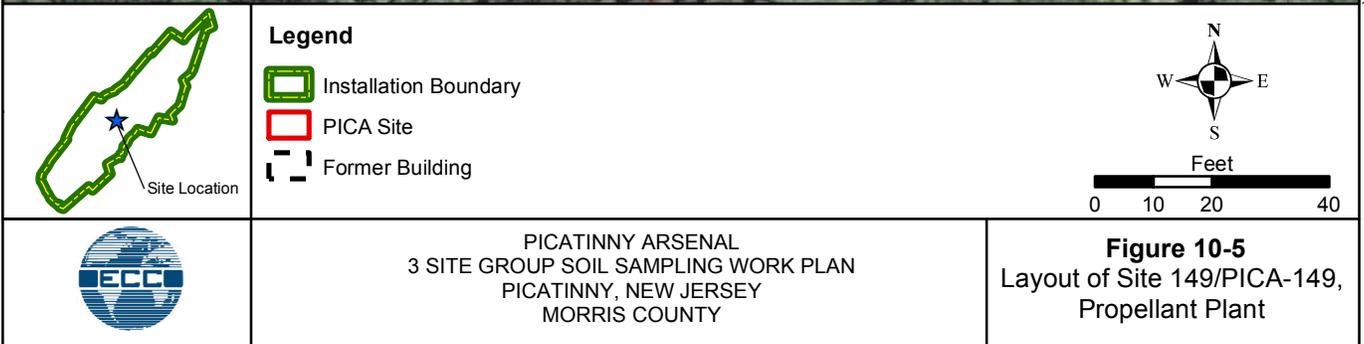


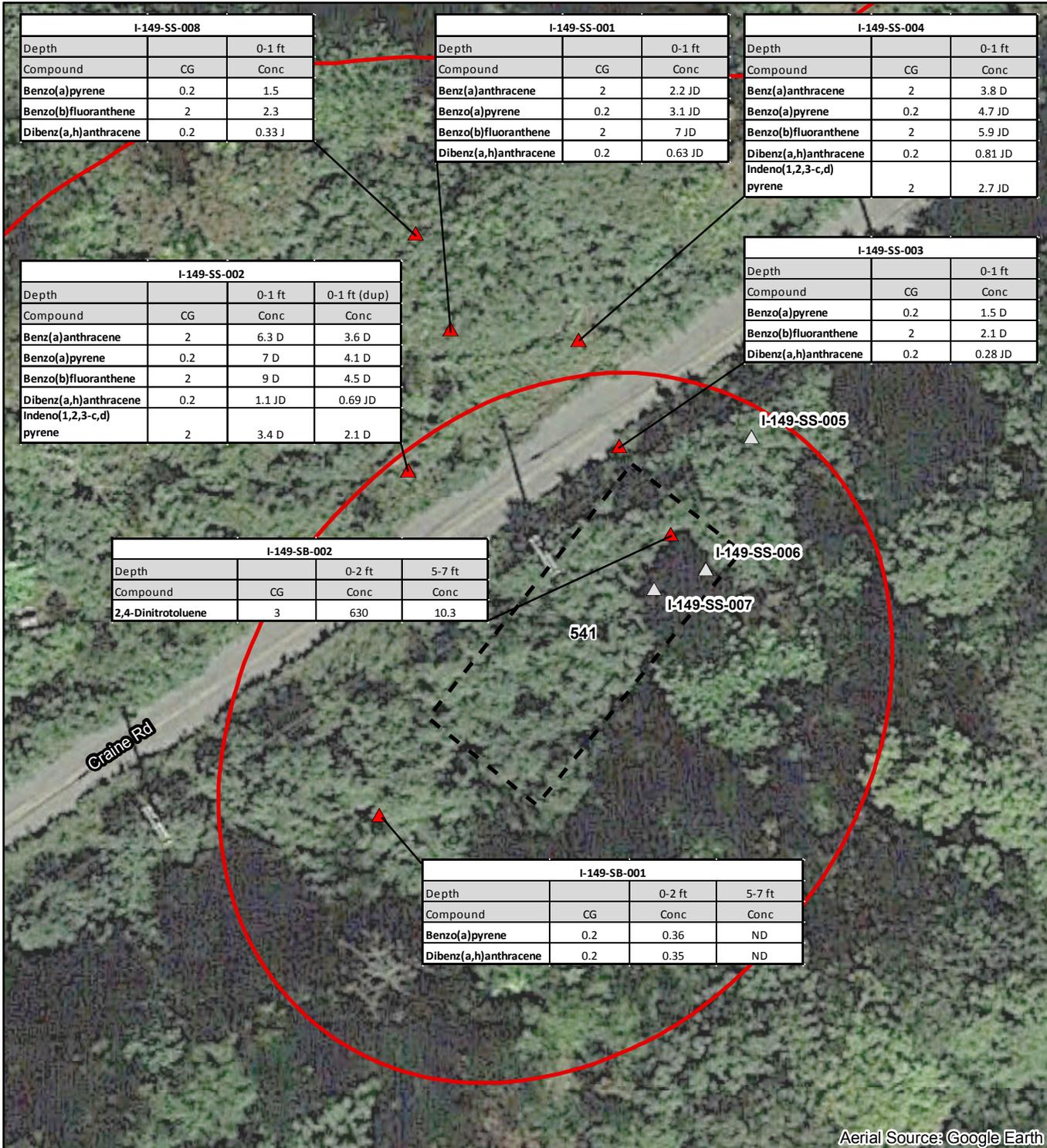
\\ovetongis\GIS\data\Federal\Northeast\NewJersey\Picatinny_RAO_L1\TMMXD\GISite_WP\3SiteWP_Figure 10-5 Site 131/PICA-131 Historical Soil Sample Exceedances.mxd

 Site Location	<p>Legend</p> <ul style="list-style-type: none"> Installation Boundary PICA Site ▲ Contaminant Concentrations Exceed Cleanup Goal ▲ Contaminant Concentrations less than Cleanup Goal 	<p>NOTE: All analyte results in mg/kg CG - Cleanup Goal</p>	 Feet 0 10 20 40
	<p>PICATINNY ARSENAL 3 SITE GROUP SOIL SAMPLING WORK PLAN PICATINNY, NEW JERSEY MORRIS COUNTY</p>	<p>Figure 10-4 Historical Soil Sample Exceedances of Cleanup Goals at Site 131/PICA-131</p>	



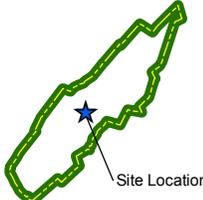
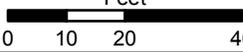
\\ovetongis\GISdata\Federal\NewJersey\Picatinny_RAO_L\TMMXD\Site_WP\3SiteWP_Figure 10-3 Site 149/PICA-149 Prop Plant Site Layout.mxd

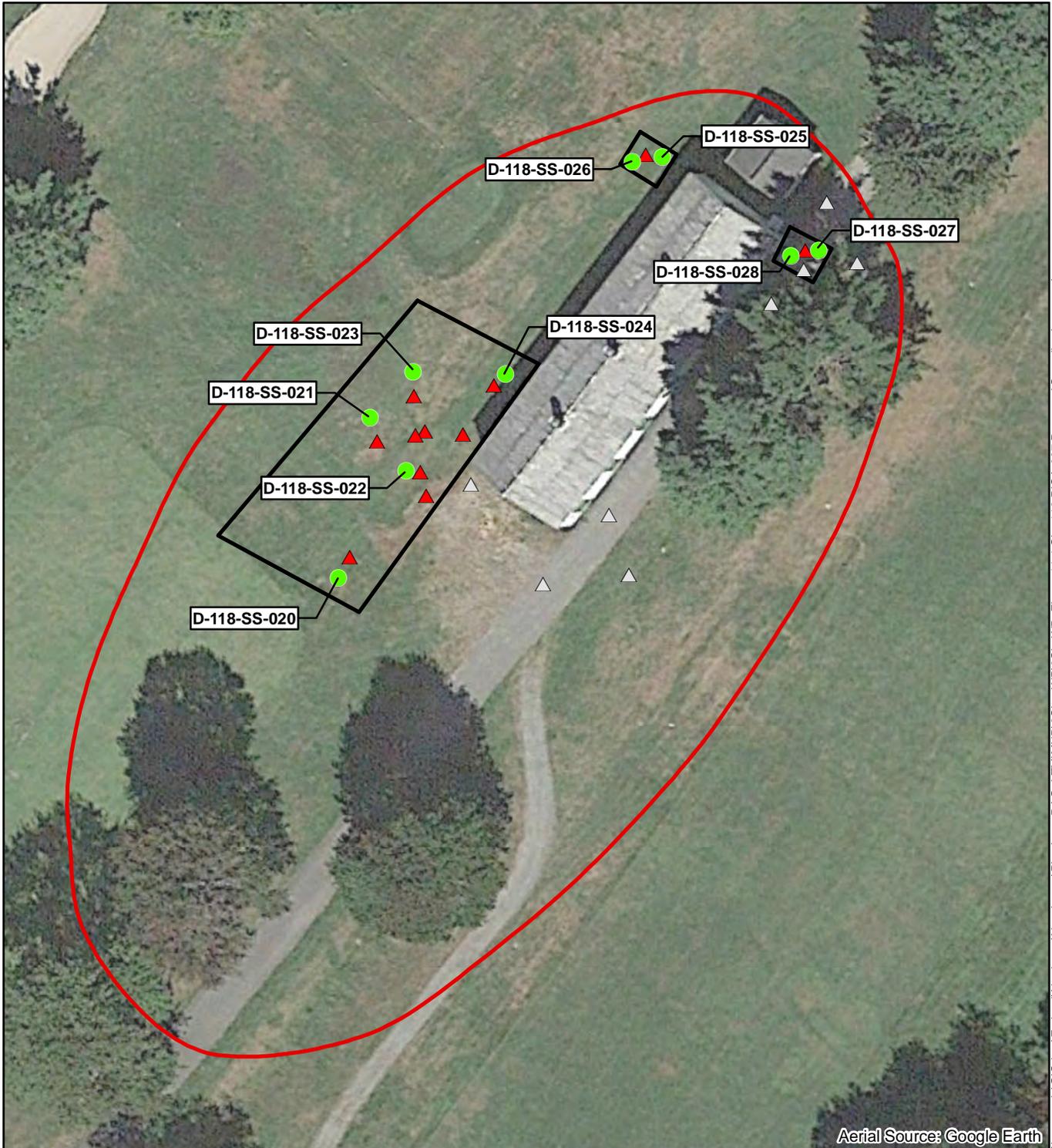




\\ovetongis\GISdata\Federal\NewJersey\Picatiny_RAO_L1TMMXD\Site_WP3\SiteWP_Figure 10-6 Site 149/PICA-149 Historical Soil Sample Exceedances.mxd

Aerial Source: Google Earth

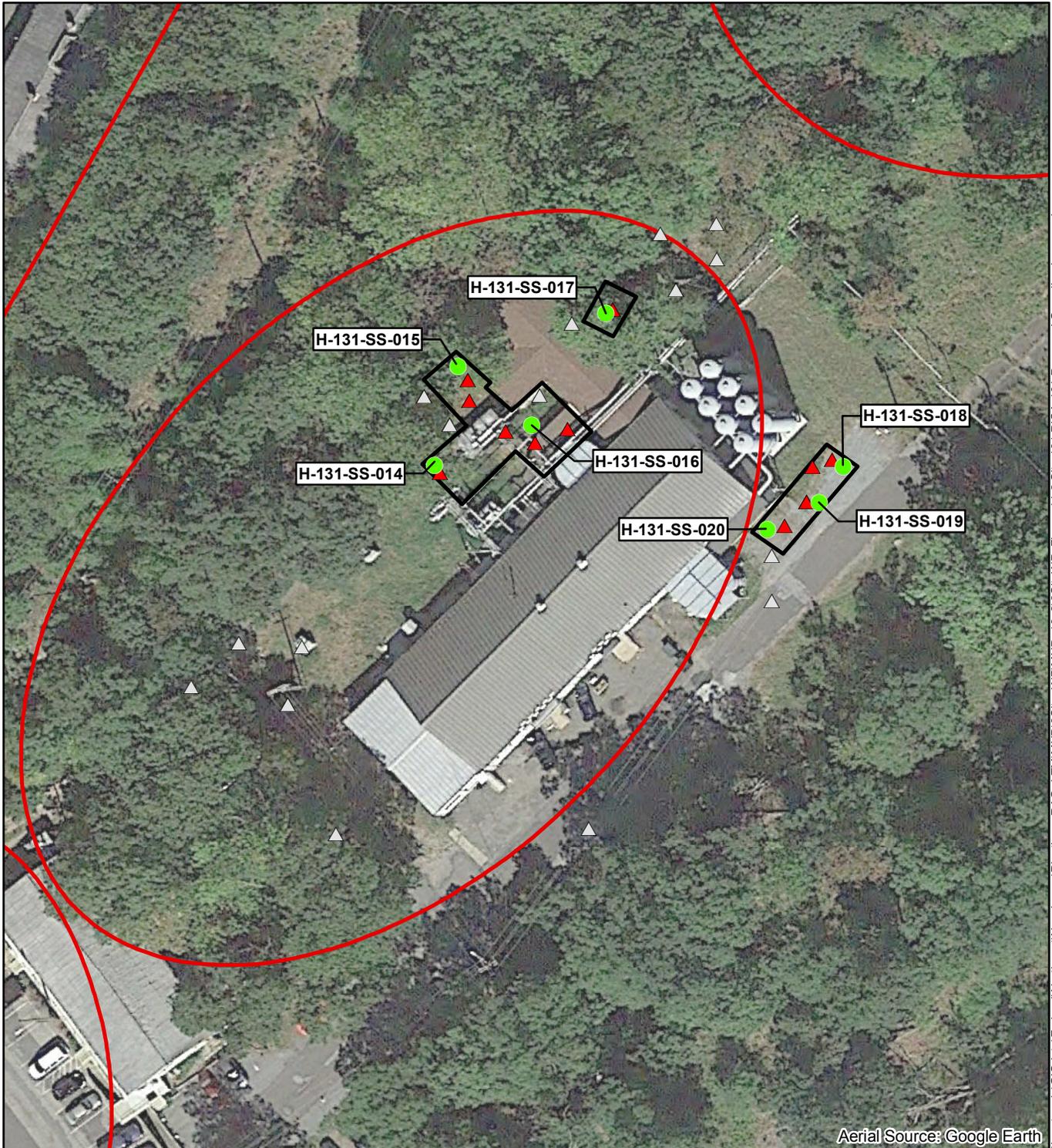
 <p style="text-align: center;">Site Location</p>	<p>Legend</p> <ul style="list-style-type: none"> Installation Boundary PICA Site Former Building ▲ Contaminant Concentrations Exceed Cleanup Goal △ Contaminant Concentrations less than Cleanup Goal 	<p>NOTE: All analyte results in mg/kg CG - Cleanup Goal</p> <div style="text-align: center;">  <p>Feet</p>  </div>
	<p>PICATINNY ARSENAL 3 SITE GROUP SOIL SAMPLING WORK PLAN PICATINNY, NEW JERSEY MORRIS COUNTY</p>	<p>Figure 10-6 Historical Soil Sample Exceedances of Cleanup Goals at Site 149/PICA-149</p>



Aerial Source: Google Earth

\\lovetongis\GISdata\Federal\NewJersey\Picatinny_RAO_LTM\XD\3Site_WP\3SiteWP_Figure 11-1 Site 118/PICA-097 Proposed Sampling Loes.mxd

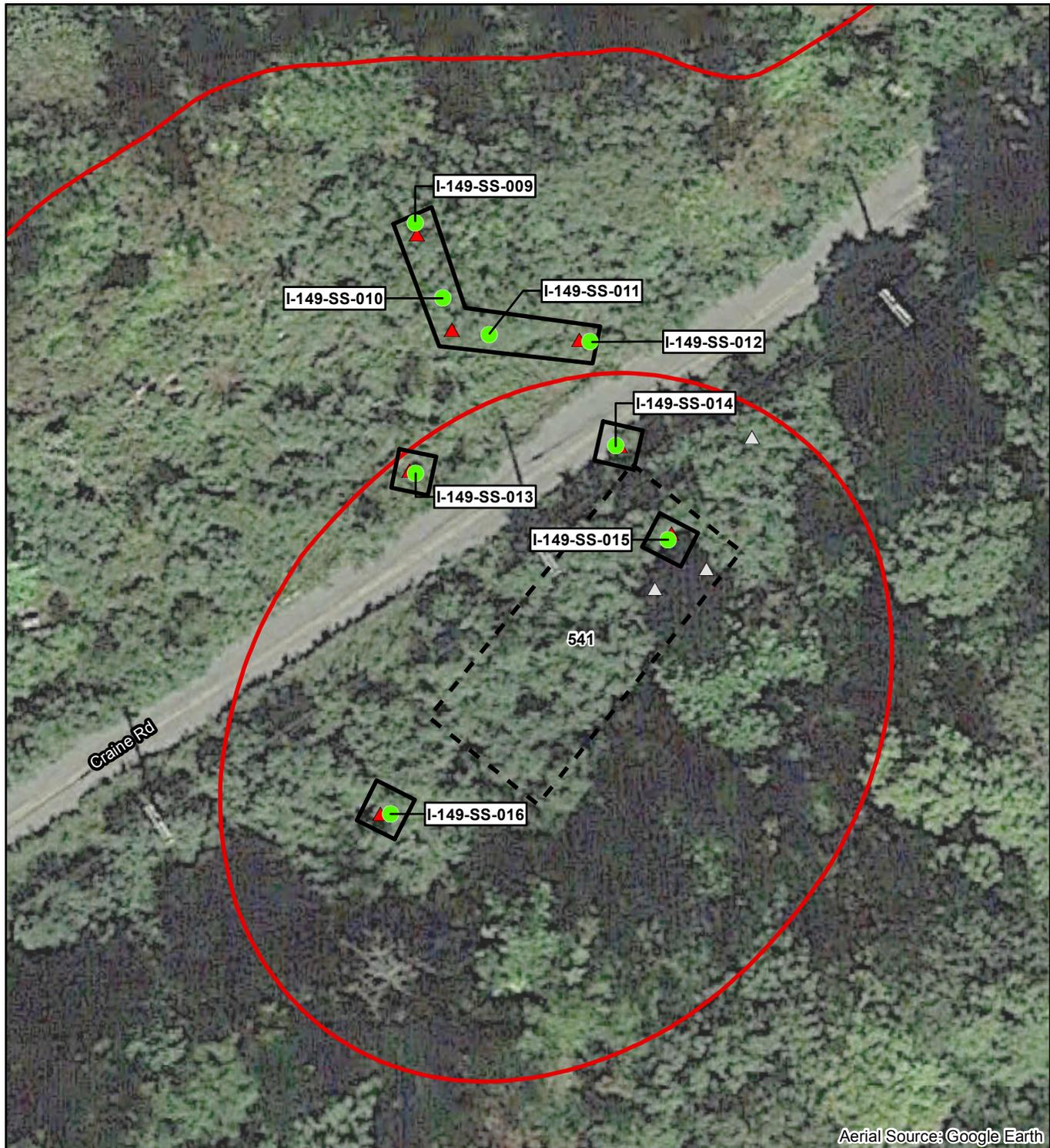
<p>Site Location</p>	<p>Legend</p> <ul style="list-style-type: none"> Installation Boundary PICA Site Area of Attainment ● Proposed Soil Sampling Location ▲ Contaminant Concentrations Exceed Cleanup Goal △ Contaminant Concentrations less than Cleanup Goal 	
	<p>PICATINNY ARSENAL 3 SITE GROUP SOIL SAMPLING WORK PLAN PICATINNY, NEW JERSEY MORRIS COUNTY</p>	<p>Figure 10-7 Site 118/PICA-097 Proposed Soil Sampling Locations</p>



Aerial Source: Google Earth

\\ovetongis\GISdata\Federal\NewJersey\Picatinny_RAO_L1TMMXD\GISite_WP\MXD_10_21\GISiteWP_Figure 11-2 Site 131 PICA-131 Proposed Sampling Locs.mxd

<p>Site Location</p>	<p>Legend</p> <ul style="list-style-type: none"> Installation Boundary PICA Site Area of Attainment ● Proposed Soil Sampling Location ▲ Contaminant Concentrations Exceed Cleanup Goal ▲ Contaminant Concentrations less than Cleanup Goal 	
	<p>PICATINNY ARSENAL 3 SITE GROUP SOIL SAMPLING WORK PLAN PICATINNY, NEW JERSEY MORRIS COUNTY</p>	<p>Figure 10-8 Site 131/PICA-131 Proposed Soil Sampling Locations</p>



Aerial Source: Google Earth

\\levelong\gis\GISdata\Federal\NewJersey\Picatinny_RAO_LTM\MMXD\Site_WP\3SiteWP_Figure 11-3 Site 149 PICA-149 Proposed Sampling Locs.mxd

<p>Site Location</p>	<p>Legend</p> <ul style="list-style-type: none"> Installation Boundary PICA Site Area of Attainment Former Building ● Proposed Soil Sampling Location ▲ Contaminant Concentrations Exceed Cleanup Goal ▲ Contaminant Concentrations less than Cleanup Goal 	
	<p>PICATINNY ARSENAL 3 SITE GROUP SOIL SAMPLING WORK PLAN PICATINNY, NEW JERSEY MORRIS COUNTY</p>	<p>Figure 10-9 Site 149/PICA-149 Proposed Soil Sampling Locations</p>