DEPARTMENT OF THE ARMY
INSTALLATION MANAGEMENT COMMAND
HEADQUARTERS, UNITED STATES ARMY GARRISON
PICATINNY ARSENAL, NEW JERSEY 07806-5000

July 22, 2014

REPLAY TO ATTENTION OF
IMPI-PWE

SUBJECT: Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)/Interagency Agreement (IAG) Administrative Docket No. II-CERCLA-FFA-001-04: Submittal of **Final Letter Report 300 Marsh Area:** Reviews are ER,A-eligible

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Dear Sir and Madam:

Attached for your records are copies of **Final Letter Report 300 Marsh Area.**

The Draft Final version of document was approved by the NJDEP per the May 5th 2014 email from Anne Pavelka which stated that “The revised Draft Final Letter Report on the 300 Marsh Area is acceptable.” EPA has not provided any comments on this document since the EPA’s initial review of a draft version in April of 2013.

As a reminder as was noted in my email of May 27th and the recent IAG schedulke, the implementation of the proposed "SI" sampling plan for the "Eastern bank of Green Pond Brook” will be included in the next PBC contract.

Sincerely,

Project Manager for Environmental Restoration

Enclosures
CC:
Ms. Barbara Dolce, TAPP Contractor (FTP Site only)
Mr. Jim Kealy, NJDEP

Picatinny Installation Restoration Program

Picatinny is an Official Hawk Watch Site

FINAL LETTER REPORT
300 MARSH AREA

PICATINNY ARSENAL
NEW JERSEY

July 2014

Prepared for:
USACE – Baltimore District

US Army Corps of Engineers®

Contract No. W912DR-09-D-0006

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Acronyms and Abbreviations

AEDB-R	Army Environmental Database – Restoration
bgs	Below Ground Surface
COC	Contaminant of Concern
DDD	dichlorodiphenyl dichloroethane
DDE	dichlorodiphenyl dichloroethene
DDT	dichlorodiphenyltrichloroethane
DL	Detection Limit
DRMO	Defense Reutilization Marketing Office
FS	Feasibility Study
IRP	Installation Restoration Program
LOC	Level of Concern
MD	Munitions Debris
MEC	Munitions and Explosives of Concern
mg/kg	Milligrams per Kilogram
mm	millimeter
MMRP	Military Munitions Response Program
MRS	Munitions Response Site
NJDEP	New Jersey Department of Environmental Protection
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PRG	Preliminary Remediation Goal
PTA	Picatinny Arsenal
QAPP	Quality Assurance Project Plan
R&D	Research and Development
RI	Remedial Investigation
RL	Reporting Limit
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SI	Site Investigation
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
TNT	Trinitrotoluene
TPH	Total Petroleum Hydrocarbons
U.S.	United States
USACE	U.S. Army Corps of Engineers, Baltimore District
USEPA	United States Environmental Protection Agency
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound
WESTON	Weston Solutions, Inc.
µg/kg	Micrograms per Kilogram
%	Percent

1 INTRODUCTION

1.1 Purpose

The United States (U.S.) Army Corps of Engineers, Baltimore District (USACE) has tasked Weston Solutions, Inc. (WESTON) under Contract W912DR-09-D-0006 with performing a site inspection level investigation at the 300 Marsh Area at Picatinny Arsenal (PTA) in Morris County, New Jersey. ARCADIS/Malcolm Pirnie performed the site investigation (SI) activities on behalf of WESTON. All activities were conducted in accordance with the *Draft Final Sampling and Analysis Plan for the Marshy Area Across Green Pond Brook from the Former DRMO Yard* (Shaw 2007). The purpose of this letter report is to present a summary of the investigation activities for the 300 Marsh Area and an interpretation of the results.

1.2 Picatinny Arsenal

PTA, which covers approximately 5,801 acres, is located in Morris County, New Jersey, approximately 45 miles west of New York City, in the Highlands Region. PTA is bordered by numerous major highways including State Route 15, Interstate 80, and U.S. Route 46. Refer to Figure 1 in Appendix A for the location of PTA.

PTA was initially established in the late 1800s as a storage and powder depot. Production activities began in the 1890s, and by the beginning of World War I, PTA was manufacturing smokeless powder and munitions of various sizes. By the end of the war, PTA had begun new operations including the melt-loading of projectiles; the manufacture of pyrotechnic signals and flares; the experimental manufacture of modern propellants, high explosives, fuzes, and metal components; and the loading of trinitrotoluene (TNT) and amatol into bombs and projectiles.

During World War II, PTA produced artillery ammunition, bombs, high explosives, pyrotechnics, and other munitions. After World War II, PTA's primary role was the research and engineering of new munitions; however, PTA resumed the production and development of explosives, ammunition, and mine systems during the Korean and Vietnam conflicts. PTA's current mission has shifted to conducting and managing research and development (R&D), lifecycle engineering, and support of other military weapons and weapon systems. PTA is currently the site of the Armaments Research, Development and Engineering Center, whose mission is conducting and managing R&D for all assigned weapons systems.

2 BACKGROUND

2.1 300 Marsh Area Setting and History

The 300 Marsh Area is a 4.6-acre densely vegetated wetland located in the central valley of PTA approximately 2,500 feet southwest of Picatinny Lake and adjacent to Green Pond Brook. The 300 Marsh Area is part of a 21-acre deciduous wooded wetland located east of Green Pond Brook, west of Kibler Road, and between 9th Street to the north and Farley Avenue to the south. Refer to Figure 2 in Appendix A. No structures and no known utilities are located within the 300 Marsh Area. It is unknown what, if any, activities occurred in this area; however, aerial photography from 1940 through 1987 does not indicate any material storage or operational activities occurring during this period. The Former Defense Reutilization Marketing Office (DRMO) Yard is located across from the 300 Marsh Area on the opposite side of Green Pond Brook, and a bridge that leads over Green Pond Brook to the 300 Marsh Area is located on the southern edge of the Former DRMO Yard. Due to the proximity of the 300 Marsh Area to the Former DRMO Yard and Green Pond Brook, it is possible that activities conducted in the brook and at the Former DRMO Yard could have affected the 300 Marsh Area. Activities conducted at the Former DRMO Yard and Green Pond Brook, along with chemical constituents associated with these activities, are discussed in Section 2.2.

2.2 Former DRMO Yard and Green Pond Brook Setting and History

The Former DRMO Yard is located in downtown PTA, adjacent to Green Pond Brook. Three buildings, Buildings 314, 314D, and 314E, are located within the Former DRMO Yard; the use of these buildings is unknown. Currently, the majority of the Former DRMO Yard is paved; however, historically this area was a low-lying marsh. Refer to Figure 3 in Appendix A for a copy of the map from the *Final Proposed Plan, Sites 31 and 101 (PICA 072), Former DRMO Yard and Former Gas Station* (ARCADIS 2007c) that shows the Former DRMO Yard. It is suspected that the marsh was filled with debris related to the 1926 explosion[1] to bring the area up to grade (Shaw 2005[2]). From the 1920s to the 1940s, a portion of the Former DRMO Yard was used as a burning ground for smokeless powder and TNT. From 1955 until 1988, the Former DRMO Yard was used as a storage yard for the disposal, salvage, and sale of excess materials including materials used in the manufacturing and testing of explosives, pyrotechnics, and munitions; potential polychlorinated biphenyl (PCB)-containing transformers; vehicles; scrap metal; batteries; and office equipment. Dumpsters that contained flashed and unflashed shells were located behind Building 314 (Shaw 2005).

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[1] On July 10, 1926, lightning struck the southwest end of the Lake Denmark Naval Ammunition Depot, which was located on what is currently the eastern portion of PTA, setting off a series of explosions. According to a historical report, it was estimated that 2.5 million pounds of explosives detonated in the explosion. The depot was used by the Navy from the late 1800s to the 1960s, mainly for storage of materials such as high explosives, smokeless powder, black powder, and projectiles.

[2] Background information for the DRMO Yard was obtained from the *Final Feasibility Study for Sites 31 and 101, Picatinny Arsenal, New Jersey* (Shaw 2005).

Green Pond Brook, which is the primary surface water drainage for PTA and is approximately 22,400 linear feet long, originates from Green Pond, north of PTA's boundary, and exits PTA on the south. The majority of Green Pond Brook south of Picatinny Lake has been altered through channelization, including the portion of Green Pond Brook adjacent to the 300 Marsh Area. As shown on Figures 4 and 5 in Appendix A, in 1931 Green Pond Brook formed an oxbow around the 300 Marsh Area; however, by 1940 Green Pond Brook had become a straight channel with the Former DRMO Yard along the western bank and the 300 Marsh Area on the eastern bank. Based on the following historical documentation, it has been reported that munitions and explosives of concern (MEC) have been found in the banks of Green Pond Brook, near or adjacent to the Former DRMO Yard:

- As discussed in the *Memorandum for Record, Trip Report, Picatinny Arsenal, New Jersey*, dated 22 June 93, "Upon further investigation along the stream to the Southeast of Building 314, we located additional UXO [unexploded ordnance] protruding from the stream banks." The type(s) of UXO found was not specified. Refer to Appendix B for a copy of this memorandum.

- According to Installation Safety Office documentation, a 66-millimeter (mm) rocket was found in Green Pond Brook where the 9th Street Bridge crosses the brook.

A significant number of investigations[3] have been conducted both at the Former DRMO Yard and along the entire length of Green Pond Brook. The majority of these investigations have been conducted under either the installation restoration program (IRP) or the military munitions response program (MMRP). Information from these investigations that is relevant to the 300 Marsh Area is discussed in the following sections.

2.2.1 Installation Restoration Program Investigations Associated with the Former DRMO Yard

The Former DRMO Yard, which is listed in the Army Environmental Database – Restoration (AEDB-R) as Restoration Site PICA-072/Site 31, has been extensively investigated under the IRP. PICA-072/Site 31 is shown on Figure 3 in Appendix A. During these investigations a number of analytes were detected in soil at concentrations above their respective levels of concern (LOCs)[4] including PCBs, semi-volatile organic compounds (SVOCs), and numerous metals (ARCADIS 2007c). According to the 2007 Proposed Plan, the contaminants of concern (COCs) for Site 31[5] include the following:

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[3] According to the *Final Feasibility Study for Sites 31 and 101, Picatinny Arsenal, New Jersey* (Shaw 2005), eight studies were conducted at the DRMO Yard between 1989 and 1999. According to the *Record of Decision Green Pond Brook/Bear Swamp Brook Picatinny, New Jersey*, nine Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-related investigations were conducted at Green Pond Brook between 1989 and 2003.

[4] The LOCs for the IRP are contained in the Facility-Wide Field Sampling Plans and/or Quality Assurance Project Plans that were in effect at the time the sampling was conducted.

[5] The 2007 Proposed Plan covers Sites 31 and 101. These two sites were combined for the purpose of the 2005 Feasibility Study and the 2007 Proposed Plan since Site 101, which encompasses a former gas station and Building 319, is located immediately northeast of Site 31.

- **Metals** – antimony, arsenic, cadmium, copper, lead, mercury, thallium, and zinc
- **Polycyclic aromatic hydrocarbons (PAHs)** – benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and pyrene
- **PCBs** – Aroclor-1248, Aroclor-1254, and Aroclor-1260
- **Explosives** – 2,4-dinitrotoluene
- **Dioxins** – 1,2,3,4,6,7,8-heptachlorodibenzo-p-diozin

While the majority of the samples collected during investigations at PICA-072/Site 31 were collected west of Green Pond Brook in the Former DRMO Yard, three soil samples were collected from the eastern bank of Green Pond Brook adjacent to the 300 Marsh Area. Two samples were collected from test pits installed in 1993 and one surface soil sample was collected in 2003. These samples are described in more detail below.

1993 Sampling

In 1993, a non-time critical removal action was conducted at the Former DRMO Yard when buried UXO was discovered during installation of a fence post; the location of the fence post is unknown. Refer to Appendix C for a copy of the *Non-Time Critical Removal Action Site Investigation Report of the DRMO (RI – Concept Site No. 31)*, dated July 1994 (Roy F. Weston, Inc. 1994). To characterize the extent of the UXO, and to determine what other buried waste, if any, was present near Building 314, 14 test pits were installed and one soil sample was collected from each test pit. According to the Non-Time Critical Removal Action Report, two of the test pits, Test Pits N and O, were installed on the eastern bank of Green Pond Brook within the 300 Marsh Area. Refer to Figure 6 in Appendix A for the approximate test pit locations[6].

Test Pit N was installed to six feet below ground surface (bgs) and a composite soil sample (DRMO-1213-TPN) was collected from grab samples, biased toward areas of staining, which were collected at two foot intervals. Sample DRMO-1213-TPN was analyzed for volatile organic compounds (VOCs), SVOCs, explosives, metals, PCBs, and total petroleum hydrocarbons (TPH). The soil sample from Test Pit O (DRMO-1213-TPO) was a surface grab sample collected from a disturbed area along the bank of Green Pond Brook. DRMO-1213-TPO was analyzed for metals and explosives. Analysis of these samples indicated the presence of nitrocellulose, which does not have an Level of Concern (LOC), along with several metals at levels above the LOCs currently in effect under the IRP (refer to Section 3.2.2). The analytes detected and the concentrations detected are listed in Table 2-1. VOCs, SVOCs, PCBs, TPH, and all explosives, with the exception of nitrocellulose, either were not detected or were found at concentrations below their respective LOCs (*i.e.*, the LOCs currently in effect under the IRP) (Roy F. Weston, Inc. 1994).

[6] Coordinates are not available for the test pit locations and the map showing the locations of the test pits is not drawn to scale.

Table 2-1
Non-Time Critical Removal Action Test Pit N and O Soil Data Results

Analyte	PTA Specific Background[1]	LOC[2]	Concentration Detected	Sample/Test Pit
	milligrams per kilogram			
Nitrocellulose	None Available	None Available	26.7	Test Pit N
			65.9	Test Pit O
Antimony	1	14	299	Test Pit O
Arsenic	9	20	33.4	Test Pit O
Cadmium	0.7	39	101	Test Pit O
Copper	36	600	18,200	Test Pit N
			15,000	Test Pit O
Lead	75	400	8,490	Test Pit O
Mercury	0.3	14	25.4	Test Pit O
Zinc	77	1,500	3,880	Test Pit N
			8,980	Test Pit O

Notes:
1. The PTA-specific background values were taken from the *Picatinny Arsenal Facility-Wide Background Investigation* (IT Corporation 2002).
2. The LOCs shown in this table are the LOCs currently in effect for the IRP, which are contained in the *Final Quality Assurance Project Plan (QAPP)* (ARCADIS 2007b). Refer to Section 3.2.2.

2003 Sampling

According to the 2005 Feasibility Study (FS)[7], in 2003 surface soil sample 31GR-S18 was collected from a disturbed area along the eastern bank of Green Pond Brook, across from Building 314, within the 300 Marsh Area. This sample was analyzed for metals. The 2005 FS indicated that this sample location appeared to have "*a very limited amount of non-native material…*" Analysis of sample 31GR-S18 indicated the presence of numerous metals at concentrations above the LOCs currently in effect under the IRP (refer to Section 3.2.2). Refer to Figure 7 in Appendix A for the sample location and Table 2-2 for a summary of the analytical results.

[7] Sample 31GR-S18 is referenced in the 2005 FS and is contained in the IRP website database (eprism); however, a report summarizing the collection of this sample is not available. According to eprism, this sample was collected in July 2003.

Table 2-2
Soil Sample 31GR-S18 Analytical Results

Analyte	PTA Specific Background[1]	LOC[2]	Concentration Detected
	milligrams per kilogram		
Antimony	1	14	2,230
Arsenic	9	20	85.2
Cadmium	0.7	39	91.8
Copper	36	600	68,500
Lead	75	400	35,900
Mercury	0.3	14	1,250
Zinc	77	1500	53,800

Notes:
1. The PTA-specific background values were taken from the 2002 Background Investigation (IT Corporation 2002).
2. The LOCs shown in this table are the LOCs currently in effect for the IRP, which are contained in the 2007 QAPP (ARCADIS 2007b). Refer to Section 3.2.2.

2.2.2 Installation Restoration Program Investigations Associated with Green Pond Brook

Green Pond Brook, which is associated with AEDB-R IRP Site PICA-193, has been extensively investigated during the IRP. COCs identified for PICA-193 include PAHs, PCBs, pesticides, and copper. A Record of Decision (ROD) for PICA-193 (2004 ROD) was completed in 2004 and signed by the United States Environmental Protection Agency (USEPA) on July 18, 2005. The selected remedy includes chemical and biological monitoring, along with the implementation of land use controls (2004 ROD).

For the purpose of the remedial action, Site PICA-193 has been divided into four regions. Refer to Figure 8 in Appendix A for the locations of three of the four regions. Region 2 contains that portion of Green Pond Brook that flows past the 300 Marsh Area (2004 ROD). Region 1, which is not shown on Figure 8, is located north of Picatinny Lake. While the COCs identified for PICA-193 Region 2 in the 2004 ROD include benz(a)anthracene, fluoranthene, phenanthrene, pyrene, Aroclor-1260, dichlorodiphenyl dichloroethane (DDD), dichlorodiphenyl dichloroethene (DDE), dichlorodiphenyltrichloroethane (DDT), and copper, only copper was identified in the region near the Former DRMO Yard, and consequently the 300 Marsh Area; the remaining COCs were identified in a swale leading to Green Pond Brook.

2.2.3 Military Munitions Response Program Remedial Investigation

The Green Pond Munitions Response Site (MRS), which is listed in the AEDB-R as PICA-005-R-01, is located south of the 9th Street Bridge and east of and adjacent to the Former DRMO Yard. Refer to Figure 9 in Appendix A for the location of the Green Pond MRS. Under the MMRP, a remedial investigation (RI) was conducted in 2012 at the Former DRMO Yard and the adjacent Green Pond Brook, in accordance with the 2012 *Work Plan Military Munitions Response Program Remedial Investigation Picatinny Arsenal, Morris County, New Jersey* (WESTON 2012). According to the Final MMRP Work Plan, the purpose of the RI in the Green Pond MRS was as follows: “Determine if MEC [munitions and explosives of concern] burial areas or individual MEC

exist in and along the banks of Green Pond Brook and if so, define their extent." Refer to Figure 10 in Appendix A for the proposed RI characterization approach.

Geophysical investigations were conducted along the banks of Green Pond Brook near the Former DRMO Yard to determine if subsurface anomalies were present. Based on the results of the geophysical investigations, more than 400 anomalies were identified and intrusively investigated. Munitions debris (MD) was found at four locations in Green Pond Brook adjacent to the 300 Marsh Area. MD found included multiple fuzes and grenades, a 40-mm projectile, and other miscellaneous ordnance.

In April 2012 two soil samples were collected; one each from the northernmost and southernmost MD locations, and analyzed for metals, PCBs, SVOCs, and explosives[8]. Analysis of these samples indicated the presence of antimony, arsenic, barium, beryllium, copper, lead, and zinc at concentrations above their LOCs (*i.e.*, the LOCs currently in effect under the IRP; refer to Section 3.2.2). Refer to Figure 11 in Appendix A for the MD and sample locations, Table 2-3 for a summary of the analytical results, and the table in Appendix D for all analytical results. Additional information regarding the MMRP RI results will be contained in the MMRP RI Report, which has not been finalized as of the date of this report.

Table 2-3
Green Pond MRS Soil Data Results

Analyte	PTA Specific Background[1]	LOC[2]	Concentration Detected	Sample ID
	milligrams per kilogram			
Antimony	1	14	120	300MA-0001
Arsenic	9	20	46	300MA-0001
Barium	160	700	890	300MA-0002
Beryllium	1	2	2.6 J[3]	300MA-0002
Copper	36	600	36,000	300MA-0001
Lead	75	400	3,400	300MA-0001
Zinc	77	1,500	9,900	300MA-0001

Notes:
1. The PTA-specific background values were taken from the 2002 Background Investigation (IT Corporation 2002).
2. The LOCs shown in this table are the LOCs currently in effect for the IRP, which are contained in the 2007 QAPP (ARCADIS 2007b). Refer to Section 3.2.2.
3. J – estimated result

As shown on Figure 11 in Appendix A, MMRP sample 300MA-0001, which was collected from the eastern bank of Green Pond Brook where MD were found, is located approximately 20 feet west of sample 31GR-S18, which was collected in 2003 under the IRP. In both 31GR-S18 and

[8] It should be noted that the majority of the soil samples collected under the MMRP RI were analyzed for explosives and metals associated with MEC previously found at PTA. However, due to the proximity to the DRMO Yard and 300 Marsh Area, these soil samples were analyzed for the list of parameters detailed in the 2007 Sampling and Analysis Plan. The LOCs used for these samples were the LOCs in the 2007 QAPP.

300MA-001, antimony, arsenic, copper, lead, and zinc were found at concentrations above the LOCs currently in effect under the IRP. Mercury was also found above the LOC currently in effect under the IRP in 31GR-S18. All of these metals are listed in the 2007 Proposed Plan as COCs for PICA-072/Site 31. In addition, according to the Final MMRP RI Work Plan, antimony, copper, lead, and zinc are associated with munitions known to have been used and/or that have been found at PTA.

3 300 MARSH AREA SITE INVESTIGATION

An SI was conducted in 2012 and 2013 at the 300 Marsh Area in accordance with the 2007 Sampling and Analysis Plan (SAP), which was approved by the Army and the regulatory agencies in 2007. This investigation was conducted in conjunction with the MMRP RI discussed in Section 2.2.3. As stated in the 2007 SAP "*NJDEP expressed concern that in the past a portion of land now surrounded by GPB [Green Pond Brook] may have been contiguous with Site 31 and operations performed at the site [Site 31] could have resulted in contamination of this portion of land [300 Marsh Area] that has never been adequately characterized.*" Therefore, the objectives of the SI were the following:

1. Determine if geophysical anomalies were present in the 300 Marsh Area adjacent to the banks of Green Pond Brook. If so, intrusively investigate the anomalies to determine the nature of the anomalous reading (*i.e.*, is the anomalous reading due to MEC).

2. Ascertain whether specific analytes [*i.e.*, target analyte list (TAL) metals, PCBs, target compound list (TCL) SVOCs, and explosives] were present in the soil at concentrations above the LOCs currently in effect under the IRP. Refer to Section 3.2.2.

3.1 Geophysical Investigation

As discussed in Section 2.2.3, during the MMRP RI conducted along the banks of Green Pond Brook near the 300 Marsh Area, four locations containing MD were found. Therefore, in accordance with the 2007 SAP, additional geophysical investigations were required. Under this SI, UXO technicians performed a mag and dig operation along a 50-foot-wide area adjacent to the banks of the brook. The UXO technicians established search lanes and swept each five foot lane using a hand-held White's all-metals detector. Munitions from the 1926 explosion (*e.g.*, 3-inch to 8-inch projectiles) are detectable with the all metals detector to depths of approximately 33 inches or more. Metallic surface debris was identified during the mag and dig operation; however, the metallic debris was non-munitions related and no subsurface anomalies were detected. Refer to Figure 12 in Appendix A for the location of the geophysical survey (WESTON 2012).

3.2 Soil Sample Collection

3.2.1 General

Soil samples were collected from the 300 Marsh Area under the SI on May 2, 2012, July 31, 2012, and October 22, 2013. Refer to Figure 13 in Appendix A for the soil sample locations, Appendix E for the soil sampling logs and Appendix F for a photograph log. Field activities and chemical analyses were conducted in accordance with the *Final Facility-Wide Field Sampling Plan* (ARCADIS 2007a) and the 2007 QAPP (ARCADIS 2007b), as well as guidance from USACE, New Jersey Department of Environmental Protection (NJDEP), and USEPA Region 2 including the NJDEP *Field Sampling Procedures Manual* (NJDEP 2005) and the *Technical Requirements for Site Remediation* (NJDEP 2011).

TestAmerica, Laboratory, Inc., a National Environmental Laboratory Accreditation Program accredited laboratory, provided all analytical services. Copies of the laboratory analytical data packages are provided in Appendix G. The data qualifier summary report is provided in Appendix H. All data collected for this project were validated in accordance with the 2007 QAPP, which requires validation in accordance with the following documents:

- USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, October 1999
- USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, July 2002

3.2.2 Levels of Concern

The LOCs associated with all of the analytes included in this sampling program can be found in the table in Appendix D. Note that throughout Section 3, references to an LOC refer to the LOC obtained from the 2007 Final QAPP (ARCADIS 2007b). The LOCs for this SI were obtained from the 2007 QAPP and are the more stringent of the following:

- NJDEP Impact to Groundwater
- NJDEP Non-Residential Soil Cleanup Criteria
- USEPA Region III Risk-Based Concentrations (2003)

3.2.3 Summary of Sampling and Analytical Results

Since no anomalies were identified in the western portion of the 300 Marsh Area during the SI geophysical investigation, in accordance with the 2007 SAP soil samples[9] were collected at approximately 200-foot gridded intervals to obtain information regarding spatial distribution of chemical contamination, if any, in the marsh. Initially, 13 soil samples were collected, 300MA-0003 through 300MA-0015. These samples, which were collected from zero to six inches bgs, were analyzed for TAL metals, PCBs, TCL SVOCs, and explosives. As discussed in Section 4, arsenic was detected at concentrations above the LOC in many of these samples. Therefore, to delineate the horizontal and vertical extent of the arsenic contamination, seven step-out soil samples[10] were collected during follow-up sampling events (July 31, 2012 and October 22, 2013) from the following five locations and analyzed for arsenic only:

[9] The sampled environmental medium is not bed sediment, as would occur in a surface water body, but is more accurately characterized as hydric soil. Therefore, the samples collected during the SI are considered soil samples and not sediment samples.

[10] A field duplicate sample, 300MA-0020D, was collected from the same location as 300MA-0010D. This sample is not discussed further in this report since it was collected for quality control purposes. The results for this sample are shown in the table in Appendix D.

- **300MA-0010** is the farthest south location sampled within the 300 Marsh Area. 300MA-0010D was collected adjacent to original sample location 300MA-0010, which had an arsenic concentration above the LOC, to determine if arsenic concentrations above the LOC are found in the southern portion of the 300 Marsh Area below the surface soil layer (*i.e.*, the top six inches).

- **300MA-0016** was placed east of 300MA-0012, which had an arsenic concentration above the LOC, to delineate the southeastern extent of arsenic concentrations in the 300 Marsh Area soil above the LOC. Two soil samples were collected from this location: one sample from 0 to 6 inches bgs and one sample from 12 to 18 inches bgs. The sample from 12 to 18 inches bgs was collected to determine if arsenic concentrations above the LOC are found in the southeastern portion of the 300 Marsh Area below the surface soil layer.

- **300MA-0017** was placed between 300MA-0005, which had an arsenic concentration above the LOC, and 300MA-006, which did not have an arsenic concentration above the LOC, to delineate the northeastern extent of arsenic concentrations in the 300 Marsh Area soil above the LOC. Two soil samples were collected from this location: one sample from 0 to 6 inches bgs and one sample from 12 to 18 inches bgs. The sample from 12 to 18 inches bgs was collected to determine if arsenic concentrations above the LOC are found in the northeastern portion of the 300 Marsh Area below the surface soil layer.

- **300MA-0013** exhibited the highest concentration of arsenic measured in the zero to six inch bgs interval [38 milligrams per kilogram (mg/kg)]. To further investigate whether arsenic concentrations exceed the LOC at depths below the surface soil layer (0 to 6 inches bgs), 300MA-0013D was collected adjacent to the original sample location 300MA-0013 from a depth of 2 to 2.5 feet bgs.

- **300MA-0014** exhibited the second highest concentration of arsenic measured in the zero to six inch bgs interval (37 mg/kg). Similar to 300MA-0013, 300MA-0014D was collected adjacent to the original sample location 300MA-0014 from a depth of 2 to 2.5 feet bgs to further investigate whether arsenic concentrations exceed the LOC at depths below the surface soil layer (0 to 6 inches bgs).

Refer to Figure 13 in Appendix A for the sample locations, Table 3-1 for a summary of the analytical results, and the table in Appendix D for the analytical results for all samples. The analytical results indicated the following:

- **Metals** – Two metals, arsenic and lead, were detected at concentrations above their LOCs; all other metals were detected at concentrations below their LOCs.

- **SVOCs** – One PAH, benzo(b)fluoranthene, was detected at a concentration above the LOC; all other SVOCs either were not detected or were found at concentrations below their LOCs.

- **PCBs** – PCB Aroclors either were not detected or were found at concentrations below the LOC.

- **Explosives** – Explosives either were not detected or were found at concentrations below their LOCs.

Table 3-1
Summary of SI Data

Analyte	LOC	Background Concentration[1]	No. of Detections	No. of Detections > LOC	No. of Samples Collected	Maximum Concentration
Arsenic	20 mg/kg	16 mg/kg	21	9	21	38 mg/kg
Lead	400 mg/kg	39 mg/kg	13	1	13	410 mg/kg
Benzo(b) fluoranthene	900 µg/kg[2]	NA[3]	6	2	13	11,000 J[4] µg/kg

Notes:
1. Background concentrations, which are applicable only to metals, were taken from the 2002 Background Investigation (IT Corporation 2002).
2. µg/kg – micrograms per kilogram
3. NA – not applicable
4. J – estimated value based on data validation

3.2.4 Data Usability

As noted in Section 3.2.1, all sampling activities were conducted in accordance with the 2007 SAP (Shaw 2007) and the 2007 QAPP (ARCADIS 2007b). No major deficiencies were noted during data validation, and none of the data from the 300 Marsh Area were rejected as a result of the data validation process. Specifically, data precision and accuracy are considered acceptable based on the use of USEPA-approved analytical methods with acceptable performance for method blanks, control samples, instrument calibration, and interference checks. The sampling protocols included in the 2007 SAP and 2007 QAPP were developed to ensure that the samples collected are representative of the media under study, and field handling protocols (including storage, field handling, and shipping) were designed to preserve the representativeness of the collected samples. Therefore, all data are considered usable from the field perspective. Further, because all collected data are considered useable, the dataset itself is considered complete. However, it should be noted that some of the SVOC data had reporting limits (RLs) and detection limits (DLs)[11] that were above the LOC for certain analytes. For the reasons detailed below, it does not appear that the elevated RLs and DLs have an impact on the data evaluation. Finally, since data usability is based on procedures outlined in the 2007 SAP and 2007 QAPP, comparisons of current data with data that predate these documents should be considered qualitative.

According to the laboratory, some of the RLs and DLs had to be adjusted since the samples required dilution prior to analysis due to the viscosity of the sample. This was likely a result of the high organic matter content since peat, which is partially decomposed vegetation found in marshes,

[11] The DL is defined as the minimum concentration of an analyte that can be identified with 99% confidence that the analyte concentration is greater than zero and the RL is defined as the minimum value of the calibration range.

often forms a viscous fluid during sample preparation[12]. While the laboratory reports non-detect values to the RL, the DL was reviewed for this evaluation since the DL is typically lower than the RL. The DL is still considered a valid limit since it is defined as the minimum concentration of an analyte that can be identified with 99% confidence that the concentration is greater than zero. All SVOCs and the associated samples with DLs above the LOCs are shown in Table 3-2.

Table 3-2
Analytes With RLs/DLs Above LOCs

Analyte	Samples with DLs Above LOC[1,2]	No. of Samples Above LOC/ No. of Samples Below LOC
Analytes Identified as COC[3]		
Chrysene	9	1 of 13
Benzo(b)fluoranthene	5, 9	2 of 13
Benz(a)anthracene	3, 4, 5, 9	4 of 13
Indeno(1,2,3-c,d)pyrene	3, 4, 5, 9	4 of 13
Dibenz(a,h)anthracene	3, 4, 5, 9, 11	5 of 13
Benzo(a)pyrene	3, 4, 5, 9, 10, 11	6 of 13
Benzo(k)fluoranthene	3, 4, 5, 9, 10, 11	6 of 13
Analytes Not Identified as COC[4]		
Bis(Chloroisopropyl)Ether	9	1 of 13
Nitrobenzene	9	1 of 13
Hexachloroethane	5, 9	2 of 13
Hexachlorobutadiene	3, 4, 5, 9	4 of 13
bis(2-Chloroethyl)ether	3, 4, 5, 9, 10	5 of 13
3,3'-Dichlorobenzidine	3, 4, 5, 9, 10, 11	6 of 13
Hexachlorobenzene	3, 4, 5, 9, 10, 11	6 of 13
n-Nitroso-di-n-propylamine	3, 4, 5, 9, 10, 11	6 of 13
Pentachlorophenol	3, 4, 5, 6, 9, 10, 11	7 of 13

Notes:
1. All sample IDs begin with PTA-2012-300MA-00 (for two-digit sample IDs) or PTA-2012-300MA-000 (for single-digit sample IDs).
2. Throughout this section, samples with elevated DLs are referred to as diluted samples while samples without elevated DLs are referred to as undiluted samples.
3. These include analytes identified as COCs for PICA-072/Site 31 in the 2007 Proposed Plan (ARCADIS 2007c) and analytes identified as COCs for PICA-193 in the 2004 ROD (PTA 2004).
4. There are no known activities that occurred in the 300 Marsh Area; therefore, it is likely that if chemical contamination is present, it is due either to activities conducted at the Former DRMO Yard or activities that caused chemical contamination in Green Pond Brook. These SVOCs are not listed as COCs for Sites 31 and 193, which are adjacent to the 300 Marsh Area, and there are no known sources for these SVOCs.

As shown in Table 3-2, seven SVOCs are COCs for the Former DRMO Yard (IRP Site 31) or Green Pond Brook (Site PICA-193), and nine SVOCs are not COCs for Site 31 or PICA-193. None of these SVOCs have been detected at levels above their LOC in the undiluted soil samples. Benzo(b)fluoranthene, which is the only SVOC detected at a concentration above the

[12] All of the sample logs (see Appendix E) for the surface soil samples (*i.e.*, less than six inches bgs) indicate the presence of organic matter. Therefore, it is unlikely that it would be possible to obtain surface soil samples from the 300 Marsh Area that do not contain peat.

LOC was found in two diluted samples. Therefore, significant SVOC contamination is not indicated at the 300 Marsh Area.

4 DATA EVALUATION

4.1 300 Marsh Area

Arsenic was the only analyte detected in the 300 Marsh Area at concentrations above the LOC and over a relatively widespread area. Refer to Figure 14 in Appendix A. Other analytes either were not detected at concentrations above their respective LOCs or did not show significant spatial distribution throughout the 300 Marsh Area sampling area. Arsenic, which was detected in all 21 samples collected from the 300 Marsh Area, was found in nine samples at concentrations above the LOC of 20 milligrams per kilogram (mg/kg). Samples with arsenic concentrations above the LOC were shallow soil samples (*i.e.*, collected from 0 to 6 inches bgs). Arsenic concentrations in the samples collected from 12 to 18 inches bgs ranged from 4 mg/kg to 6.5 mg/kg, and the two samples collected from 24 to 30 inches bgs exhibited concentrations of 5.4 mg/kg and 14 mg/kg (all below the background concentration of 16 mg/kg provided in Table 3-1).

As discussed above, within the 300 Marsh Area arsenic has been found at concentrations above the LOC in only the upper six inches of soil. Soil samples were collected as a function of depth at five of the fifteen sampling locations (Refer to Table 4-1), including the two locations exhibiting the highest surface soil arsenic LOC exceedances. At these locations, soil arsenic concentrations decreased with depth between 43% and 85% relative to surface soil concentrations, with all of the deeper samples exhibiting concentrations below the background level of 16 mg/kg (Table 3-1).

The fact that arsenic is observed at higher concentrations in the top 0 to 6 inches of soil strongly suggests that the arsenic is not highly mobile within the soil column. In particular, it can be inferred that the arsenic is exhibiting a high degree of partitioning to the soil phase, with aqueous concentrations remaining low as water travels down through the soil, since release of soil-bound arsenic into solution would cause a downward migration or “smearing” within the soil column.

Table 4-1
Arsenic Concentrations with Depth in 300 Marsh Area Soils

Sample	Date Collected	Depth (ft bgs)	Arsenic Concentration (mg/kg)	Percent Decrease with Depth
300 MA-0010	5/2/12	0 – 0.5	**22**	76
300 MA-0010D	5/2/12	1 – 1.5	5.3	
300 MA-0013	5/2/12	0 – 0.5	**38**	63
300 MA-0013D	10/22/13	2 – 2.5	14	
300 MA-0014	5/2/12	0 – 0.5	**37**	85
300 MA-0014D	10/22/13	2 – 2.5	5.4	
300 MA-0016	7/30/12	0 – 0.5	18	64
300 MA-0016D	7/30/12	1 – 1.5	6.5	
300 MA-0017	7/30/12	0 – 0.5	7	43
300 MA-0017D	7/30/12	1 – 1.5	4	

Note: bold values exceed the LOC

4.1.1 Arsenic-Soil Association and Ecological Risk

4.1.1.1 Potential Release Mechanisms

A number of potential release mechanisms for arsenic, listed below, are present within the 300 Marsh Area. This section evaluates whether these release mechanisms are viable, given the conditions present in the 300 Marsh Area. As discussed below, based on this evaluation it does not appear that release of arsenic in the 300 Marsh Area to the surrounding environment is occurring. Instead, it appears likely that geochemical controls within the 300 Marsh Area are providing a substantial limitation on the mobility of the arsenic. Therefore, no potential exposure pathways to human and/or ecological receptors appear to be present.

- Release through soil disturbance that may cause redistribution via infiltration/percolation of precipitation through soil, leaching from soil to groundwater, and surface runoff to a nearby water body.

- Secondary release mechanisms, including discharge of groundwater to surface water, surface water recharge to groundwater, and biotransfer of bioaccumulated arsenic through the food web.

4.1.1.2 Factors Potentially Affecting Arsenic Mobility

As discussed above, arsenic has been found at concentrations above the LOC only within the top six inches of soil. The high capacity for arsenic within the surface layer of soil in the 300 Marsh Area may be due to a number of factors, including the following:

- High Organic Matter Content (Peat) - Although this influence can be complicated, arsenic has the capacity to bind with solid and dissolved-phase organic matter (Wang and Mulligan 2006; references therein). In some systems, organic matter may enhance arsenic mobility by binding with arsenic in the dissolved phase and/or blocking or displacing it from iron oxide surfaces (Jiang *et al*. 2005), whereas in other systems, insoluble organic matter (existing as discrete particles or coatings on mineral surfaces) will enhance arsenic uptake, limiting mobility (*e.g.*, Saada *et al.* 2003). This control on arsenic immobilization has specifically been observed in wetland/peat systems, where strong arsenic-organic matter association can actually lead to an enrichment of arsenic in the organic matter layer over time as the soil column develops (Langner *et al*. 2012).

- Presence of Sulfide Minerals - Depending on the redox conditions and level of water saturation of the surficial soils, sulfide minerals may also be controlling the observed low mobility of arsenic. Specifically, in sulfate-reducing environments, arsenic can become entrapped in arsenic sulfide and mixed arsenic/iron sulfide phases or may adsorb to sulfide mineral surfaces (Onstott *et al*. 2011; references therein).

- Association of Arsenic with Iron - The transport of inorganic arsenic in shallow soil is very often controlled by adsorption onto/coprecipitation within iron oxides (Campbell and Hering 2008; Welch *et al*. 2000). Evidence for an iron-arsenic association within the 300 Marsh Area is provided by the strong correlation observed between iron and arsenic

concentrations. Refer to Figure 15 in Appendix A. Specifically, samples with higher arsenic concentrations tend to be associated with samples having higher iron concentrations, suggesting that these higher arsenic levels are stabilized by the iron present in the soil. This stabilization may be the result of a co-association of iron and arsenic in organic matter, association of arsenic within iron sulfides, and/or sorption of arsenic onto iron oxides.

Furthermore, the likelihood of disturbance within the 300 Marsh Area is expected to be minimal since the 300 Marsh Area is a protected wetland and no changes in land use are anticipated.

The observed low mobility (high soil-water partitioning) of arsenic in this area, coupled with a lack of soil disturbance, will limit the amount of arsenic that can be taken up by plants through the dissolved phase or that can migrate out of the 300 Area Marsh. Accordingly, arsenic exposure through these pathways is unlikely.

4.1.1.3 NJDEP Soil Ecological Screening Criteria

To provide further context on the arsenic LOC exceedances, the arsenic LOC was compared to the NJDEP soil ecological screening criteria in Table 4-2 below (NJDEP 2009). The NJDEP soil criteria vary substantially depending on receptor, with different criteria that are above and below the LOC and PTA-specific background. Screening levels based on plant receptors vary from 10 mg/kg (below the site-specific background) to 18 mg/kg, although as discussed above, plant uptake may be limited by the fact that arsenic is strongly bound to the soil. In contrast, ecological soil screening levels for birds and mammals are listed as 43 mg/kg and 46 mg/kg, respectively, which are both above the highest arsenic concentrations observed in the 300 Marsh Area. An additional soil screening level of 9.9 mg/kg (below the site-specific background) is listed in the NJDEP criteria as a Wildlife Preliminary Remediation Goal (PRG). However, this number is based on plant and shrew studies that may not be applicable to the 300 Marsh Area (see footnotes in NJDEP 2009).

Table 4-2
300 Marsh Area Arsenic Results vs. NJDEP Ecological Screening Criteria

300 Marsh Area Maximum Conc. (mg/kg[1])	LOC (mg/kg)	Back-ground Conc.[2] (mg/kg)	NJDEP Ecological Screening Criteria for Soil[3] (mg/kg)					
			Wildlife PRGs[4]	Terrestrial Plant Tox Benchmarks	EcoSSLs[5]			
					Plants	Soil Invertebrates	Avian	Mammalian
38	20	16	9.9	10	18	---	43	46

Notes:
1. mg/kg – milligrams per kilogram
2. Background concentration was taken from the 2002 Background Investigation (IT Corporation 2002).
3. NJDEP 2009. http://www.nj.gov/dep/srp/guidance/ecoscreening/esc_table.pdf
4. PRG – Preliminary Remediation Goal (see footnotes in NJDEP 2009)
5. EcoSSL – Ecological Soil Screening Level (see footnotes in NJDEP 2009)

4.1.2 Arsenic Source Evaluation

To evaluate the possibility that arsenic within the 300 Marsh Area may be related to historical activities within the Former DRMO Yard, the 300 Marsh Area results were compared to Former DRMO Yard surface soil data obtained from the IRP website eprism database. The Former DRMO Yard data analysis focused on surface soil data (zero to one foot bgs interval) with sample IDs beginning with "31GR," representing the 2003 sampling event. The analytical procedures for this set of samples were sufficiently comparable to those used in the 300 Marsh Area analyses to allow for quantitative comparison, with USEPA Method 6010B (ICP-AES) used in the Former DRMO Yard analyses and USEPA Method 6020 (ICP-MS) used in the 300 Marsh Area analyses following total acid digestion. However, the comparison below may be considered qualitative since the 31GR samples predate the 2007 QAPP, as indicated in Section 3.2.4.

Metal-to-arsenic concentration ratios were determined for metals identified as COCs for the Former DRMO Yard and the ratios for the Former DRMO Yard data were compared to the 300 Marsh Area data. The results for cadmium, copper, lead, and zinc are shown on Figure 16 in Appendix A. For each area, the ratio results are shown collectively using box-and-whisker plots. In these plots, the box boundaries encompass all data points between the 25th and 75th percentiles, the whiskers encompass data points between the 10th and 90th percentiles, and the points outside of the whiskers include data points that fall outside of the 10th and 90th percentiles. The median value (50th percentile) is indicated by the solid line within the box.

Comparison of the box-and-whisker plots illustrates that the metal to arsenic ratios in surface soils differ substantially between the Former DRMO Yard and the 300 Marsh Area, with higher cadmium to arsenic, copper to arsenic, lead to arsenic, and zinc to arsenic ratios observed in the Former DRMO Yard samples. These results suggest that the processes controlling historical deposition of COCs within the Former DRMO Yard, which ultimately influenced the ratios of different COCs in surface soils, are not the same processes that controlled arsenic deposition in the 300 Marsh Area.

Although it is possible that different depositional modes may be responsible for the placement of arsenic in the DRMO Yard and in the 300 Marsh Area, any process that may have transported arsenic and other metals to the 300 Marsh Area from the DRMO Yard would have also deposited arsenic in the DRMO Yard itself. However, comparison of the arsenic levels within the 300 Marsh Area and Former DRMO Yard (Figure 17 in Appendix A) illustrates that arsenic concentrations within the 300 Marsh Area are similar, and in fact a little higher, than within the DRMO Yard.

There are three potential pathways by which arsenic could have been transported to the 300 Marsh Area from the DRMO Yard: 1) water transport (*i.e.*, dissolved and/or particulate form within either surface water or rain water), 2) wind transport (*i.e.*, transport of dust, fine soil, or other particulates through the air), or 3) burning activities causing arsenic volatilization, followed by wet and/or dry deposition. It is highly unlikely, however, that any of these processes could deposit arsenic in the 300 Marsh Area that would result in arsenic concentrations that are both 1) similar to the total soil arsenic observed in the DRMO Yard and 2) differ so substantially in metal-to-arsenic ratios as in the DRMO Yard. Specifically, if arsenic were transported to the DRMO Yard in particulate form, either through wind or water, it would be anticipated that metal-to-arsenic ratios as observed in soil

samples would be more similar than they are. It would also be expected that the soil arsenic concentration would exhibit a decreasing trend with distance from the DRMO Yard; however, this does not appear to be the case. Figure 18 shows surface soil arsenic concentrations plotted as a function of perpendicular distance from Green Pond Brook, with trend lines fit to the data to determine whether a decreasing trend with distance could be observed. A linear fit to all of the concentration data (above- and below-LOC values), although exhibiting a negative slope, yields an R^2 value of 0.159, indicating that the decrease in arsenic concentration with distance from the DRMO yard is not statistically significant. Focusing on the above-LOC values only, the trend line actually has a slightly increasing slope (*i.e.*, increasing arsenic concentrations with distance from Green Pond Brook), though again the trend is not statistically significant. Thus, the arsenic concentrations observed within the 300 Marsh Area are not statistically higher in the vicinity of the DRMO Yard than they are at points more distant from the DRMO Yard.

Transport of arsenic to the 300 Marsh Area in dissolved surface water (*e.g.*, before Green Pond Brook was re-routed between the two areas) is also highly unlikely, as arsenic within surface water would be extremely diluted and would not be taken up by the soil in such uniformly high concentrations across the marsh. Finally, if arsenic were liberated from the DRMO Yard through volatilization during burning activities and deposited in the 300 Marsh Area, it would be anticipated that other volatile metals, including lead and cadmium, would have been deposited as well, and thus the metal-to-arsenic ratios would be more similar in the two areas. Based on these results, it appears extremely unlikely that the arsenic in the 300 Marsh Area is related to the DRMO Yard.

Ultimately, the source of arsenic levels above the LOC in the 300 Marsh Area is unknown; however, it is probable that the arsenic levels observed in the surficial soils of the 300 Marsh Area are primarily the result of enriched naturally occurring arsenic. As discussed above, arsenic levels above the LOC are restricted to the surface, where high concentrations of organic matter reside. Arsenic concentrations in the 300 Area, although above the site LOC, are not substantially above background levels and do not appear to be associated with the former DRMO Yard. The above facts suggest that the arsenic levels observed are a result of an enrichment of arsenic in the organic matter layer as a result of geochemical processes. Therefore, further investigation of the 300 Marsh Area does not appear warranted.

4.2 East Bank Green Pond Brook

Analysis of three historical samples collected from the east bank of Green Pond Brook in the area of the DRMO Yard has indicated the presence of numerous metals, including antimony, arsenic, cadmium, copper, lead, mercury, and zinc at concentrations above the LOCs. Two of these sample locations cannot be accurately determined since sample coordinates are not available and the original map showing the sample locations is not to scale. The third sample, 31GR-S18, which was collected in 2005, is located along the north portion of the 300 Marsh Area.

According to the Final FS for Sites 31 and 101 (Shaw, 2005), contaminated soil associated with sample 31GR-S18 was to be addressed under the Sites 31 and 101 ROD as area of attainment AA_{S-3}. However, as indicated in the Final Record of Decision for Site 31/101 (PICA 072) Soil (ARCADIS, 2008) that "*in the Feasibility Study (FS) for Site 31/101 (PICA 072), a response*

action recommendation was made for apparently isolated soil deposit located on the eastern bank of Green Pond Brook (GPB), opposite Building 314 (former DRMO Yard). This sample location (31GR-S18) and surrounding area will be investigated in the future as a new Installation Restoration Program (IRP) site or as part of the Military Munitions Response Program (MMRP)."

Therefore, during the MMRP RI, geophysical investigations were conducted along the banks of Green Pond Brook near the Former DRMO Yard. Although more than 400 anomalies were identified and intrusively investigated, MD was only found at four locations; two locations in the western bank of the brook and two locations in the eastern bank of the brook

Two soil samples, 300MA-0001 and 300MA-0002, were collected from the eastern bank of Green Pond Brook at locations where MD was found during the MMRP. Numerous metals including antimony, arsenic, copper, lead and zinc, were found at concentrations above their respective LOCs in 300MA-0001, which was located approximately 20 feet from sample 31GR-S18. Barium and beryllium were detected above their respective LOCs in sample 300MA-0002, which was located near the center of the 300 Marsh Area.

The data from samples 300MA-0001, 300MA-0002, and 31GR-S18 indicate the metals detected in the east bank of Green Pond Brook soils may be associated with MD. Although the MMRP investigation did not indicate the presence of large burial areas in the eastern bank, the extent of soil containing metals at concentrations above their respective LOCs is unknown. Therefore, it is recommended that additional systematic and biased soil samples be collected from the eastern bank of Green Pond Brook, in the vicinity of the DRMO Yard, and analyzed for antimony, arsenic, cadmium, copper, lead, mercury, and zinc.

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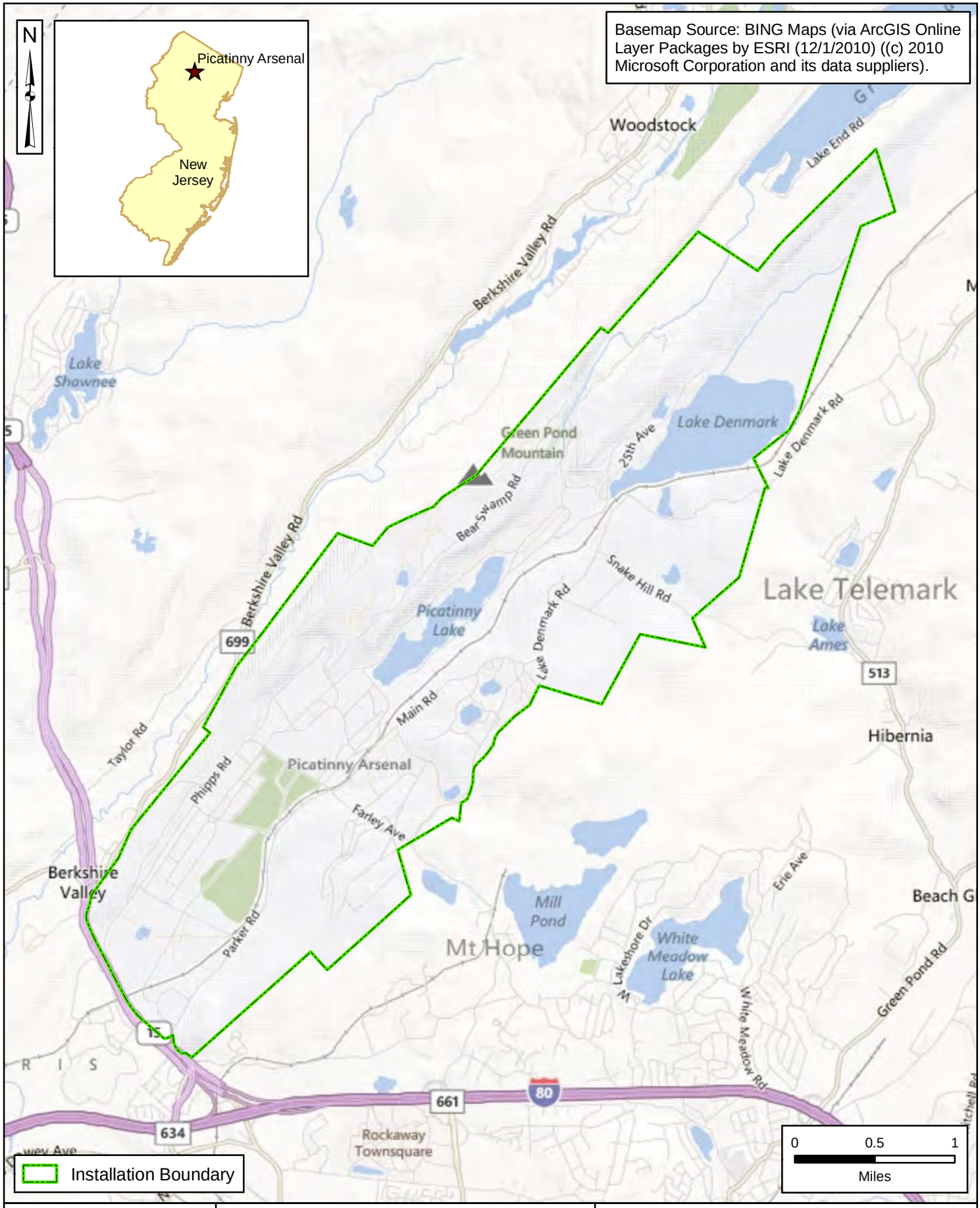
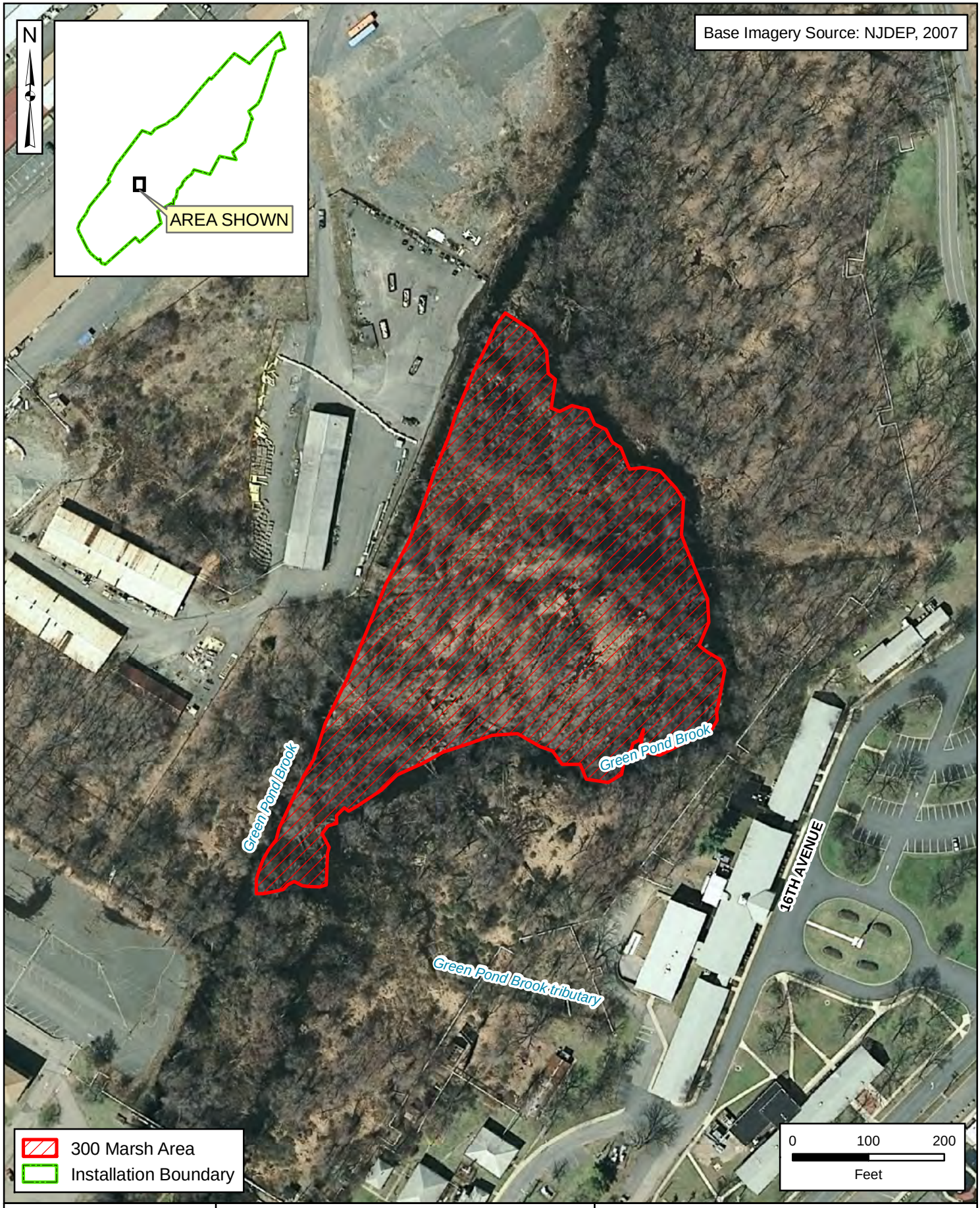
APPENDIX A – Figures



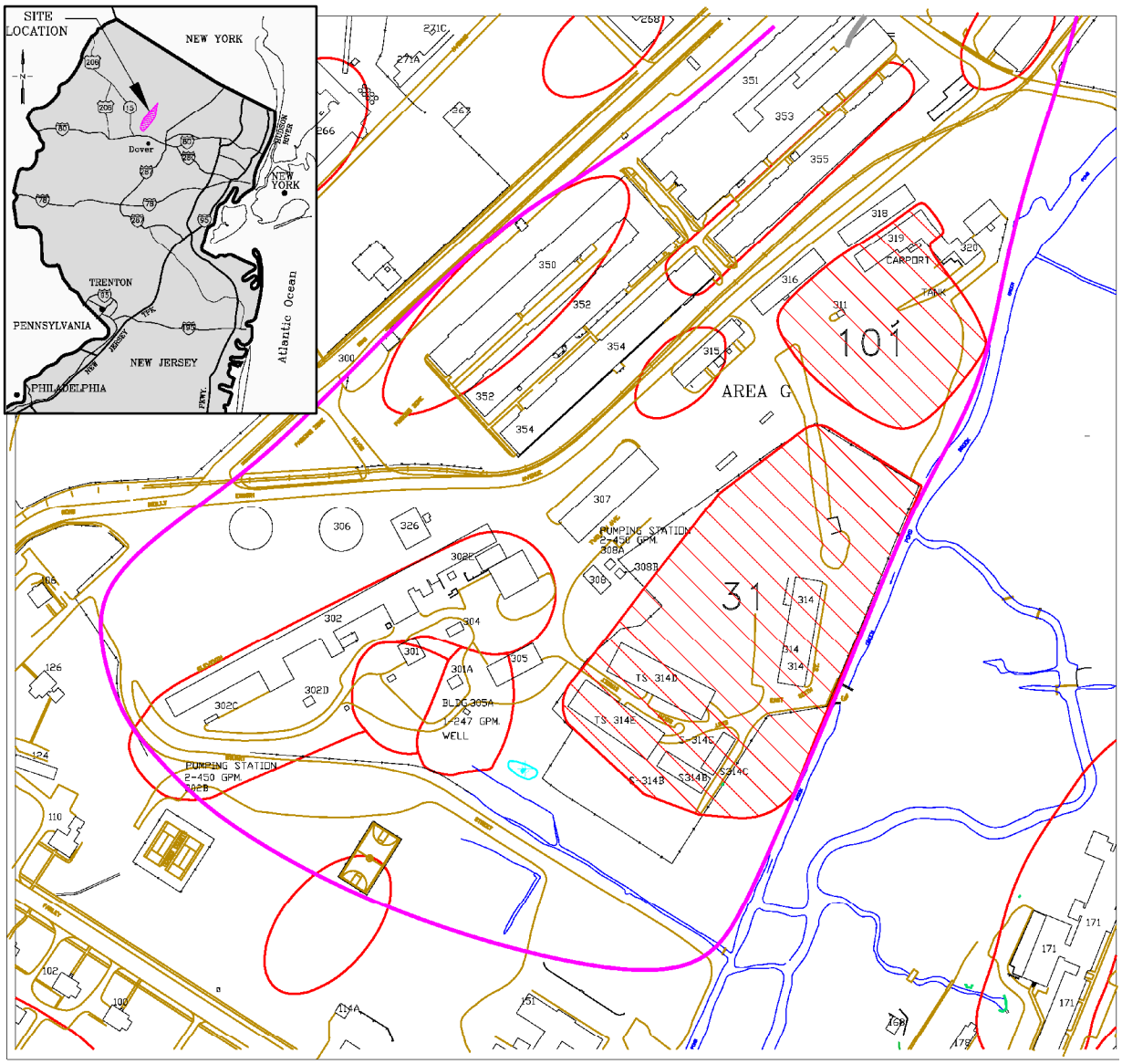
ARCADIS	**PICATINNY ARSENAL** **MORRIS COUNTY, NEW JERSEY**	**FIGURE 1** **PICATINNY ARSENAL LOCATION**

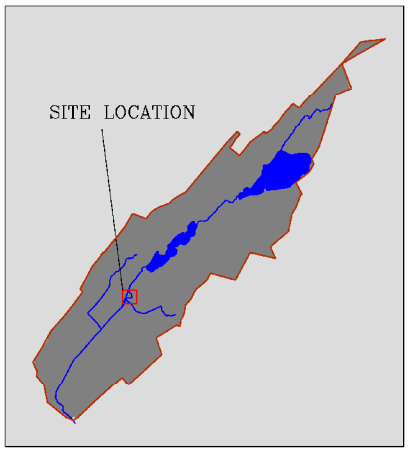


ARCADIS

PICATINNY ARSENAL
MORRIS COUNTY, NEW JERSEY

FIGURE 2
300 MARSH AREA





LEGEND

- ROAD
- BUILDING
- FORMER BLDG.
- WATER/STREAM
- FENCE
- AREA BOUNDARY
- STUDY SITE
- SITE BOUNDARY

SCALE

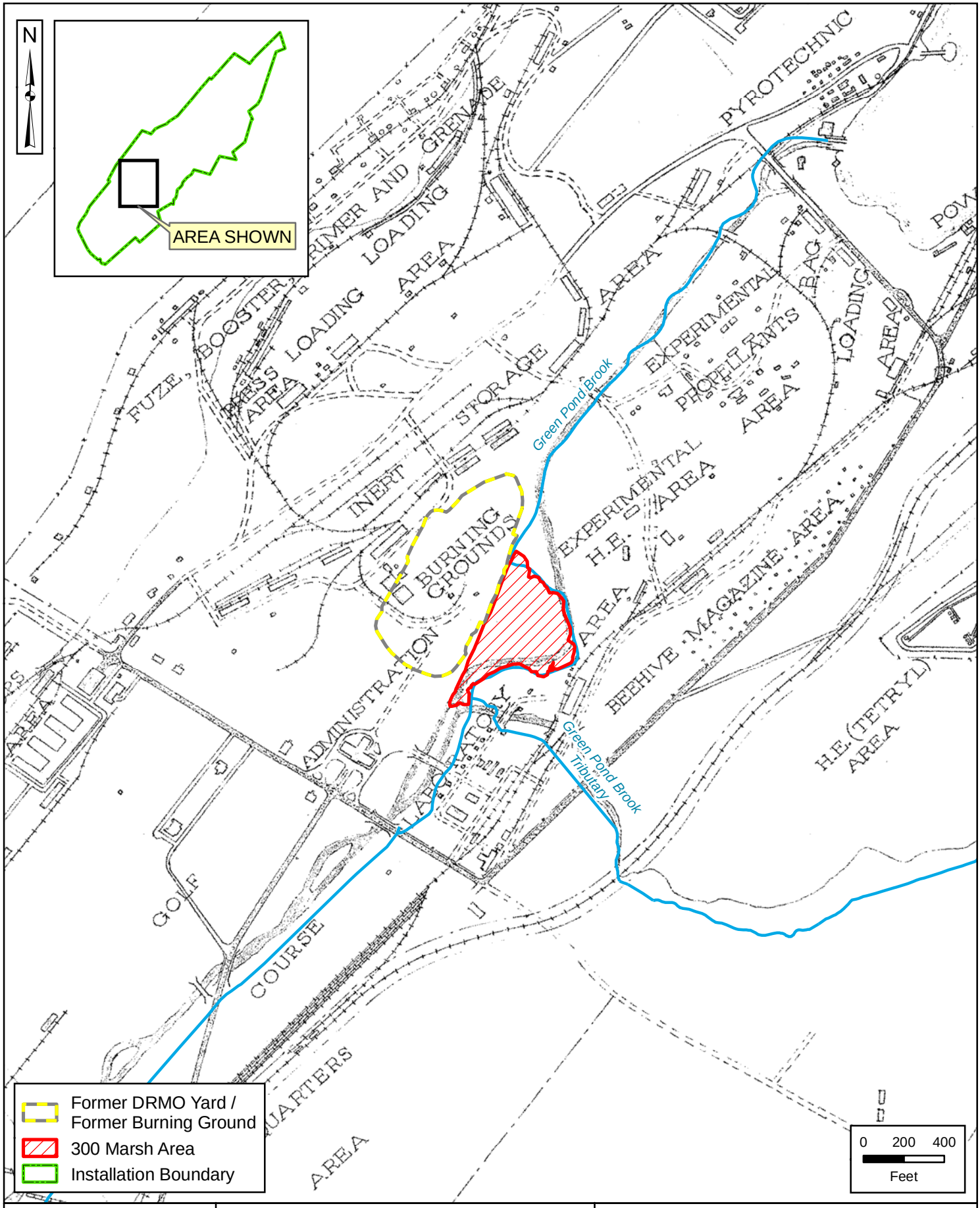
0 200 400 FEET

Source: ARCADIS, Inc., *Final Proposed Plan Sites 31 and 101 (PICA 072), Former DRMO Yard and Former Gas Station*, September 2007

ARCADIS

PICATINNY ARSENAL
MORRIS COUNTY, NEW JERSEY

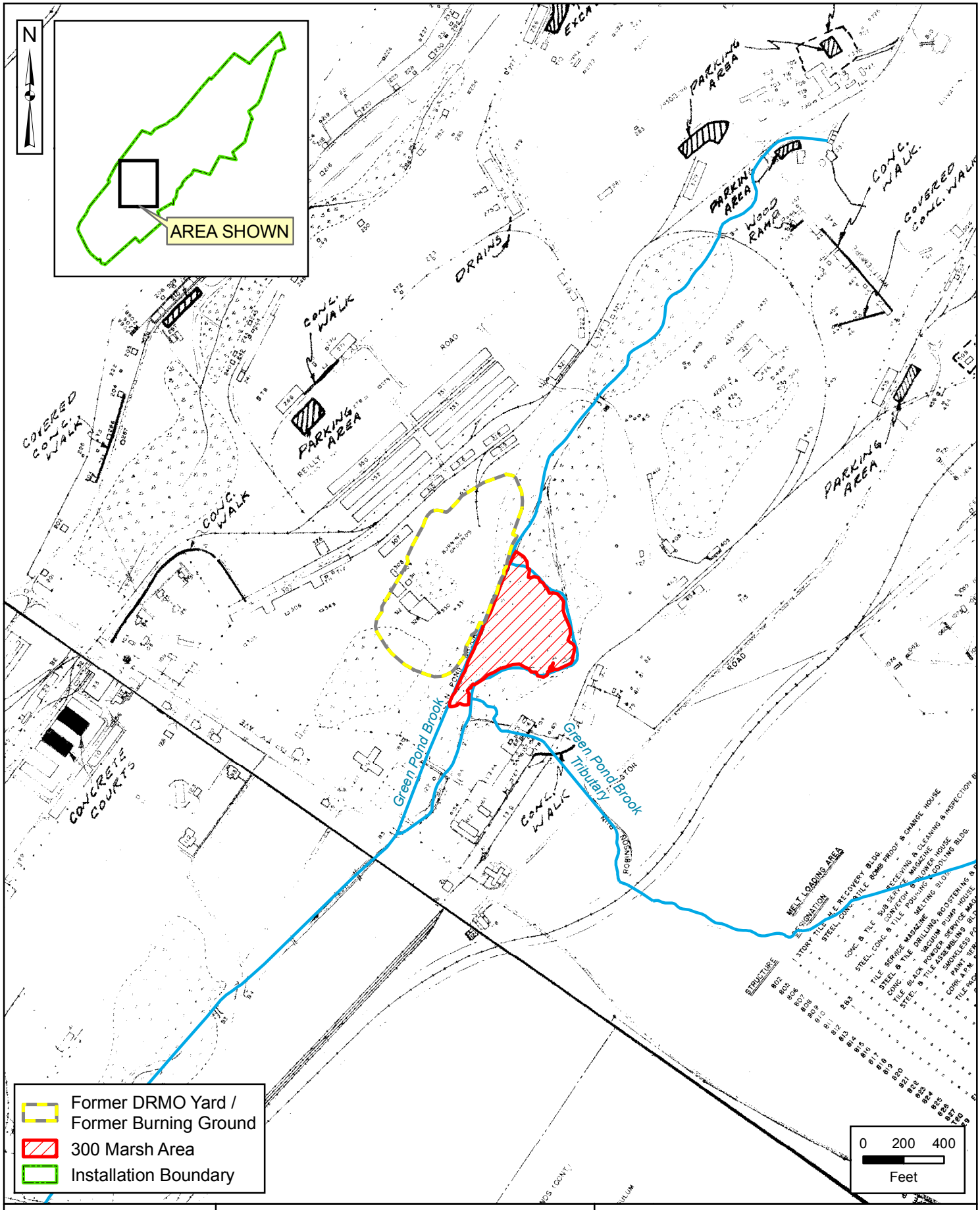
FIGURE 3
PICA-072/SITE 31 LOCATION



ARCADIS

PICATINNY ARSENAL
MORRIS COUNTY, NEW JERSEY

FIGURE 4
1931 RESERVATION MAP
PICATINNY ARSENAL



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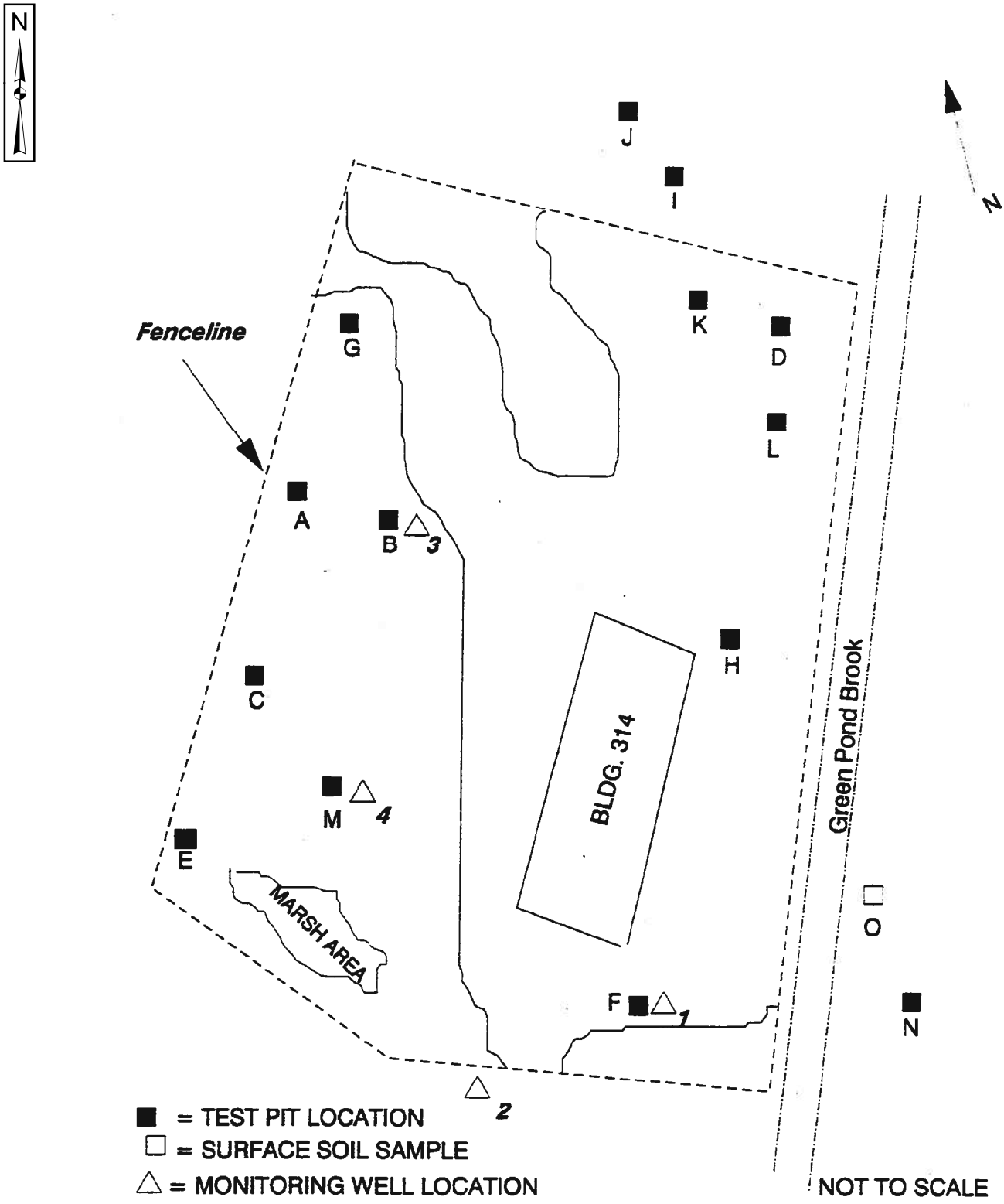
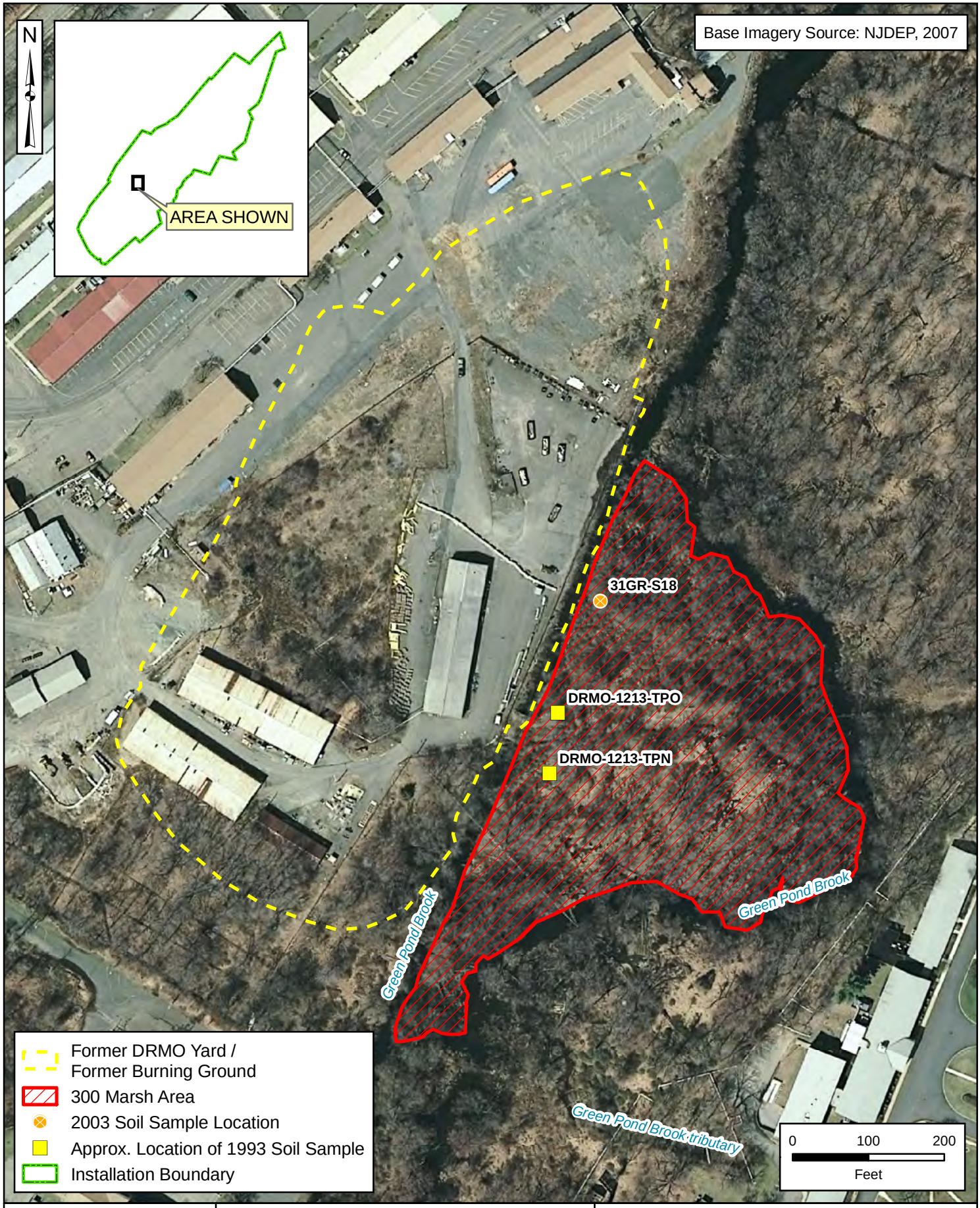
PICATINNY ARSENAL
MORRIS COUNTY, NEW JERSEY

FIGURE 5
1940 RESERVATION MAP
PICATINNY ARSENAL



Source: Roy F. Weston, Inc., *Non-Time Critical Removal Action Site Investigation Report of the DRMO (RI – Concept Site No. 31)*, July 1994

ARCADIS	**PICATINNY ARSENAL** **MORRIS COUNTY, NEW JERSEY**	**FIGURE 6** **NON-TIME CRITICAL REMOVAL ACTION** **TEST PIT LOCATIONS**



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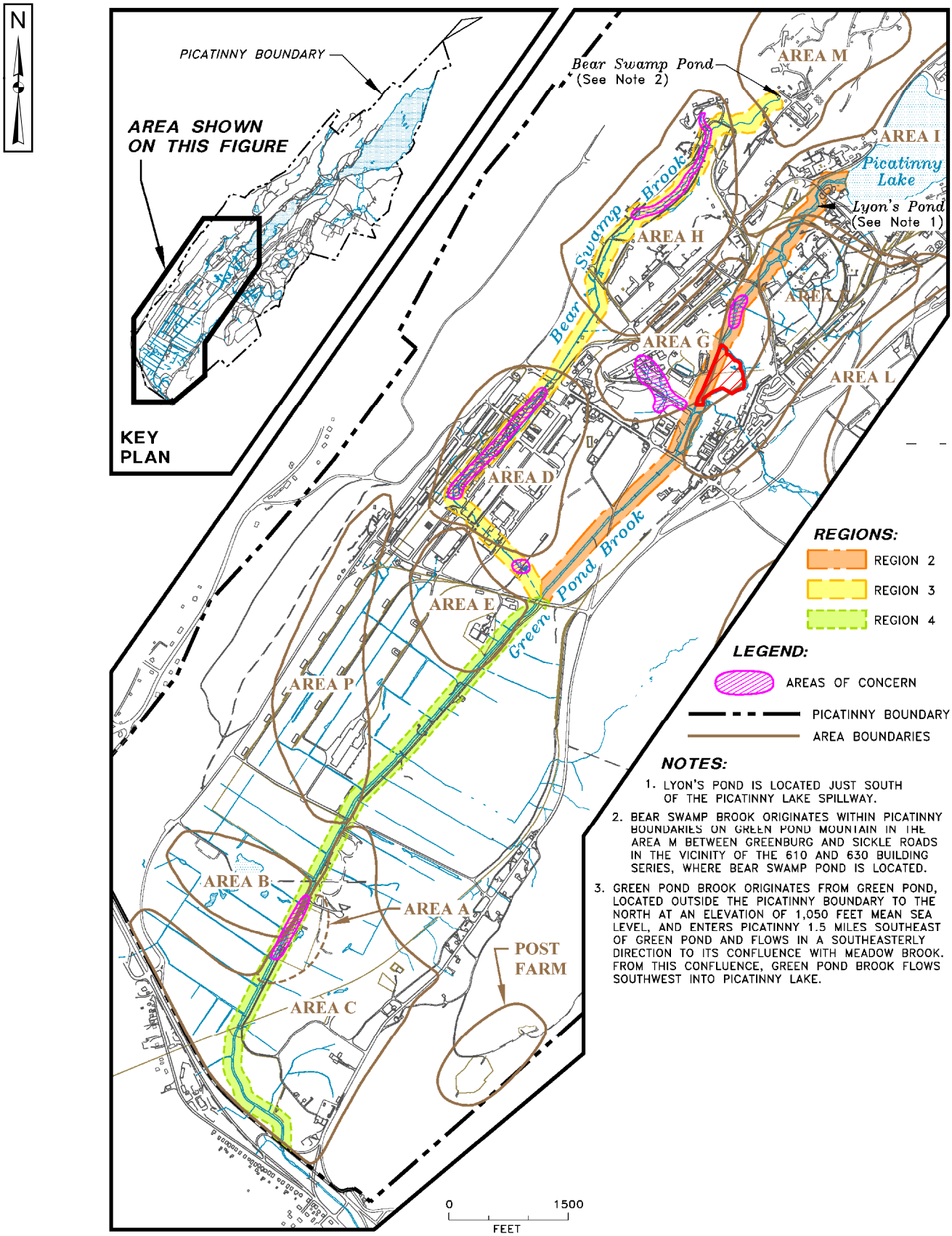
PICATINNY ARSENAL
MORRIS COUNTY, NEW JERSEY

FIGURE 7
IRP SOIL SAMPLE LOCATIONS



Source: PTA, *Record of Decision, Green Pond Brook/Bear Swamp Brook, Picatinny, New Jersey*, December 2004

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PICATINNY ARSENAL
MORRIS COUNTY, NEW JERSEY

FIGURE 8
GREEN POND BROOK
REMEDIAL ACTION REGIONS

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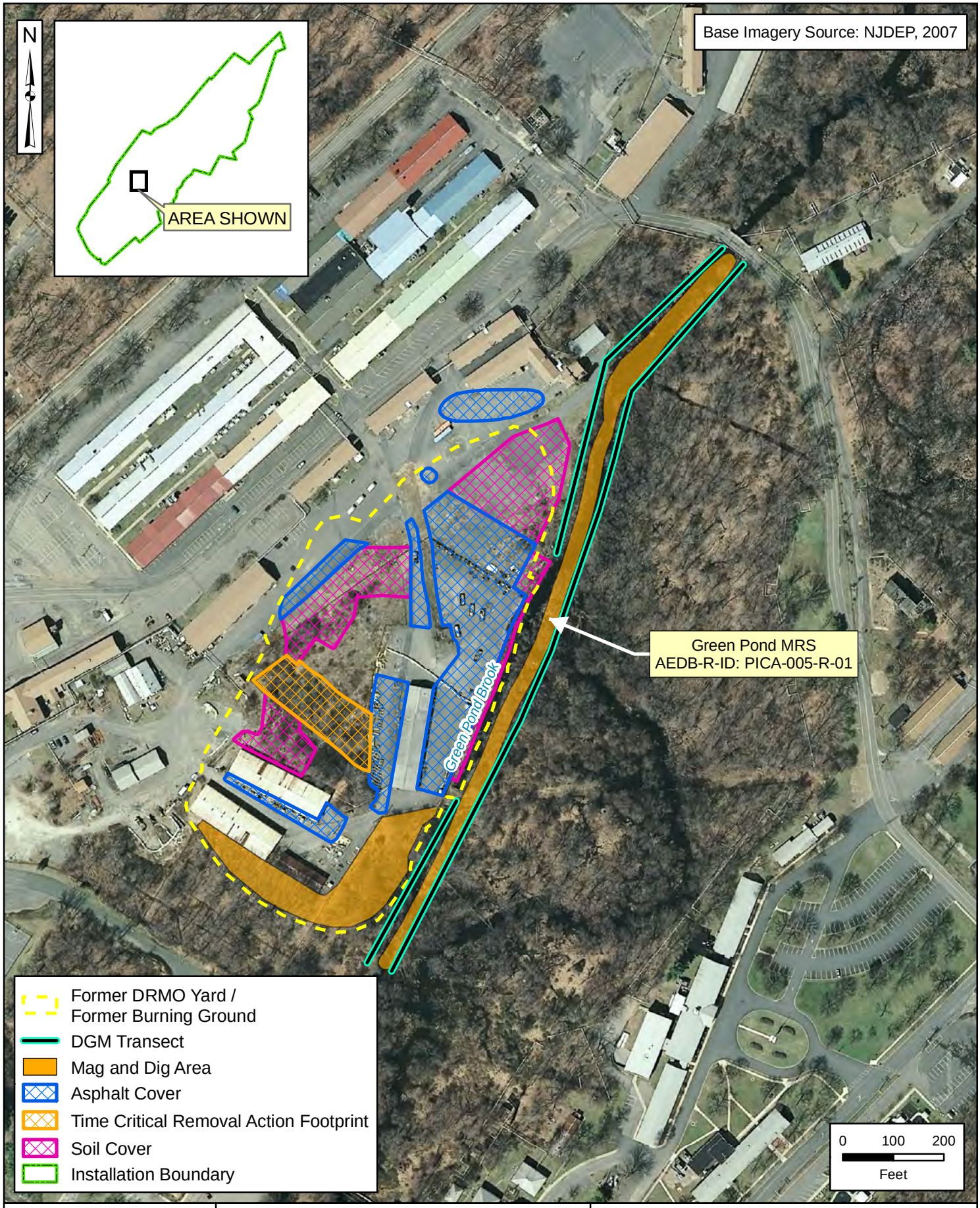
PICATINNY ARSENAL
MORRIS COUNTY, NEW JERSEY

FIGURE 9
GREEN POND MRS



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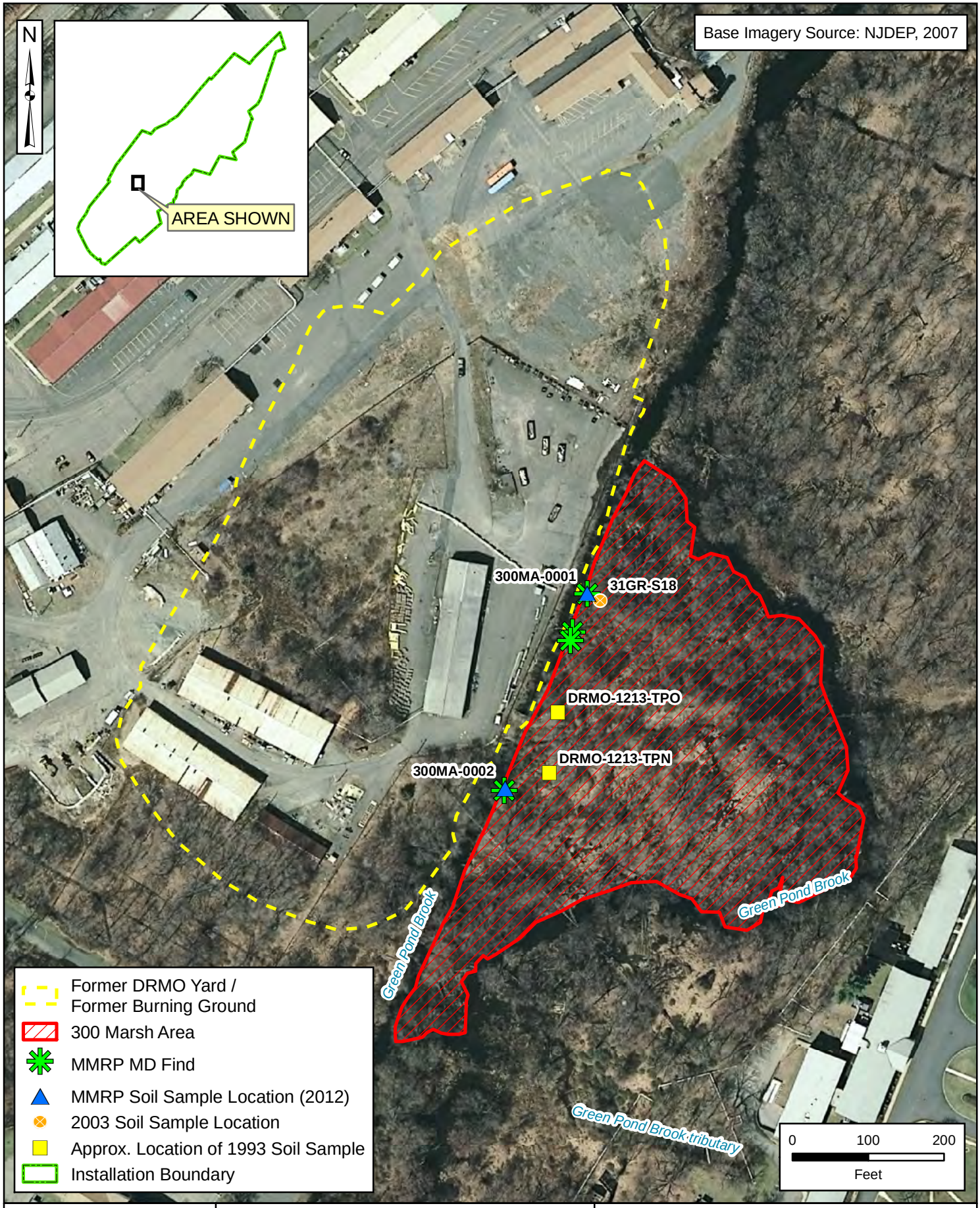
PICATINNY ARSENAL
MORRIS COUNTY, NEW JERSEY

FIGURE 10
GREEN POND MRS
MMRP CHARACTERIZATION APPROACH



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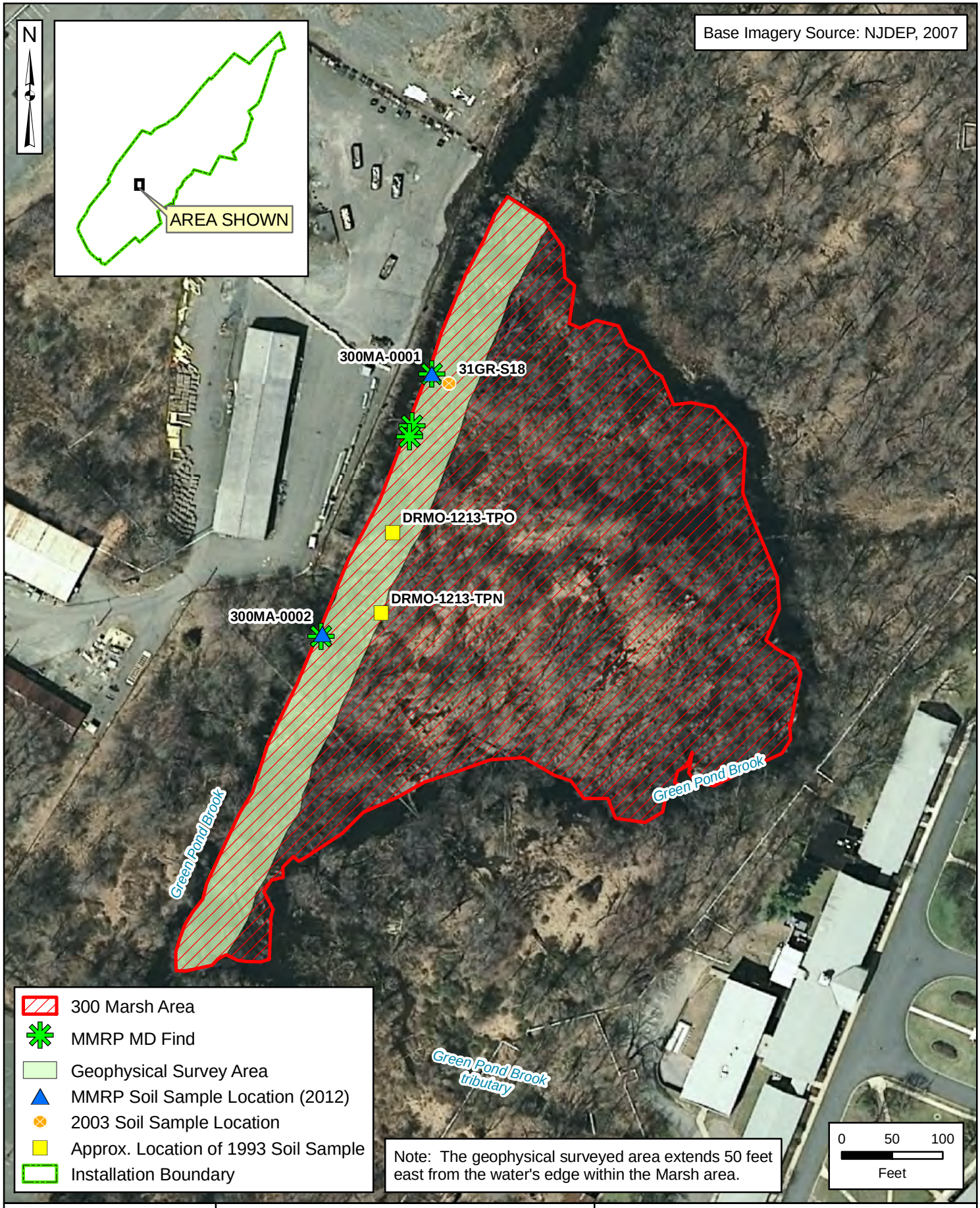
PICATINNY ARSENAL
MORRIS COUNTY, NEW JERSEY

FIGURE 11
IRP AND MMRP GREEN POND MRS
SOIL SAMPLE LOCATIONS



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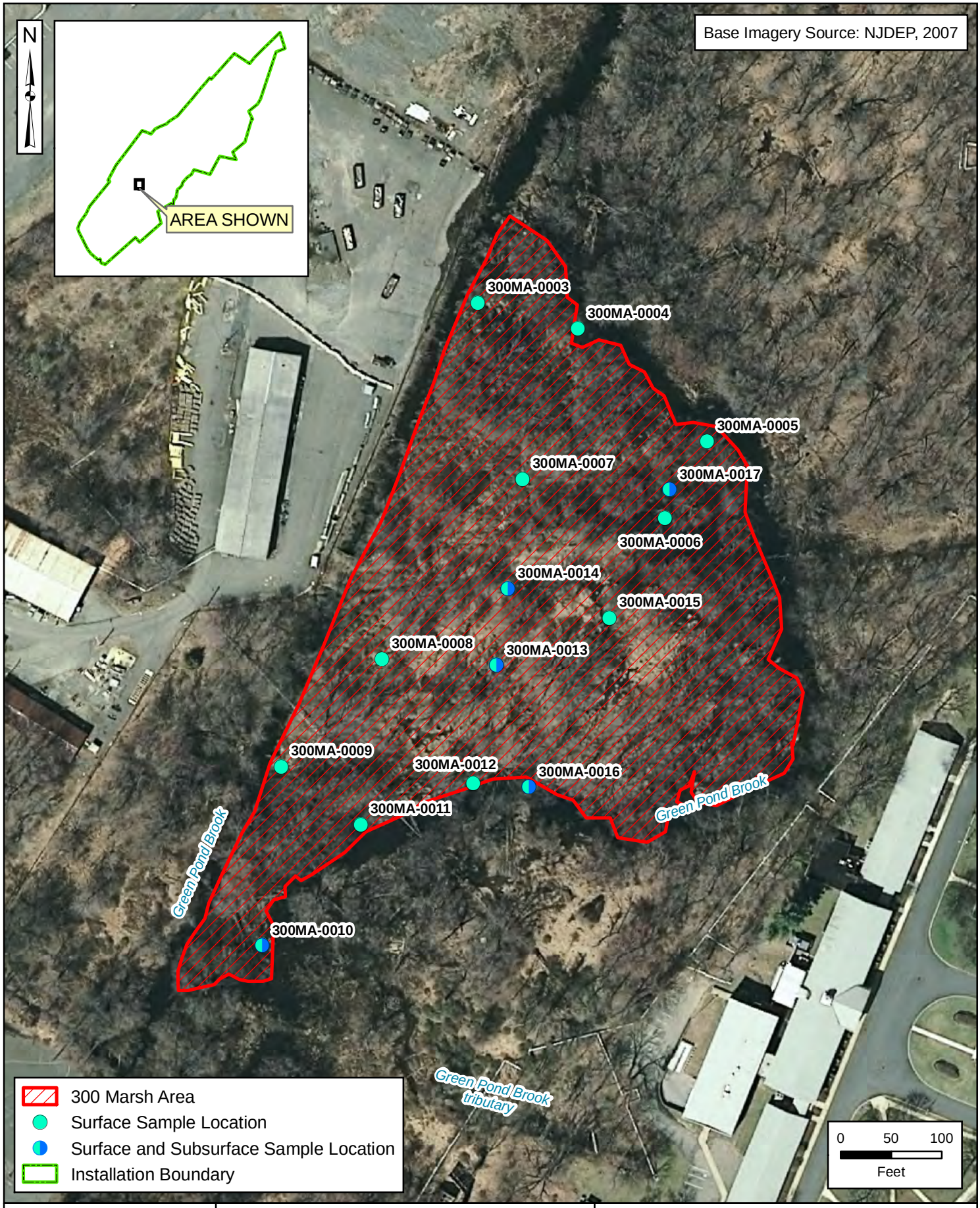
PICATINNY ARSENAL
MORRIS COUNTY, NEW JERSEY

FIGURE 12
GEOPHYSICAL SURVEY AREA



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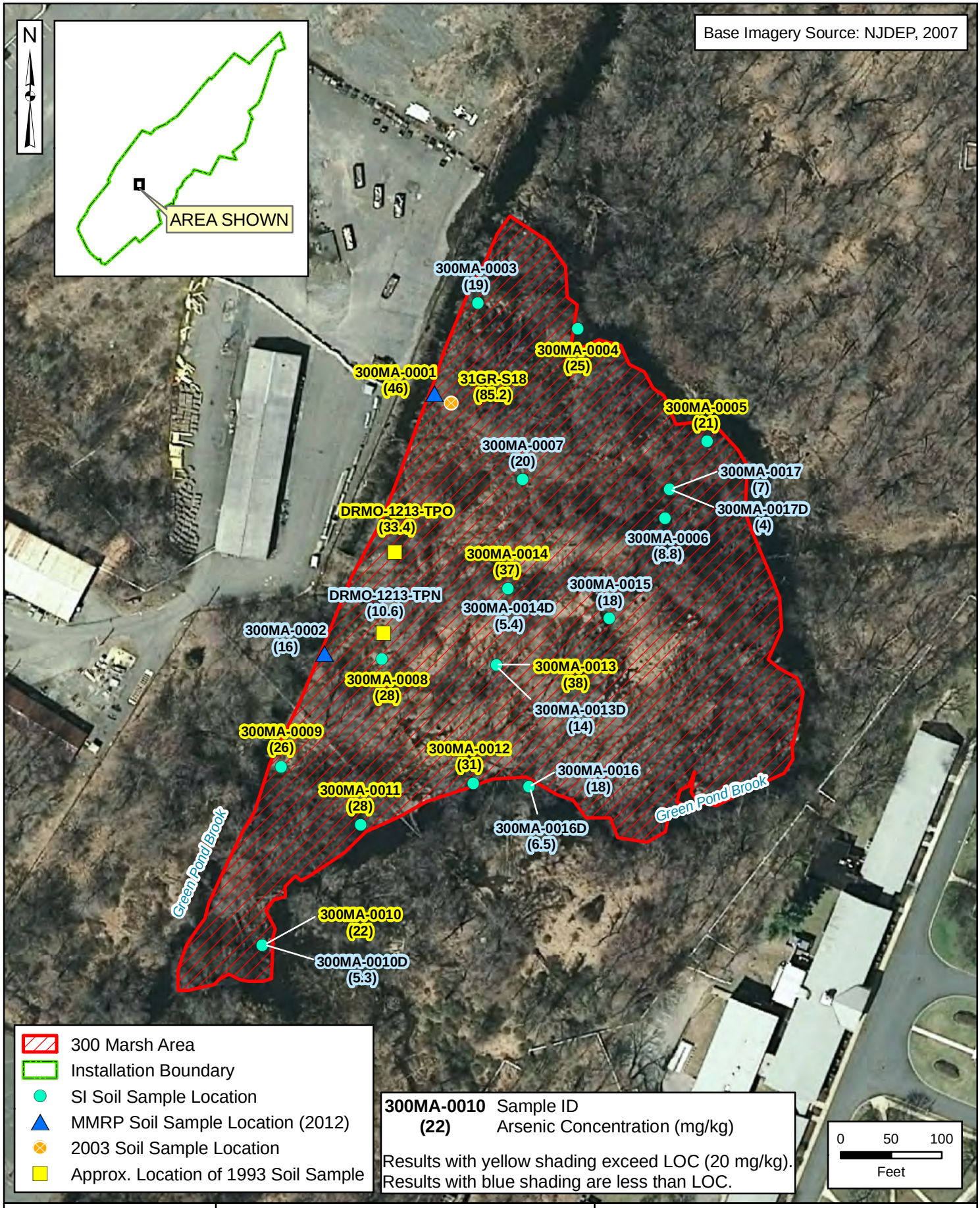
PICATINNY ARSENAL
MORRIS COUNTY, NEW JERSEY

FIGURE 13
300 MARSH AREA
SOIL SAMPLE LOCATIONS



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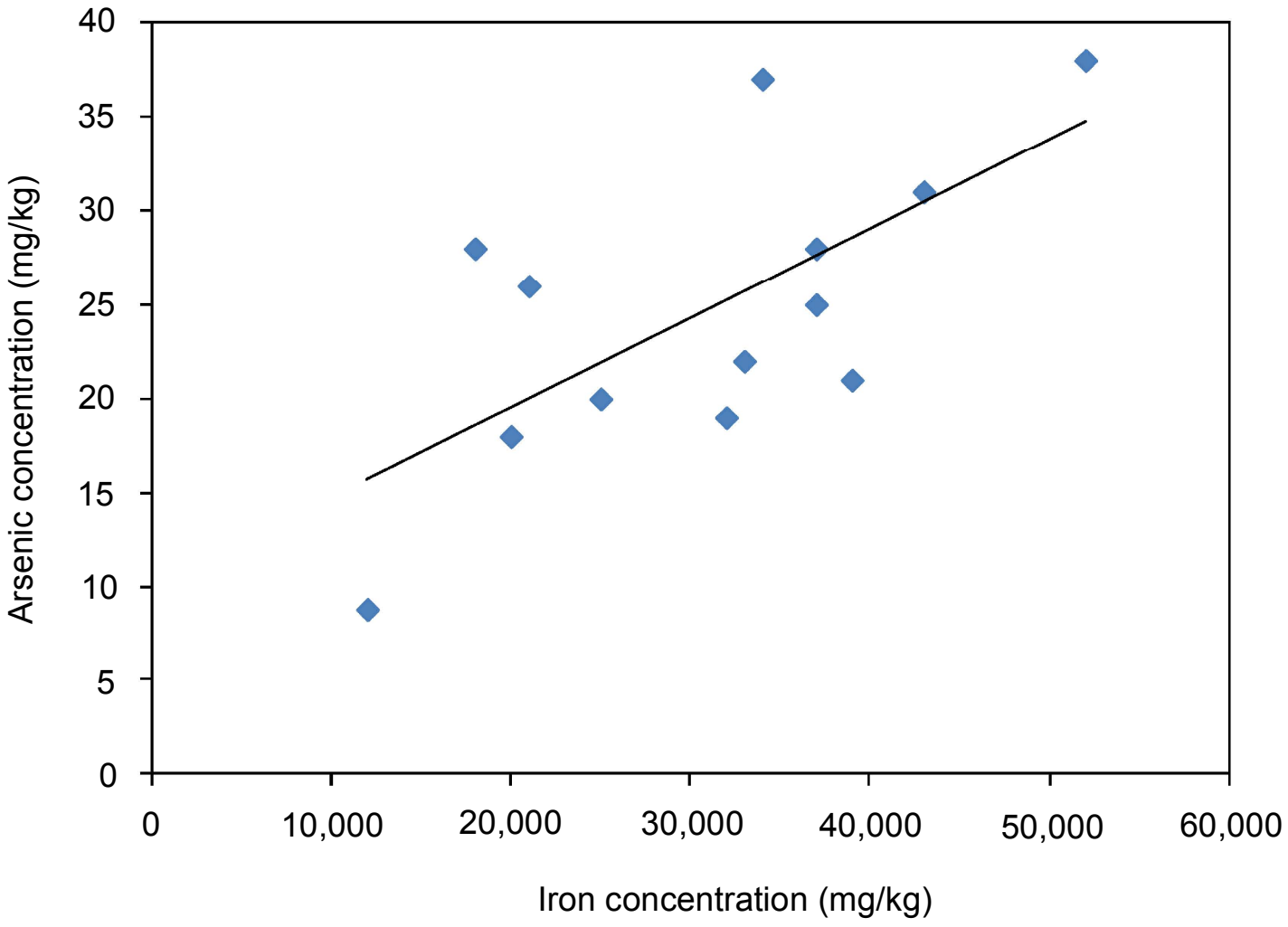
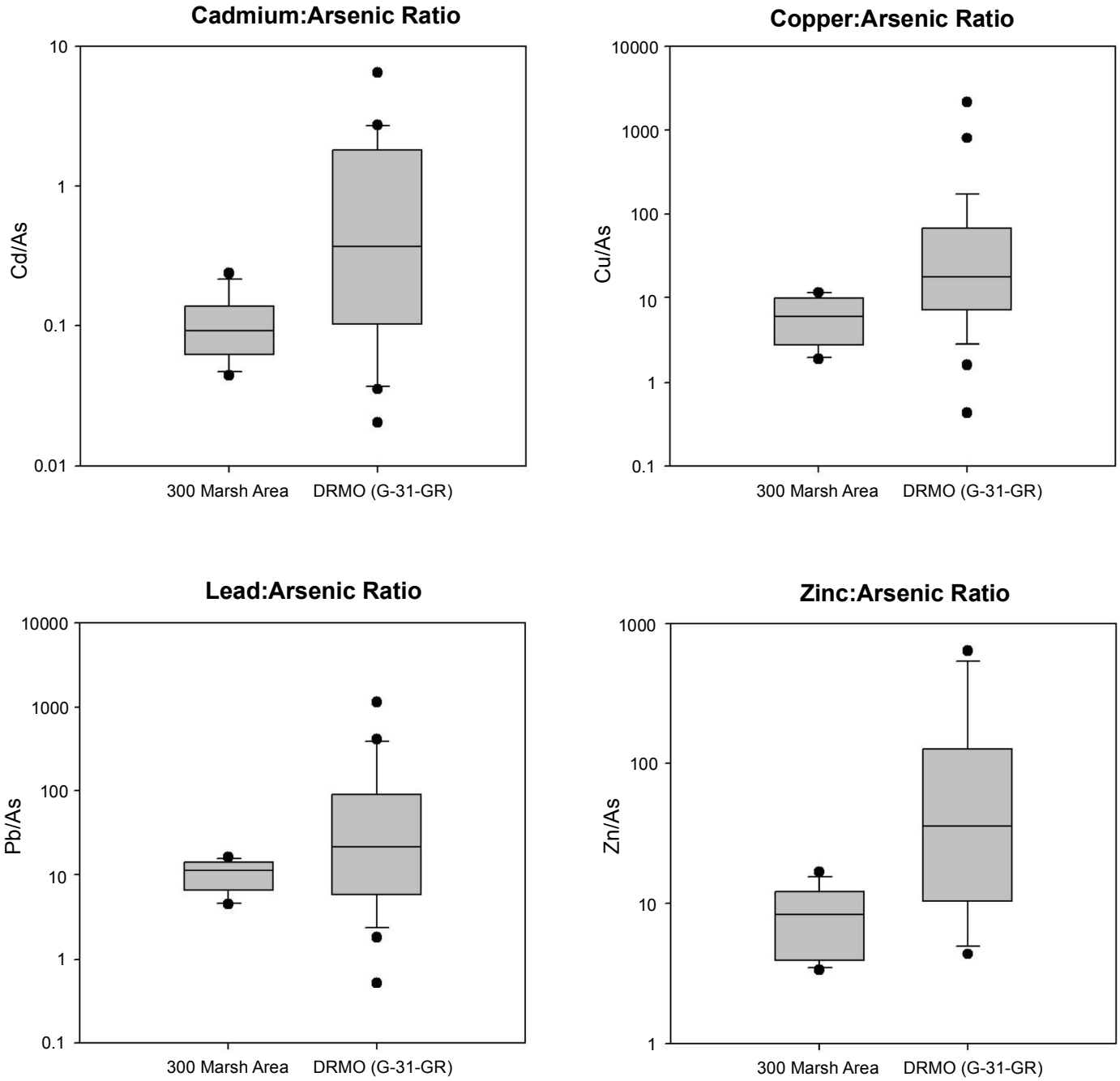
PICATINNY ARSENAL
MORRIS COUNTY, NEW JERSEY

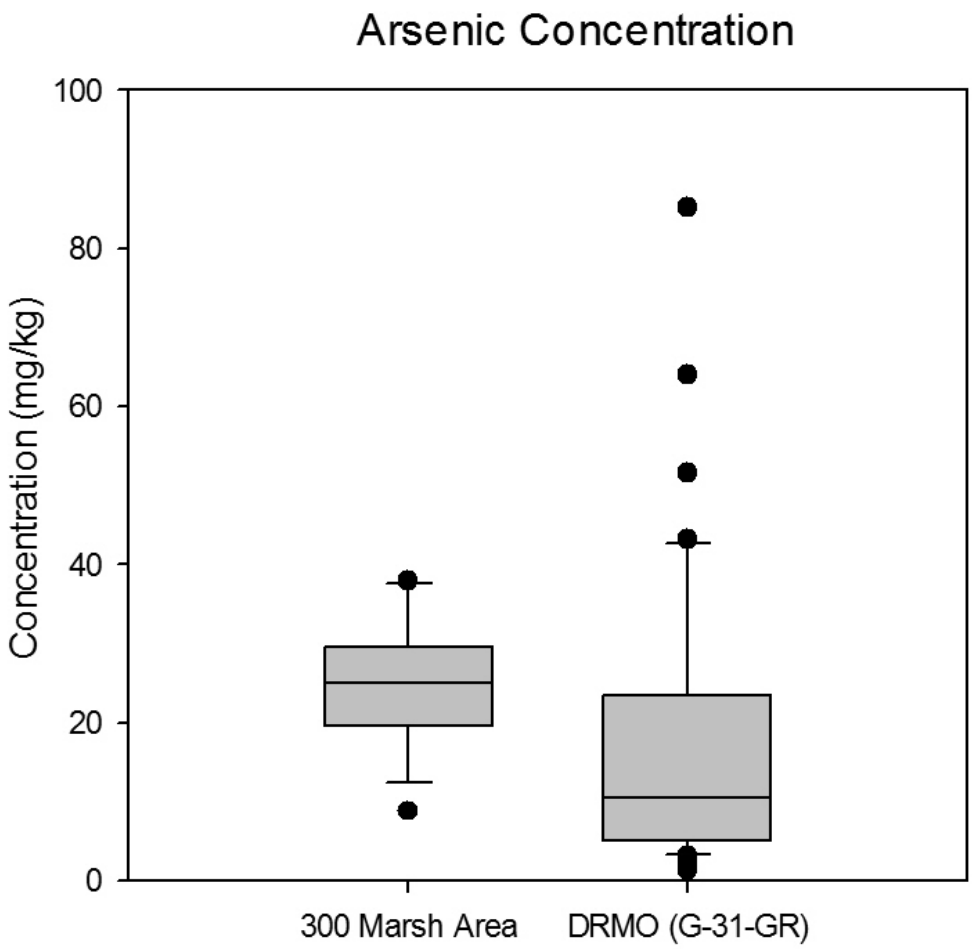
FIGURE 14
ARSENIC DISTRIBUTION



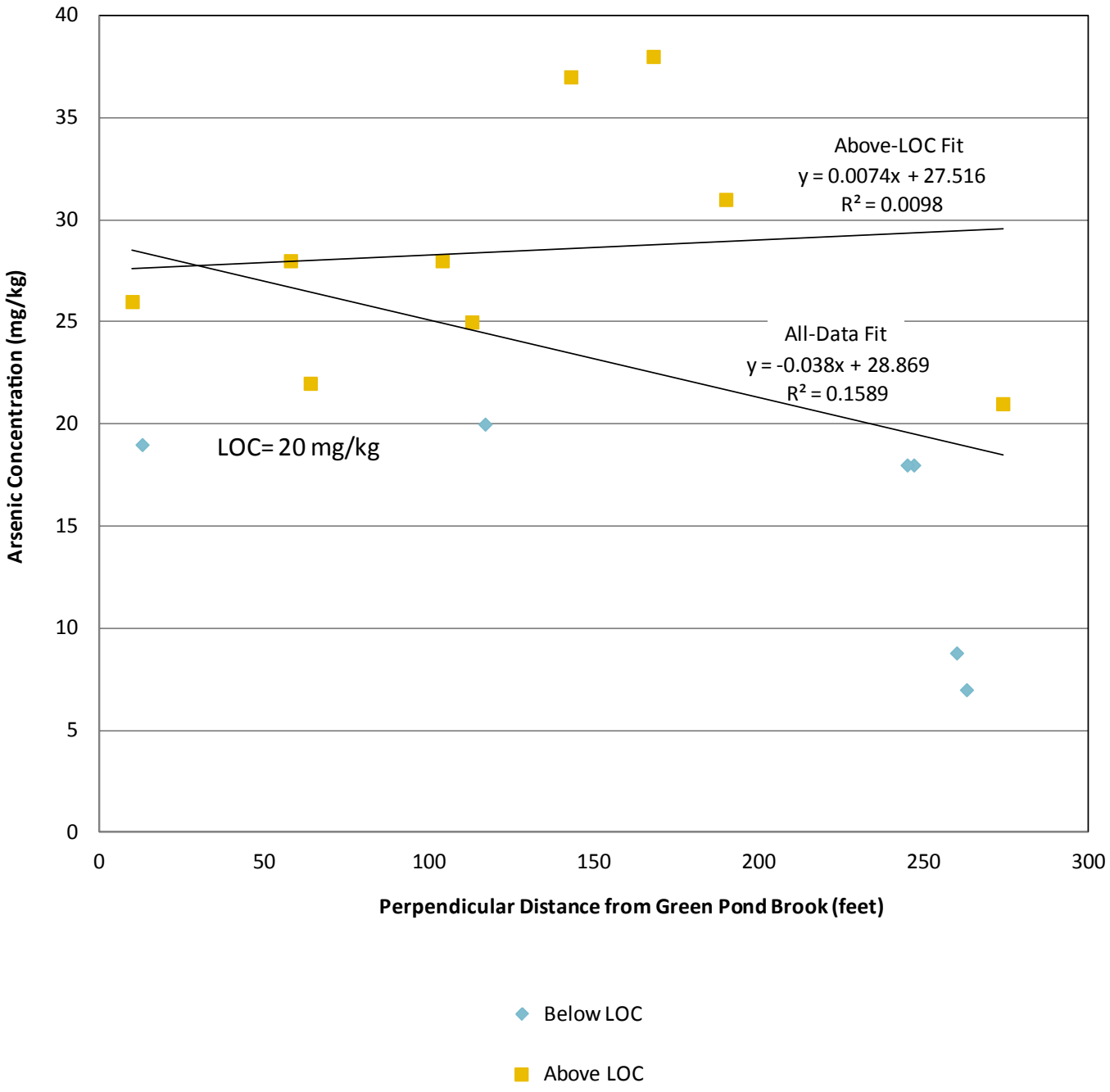
ARCADIS	PICATINNY ARSENAL MORRIS COUNTY, NEW JERSEY	FIGURE 15 ARSENIC VS. IRON SCATTER PLOT



ARCADIS	PICATINNY ARSENAL MORRIS COUNTY, NEW JERSEY	FIGURE 16 METAL:ARSENIC CONCENTRATION RATIOS



ARCADIS	PICATINNY ARSENAL MORRIS COUNTY, NEW JERSEY	FIGURE 17 ARSENIC CONCENTRATIONS IN THE 300 MARSH AREA AND FORMER DRMO YARD



ARCADIS	PICATINNY ARSENAL MORRIS COUNTY, NEW JERSEY	FIGURE 18 ARSENIC CONCENTRATIONS IN THE 300 MARSH AREA AS A FUNCTION OF DISTANCE FROM GREEN POND BROOK

APPENDIX B – Memorandum for Record, Trip Report, Picatinny Arsenal, 22 June 93

PICA00099

CEHND-PM-OT (415-10f) 22 June 93

MEMORANDUM FOR RECORD

SUBJECT: Trip Report, Picatinny Arsenal, NJ

1. INCLUSIVE DATES OF TRAVEL: 8-10 June 93.

2. LOCATION: Picatinny Arsenal, NJ.

3. PURPOSE: To perform site visit.

4. NAME OF TRAVELER: Raymond W. Leone, PM-OT

5. PERSONS CONTACTED: Mr. Paul Reibel and Mr. Ted Gabel, Environmental Office; Mr. John Kirkpatric, Safety Office; and Mr. Bill Sisolak and SFC Jeffrey Nesmeyer, Army EOD.

6. NARRATIVE:

a. On 9 June 93, I met with Mr. Paul Reibel and traveled to the Defense Reutilization and Marketing Office (DRMO), Building 314.

b. We met with the Picatinny Arsenal Safety Officer and Army EOD representatives, and walked the site.

c. In the afternoon, Mr. Reibel and I met with the installation historian and then Mr. Ted Gabel to discuss remediation of the site.

7. DISCUSSION:

a. When expanding the DRMO parking area to the Northwest of Building 314 (see site sketch, Encl 1); workers located unexploded ordnance (UXO) on the surface.

b. A temporary snow fence was immediately erected to reduce the imminent safety hazard and the Directorate of Engineering and Housing (DEH) attempted to install a permanent chain link fence behind the snow fence. However, augering was halted when workers unearthed more UXO when drilling for the first two post holes.

c. Site investigation on 9 June revealed several types of munitions laying on the surface.

d. Upon further investigation along the stream to the Southeast of Building 314, we located additional UXO protruding from the stream banks.

e. Later that afternoon, the installation historian provided us with a map (Encl 2), dated 1904, which shows a sand pit in the approximate location of the surface UXO. The same map shows the entire area, where Building 314 is now located, as a swampy area adjacent to Green Pond Brook.

f. On July 10, 1926, probably the result of a lightning strike, hundreds of thousands of pounds of explosives detonated. As a result, buildings as far away as one mile sustained damage (see photos, Encl 3).

g. It appears likely, therefor that ordnance and explosive waste (OEW) from the 1926 explosion may have been used to fill in the sand pit shown on the 1904 map. Further, it appears possible, given that ordnance is protruding from the banks of Green Pond Brook, that the entire area under/around Building 314 (built in 1943) has been built up with OEW from the 1926 explosion.

h. Mr. Reibel and I briefed our findings to Mr. Gabel in the afternoon. Mr. Gabel provided me with a copy of a 1383 Report Project Exhibit (Encl 4) summarizing his request for $150K for site investigation and $1M for site remediation.

8. CONCLUSION: The OEW-contaminated area to the North WEST of Building 314 at Picatinny Arsenal poses an imminent safety hazard to individuals who work in and around that building. Employees must be warned to stay out of contaminated areas. Further, the U.S. Army Environmental Center (AEC) needs to place a high priority on funding further site investigation during 4Q93 with remediation following in FY94.

9. RECOMMENDATION: That the Picatinny Arsenal Safety Office inform workers of the imminent hazards associated with OEW adjacent to Building 314. Further, that the Safety Officer consider closing the DRMO compound until the site can be investigated and remediated.

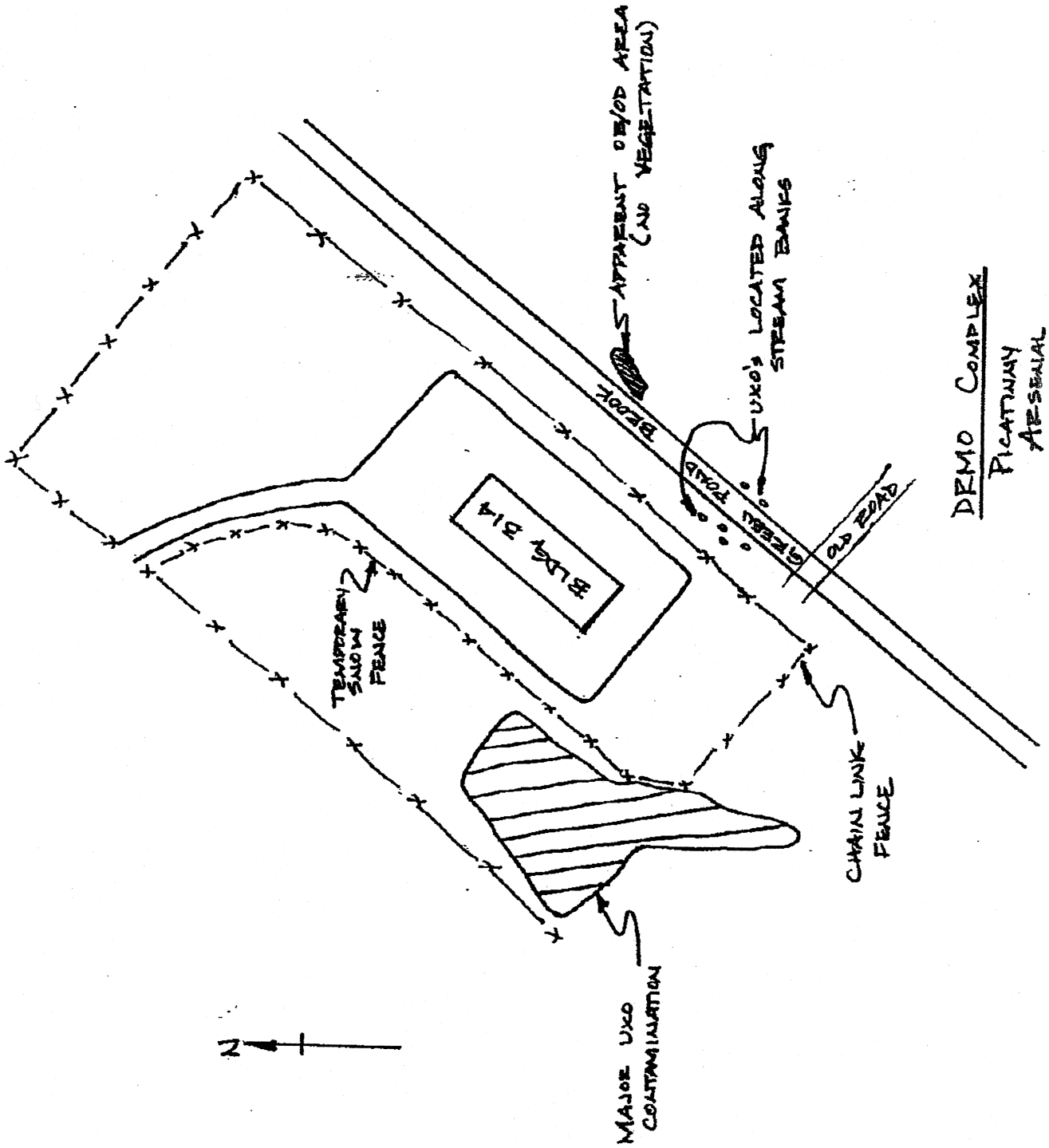
10. ACTION ITEMS: Periodically coordinate with Picatinny Arsenal representatives to determine status of funding for further investigation and remediation.

Raymond W. Leone

Raymond W. Leone, PE
Project Manager

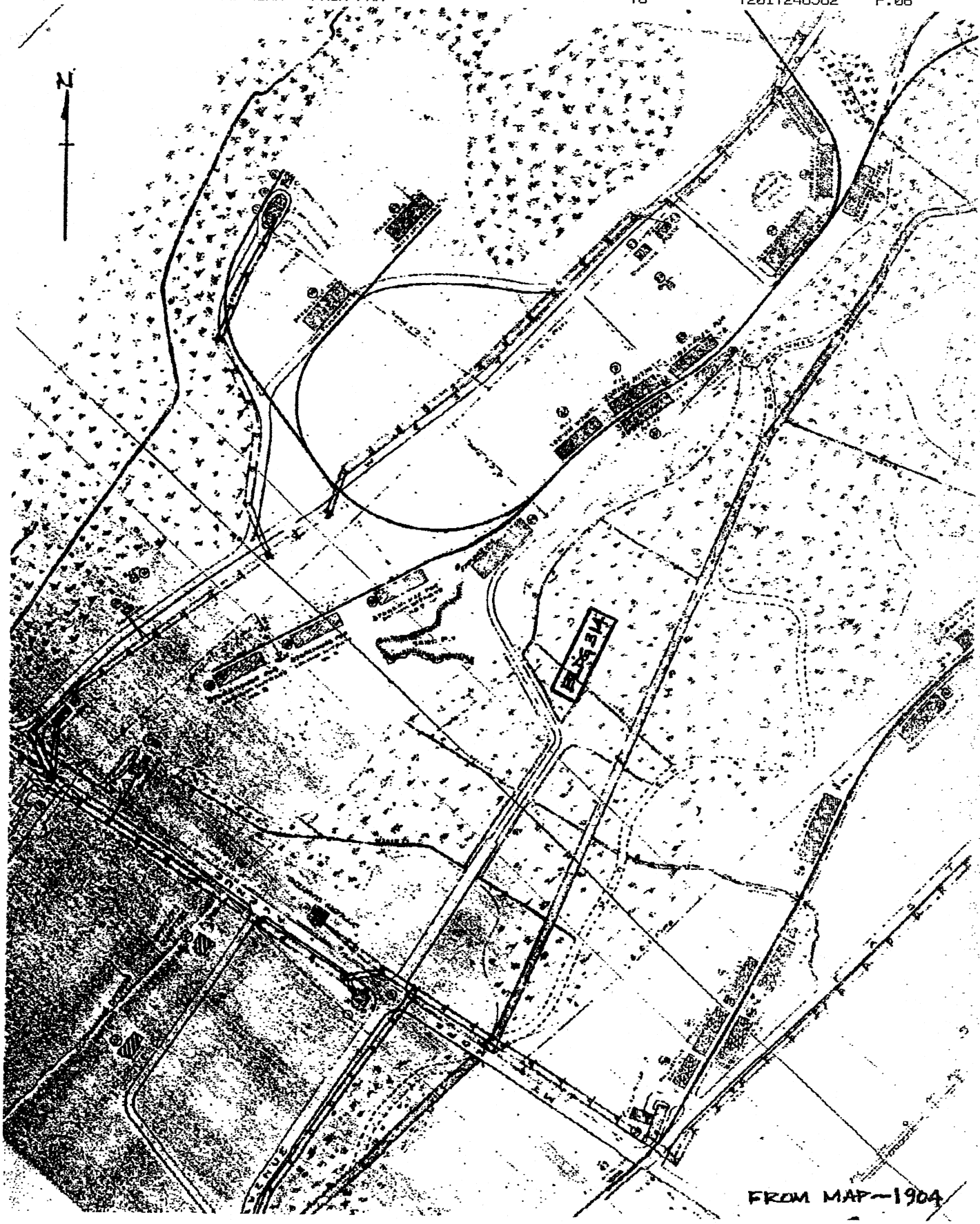
4 Enclosures

CF:
CEHND-PM, Carden
CEHND-PM-OT, Javins/Heaton/King
CEHND-ED-SY, Douthat/Nore/Ferris
CEHND-ED, File/Read



DEMO COMPLEX
PICATINNY ARSENAL
NJ

ENCL 1


N
FROM MAP—1904

APPENDIX C – Non-Time Critical Removal Action Site Investigation Report of the DRMO, July 1994

BOOK CASE 2 SHELF 2

U.S. ARMY ENGINEER DISTRICT-NEW YORK
NEW YORK, N.Y.

NON-TIME CRITICAL REMOVAL ACTION SITE INVESTIGATION REPORT OF THE DRMO (RI - Concept Site No. 31)

PA/SI Work Plan for DRMO

PHI4.2.3.2.10-27-96

WESTON
MANAGERS DESIGNERS/CONSULTANTS

U.S. ARMY ENGINEER DISTRICT-NEW YORK
NEW YORK, N.Y.

NON-TIME CRITICAL REMOVAL ACTION SITE INVESTIGATION REPORT OF THE DRMO (RI - Concept Site No. 31)

Contract/Purchase Order No. DACA87-90-D-0054

Delivery Order No. 13
DRMO Test Pit Excavation
Technical Report

July 1994

Prepared by:
Roy F. Weston, Inc.
One Weston Way
West Chester, Pennsylvania 19380

DELIVERY ORDER NO. 13
DRMO TEST PIT EXCAVATION
TECHNICAL REPORT

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1.0 INTRODUCTION

1.1 BACKGROUND INFORMATION

The Defense Reutilization and Marketing Office (DRMO) compound is the storage yard for excess materials belonging to the U.S. Government and is located southeast of Reilly Road and directly west of Green Pond Brook. The DRMO office is located in Building 314 and Buildings 314B, C, D, and E are used for storage. The DRMO collects materials declared excess by Picatinny Arsenal and offers them for public sale before disposal. Items for sale and/or disposal include vehicles, machines, scrap metal, office equipment, and unusable ordnance parts.

Presently, most of the DRMO yard area is paved and fenced, but historical records indicate that the DRMO yard was originally a marsh area adjacent to Green Pond Brook. It is believed that the marsh area was covered with fill material to bring the area up to its present grade. It is suspected that building debris from the 1926 explosion was used as fill material to cover the marshlands. Historical maps of the area indicate that the area was used as a burning ground in the early 1930's.

The fill material used to cover the marshlands is littered with various metallic debris. During recent inspections of the DRMO yard, ordnance-related items were found such as parts to grenades and discarded casings. Previous sampling efforts in Green Pond Brook produced reports of ordnance-related items protruding from the banks of the brook. It is not apparent as to whether the ordnance items were deposited in or around the brook or were materials exposed from previous burning activities.

1.2 SCOPE OF WORK

The objective of remediation activities within the DRMO facility was to determine the presence and nature of unexploded ordnance (UXO) and chemical contamination.

The scope of work to accomplish the above objective included: development of a preliminary assessment, development of a site investigation plan, and performance of a site investigation. The preliminary assessment summarized available information for development of the site investigation plan and is included in Appendix A.

The approach to performance of the site investigation included surface and subsurface soils, and groundwater sampling. Soil evaluation was accomplished by collection of soil samples from test pit excavations. Composite subsurface samples were collected at a standard interval between the surface and the groundwater table. Monitoring wells were installed for collection of groundwater samples.

2.0 TECHNICAL APPROACH

2.1 VISUAL INSPECTION/ RECORD REVIEW

Prior to development of the Preliminary Assessment, the site was visited and the existing records reviewed. Several site visits were conducted to determine site boundaries, compare site topographic features to aerial photographs, and make visual observations of the surface contamination on-site.

In consideration of the suspected origin of the fill material used in the DRMO yard and the observed ordnance-related contamination, an EOD subcontractor (HFA, Inc.) was consulted for guidance on methodologies available for subsurface investigations in UXO contaminated soils. HFA's input provided the basis for establishing excavation limits. WESTON and HFA agreed on discontinuing excavation upon reaching groundwater due to the lack of ability to properly identify detected metallic debris below the waters surface. Also, since the UXO contamination originated from fill material, excavation would end upon reaching the extent of the fill material depth or virgin soils.

Due to the limitation of conducting UXO searches in areas free of surface water or groundwater, it was determined that no test pits would be excavated in the wetlands areas. Those areas are defined in Figure 2-1 which was delineated by the Wetlands Experimental Station (WES).

2.2 MOBILIZATION

Upon approval of the work and safety plans and acquisition of a safety permit from the facility safety office, equipment and personnel were mobilized to the site. The test pit locations were marked with labeled wooden stakes. Figure 2-2 illustrates the locations of the test pit excavations.

2.3 UXO SURVEY

Due to the suspected UXO contamination in the DRMO yard, no excavation was to be performed without a subsurface search for UXO. Human Factors Applications, Inc. (HFA), UXO specialists, performed the subsurface UXO survey with the use of electronic metal detection instruments. Initially, a surface UXO sweep was performed to allow for the safe travel of the track-hoe excavator and personnel across the fill areas to test pit locations. Corridors of cleared surface area were marked with pin flags and all equipment traffic restricted to those pathways.

All subsurface targets were hand-excavated by the UXO specialists. If the detected metal item was identified as ordnance-related, it was set aside for collection by the facility's Explosive Ordnance Detachment (EOD). However, no ordnance-related items were found to be intact or "live".

2.4 TEST PIT EXCAVATION

Subsurface investigation commenced on 8 December 1993 with the excavation of Test Pit G which is located just south of the entrance to the DRMO yard, to the immediate right as one would enter the fenced area. The following is the observations and description of the subsurface soils in each test pit (taken from field notes included as Appendix B):

Test Pit G:

0 - 6"	Brownish black [5 yr 2/1]* 90% silt with some M-C gravel (10%)
6"-12"	Brownish black [5yr 2/1] 80% silt, 20% well rounded gravel
12"-24"	Same as above, various debris
24"-30"	Brownish black [5yr 2/1] 50% F-sand, 40% silt, 10% F-rounded gravel, scrap metal piping
30"-36"	Grayish brown [5yr 3/2] 50% M-F sand, 40% silt, 10% C-gravel, fill, some metal debris
36"-42"	Moderate brown [5yr 3/4] 70% coarse sand, 20% silt, 10% coarse gravel, large boulders and some cinders, scrap metal pieces, fill, stump.
42"-48"	Grayish brown [5yr 3/2] 50% C-M sand, 5% silt, 5% C-stone, a lot of scrap metal/wood, fill
48"-72"	Grayish brown [5yr 3/2] w/mixed moderate brown [5yr 3/4] 50% C-sand, little silt, 50% various debris, large log on side of hole, a lot of scrap metal, logs, cinders
72"-10'	Grayish brown [5yr 3/2] 50% stone and scrap, 45% M-sand, 5% silt, a lot of wood, stone, cinders, metal pipe, moist, fill
10'	Groundwater encountered.

Test Pit A: Scattered metal debris on surface.

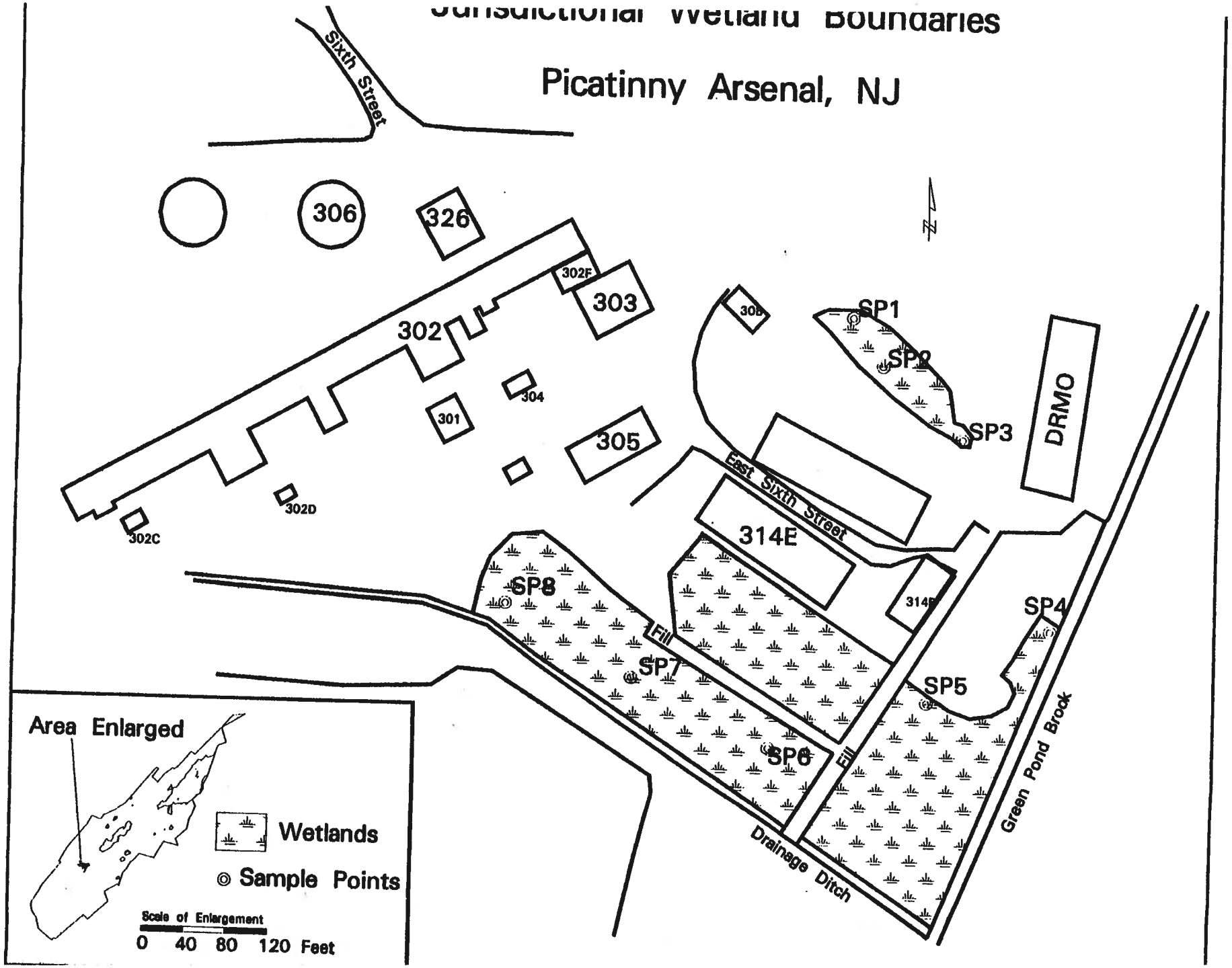
0"-6"	Grayish brown [5yr 3/2] 90% silt, 10% F-sand
6"-12"	Grayish orange [10yr 7/4] 80% F-sand, 10% silt, 10% C-sand, very little metal
1'-3'	Dark yellowish brown [10yr 4/2] 90% C-sand, 10% coarse gravel, some metal objects
3'-4'	Moderate yellowish brown [10yr 5/4] 60% F-sand, 20% silt, 20% M-gravel, moist, no debris. Organic odor, no visible staining, OVA peaked at 500 ppm.
4'-5.5'	Dark yellowish brown [10yr 4/2] 60% M-sand, 30% silt, 10% M-gravel, no debris
6'	Black organic material, 100% organic material. Groundwater encountered.

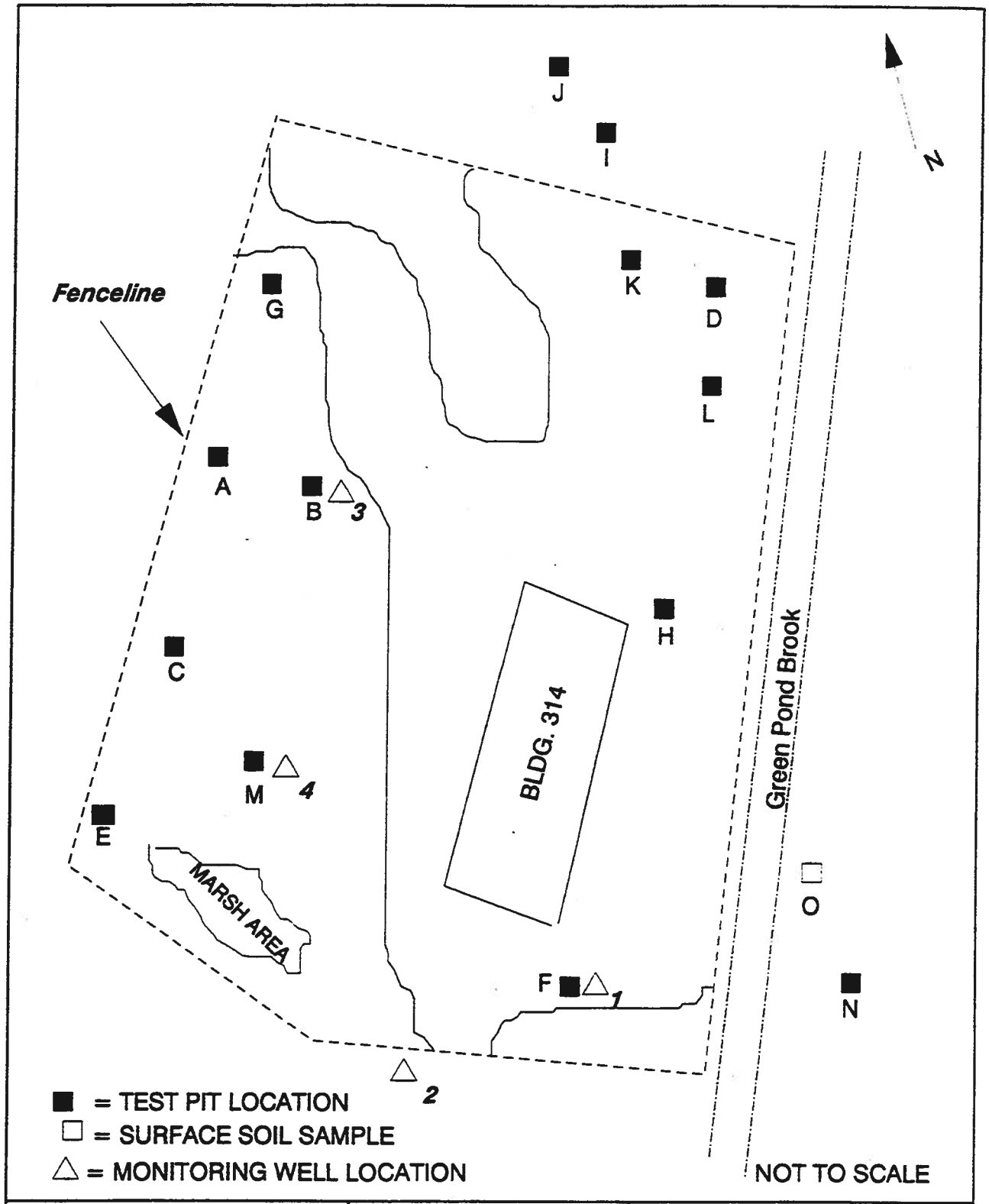
Test Pit B:

0'-2'	Moderate brown [5yr 4/4] 60% F-sand, 20% silt, 20% large cobbles, no debris uncovered, cobbles well rounded, soil dry
2'-4'	Moderate brown [5yr 4/4] 60% C-sand, 10% silt, 30% cinders, large cobbles, several metallic objects
4'-6'	Dark gray [N3] 40% coarse gravel, 50% coarse sand, 10% large cobbles and boulders, few metallic objects

Jurisdictional Wetland Boundaries

Picatinny Arsenal, NJ





WESTON
MANAGERS DESIGNERS/CONSULTANTS

SITE MAP

Figure 2-2

PICATINNY ARSENAL
DRMO FACILITY
DOVER, NJ

6'-8'	Same as above
7.5'	Groundwater encountered.

Test Pit C:

0'-2'	Brownish black, 10% silt, 30% M-sand, 60% wood, metal debris, concrete, several ordnance items
3'	Groundwater encountered. Soil composition consistent to 3'.

Test Pit M:

0'-1.5'	Dusky yellow brown [10yr 2/2] 80% M-gravel, angular, 15% M-sand, 5% silt. No debris.
1.5'-2.5'	Black, 50% C-sand, 50% wood, cable, concrete, boulders, etc...
2.5'-3'	Black, 100% M-F sand.
3'	Groundwater encountered.

Test Pit K:

0'-2'	Grayish brown [5yr 3/2] 40% M-sand, 10% silt, 40% angular C-gravel, 10% cinder block, very little metal debris.
2'-3.5'	Blackish red [5R 2/2] 80% C-gravel, 10% C-sand, 10% brick, a lot of metal debris.
3.5'-5'	Dusky brown [5yr 2/2] 40% C-gravel, 40% C-sand, 20% clay.
5'	Groundwater encountered.

Test Pit F:

0'-2'	Grayish brown [5yr 3/2] 40% coarse sand, 10% silt, 50% C-gravel, dry, no metal debris.
2'-4'	Black red [5R 2/2] 50% boulders, 40% C-sand, 10% C-gravel, large boulders, no metal.
4'-8'	Black, 50% F-sand, 50% silt, a lot of odor
8'-10'	Brown organic peat, virgin material, stop excavation.

Test Pit H:

0'-1'	Grayish brown [5yr 3/2] 80% gravel (coarse), 20% C-sand, minimal metal debris.
1'-2'	Brownish black [5yr 2/1] 80% C-gravel, 10% C-sand, 10% silt
2'-7'	Moderate yellowish brown [10yr 5/4] 80% C-gravel, 20% C-sand, sand, fill, no debris.
7'	Groundwater encountered.

Test Pit L:

0'-2'	Grayish brown [5yr 3/2] 80% gravel, 10% cinders, 10% C-sand
22"	Groundwater encountered.

Test Pit I:

0"-6"	Grayish brown [5yr 3/2] 80% gravel, 20% C-sand, no metallic debris.
6"-18"	Moderate brown [5yr 4/4] 80% C-gravel, 10% large cobbles, 10% C-sand, no metal objects.
18"-24"	Pale yellowish brown [10yr 6/2] 50% cinders, white brick, 50% C-sand
24"-4'	Black ash, burn residue
4'	Groundwater encountered.

Test Pit D:

0'-1'	Black, cinders, brick, stone, 10% C-sand, 90% other (brick, stone, gravel)
1'-1.5'	Black layer, 50% organic material, 50% coarse sand
1.5'-2.8'	Black sand, 80% C-sand, 20% C-gravel
2.8'	Groundwater encountered.

Test Pit E:

0-2'	Brownish black [5yr 2/1] 50% C-sand, 50% wood, metal, and brick
2'-8'	Moderate brown [5yr 4/4] 50% C-sand, 50% gravel and stone, a lot of wood, metal, glass, and various types of garbage
8'-13'	Pale yellow brown [10yr 6/2] 50% C-sand, 50% C-gravel, moist
13'	Groundwater encountered. Fill= 0-8' Virgin soil 8'-13'

Test Pit J:

0-2'	Black [N1] 50% C-sand, 50% C-gravel, a lot of debris, ash, and melted material
2'-7.5'	Brownish black, 80% C-gravel, 20% C-sand
7.5'	Groundwater encountered.

Test Pit N:

0-6'	Dusky brown [5yr 3/2] 50% stone, 20% C-gravel, 30% C-sand, some metal debris
6'	Groundwater encountered.

[*] Indicates the reference to the Munsell Soil Color Chart.

2.4.1 Soil Sampling

One soil sample was collected from each test pit using a clean stainless-steel trowel. The sample was a composite, made up of grab samples from every two-foot interval. Grabs were also collected from areas of obvious staining or soil discoloration. The grab samples were homogenized, except the volatile organic fraction, in a stainless steel bowl and placed into the required sample jars. The grab portions of the volatilize organic fraction were transferred to the sample container immediately upon collection with no mixing or agitation. Enough soil was collected to analyze for Total Petroleum Hydrocarbons, volatile organics, semi-volatile organics, metals, nitroglycerine, nitrocellulose, PCBs, and explosives. Dioxins and Furans were analyzed in samples collected from test pits which exhibited evidence of past burning activity.

2.5 MONITORING WELL INSTALLATION

Four, four-inch diameter PVC-cased monitoring wells were installed in the DRMO area on 24 and 25 January 1994. Two wells were located downgradient (south of Building 314), one at the edge of the marsh area, and one upgradient from the marsh area. Since a UXO search had been performed for test pit excavation, three (3) monitoring wells were installed in previous test pit locations. The following list defines the locations of each monitoring well (see Figure 2-1):

Monitoring Well Locations

Monitoring Well	MW 1	=	Test Pit F
	MW 2	=	Outside southern gate to west of paved roadway.
	MW 3	=	Test Pit B
	MW 4	=	Test Pit M

Monitoring Well number one (MW1) was installed in the area previously cleared for Test Pit F. Drilling commenced after steam cleaning of the augers. Since the test pit excavation had been cleared to 10 feet, drilling was allowed to a depth of ten feet without UXO clearance. At 10 feet, the borehole was searched for UXO and drilling continued. Groundwater was indicated at 13 feet and confirmed with a water level indicator at 10 feet. The borehole was then advanced to 15 feet. Well screening was placed in the interval between 5 and 15 feet. At the completion of well drilling and installation, the water level was measured to be at 8 feet and 3 inches. The well installation logs are presented in Appendix C. An OVM was used to monitor for organic vapors throughout the drilling process. No readings above background were reported.

After steam cleaning of the drill rig, MW2 was installed west of the paved roadway which extends out the southern gate of the DRMO yard. A UXO search was performed and clearance was given to drill to 4 feet. At 4 feet, the UXO search was continued but clearance to continue drilling could not be granted due to metallic interferences. A new location within 2 feet of the original was chosen, cleared of UXO, and drilling continued.

Groundwater was indicated at 10.5 feet and confirmed with a water level indicator at 7 feet. The well screening was set between 2 feet and 12 feet. No OVM readings above background were detected.

MW3 was installed in the previous location of Test Pit M. Drill augers were advanced to 4 feet, at which point a UXO clearance to 6 feet was conducted. Groundwater was detected at 3 feet. The well was drilled to a total of 12 feet and screened between 2 feet and 12 feet. No OVM readings were observed above background.

MW4 was installed at the previous Test Pit M location. The drilling events were similar to the previous installations and the total well depth was 13.5 feet below ground surface. The water level after well construction was 7.5 feet and no readings above background were observed using the OVM throughout drilling operations.

Well development was accomplished by hand-bailing. Development of the wells was considered complete when all sediment was removed and the water was clear. The following is a list of the development volumes:

MW1 35-40 gallons
MW2 45 gallons
MW3 40 gallons
MW4 40-45 gallons

All Monitoring Well Form A's were prepared by the New Jersey licensed well driller and are included in Appendix C. The Monitoring Well Form B's are included in Appendix D.

2.5.1 Groundwater Sampling

On 16 February 1994, 21 days after installation, the monitoring wells at the DRMO facility were sampled. Laboratory cleaned, dedicated bottom-fill PTFE bailers were used to evacuate three well volumes from the monitor wells prior to sampling. The approximate volumes of water purged from each well are as follows:

MW1 = 13.5 gallons
MW2 = 10 gallons
MW3 = 18 gallons
MW4 = 12 gallons

Samples were collected with the dedicated bailer by slowly lowering the bailer into the well, to avoid aeration of the water to be collected. The first sample collected was the volatile organics, then subsequent bailers filled for semi-volatiles, TPHC, metals, nitrocellulose, nitroglycerine, and explosives. The monitoring well sampling data forms are included in Appendix E.

2.6 SITE RESTORATION AND DEMOBILIZATION

Upon completion of test pit excavation, all excavations were backfilled with the excavated soil and compacted. Any ordnance-related items removed from the excavation were

collected and turned-in to the facility's EOD personnel. Excavations placed in paved areas were filled and graded to the surface level. The paving was patched with like material after the site investigation was completed. All discarded PPE was placed in a 55-gallon drum for disposal.

During excavation of Test Pit E, it was necessary to remove a section of the DRMO yard's perimeter fencing for access of excavation equipment. This section of fencing was repaired immediately after completion of Test Pit E excavation by a fence installation subcontractor.

Four drums of drill cuttings were created during well installation. The drums were transported to the WESTON compound to await disposal. Water from well purging and decontamination was placed in drums and also transported to the WESTON compound to await disposal. Disposal documentation will be forwarded upon completion of disposal activities.

All equipment used in well installation and test pit excavation was cleaned prior to leaving the site.

3.0 ANALYTICAL RESULTS

3.1 CHEMICAL ANALYSIS METHODS

Soil samples, collected from the test pit excavations, were analyzed for PCB's, volatile organics, total petroleum hydrocarbons, semi-volatile organics (BNA), metals, explosives, nitrocellulose, nitroglycerine, and dioxin/furans. The groundwater samples were also analyzed for these parameters except for the PCB's and dioxin/furan analyses. Table 3-1 defines the analytical methods used for each analysis.

Table 3-1
Analytical Parameters and Methods

Parameter	Method
PCB's	EPA 8080
Volatile Organics	EPA 8240
TPHC	EPA 418.1(aqueous) EPA 418 modified for soils
BNA's	EPA 8270
Metals	EPA 6010
Explosives	US ARMY 3-H
Nitrocellulose	US ARMY 3-H
Nitroglycerine	EPA 8330
Dioxin	EPA 8280

3.2 ANALYTICAL RESULTS SUMMARY

3.2.1 Subsurface Soils Sampling Results

Soil samples collected from the DRMO test pits did not indicate any significant volatiles contamination. Eight volatile organic compounds were found above detection limits at levels ranging from 6 ug/Kg to 390 ug/Kg which do not exceed regulatory standards. The volatile organic compounds detected in this range were Methylene Chloride, Trichloroethene, Tetrachloroethene, 2-Butanone, Acetone, Benzene, Carbon Disulfide, and Chlorobenzene. Table 3-2 summarizes the volatile organics analytical data. Various semivolatiles were reported above detection limits

in all but three test pits. The semi-volatile orgnaics results are summarized in Table 3-3.

Inorganic analysis of the test pit soil samples indicated the percent solids ranging from 32.9% to 93.8%. The Total Petroleum Hydrocarbons (TPH) ranged from 85 mg/kg to 3120 mg/kg. Percent solids and TPH data is summarized in Table 3-4.

Six samples were found to have PCB levels above reporting limits (Table 3-5). PCB levels in test pits C, D, F, G, I, and M ranged from 340 ug/kg to 2500 ug/kg.

All of the metals were found in various concentrations, except for Thallium and only three samples reported levels of Antimony above detection limits. The metals data is summarized in Table 3-6.

Table 3-7 summarizes the explosives, dioxins, and furans findings. Dioxins/furans were only reported in two samples, test pits I and J. Explosives were detected in samples from test pits L and D and ranged from 2900 ug/Kg to 6800 ug/Kg. Nitrocellulose and nitroglycerine were both found in reportable values in three test pits. Nitrocellulose was reported in test pits L, N, and O; nitroglycerine was reported in test pits K, I, and J.

DRMO TEST PIT EXCAVATION

Soil Samples

Total Volatile Organics Analytical Data
(ug/Kg)

Test Pit Identification	Methylene Chloride	Trichloro-ethene	Tetrachloro-ethene	2-Butanone	Benzene	Carbon Disulfide	Chlorobenzene	Acetone
DRMO-1208-TPG		7	35/21*					
DRMO-1208-TPA				25	6	17	30	250
DRMO-1209-TPB								
DRMO-1209-TPC								
DRMO-1209-TPM	8							
DRMO-1209-TPK		7*	8*					
DRMO-1209-TPF				23				
DRMO-1210-TPH								
DRMO-1210-TPL								
DRMO-1210-TPI								
DRMO-1210-TPD	14*							33
DRMO-1209-FB								
DRMO-1210-FB								
DRMO-1213-TPE								
DRMO-1213-TPJ				24		15/19*		240/350*
DRMO-1213-TPN				26/390*				100

* Analysis of a repreparation of the sample.

Note: Blank spaces indicate no detection (ND).

DRMO TEST PIT EXCAVATION

Soil Samples

Total Semivolatile Analytical Data
(ug/Kg)

Semi-Volatile Compound	DRMO-1208-TPG	DRMO-1208-TPA	DRMO-1209-TPB	DRMO-1209-TPC	DRMO-1209-TPM	DRMO-1209-TPK	DRMO-1209-TPF	DRMO-1210-TPH	DRMO-1210-TPI	DRMO-1210-TPD	DRMO-1213-TPE	DRMO-1213-TPJ	DRMO-1213-TPN
Phenanthrene	2800	770		690			380		3400	670	470		
Flouranthene	4800	990		1500	540		860		4700	1,200	700		
Pyrene	5600	870		1500	480		740		4200	1,500	710		
Benzo(a)anthracene	2900	430		1100			480		2500	870	420		
Chrysene	2900	440		1200			500		2300	1,000	360		
Bi(2-ethylhexyl)pthalate				420									
Benzo(b)fluoranthene	3200	660		1800	480		660	460	2900	1,600	550		
Benzo(k)fluoranthene	2300			760					1200	640			
Benzo(a)pyrene	2900	450		1100					1500	1,100	360		
Benzo (g,h,i)perylene	1200			870					1200	890			
Indeno(1,2,3-cd)pyrene	1300						360			910			
2,4-Dinitrotoluene								1900		430			
N-Nitrosodiphenylamine(1)								1100					
Dibenzo(a,h)anthracene									380				
Anthracene	1200								1100				
2-Methylnaphthalene												520	
Acenaphthylene	450												

Note: Blank spaces indicate no detection (ND).

TABLE 3-4

DRMO TEST PIT EXCAVATION

Soil Samples

Inorganic Data

	Percent Solids (%)	Total Petroleum Hydrocarbons (mg/Kg)
DRMO-1208-TPG	81.3	352
DRMO-1208-TPA	90.6	244
DRMO-1209-TPB	88	85
DRMO-1209-TPC	84.7	830
DRMO-1209-TPM	89.5	626
DRMO-1209-TPK	86.7	770
DRMO-1209-TPF	90.9	863
DRMO-1210-TPH	93.8	1010
DRMO-1210-TPL	79.9	3120
DRMO-1210-TPI	88.8	704
DRMO-1210-TPD	84.2	594
DRMO-1213-TPE	91.6	283
DRMO-1213-TPJ	76.8	2580
DRMO-1213-TPN	32.9	697
DRMO-1213-TPO	36.1	N/A

Note: Blank spaces indicate no detection (ND).

TABLE 3-5

DRMO TEST PIT EXCAVATION

Soil Samples

PCB Analytical Data
(ug/Kg)

Sample Identification	Aroclor 1254	Aroclor 1248	Aroclor 1260
DRMO-1208-TPG	3200	4600	
DRMO-1208-TPA			
DRMO-1209-TPB			
DRMO-1209-TPC	1200		
DRMO-1209-TPM	1600	1500	
DRMO-1209-TPK			
DRMO-1209-TPF	2500		
DRMO-1210-TPH			
DRMO-1210-TPL			
DRMO-1210-TPI			590*
DRMO-1210-TPD			340*
DRMO-1213-TPE			
DRMO-1213-TPJ			
DRMO-1213-TPN			

* Lower than regular reporting limit but on dilution was within the calibration range.
Note: Blank spaces indicate no detection (ND).

DRMO TEST PIT EXCAVATION

Soil Samples

Total Metals Analytical Data
(mg/Kg)

	DRMO-1208-TPG	DRMO-1208-TPA	DRMO-1209-TPB	DRMO-1209-TPC	DRMO-1209-TPM	DRMO-1209-TPK	DRMO-1209-TPF	DRMO-1210-TPH	DRMO-1210-TPL	DRMO-1210-TPI	DRMO-1210-TPD	DRMO-1213-TPE	DRMO-1213-TPJ	DRMO-1213-TPN	DRMO-1213-TPO
Silver						7.4		12	48.2	41.1	9.9		16.7		
Aluminum	9,110	7,220	11,100	8,420	7,600	7,300	7,480	6,410	12,500	4,960	9,480	8,840	9,380	4,320	8,370
Arsenic	13.8	1.3	1.4	11.6	3.8	12.5	2.8	1.6	15.9	9.7	12.6	9.5	22.9	10.6	33.4
Barium	275	106	77.2	117	52.2	735	116	84.8	12,900	161	2,010	48.7	749	131	159
Beryllium	0.65	0.47	0.71	0.62	0.55		0.55				0.96	0.58			
Calcium	25,600	12,100	2,860	2,560	2,970	8,910	5,010	5,090	10,700	3,380	3,100	2,230	18,500	8,850	8,110
Cadmium	10.1		1.4	15.4	6.8	13.8	2.9	3.0	38.2	2.5	215		18.1	4.5	101
Cobalt	9.6	5.8	10.0	8.1	6.9	17.2	7.1	4.9	5.3	4.1	6.4	5.9	11.5	5.1	7.4
Chromium	24.1	12.1	12.6	106	23.1	12	21.5	17.1	86.2	29.4	36.3	16.2	54.1	12.2	19
Copper	1,300	697	141	160	69.1	736	856	173	14,600	207	5,820	24.2	7,640	18,200	1,500
Iron	36,300	13,700	19,600	28,300	22,200	129,000	18,900	16,400	31,800	17,200	6,500	20,500	99,500	14,900	43,300
Mercury	0.93			3.1	0.22	0.63	1.4	0.11	0.8	0.75	2.3	0.76	1.3	1.2	25.4
Potassium	3,160	474	1,000	1,060	908	1,350	932	861	668	537	2,660	724	1,030		
Magnesium	9,790	8,530	22,180	3,770	22,700	2,320	3,530	3,520	3,040	1,170	7,470	2,950	2,830	1,910	1,030
Manganese	468	186	501	455	334	930	406	176	595	198	437	346	548	813	863
Sodium	293	108	112	11	97.6	421	137	212	200	120	325	49.1	571	77.8	100
Nickel	19.8	9.0	12.8	20.2	47.2	99.2	12.8	11.5	34.6	10.9	22.3	8.7	71.1	33.3	57.4
Lead	478	92.6	50.5	512	90.5	3,860	22	892	4,110	291	4,430	52.0	28,600	504	8,490

	DRMO-1208-TPG	DRMO-1208-TPA	DRMO-1209-TPB	DRMO-1209-TPC	DRMO-1209-TPM	DRMO-1209-TPK	DRMO-1209-TPF	DRMO-1210-TPH	DRMO-1210-TPL	DRMO-1210-TPI	DRMO-1210-TPD	DRMO-1213-TPE	DRMO-1213-TPJ	DRMO-1213-TPN	DRMO-1213-TPO
Antimony											11.6		203		299
Selenium	0.92	0.70	0.29	0.23	0.48			0.29	0.27	0.52		0.71	3.5		6.8
Thallium															
Vanadium	20.2	17.2	23.5	30.6	20.6	9.2	19.6	20.3	21.5	11.8	19.6	19	8.2	13.7	26.6
Zinc	1,220	477	180	556	140	3,740	511	214	24,900	561	4,340	145	12,500	3,880	8,980

Note: Blank spaces indicate no detection (ND).

TABLE 3-7

EXPLOSIVES, DIOXINS, FURANS, NITROCELLULOSE, AND NITROGLYCERINE ANALYTICAL RESULTS

	DRMO-1208-TPG	DRMO-1208-TPA	DRMO-1209-TPB	DRMO-1209-TPC	DRMO-1209-TPM	DRMO-1209-TPK	DRMO-1209-TPF	DRMO-1210-TPH	DRMO-1210-TPL	DRMO-1210-TPI	DRMO-1210-TPD	DRMO-1213-TPE	DRMO-1213-TPJ	DRMO-1213-TPN	DRMO-1213-TPO
HMX															
RDX															
1,3,5-Trinitrobenzene															
1,3-Dintrobenzene															
Nitrobenzene															
Tetryl															
2,4,6-Trinitrotoluene											6800				
2,6-Dintrotoluene															
2,4-Dintrotoluene									3000		2900				
2-Nitrotoluene															
4-Nitrotoluene															
3-Nitrotoluene															
Nitroglycerin (ug/Kg)						480				590			3300		
Nitrocellulose (mg/Kg)									8.2					26.7	65.9
Dioxins/Furans (ng/g)															
PCDD'S															
2,3,7,8-TCDD															
TCDD															
PeCDD															
HxCDD										0.4JS*			0.5JS*		
HpCDD										3.2			1.7		
OCDD										7.8			2.7		
PCDF's															
2,3,7,8-TCDF															
TCDF															
PeCDF															
HxCDF													0.1JS*		
HpCDF													0.4JS*		
OCDF															

Note: Blank spaces indicate value was below reporting limits.

* J = Indicates an estimated value.

3.2.2 Groundwater Sampling Results

The samples collected from the monitoring wells installed at DRMO did not reveal any volatile or semi-volatile organics contamination. All results, including the trip blank, were reported as "below reporting limits".

The petroleum hydrocarbons data indicated no significant levels of contamination. Table 3-8 summarizes the results and also indicates that DRMO-DUP was a duplicate of DRMO-MW1 which is the only sample location with a petroleum hydrocarbons concentration exceeding 1 ppm.

All of the metals were detected in various concentrations except for silver, antimony, selenium, and thallium. None of the four were found in concentrations above the reporting limits. Table 3-9 is a summary of the metals analytical results.

All of the monitoring wells samples were analyzed for nitrocellulose, nitroglycerine, and explosives. None of the samples contained these constituents.

TABLE 3-8

MONITORING WELL SAMPLING

Groundwater Samples

Total Petroleum Hydrocarbons Analytical Data

Sample Identification	Total Petroleum Hydrocarbons (mg/L)
DRMO - MW1	1.5
DRMO - MW2	0.90
DRMO - MW3	0.72
DRMO - MW4	0.42
DRMO - DUP	1.5

TABLE 3-9

MONITORING WELL SAMPLING

Groundwater Samples

Total Metals Analytical Results

PARAMETER (mg/L)	DRMO-MW1	DRMO-MW2	DRMO-MW3	DRMO-MW4	DRMO-DUP
Silver	0.03 u	0.03 u	0.03 u	0.03 u	0.03 u
Aluminum	241	25.2	67.7	3.3	294
Arsenic	0.11	0.036	0.11	0.0042	0.17
Barium	2.8	0.27	1.5	2.0	2.8
Beryllium	0.023	0.005 u	0.01	0.005 u	0.025
Calcium	445	52.8	432	76.6	419
Cadmium	0.047	0.01 u	0.01 u	0.011	0.046
Cobalt	0.44	0.045	0.073	0.020 u	0.52
Chromium	0.38	0.50	0.042	0.020 u	0.47
Copper	2.3	0.17	0.25	0.39	2.8
Iron	664	65.4	193	38.0	846
Mercury	0.0024	0.00041	0.0045	0.00031	0.0018
Potassium	30.4	7.2	48.4	7.6	29.2
Magnesium	198	27.2	104	15.0	243
Manganese	52.1	0.70	3.4	0.24	48.8

PARAMETER (mg/L)	DRMO-MW1	DRMO-MW2	DRMO-MW3	DRMO-MW4	DRMO-DUP
Sodium	33.0	13.7	47.2	99.5	27.7
Nickel	0.69	0.07	0.099	0.020 u	0.86
Lead	0.84	0.056	0.19	0.32	1.1
Antimony	0.10 u	0.10 u	0.10 u	0.10 u	0.10 u
Selenium	0.40 u	0.002 u	0.20 u	0.002 u	0.04 u
Thallium	0.50 u	0.50 u	0.50 u	0.50 u	0.50 u
Vanadium	0.46	0.073	0.15	0.10 u	0.53
Zinc	2.4	0.31	0.53	1.3	2.8

u = Analyte was not detected at or above the reporting limit.

3.3 RELIABILITY OF ANALYTICAL DATA

3.3.1 Sampling Methods

Test pit excavation soil samples and groundwater samples were obtained in accordance with NJDEPE sampling protocols. Stainless steel trowels and teflon bailers were decontaminated and used to collect the soil samples from the excavation and groundwater samples from the monitoring wells. The decontamination steps were as follows:

1. Detergent scrub
2. Tap water rinse
3. Distilled water rinse
4. Methyl alcohol rinse
5. Distilled water rinse
6. Air dry

3.3.2 Sample Handling and Preservation

Soil from the test pit excavation, collected with a stainless steel trowel, and water from the monitoring wells was placed into laboratory cleaned jars. The type and size of the jars were matched to the intended analytical procedure. Soil and water samples were then labeled and placed into a cooler with ice. The samples were maintained at approximately 4 degrees Centigrade using ice throughout transportation and delivery to the lab. At the lab, the samples were transferred to a refrigerator until analysis was commenced.

The field blanks were obtained by pouring analyte-free water, supplied by the lab, over field-decontaminated sampling devices.

3.3.3 Sample Handling Times

From a comparison of the sampling and analysis dates, all analyses were performed within the method prescribed sample holding times.

3.3.4 Quality Assurance Samples

Field blanks were collected as part of the soil sampling effort as required by the NJDEPE's Field Sampling Procedures Manual. The field blanks were analyzed for volatile organics. The Field Sampling Procedures Manual does not require trip blanks for soil (non-aqueous) samples. No trip blanks were collected.

During monitoring well sampling, one duplicate sample, a field blank, and a trip blank were collected. The trip blank was analyzed for volatile organics only.

3.3.5 Method Detection Limits

All of the analyses performed had method detection limits (MDLs) that were at or below the recommended limits.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 ANALYTICAL

The analytical results of soil samples collected from test pits at the DRMO facility were compared to the NJDEPE Soil Cleanup Criteria for Non-Residential Direct Contact Soils. In comparing the cleanup criteria with the volatile organic results, it was evident that no volatiles found above detection limits exceeded the cleanup criteria. The only semi-volatile compound found to exceed the cleanup criteria was benzo(a)pyrene. It was found in test pits C, D, G,and I which all lie in the northern half of the DRMO facility.

Total Petroleum Hydrocarbons were found to exceed the 1,000 ppm NJDEPE UST soil cleanup criteria in three test pits. These three test pits (H, J, and L) are oriented downgradient from an underground storage tank of gasoline located outside the DRMO fenced area. The tank has subsequently been removed as part of a separate state closure activity.

The PCB Soil Criteria was exceeded by two soil samples collected from test pit G, at the northern entrance to the DRMO area, and test pit F, located near the southern gate.

Dioxins/Furans analysis was performed on samples collected from test pits F, I, and J. No dioxins/furans were detected in the sample collected from test pit F. Samples from test pits I and J showed levels in the range of 0.1 ng/g to 7.8 ng/g.

Trace amounts of Nitroglycerin were found in test pits J, I, and K. All of these test pits are either within the area determined to be a previous open burning area or within the vicinity of the burn area. During excavation of test pits J and I, it was apparent that burning activities had been conducted in those locations due to the charred debris found in the subsurface soils.

Nitrocellulose was found in test pits L, N, and O. Test pit L is located north of Green Pond Brook near the fenceline of the DRMO facility. Test pit N is located on the south side of Green Pond Brook, outside the gate on the east fenceline. The sample identified as TPO is a surface soil sample collected from an area of obvious disposition of ordnance-related items. This area, south of Green Pond Brook, was littered with debris suspected of extending into the subsurface soils.

The metals results indicated a wide variety of metals found in all samples. Arsenic, Copper, Lead, Zinc, and in one instance Cadmium, were found in levels above the NJDEPE Soil Cleanup Criteria for Non-Residential Soils. Lead was found in only the test pits located on the eastern half of the site. These test pits would also be considered downgradient from the underground gasoline storage tank located north of the DRMO facility. Arsenic, identified in all but three test pits, exhibited an even distribution of test pit locations with values above

cleanup criteria. As with the lead distribution, zinc was found at levels above cleanup criteria only in test pits located in the eastern half of the site.

No contamination was found in the groundwater samples. All results indicated levels of constituents either well below cleanup criteria or were not detected. Specifically, when the average metals results are compared to the NJDEPE Soil Cleanup Criteria for Residential Direct Contact Soils (since there is no established criteria for "Impact to Groundwater") no values exceed 25% of any particular NJDEPE Cleanup Criteria limits. Also, only one monitor well Total Petroleum Hydrocarbon analysis exceeded 1 ppm.

From the evaluation of analytical data, it can be concluded that a removal action at the DRMO is not necessary. It appears that those contaminants found in the soils have had no impact on the groundwater at this time, eventhough many constituents were found above soil cleanup criteria. It is recommended that the DRMO yard, Site 31, be placed back into the Remedial Investigation to further characterize the extent to which these contaminants are distributed.

4.2 UXO CONTAMINATION

Human Factors Applications, Inc. provided surface and subsurface UXO detection and removal of UXO and directed excavation for the twelve test pits.

HFA's assessment: The DRMO area was essentially a dump site for a multitude of metallic scrap. Much of this debris appears to be ordnance related scrap. A large portion of this ordnance scrap appears to be experimental munitions, submunitions, or submunition-related which are not readily recognizable as UXO. The area around test pits J and I appears to have been an open burning area for the disposal of ordnance. Test pits west and north of Building 314 contained subsurface ordnance scrap. Test pits in the southeast were void of ordnance scrap.

Based on the limited investigation of the area, HFA, Inc. recommends that any surface removal or segregation of the surface debris and all subsurface activity in this area be supported with UXO personnel. HFA believes this is imperative because of the presence of experimental and submunition UXO which may not be readily identified by other than trained EOD and UXO personnel.

APPENDIX A

PRELIMINARY ASSESSMENT

Non-Time Critical Removal Action

Preliminary Assessment

U.S. ARMY ENGINEER DISTRICT-NEW YORK
NEW YORK, N.Y.

ENVIRONMENTAL REMEDIAL
ACTIONS
AT PICATINNY ARSENAL

Contract/Purchase Order No.
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November 1993

Preliminary Assessment - Picatinny Arsenal
Unexploded Ordnance Area of the DRMO Yard (site 31)

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Preliminary Assessment
Unexploded Ordnance Area of the DRMO Yard (site 31)
Picatinny Arsenal
pursuant to
40 CFR 300.410 and 40 CFR 300.1410
and the 1990 revised NCP

CONTRACT NO. DACA87-90-D-0054
DELIVERY ORDER NO. 13

1.0 INTRODUCTION

Roy F. Weston, Inc. (WESTON®) has been contracted (Contract No. DACA87-90-D-0054) by the U.S. Army Corps of Engineers - New York District (ACE) to perform environmental services at the Picatinny Arsenal, a federal enclave, near Rockaway Township, Morris County, New Jersey, as directed by the U.S. Army Armament Research Development and Engineering Center (ARDEC), Environmental Affairs Division.

Task 1 of Delivery Order No. 13 is to develop a Removal Preliminary Assessment (PA) which is represented by this submittal. The PA will be developed as stipulated in 40 CFR 300.410 and 40 CFR 300.1410 and the 1990 revised NCP. This removal action PA will include the following information:

1. Summary of the background information, including photographs (Attachment 1).
2. Identification of the source and the nature of the release or the threat of release including unexploded ordnance (UXO).
3. Evaluation of the threat to the public.
4. Evaluation of the magnitude of the threat.
5. Evaluation of factors to determine if a removal action is necessary and the type of removal action.
6. Data on site management practices, information from generators, photographs, literature searches and personnel interviews.
7. Evaluation of data gaps which would allow the development of an Engineering Evaluation/Cost Analysis (EE/CA) Document.
8. Scope of a plan to acquire this data.

Picatinny Arsenal was placed on the National Priorities List (NPL) in March of 1990. Picatinny, with the Army Environmental Center (formerly USATHAMA) developed as required under the Interagency Agreement with the United States Environmental Protection Agency (EPA) a Remedial Investigation Concept Plan (RI Concept Plan).

The objective of the RI Concept Plan was to identify and prioritize contaminated and potentially contaminated sites at the arsenal. The RI Concept Plan was based on previously developed reports and site interviews. The RI Concept Plan identified and grouped, geographically, 156

sites into 16 areas, these 16 areas (A-P) were then prioritized. The Army has agreed to conduct a remedial investigation in three (3) phases (Phases I - III RI/FS) of these 16 areas as prioritized. The DRMO Yard was identified as Site No. 31 by the RI Concept Plan and was grouped within area G which is included within the Phase I RI.

The area addressed by this scope is not entirely bounded by the area defined as the present-day DRMO facility but rather the area that was used for past disposal of potentially explosive waste (OEW) near and within the present-day DRMO yard.

There are a number of CERCLA RI-Concept-defined sites surrounding this site or area of concern:

1. Site 101 of Area G: Buildings 311 and 319, Gasoline Station and Storage located north of the site;

2. Site 135 of Area G: Building 315, Metallurgy Laboratory located in a northwesterly direction from site 31;

3. Site 52 of Area G: Building 305; and

4. Other sites within RI-Concept Plan area F including Sites 61, 124 and 125.

Information concerning these sites can be found in the RI-Concept Plan and the Phase I Remedial Investigation/Feasibility Study Work Plan dated August 1993. This Work Plan was developed by Dames and Moore for the Army Environmental Center (AEC) and Picatinny Arsenal. This RI/FS Work Plan has been conditionally approved by the EPA per the InterAgency Agreement in September of 1993. The implementation of the fieldwork pursuant to this work Plan began in late September of 1993 and is expected to continue through January 1994.

The RI/FS Work Plan did not propose an investigation for Site 31 (the DRMO yard) on the basis that the RCRA closure had occurred within building 314. The remedial investigation will be developed with the results of the first round of sampling for the Phase I RI.

2.0 OBJECTIVE

The objective of this Removal Preliminary Assessment (PA) is to obtain and summarize the available information about the disposal area in and near the present-day DRMO. This information will be used to develop a Site Investigation Plan which will lead to a Removal Action Site Investigation (SI) Plan. The information gathered during the SI will eventually be used to develop an Engineering Evaluation/Cost Analysis (EE/CA).

3.0 SUMMARY OF BACKGROUND INFORMATION

3.1 Site History and Description

The area of concern is located southeast of Reilly Road and directly west of Green Pond Brook (see Figure 1). A Review of aerial photographs and the 1904 map of the arsenal indicates that the DRMO yard was originally a marsh area surrounding Green Pond Brook. In order for this area to serve it's present purpose, the area appears to have been brought to present grade through the use of fill material.

The debris from the 1926 explosion may have served as fill material. Historical maps of the area indicate many other possible uses of the DRMO area. These maps and their descriptions are as follows:

1904 map - Indicates the DRMO area as marshlands with a sand pit to the west of the DRMO yard (Figure 2).

1926 map - Does not show the DRMO area, but shows a sludge bed to the west of the DRMO yard (Figure 3).

1931 map - Indicates "Burning Grounds" near or in area where the DRMO yard presently exists (Figure 4). Generally, information indicates that the burning grounds was located north of the present-day DRMO yard, closer to the building 318 area.

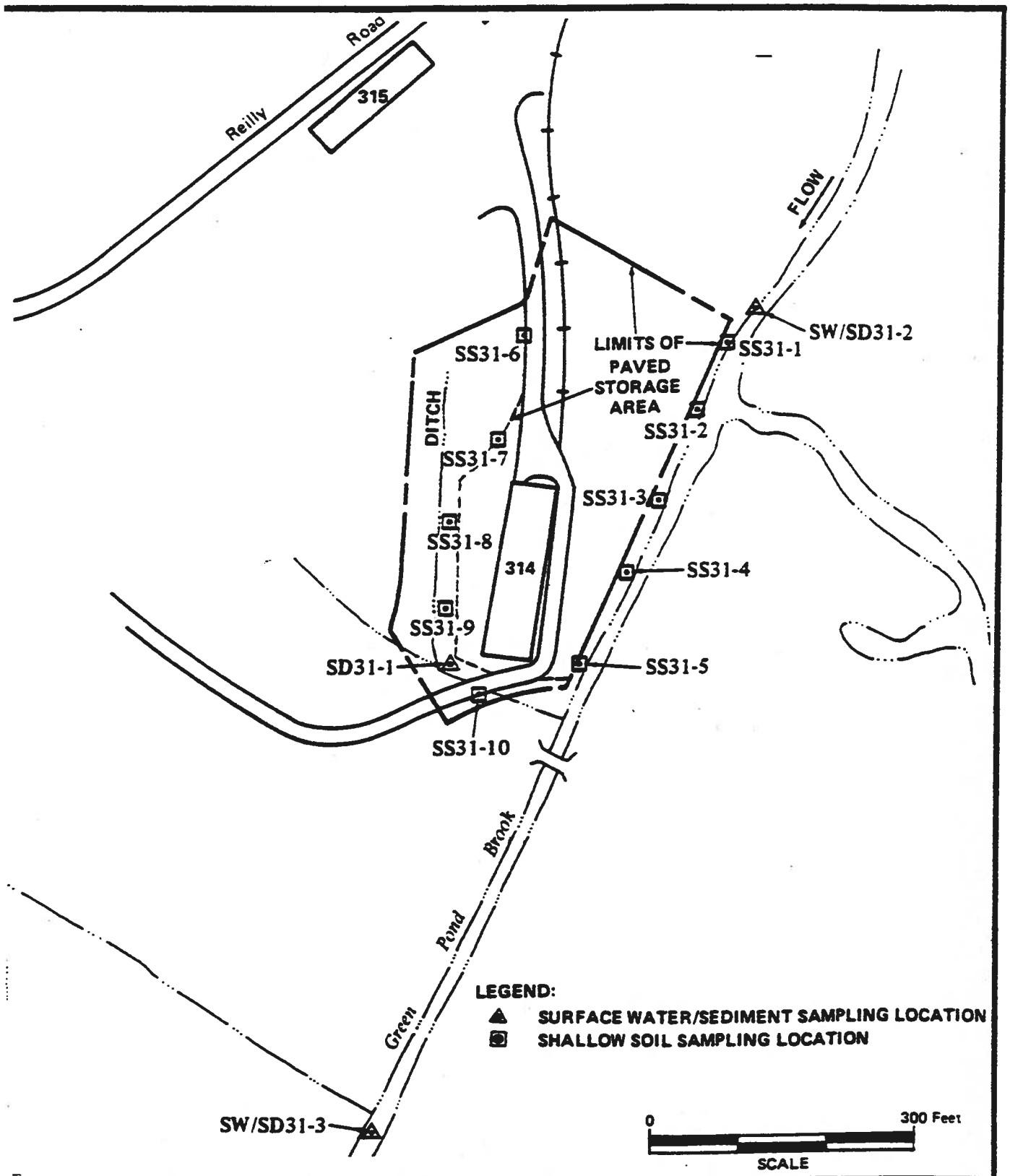
Please note that none of the illustrations of the historical uses of this area were drawn to scale and the locations of most structures or areas should be considered estimates. These maps were the only available information on the DRMO yard area before the existence of building of Building 314.

A Picatinny Arsenal employee indicated that the area to the west of Building 314 (but within the fenced yard) was marshlands until it was filled with "garbage-type" fill in the early 1970's.

When expanding the DRMO parking lot in the spring of 1993, unexploded ordinance were found in the southern portion of the DRMO. On April 22nd of 1993, the Explosive Ordnance Division at Picatinny Arsenal conducted a survey of the area. The following is an overview of the results.

1. Major items: Law Rocket Tubes and various mines and grenades all of which were found at the surface - most items were from the Vietnam era;

2. Because of the color coding and corroded condition of the exposed ordnance surfaces, it is impossible to determine by visual examination if the items had been loaded with HE or inert fillers.



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DRMO AREA LAYOUT

Figure 1

PICATINNY ARSENAL
- DRMO AREA
DOVER, NEW JERSEY

3. Various notifications and other safety requirements for the area were provided by the safety office.

On 8 June, a representative of the Huntsville Corps of Engineers conducted a site visit of the area. Below are some significant statements contained in the trip report concerning his visit:

1. Further investigation along Green Pond Brook revealed additional UXO protruding from stream banks;

2. Based on historic maps of the area from 1904 the entire area was shown to be swampy. The writer postulated that the ordnance protruding from Green Pond Brook and under building 314 itself are buried OEW from the 1926 explosion.

Presently, the DRMO is the storage yard for excess materials belonging to the U.S. Army. Records indicate that the DRMO activities started operation around 1955. All materials declared excess at Picatinny Arsenal are collected at the DRMO yard and offered for public sale before disposal. The offices for the DRMO are presently located in Building 314; Buildings 314B, C, D, and E are used for storage. 1 Most of the fenced in area of the DRMO facility is paved, excluding the area directly to the west of Building 314.

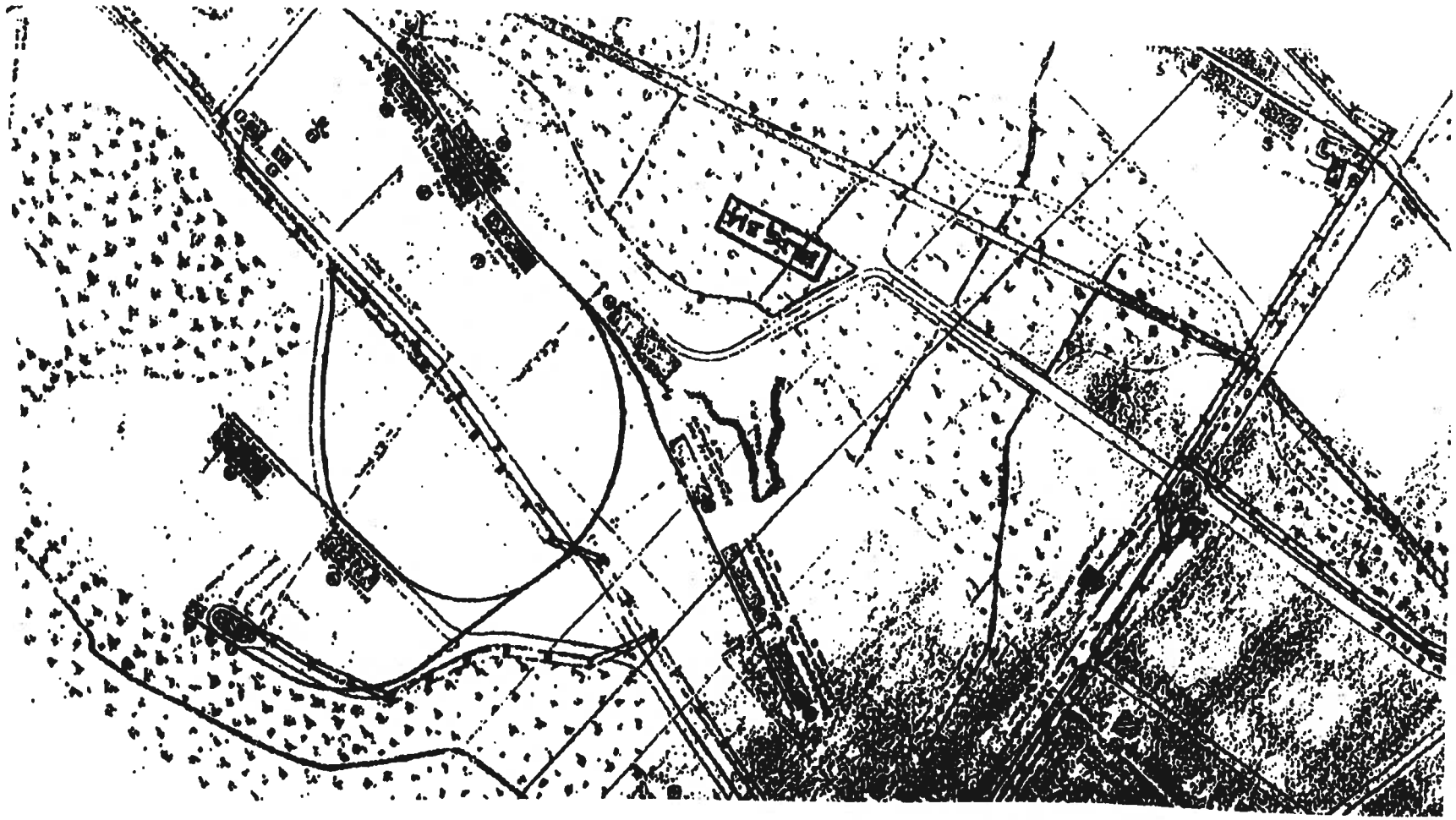
3.2 Site Hydrogeology

Measured groundwater levels at other sites in the vicinity indicate that the potentiometric surface is generally flat, shallow (generally within 10 feet of the surface) and being immediately adjacent to Green Pond Brook, the discharge point for local groundwater, which means that potential contaminant flow will be lateral rather than downward. Based on topography and water levels measured from wells at similar sites, the most probable groundwater flow direction at the site is from the northwest to the southeast, toward Green Pond Brook.

3.3 Identification of the Sources and Nature of Release

3.3.1 Soil Sampling

Based on the results of previous investigations, the surface soils have been contaminated with oils, metals and PCB's. Dames and Moore conducted a site investigative of the area in 1989 for which ten shallow soil samples SS31-1 through SS31-10 (the locations are shown in Figure 1), were collected from areas where visible contamination were observed.



History of Picatinny Arsenal - 1931

FIGURE 2

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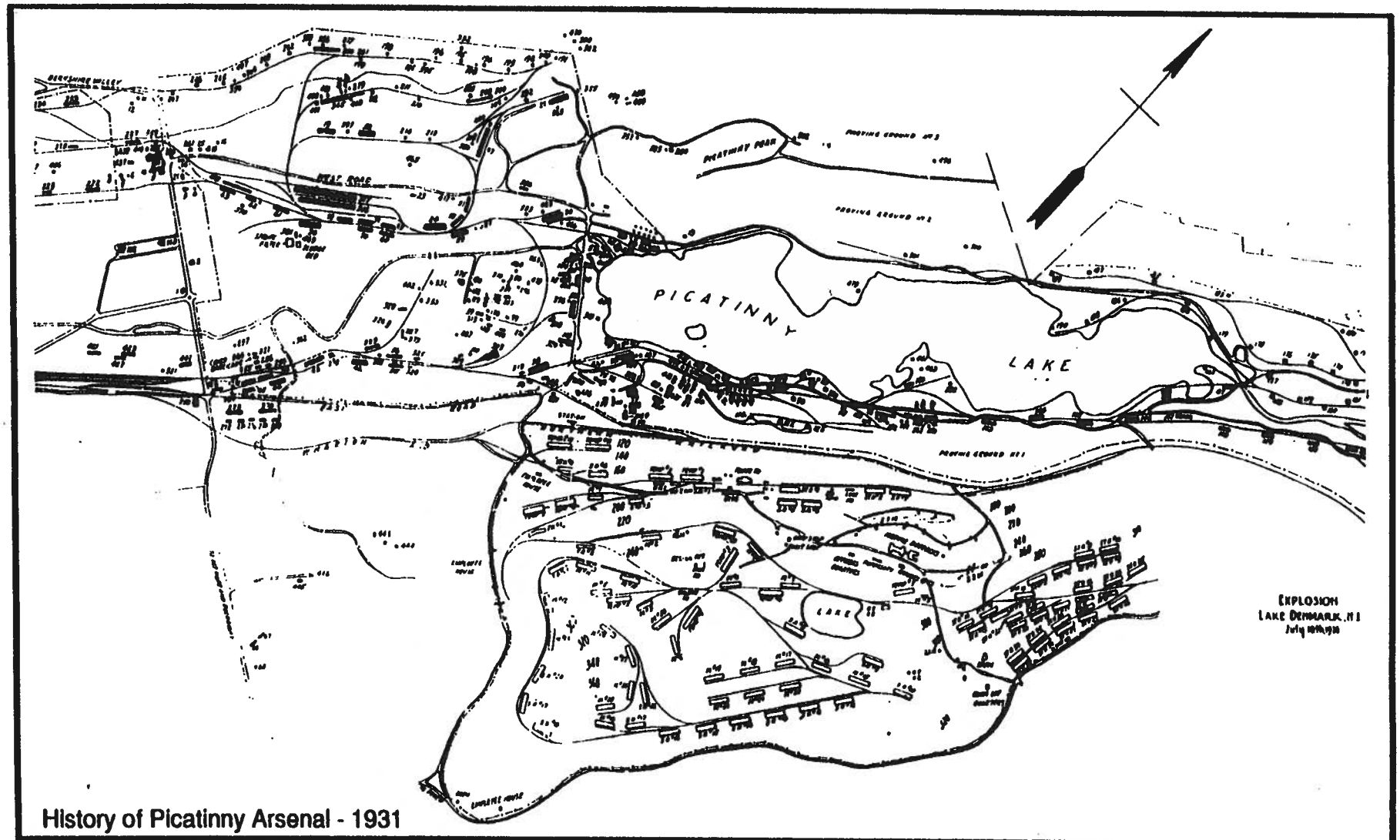
HISTORICAL MAP - DRMO AREA
PICATINNY ARSENAL



History of Picatinny Arsenal - 1931

FIGURE 3

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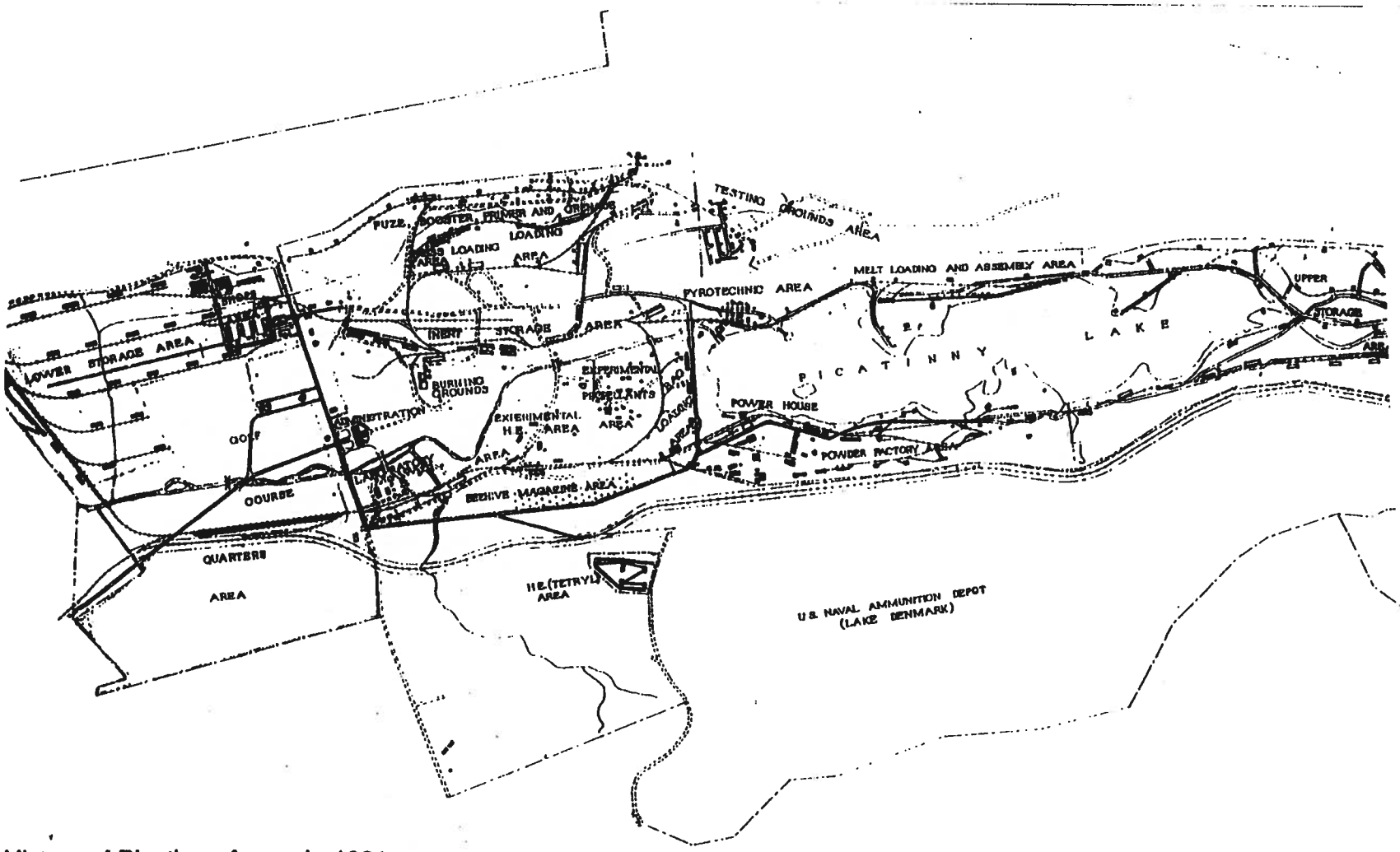
HISTORICAL MAP - DRMO AREA
PICATINNY ARSENAL



History of Picatinny Arsenal - 1931

FIGURE 4

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HISTORICAL MAP - DRMO AREA
PICATINNY ARSENAL

These samples generally consisted of sandy silt or silty clay. Metal fragments were visible at many of the sampling locations. Five of the samples, SS31-1 through SS31-5, were collected along the edge of the asphalt pavement between the eastern site boundary and Green Pond Brook at approximately 100-foot intervals. The remaining five samples, SS31-6 through SS31-10, were collected from the edge of the asphalt along the western site boundary, also at approximately 100-foot intervals. Samples were collected at the edges of the paved area, because these areas would be likely receiving points for contaminants washing off the asphalt and where contaminants would collect due to infiltration of surface runoff.

All soil samples were analyzed for explosives, nitrocellulose, nitrate, sulfate, metals, volatile organic compound, base neutral/extractable compound, cyanide, total phenols, oil and grease, and PCB's. These parameters were selected primarily because of the DRMO's present use. The results of the soil samples appear in Table 1.

Applied Environmental conducted a surface soil investigation in 1993. Four soil samples were collected and analyzed. One sample was collected as a six-part composite from composite area 2 and was analyzed for TPHC and Metals. One sample was collected as a three-part composite from composite area 1 and analyzed for TPHC and Metals. Another sample was collected from the storm sewer overfill and analyzed for Purgeable Halocarbons, BTEX, TPHC, and Metals. Another sample was collected from the machine press area and analyzed for PCB's (see Figure 5 for soil sample locations) The results of these soil samples are tabulated in Table 2.

4.0 EVALUATION OF THE THREAT TO THE PUBLIC

4.1 Surface Soils

Although the DRMO yard is currently operational and has a significant number of personnel who enter its areas; the specific area where unexploded ordinance has been found has been fenced off and access is limited by the Safety Office of Picatinny Arsenal. None of the evident contamination that was encountered during investigative activities was found in the commonly visited areas. Since the chemical contamination is found in the soil, the threat to exposure to these hazardous constituents is limited to inhalation of dust or ingestion. Neither of these exposure routes is considered a threat unless the areas of concern are actively disturbed.

Summary of Previous Soil Sampling
DRMO Area

Analyte	DL [a] in Soil (ug/g)	Concentration in Soil (ug/g)										NJDEPE Soil Cleanup Criteria (mg/kg) (nonresidential)
		SS31-1	SS31-2	SS31-3	SS31-4	SS31-5	SS31-6	SS31-7	SS31-8	SS31-9	SS31-10	
		Sample Depth (feet)										
		0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	
EXPLOSIVES												
Nitroglycerine	0.573	0.688	BDL[b]	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
METALS												
Antimony	3.10	8.38	BDL	BDL	BDL	15.3	BDL	BDL	BDL	BDL	BDL	340
Arsenic	2.00	18.0	5.82	9.40	2.32	11.9	8.29	8.73	7.88	9.82	4.77	2
Barium	5.00	1,200	440	390	130	300	86.9	40.3	63.6	59.0	87.1	47,000
Beryllium	0.330	0.686	0.536	1.12	BDL	0.905	0.691	0.745	1.37	2.22	0.451	1
Cadmium	0.036	86.0	53.0	48.0	8.80	11.0	9.30	1.40	1.70	1.50	2.50	100
Chromium (total)	1.30	65.0	63.0	24.0	7.90	18.0	BDL	8.70	4.25	11.0	18.0	N/A
Copper	12.0	>50.0[c]	1,100	1,900	330	680	180	34.6	46.7	44.8	>50.0[c]	600
Lead	0.250	24,000	780	1,500	270	3,400	340	36.0	26.0	54.0	120	600
Mercury	0.13	1.40	1.50	2.80	1.20	2.00	2.60	0.0190	0.230	BDL	0.368	270
Nickel	11.0	BDL	BDL	BDL	BDL	15.6	BDL	14.1	BDL	18.1	22.7	2,400
OIL AND GREASE	25	11,400	6,180	1,720	816	494	753	877	416	2,660	792	10,000[**]
POLYCHLORINATED BIPHENYLS												
PCB-1248	0.075	BDL	BDL	BDL	BDL	2.36	BDL	38.6	24.1	12.0	BDL	2[*]
PCB-1254	0.054	1.74	4.61	8.57	11.3	BDL	6.5	BDL	BDL	BDL	1.92	2[*]

Summary of Previous Soil Sampling
DRMO Area

Analyte	DL * in Soil (ug/g)	Concentration in Soil (ug/g)										NJDEPE Soil Cleanup Criteria (mg/kg) (nonresidential)
		SS31-1	SS31-2	SS31-3	SS31-4	SS31-5	SS31-6	SS31-7	SS31-8	SS31-9	SS31-10	
		Sample Depth (feet)										
		0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	
VOLATILE ORGANICS												
Methylene Chloride	0.005	0.765	0.0718	0.0841	0.0422	0.0458	0.0552	0.0323	0.0459	0.0444	0.0615	210
Toluene	0.0005	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.0369	1,000
PHENOLS	0.29	BDL	1.3	0.60	BDL	0.45	0.46	BDL	BDL	BDL	BDL	10,000**
ANIONS												
Sulfate	71.0	96.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	N/A
SEMIVOLATILE ORGANICS												
Benzo (a) Anthracene	0.33	BDL	0.4	0.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	4
Benzo (b) Fluoranthene	0.33	0.4	0.4	0.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	4
Benzo (k) Fluoranthene	0.33	BDL	0.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	4
Benzo (g,h,i) Perylene	0.33	2	0.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2.5
Benzo (a) Pyrene	0.33	0.5	0.5	0.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	.66
Bis (2-ethylhexyl) Phthalate	0.33	10	0.9	BDL	BDL	BDL	BDL	2.15	BDL	BDL	BDL	210
Butyl Benzyl Phthalate	0.33	BDL	0.3	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	10,000**
Chrysene	0.33	0.5	0.7	0.6	BDL	BDL	0.331	BDL	BDL	BDL	BDL	40
Dibenzo (a,b) Anthracene	0.33	2	0.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	.66

TABLE 1

Summary of Previous Soil Sampling
DRMO Area

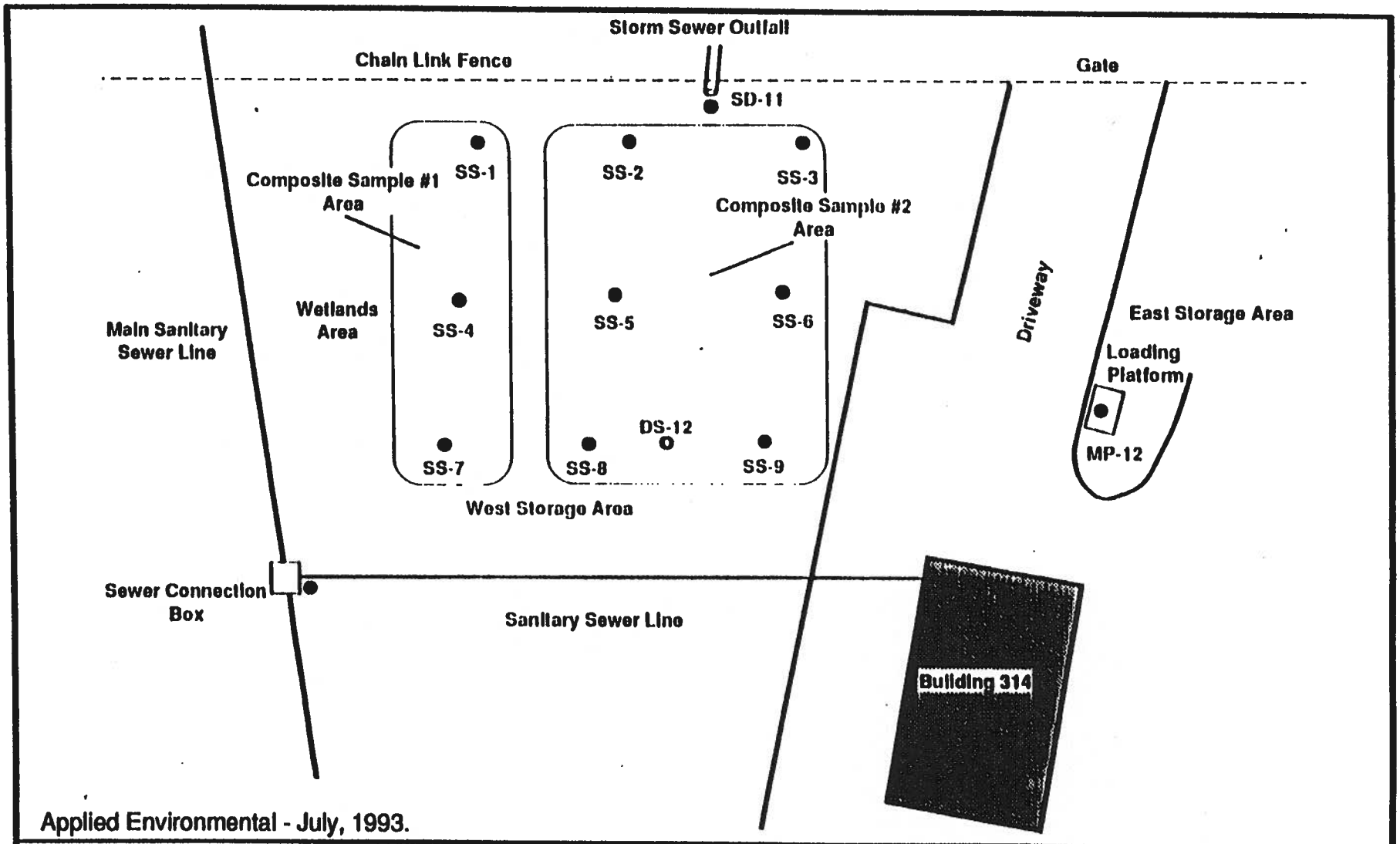
Analyte	DL [a] in Soil (ug/g)	Concentration in Soil (ug/g)										NJDEPE Soil Cleanup Criteria (mg/kg) (nonresidential)
		SS31-1	SS31-2	SS31-3	SS31-4	SS31-5	SS31-6	SS31-7	SS31-8	SS31-9	SS31-10	
		Sample Depth (feet)										
		0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	0.5 - 1	
Di-n-Butyl Phthalate	0.33	0.8	0.9	1	0.6	0.5	0.331	0.323	0.344	0.444	BDL	10,000**
Di-n-Octyl Phthalate	0.33	BDL	0.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	10,000**
Fluoranthene	0.33	BDL	0.6	0.4	BDL	BDL	0.331	BDL	BDL	BDL	BDL	10,000**
Indeno (1,2,3-c,d) Pyrene	0.33	0.9	0.6	0.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	4
Phenanthrene	0.33	BDL	0.5	0.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	N/A
Pyrene	0.33	0.3	2	0.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	10,000**

a DL = detection limit
b BDL = below detection limit
c sample digestate was not diluted to bring analyzed concentration to within the USATHAMA certified range. Result is reported as "greater than" the upper limit of the certified range.
* Total PCB's
** Total Organic Contaminants
N/A Not available

TABLE 2
SOIL SAMPLING RESULTS

Analytical Parameter	Sample Identification			
	MP-12	CS-1	CS-2	SD-11
POLYCHLORINATED BIPHENYLS (ppm)				
PCB-1016	< 0.2	N.A.	N.A.	N.A.
PCB-1221	< 1.0	N.A.	N.A.	N.A.
PCB-1232	< 0.2	N.A.	N.A.	N.A.
PCB-1242	< 0.2	N.A.	N.A.	N.A.
PCB-1248	< 0.2	N.A.	N.A.	N.A.
PCB-1254	< 0.4	N.A.	N.A.	N.A.
PCB-1260	1.0	N.A.	N.A.	N.A.
TPH (ppm)	N.A.	200	330	9,100
METALS (ppm)				
ARSENIC	N.A.	4	4	4
MERCURY	N.A.	8.3	1.4	< 0.3
SELENIUM	N.A.	< 0.5	< 0.5	< 0.5
CYANIDE	N.A.	< 0.1	0.1	1.2
BARIUM	N.A.	50	110	60
CADMIUM	N.A.	6	7	< 4
CHROMIUM	N.A.	22	21	31
LEAD	N.A.	700	210	190
SILVER	N.A.	< 4	< 4	< 4
VOLATILE ORGANICS (ppb)				
PURGEABLE HALOCARBONS	N.A.	N.A.	N.A.	BDL
BENZENE	N.A.	N.A.	N.A.	< 5
TOLUENE	N.A.	N.A.	N.A.	10
ETHYL BENZENE	N.A.	N.A.	N.A.	< 5
TOTAL XYLENES	N.A.	N.A.	N.A.	39

Note: BDL = Below detection limit N.A. = Not analyzed



Applied Environmental - July, 1993.

FIGURE 5

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SOIL SAMPLE LOCATIONS - DRMO AREA
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4.2 Groundwater

The threat to the public through migration of the surface contamination is not known. There has been no subsurface investigation of the DRMO area and there are no groundwater monitoring wells in or around the DRMO area that can be sampled.

4.3 Unexploded Ordnance

Due to the fact that ordnance and pieces of ordnance were found in many parts of the site, there is the potential for these items to be explosive. Most of the ordnance encountered on the ground surface were found to be inert, but if the DRMO was used either to receive waste from the 1926 explosion or from an Burning Ground, there is a chance some live ordnance may be encountered. Army regulations require that all OEW be considered "live" unless otherwise documented.

5.0 EVALUATION OF THE MAGNITUDE OF THE THREAT

The magnitude of the threat to the public can be divided into two general components:

1. The threat from the exposure to the explosives; and

2. The threat from the exposure pathways to contaminants.

There is a potential threat for personnel exposure to OEW but restrictions on access to the contaminated area minimizes the likelihood of this threat.

The magnitude of the threat of the exposure pathways related to the known chemical contaminants include the following:

- Dermal contact with soils that contain the hazardous substances identified within Tables 1 and 2. Most of the levels are below the New Jersey Department of Environmental Protection and Energy new actions levels for industrial sites. As this area sits near the most active area of Picatinny, use of the industrial clean-up levels for this assessment would be acceptable. Hence, the degree of the magnitude of the threat to the public from exposure with contaminated soils is low.

- The magnitude of the threat posed by the potential exposures pathways related to the leaching of contaminants from the area to surface water is moderate. This assessment is be based on the level of constituents that are known in the area, what and what may be present, and the proximity to Green Pond Brook.

- The potential pathway for the ingestion of groundwater as drinking water from the leaching of the known and unknown contaminants from the soils to the groundwater is considered moderate but difficult to accurately assess since no monitoring wells are

located directly down-gradient of the area to determine the presence of hazardous constituents or contaminants in groundwater. The closest drinking water well (# 410) is located approximately one thousand (1000) feet to the east of the site. Well # 410 is screened 95 feet below surface. Well # 410 is monitored per the state regulatory requirements. Results of that sampling and other sampling conducted by the Army from this well indicate that the volatile organic compound, trichloroethylene (TCE) is above state standards for drinking water consumption; the Well # 410 water is treated to drinking water standards before distribution. It has never been speculated from any of the numerous groundwater investigations at Picatinny Arsenal that this contaminant was originated from the DRMO area.

6.0 EVALUATION OF FACTORS TO DETERMINE IF A REMOVAL ACTION IS NECESSARY AND THE TYPE REMOVAL ACTION REQUIRED

Numerous explosive waste items have been found within the DRMO area and it is likely more exist in the subsurface beyond the known area of OEW contamination. The potential threat of explosion of these wastes and the migration of contaminants to surface water and groundwater are adequate factors to determine a non-time critical removal action as defined in 300.410.

Types of non-time critical removal actions are not strictly limited to the following:

a. Additional fencing and other security measures to ensure that access to the area of concern is severely restricted and/or controlled;

b. Capping or covering the area to limit the leaching and migration of waste constituents into the groundwater or surface water;

c. Run-on and run-off controls to prevent or limit the migration of waste to Green Pond Brook;

d. Removal and proper disposal of the OEW and specific hazardous constituents or materials (drums and containers if found) as appropriate; and

e. No action.

The selected action will be based on the information resulting from the SI of the area and the evaluation within the EE/CA.

7.0 EVALUATION OF DATA GAPS

In order to prepare a detailed EE/CA for the DRMO area and to better evaluate the magnitude of the threat to the public, there are certain data gaps that must be filled. The limited sampling data available at this time is insufficient to develop an engineering document of the remediation possibilities for the site.

The existing analytical data is limited to surface soil samples and must be extended to include investigation of the subsurface soils, groundwater, and the extent and nature of the fill material.

7.1 Subsurface Soils

The subsurface soils of the DRMO area must be investigated. It must be determined whether or not surface contamination has extended into the subsurface region. It must also be determined whether additional contamination exists below the surface due to past practices such as open dumping.

7.2 Groundwater

Presently, there is no information available pertaining to the groundwater at the DRMO area. It is possible that either the surface soil contamination or the leachate from the fill material could have impacted groundwater quality at the site. Information on groundwater flow, depth and quality will help define the threat to the public associated with the DRMO yard, and yet depending on the type of proposed removal actions may not be necessary information for the development of the EE/CA.

7.3 Extent and Nature of Fill Material

Because of the magnitude of the threat to the public due to the presence of explosive materials that may be buried in the area, it is critical that the OEW fill area be carefully and adequately defined.

8.0 SCOPE OF THE PLAN TO ELIMINATE DATA GAPS

Subsurface soils, groundwater, and nature and extent of fill material have been identified as data gaps for the investigation at the DRMO. This action proposes how these data gaps can be eliminated and what the data means in relation to the development of a remedial action plan.

8.1 Subsurface Soils

The two most practical ways of obtaining subsurface soil information are soil borings and test pits. Test pits will be the preferred method of subsurface investigation since the existence of fill material in the area can be easily determined from exposure. Test pits can be used to determine vertical, as well as horizontal, extent of sub-surface contamination. Test pits will give a good view of the subsurface conditions as well as provide a method for soil sampling. These soil samples can help categorize the contamination or lack of contamination in subsurface soils, and should be analyzed for TPHC, PCBs, semivolatiles, volatiles, metals, and explosives.

8.2 Groundwater

There is presently no available information on the groundwater at the DRMO site. This information can be gathered by observing groundwater encountered in test pits and by installing groundwater monitoring wells. Monitoring wells will provide information on depth, flow direction and water quality that will be necessary to create the EE/CA. It will be necessary to install monitoring wells down-gradient of the area of concern to determine its impact on groundwater and possible contaminant migration off site.

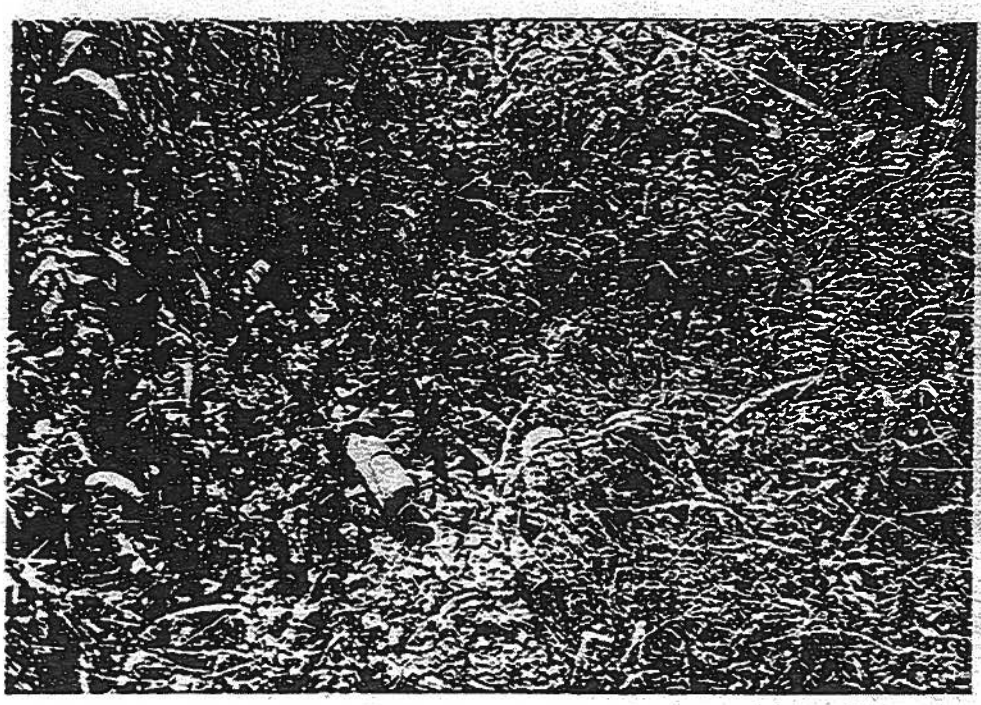
8.3 Extent and Nature of Fill Material

There is evidence that potentially contaminated fill may have been used to build-up the DRMO area as previously discussed. Test pits will assist in properly defining the nature and extent of this fill material. The test pits will be excavated to either groundwater or background soil, whichever is encountered first. The material removed and observed from the test pit will be carefully examined and recorded. Any potential unexploded ordnance that are encountered will be carefully inspected to determine their explosive potential and, if possible, their date of manufacture and disposal. The test pits will be extended as necessary to determine the extent of suspect fill.

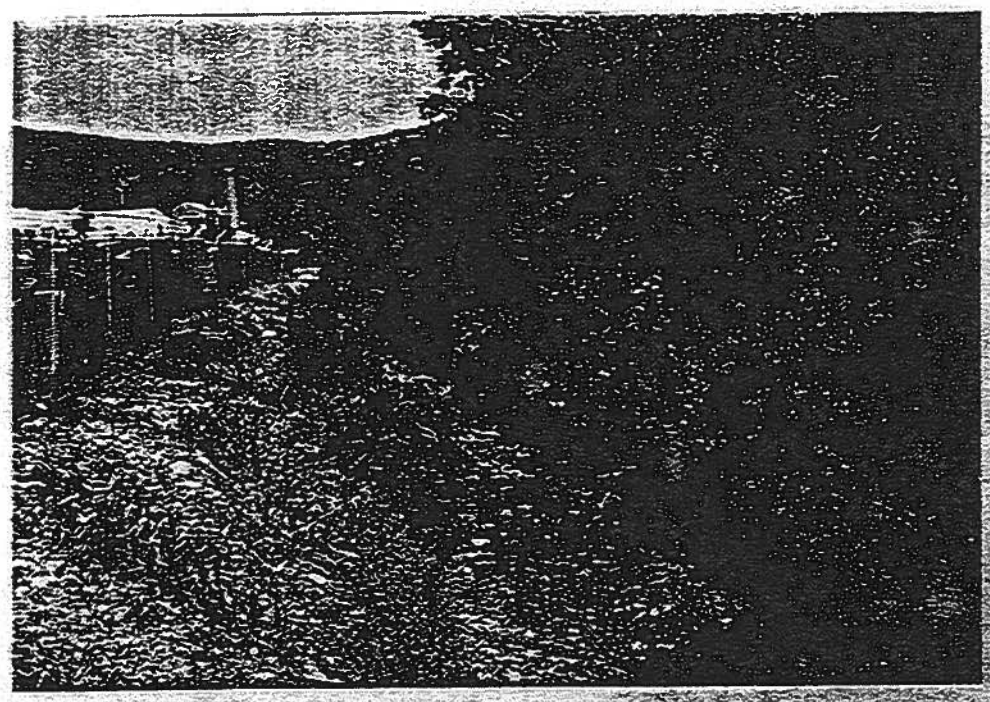
ATTACHMENT 1

ATTACHMENT 1
DRMO AREA

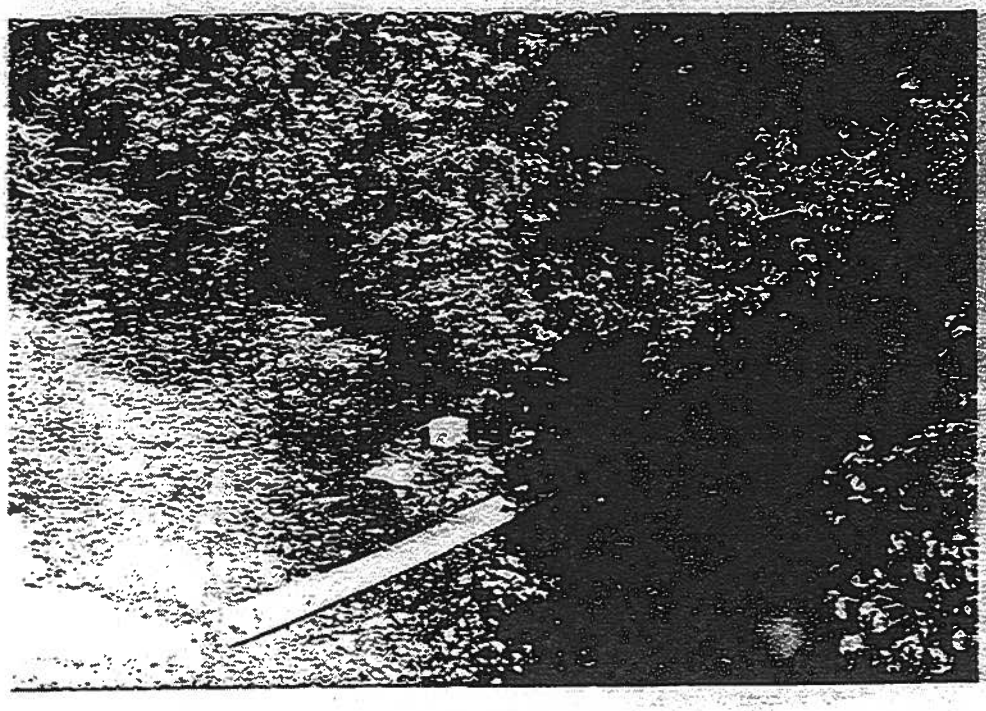
Photograghs of the area to the West of Building 314. The photographs show fill material that has been exposed. Pieces of ordnance were found in both of these locations in previous investigations.



ATTACHMENT 1
DRMO AREA



Photopraghs of Green Pond Brook which runs along the eastern border of the DRMO area. Ordnance were found protruding from the banks of Green Pond Brook during previous investigations.



APPENDIX B

FIELD NOTES

Wednesday, December 8, 1993

0700 Dave Benter (OB) arrives at Picatinny Arsenal, Weston trailer. Work to be completed at Defense Revitalization and Marketing Office

1045 Begin Digging test pit 6

Brownish black 0-6" 90% silt w/some m-c gravel 5YR 2/1

Brownish black 6"-12" 80% silt 20% well rounded coarse gravel 5YR 2/1

12"-24" same as above - various debris Fill?

24"-30" Damp 50% F-sand 40% silt 10% F-rounded gravel Color - Brownish black 5YR 2/1 - scrap metal piping

30"-36" Color Grayish Brown [5YR 3/2] 50% M-F sand 40 silt 10% C-gravel - Fill, some metal debris

36"-42" Coarse sand 70%, 20% silt; 10% Coarse gravel. Color Moderate brown 5YR 3/4, large boulders and some cinders - scrap metal pieces - Fill - Stump

42"-48" Alot of scrap metal / wood 40% scrap 50% C-M sand 5% silt, 5% C-stone Color [5YR 3/2] grayish brown - Fill - angular gravel damp

1100 48"-72" - large log on side of hole - Color [5YR 3/2] grayish brown w/mixed [5YR 3/4] moderate brown. Alot of scrap metal, logs, cinders. Coarse sand, little silt 50% c-sand, 50% various debris metal pipe

72"-10' - Alot of wood, stone & cinders, color [5YR 3/2] grayish brown, 50% stone & scrap, 40 +5% M-sand 5% silt - moist - Fill

Thursday
December 9, 1993

0700 Arrive at Weston Trailer, Picatinny Arsenal

0800 HFA clearing test pit area "B"

0810 Begin digging TPB

0-2' - Color Syr 4/4 moderate Brown - 60% F-sand 20% - silt, 20% large cobbles, NO debris uncovered, cobbles well rounded, soil dry

2'-4' Color Syr 4/4 moderate Brown, 60% c-sand 10% silt, 30% cinders, large cobbles, ect, several metalic objects uncovered

4'-6" Color N3, Dark Gray, 40% coarse gravel 50% coarse sand, 10% large cobbles & boulders few metalic objects uncovered

6-8' Same as above

0900 Groundwater at 7.5' bgs
0905 Sample DRMO-1209-TPB
0910 Sample DRMO-1209-TPB Collected

0930 Begin excavating Test Pit "C"

0'-2' Brownish Black 10% silt, 30% m-sand, 60% wood, metal debris, concrete, ect. several munitions collected

1000 Sample DRMO-1209-TPBC
Groundwater at 3' bgs. Soil composition constant to 3'

1045 Begin excavating test pit ~~K~~ DM.
0'-1.5'
1100 ~~Dbr~~ Dusky Yellow Brown [10yr 2/2], 80% m-gravel angular, 15% m-sand 5% - silt. No debris, concrete or munitions discovered

1.5' - 2.5 Black 50% c-sand, 50% wood, cable, concrete, boulders, ect.

2.5' - 3.0' Black 100% M-F Sand

Groundwater 3'

1130 Sample DRMO-1209-TP~~K~~M collected

1200-1300 Lunch

1300 Begin excavating Test Pit K

0'-2' ~~Dusky~~ Grayish Brown [5yr 3/2] 40% m-sand, 10% silt, 40% angular c-gravel, 10% cinder block
Very little metal debris.

1140 ~~10' 14' medium sand~~ DB Ground water at 10' bgs.

1200 Sample DRMO-1208-TP6

.00 - 1300 Lunch

1300 Backfilling TP6 (test pit 6)
Sample DRMO-1208-FB collected

1320 HFA cleaning Test Pit A location. Scattered metal debris on ground

1330 0"-6" Color [5YR 3/2] grayish brown
90% silt 10% F-sand
6"-12" Grayish orange [10YR 7/4] 80% F-sand
10% silt 10% C gravel very little metal

1'-3' ~~Same as above~~ DB 90% C-sand 10% ~~silt~~ DB
Coarse gravel - Dark yellowish brown 10YR 4/2
Some metal objects discovered

3-4 Moderate yellowish brown [10YR 5/4] 60% F sand
20% silt, 20% M-gravel, moist - NO debris.

1345 OVA 500 ppm - will break to see if readings decrease. Organic smell - No visible staining
4'-5.5'
1357 ~~4'-6'~~ Dark yellowish brown 10YR 4/2
60% M-sand 30% silt 10% M gravel
NO debris

1' [illegible] 10% organic material

1415 Sample DRMO-1208-TP4 Collected

1420 Water encountered at 6'

1500 ~~Temp~~ DB Test pit filled. Mobilize to Weston trailer to pack samples

1730 DB delivers samples to ~~Fedex~~ Federal Express in Hamilton NJ.

2'-~~4'~~ 3.5' Blackish Red [5R 2/2] alot of metal debris, 80% c-gravel, 10% c-sand, 10% brick

3.5'-5' Dusky Brown 5yr 2/2, 40% c-gravel 40% c-sand, 20% clay

1400 Sample DRMO-1209-TPK collected
water encountered at 5' bgs

1410 Begin Excavating TP F

0-2' Grayish Brown [5yr 3/2] 40% coarse sand 10% silt, 50% c-gravel Dry - No metal debris

2-4 Black Red [5R 2/2] large boulders, no metal 50% boulders, 40% c-sand, 10% c-gravel

4-8 Black 50 F-sand 50% silt Alot of odor

8-10 Brown organic peat, virgin material, stop excavating.

1430 Sample DRMO-1209-TPF collected and will also be analyzed for Dioxins

1500 At Weston trailer packing samples

1730 Dave Benton delivers samples to Federal Express IN Hamilton, NJ.

December 10, 1993

0800 DB arrives at Weston Compound

0900 Begin excavating test pit TPH

0'-1' Color Grayish brown 5yr 3/2 80% Gravel (Coarse) 20% c-sand minimal metalic debris

1'-2' Brownish black 5yr 2/1 80% c-gravel 10% c-sand 10% silt

2'-7' c-sand, moderate yelowish brown 10yr 5/4 some silt, no debris 80% c gravel 20% c sand

0930 WATER - 7' bgs
Sample DRMO-1210-TPH collected

0945 Begin excavating TPL

0'-2' Grayish Brown 5yr 3/2 80% gravel, 10% boulders 10% c sand

Water at 22" bgs

1000 Sample DRMO-1210-TPL collected

1010 Sample DRMO-1210-FB (field blank) collected

1020 Begin Excavating TPI

0-6" brownish brown 5yr 3/2 80% gravel 20% c. sand No metalic debris

6'-18' Moderate brown 5yr 4/4 80% C-gravel 10% large cobbles 10% C-sand - NO metallic objects

18-24' 10yr 6/2 Pale yellowish brown 50% cinders, (white brick) 50 - C-sand

24'-4' Black ash, burn residue

Water at 4' bgs

1030 Sample DEMO-1210-TPF collected
Will also be analyzed for Dioxins

11:00-1130 lunch

1130 Begin excavating TPD

0-1' Black, cinders, brick & stone
10% C-sand 90% other (brick stone, gravel)

1'-1.5' Black layer 50% organic material, 50% coarse sand.

1.5'-2.8' Black sand - 80% C-sand 20% C-gravel

1200 Sample DEMO-1210-TPD collected
Water encountered at 2.8'

1300 Back at Weston Compound. Packing samples for tech. exp

1600 Dave Bentz delivers samples to Federal Express in Hamilton, NJ.

December 15, 1992

0700 Dave Bentz arrives at Weston Trailer.

0800 Mobilize to Defense Revitilization and Marketing Office.

0830 Removing fence to mobilize to test pit DEMO-1213-TPE

0845

0-2' Brownish Black 5yr 2/1 ~~10yr 3/1~~, 50% C-sand 50% wood, metal and brick

2'-8' 50% C-sand 50% C-gravel & stone
5yr 4/4 - Moderate Brown alot of wood, metal, glass and various types of garbage

8'-13' Pale yellow Brown 10yr 6/2
50% C-sand, 50% C-gravel - moist

Water at 13'

0930 Sample DEMO-1213-TPE collected
Fill - 0'-8'
Virgin Soil 8'-13'

1015 Begin excavating Test Pit J

0-2 Black (N1) 50% c-sand, 50% c-gravel
alot of debris present. Alot of ash and melted
material also present
2-7.5 Brownish black 80% c-gravel, 20% c-sand
1100 Water encountered at 7.5'
sample DEMO-1213-TP5 collected

1200 Begin excavating test pit N

0-6' 5yr 3/2 Dusky Brown 50% stone 20% c-gravel
30% c-sand. Some metallic debris
Water encountered at 6'
1230 sample DEMO-1213-TPN collected

1/24/94 Weather 40° Cloudy

Monitoring Well Installation at DRMO

0700 Dave Bentley (DB) on-site

0800 Waiting for Safety Permit, H&S meeting, OVM Calibrated

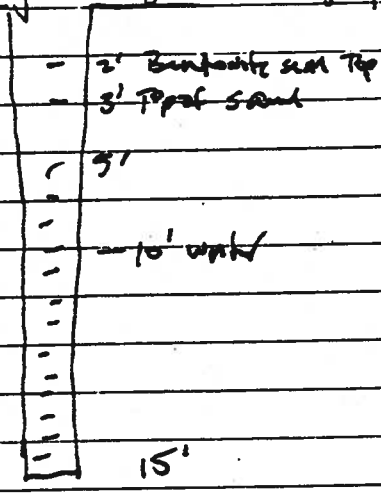
1015 Begin Drilling at DRMO-124-MW1 (originally Test Pit F

1030 At 10' - No water Continue Drilling
HFA cleaned backside of 10'

1035 Water at 13' water level w/indicator 10'
will drill to 15' - screened interval 5'-15'
sand pack 3'-15', Bentonite seal 2'-3', grout 0'-2'
No readings above background observed on OVM, Background 0
Drillers steam cleaning drill rig and drilling equipment

Total Sand - 3 bag
Bentonite Pellets 1/2 bucket

Water level at Completion of Well 8'3"



1200-1230 Lunch

1240 Monitoring well DRMO-124-MW1 - flush mount completed. Problem with water. Flush mounted well underwater from melting snow. Will check well completion tommorrow.

Tuesday 1/25/94 Weather Cloudy, 30°F, wind-calm

0700 DB, Drillers and HFA onsite
H&S meeting, calibrate OVM, Driller steam cleaning

0900 Begin drilling at MW-3 previous test pit "M"
0905 HFA clean from 4'-6' - water present at Appx 3'
No readings above background on OVM
0930 Drilling at 8' HFA cleaned to 12'

1000 MW-3 set at 12' screened interval 2-12'
sand to 1'-12', .5-1 pellets, grout .5-0.
1015 Drillers steam cleaning Rig & drill rods
1035 Set up at BRMO-MW-4

1050 Drilling to 9' HFA cleaning to 12'
No readings above back ground observed on OVM
1100-1145 lunch

1215 Will attempt to put in 15' HFA clear to 15'

MW-4 - Total depth 13.5 screened interval 3.5-13.5
bentonite seal 1-2
sand pack 2-13.5
grout 0-1
water level following well construction 7.5' bgs

1315 Set up at MW# DEM7-124-MW-2
Utility Clearance Completed

1330 Drilled to 4', HSA would not clear to go any further - moved to another location - 2'

1345 Drilling to 4' at New location
water at 10.5' water w/indicator 7'
No readings above background observed on OVM

1430 Screen set at 2'-12' sand 1'-12', bentonite .4'-1', grout 0-.4

1530 Setting flush mnt at MW-2

MW-2 Orange brown Coarse sand

1600 Darlene steam cleaning Rig + drilling Tools

1300 Drillers completing all flush mounts

1330 Development will be completed by hand bailing

1400 Development volumes

	Total volume
MW-1	35-40 gallon
MW-2	45 gallon
MW-3	40 gallon
MW-4	40-45 gallon

development completed when all sediment was removed and water was fairly clear.

Total Vsed 11 bags of sand & app 15 buckets of pellets

APPENDIX C

WELL INSTALLATION LOGS

DWR-133M (7/92) SERIAL # 38322

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION AND ENERGY
TRENTON, NJ

Mail to
Water Allocation
CN 029
Trenton, N.J. 08625

Permit No. _____

MONITORING WELL PERMIT

VALID ONLY AFTER APPROVAL BY THE D.E.P.E.

COORD #: 25.W.356

Owner: Picatinny Arsenal - ARDEC
Address: Building #1
Dover NJ 07806-5000

Driller: Summit Drilling Co. Inc.
Address: 1324 Union Ave
Bridgewater NJ 08807

Name of Facility: Building 314
Address: 11th Ave
Dover, NJ 07806-5000

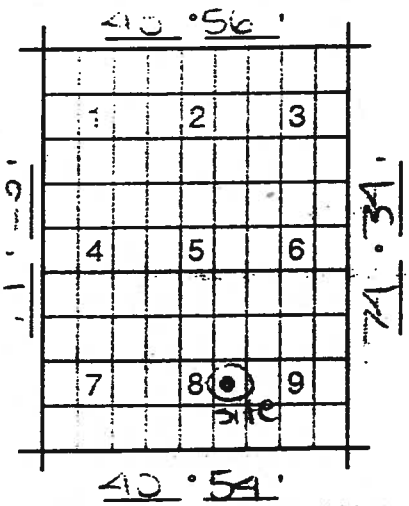
Diameter of Well(s)	4 Inches	Proposed Depth of Well(s)	30 Feet
# of Wells Applied for (max. 10)	4	Will pumping equipment be installed? YES ☐ NO ☑	
Type of Well (see reverse)	Monitoring	If Yes, give pump capacity	N/A GPM

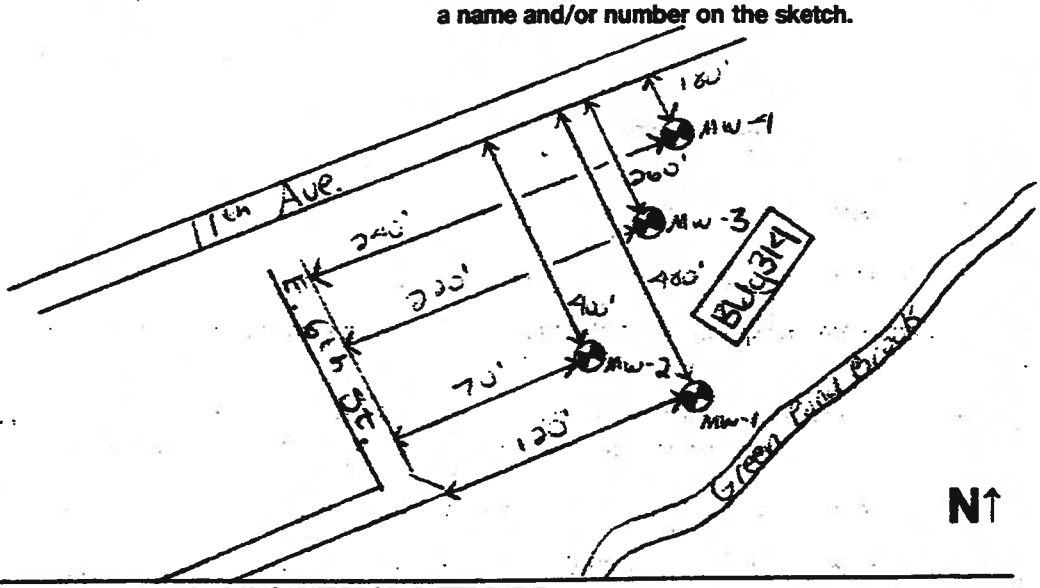
LOCATION OF WELL(S)

Lot #	Block #	Municipality	County
N/A	N/A	Dover	Morris

State Atlas Map No. 25

Draw sketch of well(s) nearest roads, buildings, etc. with marked distances in feet. Each well MUST be labeled with a name and/or number on the sketch.





FOR MONITORING WELLS, RECOVERY WELLS, OR PIEZOMETERS, THE FOLLOWING MUST BE COMPLETED BY THE APPLICANT. PLEASE INDICATE WHY THE WELLS ARE BEING INSTALLED:

- ☐ Spill Fund Case
- ☐ ECRA Case
- ☒ CERCLA (Superfund) Site
- ☐ RCRA Site
- ☐ Underground Storage Tank
- ☐ NJPDES Municipal Discharge Permit
- ☐ NJPDES Industrial Discharge Permit
- ☐ Water and Hazardous Waste Enforcement Case
- ☐ Water Supply Aquifer Test Observation Well
- ☑ Other (explain) EPA

Case I.D. Number: NJ 3210020704

This Space for Approval Stamp

WELL PERMIT APPROVED
Dept. of Environmental Protection
Water Resources/Water Allocation
JAN 11 1994

FOR D.E.P.E. USE
☐ Issuance of this permit is subject to the conditions attached. (see next page)
☑ For monitoring purposes only
☑ The well(s) may not be completed with more than 25 feet of total screened or uncased borehole.
☐ _____

SEE REVERSE SIDE FOR IMPORTANT PROVISIONS AND REGULATIONS PERTAINING TO THIS PERMIT.
compliance with N.J.S.A. 58:4A-14, application is made for a permit to drill a well as described above.

Date 1/5/94 Signature of Driller [signature] License # J1622

Signature of Owner [signature]

Test to COPIES: Water Allocation — White and Pink Health Dept. — Yellow Owner — Blue Driller — White

DWR-138 M
12/91

New Jersey Department of Environmental Protection and Energy
Bureau of Water Allocation

MONITORING WELL RECORD

Well Permit No. [illegible] - [illegible]
Atlas Sheet Coordinates [illegible] : [illegible] : [illegible]

OWNER IDENTIFICATION - Owner [illegible]
Address BUILDING #1
City DOVER State NJ Zip Code

WELL LOCATION - If not the same as owner please give address. Owner's Well No. [illegible]
County [illegible] Municipality DOVER TOWN Lot No. N/A Block No. N/A
Address

TYPE OF WELL (as per Well Permit Categories) MONITORING Date well completed [illegible]
Regulatory Program Requiring Well CERCLA Case I.D. # NJ 321[illegible]
CONSULTING FIRM/FIELD SUPERVISOR (if applicable) [illegible] Tele. # [illegible]

WELL CONSTRUCTION

Total depth drilled 15 ft.
Well finished to 15 ft.
Borehole diameter:
Top [illegible] in.
Bottom 4 in.
Well was finished: ☐ above grade ☒ flush mounted
If finished above grade, casing height (stick up) above land surface — ft.
Was steel protective casing installed? ☐ Yes ☒ No

	Depth to Top (ft.) [From land surface]	Depth to Bottom (ft.) [From land surface]	Diameter (inches)	Type and Material
Inner Casing		5	4	PVC [illegible]
Outer Casing (Not Protective Casing)	—			
Screen (Note slot size)	5	15	4	PVC .020
Tail Piece	—			
Gravel Pack	3	15		Morie #1
Annular Seal/Grout	0	3		Portland Pellets
Method of Grouting	Gravity			

Static water level after drilling 7 ft.
Water level was measured using Tape
Well was developed for 1/4 hours at 24 gpm
Method of development Bailer
Was permanent pumping equipment installed? ☐ Yes ☒ No
Pump capacity N/A gpm
Pump type: N/A
Drilling Method Air Rotary
Drilling Fluid Type of Rig [illegible]
Name of Driller [illegible]
Health and Safety Plan submitted? ☒ Yes ☐ No
Level of Protection used on site (circle one) None D C B A
N.J. License No. [illegible]
Name of Drilling Company SUMMIT WELL DRILLING

GEOLOGIC LOG (Copies of other geologic logs and/or geophysical logs should be attached.)

See attached

I certify that I have drilled the above-referenced well in accordance with all well permit requirements and all applicable State rules and regulations.

Driller's Signature [illegible] Date [illegible]

COPIES: White & Green - DEPE Canary - Driller Pink - Owner Goldenrod - Health Dept.

Summit DRILLING CO., INC.
ENVIRONMENTAL SPECIALISTS

489 Union Avenue
Bridgewater, NJ 08807
Telephone: (908) 722-4266
Toll Free: (800) 242-6648
FAX: (908) 356-1009

2544D Morningside Dr.
West Columbia, SC 29169
Telephone: (803) 739-9853
Toll Free: (800) 242-6648
FAX: (803) 796-9698

WELL LOG

ELL: MW1 DATE DRILLED: 1/24/1994 COORD #: 25.02.386 PERMIT #: 25-44534 COUNTY: Morris
.ITE: Building #314, 11Th Avenue, , Dover, NJ 07806-5000 XSTREET:
WNER: Picatinny Arsenal, Building #1, , Dover, NJ 07806-5000 USE: Monitor

NNER CASING: PVC
IAMETER: 4"
.ENGTH: 5'

OUTER CASING:
DIAMETER:
LENGTH:

SCREEN TYPE: PVC
DIAMETER: 4"
LENGTH: 10'
SLOT SIZE: .020

DRILLING METHOD: Air Rotary
SAMPLING METHOD: N/A
HOLE DIAMETER: 8"
TOTAL DEPTH: 15'

ET WELL: 15'
.RAVEL PK SZ: Morie #1
)RILLER: Carmine DeCorso
:URFACE COMPLETION: M

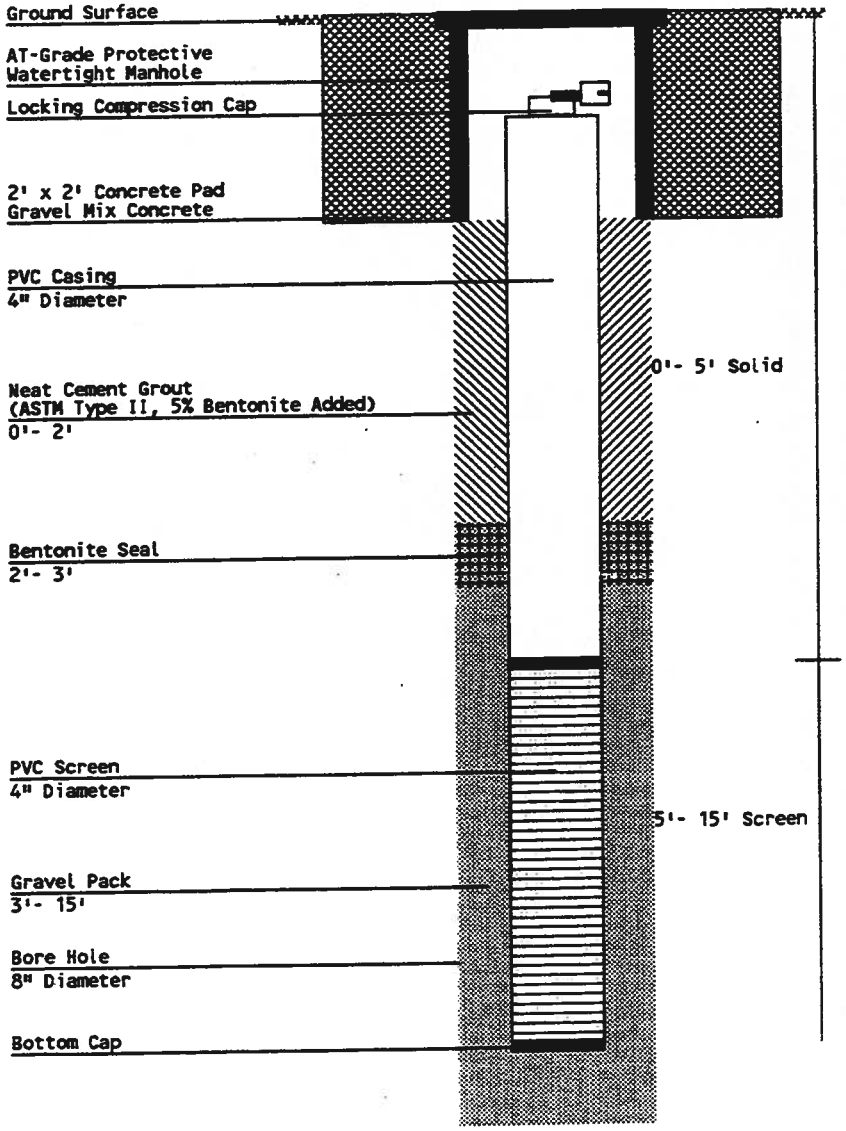
GAL PER MIN: 3-4
STAT H2O LVL: 7'
DEVELOPMENT METHOD: Bail

OPEN HOLE:
CASING SEAL: Portland & Pellets
DEVELOPMENT TIME: 1/2 Hour
GEOLOGIC FORMATION:

DEPTH BELOW SURFACE FROM - TO	BLOWS PER 6" ON SAMPLER
-	

REMARKS / SOILS IDENTIFICATION

ı' - 1'	Asphalt & road stone.
' - 4'	Red-brown clayey silt trace c/f gravel.
;' - 15'	C/f sand & gravel trace clay.



DWR-138 M
12/91

New Jersey Department of Environmental Protection and Energy
Bureau of Water Allocation

MONITORING WELL RECORD

Well Permit No. 25 - [illegible]
Atlas Sheet Coordinates [illegible] : [illegible] : [illegible]

OWNER IDENTIFICATION - Owner PICATINNY ARSENAL ARDEC
Address BUILDING #1
City DOVER State NJ Zip Code

WELL LOCATION - If not the same as owner please give address. Owner's Well No. [illegible]-2
County MORRIS Municipality DOVER TOWN Lot No. N/A Block No. N/A
Address [illegible]

TYPE OF WELL (as per Well Permit Categories) MONITORING Date well completed [illegible]
Regulatory Program Requiring Well CERCLA Case I.D. # NJ 3210020704
CONSULTING FIRM/FIELD SUPERVISOR (if applicable) [illegible] Tele. # [illegible]

WELL CONSTRUCTION

Total depth drilled [illegible] ft.
Well finished to [illegible] ft.
Borehole diameter:
Top [illegible] in.
Bottom 8 in.
Well was finished: ☐ above grade ☑ flush mounted
If finished above grade, casing height (stick up) above land surface — ft.
Was steel protective casing installed? ☐ Yes ☑ No

	Depth to Top (ft.) [From land surface]	Depth to Bottom (ft.) [From land surface]	Diameter (inches)	Type and Material
Inner Casing	0	2	4	PVC [illegible]
Outer Casing (Not Protective Casing)	—			
Screen (Note slot size)	2	12	4	PVC .020
Tail Piece	—			
Gravel Pack	1	12		Morie #1
Annular Seal/Grout	0	1		Bentonite Pellets
Method of Grouting	Gravity			

Static water level after drilling 4 ft.
Water level was measured using Tape
Well was developed for 1½ hours at 3-4 gpm
Method of development Bailer
Was permanent pumping equipment installed? ☐ Yes ☑ No
Pump capacity — gpm
Pump type: N/A
Drilling Method Air Rotary
Drilling Fluid — Type of Rig [illegible]
Name of Driller [illegible]
Health and Safety Plan submitted? ☑ Yes ☐ No
Level of Protection used on site (circle one) None D C B A
N.J. License No. [illegible]
Name of Drilling Company SUMMIT WELL DRILLING

GEOLOGIC LOG (Copies of other geologic logs and/or geophysical logs should be attached.)

See attached

I certify that I have drilled the above-referenced well in accordance with all well permit requirements and all applicable State rules and regulations.

Driller's Signature [illegible] Date [illegible]

COPIES: White & Green - DEPE Canary - Driller Pink - Owner Goldenrod - Health Dept.

Summit DRILLING CO., INC.
ENVIRONMENTAL SPECIALISTS

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2544D Morningside Dr.
West Columbia, SC 29169
Telephone: (803) 739-9853
Toll Free: (800) 242-6648
FAX: (803) 796-9698

WELL LOG

WELL: MW2 DATE DRILLED: 1/24/1994 COORD #: 25.02.386 PERMIT #: 25-44535 COUNTY: Morris
SITE: Building #314, 11Th Avenue, , Dover, NJ 07806-5000 XSTREET:
OWNER: Picatinny Arsenal, Building #1, , Dover, NJ 07806-5000 USE: Monitor

INNER CASING: PVC
DIAMETER: 4"
LENGTH: 2'

OUTER CASING:
DIAMETER:
LENGTH:

SCREEN TYPE: PVC
DIAMETER: 4"
LENGTH: 10'
SLOT SIZE: .020

DRILLING METHOD: Air Rotary
SAMPLING METHOD: N/A
HOLE DIAMETER: 8"
TOTAL DEPTH: 12'

SET WELL: 12'
GRAVEL PK SZ: Morie #1
DRILLER: Carmine DeCorso
SURFACE COMPLETION: M

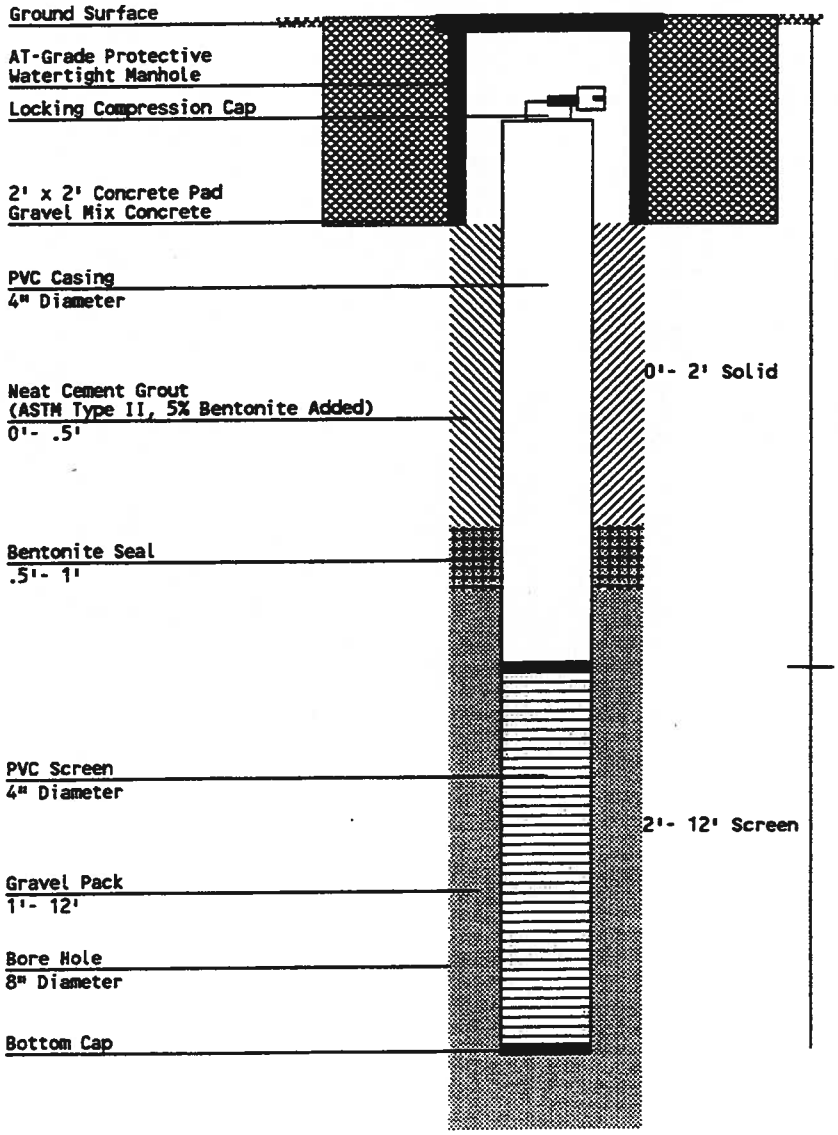
GAL PER MIN: 3-4
STAT H2O LVL: 4'
DEVELOPMENT METHOD: Bail

OPEN HOLE:
CASING SEAL: Portland & Pellets
DEVELOPMENT TIME: 1/2 Hour
GEOLOGIC FORMATION:

DEPTH BELOW SURFACE FROM - TO	BLOWS PER 6" ON SAMPLER
-	

REMARKS / SOILS IDENTIFICATION

0' - 6" Road stone.
6" - 12' Brown c/f sand trace c/f gravel.
High water, could not bring sand over the screen 2'.



DWR-138 M
12/91

New Jersey Department of Environmental Protection and Energy
Bureau of Water Allocation

MONITORING WELL RECORD

Well Permit No. [illegible] - [illegible]
Atlas Sheet Coordinates [illegible] : [illegible] : [illegible]

OWNER IDENTIFICATION - Owner [illegible]
Address BUILDING #1
City [illegible] State NJ Zip Code

WELL LOCATION - If not the same as owner please give address. Owner's Well No. MW-3
County [illegible] Municipality [illegible] Lot No. N/A Block No. N/A
Address [illegible]

TYPE OF WELL (as per Well Permit Categories) MONITORING Date well completed [illegible]
Regulatory Program Requiring Well CERCLA Case I.D. # NJ [illegible]
CONSULTING FIRM/FIELD SUPERVISOR (if applicable) [illegible] Tele. # [illegible]

WELL CONSTRUCTION

Total depth drilled [illegible] ft.
Well finished to [illegible] ft.
Borehole diameter:
Top [illegible] in.
Bottom [illegible] in.
Well was finished: ☐ above grade ☒ flush mounted
If finished above grade, casing height (stick up) above land surface — ft.
Was steel protective casing installed? ☐ Yes ☒ No

	Depth to Top (ft.) [From land surface]	Depth to Bottom (ft.)	Diameter (inches)	Type and Material
Inner Casing	0	2	4	PVC [illegible]
Outer Casing (Not Protective Casing)	—			
Screen (Note slot size)	2	12	4	PVC .020
Tail Piece	—			
Gravel Pack	1	12		Morie 1
Annular Seal/Grout	0	1		Bentonite Pellets
Method of Grouting				

Static water level after drilling 4 ft.
Water level was measured using Tape
Well was developed for 1/2 hours at 3-4 gpm
Method of development Bailer
Was permanent pumping equipment installed? ☐ Yes ☒ No
Pump capacity — gpm
Pump type: N/A
Drilling Method Air Rotary
Drilling Fluid — Type of Rig Air Rotary
Name of Driller [illegible]
Health and Safety Plan submitted? ☒ Yes ☐ No
Level of Protection used on site (circle one) None D C B A
N.J. License No. [illegible]
Name of Drilling Company SUMMIT WELL DRILLING

GEOLOGIC LOG (Copies of other geologic logs and/or geophysical logs should be attached.)

See attached

I certify that I have drilled the above-referenced well in accordance with all well permit requirements and all applicable State rules and regulations.

Driller's Signature [illegible] Date [illegible]

COPIES: White & Green - DEPE Canary - Driller Pink - Owner Goldenrod - Health Dept.

Summit DRILLING CO., INC.
ENVIRONMENTAL SPECIALISTS

489 Union Avenue
Bridgewater, NJ 08807
Telephone: (908) 722-4266
Toll Free: (800) 242-6648
FAX: (908) 356-1009

2544D Morningside Dr.
West Columbia, SC 29169
Telephone: (803) 739-9853
Toll Free: (800) 242-6648
FAX: (803) 796-9698

WELL LOG

WELL: MW3 DATE DRILLED: 1/25/1994 COORD #: 25.02.386 PERMIT #: 25-44536 COUNTY: Morris
SITE: Building #314, 11Th Avenue, , Dover, NJ 07806-5000 XSTREET:
OWNER: Picatinny Arsenal, Building #1, , Dover, NJ 07806-5000 USE: Monitor

INNER CASING: PVC
DIAMETER: 4"
LENGTH: 2'

OUTER CASING:
DIAMETER:
LENGTH:

SCREEN TYPE: PVC
DIAMETER: 4"
LENGTH: 10'
SLOT SIZE: .020

DRILLING METHOD: Air Rotary
SAMPLING METHOD: N/A
HOLE DIAMETER: 8"
TOTAL DEPTH: 12'

SET WELL: 12'
GRAVEL PK SZ: Morie #1
DRILLER: Carmine DeCorso
SURFACE COMPLETION: M

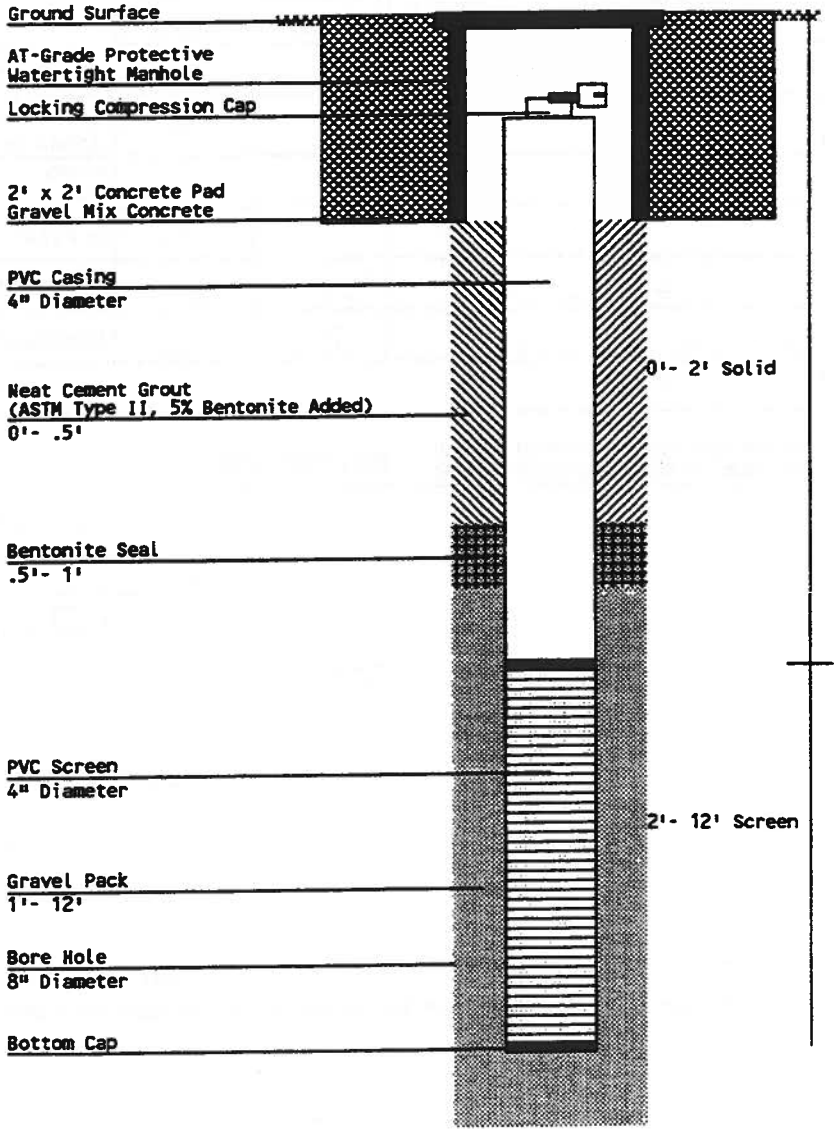
GAL PER MIN: 3-4
STAT H2O LVL: 4'
DEVELOPMENT METHOD: Bail

OPEN HOLE:
CASING SEAL: Portland & Pellets
DEVELOPMENT TIME: 1/2 Hour
GEOLOGIC FORMATION:

DEPTH BELOW SURFACE FROM - TO	BLOWS PER 6" ON SAMPLER

REMARKS / SOILS IDENTIFICATION

0' - 12' Brown clay trace black organic clay trace m/f sand.
High water, could not bring sand over the screen 2'.



DWR-138 M
12/91

New Jersey Department of Environmental Protection and Energy
Bureau of Water Allocation

MONITORING WELL RECORD

Well Permit No. [illegible] - 14037
Atlas Sheet Coordinates [illegible]

OWNER IDENTIFICATION - Owner PICATINNY ARSENAL-ARDC
Address BUILDING #1
City DOVER State NJ Zip Code

WELL LOCATION - If not the same as owner please give address. Owner's Well No. MW-4
County MORRIS Municipality DOVER TOWN Lot No. N/A Block No. N/A
Address

TYPE OF WELL (as per Well Permit Categories) MONITORING Date well completed [illegible]
Regulatory Program Requiring Well CERCLA Case I.D. # NJ [illegible]
CONSULTING FIRM/FIELD SUPERVISOR (if applicable) [illegible] Tele. # [illegible]

WELL CONSTRUCTION

Total depth drilled [illegible] ft.
Well finished to [illegible] ft.
Borehole diameter:
Top Y in.
Bottom Y in.
Well was finished: ☐ above grade ☑ flush mounted
If finished above grade, casing height (stick up) above land surface — ft.
Was steel protective casing installed? ☐ Yes ☑ No

	Depth to Top (ft.) [From land surface]	Depth to Bottom (ft.)	Diameter (inches)	Type and Material
Inner Casing		3.5	4	PVC SCH 4
Outer Casing (Not Protective Casing)	—			
Screen (Note slot size)	3.5	13.5	4	PVC .020
Tail Piece	—			
Gravel Pack	1.5	13.5		Morie #1
Annular Seal/Grout	0	1.5		Bentonite Pellet
Method of Grouting				

Static water level after drilling 4 ft.
Water level was measured using tape
Well was developed for 1/2 hours at 3-4 gpm
Method of development Bailer
Was permanent pumping equipment installed? ☐ Yes ☑ No
Pump capacity — gpm
Pump type: N/A
Drilling Method Air Rotary
Drilling Fluid — Type of Rig [illegible]
Name of Driller [illegible]
Health and Safety Plan submitted? ☑ Yes ☐ No
Level of Protection used on site (circle one) None D C B A
N.J. License No. [illegible]
Name of Drilling Company SUMMIT WELL DRILLING

GEOLOGIC LOG (Copies of other geologic logs and/or geophysical logs should be attached.)

See Attached

I certify that I have drilled the above-referenced well in accordance with all well permit requirements and all applicable State rules and regulations.

Driller's Signature [illegible] Date [illegible]

COPIES: White & Green - DEPE Canary - Driller Pink - Owner Goldenrod - Health Dept.

Summit DRILLING CO., INC.
ENVIRONMENTAL SPECIALISTS

489 Union Avenue
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2544D Morningside Dr.
West Columbia, SC 29169
Telephone: (803) 739-9853
Toll Free: (800) 242-6648
FAX: (803) 796-9698

WELL LOG

WELL: MW4 DATE DRILLED: 1/25/1994 COORD #: 25.02.386 PERMIT #: 25-44537 COUNTY: Morris
SITE: Building #314, 11Th Avenue, , Dover, NJ 07806-5000 XSTREET:
OWNER: Picatinny Arsenal, Building #1, , Dover, NJ 07806-5000 USE: Monitor

INNER CASING: PVC
DIAMETER: 4"
LENGTH: 3.5'

OUTER CASING:
DIAMETER:
LENGTH:

SCREEN TYPE: PVC
DIAMETER: 4"
LENGTH: 10'
SLOT SIZE: .020

DRILLING METHOD: Air Rotary
SAMPLING METHOD: N/A
HOLE DIAMETER: 8"
TOTAL DEPTH: 13.5'

SET WELL: 13.5'
GRAVEL PK SZ: Morie #1
DRILLER: Carmine DeCorso
SURFACE COMPLETION: M

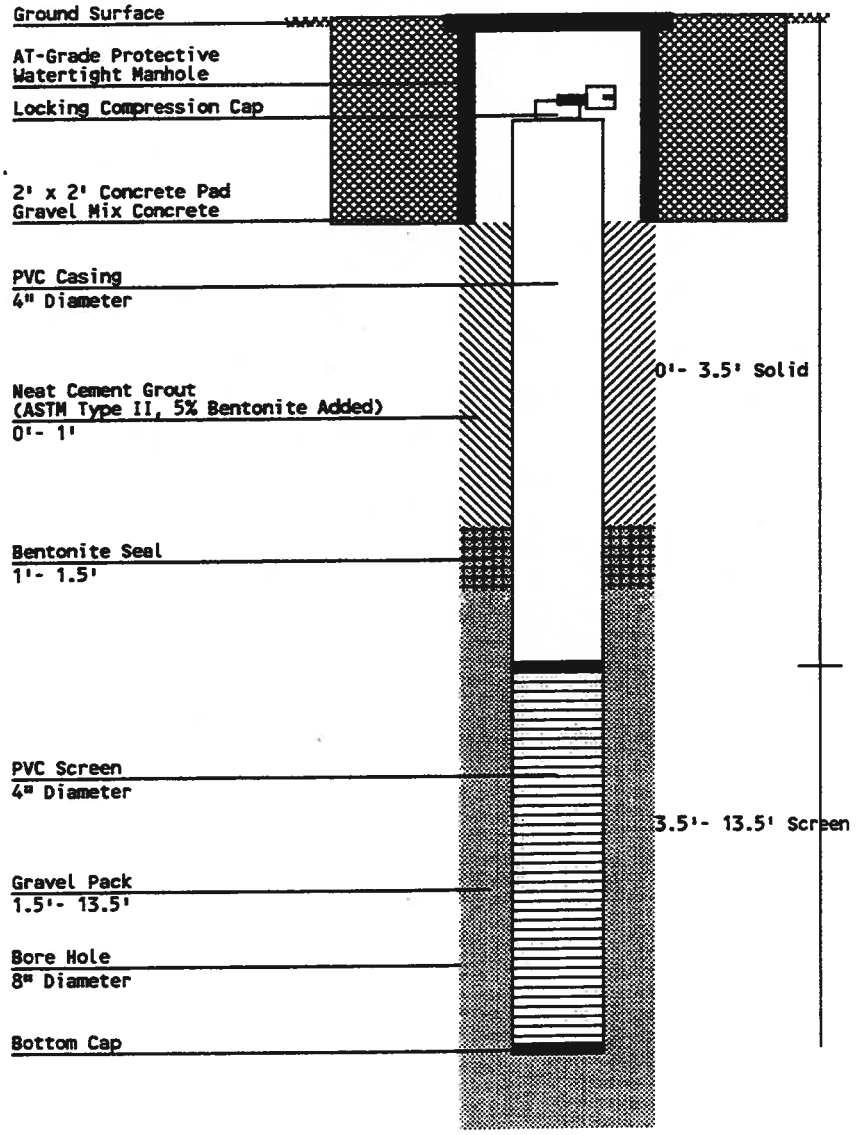
GAL PER MIN: 3-4
STAT H2O LVL: 4'
DEVELOPMENT METHOD: Bail

OPEN HOLE:
CASING SEAL: Portland & Pellets
DEVELOPMENT TIME: 1/2 Hour
GEOLOGIC FORMATION:

DEPTH BELOW SURFACE FROM - TO	BLOWS PER 6" ON SAMPLER

REMARKS / SOILS IDENTIFICATION

0' - 4' Brown & black sand.
4' - 13'6" Brown m/f sand trace clayey silt.



APPENDIX D

FORM B'S

THIS FORM MUST BE COMPLETED BY THE PERMITTEE OR HIS/HER AGENT

GROUND WATER MONITORING WELL CERTIFICATION - FORM B - LOCATION CERTIFICATION

Name of Permittee: _____

Name of Facility: Picatinny Arsenal

Location: Township of Rockaway, Morris County, New Jersey

NJPDES Number: _____

LAND SURVEYOR'S CERTIFICATION

Well Permit Number (As assigned by NJDEP's Bureau of Water Allocation: - -

This number must be permanently affixed to the well casing.

Datum NAD 27

Longitude (one-tenth of a second): West 74°-33'-47.7"

Latitude (one-tenth of a second): North 40°-56'-33.8"

Elevation of Top of Casing (cap off) (one-hundreth of a foot): WC= 696.84 /PVC= 696.58 /GRD= 696.82

Owners Well Number (As shown on application or plans): MW-1

BENCHMARK - Monument G-1-3 Elevation 782.75

MW GEOGRAPHIC POSITION - E 2,028,573.95 N 768,392.18

DATE OF SURVEY - 6/22/94

AUTHENTICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Paul J. Emilius Jr.

PROFESSIONAL LAND SURVEYOR'S SIGNATURE

Paul J. Emilius, Jr.

PROFESSIONAL LAND SURVEYOR'S NAME

(Please print or type)

SEAL

New Jersey P.L.S. License No. 37186

PROFESSIONAL LAND SURVEYOR'S LICENSE #

The Department reserves the right in cases of violation of permit specified ground water limits or Ground Water Quality Standards (N.J.A.C. 7:9-6.1 et seq.) to require that wells be resurveyed to an accuracy of one-hundredth of a second latitude and longitude. This shall not be considered to be a major modification of the N.J.P.D.E.S. permit.

THIS FORM MUST BE COMPLETED BY THE PERMITTEE OR HIS/HER AGENT

GROUND WATER MONITORING WELL CERTIFICATION - FORM B - LOCATION CERTIFICATION

Name of Permittee:
Name of Facility: Picatinny Arsenal
Location: Township of Rockaway, Morris County, New Jersey
NJPDES Number:

LAND SURVEYOR'S CERTIFICATION

Well Permit Number (As assigned by NJDEP's Bureau of Water Allocation: - -
This number must be permanently affixed to the well casing.
Datum NAD 27
Longitude (one-tenth of a second): West 74°-33'-49.2"
Latitude (one-tenth of a second): North 40°-56'-33.6"
Elevation of Top of Casing (cap off) (one-hundreth of a foot): WC= 695.59 /PVC= 696.06 /GRD= 696.52
Owners Well Number (As shown on application or plans): MW-2

BENCHMARK - Monument G-1-3 Elevation 782.75
MW GEOGRAPHIC POSITION - E 2,028,459.67 N 768,370.11
DATE OF SURVEY - 6/22/94

AUTHENTICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Paul J. Emilius Jr.
PROFESSIONAL LAND SURVEYOR'S SIGNATURE

Paul J. Emilius, Jr.
PROFESSIONAL LAND SURVEYOR'S NAME
(Please print or type)

SEAL

New Jersey P.L.S. License No. 37186
PROFESSIONAL LAND SURVEYOR'S LICENSE #

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form-b.doc

THIS FORM MUST BE COMPLETED BY THE PERMITTEE OR HIS/HER AGENT

GROUND WATER MONITORING WELL CERTIFICATION - FORM B - LOCATION CERTIFICATION

Name of Permittee:
Name of Facility: Picatinny Arsenal
Location: Township of Rockaway, Morris County, New Jersey
NJPDES Number:

LAND SURVEYOR'S CERTIFICATION

Well Permit Number (As assigned by NJDEP's Bureau of Water Allocation: - -
This number must be permanently affixed to the well casing.
Datum NAD 27
Longitude (one-tenth of a second): West 74°-33'-48.0"
Latitude (one-tenth of a second): North 40°-56'-37.5"
Elevation of Top of Casing (cap off) (one-hundreth of a foot): WC= 697.89 /PVC= 697.51 /GRD= 697.53
Owners Well Number (As shown on application or plans): MW-3

BENCHMARK - Monument G-1-3 Elevation 782.75
MW GEOGRAPHIC POSITION - E 2,028,544.38 N 768,761.67
DATE OF SURVEY - 6/22/94

AUTHENTICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Paul J. Emilius Jr.
PROFESSIONAL LAND SURVEYOR'S SIGNATURE

Paul J. Emilius, Jr.
PROFESSIONAL LAND SURVEYOR'S NAME
(Please print or type)

SEAL

New Jersey P.L.S. License No. 37186
PROFESSIONAL LAND SURVEYOR'S LICENSE #

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THIS FORM MUST BE COMPLETED BY THE PERMITTEE OR HIS/HER AGENT

GROUND WATER MONITORING WELL CERTIFICATION - FORM B - LOCATION CERTIFICATION

Name of Permittee:
Name of Facility: Picatinny Arsenal
Location: Township of Rockaway, Morris County, New Jersey
NJPDES Number:

LAND SURVEYOR'S CERTIFICATION

Well Permit Number (As assigned by NJDEP's Bureau of Water Allocation: - -
This number must be permanently affixed to the well casing.
Datum NAD 27
Longitude (one-tenth of a second): West 74°-33'-49.7"
Latitude (one-tenth of a second): North 40°-56'-36.1"
Elevation of Top of Casing (cap off) (one-hundreth of a foot): WC= 695.74 /PVC= 695.45 /GRD= 695.27
Owners Well Number (As shown on application or plans): MW-4

BENCHMARK - Monument G-1-3 Elevation 782.75
MW GEOGRAPHIC POSITION - E 2,028,416.43 N 768,621.56
DATE OF SURVEY - 6/22/94

AUTHENTICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Paul J. Emilius Jr.
PROFESSIONAL LAND SURVEYOR'S SIGNATURE

Paul J. Emilius, Jr.
PROFESSIONAL LAND SURVEYOR'S NAME
(Please print or type)

SEAL

New Jersey P.L.S. License No. 37186
PROFESSIONAL LAND SURVEYOR'S LICENSE #

The Department reserves the right in cases of violation of permit specified ground water limits or Ground Water Quality Standards (N.J.A.C. 7:9-6.1 et seq.) to require that wells be resurveyed to an accuracy of one-hundredth of a second latitude and longitude. This shall not be considered to be a major modification of the N.J.P.D.E.S. permit.

form-b.doc

APPENDIX E

MONITORING WELL SAMPLING DATA FORMS

WESTON

MONITORING WELL SAMPLING DATA FORM

Well No.: MW-2 Date: 2/16/94 Time: 1015

Boring Diameter: 6" Well Casing Diameter: 4"

Annular Space Length: _____ Stickup: _____

COLUMN OF WATER IN WELL

Casing Length (feet): 12
DTW Top of Casing (feet): 4.29
Column of Water in Well (feet): 7.71

VOLUME TO BE REMOVED

Gallons per foot of casing: .6528
Column of water length (feet): 7.71
Volume of casing (gallons): 5.03
Number of volumes to be evacuated: 3
Total volume to be evacuated (gallons): 15

Method of Purging (pump, bailer, etc.): bailer

FIELD ANALYSIS

	Start	Mid	End
Time	1045	1055	1105
pH	7.2	7.1	7.3
Conductivity (mmHOS)	941	850	790
Temperature (celsius)	13	13	13

Total Volume Purged: 15 gallons

Sample Time: _____ Sample No.: _____

Parameters: _____

Comments: _____

Signed/Sampler: Dave Bu[illegible] Date: 2/16/94

Signed/Reviewer: _____ Date: _____

WESTON

MONITORING WELL SAMPLING DATA FORM

Well No.: MW-1 Date: 2/16/94 Time: 0900

Boring Diameter: 6" Well Casing Diameter: 4"

Annular Space Length: _____ Stickup: _____

COLUMN OF WATER IN WELL

Casing Length (feet): 15'
DTW Top of Casing (feet): 8.36
Column of Water in Well (feet): 6.64

VOLUME TO BE REMOVED

Gallons per foot of casing: .6528
Column of water length (feet): 6.64
Volume of casing (gallons): 4.33
Number of volumes to be evacuated: 3
Total volume to be evacuated (gallons): 15

Method of Purging (pump, bailer, etc.): bailer

FIELD ANALYSIS

	Start	Mid	End
Time	0935	0945	0955
pH	7.2	7.1	7.1
Conductivity (mmHOS)	341	324	330
Temperature (celsius)	12	13	13

Total Volume Purged: 15 gallons

Sample Time: _____ Sample No.: _____

Parameters: _____

Comments: _____

Signed/Sampler: Daniel Benfer Date: 2/16/94

Signed/Reviewer: _____ Date: _____

r:/HUBBARD/MONTWELL.FOR

WESTON

MONITORING WELL SAMPLING DATA FORM

Well No.: MW-3 Date: 2/16/94 Time: 1235

Boring Diameter: 6" Well Casing Diameter: 4"

Annular Space Length: Stickup:

COLUMN OF WATER IN WELL

Casing Length (feet): 12
DTW Top of Casing (feet): 3.21
Column of Water in Well (feet): 8.79

VOLUME TO BE REMOVED

Gallons per foot of casing: .6528
Column of water length (feet): 8.79
Volume of casing (gallons): 5.73
Number of volumes to be evacuated: 3
Total volume to be evacuated (gallons): 18

Method of Purging (pump, bailer, etc.): bailer

FIELD ANALYSIS

	Start	Mid	End
Time	1300	1310	1320
pH	6.8	6.9	6.9
Conductivity (nmHOS)	232	241	251
Temperature (celsius)	14	14	14

Total Volume Purged: 18 gallons

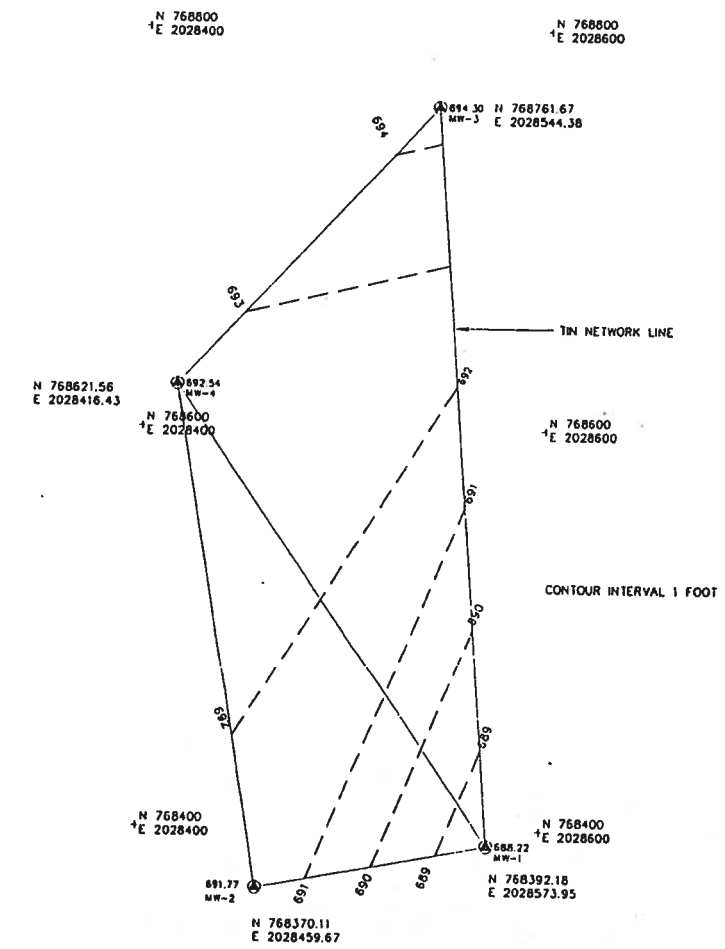
Sample Time: Sample No.:

Parameters:

Comments:

Signed/Sampler: [signature] Date: 2/16/94

Signed/Reviewer: Date:



GRAPHIC SCALE

(IN FEET)
1 inch = 40 ft.

REVISIONS

GEOD
Photogrammetric Sciences
Survey Technologies
16-24 Kanouse Road, Newfoundland, New Jersey 07435

UNDERGROUND CONTOURS
FOR
MONITORING WELLS MW-1 THRU MW-4
PICATINNY ARSENAL
ROCKAWAY TOWNSHIP, MORRIS COUNTY, NEW JERSEY

PAUL J. EMILIUS JR L.S.
N.J.P.L.S. Lic. No. 11363

DRAWN BY:	CHECKED BY:	SCALE:	DATE:	PROJ. NO.:
GEJ	R.J.S.	1"=40'	8-22-94	94-936

WESTON

MONITORING WELL SAMPLING DATA FORM

Well No.: MW-4 Date: 2/16/94 Time: 1430

Boring Diameter: 6" Well Casing Diameter: 4"

Annular Space Length: _____ Stickup: _____

COLUMN OF WATER IN WELL

Casing Length (feet): 13.5
DTW Top of Casing (feet): 2.91
Column of Water in Well (feet): 10.59

VOLUME TO BE REMOVED

Gallons per foot of casing: .6528
Column of water length (feet): 10.59
Volume of casing (gallons): 6.91
Number of volumes to be evacuated: 3
Total volume to be evacuated (gallons): 20

Method of Purging (pump, bailer, etc.): bailer

FIELD ANALYSIS

	Start	Mid	End
Time	1500	1515	1530
pH	6.9	6.8	6.7
Conductivity (mmHOS)	651	595	630
Temperature (celsius)	14	14	14

Total Volume Purged: 20 gallons

Sample Time: _____ Sample No.: _____

Parameters: _____

Comments: _____

Signed/Sampler: [signature] Date: 2/16/94

Signed/Reviewer: _____ Date: _____

APPENDIX D – Table of MMRP Soil Sample Analytical Results

Picatinny Arsenal MMRP Remedial Investigation

Sample ID	PTA Specific Background (mg/kg)	Level of Concern (LOC)	300MA-0001		300MA-0001RC		300MA-0002		300MA-0002RC		300MA-0003		300MA-0004		300MA-0005		300MA-0006		300MA-0007		300MA-0008		300MA-0009		300MA-0010		300MA-0010D		300MA-0011	
Lab Sample ID			280-28294-1		280-28486-1		280-28294-1		280-28486-2		280-28486-3		280-28486-4		280-28486-5		280-28486-6		280-28486-7		280-28486-8		280-28486-9		280-28486-10		280-31658-1		280-28486-11	
Sample Type			Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q
Sample Date			4/28/2012		5/2/2012		4/28/2012		5/2/2012		5/2/2012		5/2/2012		5/2/2012		5/2/2012		5/2/2012		5/2/2012		5/2/2012		5/2/2012		7/30/2012		5/2/2012	
Comments																														
Metals (mg/kg)																														
Aluminum	12800	NA	4200		NC		22000		NC		11000		13000		12000		7900		11000		8400		9600		14000		NC		13000	
Antimony	0.35	14	120		NC		4.2	U	NC		1.3	J	1.1	J	1.1	J	2.7	U	1.6	U	1.7	U	2.0	U	1.8	U	NC		2.3	U
Arsenic	16	20	46		NC		16	J	NC		19		25		21		8.8		20		28		26		22		5.3		28	
Barium	161	700	140		NC		890		NC		230		150		200		78		140		160		110		170		NC		220	
Beryllium	1.6	2	0.66	J	NC		2.6	J	NC		1.6		1.6		1.7		0.96	J	1.4		1.3	J	1.2	J	1.6		NC		1.9	
Cadmium	1.7	39	22		NC		1.9	J	NC		3.5		2.3		3		2.1	J	2.6		2		2.1		2.1		NC		3.7	
Calcium	5990	NA	5900		NC		61000		NC		12000		5700		8500		7800		7300		12000		6700		8600		NC		9700	
Chromium	23.8	NA	44		NC		27		NC		24		33		27		15	J	18		17		51		66		NC		36	
Cobalt	10.2	NA	12		NC		5.7	J	NC		14		16		21		4.9		10		8.2		4.9		15		NC		20	
Copper	27.2	600	36000		NC		48		NC		210		220		240		97		120		73		150		140		NC		240	
Iron	67600	NA	180000		NC		41000		NC		32000		37000		39000		12000		25000		18000		21000		33000		NC		37000	
Lead	38.8	400	3400		NC		150		NC		230		410		310		100		160		170		370		290		NC		400	
Magnesium	4260	NA	940		NC		17000		NC		2300		1900		2300		1700		1400		1300		1200		2100		NC		2300	
Manganese	832	NA	1300		NC		7700		NC		2600		1900		3500		230		1200		1500		280		1600		NC		3200	
Nickel	17.2	250	49		NC		13	J	NC		27		22		27		27		16		17		16		24		NC		30	
Potassium	821	NA	230	J	NC		1900	J	NC		560	J	510	J	620	J	600	J	480	J	740	J	560	J	630	J	NC		600	J
Selenium	0.96	63	8.8		NC		8.4	U	NC		4.1	J	5.6	J	4.6	J	5.4	U	4.8	J	5.1	J	7.1	J	3.6	J	NC		4.6	J
Silver	0.8	110	5.7		NC		1.4	U	NC		4.7		4.9		6		2.7	J	1.8	J	1.4	J	3.8	J	6.5		NC		6.2	
Sodium	638	NA	150	J	NC		780	J	NC		210	J	280	U	210	J	630	J	200	J	280	U	330	U	220	J	NC		290	J
Strontium	16	NA	30		NC		270		NC		58		28		43		32		33		43		32		41		NC		47	
Thallium	0.84	2	2.8	U	NC		8.4	U	NC		3.4	U	3.4	U	3.5	U	5.4	U	3.1	U	3.3	U	3.9	U	3.6	U	NC		4.7	U
Vanadium	72.4	370	30		NC		44		NC		42		49		48		26		47		49		49		53		NC		48	
Zinc	171	1500	9900		NC		550		NC		320		210		270		120		170		160		110		220		NC		320	
Mercury	0.25	14	7.1	J	NC		0.24		NC		3.3		6.6		5		1.1		1.3		1		2.9		3.3		NC		8.1	
PCBs (ug/kg)																														
Aroclor 1016	NA	490	R		25	U	R		12	U	29	UJ	28	U	30	U	49	U	29	U	29	U	36	U	34	U	NC		39	U
Aroclor 1221	NA	490	R		51	U	R		25	U	58	UJ	56	U	60	U	98	U	57	U	58	U	73	U	69	U	NC		78	U
Aroclor 1232	NA	490	R		25	U	R		12	U	29	UJ	28	U	30	U	49	U	29	U	29	U	36	U	34	U	NC		39	U
Aroclor 1242	NA	490	R		25	U	R		12	U	29	UJ	28	U	30	U	49	U	29	U	29	U	36	U	34	U	NC		39	U
Aroclor 1248	NA	490	R		25	U	R		12	U	29	UJ	28	U	30	U	49	U	29	U	29	U	36	U	34	U	NC		39	U
Aroclor 1254	NA	490	R		25	U	R		12	U	29	UJ	28	U	30	U	49	U	29	U	29	U	36	U	34	U	NC		39	U
Aroclor 1260	NA	490	R		25	U	R		23	J	29	UJ	170	J	160	J	49	U	60	J	110		80	J	34	U	NC		39	U
Aroclor 1262	NA	490	R		59	J	R		25	U	51	J	56	U	60	U	98	U	57	U	58	U	73	U	53	J	NC		57	J
Aroclor 1268	NA	490	R		25	U	R		12	U	29	UJ	28	U	30	U	49	U	29	U	29	U	36	U	34	U	NC		39	U
SVOCs (ug/kg)																														
1,2,4-Trichlorobenzene	NA	NA	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
1,2-Dichlorobenzene	NA	NA	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
1,2-Diphenylhydrazine	NA	NA	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
1,3-Dichlorobenzene	NA	NA	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
1,4-Dichlorobenzene	NA	NA	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
2,4,5-Trichlorophenol	NA	NA	R		1400	U	R		180	U	36000	UJ	35000	UJ	38000	UJ	2500	U	1500	U	1500	U	47000	UJ	4400	U	NC		5100	U
2,4,6-Trichlorophenol	NA	NA	R		700	U	R		90	U	18000	UJ	18000	UJ	20000	UJ	1300	U	770	U	750	U	24000	UJ	2200	U	NC		2600	U
2,4-Dichlorophenol	NA	NA	R		700	U	R		90	U	18000	UJ	18000	UJ	20000	UJ	1300	U	770	U	750	U	24000	UJ	2200	U	NC		2600	U
2,4-Dimethylphenol	NA	NA	R		1400	U	R		180	U	36000	UJ	35000	UJ	38000	UJ	2500	U	1500	U	1500	U	47000	UJ	4400	U	NC		5100	U
2,4-Dinitrophenol	NA	NA	R		7100	U	R		910	U	180000	UJ	180000	UJ	200000	UJ	13000	U	7800	U	7600	U	240000	UJ	23000	U	NC		26000	U
2,4-Dinitrotoluene	NA	NA	R		1400	U	R		180	U	36000	UJ	635000	UJ	38000	UJ	2500	U	1500	U	1500	U	47000	UJ	4400	U	NC		5100	U
2,6-Dinitrotoluene	NA	NA	R		700	U	R		90	U	18000	UJ	18000	UJ	20000	UJ	1300	U	770	U	750	U	24000	UJ	2200	U	NC		2600	U
2-Chloronaphthalene	NA	NA	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
2-Chlorophenol	NA	NA	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
2-Methylnaphthalene	NA	NA	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
2-Methylphenol	NA	NA	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
2-Nitroaniline	NA	NA	R		700	U	R		90	U	18000	UJ	18000	UJ	20000	UJ	1300	U	770	U	750	U	24000	UJ	2200	U	NC		2600	U
2-Nitrophenol	NA	NA	R		700	U	R		90	U	18000	UJ	18000	UJ	20000	UJ	1300	U	770	U	750	U	24000	UJ	2200	U	NC		2600	U

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Picatinny Arsenal MMRP Remedial Investigation

Sample ID	PTA Specific Background (mg/kg)	Level of Concern (LOC)	300MA-0001		300MA-0001RC		300MA-0002		300MA-0002RC		300MA-0003		300MA-0004		300MA-0005		300MA-0006		300MA-0007		300MA-0008		300MA-0009		300MA-0010		300MA-0010D		300MA-0011	
Lab Sample ID			280-28294-1		280-28486-1		280-28294-1		280-28486-2		280-28486-3		280-28486-4		280-28486-5		280-28486-6		280-28486-7		280-28486-8		280-28486-9		280-28486-10		280-31658-1		280-28486-11	
Sample Type			Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q
Sample Date			4/28/2012		5/2/2012		4/28/2012		5/2/2012		5/2/2012		5/2/2012		5/2/2012		5/2/2012		5/2/2012		5/2/2012		5/2/2012		5/2/2012		7/30/2012		5/2/2012	
Comments																														
3-Methylphenol, 4-Methylphenol	NA	NA	R		700	U	R		90	U	18000	UJ	18000	UJ	20000	UJ	1300	U	770	U	750	U	24000	UJ	2200	U	NC		2600	U
3,3'-Dichlorobenzidine	NA	2000	R		3500	U	R		450	U	91000	UJ	89000	UJ	98000	UJ	6400	U	3800	U	3700	U	120000	UJ	11000	U	NC		13000	U
3-Nitroaniline	NA	NA	R		1400	U	R		180	U	37000	UJ	36000	UJ	39000	UJ	2600	U	1500	U	1500	U	48000	UJ	4500	U	NC		5200	U
4,6-dinitro-2-Methylphenol	NA	NA	R		7000	U	R		900	U	180000	UJ	180000	UJ	200000	UJ	13000	U	7700	U	7500	U	240000	UJ	22000	U	NC		26000	U
4-Bromophenyl phenyl ether	NA	NA	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
4-Chloro-3-methylphenol	NA	100000	R		1400	U	R		180	U	36000	UJ	35000	UJ	38000	UJ	2500	U	1500	U	1500	U	47000	UJ	4400	U	NC		5100	U
4-Chloroaniline	NA	230000	R		1400	U	R		180	U	36000	UJ	35000	UJ	38000	UJ	2500	U	1500	U	1500	U	47000	UJ	4400	U	NC		5100	U
4-Chlorophenyl phenyl ether	NA	NA	R		700	U	R		90	U	18000	UJ	18000	UJ	20000	UJ	1300	U	770	U	750	U	24000	UJ	2200	U	NC		2600	U
4-Nitroaniline	NA	NA	R		1400	U	R		180	U	36000	UJ	35000	UJ	38000	UJ	2500	U	1500	U	1500	U	47000	UJ	4400	U	NC		5100	U
4-Nitrophenol	NA	NA	R		3500	U	R		450	U	91000	UJ	89000	UJ	98000	UJ	6400	U	3800	U	3700	U	120000	UJ	11000	U	NC		13000	U
Acenaphthene	NA	100000	R		180	U	R		23	U	4700	UJ	4600	UJ	5000	UJ	330	U	200	U	190	U	6100	UJ	570	U	NC		670	U
Acenaphthylene	NA	NA	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
Anthracene	NA	100000	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
Benz(a)anthracene	NA	900	R		260	J	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	270	J	12000	UJ	1100	U	NC		860	J
Benzo(a)pyrene	NA	660	R		250	J	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
Benzo(b)fluoranthene	NA	900	R		480	J	R		52	J	9100	UJ	11000	J	9800	UJ	640	U	380	U	420	J	12000	UJ	1100	U	NC		1500	J
Benzo(g,h,i)perylene	NA	NA	R		190	J	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
Benzo(k)fluoranthene	NA	900	R		700	U	R		90	U	18000	UJ	18000	UJ	20000	UJ	1300	U	770	U	750	U	2400	UJ	2200	U	NC		2600	U
Benzoic Acid	NA	NA	R		7000	U	R		900	U	180000	UJ	180000	UJ	200000	UJ	13000	U	7700	U	7500	U	240000	UJ	22000	U	NC		26000	U
Benzyl alcohol	NA	NA	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
Bis(Chloroisopropyl)Ether	NA	10000	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
bis(2-Chloroethoxy)methane	NA	NA	R		700	U	R		90	U	18000	UJ	18000	UJ	20000	UJ	1300	U	770	U	750	U	24000	UJ	2200	U	NC		2600	U
bis(2-Chloroethyl)ether	NA	660	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
bis(2-Ethylhexyl)phthalate	NA	49000	R		700	U	R		90	U	18000	UJ	18000	UJ	20000	UJ	1300	U	770	U	750	U	24000	UJ	2200	U	NC		2600	U
Butylbenzyl phthalate	NA	100000	R		700	U	R		90	U	18000	UJ	18000	UJ	20000	UJ	1300	U	770	U	750	U	24000	UJ	2200	U	NC		2600	U
Carbazole	NA	NA	R		710	U	R		91	U	18000	UJ	18000	UJ	20000	UJ	1300	U	780	U	760	U	24000	UJ	2300	U	NC		2600	U
Chrysene	NA	9000	R		320	J	R		39	J	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1100	J
Dibenz(a,h)anthracene	NA	660	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
Dibenzofuran	NA	NA	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
Diethylphthalate	NA	50000	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
Dimethylphthalate	NA	50000	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
di-n-Butylphthalate	NA	100000	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	J
di-n-Octylphthalate	NA	100000	R		700	U	R		90	U	18000	UJ	18000	UJ	20000	UJ	1300	U	770	U	750	U	24000	UJ	2200	U	NC		2600	U
Fluoranthene	NA	100000	R		500	J	R		90	U	18000	UJ	18000	UJ	20000	UJ	1300	U	770	U	510	J	24000	UJ	2200	U	NC		1600	J
Fluorene	NA	100000	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
Hexachlorobenzene	NA	660	R		700	U	R		90	U	18000	UJ	18000	UJ	20000	UJ	1300	U	770	U	750	U	24000	UJ	2200	U	NC		2600	U
Hexachlorobutadiene	NA	1000	R		700	U	R		90	U	18000	UJ	18000	UJ	20000	UJ	1300	U	770	U	750	U	24000	UJ	2200	U	NC		2600	U
Hexachloroethane	NA	6000	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
Indeno(1,2,3-c,d)pyrene	NA	900	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
Isophorone	NA	50000	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
Naphthalene	NA	100000	R		700	U	R		90	U	18000	UJ	18000	UJ	20000	UJ	1300	U	770	U	750	U	24000	UJ	2200	U	NC		2600	U
Nitrobenzene	NA	10000	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
N-Nitrosodimethylamine	NA	100000	R		700	U	R		90	U	1800	UJ	18000	UJ	20000	UJ	1300	U	770	U	750	U	24000	UJ	2200	U	NC		2600	U
n-Nitroso-di-n-propylamine	NA	660	R		700	U	R		90	U	1800	UJ	18000	UJ	20000	UJ	1300	U	770	U	750	U	24000	UJ	2200	U	NC		2600	U
n-Nitrosodiphenylamine	NA	NA	R		350	U	R		45	U	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	370	U	12000	UJ	1100	U	NC		1300	U
Pentachlorophenol	NA	6000	R		7100	U	R		910	U	18000	UJ	180000	UJ	200000	UJ	13000	U	7800	U	7600	U	240000	UJ	23000	U	NC		26000	U
Phenanthrene	NA	NA	R		220	J	R		30	J	9100	UJ	8900	UJ	9800	UJ	640	U	380	U	250	J	12000	UJ	1100	U	NC		790	J
Phenol	NA	50000	R		1900	J	R		45	U	9100	UJ	8900	UJ	9800	UJ	560	J	380	U	370	U	12000	UJ	1100	U	NC		1300	U
Pyrene	NA	100000	R		440	J	R		45	J	9100	UJ	5700	J	9800	UJ	400	J	260	J	460	J	12000	UJ	700	J	NC		1400	J
Explosives (mg/kg)																														
2,4,6-Trinitrotoluene	NA	NA	R		0.039	U	R		0.038	U	0.039	U	0.11	J	0.039	U	0.039	U	0.040	U	0.040	U	0.040	U	0.039	U	NC		0.040	U
2,4-Dinitrotoluene	NA	NA	R		0.034	J	R		0.038	U	0.046	J	0.38	J	0.47		0.039	U	0.040	U	0.040	U	0.045	J	0.043	J	NC		0.12	
2,6-Dinitrotoluene	NA	NA	R		0.039	U	R		0.038	U	0.039	U	0.040	U	0.039	U	0.039	U	0.040	U	0.040	U	0.040	U	0.039	U	NC		0.040	U
2-amino-4,6-Dinitrotoluene	NA	NA	R		0.039	U	R		0.038	U	0.039	U	0.040	U	0.039	U	0.039	U	0.040	U	0.040	U	0.040	U	0.039	U	NC		0.040	U

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Picatinny Arsenal MMRP Remedial Investigation

Sample ID	PTA Specific Background (mg/kg)	Level of Concern (LOC)	300MA-0001		300MA-0001RC		300MA-0002		300MA-0002RC		300MA-0003		300MA-0004		300MA-0005		300MA-0006		300MA-0007		300MA-0008		300MA-0009		300MA-0010		300MA-0010D		300MA-0011	
Lab Sample ID			280-28294-1		280-28486-1		280-28294-1		280-28486-2		280-28486-3		280-28486-4		280-28486-5		280-28486-6		280-28486-7		280-28486-8		280-28486-9		280-28486-10		280-31658-1		280-28486-11	
Sample Type			Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q
Sample Date			4/28/2012		5/2/2012		4/28/2012		5/2/2012		5/2/2012		5/2/2012		5/2/2012		5/2/2012		5/2/2012		5/2/2012		5/2/2012		5/2/2012		7/30/2012		5/2/2012	
Comments																														
4-amino-2,6-Dinitrotoluene	NA	NA	R		0.039	U	R		0.038	U	0.039	U	0.040	U	0.039	U	0.039	U	0.040	U	0.040	U	0.040	U	0.039	U	NC		0.040	U
HMX	NA	NA	R		0.039	U	R		0.038	U	0.039	U	0.040	U	0.039	U	0.039	U	0.040	U	0.040	U	0.040	U	0.039	U	NC		0.040	U
Nitroglycerin	NA	NA	R		0.39	U	R		0.38	U	0.39	U	0.40	U	0.39	U	0.39	U	0.40	U	0.40	U	0.40	U	0.39	U	NC		0.40	U
PETN	NA	NA	R		0.99	U	R		0.96	U	0.98	U	0.99	U	0.39	U	0.97	U	0.99	U	0.99	U	0.5	J	0.98	U	NC		0.99	U
Picric Acid	NA	NA	R		0.039	U	R		0.038	U	0.039	U	0.040	U	0.039	U	0.039	U	0.040	U	0.040	U	0.040	U	0.039	U	NC		0.040	U
RDX	NA	NA	R		0.045	J	R		0.077	U	0.079	U	0.079	U	0.078	U	0.078	U	0.079	U	0.057	J	0.079	U	0.079	U	NC		0.079	U
Tetryl	NA	NA	R		0.079	U	R		0.077	U	0.079	U	0.079	U	0.078	U	0.078	U	0.079	U	0.079	U	0.079	U	0.079	U	NC		0.079	U

Notes:
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(2) The level of concern was obtained from the *2007 Facility-Wide Quality Assurance Plan*, developed for the Installation Restoration Program.
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Picatinny Arsenal MMRP Remedial Investigation

Sample ID	300MA-0012		300MA-0013		300MA-0013D		300MA-0014		300MA-0014D		300MA-0015		300MA-0016		300MA-0016D		300MA-0017		300MA-0017D		300MA-0020D	
Lab Sample ID	280-28486-12		280-28486-13		280-48294-1		280-28486-14		280-48294-2		280-28486-15		280-31658-3		280-31658-4		280-31658-5		280-31658-6		280-31658-2	
Sample Type	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q
Sample Date	5/2/2012		5/2/2012		10/22/2013		5/2/2012		10/22/2013		5/2/2012		7/30/2012		7/30/2012		7/30/2012		7/30/2012		7/30/2012	
Comments																						
Metals (mg/kg)																						
Aluminum	14000		12000		NC		11000		NC		14000		NC		NC		NC		NC		NC	
Antimony	1.7	U	1.7	U	NC		1.5	J	NC		1.5	U	NC		NC		NC		NC		NC	
Arsenic	31		38		14		37		5.4		18		18		6.5		7		4		5.6	
Barium	140		170		NC		130		NC		110		NC		NC		NC		NC		NC	
Beryllium	1.6		1.5		NC		1.5	J	NC		1.1	J	NC		NC		NC		NC		NC	
Cadmium	1.7		1.7		NC		2.6		NC		0.92	J	NC		NC		NC		NC		NC	
Calcium	5900		5200		NC		10000		NC		2500		NC		NC		NC		NC		NC	
Chromium	27		27		NC		32		NC		28		NC		NC		NC		NC		NC	
Cobalt	13		16		NC		14		NC		4.3		NC		NC		NC		NC		NC	
Copper	89		71		NC		77		NC		62		NC		NC		NC		NC		NC	
Iron	43000		52000		NC		34000		NC		20000		NC		NC		NC		NC		NC	
Lead	220		170		NC		180		NC		150		NC		NC		NC		NC		NC	
Magnesium	1800		1100		NC		2000		NC		940		NC		NC		NC		NC		NC	
Manganese	860		2500		NC		2200		NC		330		NC		NC		NC		NC		NC	
Nickel	21		28		NC		24		NC		13		NC		NC		NC		NC		NC	
Potassium	850	J	500	J	NC		570	J	NC		540	J	NC		NC		NC		NC		NC	
Selenium	6.5	J	11		NC		12		NC		5.4	J	NC		NC		NC		NC		NC	
Silver	1.9	J	1.2	J	NC		2.8	J	NC		1.5	J	NC		NC		NC		NC		NC	
Sodium	190	J	290	U	NC		280	J	NC		250	U	NC		NC		NC		NC		NC	
Strontium	24		25		NC		43		NC		15		NC		NC		NC		NC		NC	
Thallium	3.5	U	3.5	U	NC		3.8	U	NC		3.0	U	NC		NC		NC		NC		NC	
Vanadium	67		61		NC		76		NC		43		NC		NC		NC		NC		NC	
Zinc	120		140		NC		150		NC		61		NC		NC		NC		NC		NC	
Mercury	2.2		1.2		NC		1.3		NC		1.2		NC		NC		NC		NC		NC	
PCBs (ug/kg)																						
Aroclor 1016	33	U	28	U	NC		31	U	NC		27	U	NC		NC		NC		NC		NC	
Aroclor 1221	66	U	57	U	NC		63	U	NC		53	U	NC		NC		NC		NC		NC	
Aroclor 1232	33	U	28	U	NC		31	U	NC		27	U	NC		NC		NC		NC		NC	
Aroclor 1242	33	U	28	U	NC		31	U	NC		27	U	NC		NC		NC		NC		NC	
Aroclor 1248	33	U	28	U	NC		31	U	NC		27	U	NC		NC		NC		NC		NC	
Aroclor 1254	33	U	28	U	NC		31	U	NC		27	U	NC		NC		NC		NC		NC	
Aroclor 1260	33	U	28	U	NC		31	U	NC		37	J	NC		NC		NC		NC		NC	
Aroclor 1262	66	U	57	U	NC		63	U	NC		53	U	NC		NC		NC		NC		NC	
Aroclor 1268	33	U	28	U	NC		31	U	NC		27	U	NC		NC		NC		NC		NC	
SVOCs (ug/kg)																						
1,2,4-Trichlorobenzene	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
1,2-Dichlorobenzene	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
1,2-Diphenylhydrazine	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
1,3-Dichlorobenzene	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
1,4-Dichlorobenzene	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
2,4,5-Trichlorophenol	1700	U	1500	U	NC		1600	U	NC		1300	U	NC		NC		NC		NC		NC	
2,4,6-Trichlorophenol	870	U	770	U	NC		810	U	NC		650	U	NC		NC		NC		NC		NC	
2,4-Dichlorophenol	870	U	770	U	NC		810	U	NC		650	U	NC		NC		NC		NC		NC	
2,4-Dimethylphenol	1700	U	1500	U	NC		1600	U	NC		1300	U	NC		NC		NC		NC		NC	
2,4-Dinitrophenol	8800	U	8900	U	NC		8200	U	NC		6600	U	NC		NC		NC		NC		NC	
2,4-Dinitrotoluene	1700	U	1500	U	NC		1600	U	NC		1300	U	NC		NC		NC		NC		NC	
2,6-Dinitrotoluene	870	U	770	U	NC		810	U	NC		650	U	NC		NC		NC		NC		NC	
2-Chloronaphthalene	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
2-Chlorophenol	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
2-Methylnaphthalene	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
2-Methylphenol	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
2-Nitroaniline	870	U	770	U	NC		810	U	NC		650	U	NC		NC		NC		NC		NC	
2-Nitrophenol	870	U	770	U	NC		810	U	NC		650	U	NC		NC		NC		NC		NC	

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Picatinny Arsenal MMRP Remedial Investigation

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Lab Sample ID	280-28486-12		280-28486-13		280-48294-1		280-28486-14		280-48294-2		280-28486-15		280-31658-3		280-31658-4		280-31658-5		280-31658-6		280-31658-2	
Sample Type	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q
Sample Date	5/2/2012		5/2/2012		10/22/2013		5/2/2012		10/22/2013		5/2/2012		7/30/2012		7/30/2012		7/30/2012		7/30/2012		7/30/2012	
Comments																						
3-Methylphenol, 4-Methylphenol	870	U	770	U	NC		810	U	NC		650	U	NC		NC		NC		NC		NC	
3,3'-Dichlorobenzidine	4300	U	3900	U	NC		4000	U	NC		3200	U	NC		NC		NC		NC		NC	
3-Nitroaniline	1700	U	1600	U	NC		1600	U	NC		1300	U	NC		NC		NC		NC		NC	
4,6-dinitro-2-Methylphenol	8700	U	7700	U	NC		8100	U	NC		6500	U	NC		NC		NC		NC		NC	
4-Bromophenyl phenyl ether	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
4-Chloro-3-methylphenol	1700	U	1500	U	NC		1600	U	NC		1300	U	NC		NC		NC		NC		NC	
4-Chloroaniline	1700	U	1500	U	NC		1600	U	NC		3100	U	NC		NC		NC		NC		NC	
4-Chlorophenyl phenyl ether	870	U	770	U	NC		810	U	NC		650	U	NC		NC		NC		NC		NC	
4-Nitroaniline	1700	U	1500	U	NC		1600	U	NC		1300	U	NC		NC		NC		NC		NC	
4-Nitrophenol	4300	U	3900	U	NC		4000	U	NC		3200	U	NC		NC		NC		NC		NC	
Acenaphthene	220	U	200	U	NC		210	U	NC		170	U	NC		NC		NC		NC		NC	
Acenaphthylene	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
Anthracene	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
Benz(a)anthracene	260	J	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
Benzo(a)pyrene	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
Benzo(b)fluoranthene	410	J	370	J	NC		340	J	NC		320	U	NC		NC		NC		NC		NC	
Benzo(g,h,i)perylene	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
Benzo(k)fluoranthene	870	U	770	U	NC		810	U	NC		650	U	NC		NC		NC		NC		NC	
Benzoic Acid	8700	U	7700	U	NC		8100	U	NC		6500	U	NC		NC		NC		NC		NC	
Benzyl alcohol	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
Bis(Chloroisopropyl)Ether	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
bis(2-Chloroethoxy)methane	870	U	770	U	NC		810	U	NC		650	U	NC		NC		NC		NC		NC	
bis(2-Chloroethyl)ether	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
bis(2-Ethylhexyl)phthalate	870	U	770	U	NC		810	U	NC		650	U	NC		NC		NC		NC		NC	
Butylbenzyl phthalate	870	U	770	U	NC		810	U	NC		650	U	NC		NC		NC		NC		NC	
Carbazole	880	U	780	U	NC		820	U	NC		660	U	NC		NC		NC		NC		NC	
Chrysene	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
Dibenz(a,h)anthracene	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
Dibenzofuran	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
Diethylphthalate	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
Dimethylphthalate	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
di-n-Butylphthalate	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
di-n-Octylphthalate	870	U	770	U	NC		810	U	NC		650	U	NC		NC		NC		NC		NC	
Fluoranthene	870	U	440	J	NC		810	U	NC		650	U	NC		NC		NC		NC		NC	
Fluorene	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
Hexachlorobenzene	870	U	770	U	NC		810	U	NC		650	U	NC		NC		NC		NC		NC	
Hexachlorobutadiene	870	U	770	U	NC		810	U	NC		650	U	NC		NC		NC		NC		NC	
Hexachloroethane	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
Indeno(1,2,3-c,d)pyrene	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
Isophorone	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
Naphthalene	870	U	770	U	NC		810	U	NC		650	U	NC		NC		NC		NC		NC	
Nitrobenzene	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
N-Nitrosodimethylamine	870	U	770	U	NC		810	U	NC		650	U	NC		NC		NC		NC		NC	
n-Nitroso-di-n-propylamine	870	U	770	U	NC		810	U	NC		650	U	NC		NC		NC		NC		NC	
n-Nitrosodiphenylamine	430	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
Pentachlorophenol	8800	U	7800	U	NC		8200	U	NC		6600	U	NC		NC		NC		NC		NC	
Phenanthrene	230	J	210	J	NC		220	J	NC		320	U	NC		NC		NC		NC		NC	
Phenol	4300	U	390	U	NC		400	U	NC		320	U	NC		NC		NC		NC		NC	
Pyrene	370	J	380	J	NC		370	J	NC		240	J	NC		NC		NC		NC		NC	
Explosives (mg/kg)																						
2,4,6-Trinitrotoluene	0.039	U	0.039	U	NC		0.040	U	NC		0.040	U	NC		NC		NC		NC		NC	
2,4-Dinitrotoluene	0.045	J	0.039	U	NC		0.040	U	NC		0.040	U	NC		NC		NC		NC		NC	
2,6-Dinitrotoluene	0.039	U	0.039	U	NC		0.040	U	NC		0.040	U	NC		NC		NC		NC		NC	
2-amino-4,6-Dinitrotoluene	0.039	U	0.039	U	NC		0.040	U	NC		0.040	U	NC		NC		NC		NC		NC	

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Sample Type	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q	Soil	Q
Sample Date	5/2/2012		5/2/2012		10/22/2013		5/2/2012		10/22/2013		5/2/2012		7/30/2012		7/30/2012		7/30/2012		7/30/2012		7/30/2012	
Comments																						
4-amino-2,6-Dinitrotoluene	0.039	U	0.039	U	NC		0.040	U	NC		0.040	U	NC		NC		NC		NC		NC	
HMX	0.039	U	0.039	U	NC		0.040	U	NC		0.040	U	NC		NC		NC		NC		NC	
Nitroglycerin	0.39	U	0.39	U	NC		0.40	U	NC		0.40	U	NC		NC		NC		NC		NC	
PETN	0.96	U	0.98	U	NC		1.0	U	NC		1.0	U	NC		NC		NC		NC		NC	
Picric Acid	0.039	U	0.039	U	NC		0.040	U	NC		0.040	U	NC		NC		NC		NC		NC	
RDX	0.077	U	0.078	U	NC		0.061	J	NC		0.080	U	NC		NC		NC		NC		NC	
Tetryl	0.077	U	0.078	U	NC		0.080	U	NC		0.080	U	NC		NC		NC		NC		NC	

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(14) - Green highlight indicates the concentration is above the background concentration but below the project level of concern

APPENDIX E – Sampling Data Sheets

PICATIINY ARSENAL
SOIL SAMPLE LOG

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny

Project No.:

Sample No.: PTA-2012-300MA-0001

Date: 28-APR-2012

Sampling Time: 0815

Weather: sunny 38°

Site Description: marsh, Rockey

Sampling Method and Material:

Depth (ft) From	Depth (ft) To	Soil Description (Color, description, moisture, odor)
9"		Rich, Dark Brown moist

OTHER

Constituents Sampled	Container Description	Preservative
SVOC		
Full list metals	8 oz amber	ice
PCBs		
Explosives	4 oz amber	ice

PICATIINY ARSENAL
SOIL SAMPLE LOG

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny

Project No.: 038116003.0000

Sample No.: PTA-2012-300MA-0001RC

Date: 5/2/12

Sampling Time: 0918

Weather: ~50's, raining

Site Description: Green Pond Marsh area

Sampling Method and Material: disposable trowel - homogenized soil in disposable bag.

Depth (ft) From	Depth (ft) To	Soil Description (Color, description, moisture, odor)
7"	HC	dark brown blackish silt. Trace clay, organic-rich, wet.

OTHER

Constituents Sampled	Container Description	Preservative
Explosives + Hg SVOCs	8 oz. amber jar	ice

PICATIINY ARSENAL
SOIL SAMPLE LOG

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny

Project No.:

Sample No.: PTA-2012-300MA-0002

Date: 28-APR-2012

Sampling Time: 0845

Weather: Sunny 38°

Site Description: Marsh,

Sampling Method and Material:

Depth (ft) From	Depth (ft) To	Soil Description (Color, description, moisture, odor)
7"		Light Brown

OTHER

Constituents Sampled	Container Description	Preservative

PICATIINY ARSENAL
SOIL SAMPLE LOG

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny

Project No.: 03816003

Sample No.: PTA-2012-300MA-0002 RC

Date: 5/2/12

Sampling Time: 0908

Weather: ~50s, raining

Site Description: Green Pond marsh area

Sampling Method and Material: trowel

Depth (ft) From	Depth (ft) To	Soil Description (Color, description, moisture, odor)
9"		blackish, dark brown silt, organic-rich, tr. clay, wet.

OTHER

Constituents Sampled	Container Description	Preservative
Explosives + Hg	8 oz. amber jar	ice
SVOCs		

PICATIINY ARSENAL
SOIL SAMPLE LOG

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny

Project No.: 03816003

Sample No.: PTA-2012-300MA-0003

Date: 5/2/12

Sampling Time: 1009

Weather: ~50s, raining

Site Description: Green Pond Marsh Area

Sampling Method and Material:

Depth ~~(ft)~~ in. From	To	Soil Description (Color, description, moisture, odor)
0	6	blackish, dark brown silt, tr. clay, organic rich, wet. Sample depth based on depth, water
		table was encountered.

OTHER

Constituents Sampled	Container Description	Preservative
Full TAL Metals + Hg + Sr	8 oz.	ice
Full list PCBs		
SVOCs		
Explosives + Ng	4 oz.	ice

PICATIINY ARSENAL
SOIL SAMPLE LOG

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny

Project No.: 03816003

Sample No.: PTA-2012-300MA-0004

Date: 5/2/12

Sampling Time: 1022

Weather: 50s, raining

Site Description: Green Pond Marsh area

Sampling Method and Material:

Depth ~~(ft)~~ in. From	To	Soil Description (Color, description, moisture, odor)
0	6	dark brownish black silt, tr. clay, organic-rich, wet. Sample depth based on depth, water table was encountered.

OTHER

Constituents Sampled	Container Description	Preservative
Full TAL metals + Hg + Sr	8 oz	ice
Full PCBs		
SVOCs		
Full Explosives + Ng	4 oz.	ice

PICATIINY ARSENAL
SOIL SAMPLE LOG

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny

Project No.: 03816003

Sample No.: PTA-2012-300MA-0005

Date: 5/2/12

Sampling Time: 1033

Weather: 50s, rain

Site Description: Green Pond marsh area

Sampling Method and Material:

Depth ~~(ft)~~ in. From	To	Soil Description (Color, description, moisture, odor)
0	6	blackish dark brown silt, tr. clay, organic rich, wet. Sample depth based on depth, water table was encountered.

OTHER

Constituents Sampled	Container Description	Preservative
TAL + Hg + Sr	8 oz.	ice
PCBs		
SVOCs		
Explosives + Mg	4 oz.	ice

PICATIINY ARSENAL
SOIL SAMPLE LOG

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny

Project No.: 03816003

Sample No.: PTA-2012-300MA-0006

Date: 5/2/12

Sampling Time: 1047

Weather: 50s, rain

Site Description: Green Pond marsh area

Sampling Method and Material:

Depth ~~(ft)~~ in		Soil Description (Color, description, moisture, odor)
From	To	
0	6	dark brownish blackish silt, tr. clay, organic rich, wet. Sample depth based on depth, water table was encountered.

OTHER

Constituents Sampled	Container Description	Preservative
TAL + Hg + Sr	8 oz	ice
SVOCs		
PCBs		
Explosives + Ng	4 oz	ice

PICATIINY ARSENAL
SOIL SAMPLE LOG

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny

Project No.: 03816003

Sample No.: PTA-2012-300MA-0007

Date: 5/2/12

Sampling Time: 1144

Weather: 50s, rain

Site Description: Green Pond marsh area

Sampling Method and Material:

Depth ~~(ft)~~ in From	To	Soil Description (Color, description, moisture, odor)
0	6	blackish dark brownish silt, tr. clay, organic-rich, wet. Sample depth based on depth, water table was encountered.

OTHER

Constituents Sampled	Container Description	Preservative
TAL + Hg + Sr	8oz.	ice
PCBs		
SVOCs		
Explosives + Ng	4oz.	ice

PICATIINY ARSENAL
SOIL SAMPLE LOG

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny

Project No.: 03816003

Sample No.: PTA-2012-300MA-0008

Date: 5/2/12

Sampling Time: 1155

Weather: 50s, rain

Site Description: Green Pond marsh area

Sampling Method and Material:

Depth ~~(ft)~~ in		Soil Description (Color, description, moisture, odor)
From	To	
0	6	blackish dark brownish silt, tr. clay, organic-rich, wet. Sample depth based on depth, water table was encountered.

OTHER

Constituents Sampled	Container Description	Preservative
TAL + Hg + Sr	8 oz.	ice
SVOCs		
PCBs		
Explosives + Ng	4 oz.	ice

PICATIINY ARSENAL
SOIL SAMPLE LOG

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny

Project No.: 03816003

Sample No.: PTA-2012-30MA-0009

Date: 5/2/12

Sampling Time: 1209

Weather: 50s, rain

Site Description: Green Pond Marsh area

Sampling Method and Material:

Depth ~~(ft)~~ in From	To	Soil Description (Color, description, moisture, odor)
0	6	blackish dark brownish silt, tr. clay organic rich, wet. Sample depth based on depth water tbl was encountered.

OTHER

Constituents Sampled	Container Description	Preservative
TAL + Hg + Sr	8 oz.	ice
SVOCs		
PCBs		
Explosives + Ng	4 oz	ice

PICATIINY ARSENAL
SOIL SAMPLE LOG

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny

Project No.: 03816003

Sample No.: PTA-2012-30MA-0010

Date: 5/2/12

Sampling Time: 1219

Weather: 50s, rain

Site Description: Green Pond Marsh Area

Sampling Method and Material:

Depth ~~(ft)~~ in From	To	Soil Description (Color, description, moisture, odor)
0	6	dark brownish blackish silt, tr. clay, organic rich, wet; sample depth based on depth, water table was encountered.

OTHER

Constituents Sampled	Container Description	Preservative
TAL + Hg + Sr		
PCBs	8 oz	ice
SVOCs		
Explosives + NG	4 oz	ice

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny Arsenal

Project No.: 3816003.0000

Sample No.: PTA-2012-300MA-0010D

Coded/Replicate No. .:

Date: 7/30/2012

Time Sampling Began: 12:50

Time Sampling Ended:

Weather: 70's, cloudy

Site Description: Green Pond Marsh Area

Sampling Method and Material: Trowels

Depth (ft)		Soil/Sediment/Sludge Description
From	To	(Color, description, moisture, odor)
1.0	1.5	dark brownish silt/peat, with vegetative matter, wet. Water table encountered at 14".

OTHER (PID Readings; etc.): Dup taken at this depth, PTA-2012-300MA-0020D (13:00)

Constituents Sampled	Container Description	Preservative
Arsenic	8 oz	ice

Remarks: N 14870022 E 1761136

Sample Personnel: Dawn Post and Morgan Parr

PICATIINY ARSENAL
SOIL SAMPLE LOG

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny

Project No.: 03816003

Sample No.: PTA-2012-300AA-0011

Date: 5/2/12

Sampling Time: 1232

Weather: 50s, rain

Site Description: Green Pond marsh area

Sampling Method and Material:

Depth ~~(ft)~~ in		Soil Description (Color, description, moisture, odor)
From	To	
0	6	dark brownish black silt, tr. clay, organic rich, wet. Sample depth based on depth, water table was encountered.

OTHER

Constituents Sampled	Container Description	Preservative
TAL + Hg + Sr	8 oz	ice
SVOCs		
PCBs		
Explosives + Ng	4 oz	ice

PICATIINY ARSENAL
SOIL SAMPLE LOG

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny

Project No.: 03816003

Sample No.: PTA-2012-300MA-0012

Date: 5/2/12

Sampling Time: 1239

Weather: 50s, rain

Site Description: Green Pond marsh area

Sampling Method and Material:

Depth (~~ft~~) in		Soil Description (Color, description, moisture, odor)
From	To	
0	6	dark brownish black silty tr-clay, organic rich, wet. Sample depth based on depth, water table was encountered.

OTHER

Constituents Sampled	Container Description	Preservative
TAL + Hg + Sr	8oz	ice
SVOCs		
PCBs		
Explosives + Ng	4 oz.	ice

PICATIINY ARSENAL
SOIL SAMPLE LOG

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny

Project No.: 03816003

Sample No.: PTA-2012-300MA-0013

Date: 5/2/12

Sampling Time: 1249

Weather: 50s, rain

Site Description: Green Pond marsh area

Sampling Method and Material:

Depth (ft) From	Depth (ft) To	Soil Description (Color, description, moisture, odor)
0	6	dark brownish black silt, tr. clay, organic rich, wet. sample depth based on depth, water table was encountered.

OTHER

Constituents Sampled	Container Description	Preservative
TAL + Hg + Sr	8 oz.	ice
PCBs		
SVOCs		
Explosives + Ng	4 oz	ice

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny Arsenal 300 Marsh Area

Project No.: 03816003

Sample No.: PTA-2013-300MA-0013D

Coded/Replicate No.: .

Date: 10/22/13

Time Sampling Began: 12:44

Time Sampling Ended: 12:45

Weather: CLOUDY, DRIZZLING, 63°

Site Description: Green Pond 300 Marsh Area, NEAR BASE OF LARGE FALLEN TREE

Sampling Method and Material: Split spoon and disposable trowels

Depth (ft) From	Depth (ft) To	Soil/Sediment/Sludge Description (Color, description, moisture, odor)
2.0	2.5	DARK BROWN / BLACK SILT, LITTLE CLAY, HIGHLY ORGANIC, WET
		NO ODOR

OTHER (PID Readings; etc.)

Constituents Sampled	Container Description	Preservative
Arsenic	(2) 4 oz jars	Ice

Remarks: Previous Coordinates: Easting 1761366.103 Northing 14870300.966

CURRENT COORDINATES: EASTING 1761368.04 NORTHING 14870316.68

Sample Personnel: DP and NC

PICATIINY ARSENAL
SOIL SAMPLE LOG

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny

Project No.: 03816003

Sample No.: PTA-2012-300MA-0014

Date: 5/2/12

Sampling Time: 1303

Weather: 50s, rain

Site Description: Green Pond marsh are

Sampling Method and Material:

Depth (ft) From	To	Soil Description (Color, description, moisture, odor)
0	6	dark brownish black silt, tr. clay, organic rich, wet. sample depth based on depth, water table was encountered.

OTHER

Constituents Sampled	Container Description	Preservative
TAL + Sr + Hg	8 oz	ice
SVOCs		
PCBs		
Explosives + Mg	4 oz	ice

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny Arsenal 300 Marsh Area

Project No.: 03816003

Sample No.: PTA-2013-300MA-0014D

Coded/Replicate No.: .

Date: 10/22/13

Time Sampling Began: 12:23

Time Sampling Ended: 12:24

Weather: CLOUDY, DRIZZLING, 63°

Site Description: Green Pond 300 Marsh Area, NEAR TREE BRANCH BY TREE, NEAR FENCE

Sampling Method and Material: Split spoon and disposable trowels

Depth (ft) From	Depth (ft) To	Soil/Sediment/Sludge Description (Color, description, moisture, odor)
2.0	2.5	BLACK, FINE GRAIN SILT, WELL SORTED, HIGHLY ORGANIC, WET
		NO ODOR

OTHER (PID Readings; etc.)

Constituents Sampled	Container Description	Preservative
Arsenic	(2) 4 oz jars	Ice

Remarks: Previous Coordinates: Easting 1761376.687 Northing 14870376.583

CURRENT COORDINATES: EASTING 1761373.93 NORTHING 14870375.37

Sample Personnel: DP and NC

PICATIINY ARSENAL
SOIL SAMPLE LOG

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny

Project No.: 03816003

Sample No.: PTA2012-300MA 0015

Date: 5/2/12

Sampling Time: 1314

Weather: 50s, rain

Site Description: Green Pond marsh area

Sampling Method and Material:

Depth (ft)		Soil Description (Color, description, moisture, odor)
From	To	
0	6	dark brownish blackish silt, tr. clay, organic-rich, wet. Sample depth based on depth, water table was encountered.

OTHER

Constituents Sampled	Container Description	Preservative
TAL + Hg + Sr	8 oz	ice
PCBs		
SVOCs		
Explosives + Ng	4 oz	ice

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny Arsenal

Project No.: 3816003.0000

Sample No.: PTA-2012-300MA-0016

Coded/Replicate No.: .

Date: 7/30/2012

Time Sampling Began: 13:40

Time Sampling Ended:

Weather: 70's, cloudy

Site Description: Green Pond Marsh Area

Sampling Method and Material: Trowels

Depth (ft)		Soil/Sediment/Sludge Description (Color, description, moisture, odor)
From	To	
0	6"	dark brownish silt/peat, with vegetative matter, moist. No water encountered.

OTHER (PID Readings; etc.)

Constituents Sampled	Container Description	Preservative
Arsenic	8 oz	ice

Remarks: N 14870180.64 E 1761398.91

Sample Personnel: Dawn Post and Morgan Parr

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny Arsenal

Project No.: 3816003.0000

Sample No.: PTA-2012-300MA-0016D

Coded/Replicate No.: .

Date: 7/30/2012

Time Sampling Began: 13:45

Time Sampling Ended:

Weather: 70's, cloudy

Site Description: Green Pond Marsh Area

Sampling Method and Material: Trowels

Depth (ft)		Soil/Sediment/Sludge Description (Color, description, moisture, odor)
From	To	
1	1.5	dark brownish silt/peat, with vegetative matter, wet. Water table encountered at 1'.

OTHER (PID Readings; etc.)

Constituents Sampled	Container Description	Preservative
Arsenic	8 oz	ice

Remarks: N 14870180.64 E 1761398.91

Sample Personnel: Dawn Post and Morgan Parr

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny Arsenal

Project No.: 3816003.0000

Sample No.: PTA-2012-300MA-0017

Coded/Replicate No.: .

Date: 7/30/2012

Time Sampling Began: 12:00

Time Sampling Ended:

Weather: 70's, cloudy

Site Description: Green Pond Marsh Area

Sampling Method and Material: Trowels

Depth (ft)		Soil/Sediment/Sludge Description (Color, description, moisture, odor)
From	To	
0	6"	dark brownish silt/peat, moist. No water encountered.

OTHER (PID Readings; etc.): N 14870475.42 E 1761536.18

Constituents Sampled	Container Description	Preservative
Arsenic	8 oz	ice

Remarks: MS/MSD was taken at this sample. There were two rows of sheet piling (one row was approximately 6' high and on the other side it was approximately 3' high). The sample was taken on the outside of the 3' high sheet piling.

Sample Personnel: Dawn Post and Morgan Parr

ARCADIS

Soil Sampling Log

Project/Site Location: Picatinny Arsenal

Project No.: 3816003.0000

Sample No.: PTA-2012-300MA-0017D

Coded/Replicate No.: .

Date: 7/30/2012

Time Sampling Began: 12:10

Time Sampling Ended:

Weather: 70's, cloudy

Site Description: Green Pond Marsh Area

Sampling Method and Material: Trowels

Depth (ft)		Soil/Sediment/Sludge Description (Color, description, moisture, odor)
From	To	
1	1.5	brownish/greyish color, sandyish type of texture, very moist. No water encountered.

OTHER (PID Readings; etc.): N 14870475.42 E 1761536.18

Constituents Sampled	Container Description	Preservative
Arsenic	8 oz	ice

Remarks: There were two rows of sheet piling (one row was approximately 6' high and on the other side it was approximately 3' high). The sample was taken on the outside of the 3' high sheet piling.

Sample Personnel: Dawn Post and Morgan Parr

APPENDIX F – Photograph Log

Picatinny Arsenal		
Project: 300 Marsh Area Sampling	**Location: Picatinny Arsenal, NJ**	**Project No.** 03816003.0000

Photo No. 1

Description:

300MA-001

Picatinny Arsenal		
Project: 300 Marsh Area Sampling	**Location: Picatinny Arsenal, NJ**	**Project No.** 03816003.0000

Photo No. 2

Description:

300MA-002

Picatinny Arsenal		
Project: 300 Marsh Area Sampling	**Location: Picatinny Arsenal, NJ**	**Project No.** 03816003.0000

Photo No. 3

Description:

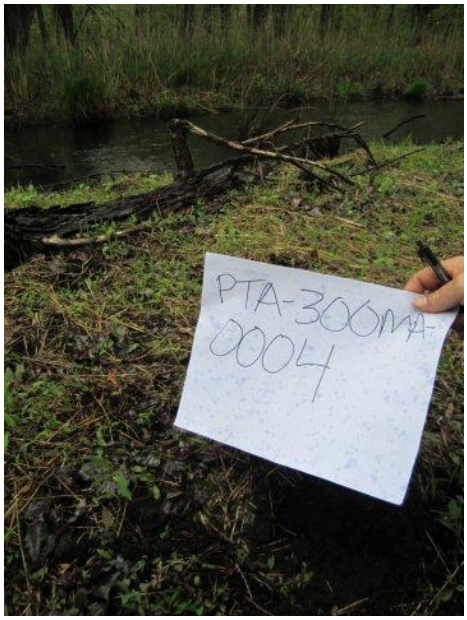
300MA-003

Picatinny Arsenal		
Project: 300 Marsh Area Sampling	**Location: Picatinny Arsenal, NJ**	**Project No.** 03816003.0000

Photo No. 4

Description:

300MA-004



Picatinny Arsenal		
Project: 300 Marsh Area Sampling	**Location: Picatinny Arsenal, NJ**	**Project No.** 03816003.0000

Photo No. 5

Description:

300MA-005

Picatinny Arsenal		
Project: 300 Marsh Area Sampling	**Location: Picatinny Arsenal, NJ**	**Project No.** 03816003.0000

Photo No. 6

Description:

300MA-006

Picatinny Arsenal		
Project: 300 Marsh Area Sampling	**Location: Picatinny Arsenal, NJ**	**Project No.** 03816003.0000

Photo No. 7

Description:

300MA-007

Picatinny Arsenal		
Project: 300 Marsh Area Sampling	**Location: Picatinny Arsenal, NJ**	**Project No.** 03816003.0000

Photo No. 8

Description:

300MA-008

Picatinny Arsenal		
Project: 300 Marsh Area Sampling	**Location: Picatinny Arsenal, NJ**	**Project No.** 03816003.0000

Photo No. 9

Description:

300MA-009

Picatinny Arsenal		
Project: 300 Marsh Area Sampling	**Location: Picatinny Arsenal, NJ**	**Project No.** 03816003.0000

Photo No. 10

Description:

300MA-010

Picatinny Arsenal		
Project: 300 Marsh Area Sampling	**Location: Picatinny Arsenal, NJ**	**Project No.** 03816003.0000

Photo No. 11

Description:

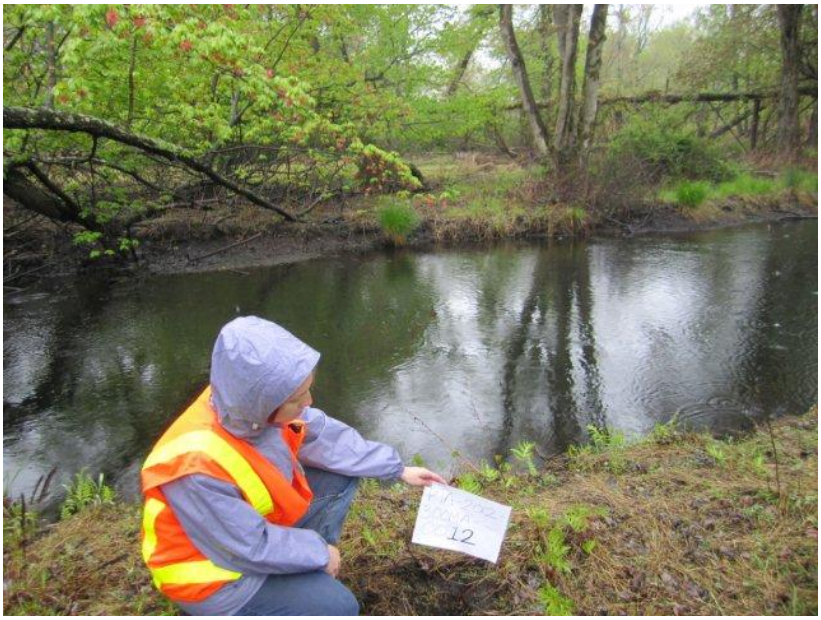
300MA-011

Picatinny Arsenal		
Project: 300 Marsh Area Sampling	**Location: Picatinny Arsenal, NJ**	**Project No.** 03816003.0000

Photo No. 12

Description:

300MA-012



Picatinny Arsenal		
Project: 300 Marsh Area Sampling	**Location: Picatinny Arsenal, NJ**	**Project No.** 03816003.0000

Photo No. 13

Description:

300MA-013

Picatinny Arsenal		
Project: 300 Marsh Area Sampling	**Location: Picatinny Arsenal, NJ**	**Project No.** 03816003.0000

Photo No.14

Description:

300MA-014

Picatinny Arsenal

Project: 300 Marsh Area Sampling	Location: Picatinny Arsenal, NJ	Project No. 03816003.0000

Photo No. 15

Description:

300MA-015

Picatinny Arsenal

Project: 300 Marsh Area Sampling	Location: Picatinny Arsenal, NJ	Project No. 03816003.0000

Photo No. 16

Description:

300MA-016

Picatinny Arsenal		
Project: 300 Marsh Area Sampling	**Location: Picatinny Arsenal, NJ**	**Project No.** 03816003.0000

Photo No. 17

Description:

300MA-017

APPENDIX G – Laboratory Data
(Provided on enclosed CD)

APPENDIX H –Data Validation Report

PICATINNY
DATA VALIDATION REPORT
SDG: 280-28486

Analytical data were evaluated in accordance with applicable USEPA SW-846 method requirements, "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review" (October 1999), "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" (July 2002), and site-specific requirements defined in the Final Uniform Federal Policy-Quality Assurance Project Plan, Remedial Investigation for Military Munitions Response Program, Picatinny Arsenal (ARCADIS and WESTON, 2011). The validation presented in this review was performed at Level III.

The Level II validation was partially conducted using electronic review programs and manual evaluation. Field documentation was not reviewed. The electronic data review was performed utilizing the EQuIS Data Qualification Module (DQM). DQM checks for the following parameters:

- Holding times and preservation;
- Blank contamination;
  - Method blanks,
  - Trip blanks,
  - Equipment blanks;
- Matrix spike and Duplicate sample recovery;
- Matrix Spike and Matrix Spike Duplicate relative percent differences;
- Laboratory Control Sample and Duplicate recovery;
- Laboratory Control Sample and Duplicate relative percent differences;
- Surrogate recovery (organic analyses only); and
- Field duplicate relative percent difference.

Manual review was performed on the following items:

- Sample dilutions and reporting limits;
- Case Narratives;
- Initial and continuing calibrations;
- System Performance and column resolution;
- TR of sample compounds;
- Serial dilutions and post digestions spikes.

Analyses were performed by TestAmerica in Denver, Colorado. Data qualifiers were applied electronically to the database with any additional qualifiers added manually. A summary of the data as amended by data qualifiers is included with the original hard copy reports.

The attached table summarizes the data that were qualified due to QC deficiencies. The table indicates compounds/analytes qualified based on electronic and manual validation. Refer to the associated method section of the validation checklist for a detailed explanation of qualification. All other data in this SDG are considered usable as reported.

PICATINNY
DATA VALIDATION REPORT
SDG: 280-28486

The following list of data qualifiers and definitions were applied in accordance with qualification criteria defined in the above guidance documents:

UB Compound/analyte detected in blank or associated blank, qualified as a non-detect at listed value.

J The analyte was positively identified, but the associated numerical value is the approximate concentration of the analyte in the sample.

UJ The analyte was not detected above the reporting limit; however, the reported quantitation limit is approximate and may, or may not represent the actual limit of quantitation necessary to accurately and precisely measure analyte in the sample.

R The sample result is rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria; and the presence or absence of the analyte cannot be verified.

Data Validation Performed By:	Rachelle Borne	June 21, 2012
Signature:	Rachelle Borne	June 21, 2012
Peer Review:		
Revised:		

PICATINNY
DATA VALIDATION REPORT
SDG: 280-28486

ANALYTICAL DATA PACKAGE DOCUMENTATION
GENERAL INFORMATION

Items Reviewed	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
1. Sample receipt condition		X		X	
2. Requested analyses and sample results		X		X	
3. Master tracking list		X		X	
4. Methods of analysis		X		X	
5. Reporting limits		X		X	
6. Sample collection date		X		X	
7. Laboratory sample received date		X		X	
8. Sample preservation verification (as applicable)		X		X	
9. Sample preparation/extraction/analysis dates		X		X	
10. Fully executed Chain-of-Custody (COC) form		X		X	
11. Narrative summary of QA or sample problems provided		X		X	
12. Data Package Completeness and Compliance		X		X	

QA - Quality Assurance

Comments:

The soils were reported on a dry weight basis.

PICATINNY
DATA VALIDATION REPORT
SDG: 280-28486

Data Verification was performed on the following samples:

SDG	Sample ID	Sample Date	Parent Sample
280-28486	PTA-2012-300MA-0001RC	05/02/12	
280-28486	PTA-2012-300MA-0002RC	05/02/12	
280-28486	PTA-2012-300MA-0003	05/02/12	
280-28486	PTA-2012-300MA-0004	05/02/12	
280-28486	PTA-2012-300MA-0005	05/02/12	
280-28486	PTA-2012-300MA-0006	05/02/12	
280-28486	PTA-2012-300MA-0007	05/02/12	
280-28486	PTA-2012-300MA-0008	05/02/12	
280-28486	PTA-2012-300MA-0009	05/02/12	
280-28486	PTA-2012-300MA-0010	05/02/12	
280-28486	PTA-2012-300MA-0011	05/02/12	
280-28486	PTA-2012-300MA-0012	05/02/12	
280-28486	PTA-2012-300MA-0013	05/02/12	
280-28486	PTA-2012-300MA-0014	05/02/12	
280-28486	PTA-2012-300MA-0015	05/02/12	

PICATINNY
DATA VALIDATION REPORT
SDG: 280-28486

Metals

	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
1. Holding times		DQM		DQM	
2. Blanks					
A. Method blanks		DQM		DQM	
B. Field and equipment blanks	X				X
C. ICB/CCB		M		M	
3. Matrix spike (MS) accuracy (%R)	X				X
4. Matrix spike duplicate (MSD) %R	X				X
5. MS/MSD precision (RPD)	X				X
6. Post-digestion spike (PDS) accuracy (%R)	X				X
7. Serial Dilution %D	X				X
8. Laboratory Control Sample (LCS) accuracy (%R)		DQM		DQM	
9. LCS Duplicate (LCSD) %R	X				X
10. LCS/LCSD precision (RPD)	X				X
11. Field duplicate Samples RPD	X				X
12. Initial Calibration %RSD		X		X	
13. Continuing Calibration %D		X		X	
14. CRDL Standard		X		X	
15. ICP Interference Check Sample		X		X	
16. Reporting Limits		X		X	

%R - percent recovery RPD - relative percent difference %D - percent difference

Comments:
The samples were analyzed for metals by USEPA Method 6010B and 7471A. Performance was acceptable with the following notes:

2A. Barium and manganese were detected in the method blank for batch 119364. The associated field samples were greater than five times the blank values; therefore, qualification of the data was not warranted.

15. The ICS was above the control limit for chromium, copper and strontium. The recoveries were less than120%; therefore, qualification of the data was not warranted.

PICATINNY
DATA VALIDATION REPORT
SDG: 280-28486

PCBs (Polychlorinated Biphenyls)

	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
1. Holding times		DQM		DQM	
2. Blanks					
A. Method blanks		DQM		DQM	
B. Field and equipment blanks	X				X
3. Matrix spike (MS) accuracy (%R)	X				X
4. Matrix spike duplicate (MSD) %R	X				X
5. MS/MSD precision (RPD)	X				X
6. Laboratory Control Sample (LCS) accuracy (%R)		DQM		DQM	
7. LCS Duplicate (LCSD) %R	X				X
8. LCS/LCSD precision (RPD)	X				X
9. Surrogate Recoveries (%R)		DQM	DQM		
10. Field duplicate Samples RPD		DQM		DQM	
11. Initial Calibration %RSD		X		X	
12. Continuing Calibration %D		X		X	
13. System Performance and column resolution		X		X	
14. Compound Identification and Quantitation		X		X	
15. Reporting Limits		X		X	

%R - percent recovery RPD - relative percent difference %D - percent difference

Comments:
The samples were analyzed for metals by USEPA Method 8082. Performance was acceptable with the following notes:

Note: The %D between two columns was above the 40% control limit for PCB 1260 for samples PTA-2012-300MA-0004, PTA-2012-300MA-0005, PTA-2012-300MA-0007 and PTA-2012-300MA-0009. These samples were qualified as estimated for this PCB-1260

9. Both surrogate recoveries were below the control limit for sample PTA-2012-300MS-0003. All PCB results for this sample were qualified as estimated.

PICATINNY
DATA VALIDATION REPORT
SDG: 280-28486

SVOCs

	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
1. Holding times		DQM		DQM	
2. Blanks					
A. Method blanks		DQM		DQM	
B. Field and equipment blanks	X				X
3. Matrix spike (MS) accuracy (%R)	X				X
4. Matrix spike duplicate (MSD) %R	X				X
5. MS/MSD precision (RPD)	X				X
6. Laboratory Control Sample (LCS) accuracy (%R)		DQM		DQM	
7. LCS Duplicate (LCSD) %R	X				X
8. LCS/LCSD precision (RPD)	X				X
9. Surrogate Recoveries (%R)		DQM	DQM		
10. Field duplicate Samples RPD	X				X
11. System Performance and column resolution		M		M	
12. Initial Calibration %RSD		M		M	
13. Continuing Calibration RRFs		M		M	
14. Continuing Calibration %Ds		M		M	
15. Instrument tune and Performance check		M		M	
16. Ion abundance criteria		M		M	
17. Internal Standard		M		M	
18. Compound identification and quantitation		M		M	
19. Reporting Limits		M		M	

%R - percent recovery RPD - relative percent difference %D - percent difference

Comments:
The samples were analyzed for metals by USEPA Method 8270D. Performance was acceptable with the following notes:

3-5. Sample PTA-2012-300MA-0003 was used as the MS/MSD. The sample was analyzed at a dilution and therefore, could not be evaluated. All SVOC compounds were already qualified as estimated due to the inability to evaluate the extraction efficiency due to the surrogate recoveries. Further qualification of the data is not warranted.

9. The surrogate recoveries were diluted out in the 10x dilutions of PTA-2012-300MA-0003, PTA-2012-300MA-0004, PTA-2012-300MA-0005 and PTA-2012-300MA-0009 and could not be evaluated. Due to the inability to determine the extraction efficiency, all SVOC compounds for these samples were qualified as estimated.

PICATINNY
DATA VALIDATION REPORT
SDG: 280-28486

Explosives

	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
1. Holding times		DQM		DQM	
2. Blanks					
A. Method blanks		DQM		DQM	
B. Field and equipment blanks	X				X
3. Matrix spike (MS) accuracy (%R)	X				X
4. Matrix spike duplicate (MSD) %R	X				X
5. MS/MSD precision (RPD)	X				X
6. Laboratory Control Sample (LCS) accuracy (%R)		DQM		DQM	
7. LCS Duplicate (LCSD) %R	X				X
8. LCS/LCSD precision (RPD)	X				X
9. Surrogate spike %R		DQM	DQM		
10. Field duplicate Samples RPD	X				X
11. Initial Calibration %RSD		X		X	
12. Continuing Calibration %D		X		X	
13. System performance and column resolution		X		X	
14. Quantitation Report		X		X	
15. RT of sample compounds within the established RT window		X		X	
16. Reporting Limits		X		X	

%R - percent recovery RPD - relative percent difference

Comments:
The samples were analyzed for explosives by USEPA Method 8330B. Performance was acceptable with the following notes:

9. The surrogate recovery was above the control limit in samples PTA-2012-300MA-004 and PTA-2012-300MA-0008. All detected explosive compounds in these samples were qualified as estimated.

PICATINNY AOE
DATA VALIDATION REPORT
SDGs: 280-31580, 280-31539, 280-31602, 280-31655, 280-31658, 280-31688

Analytical data were evaluated in accordance with applicable USEPA SW-846 method requirements, "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review" (June 2008), "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" (January 2010), and site-specific requirements defined in the Final Uniform Federal Policy-Quality Assurance Project Plan, Remedial Investigation for Military Munitions Response Program, Picatinny Arsenal (ARCADIS and WESTON, 2011). The validation presented in this review was performed at Level III and IV.

The Level II validation was partially conducted using electronic review programs and manual evaluation. Field documentation was not reviewed. The electronic data review was performed utilizing the EQuIS Data Qualification Module (DQM). DQM checks for the following parameters:

- Holding times and preservation;
- Blank contamination;
  - Method blanks,
  - Trip blanks,
  - Equipment blanks;
- Matrix spike and Duplicate sample recovery;
- Matrix Spike and Matrix Spike Duplicate relative percent differences;
- Laboratory Control Sample and Duplicate recovery;
- Laboratory Control Sample and Duplicate relative percent differences;
- Surrogate recovery (organic analyses only); and
- Field duplicate relative percent difference.

Manual review was performed on the following items:

- Sample dilutions and reporting limits;
- Case Narratives;
- Initial and continuing calibrations;
- System Performance and column resolution;
- TR of sample compounds;
- Raw data calculations; and
- Serial dilutions and post digestions spikes.

Analyses were performed by TestAmerica in Denver, Colorado. Data qualifiers were applied electronically to the database with any additional qualifiers added manually. A summary of the data as amended by data qualifiers is included with the original hard copy reports.

The attached table summarizes the data that were qualified due to QC deficiencies. The table indicates compounds/analytes qualified based on electronic and manual validation. Refer to the associated method

section of the validation checklist for a detailed explanation of qualification. All other data in this SDG are considered usable as reported.

The following list of data qualifiers and definitions were applied in accordance with qualification criteria defined in the above guidance documents:

UB Compound/analyte detected in blank or associated blank, qualified as a non-detect at listed value.

J The analyte was positively identified, but the associated numerical value is the approximate concentration of the analyte in the sample.

UJ The analyte was not detected above the reporting limit; however, the reported quantitation limit is approximate and may, or may not represent the actual limit of quantitation necessary to accurately and precisely measure analyte in the sample.

R The sample result is rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria; and the presence or absence of the analyte cannot be verified.

Data Validation Performed By:	Rachelle Borne	09/18/12
Signature:	Rachelle Borne	09/18/12
Peer Review:		
Revised:		

PICATINNY AOE
DATA VALIDATION REPORT
SDGs: 280-31580, 280-31539, 280-31602, 280-31655, 280-31658, 280-31688

ANALYTICAL DATA PACKAGE DOCUMENTATION
GENERAL INFORMATION

Items Reviewed	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
1. Sample receipt condition		X		X	
2. Requested analyses and sample results		X		X	
3. Master tracking list		X		X	
4. Methods of analysis		X		X	
5. Reporting limits		X		X	
6. Sample collection date		X		X	
7. Laboratory sample received date		X		X	
8. Sample preservation verification (as applicable)		X		X	
9. Sample preparation/extraction/analysis dates		X		X	
10. Fully executed Chain-of-Custody (COC) form		X		X	
11. Narrative summary of QA or sample problems provided		X		X	
12. Data Package Completeness and Compliance		X		X	

QA - Quality Assurance

Comments:

The soils were reported on a dry weight basis.

PICATINNY AOE
DATA VALIDATION REPORT
SDGs: 280-31580, 280-31539, 280-31602, 280-31655, 280-31658, 280-31688

Data Verification was performed on the following samples:

SDG	Sample ID	Sample Date	Parent Sample
280316551	C-SB3-002 (073012)	7/30/2012	
280316551	C-SB3-003 (073012)	7/30/2012	
280316551	C-SB3-01B (073012)	7/30/2012	
280316551	FB004 (073012)	7/30/2012	
280316551	TB4 (073012)	7/30/2012	
280316581	PTA-2012-300MA-0010D	7/30/2012	
280316581	PTA-2012-300MA-0016	7/30/2012	
280316581	PTA-2012-300MA-0016D	7/30/2012	
280316581	PTA-2012-300MA-0017	7/30/2012	
280316581	PTA-2012-300MA-0017D	7/30/2012	
280316581	PTA-2012-300MA-0020D	7/30/2012	
280316881	C-180-MW1801(073112)	7/31/2012	
280316881	FB005(073112)	7/31/2012	
280316881	TB5(073112)	7/31/2012	
280315391	C-25-DM002(072512)	7/25/2012	
280315391	C-25-DM003(072512)	7/25/2012	
280315391	C-25-LF002(072512)	7/25/2012	
280315391	C-25-MW008(072512)	7/25/2012	
280315391	C-25-MW016(072512)	7/25/2012	
280315391	C-25-MW06A(072512)	7/25/2012	
280315391	C-25-MW06B(072512)	7/25/2012	
280315391	C-DUP001(072512)	7/25/2012	C-25-MW016(072512)
280315391	C-DUP002(072512)	7/25/2012	C-25-MW06A(072512)
280315391	FB001(072512)	7/25/2012	
280315391	TB1(072512)	7/25/2012	
280315801	C-19-DM001 (072612)	7/26/2012	
280315801	C-19-DM002 (072612)	7/26/2012	
280315801	C-25-MW007 (072612)	7/26/2012	
280315801	C-25-MW017 (072612)	7/26/2012	
280315801	C-SB2-002 (072612)	7/26/2012	
280315801	C-SB2-003 (072612)	7/26/2012	

PICATINNY AOE
DATA VALIDATION REPORT
SDGs: 280-31580, 280-31539, 280-31602, 280-31655, 280-31658, 280-31688

SDG	Sample ID	Sample Date	Parent Sample
280315801	C-SB2-01A (072612)	7/26/2012	
280315801	FB002 (072612)	7/26/2012	
280315801	TB2 (072612)	7/26/2012	
280316021	C-19-C1B(072712)	7/27/2012	
280316021	C-SB1-001(072712)	7/27/2012	
280316021	C-SB1-002(072712)	7/27/2012	
280316021	C-SB1-003(072712)	7/27/2012	
280316021	C-SB1-005(072712)	7/27/2012	
280316021	C-SB1-006(072712)	7/27/2012	
280316021	C-SB1-007(072712)	7/27/2012	
280316021	FB003(072712)	7/27/2012	
280316021	TB3(072712)	7/27/2012	
280316881	C-1181-MW003(073112)	7/31/2012	
280316881	C-SB4-001(073112)	7/31/2012	
280316881	C-SB4-002(073112)	7/31/2012	
280316881	C-SB4-003(073112)	7/31/2012	
280316881	C-SB4-004(073112)	7/31/2012	

PICATINNY AOE
DATA VALIDATION REPORT
SDGs: 280-31580, 280-31539, 280-31602, 280-31655, 280-31658, 280-31688

Volatile Organic Compounds

	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
1. Holding times		DQM		DQM	
2. Blanks					
A. Method blanks		DQM		DQM	
B. Field and equipment blanks		DQM		DQM	
C. Trip Bank		DQM		DQM	
3. Matrix spike (MS) accuracy (%R)		DQM		DQM	
4. Matrix spike duplicate (MSD) %R		DQM		DQM	
5. MS/MSD precision (RPD)		DQM		DQM	
6. Laboratory Control Sample (LCS) accuracy (%R)		DQM		DQM	
7. LCS Duplicate (LCSD) %R	X				X
8. LCS/LCSD precision (RPD)	X				X
9. Surrogate spike %R		DQM		DQM	
10. Field duplicate Samples RPD	X				X
11. Initial Calibration %RSD		X		X	
12. Continuing Calibration %D		X		X	
13. System performance and column resolution		X		X	
14. Quantitation Report		X		X	
15. RT of sample compounds within the established RT window		X		X	
16. Transcription/calculation errors present		X		X	
17. Reporting Limits		X		X	

%R - percent recovery RPD - relative percent difference

Comments:
The samples were analyzed for VOCs by USEPA Method 8260. Performance was acceptable with the following notes:

3-5. SDG (280-31580) Sample C-SB2-002(072612) was used as the MS/MSD. The recoveries and RPDs were acceptable.

SDG (280-31602) Sample C-SB1-002(072712) was used as the MS/MSD. The recoveries and RPDs were acceptable.

9. SDG (280-31580) Two surrogate recoveries were above the control limit in C-SB2-002(072612). The sample was non-detect for all VOCs; therefore, qualification of the data was not warranted.

PICATINNY AOE
DATA VALIDATION REPORT
SDGs: 280-31580, 280-31539, 280-31602, 280-31655, 280-31658, 280-31688

Explosives

	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
1. Holding times		DQM		DQM	
2. Blanks					
A. Method blanks		DQM		DQM	
B. Field and equipment blanks		DQM		DQM	
3. Matrix spike (MS) accuracy (%R)		DQM		DQM	
4. Matrix spike duplicate (MSD) %R		DQM		DQM	
5. MS/MSD precision (RPD)		DQM		DQM	
6. Laboratory Control Sample (LCS) accuracy (%R)		DQM		DQM	
7. LCS Duplicate (LCSD) %R	X				X
8. LCS/LCSD precision (RPD)	X				X
9. Surrogate spike %R		DQM		DQM	
10. Field duplicate Samples RPD	X				X
11. Initial Calibration %RSD		X		X	
12. Continuing Calibration %D		X		X	
13. System performance and column resolution		X		X	
14. Quantitation Report		X		X	
15. RT of sample compounds within the established RT window		X		X	
16. Transcription/calculation errors present		X		X	
17. Reporting Limits		X		X	

%R - percent recovery RPD - relative percent difference

Comments:
The samples were analyzed for explosives by USEPA Method 8330B. Performance was acceptable with the following notes:

3-5. SDG (280-31580) Sample C-SB2-002(072612) was used as the MS/MSD. The recoveries and RPD were acceptable.

SDG (280-31602) Sample C-SB1-002(072712) was used as the MS/MSD. The recoveries and RPD were acceptable.

9. SDG (280-31655) The surrogate recovery was above the control limit in C-SB3-01B(073012). The sample was non-detect for RDX; therefore, qualification of the data was not warranted.

PICATINNY AOE
DATA VALIDATION REPORT
SDGs: 280-31580, 280-31539, 280-31602, 280-31655, 280-31658, 280-31688

Metals

	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
1. Holding times		DQM		DQM	
2. Blanks					
A. Method blanks		DQM		DQM	
B. Field and equipment blanks		DQM	DQM		
C. ICB/CCB		M		M	
3. Matrix spike (MS) accuracy (%R)		DQM	DQM		
4. Matrix spike duplicate (MSD) %R		DQM	DQM		
5. MS/MSD precision (RPD)		DQM		DQM	
6. Post-digestion spike (PDS) accuracy (%R)		X		X	
7. Serial Dilution %D		X		X	
8. Laboratory Control Sample (LCS) accuracy (%R)		DQM		DQM	
9. LCS Duplicate (LCSD) %R	X				X
10. LCS/LCSD precision (RPD)	X				X
11. Field duplicate Samples RPD		DQM		DQM	
12. Initial Calibration %RSD		X		X	
13. Continuing Calibration %D		X		X	
14. CRDL Standard		X		X	
15. ICP Interference Check Sample		X		X	
16. Transcription/calculation errors present		X		X	
17. Reporting Limits		X		X	

%R - percent recovery RPD - relative percent difference %D - percent difference

Comments:
The samples were analyzed for metals by USEPA Method 6010B. Performance was acceptable with the following notes:

2B. SDG (280-31655) Thallium was detected in the field blank. The associated field samples were qualified as non-detect for thallium if the sample concentrations were less than five times the blank value.

SDG (280-31688) Chromium Thallium was detected in the field blank. The associated field samples were qualified as non-detect for chromium if the sample concentrations were less than five times the blank value.

3-5. SDG (280-31580) Sample C-SB2-002(072612) was used as the MS/MSD. The recovery of thallium was below the control limit in the MS and the MSD. All field samples were qualified as estimated for thallium.

SDG (280-31539) Samples C-25-MW06A(072512) and FB001(072512) were used as the MS/MSDs. The recoveries and RPDs were acceptable.

SDG (280-31602) Sample C-SB1-002(072712) was used as the MS/MSD. The recoveries and RPDs were acceptable.

SDG (280-31655) Sample C-SB3-01B(073012)) was used as the MS/MSD. The recoveries and RPDs were acceptable.

SDG (280-31658) Sample PTA-2012-300MA-0017 was used as the MS/MSD. The recoveries and RPDs were acceptable.

SDG (280-31688) Sample FB005(073112) 0017 was used as the MS/MSD. The recoveries and RPDs were acceptable.

11. SDG (280-31539) Sample C-DUP001(072512) was collected as a field duplicate of C-25-MW06A(072512). Sample C-DUP002(072512) was collected as a field duplicate of C-25-MW016(072512). The RPDs were acceptable at less than 40%.

15. SDG (280-31580, 280-31539, 280-31602) The ICS was above the control limit for chromium. The recovery was less than120%; therefore, qualification of the data was not warranted.

    SDG (280-31655 and 280-31688) The ICS was above the control limit for chromium and nickel. The recoveries were less than120%; therefore, qualification of the data was not warranted.

PICATINNY AOE
DATA VALIDATION REPORT
SDGs: J48235, J48258, J48377, J48442, J48473 and J48294

Analytical data were evaluated in accordance with applicable USEPA SW-846 method requirements, "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review" (June 2008), "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" (January 2010), and site-specific requirements defined in the Final Uniform Federal Policy-Quality Assurance Project Plan, Remedial Investigation for Military Munitions Response Program, Picatinny Arsenal (ARCADIS and WESTON, 2011). The validation presented in this review was performed at Level III and IV.

The Level II validation was partially conducted using electronic review programs and manual evaluation. Field documentation was not reviewed. The electronic data review was performed utilizing the EQuIS Data Qualification Module (DQM). DQM checks for the following parameters:

- Holding times and preservation;
- Blank contamination;
  - Method blanks,
  - Trip blanks,
  - Equipment blanks;
- Matrix spike and Duplicate sample recovery;
- Matrix Spike and Matrix Spike Duplicate relative percent differences;
- Laboratory Control Sample and Duplicate recovery;
- Laboratory Control Sample and Duplicate relative percent differences;
- Surrogate recovery (organic analyses only); and
- Field duplicate relative percent difference.

Manual review was performed on the following items:

- Sample dilutions and reporting limits;
- Case Narratives;
- Initial and continuing calibrations;
- System Performance and column resolution;
- TR of sample compounds;
- Raw data calculations; and
- Serial dilutions and post digestions spikes.

Analyses were performed by TestAmerica in Denver, Colorado. Data qualifiers were applied electronically to the database with any additional qualifiers added manually. A summary of the data as amended by data qualifiers is included with the original hard copy reports.

The attached table summarizes the data that were qualified due to QC deficiencies. The table indicates compounds/analytes qualified based on electronic and manual validation. Refer to the associated method

section of the validation checklist for a detailed explanation of qualification. All other data in this SDG are considered usable as reported.

The following list of data qualifiers and definitions were applied in accordance with qualification criteria defined in the above guidance documents:

UB Compound/analyte detected in blank or associated blank, qualified as a non-detect at listed value.

J The analyte was positively identified, but the associated numerical value is the approximate concentration of the analyte in the sample.

UJ The analyte was not detected above the reporting limit; however, the reported quantitation limit is approximate and may, or may not represent the actual limit of quantitation necessary to accurately and precisely measure analyte in the sample.

R The sample result is rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria; and the presence or absence of the analyte cannot be verified.

Data Validation Performed By:	Rachelle Borne	12/13/13
Signature:	Rachelle Borne	12/13/13
Peer Review:		
Revised:		

PICATINNY AOE
DATA VALIDATION REPORT
SDGs: J48235, J48258, J48377, J48442, J48473 and J48294

ANALYTICAL DATA PACKAGE DOCUMENTATION
GENERAL INFORMATION

Items Reviewed	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
1. Sample receipt condition		X		X	
2. Requested analyses and sample results		X		X	
3. Master tracking list		X		X	
4. Methods of analysis		X		X	
5. Reporting limits		X		X	
6. Sample collection date		X		X	
7. Laboratory sample received date		X		X	
8. Sample preservation verification (as applicable)		X		X	
9. Sample preparation/extraction/analysis dates		X		X	
10. Fully executed Chain-of-Custody (COC) form		X		X	
11. Narrative summary of QA or sample problems provided		X		X	
12. Data Package Completeness and Compliance		X		X	

QA - Quality Assurance

Comments:

PICATINNY AOE
DATA VALIDATION REPORT
SDGs: J48235, J48258, J48377, J48442, J48473 and J48294

Data Verification was performed on the following samples:

SDG	Sample ID	Sample Date	Parent Sample
280482351	C-DM19-001(102113)	10/21/2013	
280482351	C-DM19-002(102113)	10/21/2013	
280482351	C-DUP001(102113)	10/21/2013	C-MW25-06A(102113)
280482351	C-MW25-06A(102113)	10/21/2013	
280482351	C-MW25-06B(102113)	10/21/2013	
280482351	FB001(102113)	10/21/2013	
280482351	TB1(102113)	10/21/2013	
280482581	C-SB2-002(102213)	10/22/2013	
280482581	C-SB2-003(102213)	10/22/2013	
280482581	C-SB2-01A(102213)	10/22/2013	
280482581	C-SB3-002(102213)	10/22/2013	
280482581	C-SB3-003(102213)	10/22/2013	
280482581	FB002(102213)	10/22/2013	
280482581	TB002(102213)	10/22/2013	
280482941	PTA-2013-300MA-0013D	10/22/2013	
280482941	PTA-2013-300MA-0014D	10/22/2013	
280483771	C-1181-3 (102313)	10/23/2013	
280483771	C-C1-B (102313)	10/23/2013	
280483771	C-DM25-002 (102313)	10/23/2013	
280483771	C-DM25-003 (102313)	10/23/2013	
280483771	C-LF-002 (102313)	10/23/2013	
280483771	C-MW-017 (102313)	10/23/2013	
280483771	C-MW180-1 (102313)	10/23/2013	
280483771	C-MW25-008 (102313)	10/23/2013	
280483771	FB003 (102313)	10/23/2013	
280483771	TB003 (102313)	10/23/2013	
280484421	C-DUP002(102413)	10/24/2013	C-SB1-001(102413)
280484421	C-DUP002(102413) 0.45 um	10/24/2013	C-SB1-001(102413) 0.45 um
280484421	C-DUP002(102413) 10 um	10/24/2013	C-SB1-001(102413) 10 um
280484421	C-SB1-001(102413)	10/24/2013	

280484421	C-SB1-001(102413) 0.45 um	10/24/2013	
280484421	C-SB1-001(102413) 10 um	10/24/2013	
280484421	C-SB1-002(102413)	10/24/2013	
280484421	C-SB1-002(102413) 0.45 um	10/24/2013	
280484421	C-SB1-002(102413) 10 um	10/24/2013	
280484421	C-SB1-003(102413)	10/24/2013	
280484421	C-SB1-005(102413)	10/24/2013	
280484421	C-SB1-006(102413)	10/24/2013	
280484421	C-SB1-007(102413)	10/24/2013	
280484421	C-SB3-01B(102413)	10/24/2013	
280484421	FB004(102413)	10/24/2013	
280484421	TB4(102413)	10/24/2013	
280484731	C-SB4-001 (102513)	10/25/2013	
280484731	C-SB4-002 (102513)	10/25/2013	
280484731	C-SB4-003 (102513)	10/25/2013	
280484731	C-SB4-004 (102513)	10/25/2013	
280484731	FB005 (102513)	10/25/2013	
280484731	TB005 (102513)	10/25/2013	

PICATINNY AOE
DATA VALIDATION REPORT
SDGs: J48235, J48258, J48377, J48442, J48473 and J48294

Volatile Organic Compounds

	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
1. Holding times		DQM		DQM	
2. Blanks					
A. Method blanks		DQM		DQM	
B. Field and equipment blanks		DQM		DQM	
C. Trip Bank		DQM		DQM	
3. Matrix spike (MS) accuracy (%R)		DQM		DQM	
4. Matrix spike duplicate (MSD) %R		DQM		DQM	
5. MS/MSD precision (RPD)		DQM		DQM	
6. Laboratory Control Sample (LCS) accuracy (%R)		DQM		DQM	
7. LCS Duplicate (LCSD) %R	X				X
8. LCS/LCSD precision (RPD)	X				X
9. Surrogate spike %R		DQM	DQM		
10. Field duplicate Samples RPD		DQM		DQM	
11. Initial Calibration %RSD		X		X	
12. Continuing Calibration %D		X		X	
13. System performance and column resolution		X		X	
14. Quantitation Report		X		X	
15. RT of sample compounds within the established RT window		X		X	
16. Transcription/calculation errors present		X		X	
17. Reporting Limits		X		X	

%R - percent recovery RPD - relative percent difference

Comments:
The samples were analyzed for VOCs by USEPA Method 8260. Performance was acceptable with the following notes:

3-5. SDG (J48258) Sample C-SB3-002(102213) was used as the MS/MSD. The recoveries and RPD were acceptable.

SDG (J48473) Sample C-SB4-003(102513) was used as the MS/MSD. The recoveries and RPD were acceptable.

9. SDG (J48235) One surrogate recovery was below the control limit in C-MW25-06A(102113). Vinyl chloride was qualified as estimated for this sample.

SDG (J48473) One surrogate was below the control limit in C-SB4-002(102513) and TB005(102513). Vinyl chloride was qualified as estimated for these samples.

10. SDG (J48235) Sample C-DUP001(102113) was collected as a field duplicate of C-MW25-06A(102113). The RPD was acceptable at non-detect.

    SDG (J48442) Sample C-CUP002(102413) was collected as a field duplicate of C-SB1-001(102413). The RPD was acceptable at non-detect.

PICATINNY AOE
DATA VALIDATION REPORT
SDGs: J48235, J48258, J48377, J48442, J48473 and J48294

Metals

	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
1. Holding times		DQM		DQM	
2. Blanks					
A. Method blanks		DQM	DQM		
B. Field and equipment blanks		DQM		DQM	
C. ICB/CCB		M	M		
3. Matrix spike (MS) accuracy (%R)		DQM		DQM	
4. Matrix spike duplicate (MSD) %R		DQM		DQM	
5. MS/MSD precision (RPD)		DQM		DQM	
6. Post-digestion spike (PDS) accuracy (%R)		X		X	
7. Serial Dilution %D		X		X	
8. Laboratory Control Sample (LCS) accuracy (%R)		DQM		DQM	
9. LCS Duplicate (LCSD) %R	X				X
10. LCS/LCSD precision (RPD)	X				X
11. Field duplicate Samples RPD		DQM		DQM	
12. Internal Standards		X		X	
13. Initial Calibration %RSD		X		X	
14. Continuing Calibration %D		X		X	
15. CRDL Standard		X		X	
16. ICP Interference Check Sample		X		X	
17. Transcription/calculation errors present		X		X	
18. Reporting Limits		X		X	

%R - percent recovery RPD - relative percent difference %D - percent difference

Comments:
The samples were analyzed for metals by USEPA Method 6010B/6020. Performance was acceptable with the following notes:

2A. SDGs (J48235, J48473 and J48442) Thallium was detected in the method blank. The associated field samples were qualified as non-detect for this metal if the sample concentrations were less than five times the blank value.

2C. SDGs (J48235, J48473 and J48442) Thallium was detected in the instrument blanks. The associated field samples were qualified as non-detect for this metal if the sample concentrations were less than five times the blank value.

3-5. SDG (J48235) Sample C-MW25-06A(102113) was used as the MS/MSD. The recoveries and RPDs were acceptable.

SDG (J48258) Sample C-SB3-002(102213) was used as the MS/MSD. The recoveries and RPDs were acceptable.

SDG (J48377) Sample FB003(102313) was used as the MS/MSD. The recoveries and RPDs were acceptable.

SDG (J48473) Samples C-SB4-003(102513) and FB005(102513) were used as the MS/MSDs. The recoveries and RPDs were acceptable.

SDG (J48294) Sample PTA-2013-300MW-0013D was used as the MS/MSD. The recoveries and RPDs were acceptable.

SDG (J48442) Sample C-SB1-001(102413) 10 um was used as the MS/MSD. The recoveries and RPDs were acceptable.

6. SDG (J48235) Sample C-MW25-06A(102113) was used as the post digestion spike. The recoveries were acceptable.

SDG (J48258) Sample C-SB3-002(102213) was used as the post digestion spike. The recoveries were acceptable.

SDG (J48377) Sample FB003(102313) was used as the post digestion spike. The recoveries were acceptable.

SDG (J48473) Samples C-SB4-003(102513) and FB005(102513) were used as the post digestion spikes. The recoveries were acceptable.

SDG (J48294) Sample PTA-2013-300MW-0013D was used as the post digestion spike. The recoveries were acceptable.

SDG (J48442) Sample C-SB1-001(102413) 10 um was used as the post digestion spike. The recoveries were acceptable.

7. SDG (J48235) Sample C-MW25-06A(102113) was used as the serial dilution. The %Ds were acceptable.

SDG (J48258) Sample C-SB3-002(102213) was used as the serial dilution. The %Ds were acceptable.

SDG (J48377) Sample FB003(102313) was used as the serial dilution. The %Ds were acceptable.

SDG (J48473) Samples C-SB4-003(102513) and FB005(102513) were used as the serial dilutions. The %Ds were acceptable.

SDG (J48294) Sample PTA-2013-300MW-0013D was used as the serial dilution. The %Ds were acceptable.

SDG (J48442) Sample C-SB1-001(102413) 10 um was used as the serial dilution. The %Ds were acceptable.

11. SDG (J48235) Sample C-DUP001(102113) was collected as a field duplicate of C-MW25-06A(102113). The RPD was acceptable at less than 40%.

    SDG (J48442) Sample C-DUP002(102413) 10 um was collected as a field duplicate of C-SB1-001(102413) 10 um. The RPDs were acceptable at non-detect.

    SDG (J48442) Sample C-DUP002(102413) 0.45 um was collected as a field duplicate of C-SB1-001(102413) 0.45 um. The RPDs were acceptable at non-detect.