TNT AREAS

SITE INVESTIGATION

FINAL REPORT

FOR

PLUM BROOK ORDNANCE WORKS

PLUM BROOK STATION/NASA

SANDUSKY, OHIO

Prepared for:

U.S. Army Corps of Engineers

Nashville District/Huntington District

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EXECUTIVE SUMMARY

The former Plum Brook Ordnance Works (PBOW), an approximately 9,000 acre site located in Sandusky, Ohio, was used as an explosives manufacturing facility during World War II. The site is now owned by the National Aeronautics and Space Administration (NASA) and is operated as the NASA Lewis Research Center, Plum Brook Station (PBS). Under provisions of the Department of Defense (DoD) Defense Environmental Restoration Program - Formerly Used Defense Sites, the U.S. Army Corps of Engineers (USACE), Nashville District (CEORN) conducted a Site Investigation of the three explosives manufacturing areas, TNT Area A, TNT Area B, and TNT Area C, at the former PBOW.

The objective of the TNT Areas Site Investigation was to confirm the presence of the suspected contamination in either or both the soil or the groundwater within the boundaries of the former TNT areas, and to evaluate whether additional investigation of either of these media in and around the former TNT manufacturing areas is warranted. To accomplish this objective, the Site Investigation of the TNT areas involved sampling and laboratory analysis of potentially-impacted soil and groundwater for the types of contamination most likely to be present, explosives residues (nitroaromatics) and metals.

Soils Investigation

Samples from the TNT areas were collected from locations where nitroaromatics were most likely to be present. These locations were selected based on historical information about operations at the PBOW and results of similar investigations at other TNT manufacturing facilities. Sample locations were also related, to the extent possible, to former building footprints and physical site features such as ditches that were part of the process waste water disposal system.

One hundred soil samples were collected from the three TNT areas. Sampling depths were selected considering that nitroaromatic compounds as a group are not particularly mobile in soils. While some vertical migration of contamination through the soil can

occur, generally the most significant contamination is expected to be near the surface. Therefore, soil boring depths were limited to 5 feet, and many boring depths were less than 5 feet. Samples were analyzed for 14 nitroaromatic compounds representative of TNT, its intermediate products, and degradation products, and for concentrations of 14 metals, the 13 priority pollutant metals and manganese.

The investigation indicates that explosives residues are present in soils in each of the former TNT manufacturing areas. Significant findings are as follows:

- The most significant contamination was present in TNT Area B. Thirteen of the 14 explosives residues analytes were detected in TNT Area B. Contamination by explosives residues was present in 19 of 26 locations where soil borings were installed. Concentrations of explosives residues in excess of 10,000 mg/Kg were present in soils at the former Bi-Tri House and the DNT Sweating and Graining House. In both areas, sample locations targeted outdoor tanks associated with the buildings. Also, significant levels of explosives residues (greater than 10.0 mg/Kg) were detected at the Wash House for manufacturing line 6 and the Fortifier House. No previous decontamination efforts of the soil have been documented at TNT Area B.

- In TNT Area A nine of the 14 explosives residues were detected, generally at lower concentrations than those detected in TNT Area B. Nitroaromatics were detected at 16 of 28 locations where soil borings were installed. However, most concentrations were relatively low. Significant levels of explosives residues (greater than 10.0 mg/Kg) were detected only at the Pump House, the Fortifier House, and the Mono House. Significant decontamination of TNT Area A was performed following closure of the PBOW.

- In TNT Area C, 11 of 14 nitroaromatics were detected, all at low levels. Nitroaromatics were detected in only six of 26 locations where samples were collected. All concentrations were below 10.0 mg/Kg. No previous decontamination efforts have been documented at TNT Area C.

- 2,4,6-TNT was the most commonly detected explosives residue at the TNT areas. It was present in 40 of the 100 soil samples. The highest concentrations were present in TNT Area B.

- 2,4-DNT, an intermediate product in TNT production, was the second most commonly detected nitroaromatic. It was present in 33 samples. 2,6-DNT, the other most common intermediate product of TNT production was present in 24 samples. The highest concentrations of these two compounds were present in TNT Area B.

- 1,3-DNB, an impurity in TNT manufacturing and a potential degradation product of 1,3,5-TNB, was found only in samples that also contained 1,3,5-TNB. However, 1,3-DNB was detected less often (in six samples) than 1,3,5-TNB (in nine samples).

- 4-Am-DNT and 2-Am-DNT, end products of the microbially mediated biotransformation of TNT, and 4-Am-2-NT and 2-Am-4-NT, end products of plant biotransformation of 2,4-DNT, were detected in some of the soil samples.

Fourteen background soil samples were collected from eight borings installed in areas of the site least likely to have been impacted by former DoD activities. These samples were analyzed for the same explosives residues and metals as the soils from the two red water ponds areas. In addition, in order to demonstrate that the background locations were, in fact, not impacted by former DoD activities, background soil samples were also analyzed for volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) to establish baseline soil quality. No explosives residues were detected in the background soils. However, four VOCs and one SVOC were detected. These four VOCs and one SVOC were detected in soils from many areas of the site during previous investigations and are not believed to be related to former DoD activities. They are more likely related to normal use of the site in the 50 years since operation of the PBOW ceased.

Eleven metals, antimony, arsenic, beryllium, cadmium, chromium, copper, lead, manganese, mercury, nickel, and zinc, were detected in the soil samples collected from the TNT areas. A statistical analysis comparing metals concentrations in background soil samples to concentrations in samples collected from the three TNT areas indicated that lead, manganese, and zinc levels in these areas are above background. Concentrations of all other metals are consistent with levels detected in the background soils.

Chromium, lead, manganese, nickel, and zinc were present in every soil sample. Beryllium and cadmium were detected only in TNT Area B. Mercury was detected only in one sample from TNT Area C.

A correlation was established between elevated lead levels and the presence of explosives residues in the TNT areas.

Groundwater Investigation

Groundwater at the site occurs in two basic hydrostratigraphic units: the unconsolidated overburden and the bedrock. The overburden is composed of glacial outwash materials, and varies in thickness from a few feet to over 40 feet. The bedrock consists of both limestone and shale.

The results of the groundwater investigation indicate that generally groundwater flow in both the overburden and the bedrock is to the north, eventually toward Lake Erie, as would be expected for this site. However, it is likely that with the shallow bedrock and thin veneer of overburden materials overlying the bedrock, the vertical flow of groundwater downward from the overburden into the bedrock predominates over horizontal flow in the overburden. This flow pattern, if accurate, would facilitate migration of contaminants from the overburden soils and groundwater into the bedrock aquifer.

The presence of groundwater in the overburden hydrostratigraphic unit at the site is apparently very seasonal. During the early winter when groundwater samples were collected for this investigation, several of the overburden monitoring wells were dry. However, in early spring after abundant winter precipitation, groundwater was present in all of the previously dry wells.

Low levels of explosives residues were detected in the overburden wells at TNT Areas A and B. No nitroaromatics were detected in the overburden wells sampled at TNT Area C. However, as noted above, two of the four overburden wells installed at TNT Area C for this investigation were dry at the time of sampling. At TNT Area C, low levels of explosives were detected in the bedrock well.

Groundwater at the site is not used for potable water. However, for evaluation purposes, concentrations of metals were compared to the applicable regulatory action

levels established by EPA. Nickel and thallium were present in TNT Area B groundwater samples at concentrations above their action levels. Manganese was present at concentrations above its action level in TNT Areas A and B.

Several VOCs and SVOCs were detected in the bedrock aquifer. These were generally hydrocarbons and associated compounds.

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LIST OF ACRONYMS

AL	Action Level
ASI	Analytical Services, Inc.
ATV	all terrain vehicle
BDL	below detection limit
BTEX	benzene, toluene, ethylbenzene, and xylenes
CEORN	U.S. Army Corps of Engineers, Nashville District
CREEL	Cold Regions Research and Engineering Laboratories
DNB	dinitrobenzene
DNT	dinitrotoluene
DoD	Department of Defense
EPA	U.S. Environmental Protection Agency
gpm	gallons per minute
ID	inside diameter
IT	IT Corporation
MCL	Maximum Contaminant Level
MDL	method detection limit
mg/Kg	milligrams per kilogram
mg/L	milligrams per liter
MRD	Missouri River Division
msl	Mean Sea Level
NASA	National Aeronautics and Space Administration
NB	nitrobenzene
NT	nitrotoluene
OD	outside diameter
ORD	Ohio River Division

LIST OF ACRONYMS
(Continued)

PBOW	Plum Brook Ordnance Works
PBRF	Plum Brook Reactor Facility
PBS	Plum Brook Station
PPE	personal protective equipment
PQL	Practical Quantitation Limit
PVC	polyvinyl chloride
QC	quality control
SAIC	Science Applications International Corporation
SCS	Soil Conservation Service
SMCL	Secondary MCL
SVOC	semivolatile organic compound
TNB	trinitrobenzene
TNT	trinitrotoluene
*u*g/L	micrograms per liter
*u*mhos/cm	microhms per centimeter
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
V-J	Victory Over Japan
VOCs	volatile organic compound

1.0 INTRODUCTION

The former Plum Brook Ordnance Works (PBOW), an approximately 9,000 acre site located in Sandusky, Ohio, was used as an explosives manufacturing facility during World War II. The site is now owned by the National Aeronautics and Space Administration (NASA) and is operated as the NASA Lewis Research Center, Plum Brook Station (PBS). The site location is illustrated on Figure 1-1. Under provisions of the Department of Defense (DoD) Defense Environmental Restoration Program - Formerly Used Defense Sites, the U.S. Army Corps of Engineers (USACE), Nashville District (CEORN) conducted a Site Investigation of the three explosives manufacturing areas, TNT Area A, B, and C, at the former PBOW.

1.1 SITE BACKGROUND

1.1.1 Site Location

The PBS is a 6,453.5-acre research facility located in Erie County, Ohio 4.7 miles south of Sandusky and 59 miles west of Cleveland. Although primarily in Perkins (T6N, R23W) and Oxford (T5N, R23W) Townships, the eastern edge of PBS extends into Huron and Milan Townships. The site is bounded on the north by Bogart Road, on the south by Mason Road, on the east by U.S. Highway 250, and on the west by County Road 43. State Route 4 is also located to the west. The PBS is served internally by a 62.5-mile paved road system and a currently unused 15.7-mile rail system.

The geographic coordinates for the extreme boundaries of PBS are:

Northern Boundary Latitude: 41° 23′ 39"
Southern Boundary Latitude: 41° 20′ 04"
Eastern Boundary Longitude: 82° 38′ 39"
Western Boundary Longitude: 82° 43′ 12"

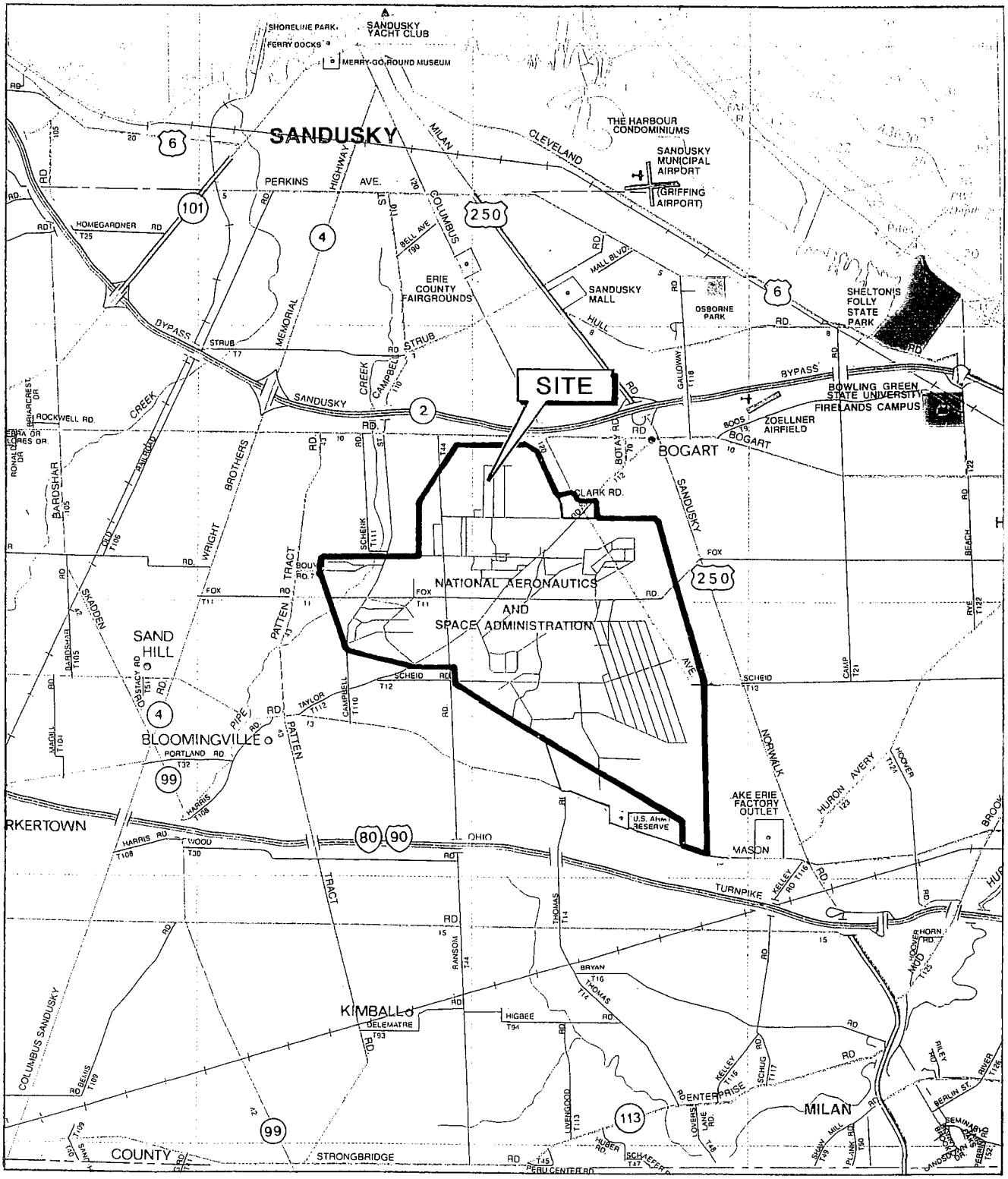

Figure 1-1

SITE LOCATION MAP

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE

1.1.2 Site History

The original PBOW site consisted of 9,071.06 acres of primarily agricultural land which were acquired by DoD for construction of an explosives manufacturing plant. From 1941 to 1945, the Trojan Powder Company manufactured trinitrotoluene (TNT), dinitrotoluene (DNT), and pentolite at the PBOW. Production of explosives ceased 2 weeks after Victory Over Japan (V-J) Day. During the 4-year operating period, over one billion pounds of explosives were manufactured.

After manufacturing activities ceased in 1945, the U.S. Army conducted decontamination and decommissioning of many of the structures used to manufacture ordnance. Decontamination of TNT, acid, and pentolite manufacturing lines was performed until the end of 1945. Typical decontamination procedures consisted of moving all structures, equipment, and manufacturing debris to a burning ground, where everything was burned. In their 1994 Site Inspection Report, MK Ferguson estimated that 65 percent of the decontamination of the PBOW was completed by the end of 1945 (MK Ferguson, 1994).

The magazine area of the PBOW was renamed the Plum Brook Depot and was used for ammunition storage. Otherwise, virtually the entire site was mothballed from 1946 to 1954 when the Plum Brook Reactor Facility (PBRF) was constructed on a 500 acre parcel in the northern part of the site. NASA acquired the entire site on March 15, 1963. Many of the remaining original structures from the PBOW were removed by NASA soon after it acquired the property.

NASA uses the site to conduct space research as a satellite operation of the NASA Lewis Research Center in Cleveland, Ohio. Throughout the 1960's and early 1970's a variety of test and research facilities were constructed and operated. NASA also operated the PBRF from 1963 to 1973. In 1974, PBS was placed in standby condition.

On April 18, 1978, NASA declared 2,152.15 acres of land excess. Of this excess, 46.023 acres were conveyed to the Perkins Board of Education on June 2, 1978. This area is used as a bus transportation center. The General Services Administration

retained the remaining acreage and currently has a use agreement with the Ohio National Guard for 604 acres of the land. In 1988, PBS began to emerge from standby status and started utilizing several of the research and test facilities again.

There are approximately 106 permanent structures and 99 munitions bunkers at the site, including a variety of structures that were a part of the original PBOW. Utilities are provided from off site, while sanitary waste discharge is processed on site. Ohio Edison Company provides the electrical power and the City of Sandusky provides the potable water supply. A PBS-owned water intake at Lake Erie supplies water for cooling, testing, and fire protection. PBS has five sanitary waste treatment systems, three of which are currently operating. The largest is a 110,000 gallon per day, high rate, trickling-filter, secondary treatment plant located on Taylor Road.

1.1.3 Environmental Investigation History

Hazardous waste disposal practices during the period of explosives manufacturing and DoD site control are unknown. Explosives manufacturing and/or handling at the site resulted in the operation of holding ponds ("red water ponds") for process waste water. Typical red water contains residues of the explosives manufacturing process and is acidic in nature. Out-of-specification explosives may have been burned or discarded on the site. Possible effects of these materials on soil, groundwater, and surface water at the site are unknown. Some of the remaining original structures (e.g., the power plants) and site features (e.g., the red water ponds) have not been remediated (USACE, 1994).

A number of environmental investigations have been conducted at the PBOW. In 1989, IT Corporation (IT) performed a limited investigation of areas of potential concern to the DoD. The field investigation activities included: collection of soil, surface water, sediment, and groundwater samples for geotechnical or chemical analysis and performance of one hydraulic conductivity test. MK Ferguson performed a preliminary sitewide environmental investigation for NASA in 1993 (report date 1994). Additional investigations have been performed by NASA (e.g., investigation

of underground storage tanks) and other interested parties (the U.S Army Reserve conducted a limited investigation of the West Area Red Water Ponds).

Three additional environmental investigations have been performed at the PBS. Science Applications International Corporation (SAIC) completed a Preliminary Assessment of the PBS in 1991. Also in 1991, Ebasco Environmental performed an assessment of underground storage tanks. H^{+}GCL characterized the Snake Road Burn Ground and the adjacent burn grounds used by NASA (referred to as "Disposal Area Three") in 1992.

1.2 PROJECT OBJECTIVES

Three TNT manufacturing areas, designated Areas A, B, and C, were constructed at the PBOW. Minimal assessment of these three TNT manufacturing areas has been included in environmental investigations performed at the PBOW. However, based on the limited amount of investigation that has been performed, the former TNT manufacturing areas are expected to be contaminated with nitroaromatics (explosives residues) and metals (lead is an indicator metal for nitroaromatics contamination) (USACE, 1994).

Nitroaromatics could be present in the site soils as a direct result of manufacturing and disposal activities that occurred while the plant was in operation. Explosives residues in the soil could have migrated into the underlying groundwater. Possible human exposure to contamination could result through inhalation, ingestion, or absorption of either contaminated soil or groundwater. No surface water bodies are present within the boundaries of the former TNT manufacturing areas, precluding possible exposure to contamination from surface water in the immediate vicinity of the former manufacturing areas. However, contamination could have migrated from the TNT areas via movement of water through a series of ditches that were part of the process waste water disposal system at PBOW.

The objective of the TNT Areas Site Investigation was to confirm the presence of the suspected contamination in either or both the soil or the groundwater within the

boundaries of the former TNT areas, and to evaluate whether additional investigation of either of these media in and around the former TNT manufacturing areas is warranted. To accomplish this objective, the Site Investigation involved sampling and laboratory analysis of potentially-impacted soil and groundwater for the types of contamination most likely to be present, explosives residues and metals.

1.3 SCOPE OF WORK

The Site Investigation of the TNT areas was performed as part of the Statement of Work for Delivery Order 0020 of Dames & Moore's Indefinite Delivery Order Contract DACA62-92-D-0015 with CEORN. This Statement of Work also included a Sitewide Groundwater Investigation (reported separately) and a Focused Remedial Investigation of the Red Water Ponds (reported separately). The field work for all three investigations was performed concurrently. The primary tasks to be performed for the TNT Areas Site Investigation included:

- Installation of shallow soil borings and collection of soil samples to assess the potential for soil contamination;
- Installation of shallow background soil borings and collection of soil samples to establish background soil quality conditions;
- Installation of shallow groundwater monitoring wells completed in the unconsolidated overburden materials and assessment of the groundwater quality in the overburden hydrostratigraphic unit;
- Installation of deep groundwater monitoring wells completed in the consolidated bedrock and evaluation of baseline groundwater quality in the bedrock hydrostratigraphic unit;
- Assessment of groundwater flow conditions in the overburden and bedrock hydrostratigraphic units; and
- Preparation of the Site Investigation Report presenting the results of the investigation.

The original Statement of Work included in Delivery Order 0020 was modified by mutual agreement between Dames & Moore and CEORN at meetings conducted at the PBS on August 29 to 31, 1994 and on September 19 through 22, 1994. The

modifications, generally changes in the sampling locations based on review of historical documents and access limitations identified when sample locations were staked in the field, were incorporated into the Final Sampling and Analysis Plan (Dames & Moore, 1994).

Additional modifications were made during the course of the field investigation. The modifications that related to the Site Investigation of the TNT areas included:

- Deletion of the overburden groundwater monitoring well at TNT Area B due to the shallow depth to bedrock;
- Deletion of the bedrock groundwater monitoring well at TNT Area B due to access limitations;
- Addition of an eighth background soil boring (when shallow bedrock was encountered before the target depth of 5 feet was reached) in two of the seven planned background soil borings;
- Addition of analysis of nitrates for all groundwater samples;
- Addition of two ditch samples in TNT Area A;
- Relocation of some sample points and modification of the planned sampling intervals and sample collection methods in all three TNT areas to avoid buried utilities, underground structures such as drain pipes, and shallow bedrock; and
- Deletion of laboratory analysis for samples from two dry overburden wells at TNT Area C.

All modifications to the field investigation were approved by representatives of CEORN during the course of the field work.

1.4 REPORT ORGANIZATION

The Site Investigation Report is organized in seven sections preceded by an Executive Summary.

This section, Section 1.0, presents the project background, the Site Investigation objectives, the Scope of Work, and the report organization.

Section 2.0 describes the PBOW environmental setting.

Section 3.0 discusses the history of the TNT manufacturing areas at the PBOW.

Section 4.0 outlines the investigation methods and activities.

Section 5.0 describes the Soils Investigation.

Section 6.0 discusses the Groundwater Investigation.

Section 7.0 provides conclusions.

References are provided after Section 7.0. The tables and figures are included in the text after the page on which they are first mentioned.

Ten appendices are included in this report.

Appendix A includes a copy of the NASA Drilling and Excavation Permit.

Appendix B includes the Boring Logs for the soil borings.

Appendix C provides the Boring Logs for the overburden and bedrock groundwater monitoring wells.

Appendix D contains the Monitoring Well Construction Diagrams.

Appendix E provides the sieve analysis results.

Appendix F contains the well development documentation.

Appendix G includes the well survey documentation.

Appendix H provides the Groundwater Sampling Records.

Appendix I provides Dames & Moore's Data Quality Assessment of the analytical laboratory data.

Appendix J provides the laboratory reports.

2.0 ENVIRONMENTAL SETTING

This section describes the environmental setting at PBS.

2.1 PHYSIOGRAPHY AND TOPOGRAPHY

The PBS is located within the Eastern Lake section of the Central Lowland Province near the southwestern shore of Lake Erie (U.S. Department of Agriculture, Soil Conservation Service [SCS], 1971). The region is characterized by lake plains, outwash plains, and till plains with occasional small hills produced during the retreat of the Wisconsin ice sheet. Approximately two-thirds of Erie County was once covered by a glacial lake that produced features such as beach ridges and wave-cut cliffs.

The area was originally a flat lake bottom resulting from glacial melt waters. Across PBS, the topography is relatively flat with a gentle NNE slope towards Lake Erie. Elevations at the site range from 675 feet above mean sea level (msl) at the southwest edge of the site to 625 feet msl in the northern portion of the property at Bogart Road (U.S. Geological Survey [USGS] Topographic Quadrangles Sandusky and Kimball, Ohio; 1969). The land surface has an average slope of less than 1 percent with steeper areas having approximately 2 percent slope.

2.2 LAND USE

Prior to acquisition of the site for construction of the PBOW, the area was largely agricultural. During construction of the PBOW, most of the forested areas were cleared. Today, second generation forests have returned to large portions of the site that are not used by NASA. Other undeveloped areas of the site are maintained in open fields. The surrounding area is mostly agricultural and residential.

2.3 CLIMATE

The climate for the Sandusky area is continental, but strongly influenced by Lake Erie. Predominately westerly winds parallel the shoreline of Lake Erie. In a 1956 study by the National Advisory Council on Aeronautics, the wind direction at PBS was from the southwest approximately 55 percent of the time throughout the year (SAIC, 1991). The frequency of northerly and northeasterly winds increases during the spring and summer.

The average annual precipitation for the city of Sandusky from 1961 to 1990 is 34.05 inches (Midwestern Climate Center, 1997). The mean monthly precipitation at the U.S. Weather Bureau Station for Sandusky for that 30 year period ranged from a low of 1.65 inches for February to a high of 3.70 inches for July. The monthly average precipitation for all months for the period 1961 to 1990 is provided on Table 2-1. This table also lists the extreme total high and low monthly precipitation for the period 1936 to 1996 and the year the extreme occurred. Finally, Table 2-1 lists the mean snowfall for the period 1961 to 1990.

Average annual temperatures for Sandusky for the 30 year period 1961 to 1990 ranged from 32.2° F in January to 82.3° F in August. The average this period was 32.2° F. Summers are moderately warm and humid, with temperatures occasionally exceeding 90° F. The monthly average maximum, minimum, and mean temperatures for all months for the period 1961 to 1990 are provided on Table 2-2. This table also lists the extreme mean high and low monthly temperatures for the period 1936 to 1996 and the year the extreme occurred. Winters are cold and cloudy, with sub-zero temperatures an average of 5 days per winter. The temperature usually first falls to freezing in October and the last freezing temperature normally occurs in April. Weather changes often occur every few days as fronts pass through the region.

TABLE 2-1

PRECIPITATION DATA FOR SANDUSKY, OHIO

Month	Mean (inches)	Extreme High (inches)	Year of Extreme High	Extreme Low (inches)	Year of Extreme Low	Mean Snowfall (inches)
January	1.73	6.58	1937	0.19	1961	8.0
February	1.65	4.53	1950	0.02	1987	7.0
March	2.60	5.44	1985	0.74	1958	3.6
April	2.95	7.19	1961	0.75	1946	0.6
May	3.44	9.04	1943	0.70	1988	0.0
June	3.85	12.51	1937	0.68	1988	0.0
July	3.70	12.60	1966	0.80	1944	0.0
August	3.41	9.93	1975	0.40	1996	0.0
September	3.12	7.72	1950	0.91	1963	0.0
October	2.18	4.91	1954	0.03	1963	0.0
November	2.80	6.53	1982	0.23	1976	0.3
December	2.62	6.44	1990	0.65	1943	6.1
Annual	34.05	50.50	1950	18.29	1963	24.8

Source: Midwestern Climate Service, 1997

TABLE 2-2

TEMPERATURE DATA FOR SANDUSKY, OHIO

Month	Average Monthly Temperature			Mean Extreme High Temperature (°F)	Year of Extreme High	Mean Extreme Low Temperature (°F)	Year of Extreme Low
	Maximum (°F)	Minimum (°F)	Mean (°F)				
January	32.2	17.5	24.8	37.2	1950	11.9	1977
February	34.3	19.2	26.7	37.1	1954	14.9	1978
March	44.4	28.8	36.7	49.2	1945	26.7	1960
April	56.6	39.3	48.0	56.5	1955	42.1	1975
May	68.1	50.5	59.3	66.5	1962	53.8	1967
June	78.0	60.1	69.1	74.9	1949	64.1	1972
July	82.4	64.8	73.6	79.1	1949	70.7	1992
August	80.6	62.9	71.7	77.8	1947	67.3	1992
September	74.1	56.1	65.1	70.2	1961	59.9	1975
October	62.2	44.5	53.4	62.0	1947	47.6	1988
November	49.9	35.3	42.6	47.4	1975	34.9	1976
December	37.2	25.7	30.5	39.7	1982	17.2	1989
Annual	58.3	41.9	50.1	54.2	1949	45.6	1982

Source: Midwestern Climate Service, 1997

2.4 SOILS

Most of the soils of Erie County were formed from either glacial till or glacial melt-water deposits. The dominant soil material was deposited by glacial till, outwash, and lacustrine deposits. Glacial till is material laid down directly from glaciers with minimum water action. Typically, it consists of particles of different sizes, and many pebbles in glacial till have sharp corners, indicating that they have not been rounded or worked by water. Outwash materials were deposited by running water from melting glaciers. The size of the particles that make up the outwash material varies according to the speed of the water in which particles were carried. Outwash deposits generally consist of layers of particles of similar size, such as sand and gravel. Lacustrine deposits, material settled from still, ponded glacial melt water, contain only the finer particles such as very fine sand, silt, and clay because the coarser material dropped out as outwash. Other soils formed from more recent deposits of alluvium or the weathering of parent rock (SCS Soil Survey of Erie County, Ohio).

Within the PBS, the soil origins are listed as lacustrine (Erie Planning Commission Report on Land Capability, 1967). The glacial drift is less than 20 feet on average and bedrock is exposed in many places (Ohio Department of Natural Resources, Division of Geological Survey; Drift Thickness of Erie County, Ohio; Open File Map 209).

The General Soil Map of Erie County, Ohio (SCS, 1970) identified four soil associations at the PBS site: Arkport-Galen, Prout, Del Rey-Lenawee, and Lewisburg. The Arkport-Galen and Prout soil associations make up the majority of soils at PBS. The Arkport-Galen soils are present in the western, central, and northern portions of the site. The Prout soils occur in the southeastern portion of PBS. The Del Rey-Lenawee soils are listed for the extreme southeast corner of PBS and Lewisburg soils are listed for the southwestern edge of PBS.

The Arkport-Galen association is characterized by deep, nearly level to moderately sloping, well-drained to moderately-well-drained soils that have a subsoil of loamy fine sand and fine sand. The Arkport soils are gently to moderately sloping, and well drained, formed in fine sand deposited by wind and water at the edge of a glacial lake. The permeability of the Arkport soils is estimated to be approximately 12 inches/hour.

The Galen soils are mostly level and moderately well-drained, formed as small sandy deposits on outwash plains and deltas. Galen soils have a fine sand or sandy loam surface layers, a subsurface of fine sand which is underlain by silt or clay. Runoff is slow, permeability is rapid, and the available moisture capacity is low. The permeability of the Galen soils is estimated to be between 6 and 12 inches/hour. The Arkport-Galen association is made up of about 40 percent Arkport soils, 30 percent Galen soils, and 30 percent minor soils.

Prout soils are moderately-deep to deep, nearly level to gently sloping, somewhat poorly drained soils that have a subsoil of heavy silt loam to silty clay loam. Prout soils are commonly underlain by shale bedrock. They are somewhat poorly drained, with slow runoff and permeability. The permeability of the Prout soils is estimated to be between 0.2 and 0.6 inches/hour. Prout soils commonly occur in uplands such as the sides of stream valleys and shale outcrop ridges.

Del Rey-Lenawee soils generally lie on old lake beds and are deep, nearly level, somewhat poorly-drained to very poorly-drained soils that have a subsoil of silty clay to clay loam. The Lewisburg association are moderately deep to deep, nearly level in depressions, and are narrow strips along natural drainageways. Runoff is slow, and permeability is moderately slow.

The thickness of soils at PBS ranges from approximately 5 feet or less for most of the site to approximately 20 feet for the extreme northern portion of the site (Erie Planning Commission Report on Land Capability, 1967).

2.5 BEDROCK GEOLOGY

The bedrock formations of northwestern Ohio consist of Devonian and Silurian carbonates (limestones and dolomites) and clastics (sandstones and shales). The regional dip is to the southeast, with younger rocks outcropping to the east. The Silurian and Devonian formations unconformably overlie sedimentary sequences of Ordovician and Cambrian Age, which in turn unconformably overlie the Pre-Cambrian crystalline Grenville basement (Ohio Department of Natural Resources, Division of

Geology, Generalized Column of Bedrock Units in Ohio, 1990). A generalized stratigraphic section of the Silurian and Devonian strata which underlie the site was presented by SAIC in their Preliminary Assessment and is reproduced in Figure 2-1 of this report.

At PBS, four Devonian formations crop out beneath the glacial drift cover. From oldest to youngest, these formations are the Delaware Limestone, the Plum Brook Shale, the Prout Limestone, and the Huron Shale. The formations dip to the southeast with a regional dip angle of approximately 35 feet per mile (Campbell, 1955). Structurally, these formations are located on the eastern limb of the Findlay Arch (Campbell, 1955). Figure 2-2 shows the estimated outcrop areas of each of the four formations beneath the PBS site.

The Delaware Limestone conformably overlies the Columbus Limestone, and is approximately 75 feet thick. The contact between the two formations occurs to the northwest of PBS. The Delaware Limestone crops out beneath the extreme northwestern corner of PBS. It is described as a massive to thin-bedded brown to gray fossiliferous limestone and dolomite. According to the PBS Preliminary Assessment (SAIC, 1991), karst topography occurs selectively in some of the Silurian and Devonian carbonates in the northern and western sections of Erie County. Subsequently, cavernous porosity occurs in some areas of the underlying carbonates.

The Plum Brook Shale unconformably overlies the Delaware Limestone and crops out underneath most of the northwest portion of the site. It is approximately 35 feet thick, and is described as a blue, soft, fossiliferous shale containing thin layers of dark, hard, fossiliferous limestone.

The Prout Limestone is a 15 foot thick limestone which conformably overlies the Plum Brook Shale. The Prout Limestone crops out as a thin (1000 to 2000 foot wide) northeast striking band across the middle of PBS. It is described as a dark-gray to bluish-gray to blue, very hard, silicious, fossiliferous limestone or dolomitic mudstone.

The Huron Shale is the lower member of the Ohio Shale and crops out under much of the southern and eastern portions of PBS. It is described as a grayish-black, dense,

Age	Formation/Group	Depth to Top (ft)	Thickness (ft) a	Hydrologic Unit b	Rock Description
DEVONIAN	Ohio Shale	c	300	Zone 3	Shale : *black, thin-bedded with bituminous and carbonaceous material.*
	Prout Limestone/ Plum Brook Shale	Surface	210		Shale : *light grey, calcareous.*
	Delaware Limestone	40	50	Zone 1 and Zone 2	Limestone : *buff, earthy, foss. interbedded with brown crystalline dolomite.*
	Columbus Limestone	90	110		Limestone : *brown to grey, fine crystalline, foss. with tan to buff-grey, partly sandy dolomite at base.*
	Lucas Dolomite	200	70		Dolomite : *brown, crystalline, porous, chert.*
	Amherstburg Dolomite	270	20		Dolomite : *tan to grey, microcrystalline, sl. argillaceous.*
SILURIAN	Bass Island Dolomite	290	30		
	Salina	320	590'		Dolomite : *anhydrite and shale sequence. Interbedded and intercalated. Dolomite is tan to brown and mostly tight. Scattered shale laminae. Few scattered oil stains. Some dolomite is shaly. few massive beds of dolomite and anhydrite.*

a. Depth to formation, formation thickness, and lithology based on deep borehole located at N 288+68, E 155+54.

b. Refer to Figure 5. for areal distribution of Zones 1, 2, and 3.

c. The Ohio shale was not encountered in the deep borehole, it outcrops in the southeasternmost portion of Plum Brook Station.

Figure 2-1

GENERALIZED STRATIGRAPHIC SECTION OF SILURIAN AND DEVONIAN STRATA UNDERLYING PLUM BROOK STATION

Plum Brook Ordnance Works
Sandusky, Ohio

REFERENCE: Reproduced from SAIC Preliminary Assessment, 1991

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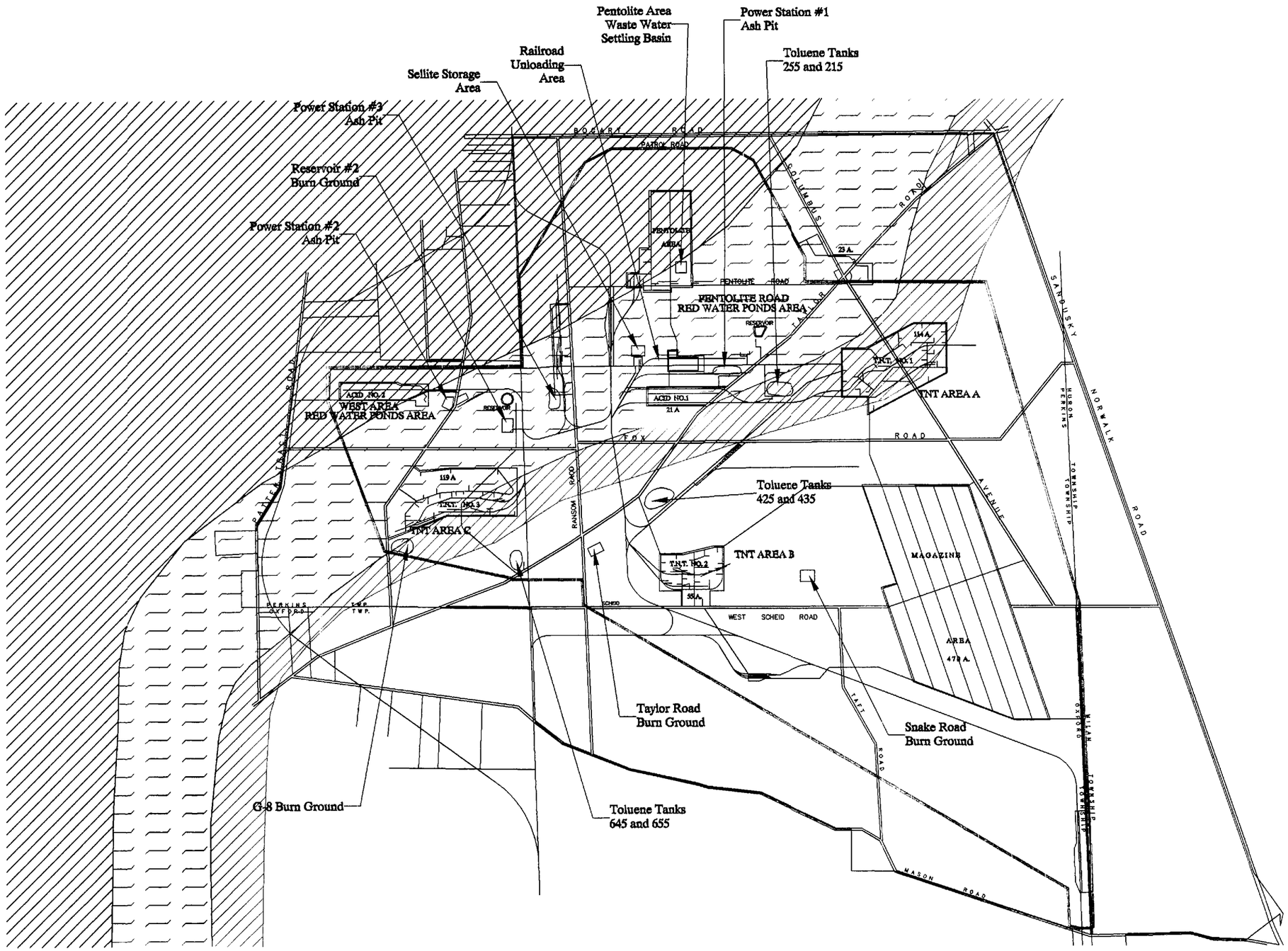

Scale: 1" = 2800'

- Ohio (Huron) Shale
- Prout Limestone
- Plum Brook Shale
- Delaware Limestone

Source: Geologic contact and bedrock unit information is from a portion of the "Bedrock Geology" map of the "Comprehensive Planning Study" included in the "Land Capability Report" by the Erie Planning Commission, 1967

Figure 2-2
Bedrock Units at NASA Plum Brook Station
Plum Brook Ordnance Works
Sandusky, Ohio

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Government Services Division; Atlanta, Georgia
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platy to fissile shale containing large pyrite/carbonate concretions (1 to 6 feet in diameter). It is up to 300 feet thick. The glacial drift cover over the Huron Shale is generally thinner than over the other formations, in many places the shale is within several feet of the surface.

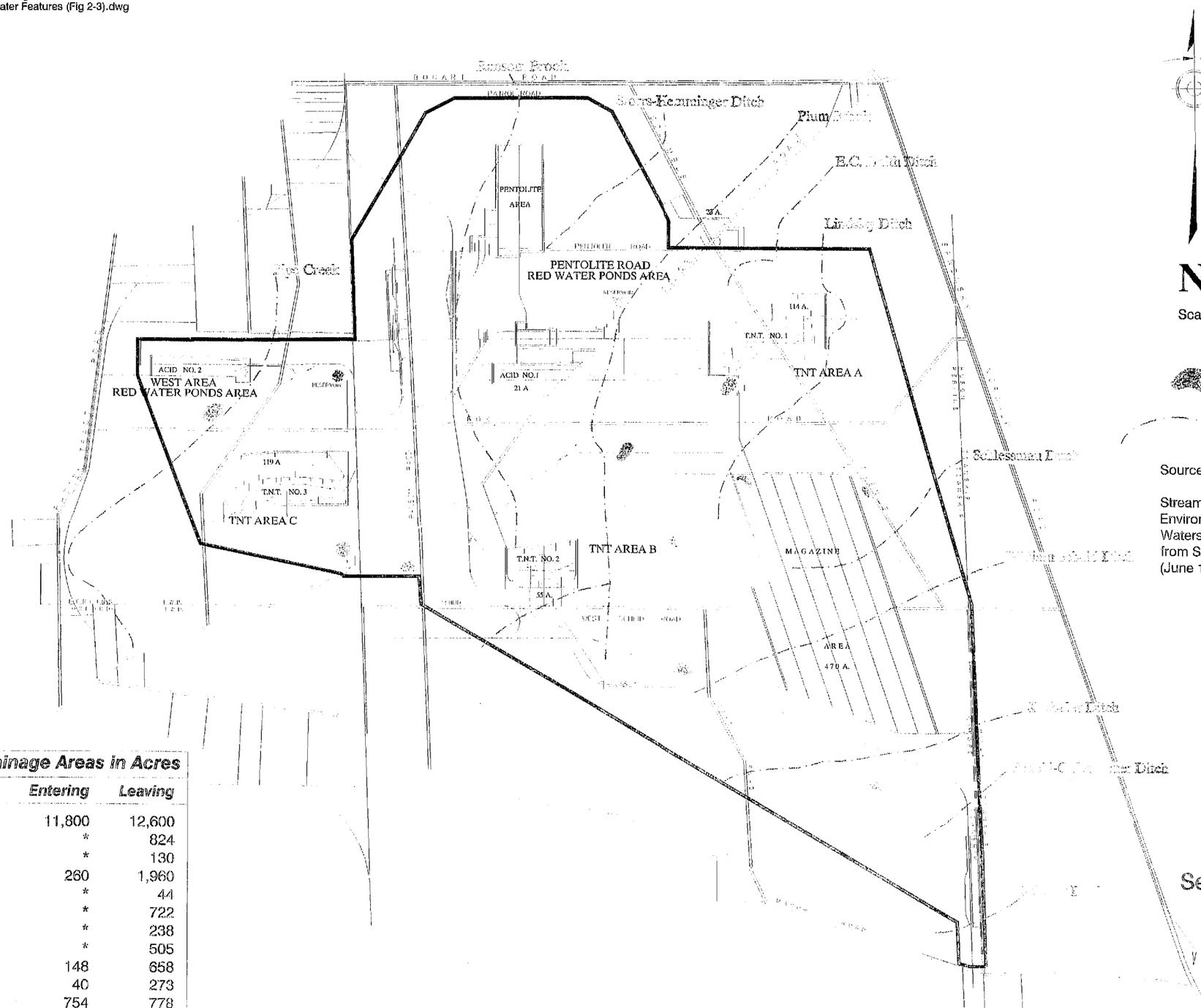
2.6 SURFACE WATER

PBS lies in the eastern region of the Pickeral Creek-Pipe Creek Basin, which, in turn, lies within the St. Lawrence River drainage basin (Ohio Department of Natural Resources Availability of Underground Water, Pickeral Creek -Pipe Creek Area, 1962 and Ground Water Pollution Potential of Erie County, Ohio; 1994). The Huron River Basin lies approximately 3.5 miles east of PBS. Sandusky Bay and Lake Erie are the largest surface water bodies within a 15 mile radius of PBS, approximately 4.5 miles north of the site.

Eleven streams pass through or originate within PBS and are a part of four drainage areas: (1) Sawmill Creek (southern PBS), (2) Plum Brook (central PBS), (3) Pipe Creek (western PBS) and (4) Storrs-Hemminger Ditch (USGS Topographic Quadrangles Sandusky and Kimball, Ohio; 1969 and SAIC, 1991). All streams flow north or northeasterly into Sandusky Bay. The locations of these streams and other selected surface water features are illustrated on Figure 2-3.

Although Sawmill Creek does not pass through PBS itself, several ditches cross the southern portion of PBS, flow easterly and feed into Sawmill Creek. The ditches, listed in order from north to south, are Schlessman Ditch, W. Scheid Ditch, Kuebelar Ditch, Scheid-Olemacher Ditch and Scherer Ditch. Lindsley and E.C. Smith Ditches flow north along the northern portion of PBS into Plum Brook just north of PBS. Ransom Ditch (northern PBS) flows northward into Pipe Creek. Additionally, ditches totalling 380,000 lineal feet are within PBS (SAIC, 1991). Numerous ponds lie within and around PBS. Seventeen isolated ponds and reservoirs and one former red water pond are located on PBS. The ponds are probably fed from shallow groundwater, and the pond water levels remain high even during dry months. (SAIC, 1991)

Government Services Division; Atlanta, Georgia
D:\COE-PLUM\January 1997\Surface Water Features (Fig 2-3).dwg



N

Scale: 1" = 2800'

Pond or Reservoir

Surface Water Drainage Feature

Sources:

Stream and ditch locations and names from NASA Environmental Resources Document (August 1990). Watershed areas and locations of ponds and reservoirs from SAIC Plum Brook Station Preliminary Assessment (June 1991).

Stream	Drainage Areas in Acres	
	Entering	Leaving
Pipe Creek	11,800	12,600
Ransom Brook	*	824
Storrs-Hemminger Ditch	*	130
Plum Brook	260	1,960
E.C. Smith Ditch	*	44
Lindsley Ditch	*	722
Schlessman Ditch	*	238
William Scheid Ditch	*	505
Kuebeler Ditch	148	658
Scheid-Ohlemacher Ditch	40	273
Scherer Ditch	754	778

* Stream originates within station boundaries

Figure 2-3
Selected Surface Water Features at Plum Brook Station

Plum Brook Ordnance Works
Sandusky, Ohio

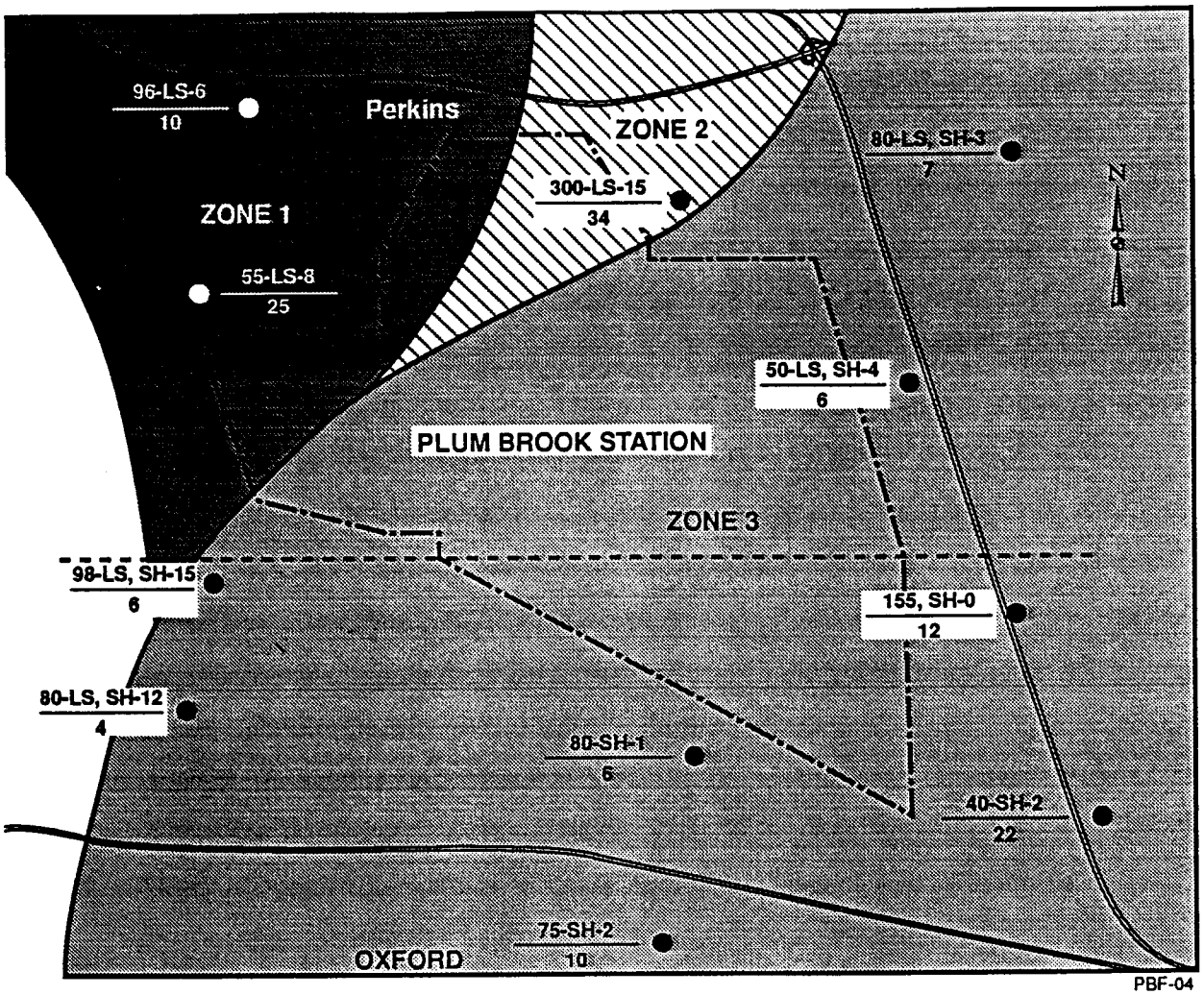
2.7 GROUNDWATER USE

Two aquifer systems are utilized for drinking water in the area surrounding PBS: a carbonate aquifer cropping out in the western portion of Erie County and a shale aquifer cropping out in the eastern portion. PBS covers the transition of the two aquifer systems. Both aquifer systems are overlain by a veneer (generally less than 20 feet) of glacial drift that is considered a poor source of ground water except in areas of sand and gravel lenses (Ground Water Pollution Potential of Erie County, Ohio; 1994).

The carbonate aquifer is subdivided into two zones by the Ohio Department of Natural Resources based on their areas of usage and yields. The shale aquifer and overlying discontinuous sand and gravel deposits are designated as zone three. Figure 2-4, reproduced from SAIC's Preliminary Assessment, illustrates the three zones. Zone one occurs in the north and northwestern portion of PBS and includes wells with yields of 100 to 500 gallons per minute (gpm) developed in cavernous limestone and dolomite, generally obtained from depths of around 100 feet. Zone two occurs in the north portion of PBS and includes wells with yields of 15 gpm or less developed in a deeper carbonate aquifer at an approximate depth of 300 feet. Zone three occurs over all of the eastern and southern portions of PBS and includes wells with yields that seldom exceed 3 gpm.

Yields from zone one are high in the karst terrain of western Erie County. From west to east in zone one yields decrease as evidenced by a well just west of PBS that has a yield of 8 gpm. Additionally, the carbonate aquifer beneath the shale aquifer will yield larger quantities of water than the shale aquifer, but the quality is considered likely to be poor due to high mineral content (Ohio Department of Natural Resources, Availability of Underground Water, Pickeral Creek - Pipe Creek Area, 1962).

According to SAIC (1991), 179 permitted private drinking water wells, listed at the Erie County Health Department, were within a 4-mile radius of PBS. Permits are not required for agricultural use.



LEGEND

ZONE 1

AREAS IN WHICH YIELDS OF 100 TO 500 GALLONS PER MINUTE MAY BE DEVELOPED.

Yields of more than 500 gallons per minute have been developed at depths of less than 200 feet in cavernous limestone and dolomite. Domestic supplies are generally obtained at depths of around 100 feet.

Hydrogen sulfide, in varying amounts, may be encountered in the bedrock.

ZONE 2

AREAS IN WHICH YIELDS OF 5 TO 25 GALLONS PER MINUTE MAY BE DEVELOPED.

Yields of 15, or less, gallons per minute are developed from wells drilled into the limestone. Hydrogen sulfide may be present in varying amounts.

ZONE 3

AREAS IN WHICH YIELDS SELDOM EXCEED 3 GALLONS PER MINUTE

Limited quantities of ground water are obtained from thin, discontinuous sand and gravel deposits interbedded in fine, sandy clay or from the underlying shale. Drilling deeper than 30 feet into the shale is not recommended. Occasional gas or salt noted in the eastern half of the county.

Larger yields may be obtained in western Huron and Oxford townships and southeastern Perkins Township. Wells may encounter water-bearing limestone beneath as much as 60 feet of impervious shale.

SCALE

1 0 1 mile

Depth (ft)

75-SH-2 → Water-bearing formation

10 → Yield (gpm)

Depth to bedrock (ft.)

● Existing Domestic Wells

Figure 2-4

REGIONAL WATER-BEARING ZONES IN THE BEDROCK AQUIFERS (Modified from Walker, 1986)

Plum Brook Ordnance Works
Sandusky, Ohio

REFERENCE: Reproduced from SAIC Preliminary Assessment, 1991

DAMES & MOORE

Residences to the north and east of PBS are served by city, county and rural water departments. Residences south and west of PBS are supplied by wells and cisterns (SAIC, 1991). According to SAIC (1991) the nearest recorded well is at 6115 Schenk Road; however a closer well was observed at 1810 Schenk Road. Additionally, two other wells are considered public drinking water supplies (used by 25 or more people for 60 days or more a year): Woussickett Golf Course clubhouse (6311 Mason Road) and Stanley's Tavern (4408 Mason Road), (SAIC, 1991).

Prior to the construction of a sewage treatment facility by Bellevue in 1971, the carbonate aquifer was contaminated by the injection of waste water through privately and municipally owned wells (Ground Water Pollution Potential of Erie County, Ohio, 1994). Samples of potable wells in the Bellevue-Castille area in 1961 contained alkyl benzene sulfonate (indicative of household detergents), ammonium nitrogen, as well as higher concentrations of nitrogen compounds than the adjacent limestone areas (Ohio Department of Natural Resources Availability of Underground Water, Pickeral Creek - Pipe Creek Area, 1962).

2.8 SURFACE WATER USAGE

Surface water intakes within 15 miles of PBS include Lake Erie, Huron River, and reservoirs fed by tributaries of the west branch of Huron River or the west branch itself.

The Erie County Health Department does not permit the use of surface water for private drinking water supply and no surface water within PBS is used as a drinking water supply (SAIC, 1991). It is unknown if surface waters are used for livestock in the local area. Crop irrigation is not common in Ohio (SAIC, 1991). Lake Erie and Sandusky Bay are a resource for recreational sports including fishing, swimming, and boating.

3.0 DESCRIPTION AND HISTORY OF TNT AREAS

While a number of explosives and related materials, including DNT and pentolite, were manufactured at the PBOW, TNT was the primary product of the facility. The PBOW used a batch manufacturing process to produce TNT. Sequential steps were performed in a series of separate buildings comprising a process line. A general description of the process is provided in Section 3.1. Section 3.2 describes the three TNT areas constructed at the PBOW. The decontamination performed at the TNT areas following shutdown of the PBOW are outlined in Section 3.3. Section 3.4 describes the current uses by NASA of the three areas. In Section 3.5, a brief description of the environmental fate of nitroaromatics is provided. Section 3.6 outlines the previous environmental investigations performed at the three TNT areas.

3.1 GENERAL TNT MANUFACTURING PROCESS

TNT is made by nitrating toluene in a three-step process (USATHAMA 1990). In this process, nitration is the substitution of a nitro group ($-NO_2$) for a hydrogen on the benzene ring of the toluene molecule. A mixture of three nitrotoluene (NT) isomers (2-NT, 3-NT, and 4-NT) and a layer of waste acid are formed during the first nitration. The second nitration produces six DNT isomers, with 2,4-DNT; 2,6-DNT; and 3,4-DNT being most abundant. Ninety five percent of the production in the third nitration step is 2,4,6-TNT, which is the desired product. To effect nitration, toluene is mixed with a solution of sulfur trioxide in sulfuric acid (oleum) and nitric acid, and heated. Water is formed by the nitration reaction, and the water combines with the sulfur trioxide to form sulfuric acid. The production of additional sulfuric acid makes the mixture of oleum and nitric acid a more effective nitrating agent than a combination of sulfuric and nitric acids. Each nitration step is progressively more difficult and stronger acid solutions are required in order to complete the reactions.

In the TNT manufacturing process, the acid mixture and the organic compounds flow in opposite directions. A fresh feed of oleum and nitric acid is used in the third step, and the acid waste is used, after fortification with nitric acid, in the second nitration. Acid from the second step is fortified and reused in the first nitration. The waste acid

from the first nitration is separated from the organic phase and denitrated using steam; the nitrogen oxide is recovered in water and heated to produce nitric acid. This acid is used to fortify the acid mixtures for the first and second nitration steps.

Each step in the nitrating process has some inherent amount of inefficiency. In each nitrating step, some of the isomers will not be converted to the next level (e.g., not all NT isomers are converted to DNT and not all DNT isomers are converted to TNT). Additionally, a small amount of NT is converted to other products during the process, nitrobenzenes being the most common. These unconverted isomers and non-nitrotoluene products are carried through the process as "impurities" until the final wash step.

Following the final nitration, the crude TNT is washed to remove acids, neutralized with soda ash, and crystallized by adding cold water. Sodium sulfite (sellite) is added to the crystalline TNT because it forms a water-soluble salt with the unwanted TNT isomers and impurities, which are removed in a water wash. The purified TNT is then melted, dried to remove water, and solidified in flake form.

The waste streams from normal production include spent sulfuric and nitric acids and red water from the purification process. The red water contains sodium salts of sulfite, sulfate, nitrite, nitrate, and sulfonates of the unwanted TNT isomers (2-NT, 3-NT, 4-NT, 2,4-DNT, 2,6-DNT, 3,4-DNT), plus other organic compounds such as 1,3,5-trinitrobenzene (TNB), 1,3-dinitrobenzene (DNB), and nitrobenzene (NB). Some of the other organics found in red water include trinitrobenzoic acid, trinitrobenzaldehyde, and trinitrobenzyl alcohol (USATHAMA 1990). The red water is disposed of in settling basins and disposal ponds where the suspended particulate matter is allowed to settle out of the water.

In addition to the waste water stream, unusual occurrences can create liquid waste from intermediate steps in the process, which could include 2-NT, 3-NT, 4-NT, 2,4-DNT, 2,6-DNT, and 3,4-DNT. For example, the contents of reaction vessels may be dumped when the process is thought to be out of control.

3.2 LOCATIONS AND DESCRIPTIONS OF THE PBOW TNT MANUFACTURING AREAS

The PBOW included three manufacturing areas designated TNT Areas A, B, and C. These areas are also identified in some historical documents as Areas 1, 2, and 3, respectively. Each manufacturing area consisted of widely scattered buildings of wood frame construction and asbestos and sheet metal covering. The locations of the three TNT manufacturing areas are illustrated on the aerial photograph reproduced as Figure 3-1. Site plans of TNT Areas A, B, and C are provided as Figures 3-2, 3-3, and 3-4, respectively.

TNT Area A, comprising approximately 114 acres, is located in the northeast portion of the site between Fox and Taylor Roads. The portion of Columbus Avenue which bisects what was TNT Area A was constructed by NASA and was not present when the PBOW was in operation. TNT Area B is located immediately north of West Scheid Road in the south central part of the site and consists of approximately 55 acres. TNT Area C, which comprises approximately 119 acres, is located on the western side of the site between Campbell Street and Ransom Road.

Twelve process lines were constructed at the PBOW, four in TNT Area A, three in TNT Area B, and five in TNT Area C. Each process line consisted of a Mono House in which the first toluene nitration was performed, a Bi-Tri-House in which the second and third nitrations were performed, a Fortifier House for acid recovery and fortification, and a Wash House which was used to wash the finished TNT. Process waste water from all process lines for each TNT area was directed to a common waste water disposal facility which generally consisted of a set of three settling tanks and a pump house. Additional structures in each area included Acid and Fume Recovery Buildings, Change Houses, Maintenance Buildings, Laboratories, and Nailing Houses. TNT Areas A and B each included a DNT Sweating and Graining House. Raw materials and intermediate products were moved between the various buildings by a series of overhead pipes and flumes. Process waste water was removed by a series of buried and/or overhead wooden flumes and pipes.

2000 1000 0 2000 4000 Feet

APPROXIMATE SCALE

BASE PHOTOGRAPH. October 19, 1950; Photo PW-3G-62; Site - Plum Brook Ordnance Works, Sandusky, Ohio

N

Figure 3-1

LOCATIONS OF TNT AREAS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE

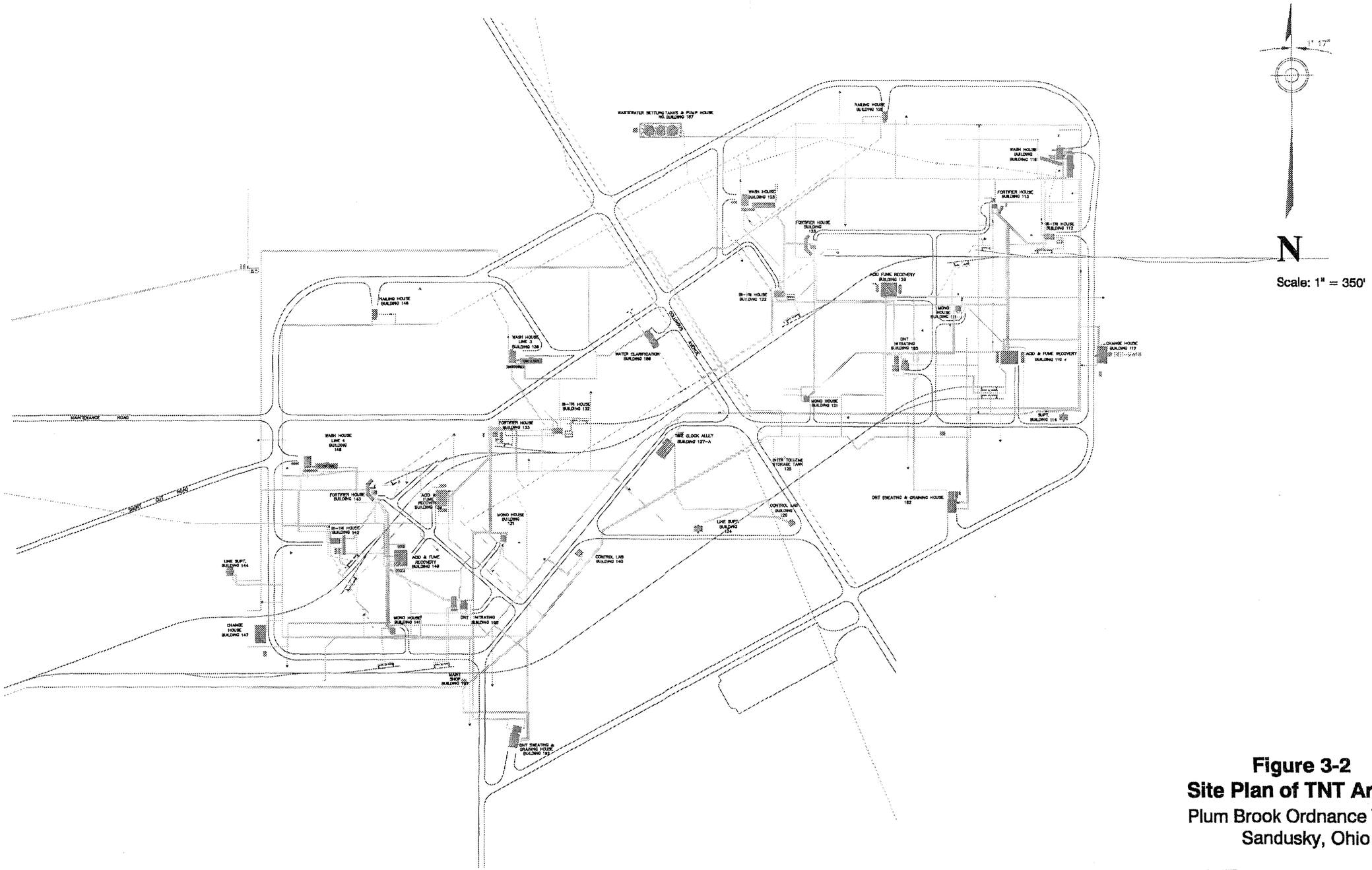
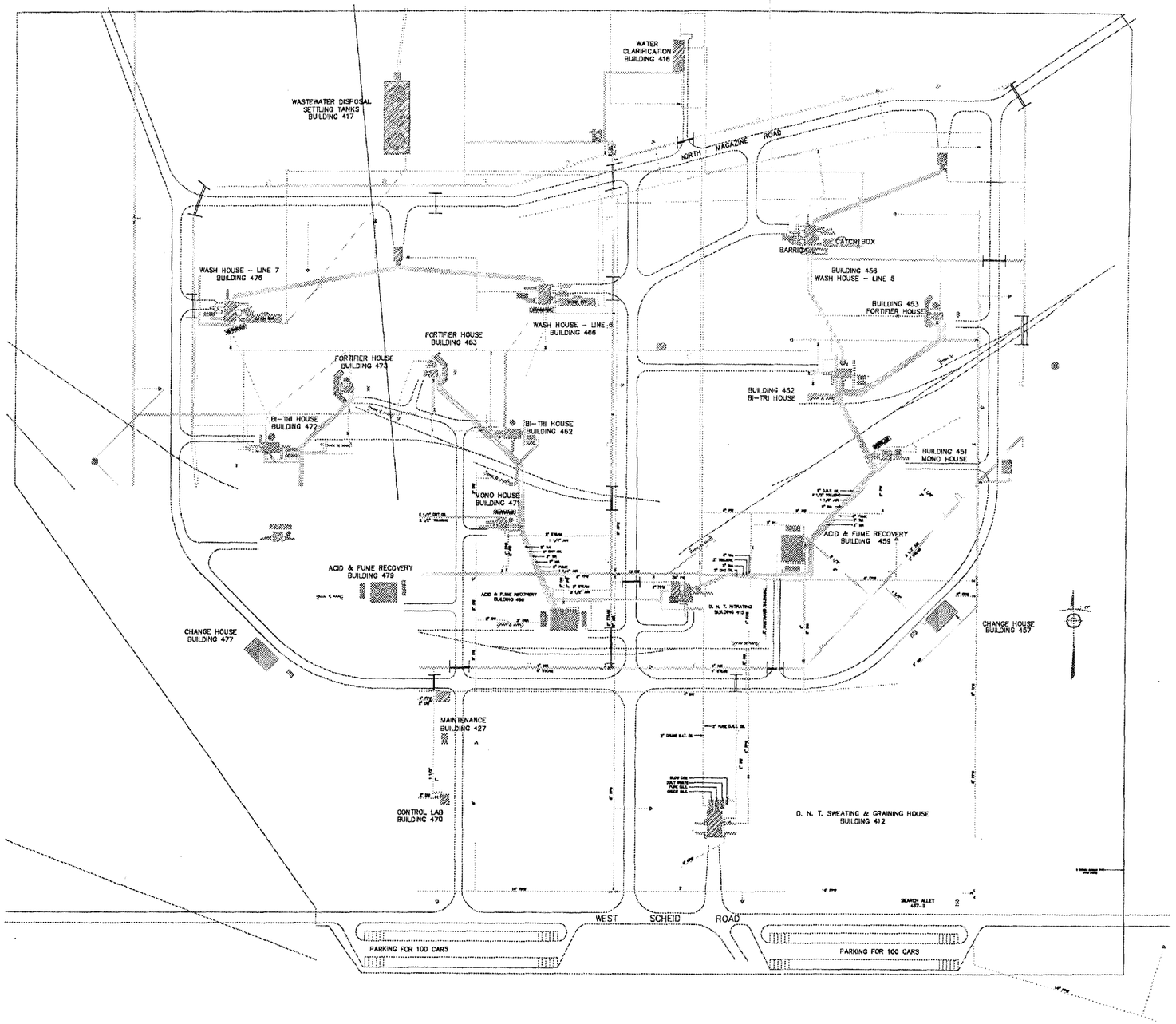
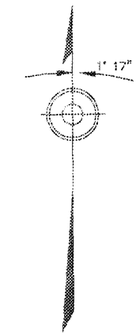


Figure 3-2
Site Plan of TNT Area A
Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

Government Services Division; Atlanta, Georgia
D:\COE-PLUM\January 1997\GWMETA.dwg





N

Scale: 1" = 250'

Figure 3-3
Site Plan of TNT Area B
Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
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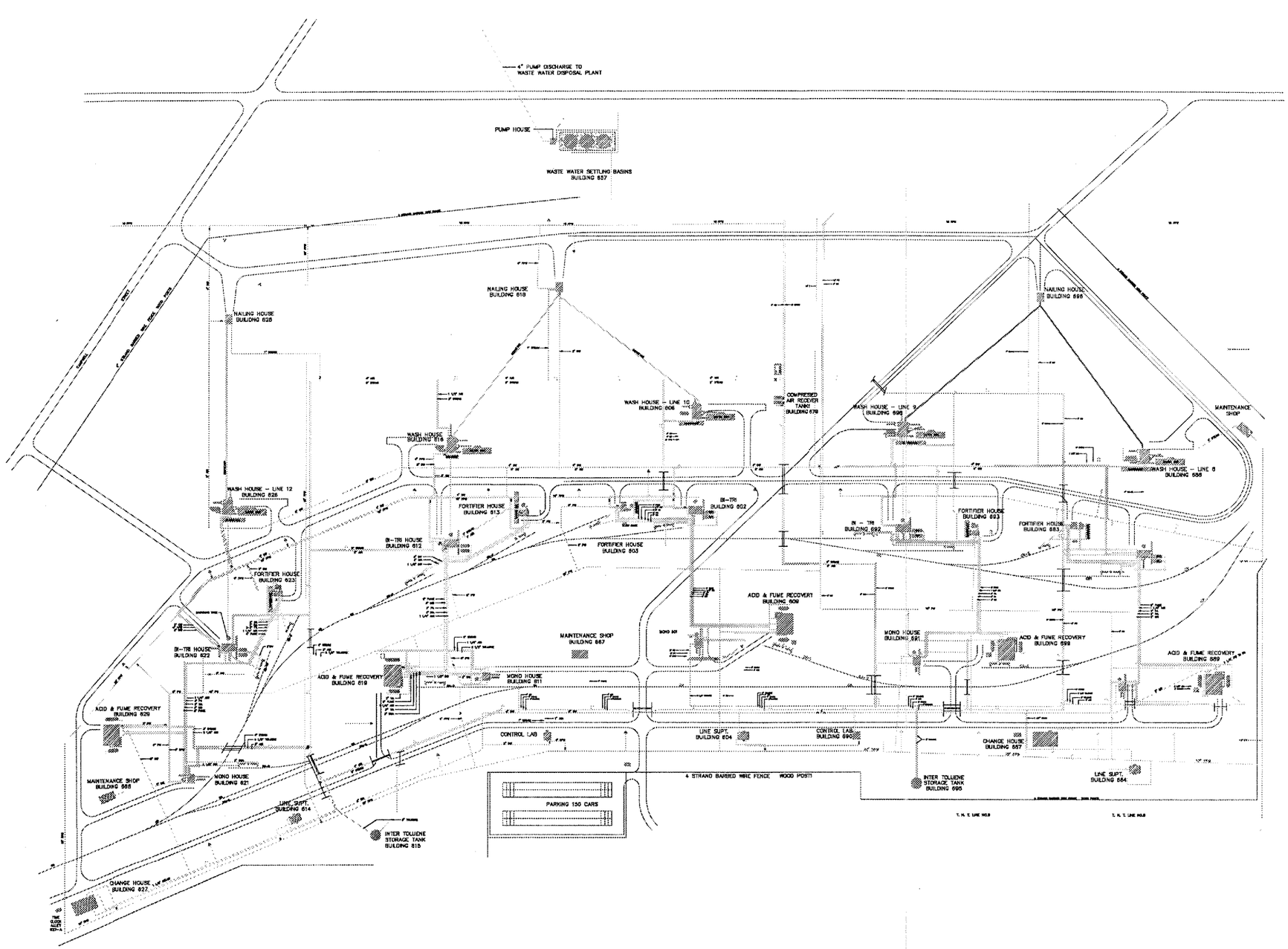
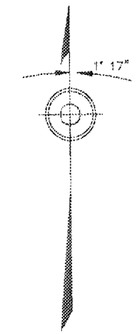
Government Services Division; Atlanta, Georgia
D:\COE-PLUM\January 1997\GWMETA.dwg





Scale: 1" = 300'

Figure 3-4
Site Plan of TNT Area C
Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

Government Services Division; Atlanta, Georgia
D:\COE-PLUM\January 1997\AreaC.dwg

3.3 PREVIOUS DECONTAMINATION OF TNT AREAS

A 1955 letter (Sanders to Commanding Officer, Ravenna Arsenal) indicates that the TNT areas were significantly contaminated at the surface and in the subsurface due to the TNT manufacturing process.

Significant decontamination was performed at TNT Area A in the summer of 1955. Sanders' 1955 letter documents this work.

> The ground around four wash houses in Area A -- Buildings 116, 126, 136, and 146 --, the ground around the Bi-Tri Houses -- Buildings 112, 122, 132, and 142 --, the Fortifier Buildings 113, 123, 133, and 143, sweating and graining building 182 and 192, DNT nitrating building 185 and 195, and nail houses 128 and 148 was taken up to a depth necessary to obtain samples of earth that showed no contamination according to the rapid method procedure as outline in Appendix 1 of our PIM RVA-1164 . . . Contaminated waste disposal sewers showing from 1 inch to 2 1/2 inch thickness or more deposit of TNT were removed as follows: Approximately 700 feet of 4 inch wooden waste disposal sewer, 600 feet of 6 inch wooden waste disposal sewer, 400 feet of 5 inch wooden waste disposal sewer and various random lengths of ceramic sewers were carefully dug up and removed to the Burning Ground where they were disposed of by burning. Many of the waste disposal sewers were not shown on the drawings but were discovered in the course of digging for known sewers. It appears in many instances that a disposal line was used for a while until it became plugged for one reason or another, after which it was abandoned and a new line laid in close proximity.
>
> In addition and beyond Area A approximately 1,050 feet of a wooden waste disposal sewer going due west from settling basin No. 187, pump house, was removed. The 6 inch wooden sewer disposal line outside of Area A lying in the direction of west southwest from pump house and extending several thousand feet remains intact.
>
> Catch basins at No. 187 were decontaminated to the extent of removing all wood and scrap lumber that was in the concrete basin. Approximately 6,000 pounds of TNT found on the concrete surface underneath the wood was removed to the Burning Ground and destroyed by burning.
>
> All in all, better than 16,000 pounds of TNT was removed from Area A.

According to Sanders' letter, the decontamination efforts at TNT Area A were the first portion of the work originally planned for the PBOW. The decontamination procedures utilized at TNT Area A were to have been implemented at TNT Areas B and C as well.

However, the Sanders letter states that the decontamination process was substantially modified in August 1955. Additional decontamination was to be limited to "surface contamination reasonably possible to detect by visual inspection." Underground flumes were to be left "as is."

The letter indicates that an exception was requested to this policy with regard to the "catch basins similar to No. 187" at TNT Areas B and C, "which, based on the one in Area A, obviously contained considerable quantities of TNT." The letter indicates that a plan for decontaminating these two catch basins at TNT Areas B and C was submitted but there is no documentation that the decontamination was authorized and implemented.

A letter from Alan D. Johnson, Director, Plum Brook Station, NASA, to Thrift G. Hanks of Aerojet-General Corporation, dated October 24, 1966 describes additional decontamination activities at the PBOW. This effort included the TNT Areas. Johnson's letter states that work was accomplished in five steps:

(1) The first phase of the decontamination consisted of inspecting the surface area above the drain tiles, flumes, etc. for contamination. Surface contamination was then removed.

(2) The second phase involved digging into the earth at intervals to spot check the tiles, flumes, etc. for contamination. Where contamination was found, tiles, flumes, etc., were removed in sections.

(3) Equipment which had been previously decontaminated and placed into three X (XXX) condition was removed and placed into storage or further decontaminated and placed in five X (XXXXX) condition for sale to outside users.

(4) Complete destruction of all building by fire followed. Removal of debris, concrete foundations, flashing of same, and flashing of complete earth area were then accomplished. Upon completion of the above, the entire area was rough graded.

(5) The fifth and final phase consisted of decontamination of sump basins and removal of concrete.

The letter does not specify the date this work was accomplished, but does indicate by inference that the work was performed in order that title to the property could be transferred to NASA. Such transfer was accomplished in 1963.

The available information on previous decontamination of the TNT areas indicates that significant subsurface decontamination has been performed at TNT Area A; decontamination at TNT Areas B and C has probably not been as thorough. The methods of decontamination utilized, including rough grading of the areas, has likely altered the original locations of contamination remaining in all three TNT areas. Significant subsurface contamination associated with underground sewer and flume lines is probably still present in all three TNT areas and in other portions of the site that were connected to the TNT areas by the underground flume and sewer lines. As indicated in Sanders' 1955 letter, underground lines were replaced during operation of the PBOW when they plugged and the locations of replacement lines were generally not documented.

3.4 CURRENT USES OF FORMER TNT MANUFACTURING AREAS

NASA constructed its administration building on the east side of Columbus Avenue in the central portion of former TNT Area A. As noted previously, significant previous remediation activities have been performed in TNT Area A. Very little above ground evidence of the former PBOW structures and features, other than abandoned railroad tracts and ditches, remains in the area once occupied by TNT Area A.

NASA's HTF test building was constructed on the outside northwest corner of what was TNT Area B. Some modifications to the northwestern portion of TNT Area B were made during the construction activities. However, significant above ground evidence of the PBOW facility remains in the form of roads, structural foundations, and remnants of utilities.

TNT Area C is located in the western portion of the PBS. NASA has no significant facilities in this part of the site although some of the existing structures in the general vicinity are used for storage. Most of TNT Area C is overgrown with trees and brush

which obscure evidence of the PBOW structures and features. However, the location of the waste water settling basins, many roads, and most ditches can be discerned in TNT Area C.

3.5 ENVIRONMENTAL FATE OF NITROAROMATICS

Nitroaromatics such as TNT and its related compounds are relatively stable in a dry aerobic environment. Particulate nitroaromatics become encrusted with surface oxidation and condensation products which inhibit environmental degradation. However, in an aqueous environment, nitroaromatics are readily transformed by biological action. 2,4-DNT is microbially mediated through a series of transformations to end products 4-Am-2-NT and 2-Am-4-NT. Dissolved TNT is biologically transformed (by plants) through a series of intermediate steps to 4-Am-2,6-DNT and 2-Am-4,6-DNT. Studies (Personal communication, Saunders, 1996) have indicated that frequently biotransformation of TNT is limited more by the rate at which TNT dissolves than by the rate at which plant mediated biotransformation occurs.

3.6 PREVIOUS ENVIRONMENTAL INVESTIGATIONS

The 1993 MK Ferguson investigation was the only environmental assessment at the PBS to include the TNT areas. MK Ferguson collected a limited number of samples of surface water, sediment, groundwater, and surface soils.

3.6.1 TNT Area A

MK Ferguson installed and sampled three monitoring wells in the vicinity of TNT Area A. No explosives residues were detected in 1993 in the groundwater at TNT Area A.

One surface water and one sediment sample were collected east of TNT Area A in Lindsley Ditch. No explosives residues were detected in these samples.

One soil sample was collected in the southwestern corner of TNT Area A. No explosives residues were detected.

3.6.2 TNT Area B

One sediment and one surface water sample were collected near the beginning of Ransom Brook north of TNT Area B. No explosives residues were detected in these samples.

MK Ferguson installed and sampled two monitoring wells near TNT Area B. One well was installed on the south side of TNT Area B in an area assumed to be upgradient with respect to the direction of groundwater flow. The other well was installed north of North Magazine Road on the downgradient side of TNT Area B near the waste water settling basins. No explosives residues were detected in the samples from these wells.

Two shallow soil samples were collected at TNT Area B. Toluene was detected in one sample at a concentration of 0.033 milligrams per kilogram (mg/Kg). The other soil sample was collected from the upper 2 feet of soil from the boring drilled for well MK-MW17 which was installed near the waste water settling basins. 2,4,6-TNT was detected at a concentration of 12 mg/Kg and 2,6-DNT was detected at a concentration of 0.06 mg/Kg.

3.6.3 TNT Area C

One surface water and one sediment sample were collected just downstream of the confluence of Pipe Creek and a small stream which traverses TNT Area C. No explosives residues were detected.

MK Ferguson did not install groundwater monitoring wells in the vicinity of TNT Area C.

Two surface soil samples were collected in the southeast corner of TNT Area C. One of the samples was collected in a location identified as "near a flume." Toluene was reported in both surface soil samples at concentrations above the Method Detection Limit, but below the Quantitation Limit. No explosives residues were reported.

4.0 INVESTIGATION PROCEDURES

The field procedures for the TNT Areas Site Investigation were performed in accordance with the Final Work Plan (Dames & Moore, 1994) and are summarized in this section of the Site Investigation Report.

Sampling activities were conducted between October 12 and December 17, 1994. CEORN representatives, including Captain Mike Riebel, Mr. Doug Webb, Mr. Tom Lerner, and Mr. Bob Hoyle, observed portions of the field investigation activities. Copies of the A/E Daily Quality Control Reports prepared for each field day were provided to CEORN during the course of the field work.

Environmental samples were analyzed by Analytical Services, Inc. (ASI) of Atlanta, Georgia. Quality Assurance samples were submitted to the USACE Ohio River Division (ORD) laboratory.

4.1 COORDINATION OF SITE ACCESS AND UTILITY CLEARANCE

Dames & Moore coordinated site access and utility clearance for field work activities with appropriate NASA personnel. A NASA "Digging and Excavation Permit" was prepared to identify proposed subsurface sampling locations to NASA for clearance at the beginning of the field work. A copy of the permit is provided in Appendix A. NASA personnel checked and cleared all sampling locations prior to initiation of subsurface activities. Sampling locations were adjusted as necessary to avoid underground utilities.

NASA personnel cleared brush and vegetation from overgrown areas of the site providing access for field sampling personnel and equipment. NASA also provided storage and staging facilities, decontamination areas, and a storage facility for investigation-derived waste. At TNT Area A, NASA personnel excavated a trench to facilitate collection of subsurface samples.

Dames & Moore and NASA coordinated the schedule for performing field activities to avoid conflicts among site uses and identify access limitations to specific areas during certain portions of the field work.

4.2 HEALTH AND SAFETY PROGRAM

The Final Site-Specific Safety and Health Plan (Dames & Moore, 1994) prepared for this project was followed during the field investigation of the PBOW. An initial site safety briefing/kick-off meeting was held prior to initiation of field work including all Dames & Moore field personnel; field personnel from the subcontracted drilling company, Belasco Drilling Company; and the on-site CEORN representatives. The briefing addressed pertinent sections of the site Health and Safety Plan, including the potential constituents of concern and their recognition, field procedures, emergency procedures, and the type of monitoring and personal protective equipment (PPE) to be used during the field work. CEORN personnel provided a review of the types of ordnance and ordnance-related items which could be encountered on the PBOW and the safety considerations related to the same. The participants also discussed how to recognize potential contamination and the actions to be followed in the event that contamination was suspected or encountered. An additional site safety briefing for all field team members was held each morning to address specific health and safety concerns and to review health and safety protocol.

No significant health and safety issues arose during the field activities. Level D PPE, including latex gloves, nitrile gloves, safety glasses, and work boots and clothes were utilized. A photoionization detector, HNu, was calibrated and zeroed to background each day and used during the soil sampling activities; readings against background were noted on the boring logs. The buddy system, whereby two personnel worked together at all times, was adhered to during all phases of the field work.

4.3 SOIL SAMPLING PROCEDURES

Bucket-type hand augers were used to sample the soils from the surface to 5 feet in depth. Five feet was the maximum depth of soil borings installed for the TNT Areas Site Investigation. Stainless steel trowels were used to sample surface soils. Stainless steel bowls and spoons were used to composite the soils collected. Background soil samples collected for analysis of volatile organic compounds (VOCs) were taken directly from the auger as it was removed from the ground, as described in the Final Sampling and Analysis Plan (Dames & Moore, 1994). However, for all remaining samples, the soils from the entire target depth interval was composited.

Each soil boring and sample was identified according to a pre-determined scheme. Each sample was first identified with the area of concern (e.g., TNTA for TNT Area A, etc.) and then with the letter "S" followed by the sample number to designate it as a soil sample. Depth intervals were also included in the sample name to more accurately describe the sample. To the extent possible, the sample depth intervals specified in the Final Sampling and Analysis Plan (Dames & Moore, 1994) were satisfied. Some variations from target depth intervals did occur, however, due to debris and/or characteristics of the sample location.

A Dames & Moore geologist or engineer completed a field log for each of the soil borings. Copies of the boring logs are included in Appendix B.

After sampling had been completed, all boreholes were backfilled to the original ground surface level with cement grout.

4.4 GROUNDWATER MONITORING WELL INSTALLATION AND SAMPLING PROCEDURES

Groundwater monitoring wells were installed in accordance with procedures outlined in the Final Monitoring Well Installation Plan (Dames & Moore, 1994) and in the USACE guidance document EM 1110-7-XX(FR) (Draft). Groundwater sampling procedures

described in the Final Sampling and Analysis Plan (Dames & Moore, 1994) were followed during the sample collection.

Six shallow groundwater monitoring wells were installed in the unconsolidated overburden materials, two at TNT Area A and four at TNT Area C. The purpose of the shallow wells was to evaluate groundwater flow and groundwater quality in the uppermost water-bearing unit. The shallow wells were constructed so that the screened interval intersected the water table.

Three deep groundwater monitoring wells were installed in the bedrock, two at TNT Area A and one at TNT Area C. The purpose of the bedrock wells was to evaluate whether nitroaromatics had migrated into the local bedrock aquifer and to establish baseline information on groundwater flow and groundwater quality in the bedrock aquifer.

The monitoring wells were installed under the technical observation of experienced Dames & Moore geologists. The Dames & Moore geologists coordinated the drilling operations, maintained a detailed boring log of each monitoring well, collected samples of subsurface materials and classified them in accordance with geologic classification systems, developed well construction diagrams, and maintained a field log of events and procedures. Drilling for the monitoring wells was performed by Belasco Drilling Company, a drilling company experienced in the construction of monitoring wells in north central Ohio.

4.4.1 Monitoring Well Installation in the Overburden

A D-50 diesel or a CME-45 all terrain vehicle (ATV) truck mounted rotary drill rig equipped with 4-1/4 inch inside diameter (ID) hollow-stem augers was used to drill boreholes for wells to be completed in the overburden stratigraphic unit. The boring for each overburden well was advanced from ground surface using hollow stem augering techniques and was extended to the top of rock as defined by auger refusal. Soil samples were collected continuously using a 2-inch outside diameter (OD) stainless steel split spoon sampler attached to drill rods. The drill rods were attached

to a 140-pound free fall hammer used to drive the split spoon sampler into the undisturbed soil in advance of the hollow stem augers.

Samples collected using the split spoon sampler were used to document and classify the soils underlying the site at each location. Soil samples were also scanned with an HNu for the presence of contamination. The boring logs prepared during the drilling are included in Appendix C.

After reaching terminating depth in each boring, a groundwater monitoring well was constructed in each borehole. The monitoring wells were constructed of 2-inch ID flush joint, threaded, schedule 40 polyvinyl chloride (PVC) riser pipe and No. 10 (0.010-inch) slot size PVC well screen.

A bottom cap was placed on the end of the screen which was then placed directly on the bottom of the borehole, with 2-inch riser pipe extending from the top of the screen to the ground surface. The annular space between the well screen and the inside wall of the boring was filled with a 20/30 silica sand pack, a material in which the grain size is such that the majority of the material should be retained on No. 20 and No. 30 slot sieves. The sand pack was extended above the top of the screen. A bentonite seal was placed above the sand pack to inhibit fluid movement vertically along the casing and to prevent grout migration into the sand pack from above. The remaining annular space from the top of the bentonite seal to near the ground surface was grouted with a cement grout.

The well was then completed above grade with a stand-up lockable protective steel casing cemented in the center of a concrete pad. Concrete-filled posts were installed at each corner of the concrete pad. The posts were painted orange for easy visibility. A plate which listed the well identification and other well specific information was adhered to the top of the lockable protective steel casing.

Monitoring well construction details are provided in Table 4-1, Overburden Monitoring Well Details. Well construction diagrams are included in Appendix D.

TABLE 4-1

OVERBURDEN MONITORING WELL DETAILS

Well Identification	Ground Surface Elevation (feet MSL)	TOC Elevation (feet MSL)	Total Depth of Well (feet BGS)	Screened Interval (feet BGS)	Top of Sand Pack (feet BGS)	Top of Bentonite Seal (feet BGS)
PB-TNTA-MW10	637.50	640.18	11.0	3.0 - 11.0	2.5	2.0
PB-TNTA-MW11	637.86	640.50	11.4	3.4 - 11.4	2.5	2.0
PB-TNTC-MW3	642.57	645.41	14.0	5.0 - 14.0	3.2	1.7
PB-TNTC-MW4	651.89	654.43	18.8	8.8 - 18.8	6.0	3.5
PB-TNTC-MW5	649.07	651.81	29.7	4.7 - 29.7	3.7	2.0
PB-TNTC-MW6	656.82	659.40	12.2	3.2 - 12.2	2.5	2.0

MSL - Mean Sea Level
BGS - Below Ground Surface
TOC - Top of Casing

Construction of each of the wells was discussed with the on-site CEORN representative during the field activities.

Soil samples from the screened interval in each well were collected for grain size analysis. Additionally, one sample of each type of filter pack material used in the construction of the monitoring wells was collected for grain size analysis. The samples were analyzed by Dames & Moore's geotechnical laboratory located in Salt Lake City, Utah, in accordance with American Society for Testing and Materials Test Procedure D422, "Particle Size Distribution in Soils." The laboratory reports and interpretation of the grain size analyses are included in Appendix E.

Overburden groundwater monitoring well DM-MW12 was to be installed in TNT Area B. During drilling, bedrock was encountered at a depth of approximately 5.5 feet. In accordance with the provisions of the project Scope of Work, a casing was installed in the borehole. This temporary well installation was dry from the time it was installed until the groundwater sampling was completed. The borehole was grouted to the surface at the conclusion of the field work.

All waste soil from the well boreholes was placed in 55-gallon drums.

4.4.2 Monitoring Well Installation in the Bedrock

A Diedrich D-120 truck-mounted rotary drill rig, NX and NQ core equipment, and a 6-inch roller cone were used for the bedrock well installation. The bedrock monitoring wells were advanced through the overburden to the top of rock using 12-inch inside diameter hollow stem augers, while continuously sampling with a split spoon sampler. After encountering the top of rock, the boring was advanced until competent rock was encountered using a 10-inch diameter roller cone bit. The boring logs prepared during the drilling are included in Appendix C.

In order to ensure the integrity of the bedrock well, at least 20 feet of 4-inch diameter PVC casing was installed in each bedrock well to seal off the unconsolidated overburden materials and incompetent bedrock near the bedrock surface. Once the

borehole had been cleaned of loose material, a 4-inch PVC riser casing was installed into the borehole and grouted in place. The casing was grouted to the surface.

The grout was allowed to cure for a minimum of 48 hours before continuing coring operations on the well. When the grout had cured, NQ coring equipment was placed through the 4-inch surface casing and a 3-inch diameter open hole was cored until the first water bearing zone was reached. Bedrock monitoring well construction details are presented on Table 4-2. Well construction diagrams are included in Appendix D.

The rock cores were stored in covered core boxes and labeled. The core within each complete box was photographed.

4.4.3 Monitoring Well Development

Following construction, the monitoring wells were developed by hand bailing water until the well water met the conditions set forth in the USACE guidance document EM 1110-7-XX(FR)(draft). Difficulty was encountered in achieving well water clarity in several of the wells after all other well development criteria were met. After concurrence with the on-site CEORN representative on when to stop well development, it was decided that, if after additional bailing was performed and no improvement in water quality was recognized, development could be terminated. After development was terminated, a water sample was collected from each well and photographed. A well development record was completed for each monitoring well. Copies of the well development records and photographs of the water collected from the wells after development are included in Appendix F.

Development water from each well was placed in 55-gallon drums which were moved to the drum storage area on Pentolite Road for later disposal.

TABLE 4-2

BEDROCK MONITORING WELL DETAILS

Well Identification	Ground Surface Elevation (feet MSL)	TOC Elevation (feet MSL)	Depth to Top of Rock (BGS feet)	Top of Rock Elevation (feet MSL)	Depth to Bottom 4" Casing (BGS)	Length of Open Rock Hole (feet)	Total Depth of Well (BGS feet)
PB-BED-MW13	645.81	648.27	40.7	605.1	46.0	29.5	75.5
PB-BED-MW17	627.34	629.97	37.3	590.0	45.0	19.4	64.4
PB-BED-MW18	648.83	651.50	30.8	618.0	51.0	24.4	75.4
PB-BED-MW20	673.57	676.33	21.5	652.1	35.0	14.5	49.5

MSL = Mean Sea Level
TOC = Top of Casing
BTOC = Below Top of Casing
BGS = Below Ground Surface

4.4.4 Survey of Well Locations

Coordinates and elevations were established for each of the monitoring wells installed by Dames & Moore in accordance with EM 1110-7-XX(FR)(draft). The top of casing and ground surface elevations are included in Tables 4-1 and 4-2. Additionally, locations of wells installed in the TNT areas by MK Ferguson used in this investigation were also surveyed. The top of casing and ground surface elevations for these wells are listed in Table 4-3. A tabulated list of the well location coordinates and elevations is included in Appendix G.

4.4.5 Monitoring Well Sampling

Groundwater samples were collected approximately 2 weeks after the development was completed to allow the groundwater to chemically stabilize from impacts caused by drilling and construction of the monitoring wells. The procedures outlined in the Final Sampling and Analysis Plan (Dames & Moore, 1994) were followed during the sampling of the monitoring wells.

Prior to sampling, the volume of water in each monitoring well was calculated utilizing water level measurements and well construction information. The monitoring wells were then purged of five volumes of water contained in the casing, screen and filter pack (or until dry) using a new dedicated bailer for each well. After purging, groundwater samples were collected from the approximate upper 5 feet in each well using each well's dedicated bailer.

Specific conductance, pH, and temperature were recorded in the field at the time of sampling. Groundwater sampling records were completed and are included in Appendix H.

TABLE 4-3

MK FERGUSON WELL ELEVATIONS

Well Identification	Ground Surface Elevation (feet MSL)	TOC Elevation (feet MSL)
MK-MW16	671.33	674.32
MK-MW17	660.97	664.64
MK-MW22	635.56	638.05
MK-MW23	636.95	639.47
MK-MW24	654.44	657.12

MSL - Mean Sea Level
TOC - Top of Casing

Wells MK-MW16, MK-MW17, MK-MW22, MK-MW23, and MK-MW24 were installed for the MK Ferguson Site Inspection performed in 1993.

4.5 SAMPLE PACKAGING, SHIPPING, AND DOCUMENTATION OF CUSTODY

Sample packaging, shipping and documentation procedures described in the Final Sampling and Analysis Plan (Dames & Moore, 1994) were followed during the field investigation of the TNT manufacturing areas. Samples were packaged and shipped to the analytical laboratories via Federal Express.

4.6 EQUIPMENT DECONTAMINATION

Equipment decontamination procedures described in the Final Sampling and Analysis Plan (Dames & Moore, 1994) and Final Monitoring Well Installation Plan (Dames & Moore, 1994) were followed during the field investigation of the TNT manufacturing areas.

All soil sampling equipment was composed of stainless steel, and was decontaminated before and after each use according to procedures outlined in the Final Sampling and Analysis Plan (Dames & Moore, 1994).

Prior to use at each location, sampling equipment was decontaminated following the procedures outlined in the Final Sampling and Analysis Plan (Dames & Moore, 1994). Latex gloves under nitrile gloves and safety glasses were worn during decontamination.

All drilling and sampling equipment used to install the groundwater monitoring wells was steam cleaned prior to drilling; between boring; and at the conclusion of the field work prior to taking the equipment from the PBOW. During drilling of each borehole, sampling equipment was decontaminated in accordance with procedures outlined in the Final Sampling and Analysis Plan (Dames & Moore, 1994).

Two main decontamination areas were established, one for cleaning sampling equipment and one for cleaning drilling equipment. The sampling equipment was decontaminated in NASA's Red Barn, a facility made available for field work support during the investigation. The drill rig decontamination area was set up near the parking lot at the Maintenance Building. Care was taken during decontamination to avoid

contaminating the surrounding area. Upon completion of the field activities, the decontamination materials were removed and placed in 55-gallon drums for later disposal.

4.7 HANDLING OF INVESTIGATION-DERIVED WASTES

Investigation-derived wastes were managed and handled in accordance with procedures described in the Final Sampling and Analysis Plan (Dames & Moore, 1994) and Final Monitoring Well Installation Plan (Dames & Moore, 1994).

Soil cuttings, rock cores, monitoring well development and purge water, and decontamination waste water were placed in separate 55-gallon drums which were labeled and stored on-site north of Pentolite Road, east of the intersection of Ransom Road and Pentolite Road.

4.8 ANALYTICAL LABORATORY ANALYSIS AND DATA EVALUATION

As a preface to the presentation of the results of the investigation, it is useful to describe the laboratory analytical methods and data evaluation, and discuss the limitations of the data presented herein. These are discussed in the following sections.

4.8.1 Laboratory Analysis

Soil samples and their associated equipment blank samples were analyzed for explosives residues concentrations using U.S. Environmental Protection Agency (EPA) Method 8330 and for concentrations of 14 metals (13 priority pollutant metals plus manganese) using methods outlined in the Final Sampling and Analysis Plan (Dames & Moore, 1994).

Background soil samples were analyzed for explosives residues, metals, VOCs, and semivolatile organic compounds (SVOCs).

Groundwater samples were analyzed for explosives residues, nitrates, and total and dissolved metals. Additionally, groundwater samples from the bedrock wells were analyzed for VOCs and SVOCs.

ASI, Dames & Moore's subcontracted analytical laboratory provided laboratory Quality Control (QC) documentation with the sample results. This documentation included the results of matrix spike and matrix spike duplicates analyses; the results of method blanks and laboratory control standards analyses; analyses of surrogates, calculations of percent recovery and precision of the above (as applicable); and inclusion of the extraction and analysis dates. A brief case narrative was included with each sample set to document methods used and any QC problems encountered.

4.8.2 Evaluation of Laboratory Data

4.8.2.1 Data Quality Assessment

Dames & Moore evaluated approximately 10 percent of the data collected during the field work. A combined data quality assessment was completed for samples collected for the Site Investigation of the TNT areas, the Focused Remedial Investigation of the Red Water Ponds areas, and the Sitewide Groundwater Investigation. Data sets which included samples from all media and all areas of the site were included in the review. The Data Quality Assessment was performed in accordance with guidance provided in the "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review" (EPA, 1993) and the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (EPA, 1994). The Data Quality Assessment is provided as Appendix I. The qualifiers applied to the data are listed on the laboratory reports provided in Appendix J, as described in the referenced report, should be acknowledged whenever reviewing the data or assessing the qualitative or quantitative reliability of the data.

4.8.2.2 Establishment of Practical Quantitation Limits for Groundwater Analysis

Groundwater samples for this project were analyzed using a Cold Regions Research and Engineering Laboratories (CRREL) modification of EPA Method 8330. The modified method was used to try to obtain the lowest possible detection limits for groundwater samples. Extremely low detection limits are necessary in some of the risk calculations which may eventually be performed for the site. Dames & Moore and ASI, in coordination with CEORN, established a Practical Quantitation Limit (PQL) of 5 micrograms per liter (μg/L) for use in interpreting the results for groundwater samples. The rationale for use of a PQL was prepared by ASI and is presented in Appendix J with the laboratory reports. Only sample results above the PQL are interpreted in this Sitewide Groundwater Investigation Report. However, the laboratory reports included in Appendix J list all results, including those below the PQL and above the method detection limit (MDL) which is referred to as Below Detection Limit (BDL) on the laboratory reports.

4.8.3 Groundwater Data Limitations

Several limitations were identified with respect to the laboratory data generated during this investigation. These limitations are discussed in the following sections.

4.8.3.1 Explosives

Dames & Moore collected a sample of the potable water from PBS at the conclusion of the field work on December 15, 1994. Water from this source was utilized during drilling of the bedrock wells during rock coring. Duplicate samples were submitted to the ORD laboratory and to ASI.

No explosives residues were detected in the sample analyzed by ORD. However, ASI detected 1,3,5-trinitrobenzene at a concentration of 13 μg/L; 4-Am-2-NT at a concentration of 1.6 μg/L; and 2-Am-DNT at a concentration of 0.4 μg/L. The PBS potable water supply does not originate on site and the presence of explosives residues

in the sample was suspect. Therefore, in order to confirm the results, a second sample was collected on February 13, 1995 and analyzed by ASI. Explosives were again detected. In the February 1995 sample, 1,3,5-TNB was detected at a concentration of 1.1 μg/L and 4-Am-DNT was detected at a concentration of 1.7 μg/L.

A third sample was collected on August 15, 1995. Four replicate samples were collected and analyzed by ASI, a private laboratory contracted by CEORN, the USACE Missouri River Division (MRD) laboratory, and the USACE Waterways Experiment Laboratory. No explosives residues were detected in any of the four replicate samples collected in August 1995. Therefore, it is reasonable to assume that explosives residues are not present in the potable water supply at PBS.

The reason explosives residues were detected by ASI in the first two samples is not known. Most of the concentrations are below the PQL and are considered estimated. However, the concentration of 13 μg/L 1,3,5-TNB in the December 1994 sample is well above the PQL. Personnel from the USACE MRD laboratory who reviewed the laboratory data considered the 1,3,5-TNB concentration a false positive. However, ASI considered that the method requirements for reporting the compound were technically satisfied. Users of the groundwater data are advised to interpret it with caution in the event false positives were detected in one or more of the groundwater samples. For purposes of this report all concentrations reported above the PQL were interpreted.

4.8.3.2 Metals

Groundwater monitoring wells installed for the TNT Areas Site Investigation, Red Water Ponds Focused Remedial Investigation, and Sitewide Groundwater Investigation were all sampled within a few days of each other in December 1994. Three groundwater equipment blanks were collected during the sampling, one from a bedrock monitoring well (BED-MW18) and two from overburden wells (WA-DM-MW2 and TNTA-DM-MW10). This provided an equipment blank-to-sample type ratio of at least 10 percent. Both filtered and unfiltered equipment blanks were submitted for metals analysis.

Two metals were detected in the equipment blanks. Zinc was detected in the unfiltered equipment blanks prepared during sampling of wells BED-MW18 and WA-DM-MW2. The concentrations were 28 μg/L and 37 μg/L, respectively. Zinc was also detected in the equipment blank prepared during collection of background soil samples. This may indicate that some of the zinc detected in the samples is related to the sampling procedures. However, because zinc was not consistently detected in the equipment blanks, all of the zinc detected in the samples cannot be attributed to collection procedures.

Antimony was detected in eight groundwater samples during the PBOW investigation. Seven of the eight times, it was reported in the filtered sample and not in the corresponding unfiltered sample. Antimony was also detected in the filtered drill water sample collected on December 15, 1994 at a concentration of 10 μg/L but not in the corresponding unfiltered sample. Finally, antimony was detected in two of the three equipment blank samples collected during the groundwater sampling. In both samples, it was detected in the filtered sample, but not in the unfiltered sample. The consistent presence of antimony only in filtered samples appears to indicate that it is related to the filtering process. The equipment blanks were prepared with distilled water which should have contained no metals.

5.0 SOILS INVESTIGATION

The primary source of contamination at the TNT areas is expected to be surface disposal of materials produced during the manufacturing process. These include the final TNT product, intermediate products such as DNTs and NTs, and impurities such as TNB and DNB. Additionally, if natural attenuation of these compounds is occurring, degradation products may be present in the soil.

Because the objective of the Site Investigation was to confirm the presence of nitroaromatics, samples from the TNT areas were collected from locations where nitroaromatics were likely to be present. These locations were selected based on historical information about operations at the PBOW and results of similar investigations at other TNT manufacturing facilities. Sample locations were also related, to the extent possible, to former building footprints and physical site features such as ditches that were part of the process waste water disposal system. However, translation of the sample locations from site plans to the field was problematic as the buildings are no longer present and many of the site features have been altered with the passage of time. As noted in Section 3.0, TNT Area C, in particular, is overgrown and few landmarks except roads remain.

Nitroaromatic compounds as a group are not particularly mobile in soils. While some vertical migration of contamination through the soil may have occurred, generally the most significant contamination is expected to be near the surface. Therefore, soil boring depths were limited to 5 feet, and many boring depths were less than 5 feet.

The Site Investigation included collection of 100 soil samples from the three TNT areas and 14 soil samples from background locations. Samples were analyzed for 14 nitroaromatic compounds representative of TNT, its intermediate products, and degradation products, and for concentrations of 14 metals, the 13 priority pollutant metals and manganese.

The investigation indicates that explosives residues are present in soils in each of the former TNT manufacturing areas.

- The greatest number of nitroaromatic compounds was detected in TNT Area B which was not remediated following closure of the PBOW. Thirteen of the 14 explosives residues analytes were detected in TNT Area B. Field conditions in TNT Area B were more conducive to accurate selection of sampling locations in the field than in either TNT Areas A or C. In TNT Area A nine of the 14 explosives residues were detected. In TNT Area C, 11 of 14 were detected.

- Nitroaromatics were reported at more boring locations (19 of 26 or 73 percent) in TNT Area B than in either TNT A (16 of 28 or 57 percent) or TNT Area C (six of 26 or 23 percent).

- 2,4,6-TNT was the most commonly detected explosives residue. It was present in 40 of the 100 soil samples. The highest concentrations were present in TNT Area B.

- 2,4-DNT, an intermediate product in TNT production, was the second most commonly detected nitroaromatic. It was present in 33 samples. 2,6-DNT, the other most common intermediate product of TNT production, was present in 24 samples. The highest concentrations of these two compounds were present in TNT Area B.

- 1,3-DNB, an impurity in TNT manufacturing and a potential degradation product of 1,3,5-TNB, was found only in samples that also contained 1,3,5-TNB. However, 1,3-DNB was detected less often (in six samples) than 1,3,5-TNB (in nine samples).

- 4-Am-DNT and 2-Am-DNT, end products of the microbially mediated biotransformation of TNT, were always found in samples which also contained 2,4,6-TNT.

- 4-Am-2-NT and 2-Am-4-NT, end products of plant biotransformation of 2,4-DNT, were always found in samples which also contained 2,4-DNT.

Sections 5.1, 5.2, and 5.3 below describe the sampling locations and discuss the results of the analysis of explosives residues in soils in the TNT Areas A, B, and C, respectively.

Fourteen background soil samples were collected from eight borings installed in areas of the site least likely to have been impacted by former DoD activities. Background borings were installed to depths of 4 to 5 feet. In order to establish baseline soil quality, background soil samples were analyzed for explosives residues, metals, VOCs and SVOCs. No explosives residues were detected in the background soil samples.

Background soil conditions for analytical parameters except metals are assessed in Section 5.4.

Soil samples were analyzed for concentrations of the 13 priority pollutant metals and manganese. Metals concentrations in the TNT areas were compared to background metals concentrations to evaluate whether a correlation existed between high levels of metals and the presence of explosives residues. Such a correlation was established for lead. Additionally, the statistical analysis showed that manganese levels in the soils in areas of the site used by the PBOW were significantly higher than background soil manganese levels. The metals analysis is provided in Section 5.5.

5.1 TNT AREA A

At TNT Area A, 36 soil samples were collected from 28 borings. Two borings were installed in a test pit excavated by NASA at the Wash House for TNT manufacturing line 4. Borings were installed at the Waste Water Settling Tanks and Pump House; the Wash House for manufacturing line 3; the Wash House, Bi-Tri House, Fortifier House, and Mono House for manufacturing line 4; ditches associated with the waste water disposal system; and the DNT Sweating & Graining House. The boring locations are illustrated on Figure 5-1.

Nine of the 14 explosives residues included in the analyte list were detected in TNT Area A. 2,4,6-TNT, the most commonly detected nitroaromatic, was present in a third (12 of 36) of the soil samples. The highest concentration of 2,4,6-TNT detected in TNT Area A was 580 mg/Kg at the Waste Water Settling Tanks and Pump House. 2,4-DNT and 2,6-DNT were each detected in slightly less than a third of the samples. All other nitroaromatics were detected in five or fewer samples. The concentrations of explosives residues reported for the TNT Area A soil samples are listed on Table 5-1 and are also provided on Figure 5-1.

TNTA-S32 Soil Boring Location

BED-MW17 Bedrock Groundwater Monitoring Well Location

MK-MW24 Overburden Groundwater Monitoring Well Location

Concentrations are in mg/kg

Scale: 1" = 400'

TNTA-S32-0.0/1.0	
Analyte	Concentration
2,4,6-TNT	3.2
2,4-DNT	0.3
4-Am-DNT	0.5

TNTA-S1-1.5/5.0	
Analyte	Concentration
2,4,6-TNT	580
1,3,5-TNB	2.5
2,4-DNT	4.8
2,6-DNT	5.6
4-Am-2-NT	0.3
3,4-DNT	0.7
4-Am-DNT	5.6
2-Am-DNT	7
1,3-DNB	0.4

TNTA-S1-0.0/1.5	
Analyte	Concentration
2,4,6-TNT	4.9
4-Am-DNT	1
2-Am-DNT	1.7

TNTA-S31-0.0/1.0	
Analyte	Concentration
2,4,6-TNT	0.9

TNTA-S5-2.5/3.5	
Analyte	Concentration
2,4,6-TNT	0.3
2-Am-DNT	0.7

TNTA-S16-0.0/2.0	
Analyte	Concentration
2,4,6-TNT	19
2,4-DNT	1.5
2,6-DNT	1.3

TNTA-S15-0.0/2.0	
Analyte	Concentration
2,4,6-TNT	53
2,4-DNT	0.5
2,6-DNT	0.8

TNTA-S17-0.0/2.0	
Analyte	Concentration
2,4,6-TNT	1.1
2,4-DNT	0.5

TNTA-S18-0.5/1.5	
Analyte	Concentration
2,4,6-TNT	0.5
2-Am-DNT	0.5

TNTA-S19-0.5/1.5	
Analyte	Concentration
2,4,6-TNT	0.3

TNTA-S20-0.5/1.5	
Analyte	Concentration
2,4,6-TNT	4.3
2,4-DNT	0.6
2,6-DNT	0.7
4-Am-DNT	0.7
2-Am-DNT	1.1

TNTA-S21-0.0/2.0	
Analyte	Concentration
2,4,6-TNT	0.3
2,4-DNT	0.6
2,6-DNT	0.7

TNTA-S22-0.0/2.0	
Analyte	Concentration
2,4-DNT	45
2,6-DNT	47

TNTA-S24-1.5/3.0	
Analyte	Concentration
2,4-DNT	0.3
3,4-DNT	0.6

TNTA-S23-0.0/2.0	
Analyte	Concentration
2,6-DNT	0.4

TNTA-S25-0.0/1.5	
Analyte	Concentration
2,4-DNT	2.7
2,6-DNT	0.4
4-Am-2-NT	0.4

TNTA-S26-0.0/1.5	
Analyte	Concentration
2,4-DNT	0.6
2,6-DNT	0.6
3,4-DNT	8.9

FIGURE 5-1
TNT AREA A SOIL BORING LOCATIONS AND EXPLOSIVES RESIDUES AND CONCENTRATIONS

Plum Brook Ordnance Works
Sandusky, Ohio

Dames & Moore, Inc.

FILENAME: H:\CAD\COE-PLUM\PLOT\SLEXPA.DWG

TABLE 5-1

EXPLOSIVES RESIDUES CONCENTRATIONS IN SOIL SAMPLES TNT AREA A

	Sample ID	2,4,6-TNT	1,3,5-TNB	NB	2,4-DNT	2,6-DNT	4-Am-2-NT	3,4-DNT	4-Am-DNT	2-Am-DNT	2-NT	3-NT	4-NT	2-Am-4-NT	1,3-DNB
Wastewater Settling Tanks and Pump House - Bldg 187	TNTA-S1-0.0/1.5	4.9							1.0	1.7					
	TNTA-S1-1.5/5.0	580	2.5		4.8	5.6	0.3	0.7	5.6	7.0					0.4
	TNTA-S2-0.0/1.5														
	TNTA-S2-1.5/3.0														
	TNTA-S3-0.0/1.5														
	TNTA-S3-1.5/3.0														
	TNTA-S4-0.0/1.5														
	TNTA-S4-1.5/5.0														
Wash House - Line 3 - Bldg 136	TNTA-S5-1.0/2.0														
	TNTA-S5-2.5/3.5	0.3								0.7					
	TNTA-S6-1.0/2.0														
	TNTA-S6-2.5/3.5														
	TNTA-S7-1.0/2.0														
	TNTA-S7-2.5/3.5														
	TNTA-S8-2.5/3.5														
Ditch North of Maintenance Road	TNTA-S9-0.0/1.0														

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., TNTA = TNT Area A); the soil boring number (e.g., S1 = soil boring 1 in TNT Area A); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 nitroaromatic compounds listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

G:\WP\C\CDE\PLUM-BRO.OK\TNT\TAB5-1

Sample TNTA-S4-1.5/5.0 is a split of QC sample TNTA-S28-1.5/5.0.

TABLE 5-1
(Continued)

	Sample ID	2,4,6-TNT	1,3,5-TNB	NB	2,4-DNT	2,6-DNT	4-Am-2-NT	3,4-DNT	4-Am-DNT	2-Am-DNT	2-NT	3-NT	4-NT	2-Am-4-NT	1,3-DNB
Wash House - Line 4 - Bldg 146	TNTA-S10-2.5/3.5														
	TNTA-S11-2.5/3.5														
	TNTA-S12-1.0/1.5														
	TNTA-S13-1.0/1.5														
Fortifier House - Bldg 143	TNTA-S14-0.0/2.0														
	TNTA-S15-0.0/2.0	53			0.5	0.8									
	TNTA-S16-0.0/2.0	19			1.5	1.3									
	TNTA-S17-0.0/2.0	1.1			0.5										
Bi-Tri House - Bldg 142	TNTA-S18-0.5/1.5	0.5								0.5					
	TNTA-S19-0.5/1.5	0.3													
	TNTA-S20-0.5/1.5	4.3			0.6	0.7			0.7	1.1					
Mono House - Bldg 141	TNTA-S21-0.0/2.0	0.3			0.6	0.7									
	TNTA-S22-0.0/2.0				45	47									
	TNTA-S23-0.0/2.0					0.4									
DNT Sweating and Graining House - Bldg 192	TNTA-S24-0.0/1.5														
	TNTA-S24-1.5/3.0				0.3			0.6							
	TNTA-S25-0.0/1.5				2.7	0.4	0.4								
	TNTA-S26-0.0/1.5				0.6	0.6		8.9							

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., TNTA = TNT Area A); the soil boring number (e.g., S1 = soil boring 1 in TNT Area A); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 nitroaromatic compounds listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

Sample TNTA-S11-2.5/3.5 is a split of QC sample TNTA-S27-2.5/3.5.
Sample TNTA-S16-0.0/2.0 is a split of QC sample TNTA-S29-0.0/2.0.
Sample TNTA-S24-1.5/3.0 is a split of QC sample TNTA-S30-1.5/3.0.

TABLE 5-1
(Continued)

	Sample ID	2,4,6-TNT	1,3,5-TNB	NB	2,4-DNT	2,6-DNT	4-Am-2-NT	3,4-DNT	4-Am-DNT	2-Am-DNT	2-NT	3-NT	4-NT	2-Am-4-NT	1,3-DNB
QC Samples	TNTA-S27-2.5/3.5														
	TNTA-S28-1.5/5.0														
	TNTA-S29-0.0/2.0	5.5			2.7	1.5		0.4							
	TNTA-S30-1.5/3.0				0.3	0.5		0.8							
Ditch West of Wastewater Disposal Settling Tanks	TNTA-S31-0.0/1.0	0.9													
	TNTA-S32-0.0/1.0	3.2			0.3				0.5						

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., TNTA = TNT Area A); the soil boring number (e.g., S1 = soil boring 1 in TNT Area A); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 nitroaromatic compounds listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

G:\WP\C\COE\PLUM-BRO.OK\TNT\TAB5-1

QC sample TNTA-S27-2.5/3.5 is a split of TNTA-S11-2.5/3.5.
QC sample TNTA-S28-1.5/5.0 is a split of TNTA-S4-1.5/5.0.
QC sample TNTA-S29-0.0/2.0 is a split of TNTA-S16-0.0/2.0.
QC sample TNTA-S30-1.5/3.0 is a split of TNTA-S24-1.5/3.0.

5.1.1 Waste Water Disposal Settling Tanks and Pump House (Building 187) and Ditches

Eight samples were collected from four soil borings, TNTA-S1, -S2, -S3, and -S4, installed at the TNT Area A Waste Water Settling Tanks and Pump House (Building 187). Samples were to be collected from depth intervals of 0 to 1.5 feet and 1.5 to approximately 5 feet. However, two of the four borings were terminated at auger refusal at depths of approximately 3 feet and a sample was obtained from 1.5 to 3 feet.

Explosives residues were reported in each of the two samples from Boring TNTA-S1, which was installed where the Pump House was thought to have been located. Three compounds, 2,4,6-TNT, 4-Am-DNT, and 2-Am-DNT were found in the shallower sample, TNTA-S1-0.0/1.5, at concentrations of 4.9 mg/Kg, 1.0 mg/Kg, and 1.7 mg/Kg, respectively. These three compounds plus an additional six nitroaromatics were also found in the sample collected from the 1.5 to 5.0 foot depth interval. Of note is the 2,4,6-TNT concentration of 580 mg/Kg. This is the highest concentration of TNT or any nitroaromatic detected in TNT Area A. The concentrations of the other explosives residues compounds detected in sample TNTA-S1-1.5/5.0 ranged from a low 0.3 mg/Kg for 4-Am-2-NT to 7.0 mg/Kg for 2-Am-DNT.

No explosives residues were detected in the samples collected from borings TNTA-S2, -S3, or -S4.

Two borings, TNTA-S31 and TNTA-S32, were installed in the ditch which carried water from the settling tanks to other waste water treatment and disposal facilities. Soil samples were collected from 0 to 1 foot in depth at two locations, one on either side of Columbus Road. Explosives residues were reported in both samples. The highest nitroaromatic concentration was 3.2 mg/Kg 2,4,6-TNT in sample TNTA-S32-0.0/1.0. All other nitroaromatics concentrations were below 0.9 mg/Kg.

QC sample TNTA-S28-1.5/5.0 was a split of sample TNTA-S4-1.5/5.0 which was collected in this area. No explosives residues were detected in either sample.

5.1.2 Wash House (line 3) (Building 136)

Four soil borings, TNTA-S5, -S6, -S7, and -S8, were installed in the vicinity of the Wash House (Building 136) for TNT manufacturing line 3. Seven samples were collected, two each from borings TNTA-S5, S6, and S7 and one from boring TNTA-S8.

This area contained what appeared to be building debris (nails, bricks, rocks, etc.) which made hand augering very difficult. Target sample depth intervals for the two samples from borings TNTA-S5, -S6, and -S7 were 1 to 2 feet and 2.5 to 3.5 feet. In boring TNTA-S8, the target depth interval was 2.5 to 3.5 feet. Each of the four borings was offset several times until the target depth was achieved.

The only explosives residues found in this area, 2,4,6-TNT and its biotransformation product 2-Am-DNT, were reported in the 2.5 to 3.5 foot interval of boring TNTA-S5. Concentrations for both compounds were below 1 mg/Kg.

No explosives residues were detected in the samples collected from borings TNTA-S6, -S7, or -S8.

5.1.3 Wash House (line 4) (Building 146) and Associated Waste Water Disposal Ditch

Four soil borings, TNTA-S10, -S11, -S12, and -S13, were installed in the vicinity of the Wash House (Building 146) for TNT manufacturing line 4. One sample was collected from each boring.

Due to the amount of building debris in this area, borings TNTA-S10 and TNTA-S11 were offset several times before a sample could be collected at the target depth interval of 2.5 feet to 3.5 feet. The remaining two borings, to be installed in the vicinity of the former "catch box", were not completed until the area was excavated using a backhoe. NASA personnel excavated a test pit in the area where the catch box was thought to be. The test pit was excavated to a depth of approximately 4 feet. Concrete footings and building debris were exposed, but an intact catch box was

not located. Samples TNTA-S12 and TNTA-S13 were collected at a depth interval of 1 to 1.5 feet from the walls of the excavation.

No explosives residues were detected in the samples collected from borings TNTA-S10, -S11, -S12, or -S13.

One ditch sample, TNTA-S9-0.0/1.0, was collected from a waste water disposal system drainage system ditch north of the Line 4 Wash House on the north side of Maintenance Road. No explosives residues were detected in this ditch sample.

QC sample TNTA-S27-2.5/3.5 was a split of sample TNTA-S11-2.5/3.5 which was collected in this area. No explosives residues were detected in either sample.

5.1.4 Fortifier House (line 4) (Building 143)

Four soil borings, TNTA-S14, -S15, -S16, and -S17, were installed in the vicinity the Fortifier House (Building 143) for TNT manufacturing line 4. One sample was collected from each boring a depth interval of approximately 0 to 2 feet. Auger refusal on large gravel forced several of the borings to be offset, but all target depth intervals were achieved.

Three of the four samples, TNTA-S15, -16, -17-0.0/2.0, contained explosives residues. Two compounds, 2,4,6-TNT and 2,4-DNT, were present in all three samples. 2,6-DNT was found in only two of the samples, TNTA-S15 and -S16. All concentrations were below 1.5 mg/Kg except for 2,4,6-TNT concentrations in TNTA-S15 and TNTA-S16. These concentrations were 53 and 19 mg/Kg, respectively. The source of these nitroaromatics at the acid Fortifier House is assumed to be the acid waste stream delivery to this structure for fortification prior to reuse in the process.

QC sample TNTA-S29-0.0/2.0 was a split of sample TNTA-S16-0.0/2.0. Three nitroaromatic compounds were detected in both samples from the split pair at generally similar concentrations. 3,4-DNT was detected at a low concentration (0.4 mg/Kg in one sample but not in the other).

5.1.5 Bi-Tri House (line 4) (Building 142)

Three soil borings, TNTA-S18, -S19, and -S20, were installed in the vicinity of the Bi-Tri House (Building 142) for TNT manufacturing line 4. One sample was collected from each boring at a depth interval of approximately 0.5 to 1.5 feet. Gravel and building debris were noted during the installation of these borings. Boring TNTA-S19 was offset after auger refusal at 1 foot due to the presence of nails, transite, and other building debris including re-bar.

Low levels of explosives residues were found in each of the samples. The only compound that appeared in all three samples was 2,4,6-TNT. The highest number of nitroaromatics were found in sample TNTA-S20-0.5/1.5, in which five compounds were reported. 2,4,6-TNT was detected at a concentration of 4.3 mg/Kg in sample TNTA-S20. Concentrations of all other explosives residues were below 1.1 mg/Kg.

5.1.6 Mono House (line 4) (Building 141)

Three soil borings, TNTA-S21, -S22, and S-23, were installed in the vicinity of the Mono House (Building 141) for TNT manufacturing line 4. One sample was collected from each boring at a depth interval of approximately 0 to 2 feet. Some of the borings were offset after auger refusal on building debris (including transite). All target depth intervals were achieved.

Explosives residues were found in each of the samples. The only compound that appeared in all three samples was 2,6-DNT. The highest level of contamination appeared in sample TNTA-S22-0.0/2.0. Concentrations of 45 mg/Kg and 47 mg/Kg, respectively, were reported for 2,4-DNT and 2,6-DNT.

5.1.7 DNT Sweating & Graining House (Building 192)

Three soil borings, TNTA-S24, -S25, and -S26, were installed at the DNT Sweating & Graining House (Building 192). Two samples were collected from boring TNTA-S24 which was thought to be installed in the crude DNT tank area. Samples were collected at depth intervals of 0 to 1.5 feet and 1.5 to 3.0 feet. One sample was collected from each of borings TNTA-S25 and -S26 at a depth interval of approximately 0 to 1.5 feet. Gravel was noted in the borings, but it did not prove to be a problem.

Three of the four samples contained explosives residues. Only sample TNTA-S24-0.0/1.5 did not contain explosives residues. The highest levels of nitroaromatics reported were 2.7 mg/Kg 2,4-DNT in sample TNTA-S25-0.0/1.5 and 8.9 mg/Kg 3,4-DNT in sample TNTA-S26-0.0/1.5. Several other compounds were reported at low levels.

QC sample TNTA-S30-1.5/3.0 was a split of sample TNTA-S24-1.5/3.0. Two nitroaromatic compounds were reported in each sample from the split pair at comparable concentrations. A low level of 2,6-DNT (0.5 mg/Kg) was reported in one sample but not in the other.

5.1.8 Summary of Explosives Residues Contamination in TNT Area A

As discussed in Section 3.0, significant decontamination of TNT Area A was performed following closure of the PBOW including removal of contaminated soil. However, nine explosives residues were still present in TNT Area A albeit at relatively low concentrations. Nitroaromatics were detected at 16 of 28 locations where soil borings were installed. Explosives residues were detected at the Waste Water Treatment Settling Tanks Pump House and in the associated ditches, at the Wash House for manufacturing line 3, at three locations at the Fortifier House for line 4, at three locations for the Bi-Tri House for line 4, at three locations for the Mono House for line 4, and at the DNT Sweating and Draining House. Significant levels of explosives residues (greater than 10 mg/Kg) were detected only at the Pump House (580 mg/Kg 2,4,6-TNT in one sample), the Fortifier House (53 mg/Kg and 19 mg/Kg

2,4,6-TNT in two different samples), and the Mono House (45 mg/Kg 2,4-DNT and 47 mg/Kg 2,6-DNT in the same sample). Three biotransformation products were also detected in several samples, indicating that natural biological attenuation is probably occurring.

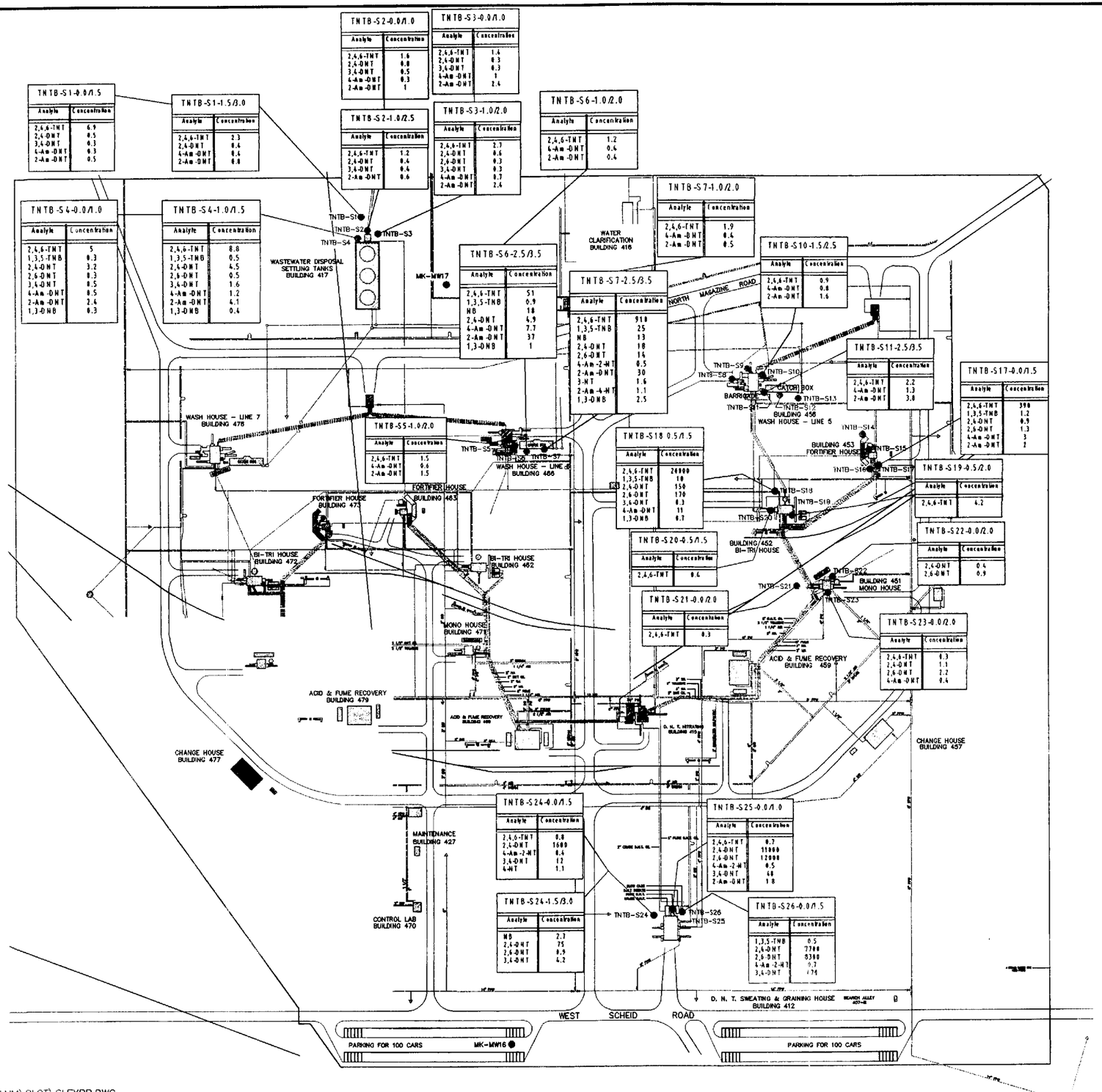
Concentrations of 2,4,6-TNT exceeded the EPA Region III (Region III) industrial scenario risk-based screening criteria of 190 mg/Kg in two samples. The concentrations in excess of the screening criteria were 580 mg/Kg in sample TNTA-S1-1.5/5.0 at the Wastewater Settling Tanks and Pump House and 53 mg/Kg in sample TNTA-S15-0.0/2.0 at the Fortifier House. The concentration in sample TNTA-S1-1.5/5.0 also exceeded the residential screening criteria of 21 mg/Kg.

Previously, one soil sample was collected in the southwestern corner of TNT Area A during the MK Ferguson investigation. The location at which this sample was collected does not appear to have been directly related to the former PBOW activities and no explosives residues were detected.

5.2 TNT AREA B

At TNT Area B, 34 soil samples were collected from 26 borings. The borings were installed at the Waste Disposal Tanks and Pump House; the Wash House for manufacturing line 5; the Wash House, Bi-Tri House, Fortifier House, and Mono House for manufacturing line 6; and DNT Sweating & Graining House. The boring locations are illustrated on Figure 5-2.

Thirteen of the 14 nitroaromatics were reported in TNT Area B. 2,4,6-TNT was detected in two thirds (23 of 34) of the samples. The highest concentration of 2,4,6-TNT detected in TNT Area B was 24,500 mg/Kg (average of two split samples) was collected from a depth of 0.5 to 1.5 feet at the Bi-Tri House for line 5. 2,4-DNT was detected in over half (18 of 34) of the samples. 2-Am-DNT and 4-Am-DNT, end products of microbial biotransformation of TNT, were each detected in at least half of the samples. The concentrations of explosives residues reported for the samples collected from TNT Area B are listed on Table 5-2 and are also provided on Figure 5-2.



Scale: 1" = 300'

TNTB-S3 ● Soil Boring Location

MK-MW17 ● Overburden Groundwater Monitoring Well Location

Concentrations are in mg/Kg

FIGURE 5-2
TNT AREA B SOIL BORING LOCATIONS AND EXPLOSIVES RESIDUES AND CONCENTRATIONS

Plum Brook Ordnance Works
Sandusky, Ohio

Dames & Moore, Inc.

FILENAME: H:\CAD\COE-PLUM\PLOT\SLEXPB.DWG

H: \C\ PLUM\PLOT\SLEXPB Thu Apr 03 20:57:15 1997 Dames & - Atlanta, GA

TABLE 5-2

EXPLOSIVES RESIDUES CONCENTRATIONS IN SOIL SAMPLES TNT AREA B

	Sample ID	2,4,6-TNT	1,3,5-TNB	NB	2,4-DNT	2,6-DNT	4-Am-2-NT	3,4-DNT	4-Am-DNT	2-Am-DNT	2-NT	3-NT	4-NT	2-Am-4-NT	1,3-DNB
Wastewater Disposal Settling Tanks - Bldg 417	TNTB-S1-0.0/1.5	6.9			0.5			0.3	0.3	0.5					
	TNTB-S1-1.5/3.0	2.3			0.4				0.4	0.8					
	TNTB-S2-0.0/1.0	1.6			0.8			0.5	0.3	1.0					
	TNTB-S2-1.0/2.5	1.2			0.4			0.4		0.6					
	TNTB-S3-0.0/1.0	1.4			0.3			0.3	1.0	2.4					
	TNTB-S3-1.0/2.0	2.7			0.6	0.3		0.3	0.7	2.4					
	TNTB-S4-0.0/1.0	5.0	0.3		3.2	0.3		0.5	0.5	2.4					0.3
	TNTB-S4-1.0/1.5	8.8	0.5		4.5	0.5		1.6	1.2	4.1					0.4
Wash House - Line 6 - Bldg 466	TNTB-S5-1.0/2.0	1.5							0.6	1.5					
	TNTB-S5-2.5/3.0														
	TNTB-S6-1.0/2.0	1.2							0.4	0.4					
	TNTB-S6-2.5/3.5	51	0.9	18	4.9				7.7	37					1.0
	TNTB-S7-1.0/2.0	1.9							0.4	0.5					
	TNTB-S7-2.5/3.5	910	25	13	18	14	0.5			30		1.6		1.1	2.5
Wash House - Line 5 - Bldg 456	TNTB-S8-2.5/3.0														
	TNTB-S9-1.5/2.7														
	TNTB-S10-1.5/2.5	0.9							0.8	1.6					
	TNTB-S11-2.5/3.5	2.2							1.3	3.8					

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., TNTB = TNT Area B); the soil boring number (e.g., S1 = soil boring 1 in TNT Area B); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (Column 2) were analyzed for all 14 nitroaromatic compounds listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

Sample TNTB-S11-2.5/3.5 is a split of QC sample TNTB-S27-2.5/3.5

G:\WP\C\COE\PLUM-BRO.OK\TNT\TAB5-2

TABLE 5-2
(Continued)

	Sample ID	2,4,6-TNT	1,3,5-TNB	NB	2,4-DNT	2,6-DNT	4-Am-2-NT	3,4-DNT	4-Am-DNT	2-Am-DNT	2-NT	3-NT	4-NT	2-Am-4-NT	1,3-DNB
	TNTB-S12-1.0/2.0														
	TNTB-S13-1.0/2.0														
Fortifier House - Bldg 453	TNTB-S14-0.0/2.0														
	TNTB-S15-0.0/2.0														
	TNTB-S16-0.0/2.0														
	TNTB-S17-0.0/1.5	390	1.2		0.9	1.3			3.0	2.0					
Bi-Tri House - Bldg 452	TNTB-S18-0.5/1.5	20,000	10		150	170		0.3	11						0.7
	TNTB-S19-0.5/2.0	4.2													
	TNTB-S20-0.5/1.5	0.4													
Mono House - Bldg 451	TNTB-S21-0.0/2.0	0.3													
	TNTB-S22-0.0/2.0				0.4	0.9									
	TNTB-S23-0.0/2.0	0.3			1.1	2.2			0.4						
DNT Sweating and Graining House - Bldg 412	TNTB-S24-0.0/1.5	0.8			1,600		0.4	12					1.1	0.4	
	TNTB-S24-1.5/3.0			2.7	75	0.9		4.2							
	TNTB-S25-0.0/1.0	0.7			11,000	12,000	0.5	48		1.8					
	TNTB-S26-0.0/1.5		0.5		7,700	8,300	0.7	470							
QC Samples	TNTB-S27-2.5/3.5	1.8							1.1	3.3					
	TNTB-S28-0.5/1.5	29,000	14		810	230	0.3	0.6		2.5					1.0
	TNTB-S29-0.0/2.0														

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., TNTB = TNT Area B); the soil boring number (e.g., S1 = soil boring 1 in TNT Area B); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (Column 2) were analyzed for all 14 nitroaromatic compounds listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

QC sample TNTB-S27-2.5/3.5 is a split of TNTB-S11-2.5/3.5.
QC sample TNTB-S28-0.5/1.5 is a split of TNTB-S18-0.5/1.5.
QC sample TNTB-S29-0.0/2.0 is a split of TNTB-S21-0.0/2.0.

5.2.1 Waste Disposal Tanks and Pump House (Building 417)

Eight soil samples were collected from four soil borings, TNTB-S1, -S2, -S3, and -S4, installed around the Pump House (Building 417) at the northern end of the waste water disposal tanks. Samples were to be collected from depth intervals of 0 to 1.5 feet and 1.5 to approximately 5 feet.

The area around the former Pump House was covered by shale. This shale was visible at the surface throughout a large portion of TNT Area B. Because of the shale, augering was difficult and none of the target depths were achieved. One of the borings (TNTB-S1) reached water at approximately 2 feet. The water in this boring and the soil/shale from this and the other borings had a distinct petroleum odor and registered trace readings on the HNu. Two samples were collected from each boring at varying depth intervals. Samples were collected at depth intervals of 0 to 1.5 feet and 1.5 feet to auger refusal at 3.0, 2.5, 2.0, and 1.5 feet, respectively, for borings TNTB-S1, -S2, -S3, and -S4.

Explosives residues were reported in each sample collected from the Pump House area. The largest number of compounds at the highest concentrations were in the samples from boring TNTB-S4. TNTB-S4-0.0/1.0 and TNTB-S4-1.0/1.5 contained the same nitroaromatics and the levels tended to increase with depth. The highest concentration was 8.8 mg/Kg 2,4,6-TNT found in sample TNTB-S4-1.0/1.5. Boring TNTB-S4 was installed immediately adjacent to the foundation surrounding the former settling basins. The top of the foundation wall is still visible. Lower levels of several nitroaromatics including 2,4,6-TNT, 2,4-DNT, 3,4-DNT, 4-Am-DNT, and 2-Am-DNT were reported in at least one sample from each boring.

5.2.2 Wash House (line 6) (Building 466)

Six samples were collected from three soil borings, TNTB-S5, -S6, and -S7, installed in the vicinity of the Wash House (Building 466) for TNT manufacturing line 6.

This area contained gravel and some shale which made auguring difficult. Each boring was offset at least once. Target total depth for these borings was to be 3.5 feet which was achieved at most locations. Only in boring TNTB-S5 was the boring terminated at a depth of 3 feet at auger refusal. Samples were collected from 1.0 to 2.0 feet and from 2.5 feet to the bottom of the boring. In addition to the shale and gravel, building debris including nails was encountered. Several unidentified materials were observed during the sampling including chunks of wood, possibly from the "catch box"; a black coal-like material; and, a white fluffy material.

Explosives residues were found in five of the six samples collected from this area. In boring TNTB-S5, relatively low levels of nitroaromatics were found only in the shallower of the two samples collected. In the other two borings, TNTB-S6 and -S7, low levels of explosives residues were present in the more shallow sample and significantly higher concentrations were found in the deeper samples. 2,4,6-TNT was present in the samples collected from 2.5 to 3.5 feet in the borings TNTB-S6 and -S7 at concentrations of 51 and 910 mg/Kg, respectively. The sample in which the most compounds were reported, TNTB-S7-2.5/3.5, also had the highest concentrations of most of the compounds detected.

5.2.3 Wash House (line 5) (Building 456)

Six soil borings, TNTB-S8, -S9, -S10, -S11, -S12, and -S13, were installed in the vicinity of the Wash House (Building 456) for manufacturing line 5. One sample was collected from each boring.

A large amount of gravel and shale were noted in this area. Because of this, augering was again difficult and many of the borings were offset several times. Two borings were installed in an area thought to be inside the "catch box." Samples were collected at a depth interval of approximately 1 to 2 feet. The remaining four samples were to be collected at an approximate depth interval of 2.5 to 3.5 feet. However, only one of the borings reached target depth. The remaining borings were terminated at refusal and samples were taken of the soil collected to that point. A chunk of wood, perhaps from the catch box, was collected with sample TNTB-S13-1.0/2.0.

Of the six samples collected, only two, TNTB-S10-1.5/2.5 and TNTB-S11-2.5/3.5, contained explosives residues. The same three compounds, 2,4,6-TNT and its biotransformation products 4-Am-DNT and 2-Am-DNT, were reported in both samples. Concentrations ranged from 1.3 mg/Kg to 3.8 mg/Kg for sample TNTB-S11-2.5/3.5 and from 0.8 mg/Kg to 1.6 mg/Kg for sample TNTB-S10-1.5/2.5.

QC sample TNTB-S27-2.5/3.5 was a split of sample TNTB-S11-2.5/3.5. The same three explosives residues compounds were detected in both split samples at very similar concentrations.

5.2.4 Fortifier House (Building 453)

Four soil borings, TNTB-S14, -S15, -S16, and -S17, were installed in the vicinity of the Fortifier House (Building 453) for manufacturing line 5. One sample was collected from each boring. All four samples were to be collected at an approximate depth interval of 0 to 2 feet. Target depth intervals were achieved in three of the four borings and the fourth sample from boring TNTB-S17 was collected from 0 to 1.5 feet.

Gravel and building debris again made augering difficult and were responsible for several offsets. The coal-like material observed at the Line 6 Wash House was noted again.

Sample TNTB-S17-0.0/1.5 was the only sample that contained explosives residues. Six compounds were reported. The highest concentration was 390 mg/Kg 2,4,6-TNT. Concentrations of the five other compounds were 3.0 mg/Kg or below.

5.2.5 Bi-Tri House (Building 452)

Three soil borings, TNTB-S18, -S19, and -S20, were installed in the vicinity of the Bi-Tri House (Building 462) for manufacturing line 5. One sample was collected from each boring.

This area had some gravel and building debris, but not a lot of shale at the surface. The target depth interval for sample collection in two of the three borings was 0.5 to 1.5 feet and the third was 0.5 to 2.0 feet. Although auger refusal was reached on the 0.5 to 2.0 feet sample (TNTB-S19), all target depths were achieved.

Significant levels of explosives residues were found in sample TNTB-S18-0.5/1.5 which was installed in an area thought (though not confirmed) to be on the north side of the Bi-Tri House near the drowning tank. The reported concentration of 2,4,6-TNT was 20,000 mg/Kg. 2,4-DNT and 2,6-DNT were also reported at concentrations of 150 mg/Kg and 170 mg/Kg, respectively. Lower levels of three other explosives residues were found in sample TNTB-S18-0.5/1.5. Low levels of 2,4,6-TNT were detected in samples TNTB-S19-0.5/2.0 and TNTB-S20-0.5/1.5.

QC sample TNTB-S28-0.5/1.5 was a split of sample TNTB-S18-0.5/1.5. Multiple explosives residues compounds were detected in both of the split samples. Significant concentrations of 2,4,6-TNT, 1,3,5-TNB, 2,4-DNT, and 2,6-DNT were detected in both of the split samples. Three biotransformation products, 4-Am-2-NT, 4-Am-DNT, and 2-Am-DNT, were detected in one or the other of the split samples but not in both. Concentrations were generally low.

5.2.6 Mono House (Building 451)

Three soil borings, TNTB-S21, -S22, -S23, were installed in the vicinity of the Mono House (Building 451) for manufacturing line 5. One sample was collected from each boring. Target depth intervals for these borings were 0 to 2 feet. They were achieved for all three borings.

Gravel and building debris were observed in this area and were responsible for several offsets. The coal-like material and wood were also observed during the sampling.

Explosives residues were reported in all three samples. All concentrations were 2.2 mg/Kg or below.

QC sample TNTB-S29-0.0/2.0 was a split of sample TNTB-S21-0.0/1.0. No explosives residues were detected in sample TNTB-S29-0.0/2.0. However, a low level (0.3 mg/Kg) of 2,4,6-TNT was detected in sample TNTB-S21-0.0/2.0.

5.2.7 DNT Sweating & Graining House (Building 412)

Four samples were collected from three soil borings, TNTB-S24, -S25, and -S26, were installed at the DNT Sweating & Graining House (Building 412). The borings were installed on the north side of the building in the area thought to be the former locations of the Crude DNT, Pure DNT, and Sweats DNT tanks. While the exact locations of these tanks are not known, the locations can be relatively accurately identified based on the location where the driveway to the building ends. This site feature is still clearly discernable at the former DNT Sweating and Graining House at TNT Area B.

Two samples were collected from boring TNTB-S24 (thought to be the location of the Crude DNT tank) at depth intervals of 0.0 to 1.5 feet and 1.5 to 3.0 feet. One sample was collected from each of borings TNTB-S25 and -S26 at depth intervals of 0.0 to 1.0 and 0.0 to 1.5 feet, respectively.

Building debris was responsible for several offsets, but target depth intervals were achieved except at boring TNTB-S25 where refusal was reached at 1 foot. Greenish yellow crystals and a sulfur-like odor were noted in boring TNTB-S26. The crystals were included in sample TNTB-S26-0.0/1.5. For investigative purposes, boring TNTB-S26 was then continued to a depth of 3 feet. The crystals graded out but the sulfur odor was still distinct.

Explosives residues were reported in all four samples collected in this area. It appears that contaminant levels are greater nearer the surface in this area, possibly as a result of spillage from the tanks. Elevated levels of 2,4-DNT were reported in each of the 0.0 to 1.5 feet samples with concentrations of 1,600 mg/Kg, 11,000 mg/Kg, and 7,700 mg/Kg, respectively, for samples from borings TNTB-S24, -S25, and -S26. Very high levels of 2,6-DNT, 12,000 mg/Kg and 8,300 mg/Kg, respectively, were reported in samples TNTB-S25-0.0/1.5 and TNTB-S26-0.0/1.5. 3,4-DNT was also

found in all four samples, with a maximum concentration of 470 mg/Kg in sample TNTB-S26-0.0/1.5.

5.2.8 Summary of Explosives Residues Contamination in TNT Area B

No previous decontamination efforts have been documented at TNT Area B. Contamination by explosives residues was present in 19 of 26 locations where soil borings were installed. Explosives residues were detected in all eight samples collected at the Waste Water Treatment Settling Tanks Pump House, in all four borings installed at the Wash House for manufacturing line 6, at two of six locations at the Wash House for manufacturing line 5, in one of four borings at the Fortifier House for line 5, at all three locations for the Bi-Tri House for line 5, at all three locations for the Mono House for line 5, and in all four samples collected from the three borings installed at the DNT Sweating and Draining House. Significant levels of explosives residues (greater than 10 mg/Kg) were detected at the Wash House for manufacturing line 6, the Fortifier House, the Bi-Tri House, and the DNT Sweating and Graining House. Concentrations of explosives residues in excess of 10,000 mg/Kg were present in soils at the former Bi-Tri House and the DNT Sweating and Graining House. In both areas, sample locations targeted outdoor tanks associated with the buildings.

These results appear to indicate that, in the absence of any previous soil removal or remediation at TNT Area B, soil contamination by explosives residues is ubiquitous. Although the exact locations of sampling points with respect to the former building and structures cannot be known with certainty, it appears that significant contamination is present in areas where it would be expected such as former drowning tanks (at the Bi-Tri House) and process tanks (at the DNT Sweating and Graining House). Lower levels of contamination are present throughout TNT Area B. Three biotransformation products were detected in samples collected in TNT Area B indicating that natural biological attenuation is occurring.

Contamination would be expected at the former Wash Houses and was present at all three sampling locations at Building 466, the Wash House for manufacturing line 6. It is worth noting that the sampling locations at the line 6 Wash House probably had

a higher probability of being at their targeted points than did the sampling locations at Building 456, the Wash House for line 5. Wash House 466 was located at the end of a relatively short driveway, the remnants of which were still visible enhancing the probability that borings were installed in the targeted locations. Two much longer driveways accessed the former Wash House 456, and both have been obliterated except for portions immediately off the main roads. Therefore, the borings at Wash House 456 may not have been exactly in the locations intended. This may account for the general absence of contamination detected at Wash House 456 where it would otherwise have been expected.

Thirteen nitroaromatics concentrations in TNT Area B exceeded the EPA Region III residential scenario risk-based screening criteria. Of these, seven concentrations exceeded the industrial scenario risk-based screening criteria.

- 2,4,6-TNT exceeded the industrial scenario screening criteria of 190 mg/Kg in three samples. The concentrations in excess of the screening criteria were 910 mg/Kg in sample TNTB-S7-2.5/3.5 at the Wash House for manufacturing line 6; 390 mg/Kg in sample TNTB-S17-0.0/1.5 at the Fortifier House; and 24,500 (average of two split samples) in sample TNTB-S18-0.5/1.5 at the Bi-Tri House. The concentration of 51 mg/Kg in sample TNTB-S6-2.5/3.5 at the Wash House for line 6 did not exceed the industrial scenario screening criteria, but did exceed the residential screening criteria of 21 mg/Kg.

- 1,3,5-TNB exceeded residential scenario screening criteria of 21 mg/Kg in two samples. The concentration of 25 mg/Kg in sample TNTB-S7-2.5/3.5 at the Wash House for line 6 and the concentrations of 12 mg/Kg (average of two split samples) at the Bi-Tri House both exceeded the screening criteria.

- 2,4-DNT exceeded the industrial scenario screening criteria of 190 mg/Kg in two samples. The concentrations in excess of the screening criteria were 11,000 mg/Kg in sample TNTB-S25-0.0/1.0 and 7,700 mg/Kg in sample TNTB-S26-0.0/1.5, both at the DNT Sweating and Graining House. Each of these concentrations was also above the residential scenario screening criteria of 21 mg/Kg. The concentrations of 480 mg/Kg (average of two split samples) in sample TNTB-S18-0.5/1.5 at the Bi-Tri House and 1,600 mg/Kg in sample TNTB-S24-0.0/1.5 at the DNT Sweating and Graining House also exceeded the residential screening criteria.

- 2,6-DNT exceeded the industrial scenario screening criteria of 190 mg/Kg in two samples. The concentrations in excess of the screening criteria were 21,000 mg/Kg in sample TNTB-S25-0.0/1.0 and 8,300 mg/Kg in sample

TNTB-S26-0.0/1.5, both at the DNT Sweating and Graining House. Each of these concentrations was also above the residential scenario screening criteria of 21 mg/Kg. The concentrations of 200 mg/Kg (average of two split samples) in sample TNTB-S18-0.5/1.5 at the Bi-Tri House also exceeded the residential screening criteria.

Previously, during the MK Ferguson investigation, two soil samples were collected at TNT Area B. One sample was collected from the upper 2 feet of the boring for groundwater monitoring well MK-MW17 which is located near the Waste Water Settling Basins. 2,4,6-TNT and 2,6-DNT were detected at concentrations of 12 mg/Kg and 0.06 mg/Kg, respectively. No explosives were detected in the other sample which was reported to be collected near a flume line.

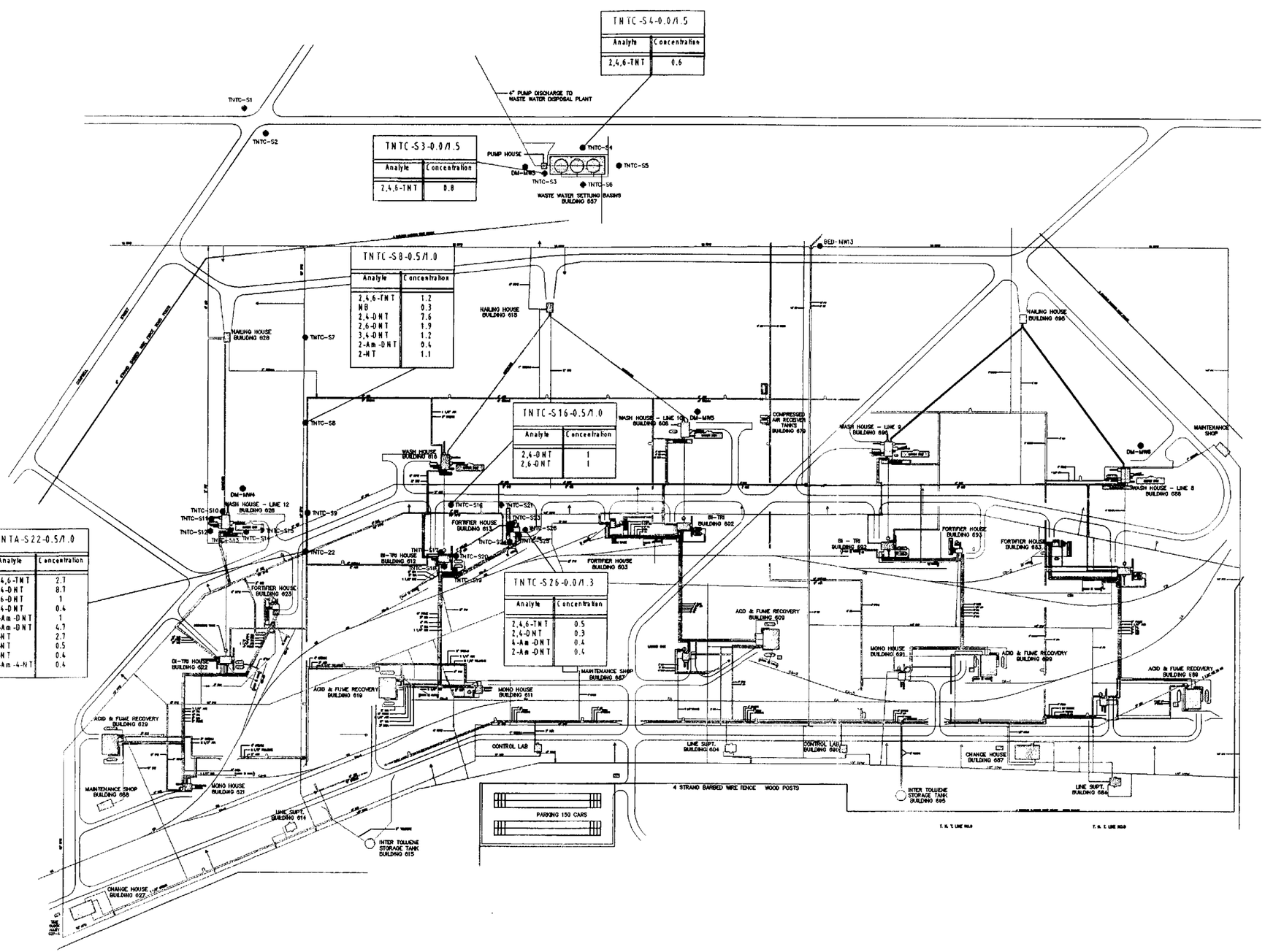
5.3 TNT AREA C

At TNT Area C, 30 soil samples were collected from 26 borings. The samples were collected from the Waste Water Disposal Settling Tank, the Wash House (line 1), Bi-Tri House (line 11), Fortifier House (line 11), and process waste water ditches. The sampling scheme for TNT Area C differed from those for TNT Areas A and B in that it was weighted more heavily toward sampling the process waste water ditches than areas around former buildings. The boring locations are illustrated on Figure 5-3.

Eleven of the 14 nitroaromatics included in the analyte list were detected in TNT Area C. 2,4,6-TNT was reported in five samples. 2,4-DNT was detected in four samples. 2,6-DNT was detected in three samples. All other explosives residues were reported in three or fewer samples. The concentrations of explosives residues are listed on Table 5-3 and provided on Figure 5-3.

5.3.1 Waste Water Disposal Settling Tanks and Pump House (Building 657) and Associated Ditches

Two borings, TNTC-S1 and TNTC-S2, were installed in ditches which carried waste water from the TNT Area C Waste Water Disposal Settling Tanks to the West Area



Scale: 1" = 350'

DM-MW3 Overburden Groundwater Monitoring Well Location

TNTC-S3 Soil Boring Location

BED-MW13 Bedrock Groundwater Monitoring Well Location

Concentrations are in mg/kg

FIGURE 5-3
TNT AREA C SOIL BORING LOCATIONS AND EXPLOSIVES RESIDUES AND CONCENTRATIONS

Plum Brook Ordnance Works
Sandusky, Ohio

Dames & Moore, Inc.

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H: -PLUM\PLOT\SLEXPC Thu Apr 03 21:01:17 1997 Dames - Atlanta, GA

TABLE 5-3

EXPLOSIVES RESIDUES CONCENTRATIONS IN SOIL SAMPLES TNT AREA C

	Sample ID	2,4,6-TNT	1,3,5-TNB	NB	2,4-DNT	2,6-DNT	4-Am-2-NT	3,4-DNT	4-Am-DNT	2-Am-DNT	2-NT	3-NT	4-NT	2-Am-4-NT	1,3-DNB
Ditch	TNTC-S1-0.5/1.0														
	TNTC-S2-0.5/1.0														
Wastewater Settling Basins	TNTC-S3-0.0/1.5	0.8													
	TNTC-S3-1.5/3.5														
	TNTC-S4-0.0/1.5	0.6													
	TNTC-S4-1.5/5.0														
	TNTC-S5-0.0/1.5														
	TNTC-S5-1.5/5.0														
	TNTC-S6-0.0/1.5														
	TNTC-S6-1.5/4.5														
Ditch	TNTC-S7-0.5/1.0														
	TNTC-S8-0.5/1.0	1.2		0.3	7.6	1.9		1.2		0.4	1.1				
	TNTC-S9-0.5/1.0														
Wash House - Line 12 - Bldg 626	TNTC-S10-2.5/3.5														
	TNTC-S11-2.5/3.5														
	TNTC-S12-2.5/3.5														

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., TNTC = TNT Area C); the soil boring number (e.g., S1 = soil boring 1 in TNT Area C); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 nitroaromatic compounds listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

TABLE 5-3
(Continued)

	Sample ID	2,4,6-TNT	1,3,5-TNB	NB	2,4-DNT	2,6-DNT	4-Am-2-NT	3,4-DNT	4-Am-DNT	2-Am-DNT	2-NT	3-NT	4-NT	2-Am-4-NT	1,3-DNB
Wash House - Line 12 - Bldg 626 (Continued)	TNTC-S13-2.5/3.5														
	TNTC-S14-1.0/2.0														
	TNTC-S15-1.0/2.0														
Ditch	TNTC-S16-0.5/1.0				1.0	1.0									
Bi-Tri House - Bldg 612	TNTC-S17-0.0/1.5														
	TNTC-S18-0.0/1.5														
	TNTC-S19-0.5/2.0														
	TNTC-S20-0.0/1.25														
Ditch	TNTC-S21-0.5/1.0														
	TNTC-S22-0.5/1.0	2.7			8.7	1.0		0.4	1.0	4.7	2.7	0.5	0.4	0.4	
Fortifier House - Bldg 613	TNTC-S23-0.0/2.0														
	TNTC-S24-0.0/1.75														
	TNTC-S25-0.0/1.2														
	TNTC-S26-0.0/1.3	0.5			0.3				0.4	0.4					
QC Samples	TNTC-S27-0.5/1.0				0.5	0.4									
	TNTC-S28-0.5/1.5														
	TNTC-S29-0.0/2.0														

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., TNTC = TNT Area C); the soil boring number (e.g., S1 = soil boring 1 in TNT Area C); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 nitroaromatic compounds listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

QC sample TNTC-S27-0.5/1.0 is a split of TNTC-S16-0.5/1.0.
QC sample TNTC-S28-0.5/1.5 is a split of TNTC-S18-0.5/1.5.
QC sample TNTC-S29-0.0/2.0 is a split of TNTC-S23-0.0/2.0.

Red Water Ponds. Both borings were installed in the ditch near the junction of Campbell and Fox Roads. Samples were collected on the north and south sides of the intersection. No explosives residues were detected in either sample.

A total of eight samples were collected from four soil borings, TNTC-S3, -S4, -S5, and -S6, installed at the Waste Water Disposal Settling Tanks and Pump House (Building 657). Boring locations were selected to assess soil conditions on each side of the foundation which formerly contained the settling basins. The foundation is still clearly visible.

Two samples were to be collected from each boring at approximately 0 to 1.5 feet and approximately 1.5 to 5.0 feet. Gravel and building debris were responsible for many offsets. Boring TNTC-S3 was terminated at 3.5 feet and boring TNTC-S6 was terminated at 4.5 feet, both at auger refusal. No unusual findings were noted.

Only two the eight samples contained explosives residues. Samples TNTC-S3-0.0/1.5 and TNT-S4-0.0/1.5 both contained 2,4,6-TNT at relatively low concentrations of 0.8 mg/Kg and 0.6 mg/Kg, respectively.

5.3.2 Wash House (line 12) (Building 626)

Six soil borings, TNTC-S10, -S11, -S12, -S13, -S14, and -S15, were installed in the vicinity of the Wash House (Building 626) for TNT line 12. One sample was collected from each boring.

Two borings were to be installed from an area thought to be the "catch box." Samples were to be collected from an approximate depth interval of 1.0 to 2.0 feet. The other four samples were to be collected at depth intervals of 2.5 to 3.5 feet. Gravel and building debris caused several offsets but all target depth intervals were achieved.

No explosives residues were detected in any of the samples collected from this area.

5.3.3 Bi-Tri House (Building 612)

Four soil borings, TNTC-S17, -S18, -S19, and -S20, were installed in the vicinity of the Bi-Tri House (Building 612) for manufacturing line 11. One sample was collected from each boring. All samples were to be collected from depth intervals between 0.0 to 2.0 feet. Large gravel and building debris made augering difficult and were responsible for many offsets. Actual depth intervals for sample collection were dependent on depth at auger refusal.

No explosives residues were found in any of these samples.

QC sample TNTC-S28-0.0/1.5 was a split of sample TNTC-S18-0.0/1.5. No explosives residues were detected in either of the split samples.

5.3.4 Fortifier House (Building 613)

Four borings, TNTC-S23, -S24, -S25, and S-26, were installed at the Fortifier House (Building 613) for manufacturing line 11. One sample was collected from each location.

Target depth intervals for these samples was to be 0 to 2 feet. However, because of gravel and building debris three of the four borings were terminated before target depths could be achieved. Several pieces of a coal-like material, similar to that observed in TNT Area B, were noted. A number of chunks of wood and metal were also observed.

Explosives residues were found in only one of the samples in this area, TNTC-S26-0.0/1.3. Low levels of four explosives residues were detected at concentrations ranging from 0.3 mg/Kg to 0.5 mg/Kg.

QC sample TNTC-S29-0.0/2.0 was a split of sample TNTC-S23-0.0/20. No explosives residues were detected in either of the split samples.

5.3.5 Ditches

At TNT Area C, sampling locations were selected to assess the potential for contamination to site soils in ditches which carried waste process water from the manufacturing areas to the waste water disposal areas. Ditch samples were collected at eight locations. The two ditch samples associated with the Waste Water Settling Basins were discussed in Section 5.3.1.

Four borings, TNTC-S7, -S8, -S9, and -S22, were installed along a main waste water disposal ditch that trends north-south between manufacturing lines 11 and 12 to eventually empty into the Waste Water Settling Basins along Fox Road. This ditch is still present and clearly identifiable. One sample was collected from each boring at an approximate depth interval of 0.5 to 1.0 feet.

Two of the four samples, TNTC-S8-0.5/1.0 and TNTC-S22-0.5/1.0, contained explosives residues. A number of compounds were found in each sample with concentrations ranging from 0.3 mg/Kg to 7.6 mg/Kg in sample TNTC-S8-0.5/1.0 and from 0.4 mg/Kg to 8.7 mg/Kg in sample TNTC-S22-0.5/1.0.

The remaining two ditch borings, TNTC-S16 and -S21, were installed in the main drainage ditch that trends east-west along the main road through TNT Area C. The borings were installed on the south side of the road between the Bi-Tri House and the Fortifier House for line 11. This ditch is still present and clearly identifiable. One of the borings, TNTC-S21, was terminated just short of 1 foot when auger refusal was reached on a ceramic tile/pipe. It was suggested by site personnel that some of the old drainage ditches were lined with ceramic pipe and it was possible that this was part of such a pipe.

Sample TNTC-S16-0.5/1.0 was the only sample from this ditch which contained explosives residues. Both 2,4-DNT and 2,6-DNT were reported in this sample at concentrations of 1.0 mg/Kg.

QC sample TNTC-S27-0.5/1.0 was a split of sample TNTC-S16-0.5/1.0. 2,4-DNT and 2,6-DNT were detected in both samples at relatively similar concentrations.

5.3.6 Summary of Explosives Residues Contamination in TNT Area C

No previous decontamination efforts of the soil have been documented at TNT Area C. However, contamination by explosives residues was present in only 6 of 26 locations where samples were collected. Contamination was detected at the Waste Water Treatment Settling Tanks, in 3 of the 8 ditch samples, and at the Fortifier House for line 11. All explosives residues concentrations detected were below 10 mg/Kg and the majority were below 5 mg/Kg. Three biotransformation products were detected at low concentrations. None of the nitroaromatics concentrations detected at TNT Area C exceeded the Region III risk-based screening criteria.

As stated previously, TNT Area C is overgrown with trees and brush. The locations of driveways and other structural features related to the former buildings are not as discernible in TNT Area C as they are in TNT Areas A and B. While every effort was made to collect samples from locations immediately surrounding the former Wash House, Bi-Tri House, and Fortifier House, this may not in fact have been achieved. The probability of sample locations actually being in the intended locations is significantly higher in TNT Areas A and B where the former site layout is generally still more evident. This may account for the comparative absence of evidence of contamination in TNT Area C.

The investigation at TNT Area C confirms the results observed at TNT Area A that low levels of explosives residues contamination are present in the ditches which carried process waste water during operation of the PBOW.

Two surface soil samples were collected in the southeast corner of TNT Area C during the 1993 MK Ferguson investigation. One of the samples was collected in a location identified as "near a flume." No explosives residues were reported in either sample.

5.4 BACKGROUND SOILS INVESTIGATION

Background soil borings were installed in areas of the site where contamination was least likely to be present based on known historical uses of the property. Locations of the background soil borings are shown on Figure 5-4. The areas where the borings were installed were screened using Drawing 1661-S-3 entitled "Key to Acquired Buildings on Plum Brook Ordnance Works Reservation" to try to identify areas where buildings were historically present. Additionally, no DoD or NASA environmental concerns had been identified in these areas.

Initially, seven soil borings were to be installed and two samples were to be collected from each boring for a total of 14 background soil samples. Samples were to be collected from each boring at depth intervals of approximately 0.5 to 3 feet and from 3 to 5 feet. Target depth intervals were only achieved for three borings (BG-S1, -S2, and -S5). Two of the borings, BG-S3 and -S6, reached auger refusal on shale at 4 feet and 4.5 feet, respectively. Samples were collected from the soil obtained to the point of refusal and the borings were terminated. The remaining two borings, BG-S4 and -S7, both reached auger refusal because of weathered shale at 3 feet and were terminated. Because only one sample was collected from each boring, an additional boring BG-S9 was installed. Both target depth intervals were achieved in boring BG-S9.

All background soil samples were analyzed for explosives residues, metals, SVOCs, and VOCs.

5.4.1 Explosives Residues in Background Soils

No explosives residues were detected in any of the 14 background soil samples.

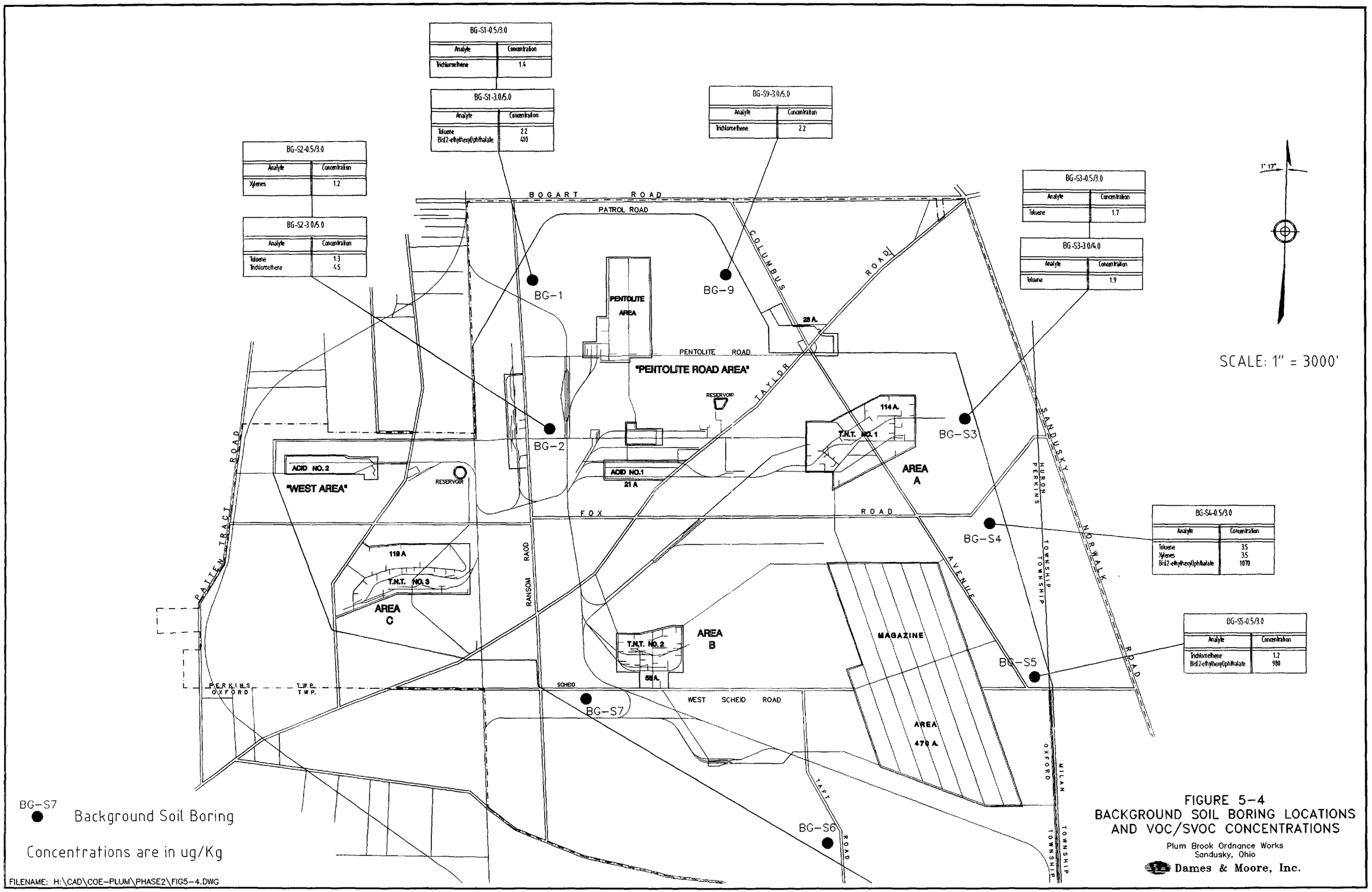


FIGURE 5-4
BACKGROUND SOIL BORING LOCATIONS
AND VOC/SVOC CONCENTRATIONS

Plum Brook Ordnance Works
Sandusky, Ohio

Dames & Moore, Inc.

H:\CAD\COE-PLUM\PHASE2\FIG5-4 Thu Apr 03 19:30:14 1997 Dames & Moore - Atlanta, GA

5.4.2 VOC and SVOC Concentrations in Background Soils

The VOC and SVOC concentrations detected in the background soil samples are listed on Table 5-4 and are illustrated on Figure 5-4.

Four VOCs, cis-1,2-dichloroethene, toluene, trichloroethene, and xylenes were detected, all at concentrations below 5 ug/kg. Toluene and trichloroethene were each detected in five samples. Xylenes were reported in two samples. Cis-1,2-dichloroethene was only detected once, in a sample which also contained trichloroethene. (Cis-1,2-dichloroethene is a daughter product of trichloroethene.) The background samples were generally collected in areas adjacent to site roads. The VOC compounds reported in the background samples are indicative of moderate but ubiquitous soil contamination that would be expected along roadways.

VOCs were detected in a number of soil samples collected during previous investigations. Acetone, toluene, and xylenes were among the compounds previously reported.

Bis(2-ethylhexyl)phthalate, an SVOC compound, was reported in three samples. This compound was also reported in soil samples collected during previous investigations.

QC sample BG-S8-0.5/3.0 was a split of sample BG-S4-0.5/3.0. Two different VOCs were reported in each of the split samples. Toluene and xylenes were present in sample BG-S4-0.5/3.0. Trichloroethene and its daughter product, cis-1,2-dichloroethene, were present in sample BG-S8-0.5/3.0.

5.4.3 Metals Concentrations in Background Soils

Thirteen priority pollutant metals plus manganese were analyzed for each background soil sample. Beryllium, cadmium, mercury, selenium, silver, and thallium were not detected in any of the samples. The results for the metals that were detected in the background soil samples are discussed in Section 5.5 with the metals results for the three TNT areas.

TABLE 5-4

VOC AND SVOC CONCENTRATIONS IN BACKGROUND SOILS

Sample Location	VOCs					SVOCs
	Sample ID	Toluene	Trichloroethane	Xylenes	Cis-1,2-dichloroethene	Bis(2-ethylhexyl)phthalate
Ranson Road/Patrol Road (North)	BG-S1-0.5/3.0		1.4			
	BG-S1-3.0/5.0	2.2				410
Ranson Road/ Pentolite Road	BG-S2-0.5/3.0			1.2		
	BG-S2-3.0/5.0	1.3	4.5			
Patrol Road (Northeast)	BG-S3-0.5/3.0	1.7				
	BG-S3-3.0/4.0	1.9				
Patrol Road South of Fox Road	BG-S4-0.5/3.0	3.5		3.5		1070
Patrol Road/ Columbus Road	BG-S5-0.5/3.0		1.2			980
	BG-S5-3.0/5.0					
Patrol Road/ Taft Road	BG-S6-0.5/3.0					
	BG-S6-3.0/4.5					
Ranson Road/ W. Scheid Road	BG-S7-0.5/3.0					
Patrol Road (North)	BG-S9-0.5/3.0					
	BG-S9-3.0/5.0		2.2			
QC sample	BG-S8-0.5/3.0		4.6		1.3	

VOCs = Volatile organic compounds
SVOCs = semivolatile organic compounds

Concentrations are listed in µg/kg or ppb.

All samples listed in the Sample ID column (column 2) were analyzed for all analytes on the VOC and SVOC method analysis lists. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., BG = Background Location); the soil boring number (e.g., S1 = background soil boring 1); and the depth interval over which the sample was collected (e.g., 0.5/3.0 = soils from 0.5 to 3.0 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

QC sample BG-S8-0.5/3.0 is a split sample of BG-S4-0.5/3.0.

5.5 ANALYSIS OF METALS CONCENTRATIONS

The analysis of the soil metals data involved comparison of metals concentrations in potentially impacted soil to concentrations in background soil. Background soil samples were collected in areas judged to be uninfluenced by practices at the time the site was used for explosives manufacturing. A comparison was necessary because metals are common, natural soil constituents and concentrations would have to be above background levels to be considered contamination.

Section 5.5.1 describes and compares the metals concentrations detected in the soils in the three TNT Areas and in the background samples. Section 5.5.2 presents the statistical comparison of metals concentrations in background soils to concentrations in the three TNT Areas. A summary of metals analysis is provided in Section 5.5.3.

5.5.1 Occurrence of Metals in Soils

As stated previously, the 13 priority pollutant metals plus manganese were analyzed in the soil samples. Metals concentrations in the background soils are listed on Table 5-5 and are illustrated on Figure 5-5. The metals concentrations detected in TNT Areas A, B, and C are listed in Tables 5-6 through 5-8, respectively. Metals concentrations are also illustrated on Figures 5-6 through 5-8.

Descriptive statistics of the metals concentrations in the soils were developed using SAS for the PC, a software system for statistics, data storage, and data handling. Dames & Moore received 61 electronically stored files (in dBase format) from the analytical laboratory which were read directly into SAS. The dBase files included chemical data for all sampled media. Values for alphanumeric variables in the SAS dataset were checked for consistency, and some analyte names were corrected. A soil dataset was then created which excluded other media, limited analytes to explosives and metals, had "background" and "potentially impacted" categories assigned, and specified area designations (e.g., TNT A). In order to have all sample values available for calculations, concentrations reported as "less than the detection limit" were set

TABLE 5-5

METALS CONCENTRATIONS IN BACKGROUND SOIL SAMPLES

Sample Location	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
Ranson Road/Patrol Road (North)	BG-S1-0.5/3.0		6.8			11	3.6	8.5	270		13				41
	BG-S1-3.0/5.0		10			14	5.2	9.5	400		16				39
Ranson Road/ Pentolite Road	BG-S2-0.5/3.0	6.3	8.4			17	2.3	11	340		16				51
	BG-S2-3.0/5.0		12			17	4.0	9.9	314		17				45
Patrol Road (Northeast)	BG-S3-0.5/3.0		3.5			6.2		5.3	152		9.0				43
	BG-S3-3.0/4.0		15			13	35	24	154		33				187
Patrol Road South of Fox Road	BG-S4-0.5/3.0	7.6	17			13	34	27	24		11				13
Patrol Road/ Columbus Road	BG-S5-0.5/3.0	6.7	17			17	10	11	220		28				54
	BG-S5-3.0/5.0	5.9	6.1			29	6.7	13	330		33				64
Patrol Road/Taft Road	BG-S6-0.5/3.0	6.4	23			6.0	14	15	78		15				56
	BG-S6-3.0/4.5		8.3			9.1	7.5	11	21		20				34
Ranson Road/W. Scheid Road	BG-S7-0.5/3.0	7.5	14			14	34	22	63		24				32
QC Sample	BG-S8-0.5/3.0	6.4	19			10	27	23	8.7		9.4				10
Patrol Road (North)	BG-S9-0.5/3.0					9.2		6.6	133		7.6				24
	BG-S9-3.0/5.0					15	17	15	695		30				61

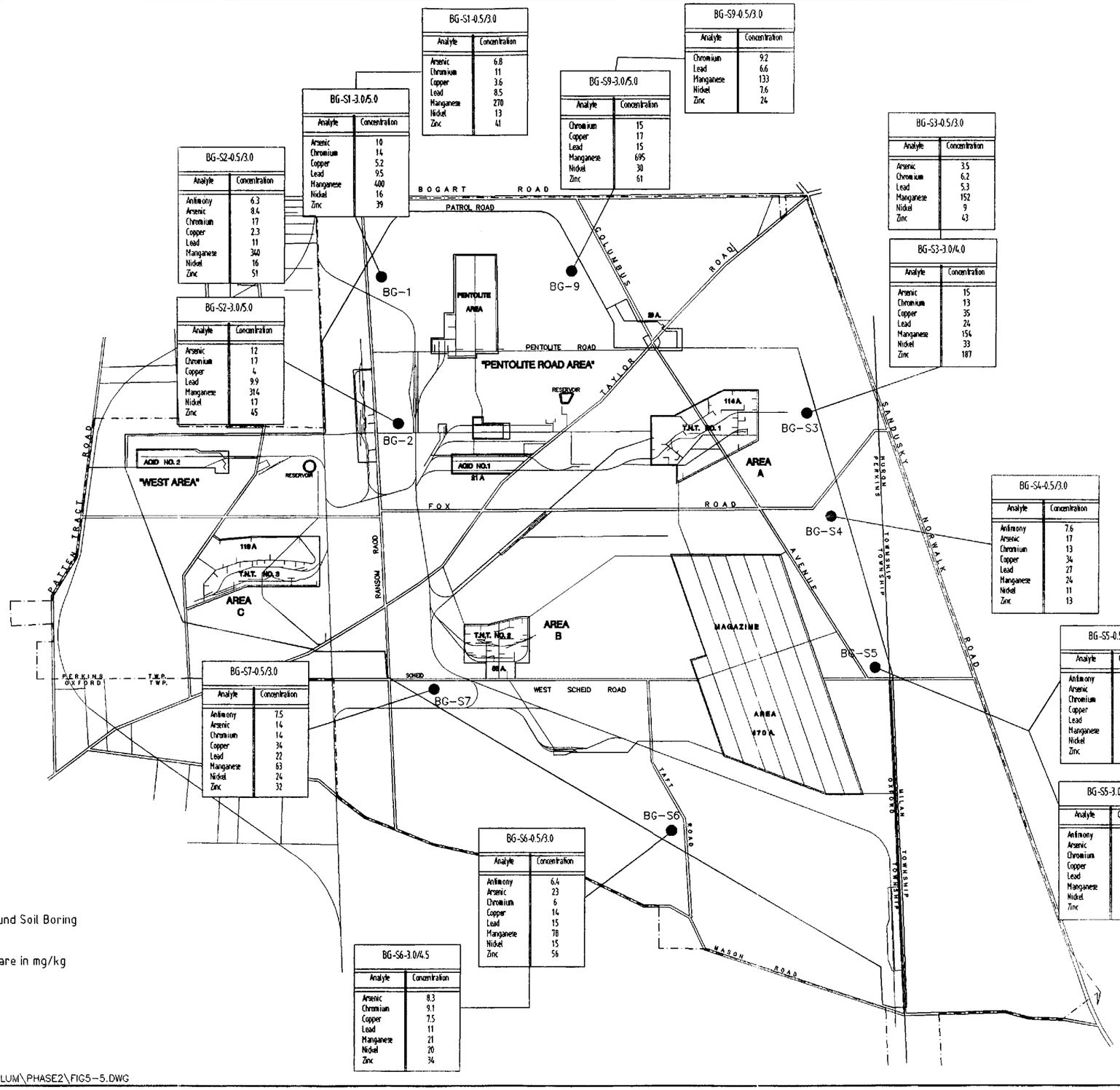
Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., BG = Background Location); the soil boring number (e.g., S1 = background soil boring 1); and the depth interval over which the sample was collected (e.g., 0.5/3.0 = soils from 0.5 to 3.0 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (Column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

G:\WP\C\COE\PLUM-BRO.OK\TNT\TAB5-5.WPD

QC sample BG-S8-0.5/3.0 is a split of sample BG-S4-0.5/3.0.



BG-S1-0.5/3.0	
Analyte	Concentration
Arsenic	6.8
Chromium	11
Copper	3.6
Lead	8.5
Manganese	270
Nickel	13
Zinc	41

BG-S1-3.0/5.0	
Analyte	Concentration
Arsenic	10
Chromium	14
Copper	5.2
Lead	9.5
Manganese	400
Nickel	16
Zinc	39

BG-S2-0.5/3.0	
Analyte	Concentration
Antimony	6.3
Arsenic	8.4
Chromium	17
Copper	2.3
Lead	11
Manganese	340
Nickel	16
Zinc	51

BG-S2-3.0/5.0	
Analyte	Concentration
Arsenic	12
Chromium	17
Copper	4
Lead	9.9
Manganese	314
Nickel	17
Zinc	45

BG-S9-0.5/3.0	
Analyte	Concentration
Chromium	9.2
Lead	6.6
Manganese	133
Nickel	7.6
Zinc	24

BG-S9-3.0/5.0	
Analyte	Concentration
Chromium	15
Copper	17
Lead	15
Manganese	695
Nickel	30
Zinc	61

BG-S3-0.5/3.0	
Analyte	Concentration
Arsenic	3.5
Chromium	6.2
Lead	5.3
Manganese	152
Nickel	9
Zinc	43

BG-S3-3.0/4.0	
Analyte	Concentration
Arsenic	15
Chromium	13
Copper	35
Lead	24
Manganese	154
Nickel	33
Zinc	187

BG-S4-0.5/3.0	
Analyte	Concentration
Antimony	7.6
Arsenic	17
Chromium	13
Copper	34
Lead	27
Manganese	24
Nickel	11
Zinc	13

BG-S5-0.5/3.0	
Analyte	Concentration
Antimony	6.7
Arsenic	17
Chromium	17
Copper	10
Lead	11
Manganese	220
Nickel	28
Zinc	54

BG-S5-3.0/5.0	
Analyte	Concentration
Antimony	5.9
Arsenic	6.1
Chromium	29
Copper	6.7
Lead	13
Manganese	330
Nickel	33
Zinc	64

BG-S7-0.5/3.0	
Analyte	Concentration
Antimony	7.5
Arsenic	14
Chromium	14
Copper	34
Lead	22
Manganese	63
Nickel	24
Zinc	32

BG-S6-0.5/3.0	
Analyte	Concentration
Antimony	6.4
Arsenic	23
Chromium	6
Copper	14
Lead	15
Manganese	78
Nickel	15
Zinc	56

BG-S6-3.0/4.5	
Analyte	Concentration
Arsenic	8.3
Chromium	9.1
Copper	7.5
Lead	11
Manganese	21
Nickel	20
Zinc	34

● BG-S7 Background Soil Boring

Concentrations are in mg/kg

FIGURE 5-5
METALS CONCENTRATION
IN BACKGROUND SOIL BORINGS

Plum Brook Ordnance Works
Sandusky, Ohio

Dames & Moore, Inc.

FILENAME: H:\CAD\COE-PLUM\PHASE2\FIG5-5.DWG

H:\CAD\COE-PLUM\PHASE2\FIG5-5 Thu Apr 03 19:31:13 1997 Dames & Moore - Atlanta, GA

TABLE 5-6

METALS CONCENTRATIONS IN SOIL SAMPLES TNT AREA A

	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
Wastewater Settling Tanks and Pump House - Bldg 187	TNTA-S1-0.0/1.5		4.1			13	5.5	13	187		13				38
	TNTA-S1-1.5/5.0		4.6			13	6.9	10.4	178		17				41
	TNTA-S2-0.0/1.5		3.7			13		9.1	236		9.0				24
	TNTA-S2-1.5/3.0	7.9	5.9			14	5.5	11	1,000		14				33
	TNTA-S3-0.0/1.5		9.1			14	4.4	15	473		19				47
	TNTA-S3-1.5/3.0		3.5			12		6.6	175		8.4				25
	TNTA-S4-0.0/1.5		5.0			12		4.7	138		8.6				24
	TNTA-S4-1.5/5.0					9.8	3.1	4.8	349		9.3				27
Wash House - Line 3 - Bldg 136	TNTA-S5-1.0/2.0		5.3			11.0		5.6	74		5.2				26
	TNTA-S5-2.5/3.5					8.2		5.1	55		6.3				25
	TNTA-S6-1.0/2.0		3.9			53		13	91		7.3				290
	TNTA-S6-2.5/3.5	6.6	6.9			19		18	7,600		54				81
	TNTA-S7-1.0/2.0					34		4.7	240		6.4				300
	TNTA-S7-2.5/3.5					14		6.3	55		5.1				150
	TNTA-S8-2.5/3.5		6.8			20		9.3	500		32				52
Ditch North of Maintenance Road	TNTA-S9-0.0/1.0					8.9		8.3	88		7.6				46

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., TNTA = TNT Area A); the soil boring number (e.g., S1 = soil boring 1 in TNT Area A); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

Sample TNTA-S4-1.5/5.0 is a split of QC sample TNTA-S28-1.5/5.0.

G:\WP\C\CDE\PLUM-BRO.OK\TNT\TAB5-6

TABLE 5-6
(Continued)

	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
Wash House - Line 4 - Bldg 146	TNTA-S10-2.5/3.5					19	12	60	325		25				180
	TNTA-S11-2.5/3.5	5.8	4.8			22		15	270		29				60
	TNTA-S12-1.0/1.5		6.5			21		9.1	330		21				37
	TNTA-S13-1.0/1.5		3.8			30		44	310		23				86
Fortifier House - Bldg 143	TNTA-S14-0.0/2.0		3.5			11	4.3	8.8	170		6.4				51
	TNTA-S15-0.0/2.0					6.2	5.2	48	165		5.2				30
	TNTA-S16-0.0/2.0					46		38	132		6.6				209
	TNTA-S17-0.0/2.0					7.4		20	106		5.3				26
Bi-Tri House - Bldg 142	TNTA-S18-0.5/1.5		3.3			8.4	7.4	9.4	168		6.3				39
	TNTA-S19-0.5/1.5					7.4		14	245		5.3				28
	TNTA-S20-0.5/1.5	7.0	4.1			28	489	1,809	181		32				447
Mono House - Bldg 141	TNTA-S21-0.0/2.0					11		26	290		6.5				34
	TNTA-S22-0.0/2.0	13				7.3	3.1	22	125		4.2				56
	TNTA-S23-0.0/2.0					14	7.7	187	165		5.5				154
DNT Sweating and Graining House - Bldg 192	TNTA-S24-0.0/1.5					23	19	256	344		10.7				267
	TNTA-S24-1.5/3.0					6.2		3.3	86		5.2				19
	TNTA-S25-0.0/1.5					23	3.9	1,400	130		8.6				73
	TNTA-S26-0.0/1.5	7.4				22	6.2	130	140		7.5				56

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., TNTA = TNT Area A); the soil boring number (e.g., S1 = soil boring 1 in TNT Area A); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

Sample TNTA-S11-2.5/3.5 is a split of QC sample TNTA-S27-2.5/3.5.
Sample TNTA-S16-0.0/2.0 is a split of QC sample TNTA-S29-0.0/2.0.
Sample TNTA-S24-1.5/3.0 is a split of QC sample TNTA-S30-1.5/3.0.

G:\WP\C\COE\PLUM-BRO.OK\TNT\TAB5-6

TABLE 5-6
(Continued)

	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
QC Samples	TNTA-S27-2.5/3.5		4.8			18		13	590		26				57
	TNTA-S28-1.5/5.0					10.2		5.3	259		9.4				30
	TNTA-S29-0.0/2.0					52	4.4	55	121		6.6				253
	TNTA-S30-1.5/3.0					5.2		3.4	80		5.2				17
Ditch West of Wastewater Disposal Settling Tanks	TNTA-S31-0.0/1.0		4.6			22	8.6	34	300		23				63
	TNTA-S32-0.0/1.0	6.8				24	38	31	200		23				64

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., TNTA = TNT Area A); the soil boring number (e.g., S1 = soil boring 1 in TNT Area A); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

G:\WP\C\COE\PLUM-BRO.OK\TNT\TAB5-6

QC sample TNTA-S27-2.5/3.5 is a split of TNTA-S11-2.5/3.5.
QC sample TNTA-S28-1.5/5.0 is a split of TNTA-S4-1.5/5.0.
QC sample TNTA-S29-0.0/2.0 is a split of TNTA-S16-0.0/2.0.
QC sample TNTA-S30-1.5/3.0 is a split of TNTA-S24-1.5/3.0.

TABLE 5-7

METALS CONCENTRATIONS IN SOIL SAMPLES TNT AREA TNT AREA B

	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
Wastewater Disposal Settling Tanks - Bldg 417	TNTB-S1-0.0/1.5	8.6	30			15	44	26	77		44				63
	TNTB-S1-1.5/3.0		20			12	25	24	61		25				60
	TNTB-S2-0.0/1.0	7.3	16			9.6	42	29	940		60				95
	TNTB-S2-1.0/2.5		8.5			9.4	29	27	108		23				31
	TNTB-S3-0.0/1.0	7.3	13			10.2	38	55	37		17				43
	TNTB-S3-1.0/2.0	11	17			10.3	48	34	77		36				159
	TNTB-S4-0.0/1.0	11	11			10.2	35	37	87		24				43
	TNTB-S4-1.0/1.5	7.3	14			9.8	40	28	55		23				30
Wash House - Line 6 - Bldg 466	TNTB-S5-1.0/2.0	5.4	6.4			11	18	20	304		21				51
	TNTB-S5-2.5/3.0	6.5	7.7			11	12	11	153		15				48
	TNTB-S6-1.0/2.0		6.4			9.4	18	21	161		16				60
	TNTB-S6-2.5/3.5	8.1	8.7			17	27	76	291		24				128
	TNTB-S7-1.0/2.0	5.2				5.3	17	11	125		10				46
	TNTB-S7-2.5/3.5		7.4			19	26	725	288		28				238
Wash House - Line 5 - Bldg 456	TNTB-S8-2.5/3.0	8.4	29		1.4	13	53	31	326		77				101
	TNTB-S9-1.5/2.7	8.1	22	1.4	1.4	20	47	39	588		49				106
	TNTB-S10-1.5/2.5	10.5	19	1.3	1.3	28	52	37	151		43				70
	TNTB-S11-2.5/3.5	11	20		1.3	13	46	25	190		61				93
Wash House - Line 5 - Bldg 456 (Continued)	TNTB-S12-1.0/2.0	10.6	9.9			10.7	48	21	333		39				63
	TNTB-S13-1.0/2.0	9.2	15	1.3		16	31	32	1609		55				79

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., TNTB = TNT Area B); the soil boring number (e.g., S1 = soil boring 1 in TNT Area B); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (Column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

Sample TNTB-S11-2.5/3.5 is a split of QC sample TNTB-S27-2.5/3.5

TABLE 5-7
(Continued)

	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mangenese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
Fortifier House - Bldg 453	TNTB-S14-0.0/2.0					26	5.5	8.2	220		9.9				168
	TNTB-S15-0.0/2.0					30	4.1	145	248		11				114
	TNTB-S16-0.0/2.0		3.2			5.9	6.5	12	178		9.7				52
	TNTB-S17-0.0/1.5		6.4			10.5	9.0	25	201		14				91
Bi-Tri House - Bldg 452	TNTB-S18-0.5/1.5	17	4.4			12	35	962	118		9.3				214
	TNTB-S19-0.5/2.0				1.2	5.9	5.1	174	99		7.4				154
	TNTB-S20-0.5/1.5					3.1	6.8	90	36		3.4				51
Mono House - Bldg 451	TNTB-S21-0.0/2.0					7.1		3.8	117		9.2				138
	TNTB-S22-0.0/2.0		3.6			18	4.6	19	191		10.3				99
	TNTB-S23-0.0/2.0		4.5		3.4	8.4	33	105	348		8.9				116
DNT Sweating and Graining House - Bldg 412	TNTB-S24-0.0/1.5		10.9			20	166	354	110		33				71
	TNTB-S24-1.5/3.0		14			14	42	38	70		44				71
	TNTB-S25-0/1.5		8			10.8	62	8,111	94		33				54
	TNTB-S26-0/1.5		7.5			13	35	1,236	135		31				157
QC Samples	TNTB-S27-2.5/3.5	9.0	16	1.3		12	57	29	268		80				134
	TNTB-S28-0.5/1.5	18				16	205	1078	119		9.7				873
	TNTB-S29-0.0/2.0					19		9.6	219		13.2				205

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., TNTB = TNT Area B); the soil boring number (e.g., S1 = soil boring 1 in TNT Area B); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (Column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

QC sample TNTB-S27-2.5/3.5 is a split of TNTB-S11-2.5/3.5.
QC sample TNTB-S28-0.5/1.5 is a split of TNTB-S18-0.5/1.5.
QC sample TNTB-S29-0.0/2.0 is a split of TNTB-S16-0.0/2.0.

TABLE 5-8

METALS CONCENTRATIONS IN SOIL SAMPLES TNT AREA C

	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
Ditch	TNTC-S1-0.5/1.0		10.9			15	15	15	322		26				69
	TNTC-S2-0.5/1.0		10.4			24	10.0	23	310		36				76
Wastewater Settling Basins	TNTC-S3-0.0/1.5		5.7			10.9	11	79	231		13				86
	TNTC-S3-1.5/3.5		4.2			10.4	19	85	194		9.4				94
	TNTC-S4-0.0/1.5		5.9			15	9.5	173	333		20				99
	TNTC-S4-1.5/5.0		6.7			18	10.0	16	386		26				67
	TNTC-S5-0.0/1.5		5.3			15	8.1	51	236	0.98	17				71
	TNTC-S5-1.5/5.0		7.4			22	8.0	20	367		26				62
	TNTC-S6-0.0/1.5	7.0	6.0			14	18	23	356		23				74
	TNTC-S6-1.5/4.5	7.2	7.4			19	6.2	15	618		29				70
Ditch	TNTC-S7-0.5/1.0		6.2			14	8.4	18	456		23				61
	TNTC-S8-0.5/1.0		7.5			21	9.7	19	472		31				79
	TNTC-S9-0.5/1.0		9.5			15	13	18	512		30				70
Wash House - Line 12 - Bldg 626	TNTC-S10-2.5/3.5	8.0	7.6			22	9.1	22	824		34				67
	TNTC-S11-2.5/3.5	7.2	8.3			24	15	20	663		39				135
	TNTC-S12-2.5/3.5		8.5			23	5.5	14	598		34				74
	TNTC-S13-2.5/3.5					11	3.1	9.2	244		14				39
	TNTC-S14-1.0/2.0					6.0		4.5	137		5.7				20
	TNTC-S15-1.0/2.0	9.0				8.6		6.4	98		7.2				25

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., TNTC = TNT Area C); the soil boring number (e.g., S1 = soil boring 1 in TNT Area C); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

TABLE 5-8
(Continued)

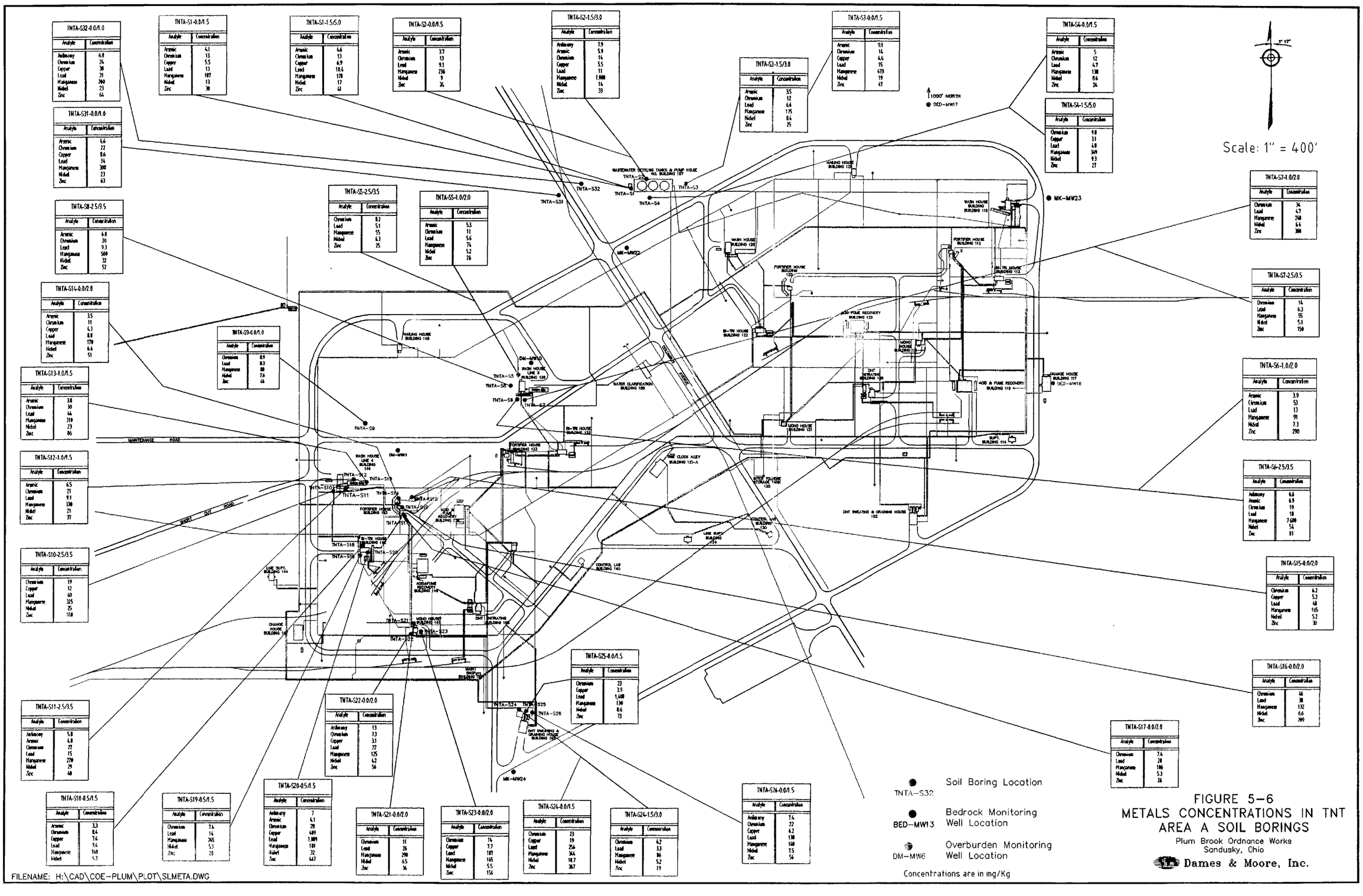
	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
Ditch	TNTC-S16-0.5/1.0					15	8	15	642		36				22
Bi-Tri House - Bldg 612	TNTC-S17-0.0/1.5	13.2				7.8	7.1	75	1,074		12.6				144
	TNTC-S18-0.0/1.5	8.1	6.0			5.2	5.9	35	1,376		8.5				72
	TNTC-S19-0.5/2.0	5.5	3.2			5.9	4.5	90	925		7.8				80
	TNTC-S20-0.0/1.25					5.8		12	325		5.7				25
Ditch	TNTC-S21-0.5/1.0					20		10.1	830		15				35
	TNTC-S22-0.5/1.0	7.6	9.0			21	13	22	756		45				90
Fortifier House - Bldg 613	TNTC-S23-0.0/2.0					6.6		6.0	164		7.8				29
	TNTC-S24-0.0/1.75					17	26	19	123		6.4				71
	TNTC-S25-0.0/1.2					11		125	188		7.6				49
	TNTC-S26-0.0/1.3					24		34	330		15				44
QC Samples	TNTC-S27-0.5/1.0					20		8.0	617		31				23
	TNTC-S28-0.5/1.5	5.8	4.8			5.8	7.0	32	1,682		10.1				77
	TNTC-S29-0.0/2.0					5.2		5.6	123		5.3				20

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., TNTC = TNT Area C); the soil boring number (e.g., S1 = soil boring 1 in TNT Area C); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

QC sample TNTC-S27-0.5/1.0 is a split of TNTC-S16-0.5/1.0.
QC sample TNTC-S28-0.5/1.5 is a split of TNTC-S18-0.5/1.5.
QC sample TNTC-S29-0.0/2.0 is a split of TNTC-S23-0.0/2.0.



TNTA-S32-0.0/1.0

Analyte	Concentration
Antimony	6.8
Chromium	24
Copper	38
Lead	31
Manganese	240
Nickel	23
Zinc	66

TNTA-S31-0.0/1.0

Analyte	Concentration
Arsenic	4.6
Chromium	22
Copper	8.6
Lead	34
Manganese	300
Nickel	23
Zinc	63

TNTA-S1-0.0/1.5

Analyte	Concentration
Arsenic	4.1
Chromium	13
Copper	5.5
Lead	13
Manganese	107
Nickel	13
Zinc	38

TNTA-S1-1.5/5.0

Analyte	Concentration
Arsenic	4.6
Chromium	13
Copper	6.9
Lead	10.4
Manganese	170
Nickel	17
Zinc	41

TNTA-S2-0.0/1.5

Analyte	Concentration
Arsenic	3.7
Chromium	13
Lead	9.1
Manganese	236
Nickel	9
Zinc	24

TNTA-S2-1.5/3.0

Analyte	Concentration
Antimony	7.9
Arsenic	5.9
Chromium	14
Copper	5.5
Lead	11
Manganese	1,900
Nickel	14
Zinc	33

TNTA-S3-1.5/3.0

Analyte	Concentration
Arsenic	3.5
Chromium	12
Lead	6.4
Manganese	175
Nickel	8.4
Zinc	25

TNTA-S3-0.0/1.5

Analyte	Concentration
Arsenic	9.1
Chromium	14
Copper	4.4
Lead	15
Manganese	473
Nickel	19
Zinc	47

TNTA-S4-0.0/1.5

Analyte	Concentration
Arsenic	5
Chromium	12
Lead	4.7
Manganese	138
Nickel	8.6
Zinc	24

TNTA-S4-1.5/5.0

Analyte	Concentration
Chromium	9.8
Copper	3.1
Lead	4.8
Manganese	349
Nickel	9.3
Zinc	27

TNTA-S5-2.5/3.5

Analyte	Concentration
Chromium	8.2
Lead	5.1
Manganese	55
Nickel	6.3
Zinc	25

TNTA-S5-1.0/2.0

Analyte	Concentration
Arsenic	5.3
Chromium	11
Lead	5.6
Manganese	74
Nickel	5.2
Zinc	26

TNTA-S8-2.5/3.5

Analyte	Concentration
Arsenic	6.8
Chromium	20
Lead	9.3
Manganese	500
Nickel	32
Zinc	52

TNTA-S14-0.0/2.0

Analyte	Concentration
Arsenic	3.5
Chromium	11
Copper	4.3
Lead	8.8
Manganese	170
Nickel	6.4
Zinc	51

TNTA-S9-0.0/1.0

Analyte	Concentration
Chromium	8.9
Lead	8.3
Manganese	88
Nickel	7.6
Zinc	46

TNTA-S13-1.0/1.5

Analyte	Concentration
Arsenic	3.8
Chromium	30
Lead	44
Manganese	310
Nickel	23
Zinc	86

TNTA-S12-1.0/1.5

Analyte	Concentration
Arsenic	6.5
Chromium	21
Lead	9.1
Manganese	330
Nickel	21
Zinc	37

TNTA-S10-2.5/3.5

Analyte	Concentration
Chromium	19
Lead	12
Manganese	60
Nickel	325
Zinc	25
	180

TNTA-S11-2.5/3.5

Analyte	Concentration
Antimony	5.8
Arsenic	4.8
Chromium	22
Lead	15
Manganese	270
Nickel	29
Zinc	48

TNTA-S7-1.0/2.0

Analyte	Concentration
Chromium	34
Lead	4.7
Manganese	240
Nickel	6.4
Zinc	300

TNTA-S7-2.5/3.5

Analyte	Concentration
Chromium	14
Lead	6.3
Manganese	55
Nickel	5.1
Zinc	150

TNTA-S6-1.0/2.0

Analyte	Concentration
Arsenic	3.9
Chromium	53
Lead	13
Manganese	91
Nickel	7.3
Zinc	290

TNTA-S6-2.5/3.5

Analyte	Concentration
Antimony	6.8
Arsenic	6.9
Chromium	19
Lead	18
Manganese	7,600
Nickel	54
Zinc	91

TNTA-S15-0.0/2.0

Analyte	Concentration
Chromium	6.2
Copper	5.2
Lead	48
Manganese	165
Nickel	5.2
Zinc	30

TNTA-S16-0.0/2.0

Analyte	Concentration
Chromium	46
Lead	38
Manganese	132
Nickel	6.6
Zinc	299

TNTA-S17-0.0/2.0

Analyte	Concentration
Chromium	7.4
Lead	28
Manganese	196
Nickel	5.3
Zinc	26

TNTA-S18-0.5/1.5

Analyte	Concentration
Arsenic	3.3
Chromium	8.4
Copper	7.4
Lead	9.4
Manganese	160
Nickel	5.3

TNTA-S19-0.5/1.5

Analyte	Concentration
Chromium	7.4
Lead	14
Manganese	265
Nickel	5.3
Zinc	28

TNTA-S20-0.5/1.5

Analyte	Concentration
Antimony	7
Arsenic	4.1
Chromium	28
Copper	489
Lead	1,800
Manganese	181
Nickel	32
Zinc	447

TNTA-S22-0.0/2.0

Analyte	Concentration
Antimony	13
Chromium	73
Copper	3.1
Lead	22
Manganese	125
Nickel	4.2
Zinc	56

TNTA-S21-0.0/2.0

Analyte	Concentration
Chromium	11
Lead	26
Manganese	290
Nickel	6.5
Zinc	36

TNTA-S23-0.0/2.0

Analyte	Concentration
Chromium	16
Copper	7.7
Lead	187
Manganese	165
Nickel	5.5
Zinc	156

TNTA-S24-0.0/1.5

Analyte	Concentration
Chromium	23
Copper	19
Lead	256
Manganese	364
Nickel	18.7
Zinc	267

TNTA-S24-1.5/3.0

Analyte	Concentration
Chromium	6.2
Lead	3.3
Manganese	86
Nickel	5.2
Zinc	19

TNTA-S25-0.0/1.5

Analyte	Concentration
Chromium	23
Copper	3.9
Lead	1,400
Manganese	130
Nickel	8.6
Zinc	73

TNTA-S26-0.0/1.5

Analyte	Concentration
Antimony	7.4
Chromium	22
Copper	6.2
Lead	130
Manganese	160
Nickel	7.5
Zinc	56

FIGURE 5-6
METALS CONCENTRATIONS IN TNT AREA A SOIL BORINGS

Plum Brook Ordnance Works
Sandusky, Ohio

Dames & Moore, Inc.

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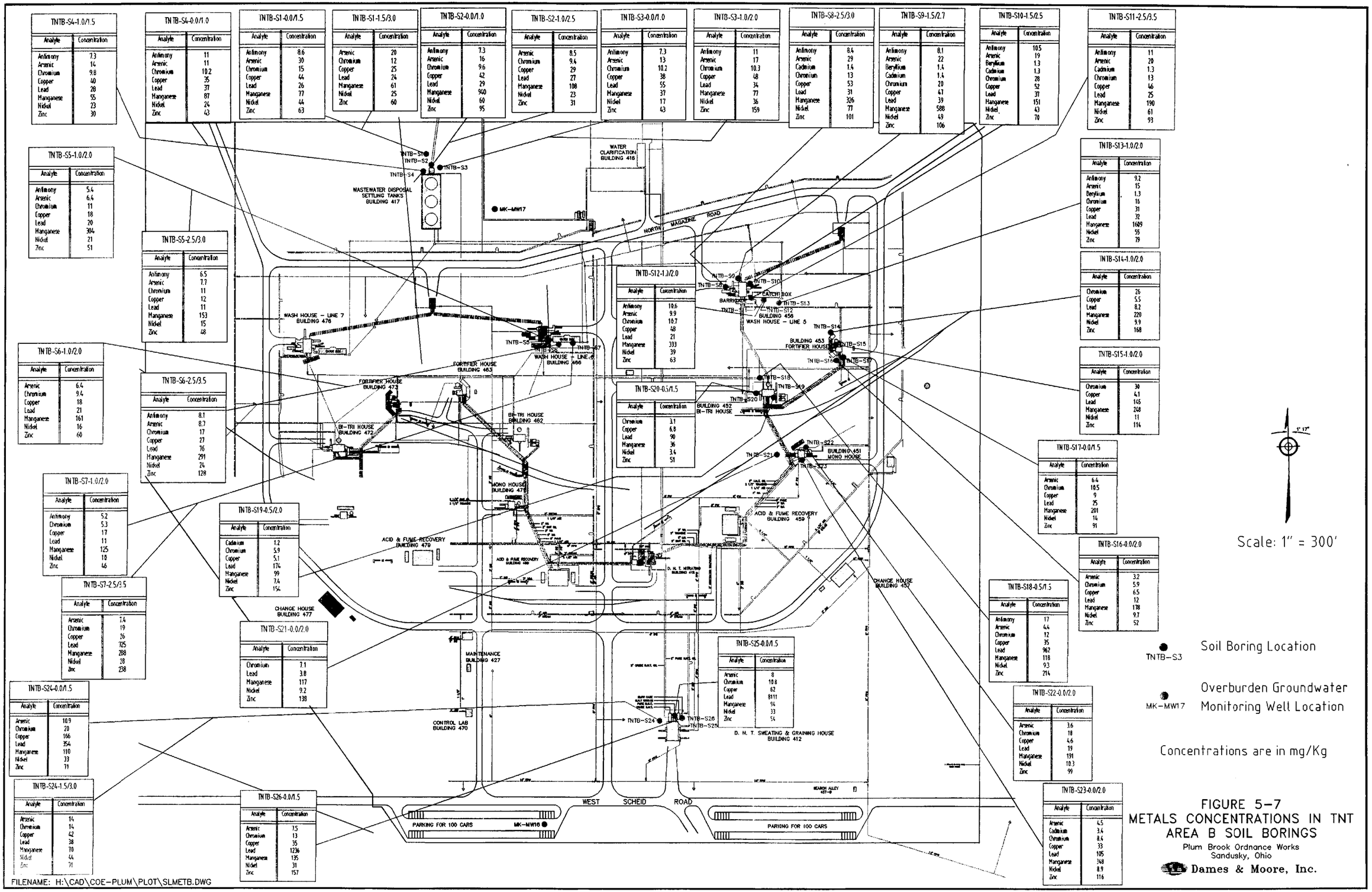

TNTB-S4-1.0/1.5

Analyte	Concentration
Antimony	7.3
Arsenic	14
Chromium	9.8
Copper	40
Lead	28
Manganese	55
Nickel	23
Zinc	30

TNTB-S4-0.0/1.0

Analyte	Concentration
Antimony	11
Arsenic	11
Chromium	10.2
Copper	35
Lead	37
Manganese	87
Nickel	24
Zinc	43

TNTB-S1-0.0/1.5

Analyte	Concentration
Antimony	8.6
Arsenic	30
Chromium	15
Copper	44
Lead	26
Manganese	77
Nickel	44
Zinc	63

TNTB-S1-1.5/3.0

Analyte	Concentration
Arsenic	20
Chromium	12
Copper	25
Lead	24
Manganese	61
Nickel	25
Zinc	60

TNTB-S2-0.0/1.0

Analyte	Concentration
Antimony	7.3
Arsenic	16
Chromium	9.6
Copper	42
Lead	29
Manganese	940
Nickel	60
Zinc	95

TNTB-S2-1.0/2.5

Analyte	Concentration
Arsenic	8.5
Chromium	9.4
Copper	29
Lead	27
Manganese	108
Nickel	23
Zinc	31

TNTB-S3-0.0/1.0

Analyte	Concentration
Antimony	7.3
Arsenic	13
Chromium	10.2
Copper	38
Lead	55
Manganese	37
Nickel	17
Zinc	43

TNTB-S3-1.0/2.0

Analyte	Concentration
Antimony	11
Arsenic	17
Chromium	10.3
Copper	48
Lead	34
Manganese	77
Nickel	36
Zinc	159

TNTB-S8-2.5/3.0

Analyte	Concentration
Antimony	8.4
Arsenic	29
Cadmium	1.4
Chromium	13
Copper	53
Lead	31
Manganese	326
Nickel	77
Zinc	101

TNTB-S9-1.5/2.7

Analyte	Concentration
Antimony	8.1
Arsenic	22
Beryllium	1.4
Cadmium	1.4
Chromium	20
Copper	47
Lead	39
Manganese	588
Nickel	49
Zinc	106

TNTB-S10-1.5/2.5

Analyte	Concentration
Antimony	10.5
Arsenic	19
Beryllium	1.3
Cadmium	1.3
Chromium	28
Copper	52
Lead	31
Manganese	151
Nickel	43
Zinc	70

TNTB-S11-2.5/3.5

Analyte	Concentration
Antimony	11
Arsenic	20
Cadmium	1.3
Chromium	13
Copper	46
Lead	25
Manganese	190
Nickel	61
Zinc	93

TNTB-S5-1.0/2.0

Analyte	Concentration
Antimony	5.4
Arsenic	6.4
Chromium	11
Copper	18
Lead	20
Manganese	304
Nickel	21
Zinc	51

TNTB-S5-2.5/3.0

Analyte	Concentration
Antimony	6.5
Arsenic	7.7
Chromium	11
Copper	12
Lead	11
Manganese	153
Nickel	15
Zinc	48

TNTB-S12-1.0/2.0

Analyte	Concentration
Antimony	10.6
Arsenic	9.9
Chromium	10.7
Copper	48
Lead	21
Manganese	333
Nickel	39
Zinc	63

TNTB-S13-1.0/2.0

Analyte	Concentration
Antimony	9.2
Arsenic	15
Beryllium	1.3
Chromium	16
Copper	31
Lead	32
Manganese	1689
Nickel	55
Zinc	79

TNTB-S14-1.0/2.0

Analyte	Concentration
Chromium	26
Copper	5.5
Lead	8.2
Manganese	220
Nickel	9.9
Zinc	168

TNTB-S6-1.0/2.0

Analyte	Concentration
Arsenic	6.4
Chromium	9.4
Copper	18
Lead	21
Manganese	161
Nickel	16
Zinc	60

TNTB-S6-2.5/3.5

Analyte	Concentration
Antimony	8.1
Arsenic	8.7
Chromium	17
Copper	27
Lead	16
Manganese	291
Nickel	24
Zinc	128

TNTB-S20-0.5/1.5

Analyte	Concentration
Chromium	3.1
Copper	6.8
Lead	90
Manganese	36
Nickel	3.4
Zinc	51

TNTB-S15-1.0/2.0

Analyte	Concentration
Chromium	30
Copper	4.1
Lead	165
Manganese	268
Nickel	11
Zinc	114

TNTB-S17-0.0/1.5

Analyte	Concentration
Arsenic	6.4
Chromium	10.5
Copper	9
Lead	25
Manganese	201
Nickel	14
Zinc	91

TNTB-S7-1.0/2.0

Analyte	Concentration
Antimony	5.2
Chromium	5.3
Copper	17
Lead	11
Manganese	125
Nickel	10
Zinc	46

TNTB-S19-0.5/2.0

Analyte	Concentration
Cadmium	1.2
Chromium	5.9
Copper	5.1
Lead	174
Manganese	99
Nickel	7.4
Zinc	154

TNTB-S16-0.0/2.0

Analyte	Concentration
Arsenic	3.2
Chromium	5.9
Copper	6.5
Lead	12
Manganese	138
Nickel	9.7
Zinc	52

TNTB-S7-2.5/3.5

Analyte	Concentration
Arsenic	7.4
Chromium	19
Copper	16
Lead	725
Manganese	288
Nickel	18
Zinc	238

TNTB-S18-0.5/1.5

Analyte	Concentration
Antimony	17
Arsenic	4.4
Chromium	12
Copper	35
Lead	962
Manganese	118
Nickel	9.3
Zinc	214

TNTB-S21-0.0/2.0

Analyte	Concentration
Chromium	7.1
Lead	3.8
Manganese	117
Nickel	9.2
Zinc	138

TNTB-S25-0.0/1.5

Analyte	Concentration
Arsenic	8
Chromium	10.8
Copper	62
Lead	8111
Manganese	94
Nickel	33
Zinc	54

TNTB-S22-0.0/2.0

Analyte	Concentration
Arsenic	3.6
Chromium	18
Copper	4.6
Lead	19
Manganese	191
Nickel	10.3
Zinc	99

TNTB-S24-0.0/1.5

Analyte	Concentration
Arsenic	10.9
Chromium	20
Copper	166
Lead	354
Manganese	110
Nickel	33
Zinc	71

TNTB-S24-1.5/3.0

Analyte	Concentration
Arsenic	14
Chromium	14
Copper	42
Lead	38
Manganese	70
Nickel	44
Zinc	71

TNTB-S26-0.0/1.5

Analyte	Concentration
Arsenic	15
Chromium	13
Copper	35
Lead	1236
Manganese	135
Nickel	31
Zinc	157

TNTB-S23-0.0/2.0

Analyte	Concentration
Arsenic	4.5
Cadmium	3.4
Chromium	8.4
Copper	33
Lead	105
Manganese	348
Nickel	8.9
Zinc	116

FIGURE 5-7
METALS CONCENTRATIONS IN TNT AREA B SOIL BORINGS
Plum Brook Ordnance Works
Sandusky, Ohio

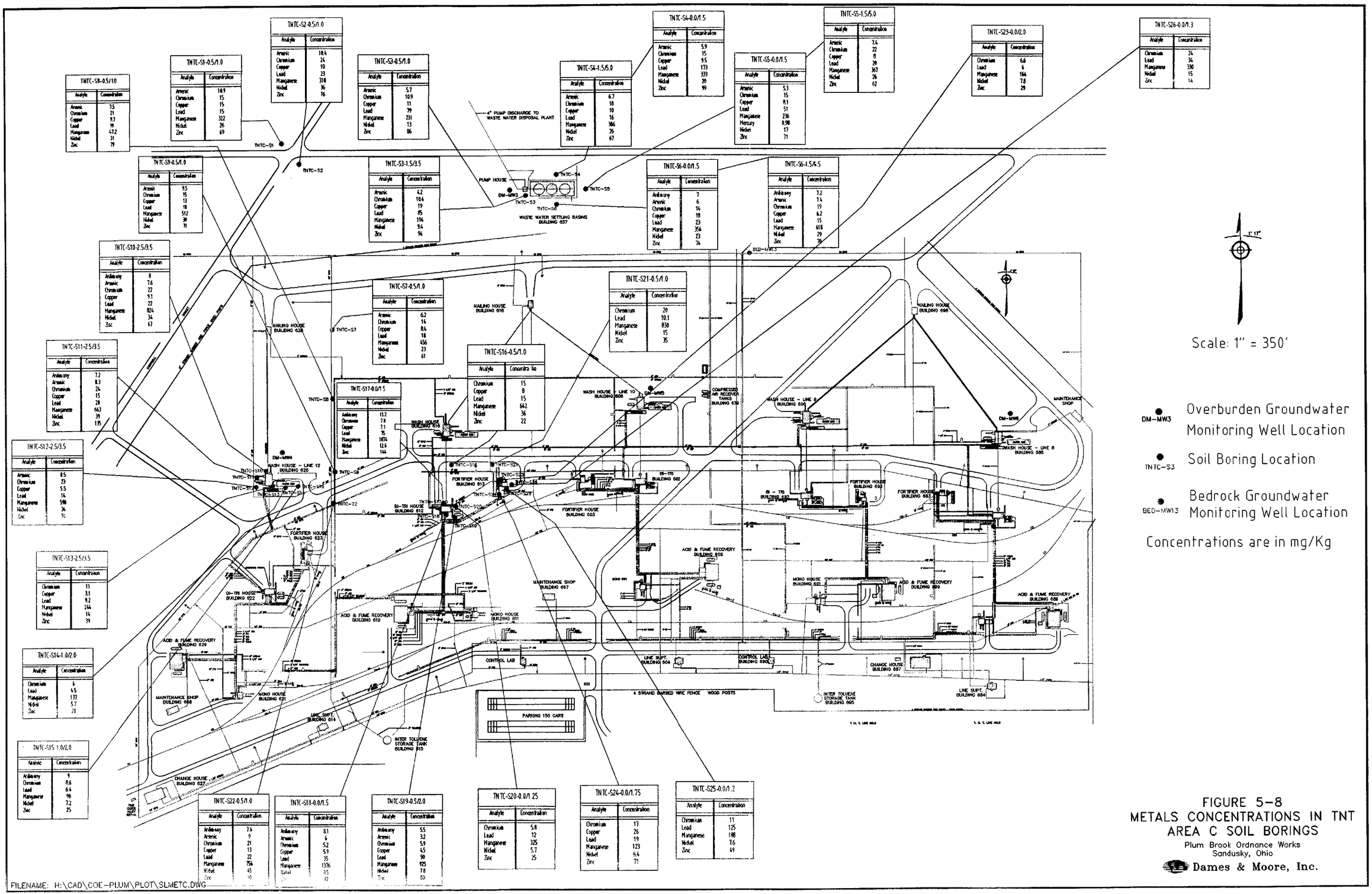

FIGURE 5-8
METALS CONCENTRATIONS IN TNT AREA C SOIL BORINGS
Plum Brook Ordnance Works
Sandusky, Ohio
Dames & Moore, Inc.

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equal to one half of the detection limit value. Split sample results were averaged to avoid bias in the statistical analysis. Following these data preparation steps, descriptive statistics for each metal were calculated in background and potentially impacted categories. The descriptive statistics for background soils and for soils in the TNT areas are provided on Table 5-9.

Selenium, silver, and thallium were not detected in any of the samples. The concentrations reported for the other 11 metals are summarized below.

5.5.1.1 Antimony

Antimony was detected in six of the 14 background soil samples. Concentrations in samples where antimony was detected ranged from 5.9 mg/Kg to 7.6 mg/Kg. The common range of antimony in soils is 2 to 10 mg/Kg (Shields, 1985). All background antimony concentrations were within this range.

Antimony was detected in soils in each of the three TNT areas. In TNT Area A, antimony was detected in only seven of 36 samples at concentrations ranging from 5.8 mg/Kg to 13 mg/Kg. In TNT Area B, antimony was detected much more frequently, in 17 of the 34 samples. Concentrations ranged from 5.2 mg/Kg to 17.5 mg/Kg (average of split samples TNTB-S18-0.5/1.5 and TNTB-S28-0.5/1.5). In TNT Area C, antimony was present in only 9 of the 30 samples. Concentrations ranged from 5.5 mg/Kg to 13.2 mg/Kg. Overall in the three TNT Areas, antimony was detected in about a third of the samples. All antimony concentrations were within the common range in the United States. Although antimony concentrations in several of the soil samples in the TNT areas were somewhat higher than in the background soils, overall concentrations were relatively similar.

The average and median antimony concentrations in the soils from the three TNT areas were consistent with the average and median antimony concentrations in the background soils.

TABLE 5-9

DESCRIPTIVE STATISTICS FOR METALS IN TNT AND BACKGROUND AREAS SOILS

Analyte	Category	Frequency of Detection (%)	Total No. Obs.	Min	Median	Average	Standard Deviation	Max DL[a]	75th %ile	95th %ile	Max	Units
Antimony	BACKGROUND	42.86	14	2.70	2.9750	4.45714	1.98870	6.10	6.400	7.5	7.5	mg/kg
	TNT AREAS	32.00	100	2.55	2.9875	4.64575	3.03608	8.65	6.975	10.8	17.5	mg/kg
Arsenic	BACKGROUND	85.71	14	1.65	9.2	10.400	6.40946	3.7	15.00	23.0	23	mg/kg
	TNT AREAS	64.00	100	1.55	4.6	6.228	5.75099	6.0	7.85	18.5	30	mg/kg
Beryllium	BACKGROUND		14	0.55	0.55	0.56429	0.02344	1.2	0.6	0.600	0.6	mg/kg
	TNT AREAS	3.00	100	0.50	0.55	0.5900	0.14412	1.9	0.6	0.725	1.4	mg/kg
Cadmium	BACKGROUND		14	0.55	0.55	0.56429	0.02344	1.2	0.6	0.600	0.6	mg/kg
	TNT AREAS	5.00	100	0.50	0.55	0.62600	0.32316	1.9	0.6	1.075	3.4	mg/kg
Chromium	BACKGROUND	100.00	14	6.0	13.500	13.5000	5.80212		17	29	29	mg/kg
	TNT AREAS	100.00	100	3.1	13.525	15.2985	8.29492		20	29	53	mg/kg
Copper	BACKGROUND	85.71	14	1.10	7.10	12.2857	12.2410	2.20	17	35.0	35	mg/kg
	TNT AREAS	71.00	100	1.05	7.25	21.0205	53.0397	9.25	22	52.5	489	mg/kg
Lead	BACKGROUND	100.00	14	5.30	11	13.343	6.243		15.00	25.0	25	mg/kg
	TNT AREAS	100.00	100	3.35	22	180.412	848.628		47.25	872.5	8111	mg/kg
Manganese	BACKGROUND	100.00	14	16.35	187.0	227.596	183.448		330	695	695	mg/kg
	TNT AREAS	100.00	100	36.00	224.5	381.540	784.009		346	970	7600	mg/kg
Mercury	BACKGROUND		14	0.135	0.14	0.14179	0.005041	0.30	0.145	0.15	0.15	mg/kg
	TNT AREAS	1.00	100	0.125	0.14	0.14945	0.084545	0.37	0.150	0.16	0.98	mg/kg

TABLE 5-9
(Continued)

Analyte	Category	Frequency of Detection (%)	Total No. Obs.	Min	Median	Average	Standard Deviation	Max DL[a]	75th %ile	95th %ile	Max	Units
Nickel	BACKGROUND	100.00	14	7.6	16.5	19.4143	8.7662		28.0	33.0	33	mg/kg
	TNT AREAS	100.00	100	3.4	15.0	20.2360	15.3398		28.5	51.5	77	mg/kg
Selenium	BACKGROUND		14	2.15	2.25	2.26786	0.09325	4.9	2.350	2.450	2.45	mg/kg
	TNT AREAS		100	2.05	2.20	2.25875	0.16478	5.9	2.375	2.525	2.95	mg/kg
Silver	BACKGROUND		14	0.55	0.55	0.56429	0.023440	1.2	0.6	0.60	0.60	mg/kg
	TNT AREAS		100	0.50	0.55	0.56400	0.044569	1.5	0.6	0.65	0.75	mg/kg
Thallium	BACKGROUND		14	2.70	2.85	2.84643	0.10278	6.1	2.9000	3.05	3.05	mg/kg
	TNT AREAS		100	2.55	2.80	2.82425	0.20528	7.4	2.9625	3.15	3.70	mg/kg
Zinc	BACKGROUND	100.00	14	11.5	44.0	53.0357	41.1603		56	187.0	187.0	mg/kg
	TNT AREAS	100.00	100	18.0	65.5	87.6700	82.5027		97	252.5	543.5	mg/kg

[a] = Detection Limit

5.5.1.2 Arsenic

Arsenic was detected in 12 of the 14 background soil samples. Concentrations in samples where arsenic was detected ranged from 3.5 mg/Kg to 23 mg/Kg. The common range of arsenic in soils is from 1 to 50 mg/Kg, with an average of 5 mg/Kg (Shields, 1985). All background arsenic concentrations were within this range.

Arsenic was also detected in soils in each of the three TNT Areas. Concentrations in the seven samples in TNT Area A ranged from 3.3 mg/Kg to 9.1 mg/Kg. In TNT Area B, arsenic was detected in 28 of the 34 samples. Concentrations ranged from 3.2 mg/Kg to 30 mg/Kg. In TNT Area C, arsenic was detected in 19 of the 30 samples at concentrations ranging from 3.2 mg/Kg to 10.9 mg/Kg. As these data indicate, the greatest frequency of arsenic detected and the highest concentrations were found in TNT Area B. All arsenic concentrations in the TNT area soils were within the common range in soils of 1 to 50 mg/Kg.

The average and median arsenic concentrations in the soils from the three TNT areas were consistent with the average and median arsenic concentrations in the background soils. In both cases, values were higher in the background soil samples.

5.5.1.3 Beryllium

Beryllium was detected in four soil samples collected from TNT Area B. No beryllium was detected in the background soil samples or in samples collected from TNT Areas A and C. Concentrations in the four samples in TNT Area B ranged from 1.3 mg/Kg to 1.4 mg/Kg. All of the samples in which beryllium was detected were collected in one area, near the Wash House for TNT manufacturing line 5. The common range of beryllium in soils is 0.1 to 40 mg/Kg, with an average of 6 mg/Kg (Shields, 1985). The values reported in the four samples at TNT Area B are within this range.

5.5.1.4 Cadmium

Cadmium was also detected only in TNT Area B. In the six samples where it was reported, concentrations ranged from 1.2 mg/Kg to 3.4 mg/Kg. Four of the six samples where cadmium was detected were also collected near the TNT manufacturing line 5 Wash House. The common range for cadmium in soils is 0.01 to 0.7 mg/Kg, with an average of 0.06 mg/Kg (Shields, 1985). These cadmium concentrations are higher than the normal concentrations in U.S. soils.

5.5.1.5 Chromium

Chromium was detected in all of the background soil samples. Concentrations ranged from 6 mg/Kg to 29 mg/Kg. The common range for chromium in soils is 1 mg/Kg to 1,000 mg/Kg, with an average of 100 mg/Kg (Shields, 1985). Chromium concentrations in the background soils are within this range.

As with the background soil samples, chromium was detected in all of the soil samples collected from the TNT areas. Concentrations were generally comparable to background levels and ranged from 5.2 mg/Kg to 53 mg/Kg in TNT Area A; from 3.1 mg/Kg to 30 mg/Kg in TNT Area B; and from 5.2 mg/Kg to 24 mg/Kg in TNT Area C. All values are within the common range for chromium in soil.

The average and median chromium concentrations in the soils from the three TNT areas were consistent with the average and median chromium concentrations in the background soils.

5.5.1.6 Copper

Copper was detected in 12 of the 14 background soil samples. Concentrations in samples where copper was detected ranged from 2.3 mg/Kg to 35 mg/Kg. The common range of copper in soils is 2 mg/Kg to 100 mg/Kg, with an average of

30 mg/Kg (Shields, 1985). Copper concentrations in background soils were within this range.

Copper was detected in slightly less than three quarters of the soil samples collected from the TNT areas. In TNT Area A, copper was detected in half of the samples. Concentrations ranged from 3.1 mg/Kg to 489 mg/Kg. The concentration of 489 mg/Kg detected in sample TNTA-S20-0.5/1.5 is outside the common range of copper concentrations in soils in the United States. It was also inconsistent with the other copper levels detected in TNT Area A, all of which were within the common range. This particular sample also had high levels of lead and zinc and is probably not representative of soil conditions sitewide. Explosives residues were detected in this sample, but only at low levels.

In TNT Area B, copper was detected in all but one of the 34 samples at concentrations ranging from 4.1 mg/Kg to 205 mg/Kg. In TNT Area B, all of the copper values except two were within the normal range for U.S. soils. One sample at the DNT Sweating and Graining House of 166 mg/Kg exceeded the normal range. A second sample, collected from the Bi-Tri House, had a value of 205 mg/Kg, also higher than the normal range. However, this sample was one of a split sample set. In the second sample, the copper value was 35 mg/Kg, well within the common range.

In TNT Area C copper was detected in 23 of 30 samples at concentrations ranging from 3.1 mg/Kg to 26 mg/Kg. All of the copper values reported at TNT Area C were within the common range.

The median copper concentration in the soils from the three TNT areas is consistent with the median copper concentration in the background soils. However, the elevated copper concentration in one sample from TNT Area A (489 mg/Kg) causes the mean copper concentration for the TNT areas samples to be slightly higher than the mean value for the background samples.

5.5.1.7 Lead

Lead was detected in all of the background soil samples. Concentrations ranged from 5.3 mg/Kg to 27 mg/Kg. The common range of lead in soils is 2 mg/Kg to 200 mg/Kg, with an average of 10 mg/Kg (Shields, 1985). Lead concentrations were within this range in background soils.

Lead was detected in all 100 soil samples collected from the three TNT areas. Concentrations ranged from 3.35 mg/Kg (average of two split samples) to 1,809 mg/Kg in TNT Area A; from 3.8 mg/Kg to 8,111 mg/Kg in TNT Area B; and from 4.5 mg/Kg to 173 mg/Kg at TNT Area C. Three samples from TNT Area A and five samples from TNT Area B were outside the common range of lead in soils. In TNT Area A, the samples with elevated lead concentrations were collected from boring TNTA-S20 installed at the Bi-Tri House and borings TNTA-S24 and -S25 installed at the DNT Sweating and Graining House. Low levels of explosives residues were detected in the sample from boring TNT-S20 at the Bi-Tri House and boring TNTA-S25 at the DNT Sweating & Graining House. However, no explosives residues were reported in the sample from boring TNTA-S24 which contained the high lead level. In TNT Area B, explosives residues were reported in all five samples with elevated lead concentrations.

Both the mean and the median lead concentrations in the soils from the three TNT areas are higher than in the background soils.

5.5.1.8 Manganese

Manganese was also detected in all of the background soil samples. Concentrations ranged from 8.7 mg/Kg to 695 mg/Kg. The common range of manganese in soils is 20 to 3,000 mg/Kg with an average of 600 mg/Kg (Shields, 1985). All manganese concentrations were within this range.

Manganese was also detected in all of the TNT areas soils. Concentrations ranged from 55 mg/Kg to 7,600 mg/Kg in TNT Area A; from 36 mg/Kg to 1,609 mg/Kg in

TNT Area B; and from 98 mg/Kg to 1,529 mg/Kg (average of two split samples) in TNT Area C. Only one sample from TNT Area A was outside the common range of manganese in soils. However, based on a comparison of the mean and median values for the background soils and the TNT areas soils, the manganese levels in the TNT areas are above background levels.

5.5.1.9 Mercury

Mercury was not detected in any of the samples collected from background areas or from TNT Areas A or B. However, mercury was detected in one sample, TNTC-S5-0.0/1.5, from TNT Area C. The reported concentration was 0.98 mg/Kg. The observed range of mercury in soils located in the Eastern United States is from 0.01 to 3.40 mg/Kg, with a mean of 0.147 mg/Kg (Carey and Barrett, 1980). The mercury concentration from this one sample from TNT Area C is within this range. No explosives residues were detected in this sample.

5.5.1.10 Nickel

Nickel was detected in all background soil samples. Concentrations ranged from 7.6 mg/Kg to 33 mg/Kg. The common range of nickel in soils is 5 mg/Kg to 500 mg/Kg with an average of 40 mg/Kg (Shields, 1985). All background nickel concentrations were within this range.

Nickel was also detected in all 100 soil samples collected from the TNT areas. Concentrations ranged from 4.2 mg/Kg to 32 mg/Kg in TNT Area A; from 3.4 mg/Kg to 77 mg/Kg in TNT Area B; and from 5.7 mg/Kg to 39 mg/Kg in TNT Area C. All values were within the common range for nickel in soils.

The average and median nickel concentrations in the soils from the three TNT areas were consistent with the average and median nickel concentrations in the background soils.

5.5.1.11 Zinc

Zinc was detected in all background soil samples. Concentrations ranged from 10 mg/Kg to 187 mg/Kg. The common range of zinc in soils is 10 mg/Kg to 300 mg/Kg with an average of 50 mg/Kg (Shields, 1985). All zinc background concentrations were within this range.

Zinc was also detected in all of the TNT areas soil samples. Concentrations ranged from 18 mg/Kg to 447 mg/Kg in TNT Area A; from 30 mg/Kg to 543.5 mg/Kg (average of two split samples) in TNT Area B; and from 20 mg/Kg to 144 mg/Kg in TNT Area C. Most of the zinc values were within the common range for soils in the United States. In one sample each from TNT Areas A and B, zinc concentrations were above the common range. As stated previously, elevated levels of zinc, lead, and copper were detected in the sample from boring TNTA-S20, although on low levels of explosives residues were reported. In zinc value above the common range in TNT Area B was reported in the sample from boring TNTB-S18 which did contain elevated levels of nitroaromatics.

Both the mean and the median zinc concentrations in the soils from the three TNT areas are higher than in the background soils.

5.5.2 Statistical Analysis of Metals in Soils

In order to evaluate the likelihood of metal contamination, the relative frequency of values greater than the maximum background concentration and greater than the maximum detection limit was determined in each of the TNT areas. Correlations between metal and explosives residues concentrations were studied as indications that potential metals contamination was related to the TNT manufacturing process. In other words, if explosives residues levels were related to metals values in areas were metal contamination was suspected, then soil contamination with metals was corroborated. Also, significant relationships may be useful for predicting explosives residues concentrations from metals levels (metals analyses are easier and cheaper).

Frequencies greater than 10 percent were regarded as indicating potential contamination and were correlated with detections of explosives residues.

Potential contamination was investigated for each area using the percent occurrence of values greater than both the maximum background concentration and the maximum detection limit. The percent occurrence for each metal in the analysis is listed on Table 5-10. As stated above, no selenium, silver, or thallium detected in any TNT area soil samples; beryllium, cadmium, and mercury were seldom detected. None of these metals were considered to be potential contaminants. Of the metals that were detected frequently, lead, manganese, and zinc had concentrations in TNT areas soils that were clearly above the background levels as indicated on Table 5-9. Lead exceeded 10 percent occurrence in each TNT area, with a maximum of 67.6 percent in TNT Area B and an overall occurrence of 44 percent. Nickel was above the maxima in 29.4 and 20.0 percent of the samples in TNT Areas B and C, respectively. Antimony, chromium, copper, manganese, and zinc exceeded 10 percent occurrence in only one area. Arsenic, with relatively high background concentrations, had fewer than 10 percent of its samples above the maxima in all areas. Therefore, arsenic was not considered to be a potential contaminant.

Using data for metals suspected of being contaminants, correlation coefficients were calculated for metal and nitroaromatics concentrations in each area. Correlation coefficients were calculated only for the areas where potential contamination was observed, and all explosives data were used. The Type I error level for the coefficients (referred to as "p") was set at 0.005; a Type I error occurs when a correlation is considered significant when it actually is not. The error level was set low because 134 correlation coefficients were determined for the PBS, and spurious findings of significance would be likely at higher error levels. Scatter plots were viewed to better understand relationships between metals and explosives concentrations. Also, coincidences of high metals and explosives concentrations were evaluated by comparing results tabulated by sampling location.

Significant ($p = 0.005$) correlations were seen for antimony, copper, and lead in TNT Area B, and lead levels were also correlated with a particular explosive residue in TNT

TABLE 5-10

PERCENT OCCURRENCE OF SOIL METALS CONCENTRATIONS EXCEEDING BOTH THE MAXIMUM BACKGROUND LEVEL AND THE MAXIMUM DETECTION LIMIT BY SAMPLING AREA

	AREA			
Metal	TNTA	TNTB	TNTC	Overall
Antimony	2.8	20.6*	6.7	10.0
Arsenic	0	5.9	0	2.0
Chromium	11.1*	2.9	0	5.0
Copper	5.6	41.2*	0	16.0
Lead	33.3*	67.6*	30.0*	44.0
Manganese	5.6	5.9	20.0*	10.0
Nickel	2.8	29.4*	20.0*	17.0
Zinc	13.9*	5.9	0	7.0

* Occurrences > 10% considered to indicate potential contamination in area, relative to background.

Beryllium, cadmium, selenium, silver, and thallium did not have any values greater than both the maximum background level and the maximum detection limit. Mercury had only one value above the maximum.

Area A. The correlations are summarized on Table 5-11. This provides further evidence for local antimony, copper, and lead contamination.

Scatter plots of explosives residues on metals concentrations showed that some significant correlations were based on the single coincidence of a high metal value with a high explosive residue value. Of the significant correlations shown in Table 5-11, only the following plots from TNT Area B indicated relationships over a range of values: 4-Am-2-NT on lead; 2,4-DNT on lead; and 2,6-DNT on lead. This shows that lead concentrations may be useful predictors of explosives residues in soil.

Coincidences of high metals and explosives residues concentrations were evaluated by comparing metals data tabulated by sampling location with explosives residues data. TNT Area A was suspected of having chromium, lead, and zinc contamination. Elevated lead and explosives residues levels occurred at the Fortifier House, Bi-Tri House, and DNT Sweating & Graining House in TNT Area A. Zinc levels were also high at the Bi-Tri House. No coincidence of high chromium and explosives residues concentrations was seen. TNT Area B had potential soil contamination from antimony, copper, lead, and nickel. Except for nickel, these metals had elevated concentrations coincident with explosives residues at the Waste Water Disposal Settling Tanks in TNT Area B. Soil antimony values were high at the TNT manufacturing line 5 Wash House and the Bi-Tri House, as were explosives residues levels. Nickel was also elevated at the line 5 Wash House. Lead and explosives residues had elevated concentrations at the Bi-Tri House and lead was strongly correlated with very high 2,4-DNT and 2,6-DNT values at the DNT Sweating & Graining House. Although lead, manganese, and nickel were suspected soil contaminants in TNT Area C, only manganese and nickel were coincident with explosives residues in one of the sampled ditches. In summary, this evaluation provides evidence for the coincidence of high lead levels with elevated explosives residues in TNT Areas A and B, and the coincidence of antimony with explosives residues in TNT Area B.

TABLE 5-11

RESULTS OF CORRELATIONS BETWEEN METALS AND EXPLOSIVES CONCENTRATIONS IN SOILS IN TNT AREAS

Metals	1,3,5-TNB	1,3-DNB	2,4,6-TNT	2,4-DNT	2,6-DNT	2-Am-DNT	2-Am-4-NT	2-NT	3,4-DNT	3-NT	4-Am-DNT	4-Am-2-NT	4-NT	NB
Antimony	NS	NS	B	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Chromium	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Copper	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	B	NS
Lead	NS	NS	NS	B	B	NS	NS	NS	NS	NS	NS	A,B	NS	NS
Manganese	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Nickel	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Zinc	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

A = Significant in TNTA Area at p = 0.005

B = Significant in TNTB Area at p = 0.005

NS = Not Significant in any Area at p = 0.005

5.5.3 Summary of Metals in Soils

In the background soils eight metals were detected: antimony, arsenic, chromium, copper, lead, manganese, nickel, and zinc. Eleven metals were reported in soils in the TNT areas: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, manganese, mercury, nickel, and zinc. Beryllium and cadmium were only detected in TNT Area B but were each present in more than one sample. Mercury was detected only in one sample from TNT Area C.

Chromium, lead, manganese, nickel, and zinc were present in every soil sample. Of these, lead, manganese, and zinc had concentrations in TNT areas soils that were clearly above the background levels.

Antimony, chromium, copper, lead, manganese, nickel, and zinc were potential contaminants due to the frequency with which their soil concentrations exceeded background (and detection limit) maxima. Except for chromium, each of these had some corroborating evidence from the correlation or coincidence investigations of being potential contaminants, although many were limited in areal extent of contamination. Only lead was relatively widespread and well-correlated with explosives residues.

6.0 GROUNDWATER INVESTIGATION

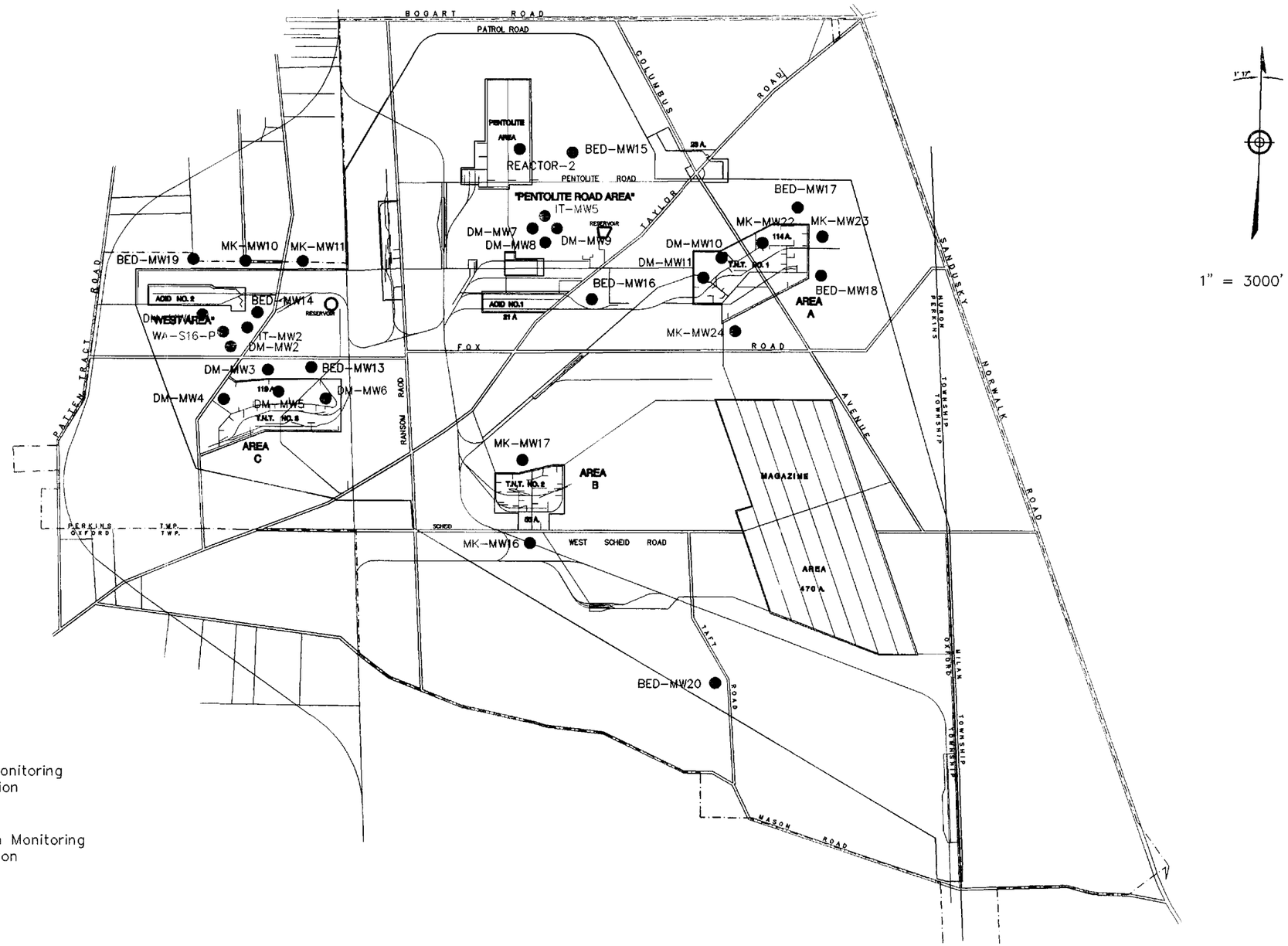
Groundwater at the site occurs in two basic hydrostratigraphic units: the overburden and the bedrock. The overburden is composed of glacial outwash materials, and varies in thickness from a few feet to over 40 feet. The bedrock consists of both limestone and shale. The hydrostratigraphic units were previously described in Section 2.0.

The groundwater portion of the Site Investigation utilized data and groundwater sampling results from wells installed for this investigation in the overburden at the TNT areas and at red water ponds areas. It also utilized data for wells installed for this investigation in the bedrock in various areas of the site. Finally, selected wells that were installed during previous investigations which are located in the TNT areas and the red water ponds areas were utilized. The locations of all these wells are illustrated on Figure 6-1.

In TNT Area A, two new overburden wells were installed and three existing wells were utilized.

- Well DM-MW10 was installed immediately downgradient of the Wash House for TNT manufacturing line 3.
- Well DM-MW11 was installed downgradient of the Wash House and Fortifier House for manufacturing line 4.
- Well MK-MW22 is located on the southeast corner of the intersection of Columbus Avenue and the unnamed loop road surrounding former TNT Area A. This location is west of manufacturing line 2 and generally upgradient of the waste water settling basins.
- Well MK-MW23 is located on the far east side of TNT Area A outside the unnamed loop road that surrounds TNT Area A. This location is northeast of the Wash House for manufacturing line 1.
- Well MK-MW24 is located on the extreme south side of TNT Area A, south of the unnamed loop road. It is south of the TNT Area A DNT Sweating and Graining Building.

Two bedrock wells were installed in the vicinity of TNT Area A.



1" = 3000'

BED-MW13 — Bedrock Monitoring Well Location

DM-MW6 — Overburden Monitoring Well Location

FIGURE 6-1
SITEWIDE WELL LOCATION MAP

Plum Brook Ordnance Works
Sandusky, Ohio

Dames & Moore, Inc.

FILENAME: H:\CAD\COE-PLUM\PLOT\SITEWELL.DWG

H:\CAD\COE-PLUM\PLOT\SITEWELL Thu Apr 03 20:48:27 1997 Dames & Moore - Atlanta, GA

- Well BED-MW17 was installed north of the eastern side of TNT Area A, generally downgradient of manufacturing lines 1 and 2.
- Well BED-MW18 was installed on the east side of TNT Area A.

In TNT Area B, two existing overburden wells installed as part of the MK Ferguson investigation were used.

- Well MK-MW16 is located on the south (upgradient) side of TNT Area B in a former PBOW parking area.
- Well MK-MW17 is located on the north side of TNT Area B, east of the Waste Water Disposal Settling Tanks. The well is located at the bottom of an embankment on the north side of North Magazine Road.

One overburden well was to have been installed for this Site Investigation on the south side of North Magazine Road downgradient from the Wash House for TNT manufacturing line 5. However, bedrock is present within a few feet of the surface in this area precluding installation of an overburden well.

Additionally, one bedrock well was to be installed in TNT Area B. However, the well was not installed during this investigation because of access limitations. Therefore, no bedrock wells are present at TNT Area B.

In TNT Area C, four overburden wells were installed.

- Well DM-MW3 was installed at the Waste Water Settling Basins for TNT Area C which are located generally on the downgradient of the former manufacturing facilities.
- Well DM-MW4 was installed downgradient of the Wash House for manufacturing line 12.
- Well DM-MW5 was installed downgradient of the Wash House for manufacturing line 10.
- Well DM-MW6 was installed downgradient of the Wash House for manufacturing line 8.

One bedrock well, BED-MW13, was installed in the vicinity of TNT Area C. It is located along Fox Road in an area generally downgradient from manufacturing lines 9 and 10.

A total of eight bedrock wells were installed as part of the Sitewide Groundwater Investigation. The locations of all the bedrock wells are illustrated on Figure 6-1.

The groundwater investigation includes assessment of the groundwater flow regime and interpretation of the laboratory analysis of the groundwater samples. The groundwater flow conditions are described in Section 6.1. Section 6.2 presents the groundwater quality assessment.

6.1 GROUNDWATER FLOW REGIME

Section 6.1.1 provides a characterization of the sitewide groundwater flow regime in both the overburden and the bedrock hydrostratigraphic units. Then, Section 6.1.2 assesses the overburden groundwater flow patterns in each of the three TNT areas.

6.1.1 Sitewide Groundwater Flow Characterization

Groundwater flow patterns are characterized on a sitewide basis for both the overburden and the bedrock hydrostratigraphic units using groundwater level measurements obtained from nine bedrock wells and the 19 overburden wells installed at the PBS. These patterns are evaluated from the two rounds of groundwater level measurements performed in December 1994 and March 1995 and data from earlier studies. Groundwater monitoring wells are clustered around areas of the site where environmental investigations have been performed. Large areas of the site have no well data. The available information was synthesized to evaluate the elevation of the bedrock surface and the thickness of the overburden since both the depth to bedrock and thickness of the overburden impact groundwater flow patterns. The available data was also used to characterize the groundwater flow patterns for both hydrogeological regimes.

In order to create the contour maps of the bedrock surface, overburden thickness, and water table elevations, it was necessary to create continuous fields from the data collected from point observations through an interpolation method. Several interpolation methods were tested, including inverse distance, minimum curvature, kriging using a linear covariance structure, and hand contouring. Except for the hand contouring, the interpolations were performed using the commercially available SURFER software (Golden Software).

Kriging uses a statistical method to calculate the autocorrelation between data points and produce a minimum variance unbiased estimate. It honors the original data points, and interpolates between the data points. In theory, no other method of grid generation can produce better estimates of the form of a mapped surface than kriging. In practice, the effectiveness of the techniques depends on the correct specification of several parameters that describe the semivariogram and the model of the drift. However, because kriging is robust, even with a naive selection of parameters the method will do no worse than conventional grid estimation procedures. The price that must be paid for optimality in estimation is computational complexity.

For the site-wide maps, the inverse distance method did not perform well, because the distribution of the data resulted in a "bulls-eye" pattern for some of the surfaces. The kriging, minimum curvature, and hand contouring methods all resulted in similar surfaces. For the maps presented in the report, kriging was used an the interpolation method. Default SURFER kriging parameters were used, which assume ordinary kriging with a linear variogram.

The only purpose of the kriging was to develop maps of the surfaces that made sense, and were consistent with the data. A detailed geostatistical and variogram analysis of the site-side data was not performed for the site-side maps. The sparsity of data, coupled with the irregular distribution of the data points, made a detailed variogram analysis inappropriate. Performing a detailed variogram analysis for the sole purpose of developing generalized site-side maps of the various surfaces would have also been inappropriate.

6.1.1.1 Top of Bedrock and Thickness of the Overburden Aquifer

In order to adequately assess the groundwater flow patterns in the overburden unit, both the top of bedrock elevations and the thickness of the overburden unit were established. In addition to the 19 wells installed for this investigation, 41 wells have been installed previously, 13 during the MK Ferguson investigation, four during the IT investigation, four during the H^+GCL investigation and 20 during the Ebasco Environmental investigation. The drilling logs for all of the wells were analyzed to evaluate the surface elevations, thickness of overburden, depth to bedrock, and type of bedrock. This information is summarized in Table 6-1 for all wells.

Some of the information from the boring logs is incomplete. For instance, ground surface elevations and/or well coordinates are not available for some of the borings. Some of the borings did not extend to the top of the bedrock, therefore the depth to bedrock and the type of bedrock are unknown. However, most of the boring logs contain sufficient information to evaluate the thickness of the overburden and the elevation of the top of bedrock.

The information contained in Table 6-1 is used to construct two contour maps:

- Figure 6-2 provides a map of the top of bedrock elevations throughout PBS; and
- Figure 6-3 provides a map of the overburden thickness throughout PBS.

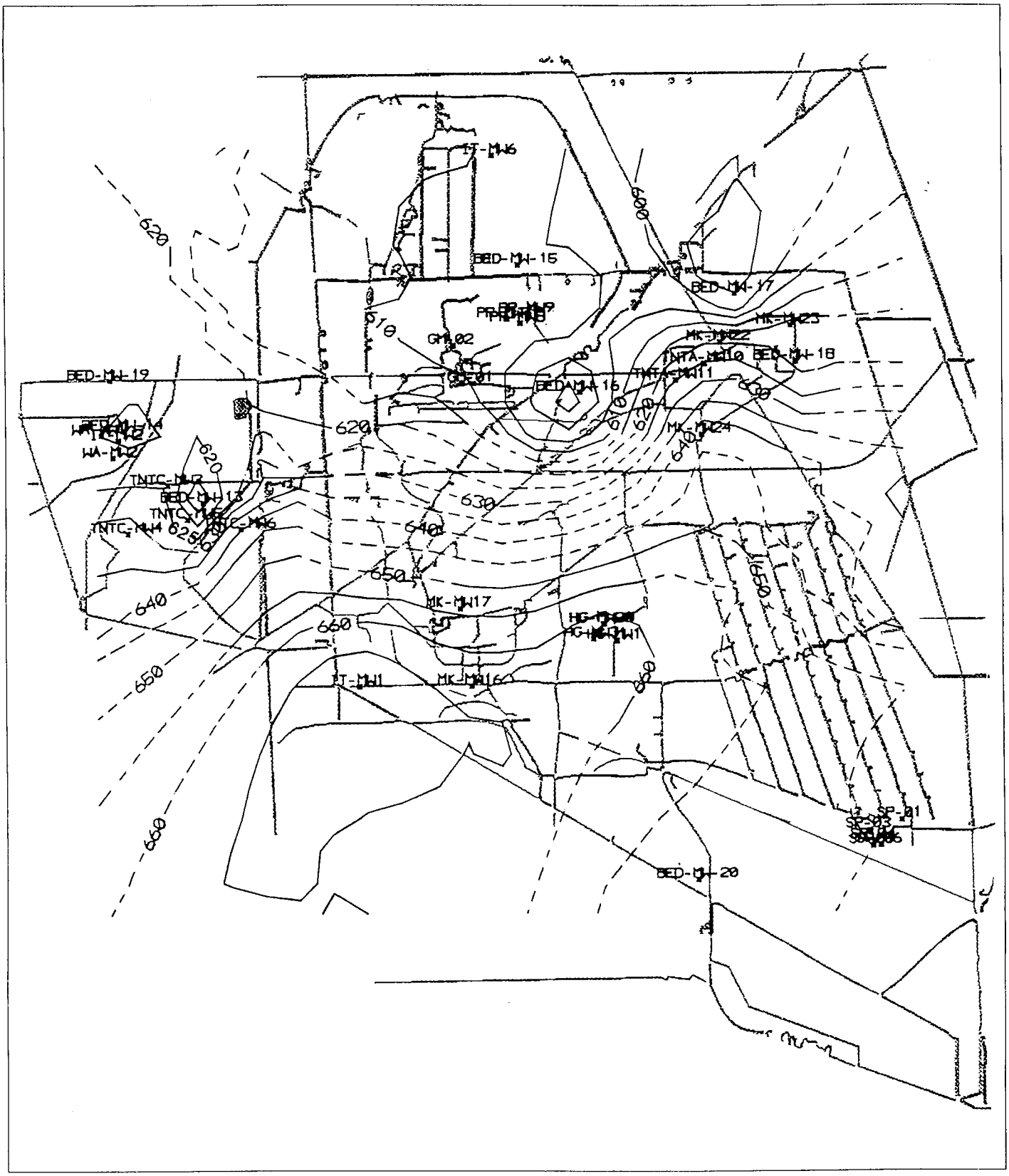
Only those wells which had sufficient information to establish the thickness of the overburden were used to construct these contour maps. Thirty-eight wells fit this criteria. For reference, the locations of the wells used to construct the contour maps are plotted on the maps.

Before interpreting these contour maps, it is important to note that the data are mainly clustered around specific investigation areas, and large portions of the site have no data available. The contour maps were constructed by kriging using the available data, and represent the best fit kriged surface to the data. The contours in the regions which have no data available should be considered speculative. However, enough data is

TABLE 6-1

SUMMARY OF WELL INFORMATION

Monitoring Well ID	General Area	Top of Casing Elevation (ft)	Ground Surface Elevation (ft)	Well Depth (ft bgs)	Easting	Northing	Depth to Top of Bedrock (ft)	Top of Bedrock Elevation (ft)	Bedrock Type
MK WELLS									
MK-MW09		645.91					no	N/A	none
MK-MW10	WA RWP	640.89	638.06	15.0	14646.65	31784.09	no	N/A	none
MK-MW11	WA RWP	637.69	634.71	14.0	15926.81	31782.65	no	N/A	none
MK-MW12		641.73					13.0	628.7	LS
MK-MW14		681.93					11.5	670.4	?
MK-MW15		681.45					9.0	672.5	?
MK-MW16	TNT B	674.32	671.33	5.5	22260.12	24938.51	8.0	663.3	SH
MK-MW17	TNT B	664.64	660.97	8.0	22019.82	26670.71	6.0	655.0	SH
MK-MW19		639.85					no	N/A	none
MK-MW20		637.86					no	N/A	none
MK-MW22	TNT A	638.05	635.56	9.5	27844.34	32580.36	9.5	626.1	?
MK-MW23	TNT A	639.07	636.95	16.0	29414.52	32934.09	16.0	621.0	?
MK-MW24	TNT A	657.12	654.44	9.5	27420.48	30494.71	9.5	644.9	?
IT WELLS									
IT-MW1		678.24	674.52	9.0	19783.00	24944.00	3.0	671.5	SH
IT-MW2	WA RWP	639.63	636.53	18.3	14437.00	30425.00	18.3	618.2	LS
IT-MW5	PR RWP	634.99	631.91	21.0	23518.73	33481.14	no	N/A	none
IT-MW6		632.97	628.90	18.5	22732.00	36752.00	18.5	610.4	?
DM WELLS									
TNTA-MW10	TNT A	640.18	637.50	11.0	27478.66	32093.12	11.0	626.5	SH
TNTA-MW11	TNT A	640.50	637.86	11.4	26832.65	31731.51	11.4	626.5	SH
TNTC-MW3	TNT C	645.41	642.57	14.0	15532.75	29408.88	14.5	628.1	SH
TNTC-MW4	TNT C	654.43	651.89	18.8	14634.99	28332.11	18.0	633.9	SH
TNTC-MW5	TNT C	651.81	649.07	29.7	15972.14	28645.94	29.5	619.6	SH
TNTC-MW6	TNT C	659.40	656.82	12.2	17169.56	28413.03	12.0	644.8	SH
WA-MW1	WA RWP	644.43	642.32	22.3	14060.58	30549.40	22.3	620.0	LS
WA-MW2	WA RWP	633.65	631.16	13.0	14301.25	30038.91	12.0	619.2	SH
PR-MW7	PR RWP	633.99	631.50	22.3	23074.69	33122.14	22.3	609.2	SH
PR-MW8	PR RWP	635.02	632.50	27.5	23364.70	33022.17	27.5	605.0	SH
PR-MW9	PR RWP	633.70	630.70	19.0	23564.68	33227.19	19.0	611.7	SH
BED-MW-13	TNT C	648.27	645.81	75.5	16324.84	29004.74	40.7	605.1	
BED-MW-14	WA RWP	646.04	643.05	52.2	14564.93	30640.67	24.5	618.6	
BED-MW-15	PR RWP	631.64	629.08	74.4	23310.10	34311.28	24.3	604.8	
BED-MW-16		636.02	633.68	74.0	24688.03	31461.03	44.2	589.5	
BED-MW-17	TNT A	629.97	627.37	64.4	28164.75	33667.92	37.3	590.1	
BED-MW-18	TNT A	651.50	648.83	75.4	29536.00	32128.05	30.8	618.0	
BED-MW-19	WA RWP	643.07	640.51	49.5	14256.32	31780.91	19.1	621.4	
BED-MW-20	Background	676.33	673.57	49.5	27305.63	20645.12	21.5	652.1	
REACTOR-2		630.68	630.72		22017.22	34762.68	unknown	N/A	
HGCL WELLS									
HG-MW1	Snake Rd BG	674.74	671.31		25489.00	25945.00	9.5	661.8	SH
HG-MW2A	Snake Rd BG	672.66	669.68		25186.00	26316.00	7.0	662.7	SH
HG-MW2B	Snake Rd BG	673.07	669.60		25208.00	26321.00	6.0	663.6	SH
HG-MW3	Snake Rd BG	671.52	668.67		24970.00	25984.00	6.0	662.7	SH
EB WELLS									
GM-01	GM Area		638.49		22328.00	31667.00	27.0	611.5	SH
GM-02			635.80		21889.00	32525.00	29.0	606.8	SH
GM-03			636.69	18.0	21849.00	32220.00	no	N/A	none
GM-04			634.49	16.0	21517.00	32132.00	no	N/A	none
GM-05			637.79	18.0	21882.00	31961.00	no	N/A	none
GM-06			637.80	18.0	21884.00	31813.00	no	N/A	none
SP-01			654.29		31880.00	21936.00	9.0	645.3	SH
SP-03			657.29		31172.00	21716.00	7.0	650.3	SH
SP-04			657.25		31279.00	21483.00	7.0	650.3	SH
SP-05			656.87		31242.00	21371.00	7.0	649.9	SH
SP-06			657.70		31418.00	21381.00	8.0	649.7	SH
PS-02			636.48	18.0	24134.00	32492.00	no	N/A	none
PS-03			635.13	18.0	24261.00	32476.00	no	N/A	none
PS-04			636.07	16.0	24334.00	32452.00	no	N/A	none
RA-01			632.30	16.0	21813.00	34061.00	no	N/A	none
RA-02			632.06	20.0	22289.00	35053.00	no	N/A	none
RA-03			631.73	22.0	22357.00	34898.00	no	N/A	none
RA-04			631.65	10.0	22402.00	34842.00	no	N/A	none
RA-05			631.41	10.0	22504.00	34831.00	no	N/A	none
RA-06			630.72	10.0	22761.00	34868.00	no	N/A	none



3000 1500 0 3000 6000 FEET

Approximate Scale

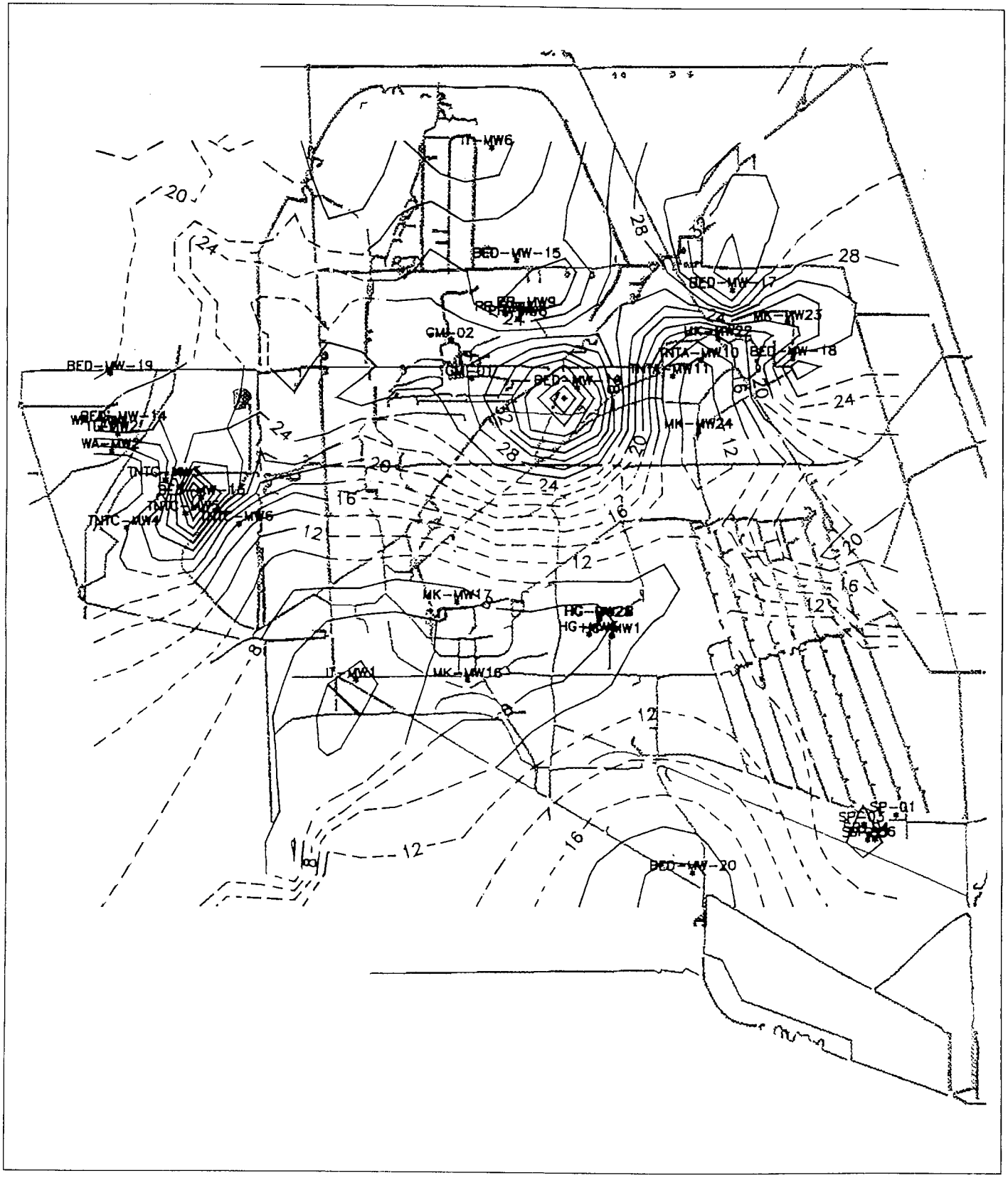
N

Figure 6-2

TOP OF BEDROCK ELEVATION CONTOUR MAP

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE



3000 1500 0 3000 6000 FEET

Approximate Scale

N

Figure 6-3

OVERBURDEN THICKNESS CONTOUR MAP

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE

present and the data is distributed such that general conclusions can be drawn from these maps.

The top of bedrock elevations are presented in Figure 6-2. The bedrock surface is highest in the south, and slopes towards the north at an average gradient of 0.0046 ft/ft (25 ft/mile) across the site. A local bedrock high occurs just to the southwest of the TNT Area B, at an elevation of approximately 667 feet. From this local high, bedrock elevations decrease gradually to the east and more steeply to the north. Insufficient data is available to assess the bedrock surface to the south and west of this bedrock high.

In the western portion of the site, top of bedrock elevations decrease uniformly toward the north until the TNT Area C, where a local bedrock low is present at an elevation of approximately 605 feet. North of TNT Area C, the top of bedrock elevations are relatively uniform at approximately 620 feet to the site boundary. In the eastern portion of the site, a top of bedrock trough is present between well BED-MW-16 (near the intersection of Taylor and Maintenance Roads) and well BED-MW-17. This trough is slightly south of and approximately parallel to Taylor Road. The elevation of this bedrock trough is approximately 590 feet. North of this trough, near the Pentolite Road area, top of bedrock elevations are approximately 605 feet.

Figure 6-3 shows a contour map of overburden thickness throughout the PBS site. This map is based on the 38 borings that went to bedrock. The patterns observed in the thickness of overburden map generally mirror the patterns noted in the top of bedrock elevations. In general, the overburden is thinnest in the southern portion of the site, and increases in thickness to the north.

Using information obtained during drilling of the background well, BED-MW-20, the overburden thickness is 20 feet at the southeastern edge of the site. Immediately northwest and northeast of this well, however, overburden thicknesses are generally much thinner. The overburden is thinnest near the bedrock high southwest of TNT Area B, with a thickness of less than 3 feet in places. In this area, shale outcrops can be seen at the surface.

A line between TNT Area B and TNT Area A areas seems to mark a transition in overburden thickness. South and east of this line, the overburden is relatively thin, with a thickness of less than 10 feet. North and west of this line, overburden thickness increases dramatically. The areas where local top of bedrock lows are present show the greatest thickness of overburden materials, up to 45 feet at well BED-MW-16. North of this wedge of thick overburden materials, overburden thickness is relatively constant at about 20 to 25 feet thick.

6.1.1.2 Groundwater Flow within the Overburden

Two rounds of groundwater level measurements were taken in 19 overburden wells, one on December 5 to 9, 1994, and the second on March 14, 1995. The groundwater level measurements are summarized in Table 6-2.

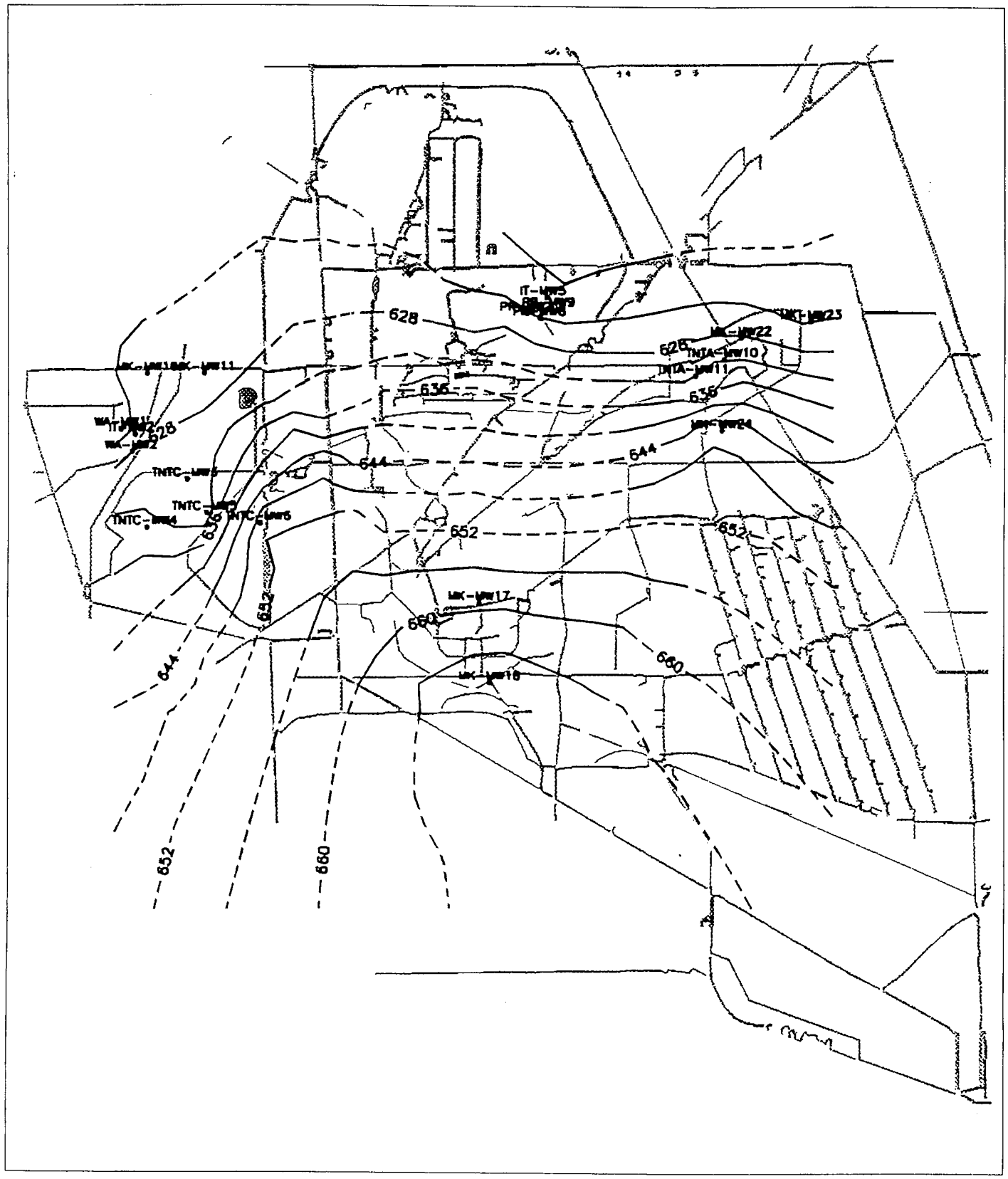
Contour maps of the groundwater elevations in the overburden hydrostratigraphic unit were constructed for each of the measurement dates. Figure 6-4 is a contour map of the groundwater elevations in the overburden on December 5 to 9, 1994. Figure 6-5 is a contour map of the groundwater elevations in the overburden on March 14, 1995.

Before interpreting these contour maps, several important points must be noted. First, the data are clustered around the investigation areas, and large portions of the site have no data available. In particular, the entire southern section of the site, south of well MK-MW-16, has no data available. The groundwater contour maps were constructed by kriging using the available data, and represent the best fit kriged surface to the data. Groundwater contours in areas with little or no data available should be considered speculative. Second, the overburden is highly heterogeneous both in thickness and hydraulic conductivity. There may be regions of relatively high hydraulic conductivity, leading to pathways of preferential flow which may not be in a direction perpendicular to groundwater contours depicted on the figures. However, on a regional basis, the contour patterns depict the overall direction of groundwater flow.

TABLE 6-2

SUMMARY OF OVERBURDEN GROUNDWATER WELL INFORMATION

Monitoring Well ID	Top of Casing Elevation (ft)		Well Depth bgs (ft)	Depth to Groundwater Dec. 1994 (ft)	Depth to Groundwater Mar. 1995 (ft)	Groundwater Elevation Dec. 1994 (ft)	Groundwater Elevation Mar. 1995 (ft)		Easting	Northing
TNT-A Area										
TNTA-MW10	640.18	637.50	11.00	6.47	3.14	633.71	637.04	-3.33	27478.66	32093.12
TNTA-MW11	640.50	637.86	11.40	9.94	7.68	630.56	632.82	-2.26	26832.65	31731.51
MK-MW22	638.05	635.56	9.50	9.20	6.50	628.85	631.55	-2.70	27844.34	32580.36
MK-MW23	636.47	636.95	16.00	15.59	8.35	620.88	628.12	-7.24	29414.52	32934.09
MK-MW24	657.12	654.44	9.50	8.81	6.35	648.31	650.77	-2.46	27420.48	30494.71
TNT-B Area										
MK-MW16	674.32	671.33	8.00	7.18	4.96	667.14	669.36	-2.22	22260.12	24938.51
MK-MW17	664.64	660.97	6.00	5.06	3.54	659.58	661.10	-1.52	22019.82	26670.71
TNT-C Area										
TNTC-MW3	645.41	642.57	14.00	dry	6.21	< 628.57	639.20	> -10.63	15532.75	29408.88
TNTC-MW4	654.43	651.89	18.83	19.56	3.36	634.87	651.07	-16.20	14634.99	28332.11
TNTC-MW5	651.81	649.07	29.70	23.80	4.19	628.01	647.62	-19.61	15972.14	28645.94
TNTC-MW6	659.40	656.82	12.20	7.47	4.20	651.93	655.20	-3.27	17169.56	28413.03
West Area RWP										
WA-MW1	644.43	642.32	22.30	24.58	24.98	619.85	619.45	0.40	14060.58	30549.4
WA-MW2	633.65	631.16	12.00	4.06	1.74	629.59	631.91	-2.32	14301.25	30038.91
IT-MW2	639.63	636.69	15.00	12.31	5.88	627.32	633.75	-6.43	14379.83	30428.08
MK-MW10	640.89	638.06	14.00	14.23	Not Measured	626.66	Not Measured	Not Measured	14646.65	31784.09
MK-MW11	637.69	634.71	13.00	12.47	6.33	625.22	631.36	-6.14	15926.81	31782.65
Pentolite Road RWP										
PR-MW7	633.99	631.50	22.30	7.67	2.34	626.32	631.65	-5.33	23074.69	33122.14
PR-MW8	635.02	632.50	27.50	10.47	5.04	624.55	629.98	-5.43	23364.7	33022.17
PR-MW9	633.70	630.70	19.00	10.78	3.58	622.92	630.12	-7.20	23564.68	33227.19
IT-MW5	634.99	631.91		14.80	5.37	620.19	629.62	-9.43	23518.73	33481.14



3000 1500 0 3000 6000 FEET

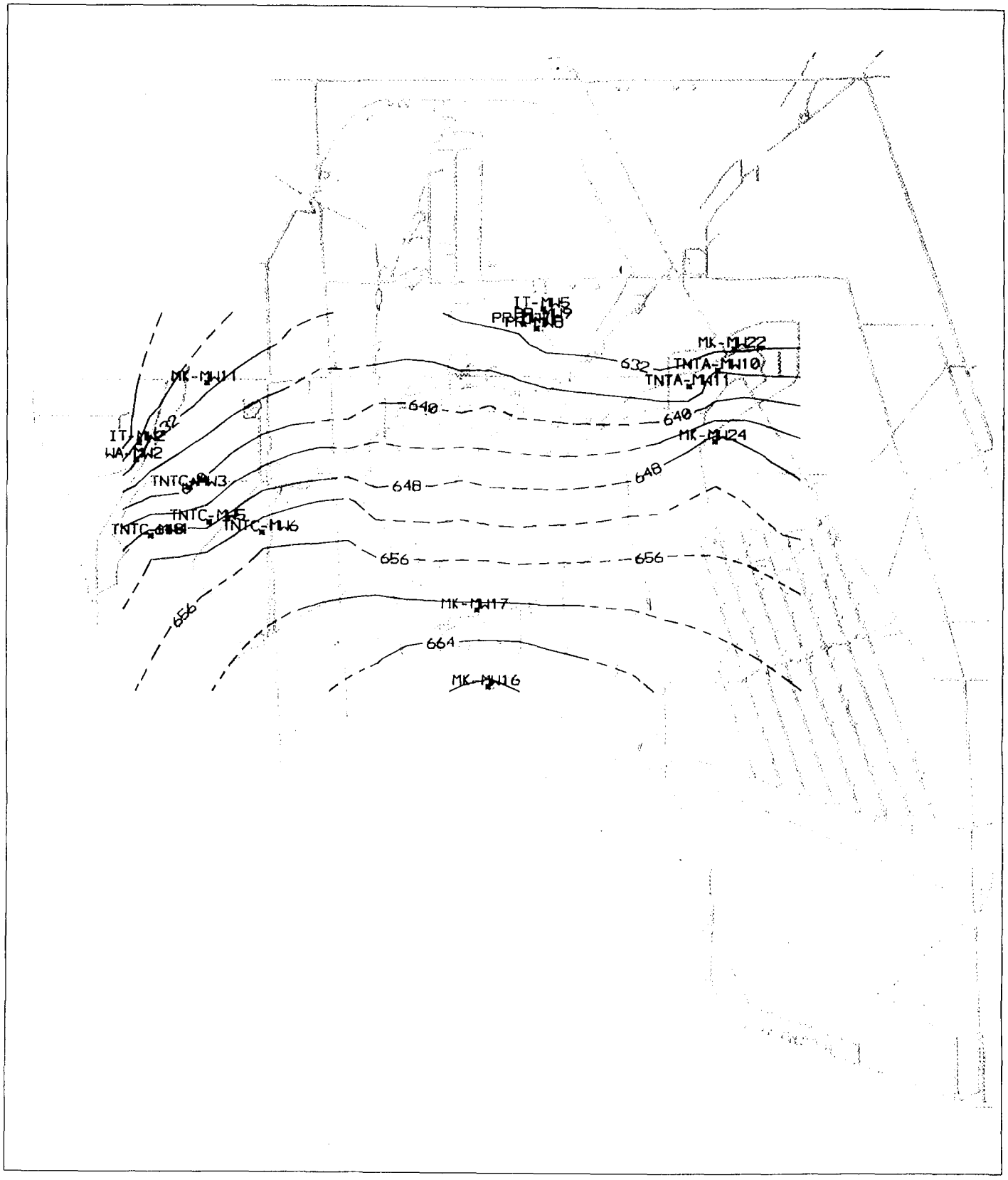
Approximate Scale

N

Figure 6-4

OVERBURDEN WATER TABLE ELEVATION CONTOUR MAP
December 1994
Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE



3000 1500 0 3000 6000 FEET

Approximate Scale

N

Figure 6-5

OVERBURDEN WATER TABLE ELEVATION CONTOUR MAP
March 1995
Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE

Both maps show an overall groundwater gradient from south to north, with an average gradient of approximately 0.0045 ft/ft (25 ft/mile). Through the central and eastern portions of the site, the groundwater elevation contours trend east-west, indicating flow directly northward. On the western side of the site the groundwater contours indicate flow to the northwest. The December 1994 measurements indicate a stronger northwest component to the flow direction on the western side of the site than the March 1995 measurements. It is likely that the change in the direction of groundwater flow on the west side of the site is related to the change in bedrock type which occurs in this area.

The overburden groundwater elevation contour maps have a close relationship with the surface elevations, especially for the second round of measurements in March 1995. The second round of measurements were made during an unseasonably warm spell in March, after snowmelt occurred. Standing water was observed in the vicinity of 15 of the 19 wells. The groundwater elevations were within 3 feet of the ground surface in 13 of the 19 wells. During the December 1994 measurements, groundwater elevations were within 3 feet of the ground surface elevations in only two of the 19 wells measured.

The groundwater elevations during March 1995 are an average of 4 feet higher than the groundwater elevations during December 1994. In some locations, especially at TNT Area C, groundwater elevations during March 1995 are up to 19 feet higher than during December 1994. The greatest variations in groundwater elevations occur at TNT Area C, and the smallest variations occur at TNT Areas A and B. The West Area Red Water Ponds and the Pentolite Road Red Water Ponds areas had variations in groundwater elevations between 3 and 9 feet.

The pattern of groundwater flow in the overburden aquifer is similar for the December 1994 and March 1995 measurements. The major difference in groundwater flow patterns occurs on the western portion of the site. Based on the December 1994 map, groundwater in the overburden aquifer near TNT Area B moves toward both the north and the northwest, towards TNT Area C. Overburden groundwater in TNT Area C moves northwest towards the West Area Red Water Ponds. Based on the March 1995 map, groundwater in the overburden near TNT Area B no longer moves toward TNT

Area C, but rather moves directly northward. Overburden groundwater at TNT Area C still moves northwest towards the West Area Red Water Ponds.

No apparent relationship exists between the overburden thickness contour map presented on Figure 6-3 and the groundwater elevation contour maps on a sitewide scale. The dramatic thickening of the overburden near well BED-MW-16, north of TNT Area A and on the east side of TNT Area C, has no apparent effect on the groundwater table in these regions. The groundwater gradient does flatten slightly north of TNT Area A, perhaps in response to the thickening of the overburden in that area. However, over most of the site, the groundwater gradient is relatively constant, and is probably more correlated with surface elevations than the thickness of the overburden.

It is difficult to estimate the volume or rate of groundwater flow in the overburden flow regime because very little site specific hydraulic conductivity information is available. Even if it were available, there is probably significant variation in the hydraulic conductivity of the overburden materials, given the nature of the glacial deposits. IT performed a rising head slug test at well IT-MW-2 near the West Area Red Water Ponds which resulted in a hydraulic conductivity value of 0.25 ft/day. Recharge in other wells was too slow to perform hydraulic conductivity testing, indicating significantly lower hydraulic conductivity values.

6.1.1.3 Groundwater Flow in the Bedrock

Two rounds of groundwater level measurements were made in nine bedrock wells at the site, eight bedrock wells installed for this investigation and one PBS Reactor Well. The measurements were made on December 5 to 9, 1994 and March 14, 1995. The results of the groundwater level measurements are summarized in Table 6-3.

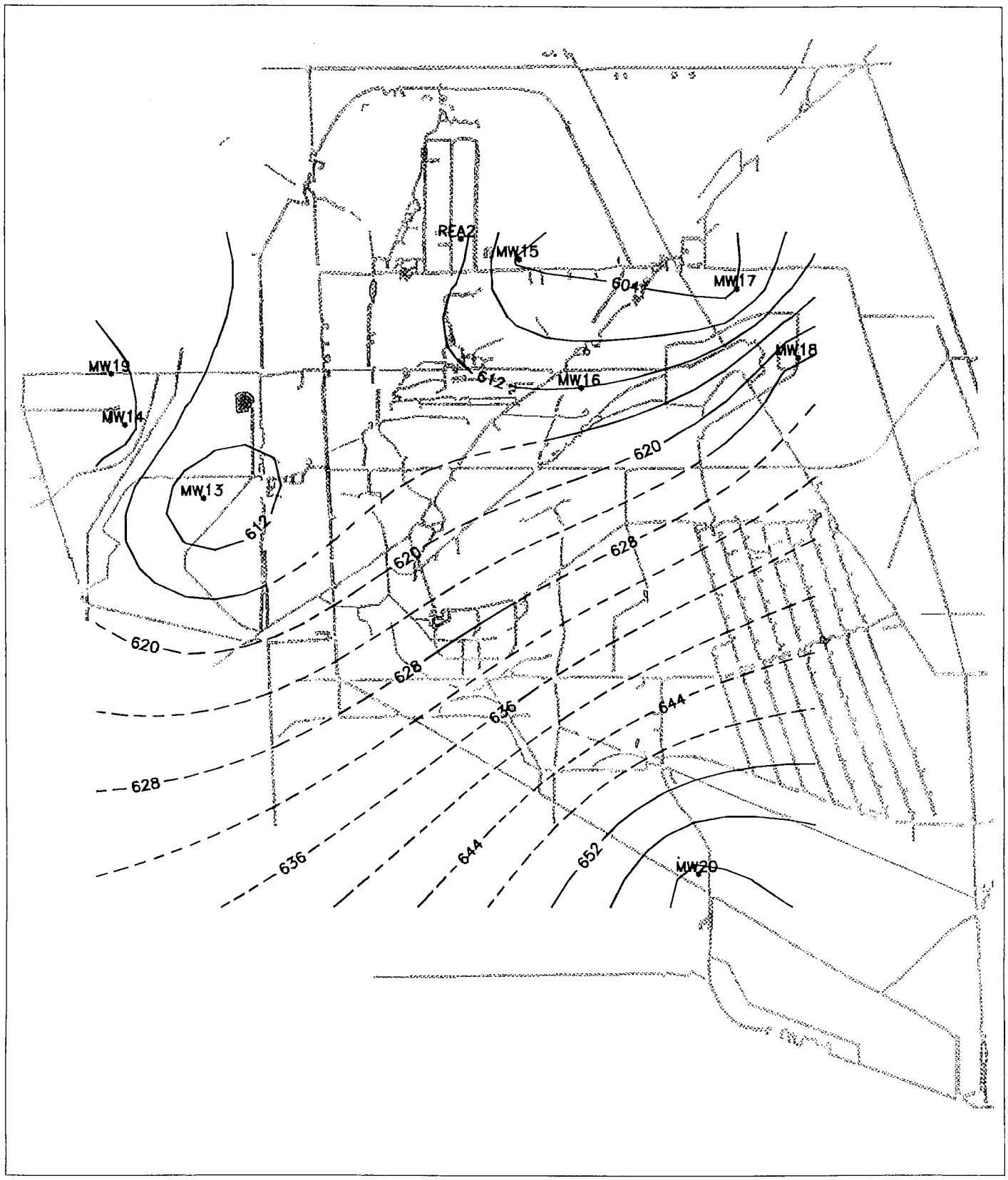
Contour maps of the groundwater elevations in the bedrock hydrostratigraphic unit were constructed for December 1994 and March 1995. Figure 6-6 is a contour map of the groundwater elevations in the bedrock on December 5 to 9, 1994. Figure 6-7 is a contour map of the groundwater elevations in the bedrock on March 14, 1995. These contour maps were constructed using all of the bedrock wells except

TABLE 6-3

SUMMARY OF BEDROCK GROUNDWATER WELL INFORMATION

Monitoring Well ID	Top of Casing Elevation (ft)	Ground Surface Elevation (ft)	Well Depth bgs (ft)	Depth to Groundwater Dec. 1994 (ft)	Depth to Groundwater Mar. 1995 (ft)	Groundwater Elevation Dec. 1994 (ft)	Groundwater Elevation Mar. 1995 (ft)	Difference between GW elevations (ft)	Depth to Top of Rock (bgs)	Easting	Northing
BED-MW-13	648.27	645.81	75.5	40.42	28.98	607.85	619.29	-11.44	40.7	16324.84	29004.74
BED-MW-14	646.04	643.05	52.20	24.28	21.65	621.76	624.39	-2.63	24.5	14564.93	30640.67
BED-MW-15	631.64	629.08	74.40	28.10	32.73	603.54	598.91	4.63	24.3	23310.1	34311.28
BED-MW-16	636.02	633.68	74.00	64.64	2.34	571.38	633.68	-62.30	44.2	24688.03	31461.03
BED-MW-17	629.97	627.37	64.40	27.40	27.07	602.57	602.90	-0.33	37.3	28164.75	33667.92
BED-MW-18	651.50	648.83	75.40	26.45	31.11	625.05	620.39	4.66	30.8	29536	32128.05
BED-MW-19	643.07	640.51	49.50	22.00	19.55	621.07	623.52	-2.45	19.1	14256.32	31780.91
BED-MW-20	676.33	673.57	49.50	14.98	15.05	661.35	661.28	0.07	21.5	27305.63	20645.12
REACTOR-2	630.68	630.72		15.97	28.79	614.71	601.89	12.82		22017.22	34762.68

bgs = below ground surface



3000 1500 0 3000 6000 FEET

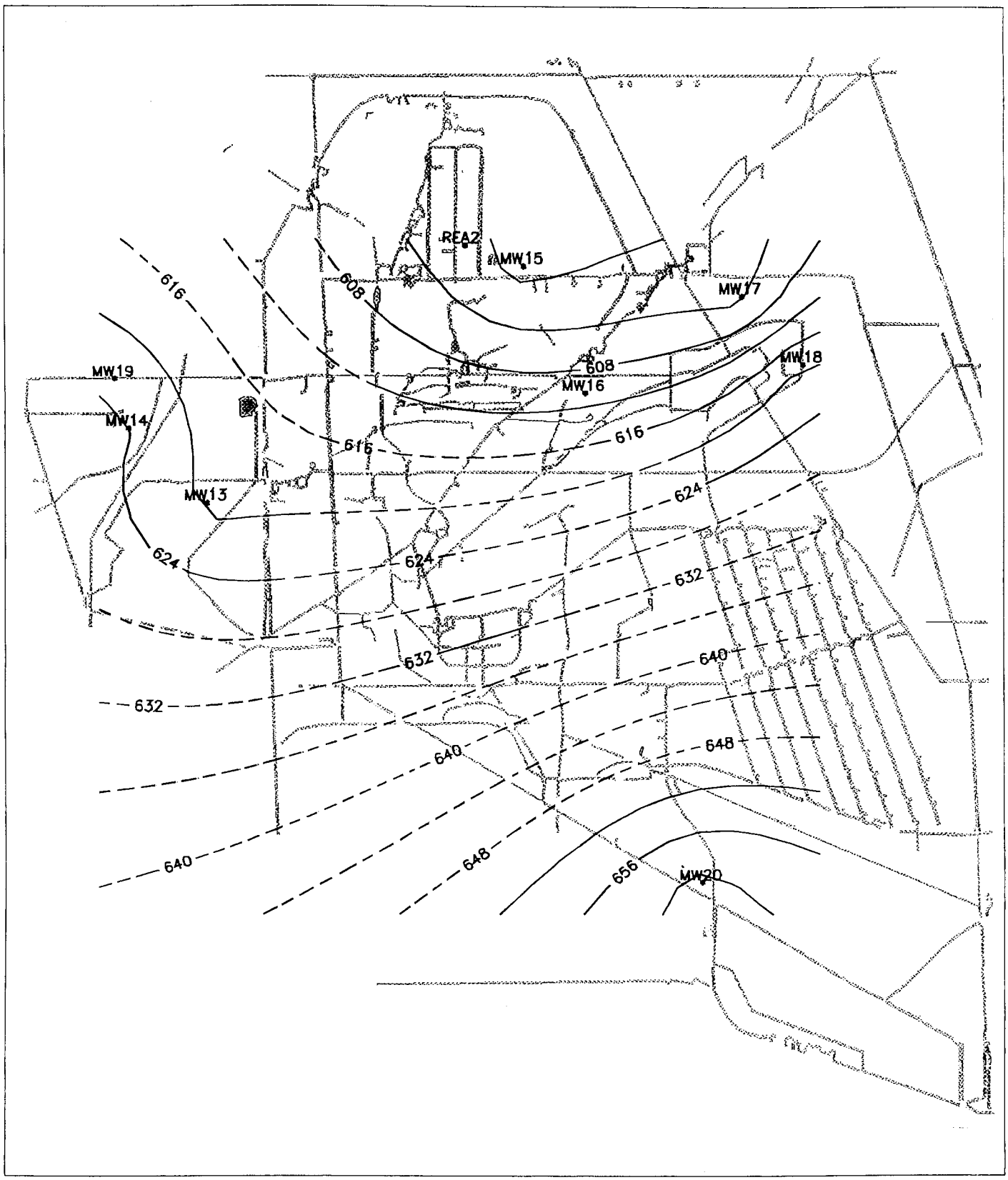
Approximate Scale

N

Figure 6-6

BEDROCK WATER TABLE ELEVATION CONTOUR MAP
December 1994
Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE



3000 1500 0 3000 6000 FEET

Approximate Scale

N

Figure 6-7

BEDROCK WATER TABLE ELEVATION CONTOUR MAP
March 1995
Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE

BED-MW-16, which showed anomalous water levels during both rounds of measurements. During the first round, the measured water level in well BED-MW-16 was below the bottom of the casing, within the open hole interval. All other wells had measured water levels above the bottom of the casing. It is possible that the water level in well BED-MW-16 had not recovered fully for the first sampling event. During the second sampling round, the measured water level in well BED-MW-16 was at the ground surface. No other bedrock wells had measured water levels within 15 feet of the ground surface. Including well BED-MW-16 for contouring water levels in the bedrock aquifer caused severe anomalies for both December 1994 and March 1995, and it was, therefore, not used in the maps presented in this report.

Several other wells showed anomalous results during one or both sets of measurements. Well BED-MW-13 showed evidence in December 1994 of not having recovered fully after development. First, the contour map of the bedrock groundwater levels for the December 1994 (Figure 6-6) indicates a local sink in the area defined by well BED-MW-13. By the March 1995 (Figure 6-7), this sink is no longer present. Second, with the obvious exception of well BED-MW-16, well BED-MW-13 showed the largest increase in measured groundwater level between the two measurement dates, with the water level being nearly 12 feet higher during March 1995.

Reactor Well 2 had a decrease in measured water level of nearly 13 feet between December 1994 and March 1995. Well BED-MW-15, about 200 feet away, had a decrease in measured water level of only about 4 feet. It is not apparent why measured water levels in Reactor Well 2 should decrease so dramatically over a 4-month period.

Care must be taken in interpreting the contour maps of the bedrock flow regime. First, only nine data points are available throughout the site, most of them in the northern portion. Second, the bedrock may contain fractures or fracture zones in which preferential flow occurs. Many of the bedrock wells were situated in locations where fracture zones were suspected to exist. The direction of groundwater flow may not always be perpendicular to the equipotentials (contours of equal groundwater levels). There may be pathways of relatively high hydraulic conductivity, leading to pathways of preferential flow which may not be in a direction perpendicular to groundwater

contours. Given only nine well locations, it is very difficult to delineate any pathways of preferential flow using the groundwater contour maps. As a first approximation, the direction of groundwater flow is assumed to be perpendicular to contours of equal groundwater elevation.

For both measurement events, the general bedrock groundwater flow direction is from south to north, with an average gradient of 0.0042 ft/ft (22 ft/mile). The map of the groundwater levels for December 1994 (Figure 6-6) shows a definite northwest trend to the groundwater flow direction across the central and southern portions of the site. However, the northwest trend may be an artifact of the anomalous reading at well BED-MW-13. In the northwest portion of the site, the groundwater flow direction is toward the east-northeast, from the West Area Red Water Ponds towards the Reactor Area. In the northeast portion of the site, the groundwater flow direction is towards the north-northwest.

The map of groundwater levels from the March 1995 measurements (Figure 6-7) may be more representative of conditions at the site. All wells had time to recover from drilling, development, and sampling activities. In the southern and eastern portions of the site (across TNT Areas A and B), groundwater contours indicate flow towards the north, with a slight northwesterly component. In the western portion of the site (across TNT Area C and West Area Red Water Ponds), groundwater contours indicate flow toward the northeast. Bedrock groundwater flow is indicated from the TNT Area C and the West Area Red Water Ponds toward the Pentolite Road Red Water Pond and Reactor Area.

The direction of groundwater flow in the bedrock may be correlated with the bedrock type. Figure 2-2 shows the location and orientation of the bedrock units underlying the PBS. The Delaware Limestone outcrops in the northwestern portion of the PBS. The assumed contact of the Delaware Limestone with the Plum Brook Shale trends northeast. Southeast of the contact between the Delaware Limestone and the Plum Brook Shale, the direction of groundwater flow in the bedrock is to the north-northwest. Where the Delaware Limestone is present, the direction of groundwater flow is toward the north-northeast. The bending in the groundwater contours

correlates well with the assumed contact between the Delaware Limestone and the Plum Brook Shale.

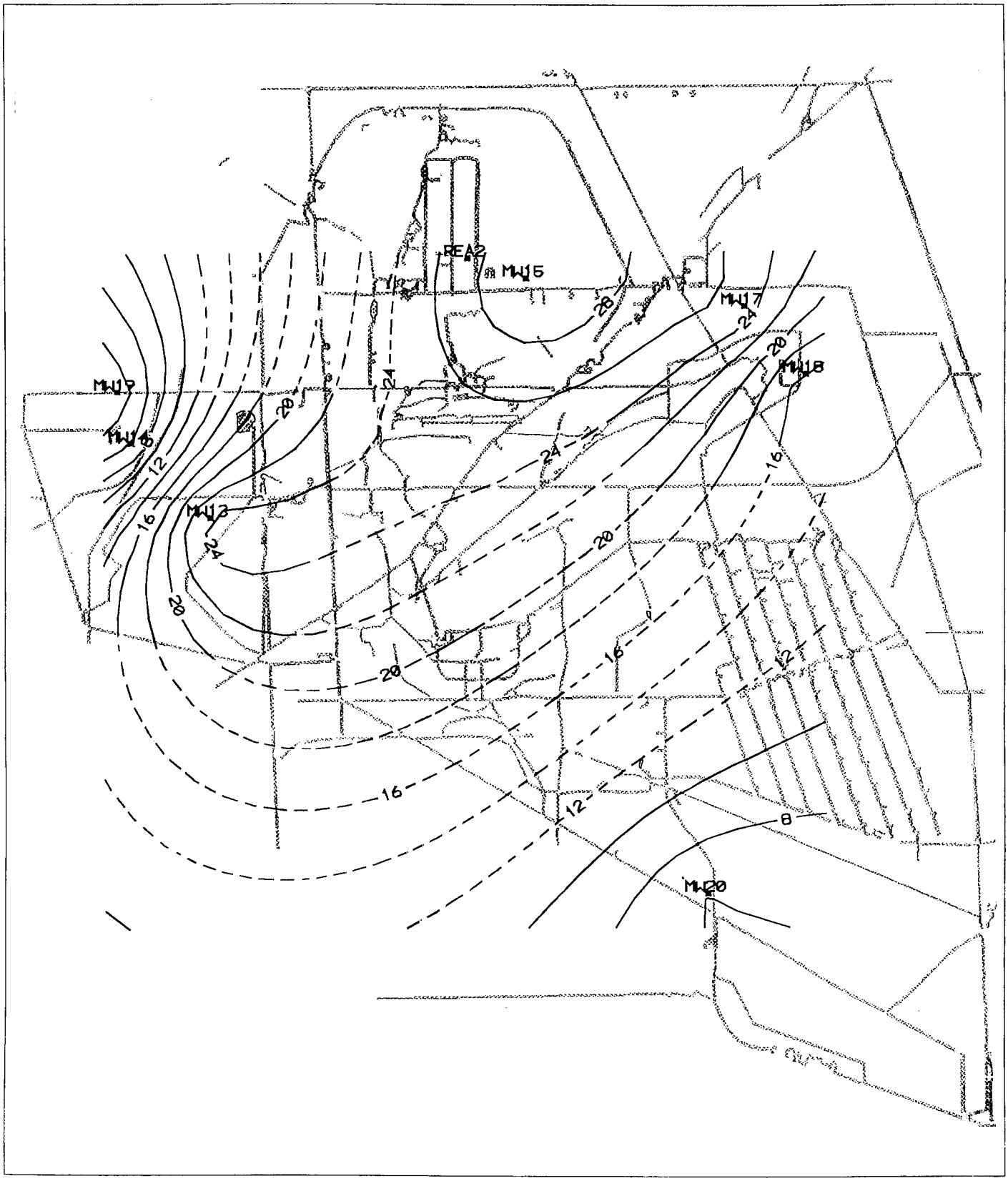
6.1.1.4 Groundwater Flow Between the Overburden and Bedrock Hydrostratigraphic Units

The overburden hydrostratigraphic unit is directly on top of the bedrock in this area. The well boring logs showed no physical evidence of any flow barrier between the overburden and the bedrock. Groundwater flow occurs between the overburden and the bedrock. The rate of groundwater flux between the two units is controlled by the hydraulic gradient and the hydraulic conductivity contrast between the two hydrostratigraphic units.

A cursory examination of the maps of the groundwater levels in both the overburden and the bedrock shows that groundwater levels in the overburden are consistently higher than groundwater levels in the bedrock. These differences in hydraulic heads indicate that downward hydraulic gradients exist throughout the site, and groundwater flows from the overburden to the bedrock.

No well pairs were installed to evaluate the true vertical gradients present at the site. However, the vertical gradient distribution across the site can be approximated. Figure 6-8 is a map showing the approximate difference in hydraulic head between the overburden and bedrock wells in March 1995. This map was constructed by contouring the water levels in the overburden wells, and then noting the difference between the contoured water level and the measured water levels in the bedrock wells. This difference in water levels was then contoured to produce Figure 6-8. The data for March 1995 is presented, because the data for December 1994 appears to be biased due to the anomalous water level at well BED-MW-13. It must be stressed that the head differences indicated by Figure 6-8 are approximate, and only represent one method of estimating the head differences in the absence of paired wells.

Figure 6-8 indicates that the smallest difference in hydraulic heads is in the south at well BED-MW-20. This portion of the map may be inaccurate, because no overburden



3000 1500 0 3000 6000 FEET

Approximate Scale

N

Figure 6-8

OVERBURDEN/BEDROCK HYDRAULIC HEAD DIFFERENCES CONTOUR MAP

March 1995

Plum Brook Ordnance Works

Sandusky, Ohio

DAMES & MOORE

wells are present near this bedrock well. Small differences in hydraulic heads are also present near the West Area Red Water Ponds. The largest differences in hydraulic heads are at the Pentolite Road Red Water Pond, with head differences up to 30 feet. The northern part of TNT Area A and TNT Area C also have significant head differences, up to 25 feet. At the TNT Area B area the head differences are between 15 and 25 feet, though these values are interpolated, since no bedrock wells exist in the area.

To evaluate the approximate vertical hydraulic gradients, the difference in hydraulic heads between the overburden and bedrock wells must be established. Water enters the overburden wells over the length of the screened interval below the water table and enters the bedrock wells over the length of the open hole. The midpoint of the intervals over which water enters the well is assumed to be the measurement point for assessing vertical gradients. The overburden wells are generally screened throughout most of the overburden, with screen lengths between about 5 to 25 feet. The bedrock wells are cased from the surface to at least 5 feet into solid bedrock, and then are open to the bottom of the hole. The open interval ranges from about 15 to 30 feet. As a very rough estimate, the average vertical separation of the midpoint of the measurement interval between the overburden and bedrock wells is approximately 25 feet. If an average vertical separation of 25 feet is assumed between the overburden and bedrock wells throughout the site, the vertical gradients range from a low of 0.08 ft/ft up to 1.0 ft/ft. These vertical gradients are only approximate; however, they indicate the range of vertical gradients present at the site.

The indicated vertical gradients are much greater than the horizontal gradient within either hydrostratigraphic unit. The strong vertical gradients implies that groundwater within the overburden unit will tend to move downward into the bedrock rather than migrate horizontally within the overburden unit.

Given the strong vertical gradients, only a high hydraulic conductivity contrast would prevent downward migration of groundwater from the overburden unit into the bedrock. The high hydraulic conductivity contrast would require that the bedrock be significantly lower in hydraulic conductivity than the overburden. Since the hydraulic

conductivity of neither unit is well known, it is difficult to estimate whether significant downward migration occurs.

6.1.2 Groundwater Flow Characterization in the Overburden in the TNT Areas

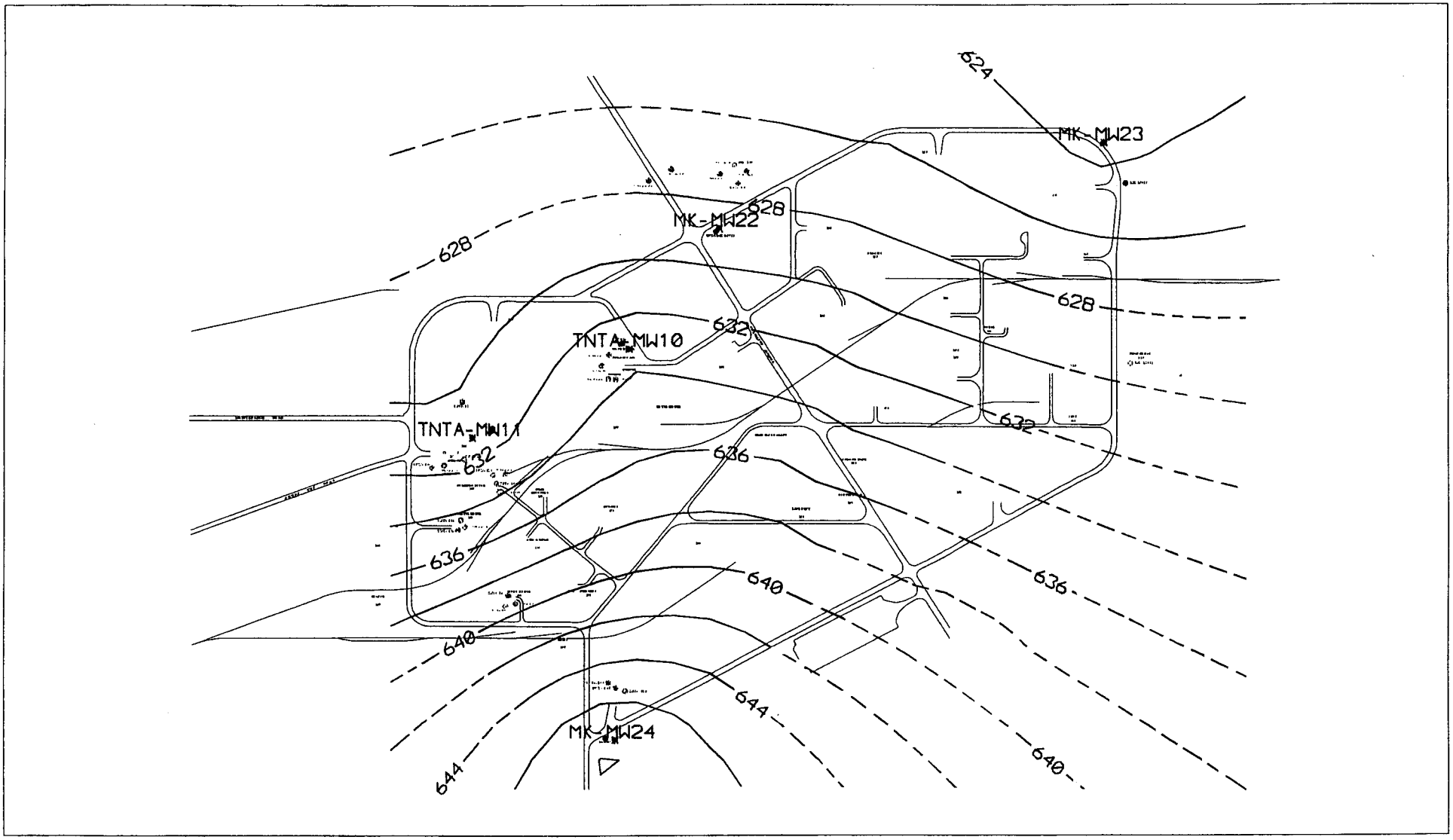
Groundwater flow patterns are characterized for each of the three TNT areas for the overburden hydrostratigraphic unit. These patterns are evaluated from the two rounds of groundwater level measurements. Where bedrock measurements are available near an investigation area, the relationship of groundwater flow between the overburden and the bedrock hydrostratigraphic units is examined.

6.1.2.1 TNT Area A

Five overburden and two bedrock wells are located near the TNT Area A. The water levels of these wells were measured in two rounds, and the results are included in Tables 6-2 and 6-3. The depth to bedrock and overburden thickness are derived from the sitewide overburden thickness evaluation included in Section 6.1.1.1 above.

At TNT Area A, the top of bedrock (Figure 6-2) dips to the north and strikes nearly east-west, with elevations ranging from about 642 feet at the southern edge of the area (at well MK-MW-24) to about 610 feet at the northern edge of the area. The top of bedrock trough lies just to the north of the TNT Area A. The thickness of the overburden (Figure 6-3) changes significantly over the TNT Area A, thickening to the north. Through the southern and central portions of the area, the overburden thickness averages about 12 feet. The overburden becomes significantly thicker in the top of bedrock trough to the north of the area, with a thickness of up to 32 feet in the top of bedrock trough. The overburden also thickens to the east of the site, up to 26 feet at well BED-MW-18.

Figures 6-9 and 6-10 are contour maps of the groundwater elevations in the overburden for the first and second sets of measurements respectively (December 1994, and March 1995) across the TNT Area A. These maps are based primarily on



700 350 0 700 1400 FEET

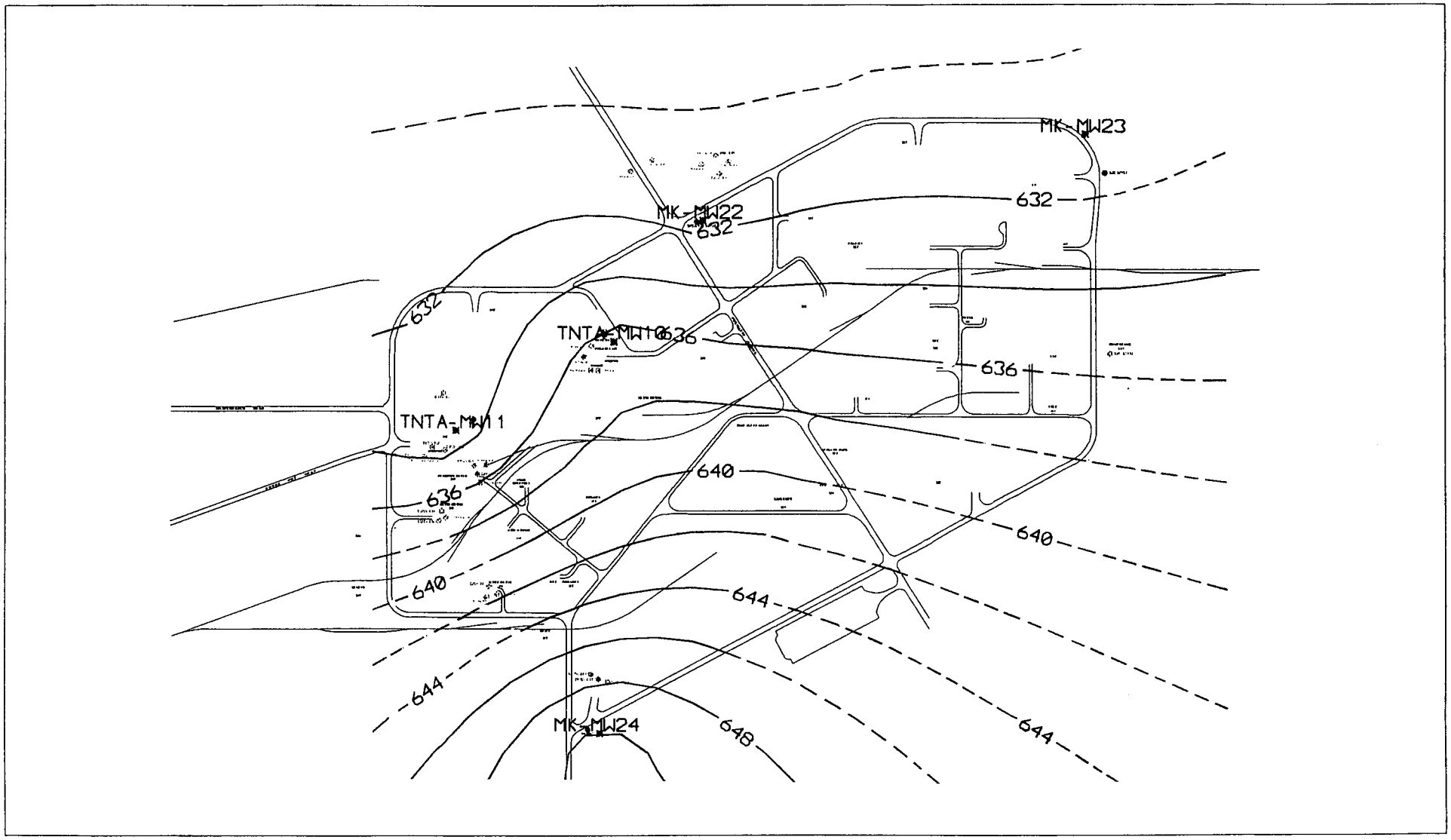
Approximate Scale

N

Figure 6-9

TNT AREA A OVERBURDEN WATER TABLE CONTOUR MAP
December 1994
Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE



700 350 0 700 1400 FEET

Approximate Scale

N

Figure 6-10

TNT AREA A OVERBURDEN
WATER TABLE CONTOUR MAP
March 1995
Plum Brook Ordnance Works
Sandusky, Ohio

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the five overburden groundwater wells in the area, but information from other areas is also used to extrapolate the groundwater contours.

Both maps show an overall groundwater gradient from south to north, with an average gradient of approximately 0.008 ft/ft. This gradient is about twice the sitewide average gradient of 0.0045 ft/ft. Through the central and eastern portions of the area, the groundwater elevation contours trend east-west, indicating flow directly northward. On the western side of the site the groundwater contours indicate flow to the northwest. The transition between flow directly north and flow to the northwest occurs between wells TNTA-MW-10 and TNTA-MW-11. The groundwater gradients are slightly steeper in the southern portion of the area, and flatten out somewhat in the northern half of the area, particularly in the March 1995 measurements. The pattern of groundwater flow in the overburden aquifer indicated by the two sets of measurements is very similar.

The groundwater elevations in the overburden at the TNT Area A area were generally between 2 and 9 feet below the ground surface. The groundwater elevations during the March 1995 sampling round are all higher than the groundwater elevations during December 1994. At well MK-MW-23 on the northeastern edge of the area, the groundwater elevation during March 1995 was 7.24 feet higher than in December 1994. All other wells in the area had much smaller differences, between 2 and 3.5 feet higher in March 1995.

There is some correlation between the thickness of overburden and the groundwater flow patterns at the TNT Area A. First, the groundwater gradient is steepest in the thinnest overburden materials to the south, and flattens where the overburden is thicker to the north. Where the overburden is thin, the overall transmissivity of the hydrostratigraphic unit is relatively low. Where the overburden becomes thicker, the transmissivity of the unit increases. This increased transmissivity leads to flatter gradients. Second, the largest change in groundwater levels between the two sampling periods occurred in well MK-MW-23, which was located in the thickest overburden materials.

Two bedrock wells are located in the vicinity of TNT Area A. Well BED-MW-18 is located on the eastern edge of the area, and well BED-MW-17 is located approximately 700 feet north of the area. The bedrock underneath the TNT Area A is shale. The groundwater elevation at well BED-MW-18 was 625.05 feet during December 1994, and decreased to 620.39 feet in March 1995. The groundwater elevation at well BED-MW-17 was approximately 603 feet for both measurement dates. The sitewide bedrock groundwater contour maps (Figures 6-6 and 6-7) indicate flow towards the north with a slight northwesterly component across the TNT Area A.

Downward hydraulic gradients exist within the TNT Area A, from the overburden to the bedrock. Though the true vertical gradients are unknown, since no well pairs were installed, it is possible to approximate the magnitude of this downward gradient. The magnitude of the downward gradient may be quite variable over time. At well BED-MW-18, the approximate difference in hydraulic head between the overburden and the bedrock is only 5 feet for the first measurement round, but is over 15 feet for the second. At well BED-MW-17, the approximate difference in hydraulic head is relatively constant at about 25 feet. Based on the well depths, these differences in hydraulic heads indicate approximate vertical gradients of between 0.1 to 1.0 ft/ft. These vertical gradients are one to two orders of magnitude higher than the horizontal hydraulic gradients within the overburden in the area.

6.1.2.2 TNT Area B

Only two overburden and no bedrock wells are located near the TNT Area B. The water levels of these two wells are included in Table 6-2. The depth to bedrock and overburden thickness are derived from the sitewide overburden thickness evaluation included in Section 6.1.1.1 above. Since groundwater flow cannot be characterized using only two wells, information from wells in other areas of the site (from the sitewide flow characterization presented previously) was used to assess groundwater flow in TNT Area B.

At the TNT Area B, the top of bedrock dips to the north and strikes nearly east-west, with elevations ranging from about 663 feet at Scheid Road south of the area (at well

MK-MW-16) to about 655 feet at the northern edge of the area (at well MK-MW-17). The thickness of the overburden is relatively constant, ranging from 6 to 8 feet. The bedrock in this area is shale.

Figures 6-11 and 6-12 are contour maps of the groundwater elevations in the overburden for December 1994 and March 1995, respectively. These maps are based primarily on the two overburden groundwater wells in the area, but information from other areas is also used to extrapolate the groundwater contours.

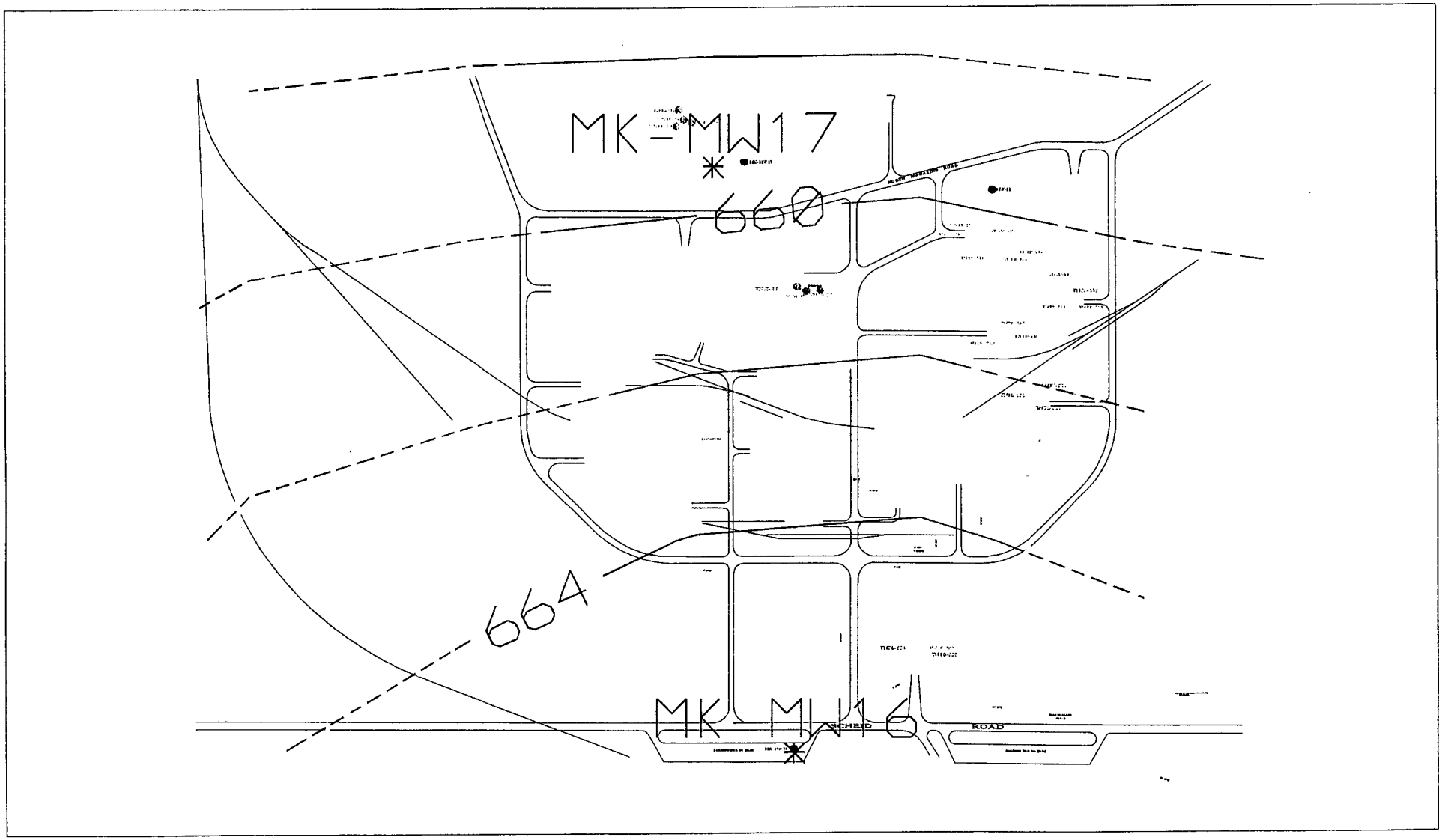
Both maps show an overall groundwater gradient from south to north, with an average gradient of approximately 0.004 ft/ft, similar to the overall sitewide gradient. The groundwater elevation contours trend east-west, indicating flow directly northward. The pattern of groundwater flow in the overburden aquifer indicated by the two measurement rounds is very similar.

The groundwater elevations in the overburden at the TNT Area B were generally between 3 and 7 feet below the ground surface. The groundwater elevations during the second measurement round are both higher than the groundwater elevations during the first measurement round, by between 1.5 and 2.2 feet.

Since the overburden is relatively thin near the TNT Area B and the depth to the water table is generally several feet, the saturated thickness of the overburden is between 2 to 3 feet for December 1994. Significant horizontal groundwater flow is unlikely in such a thin saturated unit. Since no bedrock wells were located near the TNT Area B, it is not possible to extrapolate possible gradients between the overburden and the bedrock in this area. However, it is likely that vertical migration does occur, given the thin saturated overburden unit and low horizontal gradients.

6.1.2.3 TNT Area C

Four overburden and one bedrock wells are located near the TNT Area C. The water levels of these wells were measured twice and the results are included in Tables 6-2



500 250 0 500 1000 FEET

Approximate Scale

N

Figure 6-11

TNT AREA B OVERBURDEN
WATER TABLE CONTOUR MAP
December 1994
Plum Brook Ordnance Works
Sandusky, Ohio

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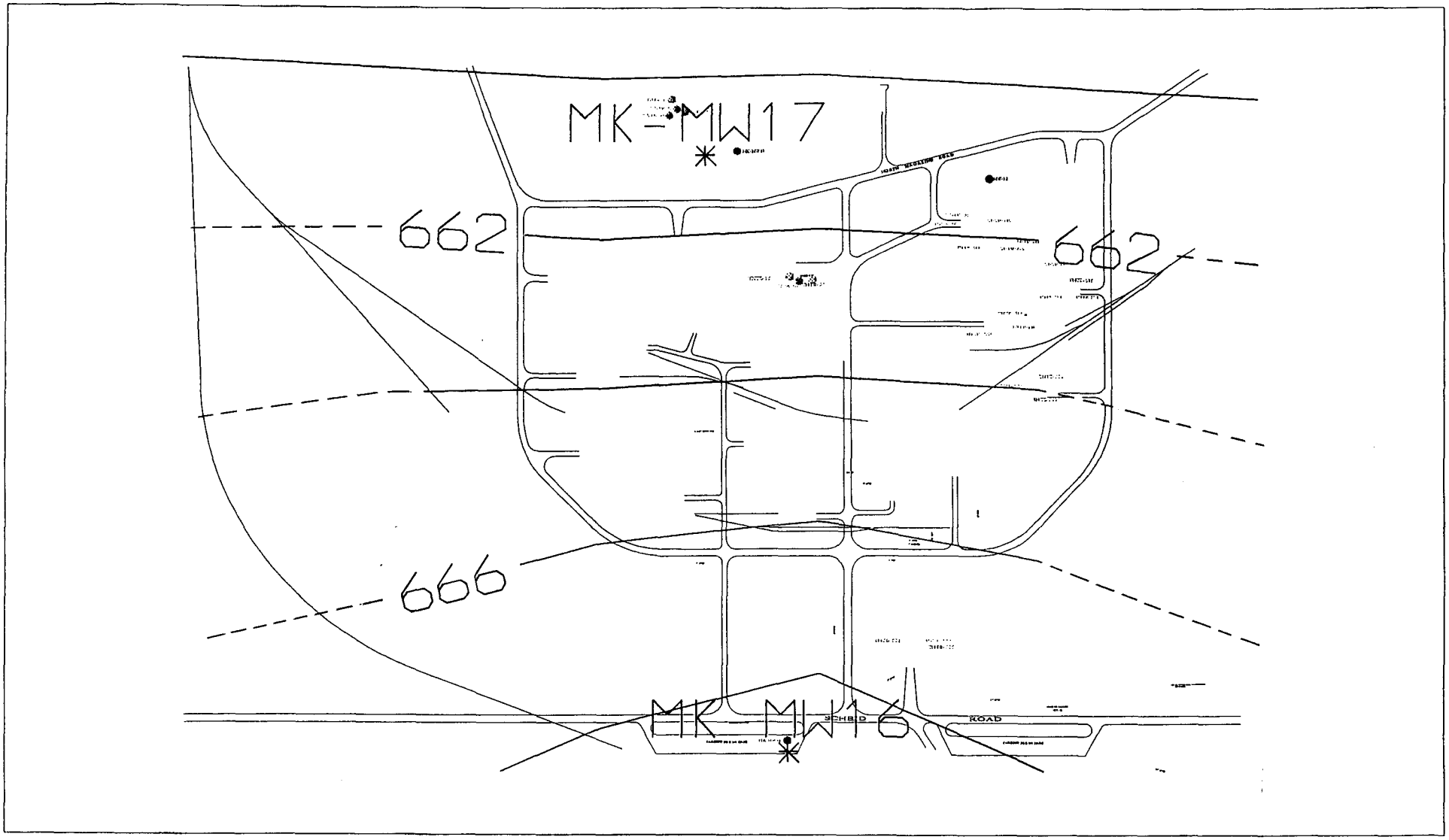

500 250 0 500 1000 FEET

Approximate Scale

N

Figure 6-12

TNT AREA B OVERBURDEN
WATER TABLE CONTOUR MAP
March 1995
Plum Brook Ordnance Works
Sandusky, Ohio

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and 6-3. The depth to bedrock and overburden thickness are derived from the sitewide overburden thickness evaluation included in Section 6.1.1.1 above.

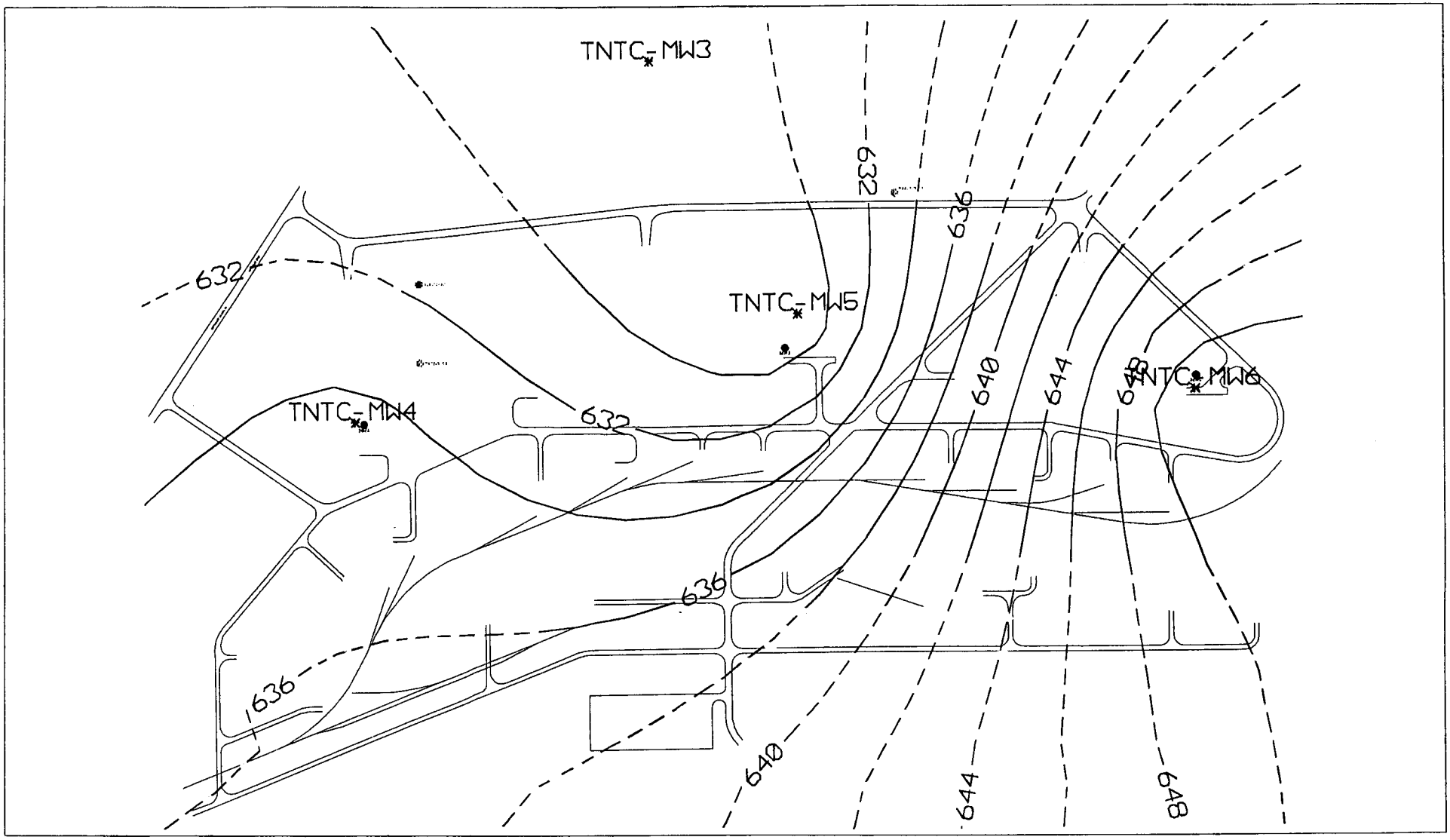
The top of bedrock surface in the vicinity of the TNT Area C is very uneven. Based on the top of bedrock map (Figure 6-2), a significant depression in the top of bedrock surface is present in the center of the TNT Area C, in the region near wells BED-MW13 and TNTC-MW5. The elevation of the top of bedrock at well BED-MW-13 is about 605 feet, and the elevation of the top of bedrock at well TNTC-MW-5 is 619 feet. All the other wells in the area have top of bedrock elevations of over 628 feet. The sitewide pattern of a northward dip of the top of bedrock is superimposed over the large depression in the center of the TNT Area C. Shale bedrock was encountered at all wells in this area.

The overburden thickness at the TNT Area C reflects the unevenness in the top of bedrock elevations. A thick wedge of overburden materials is present in the bedrock depression, with thicknesses of up to 40 feet in well BED-MW-13. At well TNTC-MW-5 the overburden is 29 feet thick. The overburden in all other wells is between 12 and 18 feet thick.

Figures 6-13 and 6-14 are contour maps of the groundwater elevations in the overburden for December 1994 and March 1995, respectively. These maps are based primarily on the four overburden groundwater wells in the area, but information from other areas is also used to extrapolate the groundwater contours.

The maps of the groundwater elevations for the two sampling periods show significantly different flow patterns. On both measurements dates, the overall groundwater flow direction is from southeast to northwest, but during December 1994 the westerly component of the flow direction is much more enhanced.

During December 1994 (Figure 6-13), the groundwater level at well TNTC-MW-5 is 628.01 feet, creating a local groundwater depression in the vicinity of the well. Well TNTC-MW-3 was dry, so the elevation of the bottom of the well, 628.57 ft, was used as an approximation of the groundwater level. The direction of groundwater flow in the eastern part of TNT Area C is to the west, and between wells TNTC-MW-6 and TNTC-



500 250 0 500 1000 FEET

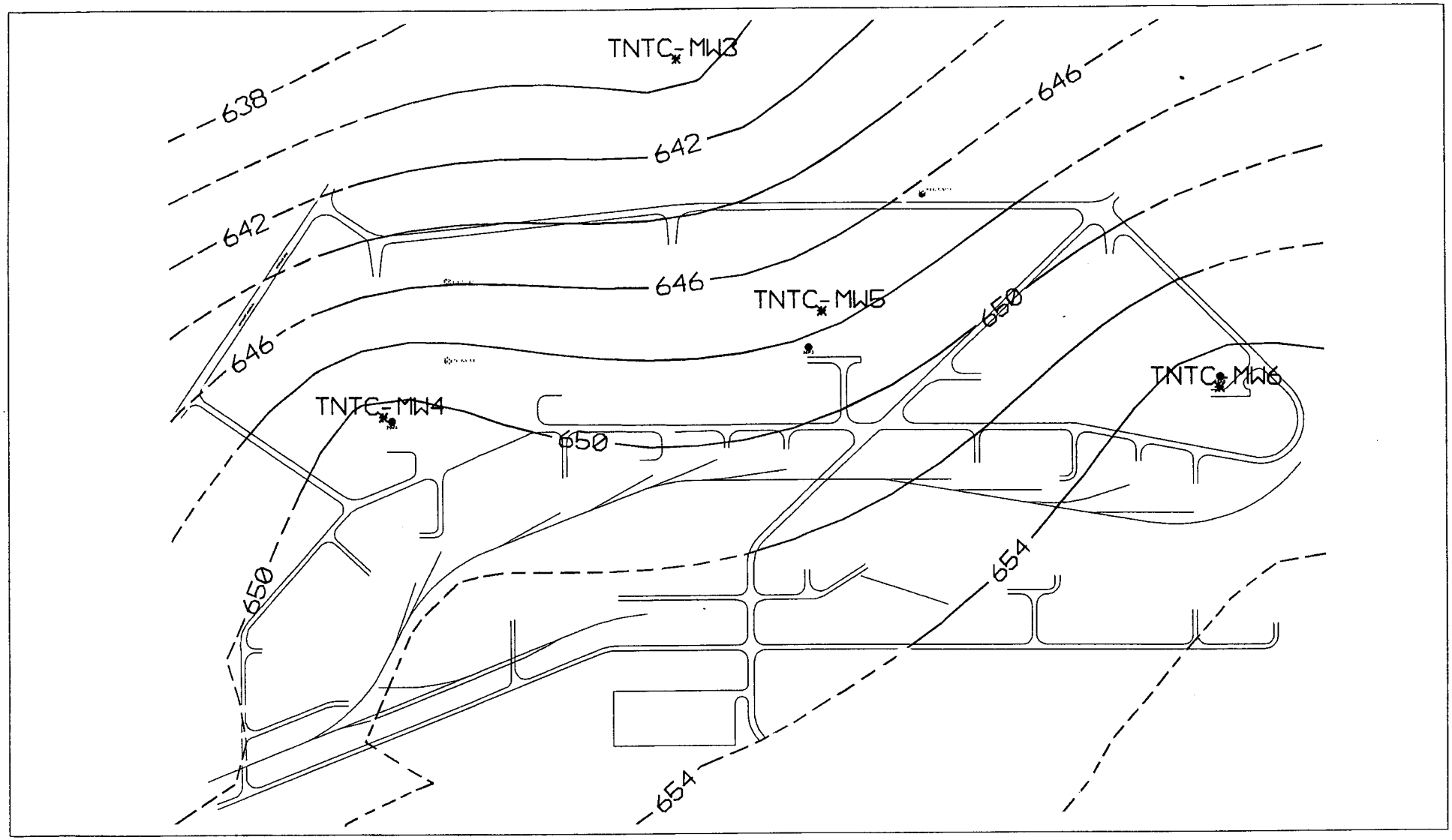
Approximate Scale

N

Figure 6-13

TNT AREA C OVERBURDEN WATER TABLE CONTOUR MAP
December 1994
Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE



500 250 0 500 1000 FEET

Approximate Scale

N

Figure 6-14

TNT AREA C OVERBURDEN WATER TABLE CONTOUR MAP
March 1995
Plum Brook Ordnance Works
Sandusky, Ohio

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MW-5 the gradient is approximately 0.02 ft/ft. In the western portion of the area the direction of flow is to the north, and the gradient is much less steep. North of well TNTC-MW-5 the gradient is much less steep, but since well TNTC-MW-3 was dry, the direction of flow and gradient is unknown.

During March 1995 (Figure 6-14), all the wells in the overburden had groundwater present, and the flow pattern was significantly different. The groundwater depression at well TNTC-MW-5 was no longer present. The direction of groundwater flow across the area was from southeast to northwest, with an average gradient of 0.005 ft/ft. The groundwater contours do curve somewhat, with a hinge axis along a line connecting wells TNTC-MW3 and TNTC-MW5. However, this curve is not nearly as pronounced as the groundwater depression that was present during December 1994.

The groundwater elevations in the overburden at TNT Area C were relatively deep below the ground surface in December 1994 with depths ranging from 7.47 feet up to 23.8 feet. During March 1995, the groundwater depths were much smaller, between 3 and 7 feet. With the exception of well TNTC-MW6, the groundwater elevations during March 1995 are over 10 feet higher than during December 1994. TNT Area C had much larger differences in groundwater elevations than any other area.

There is some correlation between the thickness of overburden and the changes in groundwater levels at TNT Area C for the two measurement periods. The largest change in groundwater levels occurred in well TNTC-MW5, in which the March 1995 groundwater level was 19.61 feet higher than the December 1994 level. The second largest change in groundwater levels occurred in well TNTC-MW4, in which the March 1995 groundwater level was 16.20 feet higher than the December 1994 level. These two wells had the greatest thickness of overburden, with well TNTC-MW-5 at 29 feet thick and well TNTC-MW-4 at 18 feet thick, respectively. The smallest change in groundwater levels between the two periods occurred in well TNTC-MW6, in which the March 1995 groundwater level was only 3.27 feet higher than the December 1995 level. This well had the smallest thickness of overburden materials, approximately 12 feet.

Only one bedrock well is located in the vicinity of TNT Area C, well BED-MW-13. The December measurement of this well may have been taken before the well had completely recovered from sampling. The March 1995 water level was 619.29 feet, nearly 27 feet lower than the overburden water level in that area. Significant downward gradients are probable at the TNT Area C, with approximate gradients of 0.5 ft/ft.

6.1.3 General Conclusions

Several patterns emerge from the area specific groundwater flow analysis.

Correlation between the overburden thickness variation and the changes in overburden groundwater levels were observed at two areas. At both TNT Area A and TNT Area C, the largest variations in overburden groundwater levels were observed in the thickest overburden materials. At other areas, the variation in overburden thickness was not significant, and this correlation was not observed. Also, at TNT Area A, the magnitude of the horizontal gradients could be correlated with the thickness of the overburden.

Most of the areas had similar groundwater flow patterns during both measurement periods. TNT Area C showed the largest variation in both local groundwater flow patterns and gradients between December 1994 and March 1995. This area also had a significant local variation in overburden thickness, which may account for the variation in flow patterns and gradients. All areas had higher overburden groundwater levels during March 1995. The largest increase in groundwater levels occurred at TNT Area C, and the smallest increase at TNT Area B.

Local overburden groundwater gradients range from a low of 0.004 ft/ft at TNT Area B to a high of 0.02 ft/ft at TNT Area C. The vertical gradients ranged from 0.1 to 1.0 ft/ft in most areas. The vertical gradients are up to two orders of magnitude higher than the horizontal gradients in all areas.

6.2 GROUNDWATER QUALITY

The results of the chemical analysis of the groundwater samples collected from the nine overburden wells and three bedrock wells installed in the TNT areas are discussed below. Samples from all 12 wells were analyzed for explosives residues, nitrates, and total and dissolved concentrations of 14 metals, the 13 priority pollutant metals plus manganese. Samples from the three bedrock wells were also analyzed for VOCs and SVOCs. The results of the chemical analysis of the samples for TNT Areas A, B, and C, respectively, are discussed in Section 6.2.1, 6.2.2, and 6.2.3. Establishment of a PQL for explosives residues compounds, were previously discussed in Section 4.0. Copies of the laboratory reports, which include explosives residues concentrations detected above the MDL but below the PQL, are included in Appendix J.

Measurements of the physical parameters pH, specific conductance, and temperature were gathered during sample collection. These measurements are discussed in Section 6.2.4.

A summary of the groundwater quality for the TNT areas is provided in Section 6.2.5.

6.2.1 TNT Area A

In TNT Area A, samples were collected from five overburden wells and two bedrock wells.

6.2.1.1 Explosives Residues

Explosives residues were detected at concentrations above the PQL in two of the overburden wells. No explosives residues were detected in either of the bedrock wells installed in TNT Area A. Concentrations above the PQL are listed in Table 6-4 and are illustrated on Figure 6-15.

TABLE 6-4

EXPLOSIVES RESIDUES CONCENTRATIONS
GROUNDWATER MONITORING WELLS

	Sample ID	2,4,6-TNT	1,3,5-TNB	NB	2,4-DNT	2,6-DNT	4-Am-2-NT	3,4-DNT	4-Am-DNT	2-Am-DNT	2-NT	3-NT	4-NT	2-Am-4-NT	1,3-DNB
TNT Area A Overburden Wells	DM-MW10	10			11				8.7	31					
	DM-MW11														
	MK-MW22														
	MK-MW23											13			
	MK-MW24														
TNT Area B Overburden Wells	MK-MW16														
	MK-MW17	6.5										5.3			
TNT Area C Overburden Wells	DM-MW5														
	DM-MW6														
Bedrock Wells	BED-MW13											11			
	BED-MW17														
	BED-MW18														
	BED-MW20											53			
QC Samples	DM-MW21														
	DM-MW22	26	570		250	10				5.2					400
	DM-MW23	10			10				7.9	29					
	Drill Water		13												

Concentrations are listed in $\mu g/L$ or ppb.

The sample IDs used in this table are abbreviated. For overburden wells, the ID is composed of two parts: the investigation for which the well was installed (e.g., DM = Dames & Moore, MK = MK Ferguson); and the well number (e.g. MW10). Bedrock wells are designated by "BED" and the well number.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 nitroaromatic compounds listed across the top row of the table. Only concentrations above the Practical Quantitation Limit (PQL) are listed on the table. Concentrations corresponding to the blank boxes were either below the laboratory detection limit (BDL) or above BDL or less than PQL.

QC sample BED-MW21 is a duplicate of BED-MW18.
QC sample DM-MW23 is a duplicate of DM-MW10.

G:\WP\C\COE\PLUM-BRO.OK\TNT\TAB6-4

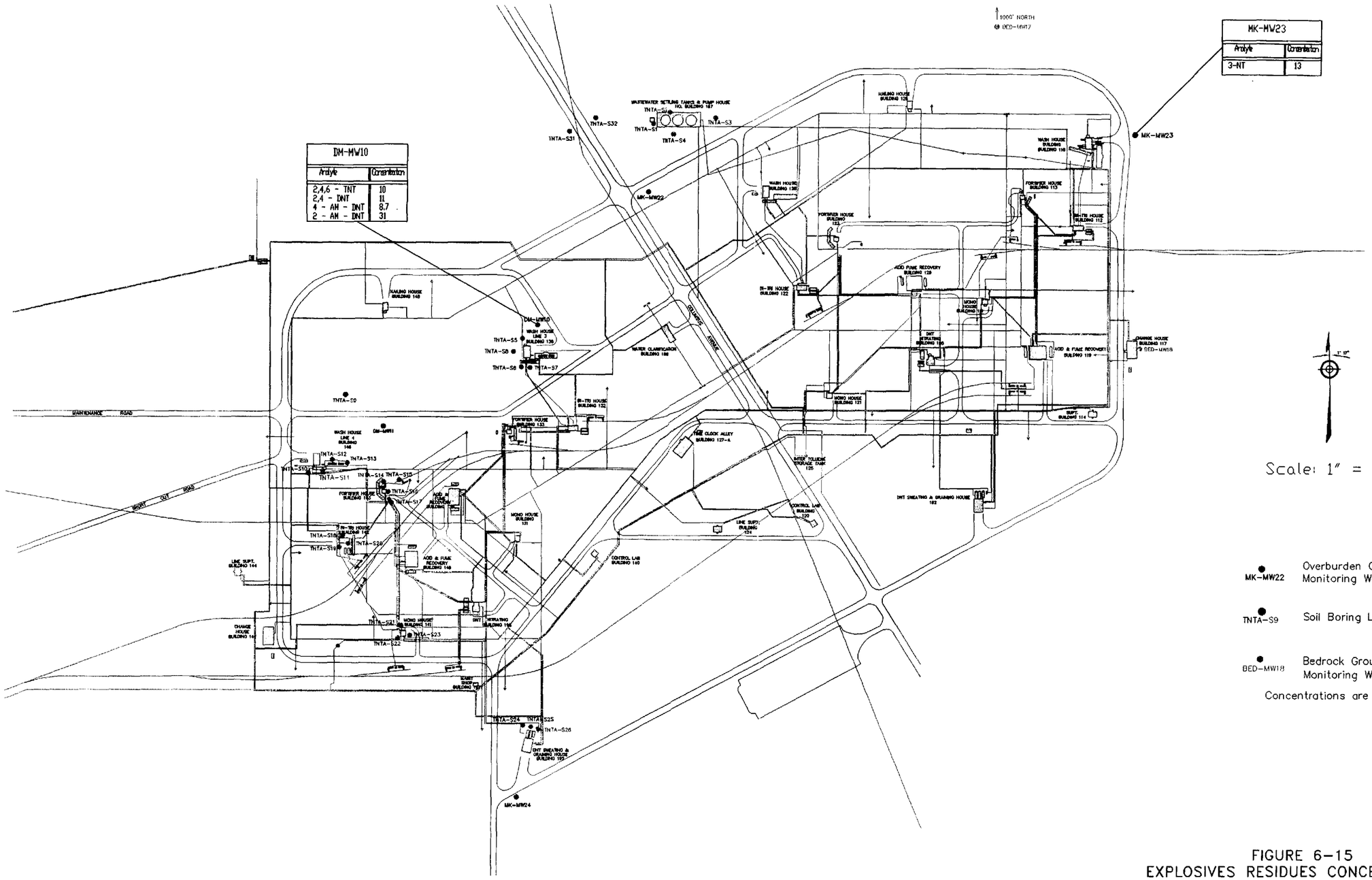


FIGURE 6-15
EXPLOSIVES RESIDUES CONCENTRATIONS IN TNT AREA A GROUNDWATER
Plum Brook Ordnance Works
Sandusky, Ohio
Dames & Moore, Inc.

FILENAME: H:\CAD\COE-PLUM\PLOT\GWMETA.DWG

H:\CAD\COE-PLUM\PLOT\GWMETA Thu Apr 03 20:29:14 1997 Dames & Moore - Atlanta, GA

The sample from well DM-MW10 contained four explosives residues compounds. The average concentrations detected in the two duplicate samples were: 10.0 μg/L of 2,4,6-TNT, 10.5 μg/L of 2,4-DNT, 8.3 μg/L of 4-Am-DNT, and 30 μg/L of 2-Am-DNT. This well is located immediately downgradient of the Wash House for manufacturing line 3. Two of these same compounds, 2,4,6-TNT and 2-Am-DNT were also detected in a soil sample from boring TNTA-S5 which was the boring installed closest to the location of Well DM-MW10. The presence of two biodegradation products in this sample, 4-Am-DNT and 2-Am-DNT indicates that natural degradation of the nitroaromatics in the groundwater is occurring.

One explosives residues compound, 3-NT, was detected at a concentration of 13 μg/L in the sample from Well MK-MW23. This well is located northeast of the Wash House for line 1. In this area, the two rounds of water level measurements made for this investigation indicated that the direction of groundwater flow in the overburden is slightly to the northeast. Well MK-MW23 had been installed and sampled for explosives residues by MK Ferguson in their 1993 investigation. No explosives residues were detected in that investigation. However, the analytical laboratory method for detecting low levels of explosives residues has been refined since 1993 when the MK Ferguson investigation was performed.

No explosives residues were detected above the PQL in the three other overburden wells, DM-MW11, MK-MW22, or MK-MW24, in TNT Area A or in either of the two bedrock wells, BED-MW17 and BED-MW18. Explosives residues were also not detected in wells MK-MW22 or MK-MW24 in the 1993 MK Ferguson investigation.

QC sample DM-MW23 was a duplicate of sample DM-MW10. The same four explosives residues compounds were found in both samples at very consistent concentrations. Additionally, QC sample BED-MW21 was a duplicate of sample BED-MW18. No explosives residues compounds were detected at concentrations above the PQL in either sample.

6.2.1.2 Nitrates

Very low levels of nitrates, listed on Table 6-5, were present in each of the eight samples from TNT Area A. Concentrations ranged from 0.2 milligrams per liter (mg/L) to 0.5 mg/L in the overburden wells and from below the laboratory detection limit to 0.2 mg/L in the bedrock wells. The nitrate concentration in the background bedrock well was 0.2 mg/L which is consistent with all nitrate values in the groundwater samples collected from TNT Area A. All of these concentrations are below the EPA established Maximum Contaminant Level (MCL) of 10 mg/L for nitrates.

The nitrate concentrations in duplicate samples DM-MW10 and DM-MW23 were both 0.3 mg/L. Additionally, the nitrate concentrations in duplicate samples BED-MW18 and BED-MW21 of 0.2 mg/L and 0.4 mg/L compare favorably.

6.2.1.3 VOCs and SVOCs

VOCs and SVOCs were analyzed only for the samples collected from the two bedrock wells. Table 6-6 lists the concentrations detected in each well.

Six VOCs, acetone, benzene, carbon disulfide, ethylbenzene, toluene, and xylenes, were detected in the TNT Area A bedrock wells. The four BTEX compounds (benzene, ethylbenzene, toluene, and xylenes) were all detected in both wells. Overall BTEX concentrations were relatively consistent between the two wells.

Acetone was detected in Well BED-MW17 at a concentration of 150 μg/L. Acetone is a common solvent with a wide variety of common industrial uses. Acetone is also used in the manufacture of pentolite, one of the products of the PBOW.

Carbon disulfide was detected in Well BED-MW18 at a concentration of 125 μg/L (average concentrations for the two duplicate samples collected from this well). Among its many used include the manufacture of dyes, explosives, and rocket fuels.

TABLE 6-5

NITRATE CONCENTRATIONS IN GROUNDWATER

	Sample ID	Nitrates (mg/L)
TNT Area A Overburden Wells	DM-MW10	0.3
	DM-MW11	0.2
	MK-MW22	0.3
	MK-MW23	0.3
	MK-MW24	0.5
TNT Area B Overburden Wells	MK-MW16	0.2
	MK-MW17	0.2
TNT Area C Overburden Wells	DM-MW5	0.2
	DM-MW6	1.4
Bedrock Wells	BED-MW13	BDL
	BED-MW17	0.2
	BED-MW18	0.2
	BED-MW20	0.2
QC Samples	BED-MW21	0.4
	DM-MW23	0.3
	Drill Water	0.3

QC sample BED-MW21 is a duplicate of BED-MW18.
QC sample DM-MW23 is a duplicate of DM-MW10.

BDL = Below Detection Limit

mg/L = milligrams per liter or ppm

The sample IDs used in this table are abbreviated. For overburden wells, the ID is composed of two parts: the investigation for which the well was installed (e.g., DM = Dames & Moore, MK = MK Ferguson); and the well number (e.g. MW10). Bedrock wells are designated by "BED" and the well number.

TABLE 6-6

VOC AND SVOC CONCENTRATIONS IN BEDROCK WELLS

		VOCs							SVOCs		
	Sample ID	Acetone	Benzene	2-Butanone	Carbon Disulfide	Ethyl-benzene	Toluene	Xylenes	2,4-Dimethyl-phenol	2-Methyl-naphthalene	Naphthalene
Bedrock Wells	BED-MW13		50			82	190	720	10	24	28
	BED-MW17	150	33			98	160	420		20	21
	BED-MW18		14		160	79	72	350	19		17
	BED-MW20		8				4	3			
QC Samples	BED-MW21		16		90	120	93	520	17		15
	Drill Water										

VOCs = Volatile organic compounds
SVOCs = Semivolatile organic compounds

Concentrations are listed in μg/L or ppb.

All samples listed in the Sample ID column (column 2) were analyzed for all analytes on the VOC and SVOC method analysis lists. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

The sample IDs used in this table are abbreviated. "BED" indicates a well completed in the bedrock. The well number is designated by MW (e.g., MW13).

QC sample BED-MW21 is a duplicate of BED-MW18.

In addition to the six VOCs, three SVOCs, 2,4-dimethylphenol, 2-methylnaphthalene, and naphthalene, were reported in the TNT Area A bedrock wells. 2-methylnaphthalene and naphthalene were detected in well BED-MW17 at concentrations of 20 μg/L and 21 μg/L, respectively. 2,4-dimethylphenol and naphthalene were detected in well BED-MW18 at concentrations of 18 μg/L and 16 μg/L (averages of concentrations for the two duplicate samples), respectively. These SVOCs were also detected at generally higher concentrations in the bedrock wells in three other parts of the site: TNT Area C, north of the Pentolite Road Red Water Ponds, and near the former toluene tanks east of Taylor Road.

QC sample BED-MW21 was a duplicate of sample BED-MW18. The same five VOCs, benzene, carbon disulfide, ethylbenzene, toluene, and xylenes, were detected in both samples at relatively similar concentrations. Also, the same two SVOCs, 2,4-dimethylphenol and naphthalene, were detected in both samples at almost identical concentrations.

6.2.1.4 Metals

At TNT Area A, eight metals - antimony, arsenic, chromium, copper, lead, manganese, nickel, and zinc - were detected in the groundwater samples. The metals concentrations in both the filtered and unfiltered samples are listed on Table 6-7 and are illustrated on Figure 6-16.

Only one well, DM-MW11, contained all eight metals. Each of the eight metals was detected in one or more of the wells completed in the overburden. Two metals, manganese and zinc, were each detected in all five of the overburden wells at TNT Area A. As was noted in Section 5, manganese and zinc are ubiquitous in the PBS soils.

Only antimony, arsenic, copper, manganese, and zinc were detected in the bedrock well samples.

TABLE 6-7

METALS CONCENTRATIONS
GROUNDWATER MONITORING WELLS

	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
TNT Area A Overburden Wells	DM-MW10-U							7	980						110
	DM-MW10-F								960						
	DM-MW11-U		10			29	21	14	1,300		46				74
	DM-MW11-F	5							710						
	MK-MW22-U								280						20
	MK-MW22-F								190						
	MK-MW23-U								460		47				53
	MK-MW23-F								240		30				20
	MK-MW24-U								310						21
	MK-MW24-F								220						
TNT Area B Overburden Wells	MK-MW16-U			2			35	6	14,000		150			2.3	160
	MK-MW16-F			2					17,000		180			2.6	140
	MK-MW17-U		13		2		37	9	2,200		320			0.9	250
	MK-MW17-F	2							2,300		320				200
TNT Area C Overburden Wells	DM-MW5-U							13	570						52
	DM-MW5-F	8							460						
	DM-MW6-U							5	1,400		29				34
	DM-MW6-F								1,600		20				

Concentrations are listed in mg/Kg or ppm.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

The sample IDs used in this table are abbreviated. For overburden wells, the ID is composed of two parts: the investigation for which the well was installed (e.g., DM = Dames & Moore, MK = MK Ferguson); and the well number (e.g. MW10). Bedrock wells are designated by "BED" and the well number.

Sample DM-MW10 is a duplicate of QC sample DM-MW23.

TABLE 6-7
(Continued)

	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
Bedrock Wells	BED-MW13-U														23
	BED-MW13-F	14													
	BED-MW17-U		18												
	BED-MW17-F	7	15												
	BED-MW18-U						36		89						20
	BED-MW18-F								80						
	BED-MW20-U						54		140						24
	BED-MW20-F								140						
QC Samples	BED-MW21-U						36		90						27
	BED-MW21-F								80						20
	DM-MW23-U							7	880						34
	DM-MW23-F								830						
	Drill Water-U						20	3.1							110
	Drill Water-F	10													240

QC sample BED-MW21 is a duplicate of BED-MW-18.
QC sample DM-MW23 is a duplicate of DM-MW10.

Concentrations are listed in mg/Kg or ppm.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

The sample IDs used in this table are abbreviated. For overburden wells, the ID is composed of two parts: the investigation for which the well was installed (e.g., DM = Dames & Moore, MK = MK Ferguson); and the well number (e.g. MW10). Bedrock wells are designated by "BED" and the well number.

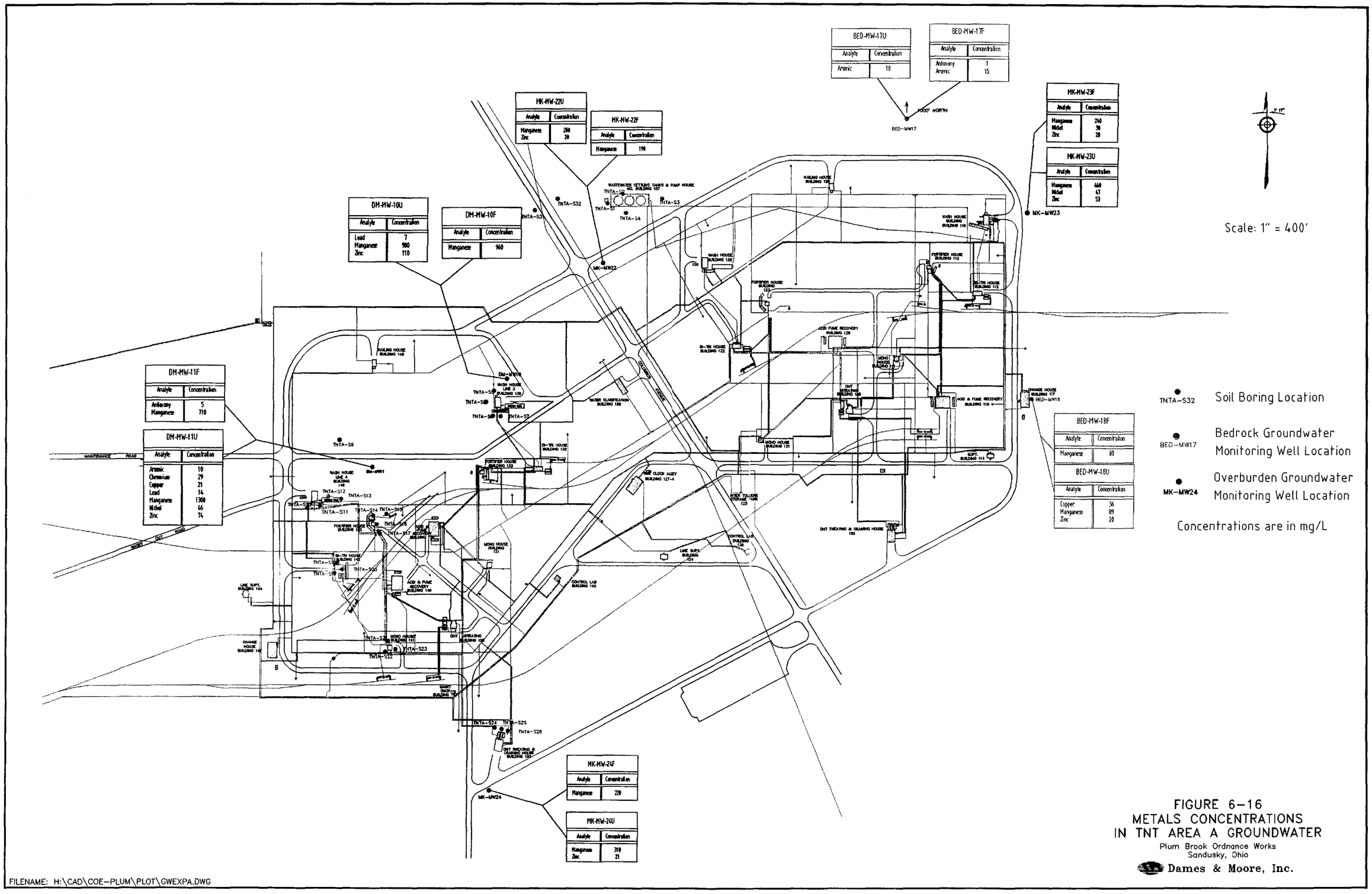


FIGURE 6-16
METALS CONCENTRATIONS
IN TNT AREA A GROUNDWATER
Plum Brook Ordnance Works
Sandusky, Ohio
Dames & Moore, Inc.

FILENAME: H:\CAD\COE-PLUM\PLOT\GWEXPA.DWG

H:\CAD\COE-PLUM\PLOT\GWEXPA Thu Apr 03 19:55:09 1997 Dames & Moore - Atlanta, GA

QC sample DM-MW23 was a duplicate of sample DM-MW10 and QC sample BED-MW21 was a duplicate of sample BED-MW18. Review of the duplicate sample results indicates good agreement in the metals analysis. The same metals species were detected in both unfiltered duplicate pairs at generally consistent concentrations. In the filtered duplicate pairs, zinc was detected in sample BED-MW21 but not in sample BED-MW18. Otherwise the results for the filtered samples were consistent and in good agreement.

Antimony

Antimony was detected in two wells in TNT Area A. In each well, antimony was detected only in the filtered sample. In overburden well DM-MW11 and bedrock well BED-MW17 the concentrations were 5 μg/L and 7 μg/L, respectively. The concentration in bedrock well BED-MW17 exceeds the MCL of 6 μg/L slightly. As was noted in Section 4, antimony concentrations in filtered groundwater samples are probably in part or in total related to the sample collection process. However, it is also noted that antimony was reported in several of the soil samples in TNT Area A.

Arsenic

Arsenic was detected in overburden well DM-MW11 and bedrock well BED-MW17. The concentrations in the unfiltered samples were 10 μg/L and 18 μg/L, respectively. Arsenic was also detected in the filtered sample from well BED-MW17 at a concentration of 15 μg/L. All three concentrations are below the MCL of 50 μg/L.

Arsenic was routinely detected in the soil samples from TNT Area A. Therefore, it is likely that the arsenic in the groundwater at TNT Area A is naturally occurring. Further, it appears that the arsenic in the sample from overburden well DM-MW11 was related to particulate matter in the sample rather than actually dissolved in the groundwater, as arsenic was not detected in the filtered sample.

Chromium

Chromium was detected in only one well DM-MW11. The concentration in the unfiltered sample of 29 μg/L is below the MCL of 100 μg/L.

Chromium was detected in every soil sample collected from TNT Area A. Therefore, it is likely that the chromium in the overburden aquifer is naturally occurring. As chromium was not detected in the filtered sample from DM-MW11, it is likely that the concentration in the unfiltered sample is related to presence of particulate matter.

Copper

Copper was detected in wells DM-MW11 and BED-MW18. The concentrations in the unfiltered samples of 21 μg/L and 36 μg/L are both well below the MCL of 1,300 μg/L and the Secondary MCL (SMCL) of 1,000 μg/L.

Copper was detected routinely in the soil samples from TNT Area A. Therefore, it is likely that the copper in the groundwater is naturally occurring. Copper was not detected in either of the filtered samples. Therefore, it is likely that the concentrations in the unfiltered samples are related to presence of particulate matter.

Lead

Lead was detected at a concentrations of 7 μg/L and 14 μg/L in the unfiltered samples from wells DM-MW10 and DM-MW11, respectively. These concentrations are all below the lead Action Level (AL) of 15 μg/L. Lead was not detected in either bedrock well in TNT Area A.

Lead was detected in every soil sample collected from TNT Area A. The statistical analysis of soils and nitroaromatics also shows a correlation between the presence of explosives residues and lead in soil. However, no explosives residues were detected

in the groundwater in this sample. Therefore, it is likely in this instance that the lead is naturally occurring and related to the presence of particulate matter in the sample.

Manganese

Manganese was detected in all five groundwater samples collected from overburden wells in TNT Area A and from one of the two bedrock wells. In each case, manganese was reported in both the filtered and unfiltered samples. Concentrations in the unfiltered samples were always higher. Concentrations in the unfiltered samples ranged from a low of 89.5 μg/L (average of two duplicate samples) in the sample collected from bedrock well BED-MW18 to a high of 1,300 μg/L in the sample collected from overburden well DM-MW11. Concentrations in the filtered samples ranged from a low of 80 μg/L, again in bedrock well BED-MW18, to a high of 895 μg/L (average of two duplicate samples) in the sampled collected from overburden well DM-MW10. Manganese values in all samples in which it was detected exceeded the SMCL of 50 μg/L.

Manganese was detected in every soil sample collected from TNT Area A. It is likely that the manganese in these groundwater samples is naturally occurring. Manganese appears to be present at high concentrations in the dissolved phase in the groundwater at the site. While concentrations were higher, sometimes by almost 50 percent, in the unfiltered samples, significant manganese concentrations were present in all samples in the dissolved phase.

Nickel

Nickel was detected at a concentrations of 47 μg/L and 30 μg/L in the unfiltered and filtered samples from well MK-MW23 and in the unfiltered sample from well DM-MW11 at a concentration of 46 μg/L. These concentrations are all below the MCL of 100 μg/L for nickel.

Nickel was detected in every soil sample collected from TNT Area A. It is likely that the nickel is naturally occurring and is generally related to the presence of particulate matter in the samples.

Zinc

Zinc was also detected in all five groundwater samples collected from overburden wells in TNT Area A and from one of the two bedrock wells. However, only in one sample was zinc reported in both the filtered and unfiltered samples. Concentrations in the unfiltered samples ranged from a low of 20 μg/L in overburden well MK-MW22 to a high of 174 μg/L in the sample collected from overburden well DM-MW11. (Zinc values in duplicate sample pairs were averaged for establishing concentrations ranges.) In Well MK-MW23 zinc was detected in both the filtered and unfiltered samples at concentrations of 20 μg/L and 53 μg/L, respectively.

Zinc was also detected in both the filtered and unfiltered samples from one of the duplicate pair of samples (BED-MW21) from well BED-MW18. The concentration in the filtered sample was less than in the unfiltered sample. In the other member of the duplicate sample pair, zinc was detected only in the unfiltered sample.

Zinc values were all well below the SMCL of 5,000 μg/L.

Zinc was detected in every soil sample collected from TNT Area A. It is likely that the zinc in these groundwater samples is naturally occurring. While zinc was detected in one sample in the dissolved phase, it appears that a significant portion of the zinc in the site groundwater is probably related to the presence of particulate matter in the samples.

6.2.2 TNT Area B

In TNT Area B, samples were collected from two overburden wells which had previously been installed as part of the MK Ferguson investigation.

6.2.2.1 Explosives Residues

Explosives residues were detected at concentrations above the PQL in well MK-MW17, the well which is installed on the upgradient side of TNT Area B and east of the Waste Water Settling Basins. 2,4,6-TNT and 3-NT were detected at concentrations of 6.5 and 5.3 μg/L, respectively. No explosives residues were detected in the sample from well MK-MW16. The concentrations are listed on Table 6-4 and are illustrated on Figure 6-17.

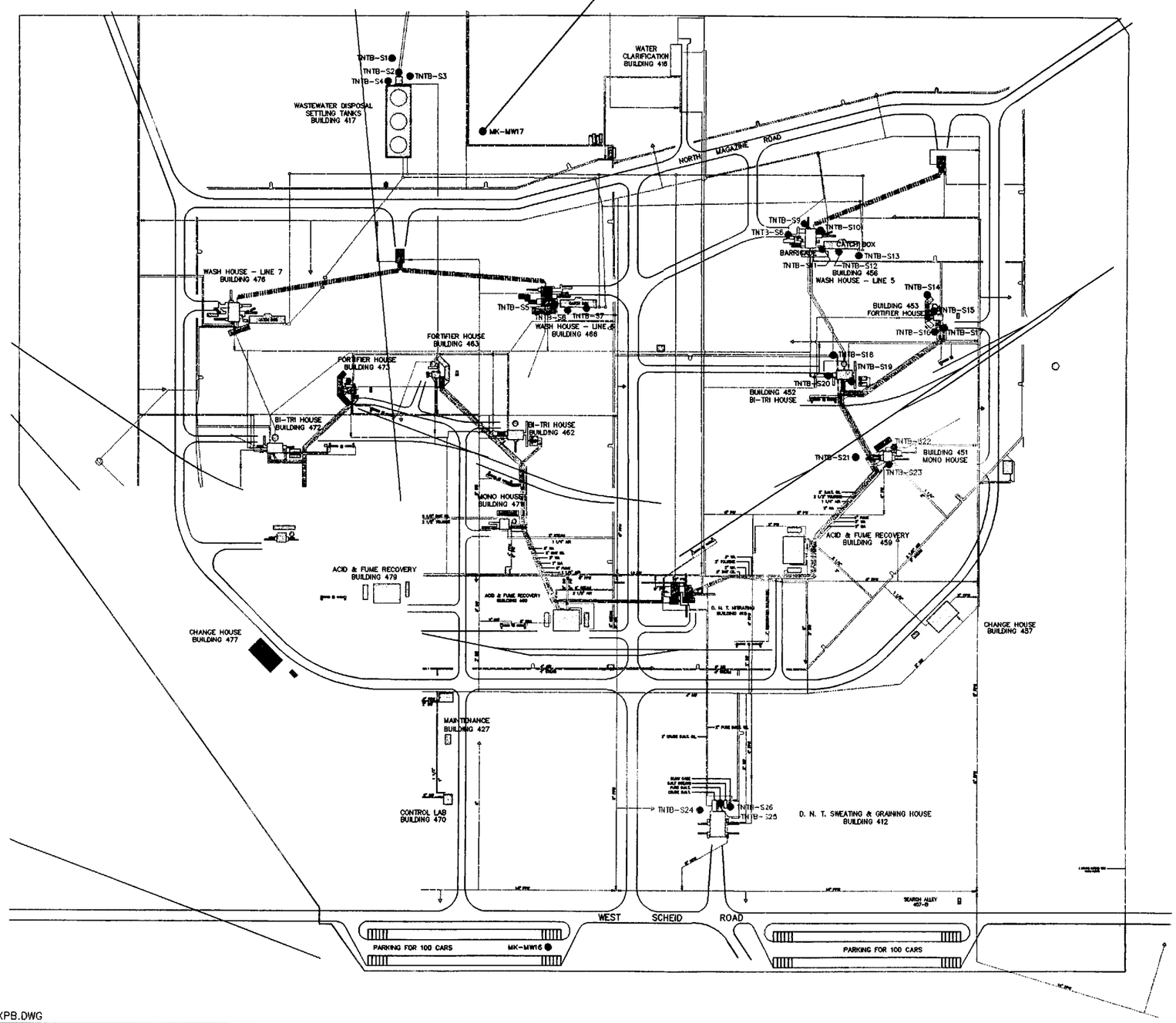
The presence of explosives residues in the groundwater in the overburden at TNT Area B is not surprising. Explosives residues are ubiquitous in the soil samples collected in this area. Additionally, as is discussed in Section 6.1, the overburden is not very thick in this portion of the site and groundwater is very shallow. Therefore, migration of explosives residues into the groundwater in the overburden would be expected.

No explosives residues were detected in either of these two wells during the 1993 MK Ferguson investigation.

6.2.2.2 Nitrates

Very low levels of nitrates, 0.2 mg/L, were present in each of the two wells at TNT Area B. These concentrations are below the MCL. Nitrate concentrations are summarized on Table 6-5.

MK-MW-17	
Analyte	Concentration
2,4,6-TNT	6.5
3-NT	5.3



Scale: 1" = 300'

TNTB-S1 Soil Boring Location

MK-MW17 Groundwater Monitoring Well Location

Concentrations are in ug/L

FIGURE 6-17
EXPLOSIVES RESIDUES CONCENTRATIONS IN TNT AREA B GROUNDWATER
Plum Brook Ordnance Works
Sandusky, Ohio

Dames & Moore, Inc.

FILENAME: H\CAD\COE-PLUM\PLOT\GWEXPB.DWG

H:\CAD\COE-PLUM\PLOT\GWEXPB Thu Apr 03 20:03:19 1997 Dames & Moore - Atlanta, GA

6.2.2.3 Metals

At TNT Area B, ten (the most of any of the three TNT areas) metals - antimony, arsenic, beryllium, cadmium, copper, lead, manganese, nickel, thallium, and zinc - were detected in the groundwater samples. Six of the ten metals, copper, lead, manganese, nickel, thallium, and zinc, were detected in both samples. The concentrations are listed on Table 6-7 and are illustrated on Figure 6-18.

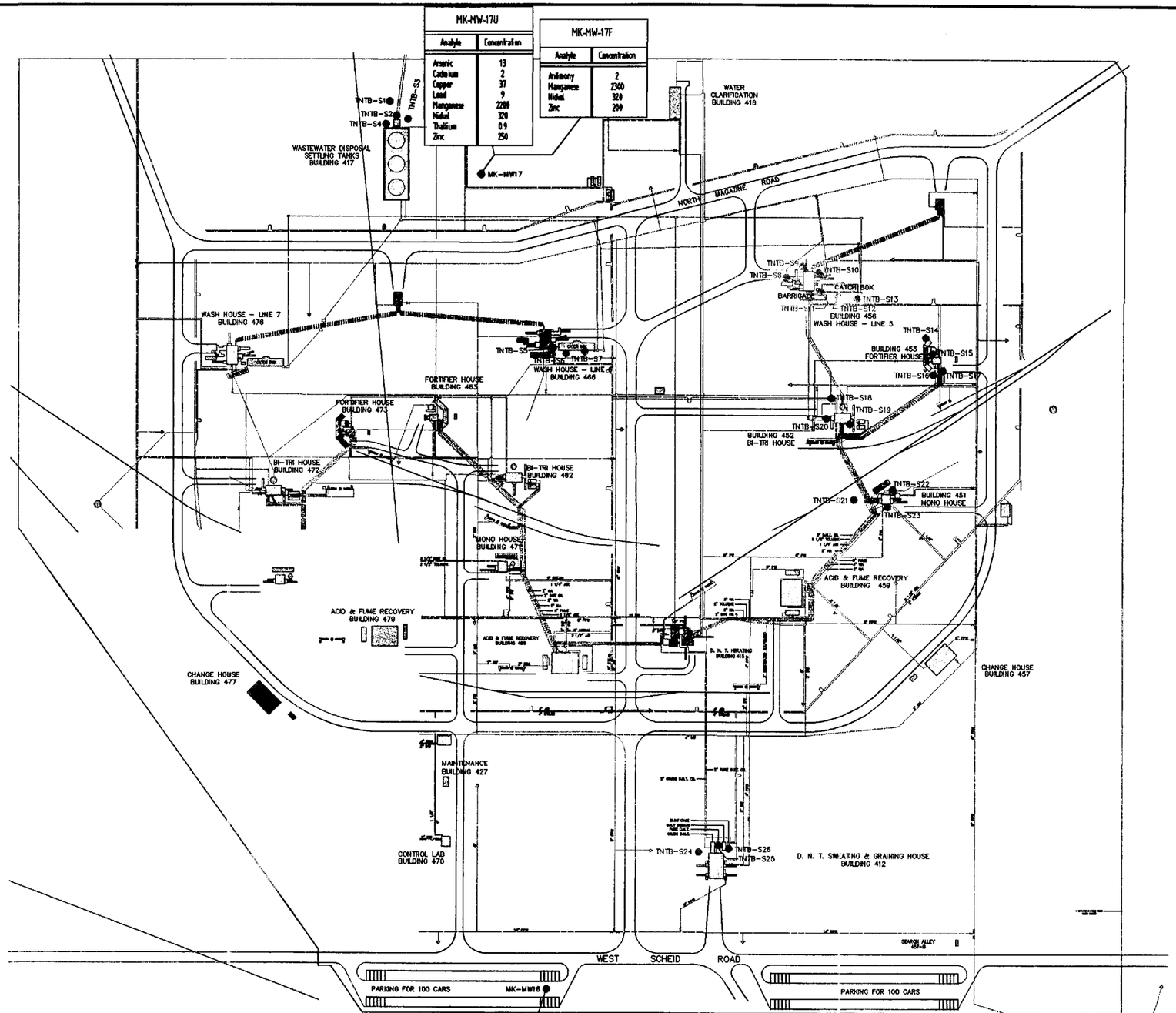
Antimony

Antimony was detected only in the filtered sample collected from well MK-MW17. The concentration of 2 μg/L is below the MCL of 6 μg/L. As stated previously, the antimony in the filtered groundwater samples can probably be attributed to the filtering process and these results should not be considered definitive of antimony contamination in the site groundwater. However, it is also noted that antimony was reported in half of the soil samples in TNT Area B.

Arsenic

Arsenic was detected in the unfiltered sample from well MK-MW17 at a concentration of 13 μg/L. It was not detected in the corresponding filtered sample. This arsenic concentration is well below the MCL of 50 μg/L.

Arsenic was routinely detected in the soil samples from TNT Area B. Therefore, it is likely that the arsenic in the groundwater at TNT Area B is naturally occurring. Further, it appears that the arsenic in the sample from overburden well MK-MW17 was related to particulate matter in the sample rather than actually dissolved in the groundwater, as arsenic was not detected in the filtered sample.



MK-MW-17U	
Analyte	Concentration
Arsenic	13
Cadmium	2
Copper	37
Lead	9
Manganese	2200
Nickel	320
Thallium	0.9
Zinc	250

MK-MW-17F	
Analyte	Concentration
Antimony	2
Manganese	2300
Nickel	320
Zinc	200

MK-MW-16U	
Analyte	Concentration
Beryllium	2
Copper	35
Lead	4
Manganese	14000
Nickel	150
Thallium	2.3
Zinc	160

MK-MW-16F	
Analyte	Concentration
Beryllium	2
Manganese	17000
Nickel	100
Thallium	2.6
Zinc	140

Scale: 1" = 300'

● TNTB-S3 Soil Boring Location

● MK-MW17 Overburden Groundwater Monitoring Well Location

Concentrations are in mg/L

FIGURE 6-18
METALS CONCENTRATIONS IN TNT AREA B GROUNDWATER
Plum Brook Ordnance Works
Sandusky, Ohio
Dames & Moore, Inc.

FILENAME: H:\CAD\COE-PLUM\PLOT\GWMETB.DWG

H:\CAD\COE-PLUM\PLOT\GWMETB Thu Apr 03 20:31:23 1997 Dames & Moore - Atlanta, GA

Beryllium

Beryllium was detected in only one well MK-MW16. The concentrations in both the unfiltered and filtered samples were 2 μg/L. This concentration is below the MCL of 4 μg/L.

Beryllium was detected in several of the soil samples collected from TNT Area B, although it was not as prevalent as many of the other metals. Beryllium has no known correlation to nitroaromatics. Additionally, well MK-MW16 is located on the upgradient side of TNT Area B. TNT Area B is, in turn, located on the upgradient side of the site. Therefore, it is likely that the beryllium present in well MK-MW16 is naturally occurring.

Because beryllium was detected in both the filtered and unfiltered samples from well MK-MW16, it is likely that it is present in the dissolved phase rather than on particulate matter suspended in the water.

Cadmium

Cadmium was detected only in the unfiltered sample from well MK-MW17. The concentration of 2 μg/L is below the MCL of 5 μg/L.

Cadmium was detected in a number of the soil samples from TNT Area B. It is not known to be related to the TNT manufacturing process. Therefore, it is likely that the cadmium in the groundwater is naturally occurring.

As cadmium was not detected in the filtered sample from well MK-MW17, it is possible that its presence is related to particulate matter suspended in the groundwater.

Copper

Copper was detected in wells MK-MW16 and MK-MW17. The concentrations in the unfiltered samples of 35 μg/L and 37 μg/L are both well below the MCL of 1,300 μg/L and the SMCL of 1,000 μg/L.

Copper was detected in all but one of the soil samples from TNT Area B. Therefore, it is likely that the copper in the groundwater is naturally occurring.

As copper was not detected in either of the filtered samples, it is likely that the concentrations in the unfiltered samples are related to presence of particulate matter.

Lead

Lead was detected in the unfiltered samples from wells MK-MW16 and MK-MW17 at concentrations of 6 μg/L and 9 μg/L, respectively. These concentrations are both below the AL for lead of 15 μg/L.

Lead was detected in all the soil samples from TNT Area B. The statistical analysis of soils and nitroaromatics also shows a correlation between the presence of explosives residues and lead in soil. However, as explosives residues were detected in the one of these groundwater samples but not in the other, and as the lead concentrations are consistent in the two samples, it appears unlikely that the lead in the groundwater is related to nitroaromatics contamination. Rather, the lead is probably naturally occurring and related to the presence of particulate matter in the samples.

Manganese

Manganese was detected in both groundwater samples collected from TNT Area B. In each case, manganese was reported in both the filtered and unfiltered samples. Concentrations in the filtered samples were higher in both wells. In well MK-MW16, the manganese concentrations in the unfiltered and filtered samples were 14,000 μg/L

and 17,000 μg/L, respectively. In well MK-MW17, the concentrations were much lower, 2,200 μg/L and 2,300 μg/L, respectively, for the unfiltered and filtered samples.

All TNT Area B manganese values significantly exceeded the SMCL of 50 μg/L.

Manganese was detected in every soil sample collected from TNT Area B. It is likely that the manganese in these groundwater samples is naturally occurring. Manganese appears to be present in the dissolved phase in the groundwater at the site based on the higher values reported in the filtered samples in this part of the site.

Nickel

Nickel was also detected in both groundwater samples collected from TNT Area B. In each case, the nickel concentration in the filtered sample was equal to or greater than the concentration in the unfiltered sample. In well MK-MW16, the nickel concentrations in the unfiltered and filtered samples were 150 μg/L and 180 μg/L, respectively. Concentrations in the both samples from well MK-MW17 were 320 μg/L. These concentrations are all above the MCL of 100 μg/L for nickel.

Nickel was detected in every soil sample collected from TNT Area B. It is likely that the nickel is naturally occurring and is present in the groundwater in the dissolved phase.

Thallium

Thallium was detected in groundwater samples from both wells MK-MW16 and MK-MW17. In well MK-MW16, the thallium concentration of 2.6 μg/L in the filtered sample was higher than the concentration of 2.3 μg/L in the unfiltered sample. Both of these concentrations are above the MCL of 2 μg/L. In well MK-MW17, thallium was only detected in the unfiltered sample. The concentration in this well of 0.9 μg/L is below the MCL.

Thallium was not detected in any of the soil samples collected for this PBOW investigation. The source of the thallium in these two wells is not known. There was not a consistent pattern to the presence of thallium in the filtered and unfiltered samples from TNT Area B.

Zinc

Zinc was detected in both groundwater samples collected from overburden wells in TNT Area B. It was also present in both the unfiltered and filtered samples from each well. Concentrations in the unfiltered samples from wells MK-MW16 and MK-MW17 were 160 μg/L and 250 μg/L, respectively. Concentrations in the filtered samples, which were slightly lower than in the unfiltered samples were 140 μg/L and 200 μg/L, respectively. All four values are well below the SMCL of 5,000 μg/L.

Zinc was detected in every soil sample collected from TNT Area B. It is likely that the zinc in these groundwater samples is naturally occurring. It also appears that a significant portion of the zinc in the groundwater in this portion of the site is probably present in the dissolved phase as concentrations in filtered samples are not significantly less than in the unfiltered samples.

6.2.3 TNT Area C

In TNT Area C, groundwater samples were collected from two of the four overburden wells and the one bedrock well installed for this investigation. Wells DM-MW3 and DM-MW4 did not contain water at the time the groundwater samples were collected in December 1994.

6.2.3.1 Explosives Residues

No explosives residues were detected at concentrations above the PQL in either of the two overburden wells sampled at TNT Area C in December 1994. 3-NT was detected at a concentration of 11 μg/L in bedrock well BED-MW13. Concentrations above the PQL are listed in Table 6-4 and are illustrated on Figure 6-19.

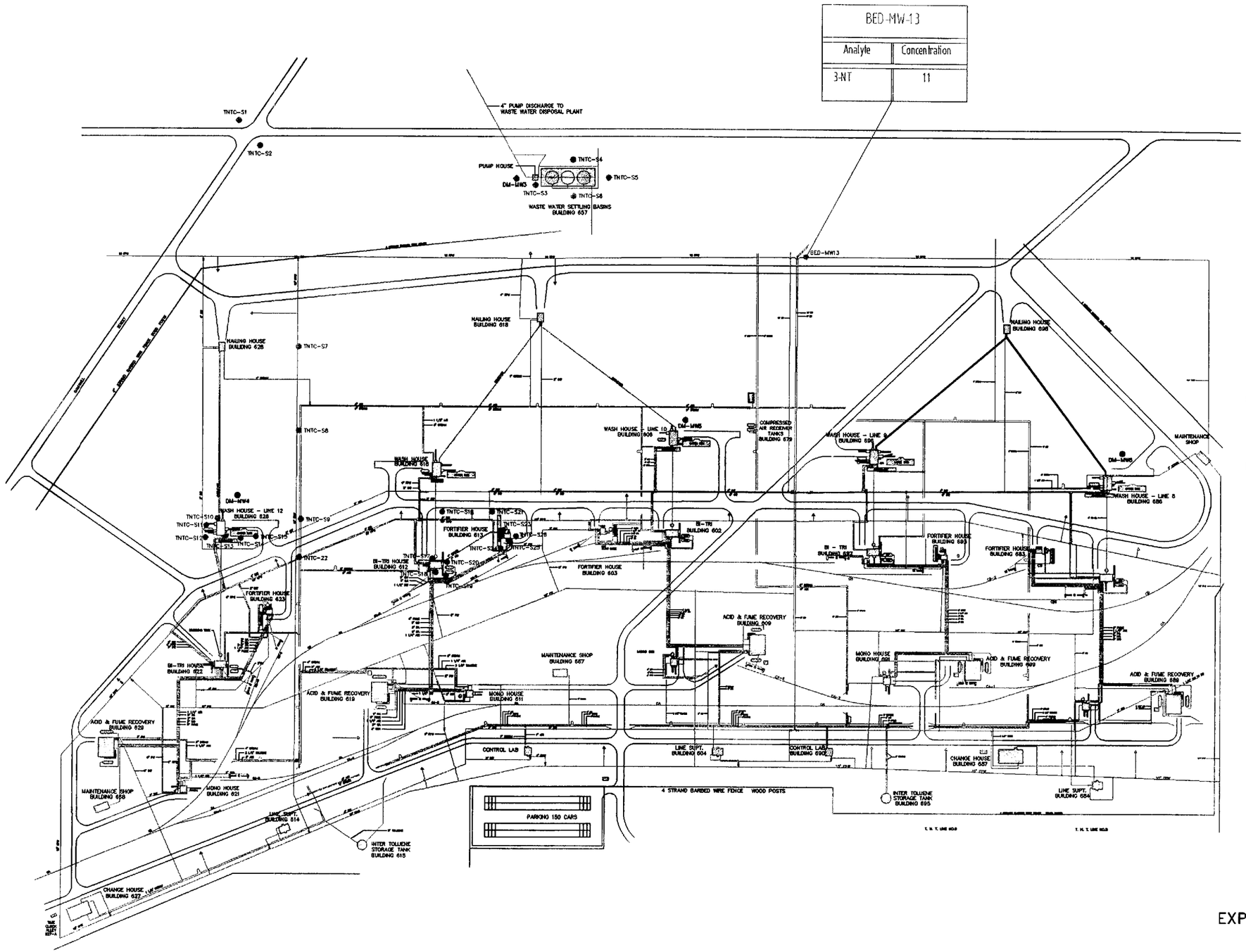
6.2.3.2 Nitrates

Very low levels of nitrates, listed on Table 6-5, were present in each of the three groundwater samples collected at TNT Area C. Concentrations ranged from below the laboratory detection limit in bedrock well BED-MW13 to 1.4 mg/L in overburden well DM-MW6. All of these concentrations are below the EPA established MCL for nitrates.

6.2.3.3 VOCs and SVOCs

BTEX compounds were reported in the bedrock well BED-MW13 at the concentrations listed on Table 6-6. The concentrations were generally similar to those reported in the two bedrock wells located in TNT Area A.

In addition to the four VOCs, three SVOCs, 2,4-dimethylphenol, 2-methylnaphthalene, and naphthalene, were reported at concentrations of 10 μg/L, 24 μg/L, and 28 μg/L, respectively, in the bedrock well BED-MW13. These SVOCs were also detected in bedrock wells in other parts of the site. As with the VOCs, SVOC concentrations at TNT Area C were generally slightly higher than at TNT Area A. However, SVOC concentrations in the samples collected from the bedrock wells at the Pentolite Road Red Water Ponds and near the former toluene tanks east of Taylor Road, concentrations were somewhat higher than at either TNT Area A or C.



Scale: 1" = 350'

TNTC-S3 Soil Boring Location

DM-MW3 Groundwater Monitoring Well Location

BED-MW13 Bedrock Monitoring Well Location

Concentrations are in ug/L

FIGURE 6-19
EXPLOSIVES RESIDUES CONCENTRATIONS IN TNT AREA C GROUNDWATER
Plum Brook Ordnance Works
Sandusky, Ohio

Dames & Moore, Inc.

FILENAME: H:\CAD\COM-PLUM\PLOT\GWEXPC.DWG

H:\CAD\COM-PLUM\PLOT\GWEXPC Thu Apr 03 20:06:24 1997 Dames & Moore - Atlanta, GA

6.2.3.4 Metals

At TNT Area C, five metals - antimony, lead, manganese, nickel, and zinc - were detected in the groundwater samples. The concentrations are listed on Table 6-7 and are illustrated on Figure 6-20. Each of these five metals was detected in one or both of the wells completed in the overburden. Only antimony and zinc were detected in the bedrock well sample.

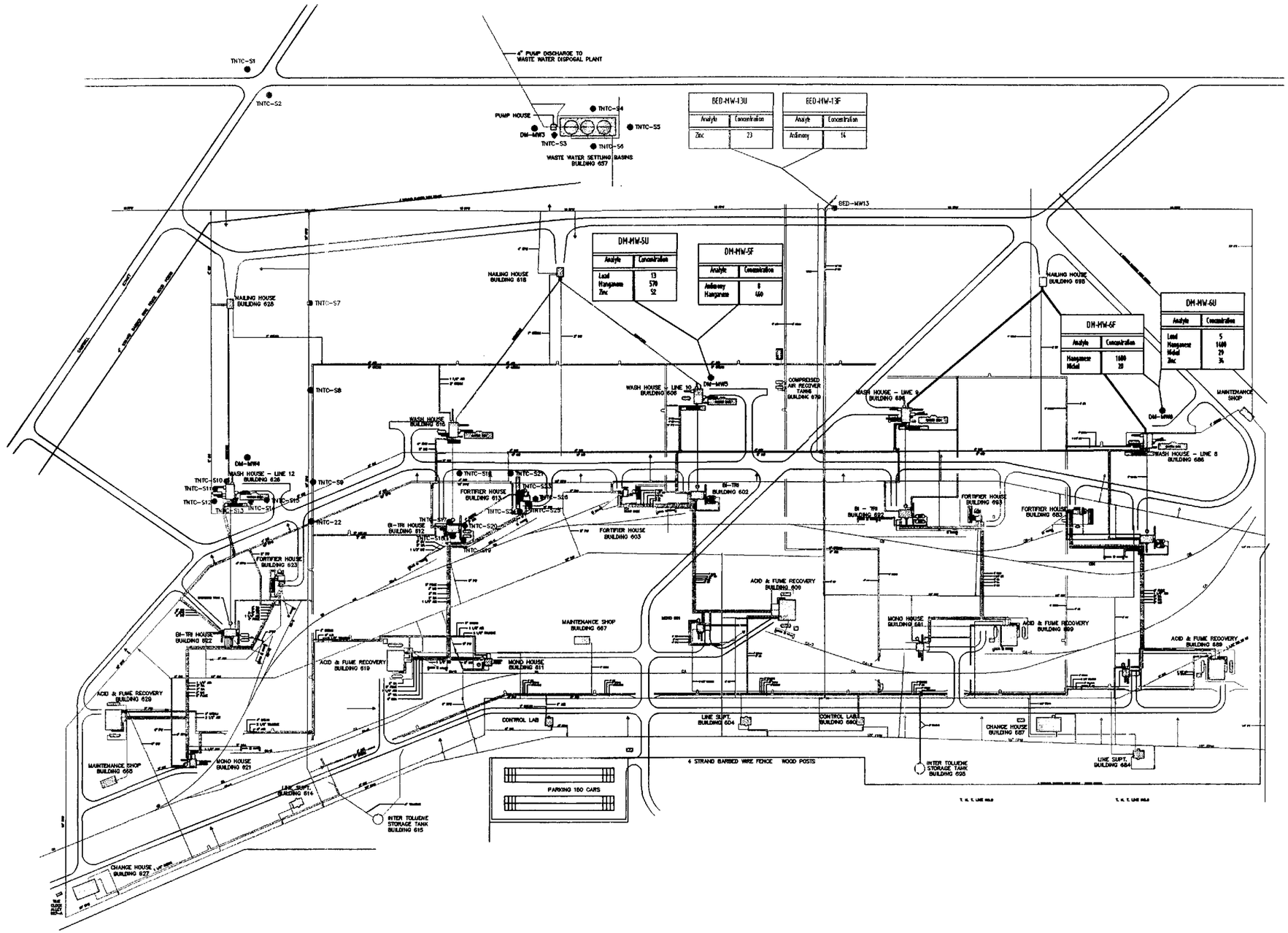
Antimony

Antimony was only detected in the filtered samples from two wells in TNT Area C, overburden well DM-MW5 and bedrock well BED-MW13. The concentrations of 8 μg/L and 14 μg/L, respectively, in DM-MW5 and BED-MW13 exceed the MCL of 6 μg/L slightly. The antimony in the filtered groundwater samples can probably be attributed to the filtering process and these results should not be considered definitive of antimony contamination in the site groundwater. However, it is also noted that antimony was reported in several of the soil samples in TNT Area C.

Lead

Lead was detected in the unfiltered samples only from both overburden wells. The concentrations of 13 μg/L and 5 μg/L in wells DM-MW5 and DM-MW6, respectively, are both below the AL of 15 μg/L for lead.

Lead was detected in every soil sample collected from TNT Area A. It is likely in this instance that the lead is naturally occurring and related to the presence of particulate matter in the sample as lead was not reported in the corresponding filtered samples.



Analyte	Concentration
Zinc	23

Analyte	Concentration
Antimony	14

Analyte	Concentration
Lead	13
Manganese	570
Zinc	52

Analyte	Concentration
Antimony	8
Manganese	460

Analyte	Concentration
Manganese	1600
Nickel	20

Analyte	Concentration
Lead	5
Manganese	1600
Nickel	29
Zinc	34

Scale: 1" = 350'

DM-MW3 Overburden Groundwater Monitoring Well Location

TNTC-S3 Soil Boring Location

BED-MW13 Bedrock Groundwater Monitoring Well Location

Concentrations are in mg/L

FIGURE 6-20
METALS CONCENTRATIONS IN TNT AREA C GROUNDWATER
Plum Brook Ordnance Works
Sandusky, Ohio

Dames & Moore, Inc.

FILENAME: H:\CAD\COE-PLUM\PLOT\GWMETC.DWG

H:\CAD\COE-PLUM\PLOT\GWMETC Thu Apr 03 20:34:08 1997 Dames & Moore - Atlanta, GA

Manganese

Manganese was also detected in both groundwater samples collected from overburden wells in TNT Area C. In each case, manganese was reported in both the filtered and unfiltered samples. The manganese concentration in the unfiltered sample from well DM-MW5 of 570 μg/L was higher than the concentration of 460 μg/L in the filtered sample. Conversely, the concentration in the filtered sample from well DM-MW6 of 1,600 μg/L was higher in the filtered sample than the concentration of 1,400 ug/l in the unfiltered sample. Manganese values in the filtered and unfiltered sample from both wells exceeded the SMCL of 50 μg/L.

Manganese was detected in every soil sample collected from TNT Area C. It is likely that the manganese in these groundwater samples is naturally occurring. Manganese appears to be present at high concentrations in the dissolved phase in the groundwater at the site based on the results for the filtered samples.

Nickel

Nickel was detected at a concentrations of 29 μg/L and 20 μg/L in the unfiltered and filtered samples from well DM-MW6. These concentrations are all below the MCL of 100 μg/L for nickel.

Nickel was detected in every soil sample collected from TNT Area C. It is likely that the nickel is naturally occurring and is generally present in the dissolved phase based on the relative concentrations in the filtered and unfiltered samples.

Zinc

Zinc was also detected in all three groundwater samples in TNT Area C, the two overburden wells and one bedrock well. In each case, it was detected only in the unfiltered samples. Concentrations ranged from 23 μg/L in bedrock well BED-MW13

to 52 μg/L in overburden well DM-MW5. Zinc values were all well below the SMCL of 5,000 μg/L.

Zinc was detected in every soil sample collected from TNT Area C. It is likely that the zinc in these groundwater samples is naturally occurring. In contrast to the metals results for other TNT areas, in TNT Area C, zinc was absent from the filtered samples indicating that its presence in the groundwater in this portion of the site may be related to particulate matter in the groundwater.

6.2.4 pH and Specific Conductance

pH, specific conductance, and temperature measurements made during the sample collection in December 1994 are listed on Table 6-8.

The normal range of pH in groundwater is 6.0 to 8.5. All of the pH values for samples collected in the TNT areas were within this range excepting the samples from wells MK-MW17 and MK-MW24. The pH in well MK-MW17 in TNT Area B was 5.5, somewhat below the normal range. The pH in well MK-MW24 in TNT Area A was 5.9, only slightly below the normal range.

pH values in all of the other overburden wells in the TNT areas ranged from 6.0 to 6.75. The pH values in the bedrock wells were slightly higher ranging from 7.5 to 8.0. Interestingly, the pH in the background bedrock well was 6.0, well below the pH values in the bedrock wells in the TNT areas.

Specific conductance is a measure of the ability of a fluid like water to conduct an electric current. Values above 1,000 microhoms per centimeter (umhos/cm) are considered elevated. Specific conductance values in all of the TNT areas wells except well MK-MW22 at TNT Area A were elevated. The specific conductance value in well MK-MW22 was 700 umhos/cm.

As is noted on Table 6-8, a hydrogen sulfide odor was obvious in the bedrock wells in the TNT areas during sampling. The source of the gas is not known, but was

TABLE 6-8

GROUNDWATER SAMPLING FIELD MEASUREMENTS

	Well Identification	pH	Temperature (°F)	Conductivity (μmhos/cm)	Remarks
TNT Area A	DM-MW10	6.75	48	1300	Water cloudy with fines
	DM-MW11	6.0	51	1570	Water cloudy with fines
	MK-MW22	6.5	51	700	Water mostly clear
	MK-MW23	6.5	54	1370	Water mostly clear
	MK-MW24	5.9	53	1294	Water mostly clear
	BED-MW17	8.0	50	>1990	Strong H_2S odor. Possible hazardous environment from CGI monitoring.
	BED-MW18	7.5	47	>1990	H_2S odor
TNT Area B	MK-MW16	6.0	49	1350	
	MK-MW17	5.5	43	1520	
TNT Area C	DM-MW5	6.5	49	1060	Water cloudy with fines
	DM-MW6	6.75	51	1470	Water cloudy with fines
	BED-MW13	8.0	51	>1990	Strong H_2S odor to H_2S bubbling into well as water draws down. Slight oil film.
Background	BED-MW20	6.0	51	>1990	

μmhos/cm - microhoms per centimeter

The sample IDs used in this table are abbreviated. For overburden wells, the ID is composed of two parts: the investigation for which the well was installed (e.g., DM = Dames & Moore, MK = MK Ferguson); and the well number (e.g. MW10). Bedrock wells are designated by "BED" and the well number.

widespread in the bedrock wells. It correlated with the highest specific conductance measurements in the wells in TNT Areas A and C.

6.2.5 Summary of Groundwater Chemistry

The results of the groundwater quality assessment indicate that low levels of explosives residues are present in the groundwater in the former TNT manufacturing areas. Also, nickel, thallium, and zinc were detected at concentrations above their respective MCLs. Manganese was detected at concentrations above the SMCL.

6.2.5.1 TNT Area A Groundwater Quality Results

Groundwater samples were collected from five overburden and two bedrock wells located at TNT Area A. Explosives residues were detected in one of the overburden wells, DM-MW10, located downgradient from the Wash House for TNT manufacturing line 3. Several VOCs and SVOCs were detected in the bedrock aquifer.

Seven priority pollutant metals, antimony, arsenic, chromium, copper, lead, nickel, and zinc, were present in the area groundwater. Groundwater at the site is not used for potable drinking water; however, it is noted that none of the concentrations of priority pollutant metals exceeded regulatory action levels. An eighth metal, manganese was detected in filtered and unfiltered samples from six of the seven groundwater monitoring wells at TNT Area A. All concentrations exceeded the SMCL.

6.2.5.2 TNT Area B Groundwater Quality Results

Groundwater samples were collected from two overburden wells located at TNT Area B. Explosives residues were detected in one of the two overburden wells, MK-MW17, located on the downgradient side of the area.

Nine priority pollutant metals, antimony, arsenic, beryllium, cadmium, copper, lead, nickel, thallium, and zinc, plus manganese were present in the area groundwater. Nickel, manganese, and thallium were detected in concentrations which exceed regulatory action levels. Manganese concentrations are two to three orders of magnitude over the SMCL.

6.2.5.3 TNT Area C Groundwater Quality Results

Groundwater samples were collected from two overburden wells and one bedrock well located at TNT Area C. One explosives residues compound was detected in the bedrock well, BED-MW13 located downgradient of the former TNT Area C. Several VOCs and SVOCs were detected in the bedrock aquifer.

Four priority pollutant metals, antimony, lead, nickel, and zinc, were present in the area groundwater. Antimony in the filtered samples from wells DM-MW5 and BED-MW13 exceeded the regulatory action level. Manganese was detected in filtered and unfiltered samples from both overburden wells at TNT Area C. All concentrations exceeded the SMCL.

7.0 CONCLUSIONS

The results of the Site Investigation indicate that explosives residues is present in soils in all three former TNT manufacturing areas at the PBOW. Additionally, low levels of explosives residues may be present in the overburden and bedrock hydrostratigraphic units.

7.1 SOILS INVESTIGATION

The most significant contamination was present in TNT Area B. Thirteen of the 14 explosives residues analytes were detected in TNT Area B. Nitroaromatics were present in more sampling locations and at higher concentrations in TNT Area B than in either TNT A or TNT Area C.

2,4,6-TNT was the most commonly detected explosives residue. It was present in 40 of the 100 soil samples collected. 2,4-DNT, an intermediate product in TNT production, was the second most commonly detected nitroaromatic. It was present in 33 samples. 2,6-DNT, the other most common intermediate product of TNT production was present in 24 samples.

Several nitroaromatic degradation products were detected in the samples. 4-Am-DNT and 2-Am-DNT, end products of the microbially mediated biotransformation of TNT, were always found in combination with 2,4,6-TNT. Additionally, 4-Am-2-NT and 2-Am-4-NT, end products of biotransformation of 2,4-DNT by plants, were also found in combination with 2,4-DNT.

A statistical analysis of metals concentrations in soils from the TNT areas and from background areas indicated that antimony, chromium, copper, lead, manganese, nickel, and zinc were potential contaminants due to the frequency with which their soil concentrations exceeded background (and detection limit) maxima. Except for chromium, each of these had some corroborating evidence from the correlation or coincidence investigations. However, antimony, copper, manganese, nickel, and zinc

correlations were limited in areal extent. Only lead was relatively widespread and well-correlated with explosives residues.

7.1.1 TNT Area A Soils Investigation

The results of this investigation indicate that low levels of explosives residues are still present at TNT Area A. Nine of the 14 explosives residues included in the analyte list were detected in TNT Area A. 2,4,6-TNT, the most commonly detected nitroaromatic, was present in a third of the soil samples.

Despite the significant decontamination of TNT Area A that was performed following closure of the PBOW, nitroaromatics were detected at 16 of 28 locations where soil borings were installed. However, most concentrations were relatively low. Significant levels of explosives residues (greater than 10.0 mg/Kg) were detected only at the Pump House (580 mg/Kg 2,4,6-TNT in one sample), the Fortifier House (53 mg/Kg and 19 mg/Kg 2,4,6-TNT in two different samples), and the Mono House (45 mg/Kg 2,4-DNT and 2,6-DNT in the same sample). Three biotransformation products were also detected in several samples, indicating that natural biological attenuation is occurring.

Antimony, arsenic, chromium, copper, lead, manganese, nickel, and zinc were present in soil samples collected from TNT Area A. Chromium, lead, manganese, nickel, and zinc were present in every soil sample. Of these, lead, manganese, and zinc had concentrations that were clearly above the background levels. A statistical correlation between lead and 4-Am-2-NT was established in TNT Area A soils.

7.1.2 TNT Area B Soils Investigation

The results of this Site Investigation conclusively demonstrate that explosives residues contamination of the soil is present in TNT Area B. Thirteen of the 14 nitroaromatics were reported in TNT Area B. 2,4,6-TNT was detected in two thirds of the samples. The highest concentration of 2,4,6-TNT detected in TNT Area B was 24,500 mg/Kg at the Bi-Tri House for line 5. 2,4-DNT was detected in over half of the samples.

2-Am-DNT and 4-Am-DNT, end products of microbial biotransformation of TNT, were each detected in at least half of the samples.

No previous decontamination efforts of the soil have been documented at TNT Area B. Contamination by explosives residues was present in 19 of 26 locations where soil borings were installed. Concentrations of explosives residues in excess of 10,000 mg/Kg were present in soils at the former Bi-Tri House and the DNT Sweating & Graining House. In both areas, samples locations targeted outdoor tanks associated with the buildings. Also, significant levels of explosives residues (greater than 10.0 mg/Kg) were detected at the Wash House for manufacturing line 6 and the Fortifier House. Three biotransformation products were detected in samples collected in TNT Area B indicating that natural biological attenuation is occurring.

Antimony, arsenic, beryllium, cadmium, chromium, copper, lead, manganese, nickel, and zinc were present in soil samples collected from TNT Area B. Beryllium and cadmium were only detected in TNT Area B but were each present in more than one sample. Chromium, lead, manganese, nickel, and zinc were present in every soil sample. Of these, lead, manganese, and zinc had concentrations that were clearly above the background levels. Several statistical correlations between metals and explosives residues were established in TNT Area B soils. Antimony correlated with 2,4,6-TNT and lead with 2,4-DNT, 2,6-DNT, and 4-Am-2-NT.

7.1.3 TNT Area C Soils Investigation

This investigation indicates that low levels of nitroaromatics are present in the soils at TNT Area C. The sampling scheme for TNT Area C was weighted more heavily toward sampling the process waste water ditches than areas around former buildings. Eleven of the 14 nitroaromatics included in the analyte list were detected in TNT Area C. Nitroaromatics were present in only six of 26 locations where sampled were collected. All explosives residues concentrations detected were below 10 mg/Kg and the majority were below 5 mg/Kg. Three biotransformation products were detected in samples collected in TNT Area C at low concentrations.

Antimony, arsenic, chromium, copper, lead, manganese, mercury, nickel, and zinc were present in soil samples collected from TNT Area C. Mercury was detected only in TNT Area C. It was present in only one sample. Chromium, lead, manganese, nickel, and zinc were present in every soil sample. Of these, lead, manganese, and zinc had concentrations that were clearly above the background levels. There was no statistical correlation between metals and explosives residues in TNT Area C soils.

7.1.4 Background Soils Investigation

No explosives residues were detected in any of the 14 background soil samples. However, four VOCs and one SVOC were detected. VOCs and SVOCs were detected in soils from many areas of the site during previous investigations.

Eight metals, antimony, arsenic, chromium, copper, lead, manganese, nickel, and zinc were detected in the background soils. Chromium, lead, manganese, nickel, and zinc were present in every soil sample.

7.2 GROUNDWATER INVESTIGATION

The results of the groundwater investigation indicate that generally groundwater flow is to the north, eventually toward Lake Erie, as would be expected for this site. However, it is likely that with the shallow bedrock and thin veneer of overburden materials overlying the bedrock, vertical flow of groundwater downward from the overburden into the bedrock predominates over horizontal flow in the overburden. This flow pattern, if accurate, would facilitate migration of contaminants from the overburden soils and groundwater into the bedrock aquifer.

The presence of groundwater in the overburden hydrostratigraphic unit at the site is apparently very seasonal. During the early winter when groundwater samples were collected for this investigation, two of the overburden monitoring wells were dry. In early spring after abundant winter precipitation, groundwater was present in all of the previously dry wells.

Low levels of explosives residues were detected in the overburden wells at TNT Areas A and B. No nitroaromatics were detected in the overburden wells sampled at TNT Area C. At TNT Area C, low levels of explosives were detected in the bedrock well installed for this investigation.

Nitrates were not detected in any of the TNT area wells above the MCL.

Several VOCs and SVOCs were detected in the bedrock aquifer. Generally, these were hydrocarbons and associated compounds.

Groundwater at the site is not used for potable water. However, nickel, and thallium were present in TNT Area B at concentrations above their MCLs. Manganese was present at concentrations above the SMCL in TNT Areas A and B.

7.2.1 TNT Area A Groundwater Investigation

Groundwater in the overburden at TNT Area A generally flows south to north; however, on the western side of the site, there is a northwestern component to the flow direction. In the bedrock, the flow also has a slight northwesterly direction across the entire area.

Low levels of explosives residues were detected in two overburden wells, DM-MW10, located downgradient from the Wash House for TNT manufacturing line 3, and MK-MW23, located northeast of the Wash House for manufacturing line 1.

Several VOCs and SVOCs, generally hydrocarbons and related compounds, were detected in the bedrock aquifer.

Seven priority pollutant metals, antimony, arsenic, chromium, copper, lead, nickel, and zinc, were present in the area groundwater. Manganese was detected at concentrations exceeding the SMCL.

7.2.2 TNT Area B Groundwater Investigation

Contouring of groundwater levels at TNT Area B indicates a groundwater flow direction in the overburden from south to north. However, because of the very shallow bedrock in this area, the dominant direction of flow is probably vertical from the overburden to the bedrock.

Low levels of explosives residues were detected in one of the two overburden wells, MK-MW17, located on the downgradient side of the area.

Nine priority pollutant metals, antimony, arsenic, beryllium, cadmium, copper, lead, nickel, thallium, and zinc, plus manganese were present in the area groundwater. Nickel, manganese, and thallium were detected at concentrations which exceed regulatory action levels. Manganese concentrations are two to three orders of magnitude over the SMCL.

7.2.3 TNT Area C Groundwater Investigation

Groundwater flow in the overburden in the vicinity of TNT Area C is generally from southeast to northwest. However, the presence of groundwater in the overburden materials in this area, and the resulting groundwater flow pattern, is apparently seasonal.

A low level of one explosives residue was detected in the bedrock well, BED-MW13, located downgradient of the former TNT Area C.

Several VOCs and SVOCs, generally hydrocarbons and related compounds, were detected in the bedrock aquifer.

Four priority pollutant metals, antimony, lead, nickel, and zinc, were present in the area groundwater. Manganese was detected in filtered and unfiltered samples from both overburden wells at TNT Area C. All concentrations exceeded the SMCL.

7.3 LIMITATIONS

The observations, findings, and conclusions included in this PBOW TNT Areas Site Investigation Report are professional opinions based upon performance of a Site Investigation for the former PBOW in Sandusky, Ohio. They are intended exclusively for the use of the Nashville and Huntington Districts of the USACE for the purposes outlined herein. Any use or reuse of this document or the comments, findings, and conclusions represented herein is at the sole risk of said user.

The observations and conclusions presented herein apply only to the investigation performed at the three former TNT manufacturing areas at the former PBOW; the site conditions existing at the time of the investigation; and the review of historical information that could reasonably and accurately be obtained during the course of the investigation and as specified in the Scope of Work for the Site Investigation. They cannot apply to subsequent changes in site conditions of which Dames & Moore is not aware and to conditions which were inaccurately portrayed to Dames & Moore by other parties.

-oOo-

Charles T. Allen, P.E.
Principal

REFERENCES

Bower, Amy, March to December 1995, Personal communications with P. Westermann of Dames & Moore.

Braig, James R., January 25, 1960, Letter, Subject: Construction Adjacent to Contaminated Flume Line.

Braig, James R., June 1, 1960, Letter, Subject: Construction Adjacent to Contaminated Flume Line.

Braig, James R., September 5, 1963, Letter to Ravenna Arsenal, Inc., Description of D&D activities to be performed.

Cheery, Lynn, March 1995, Personal Communication with P. Westermann of Dames & Moore.

Dykema, Henry J., and Lee, Harold S., March 1944, *Shut Down and Decontamination Procedures for Plum Brook Ordnance Works, Sandusky, Ohio*, Ordnance Department.

Ebasco Environmental, 1991, *Underground Storage Tank Corrective Actions Remedial Investigation, Feasibility Study, Phase I Report*, November.

Everett, John C. and Charles Campbell, 1958, "Memorandum, Subject: Plum Brook - Valuation Survey of Land - Asset Account Number 1701.508", April 5.

E.B. Badger & Sons Co., no date, "Unit Layout Map, Pentolite Area", Plan No. R-42.

E.B. Badger & Sons Co., March 1942, Drawing No. 1763-S-954 "Details of Flume Connecting Raw Wastes Storage Tank and Waste Water Basin Including Basin Layout."

E.B. Badger & Sons Co., no date, "Unit Layout Map, Power Hse., Waste Disposal Area No. 2", Plan No. R-36.

E.B. Badger & Sons Co., no date, "General Layout Map, Sheet No. 2", Plan No. R-2.

E.B. Badger & Sons Co., August 11, 1941, "Key Plan Power House", Drawing No. 1664-300.

E.B. Badger & Sons Co., no date, "Unit Layout Map, Acid Area No. 3," Plan No. R-38.

E.B. Badger & Sons Co., 1941, untitled, Drawing No. 1691-S-2.

E.B. Badger & Sons Co., October 1941, "Temporary Storage Pit for Neutralized Waste Water", Drawing No. 1663-W-2.

E.B. Badger & Sons Co., November 1941, "Ash Disposal System for Plum Brook Ordnance Works, Sandusky, Ohio", Drawing No. 1764-653.

E.B. Badger & Sons Co., January 1942, "Wastes Disposal Plant Drainage", Drawing No. 1661-S-490.

E.B. Badger & Sons Co., no date, Plan No. R-32, "Unit Layout Map, Waste Disposal & Water Supply Area No. 1."

Gallagher, T. G., Stream Pollution Section, August 1945, "Report of Stream Pollution Section".

H+GCL, 1992, *Phase I Site Characterization of Disposal Area Three, Plum Brook Station, Ohio*, June.

IT Corporation (IT), 1991, *Engineering Report for the Contamination Evaluation at the Former Plum Brook Ordnance Works, Sandusky, Ohio*, (prepared for Corps of Engineers, Nashville District), January.

Johnson, R.W. and H.B. Atkinson, March 14, 1963, Trip Report: Supervision of Decontamination of Areas A, B, and C.

Knoll, Jim, 1994, Personal Communication with P. Westermann of Dames & Moore.

Morrison Knudsen Corporation (MK), 1994, *Site Inspection Report, Plum Brook Station, Sandusky, Ohio, Volume I*, (prepared for NASA), January.

Mullendore, Doug, 1995, U.S. Army Corps of Engineers, Nashville District Comments on Draft Records Review Report.

NASA, 1962, "Marking of Area Containing Contaminated Soil", Drawing No. PF22598.

NASA LeRC PBS, May 24, 1985, Memorandum: Aquatic Life in Red Water Pond in Western Section of Plum Brook Station, author: R. J. Koch.

NASA LeRC PBS, June 30, 1989, Memorandum: Red Water Discharge into Pentolite Ditch, author: Amy L. Bower.

NASA LeRC PBS, August 29, 1990, Memorandum: Red Water Discharge into Pentolite Ditch, author: Amy L. Bower.

NASA LeRC PBS, March 7, 1991, Memorandum: Red Water Discharge into Pentolite Ditch, author: Amy L. Bower.

Ohio Army Nation Guard (OHARNG), 1985, Untitled summary of sediment and other sampling performed at West Area Red Water Ponds.

Ohio Department of Natural Resources, Division of Geological Survey, March 1984, Open File Map 209, Drift Thickness of Erie County.

Ohio Department of Natural Resources, Division of Geological Survey, March 1992, Geologic Map and Cross Section of Ohio.

Ponikvar, Gary, 1994, Personal Communication with P. Westermann of Dames & Moore.

Proposed Standard Operating Procedure for Removal of Contaminated Flume Line - TNT Area B.

Ravenna Arsenal, Inc., September 1963, "Process Operating Procedures RVA-1222 for Decontamination NASA Plum Brook Station."

Ruffing, Ray, 1994, Personal Communication with P. Westermann of Dames & Moore.

Sanders, August 19, 1955, Memorandum: Status of Decontamination Project at Plum Brook Ordnance Works.

Saunders, Michael, 1996, Personal Communication with Deborah Raede of Dames & Moore.

Science Applications International Corporation (SAIC), 1991, *Plum Brook Station Preliminary Assessment*.

Shields, Edward J. 1985, Pollution Control Engineer's Handbook, Pudvan Publishing Co., Northbrook, Illinois.

Soil Survey, Erie County, Ohio, February 1971, U.S. Department of Agriculture, Soil Conservation Service.

Teledyne Isotopes, June 28, 1977, Memorandum: Analytical Data Relating to Plum Brook Station "Red Water", written by John E. Ross.

Trojan Powder Company, March 20, 1943, "Waste Water Disposal No. 2, Pond No. 2", Drawing No. 1763-T-901-2.

Trojan Powder Company, May 19, 1943, "Proposed Underground Water Line for Car Washing Pit from 12" Fire Protection Main", Drawing No. 1663-T-503-5-¼.

Trojan Powder Company, May 3, 1944, "Rubbish Burning Ground at Taylor and Ransom Roads", Drawing No. 1669-T-603-9-½.

Trojan Powder Company, November 22, 1944, "Scheid Road Burning Grounds Between TNT Area A and Magazine", Drawing No. 1669-T-603-12.

Trojan Powder Company, August 1945, *Plum Brook Ordnance Works Operating Cost Report*.

U.S. Department of the Army, 1956, "Permit to Other Federal Government or Agency to Use Property on Plum Brook Ordnance Works".

Unknown author, no date, Untitled (Describes the PBOW) (obtained from NASA file B&G 1-2-5).

Unknown author, Stream Pollution Engineering Section, October 1942, "Report of Activities of Stream Pollution Engineering Section".

Unknown author, Stream Pollution Section, March 1945, "Report of Stream Pollution Section".

Unknown author, November 30, 1962, Bulletin 62: Subject: Disposal of Industrial Wastes at PBS.

U.S. Army Ammunition Procurement and Supply Agency (Joseph J. Beaman), May 21, 1963, Letter, Subject: Equipment Shipment to Joliet Arsenal.

Young, Don, 1994, Personal Communication with P. Westermann of Dames & Moore.

Young, Don, 1989, Memorandum: Fuel Oil Leak - West Tank (8952), to Amy Bower, dated May 18, 1995.

War Department, 1945, *Decontamination Procedures*, War Department Supply Bulletin SB 5-52, July.

Wright, Roger V., August 27, 1965, Bulletin 88-002-65: Guidelines for Disposal of Industrial Wastes at Plum Brook Station.

APPENDIX A

NASA DIGGING AND EXCAVATION PERMIT

DIGGING AND EXCAVATING PERMIT

NASA PLUM BROOK STATION
SANDUSKY, OHIO

CONTRACT NO.: N/A CONTRACTOR: Dames & Moore, Inc.

INSPECTOR: N/A WORK ORDER NO.: N/A

INITIATOR: Deborah L. Raede DATE: Sept. 13, 1994

SITE LOCATION: TNT Areas, Red Water Pond Areas, and Various Background Locations

REFERENCE DRAWINGS: Figures 3-1 through 3-22 of Dames & Moore's Sampling and Analysis Plan Dated September 1994

REMARKS:

CLEARANCES:

PLUM BROOK MANAGEMENT OFFICE AND SERVICE CONTRACTOR:

Mechanical: _____ Date: _____

Electrical: _____ Date: _____

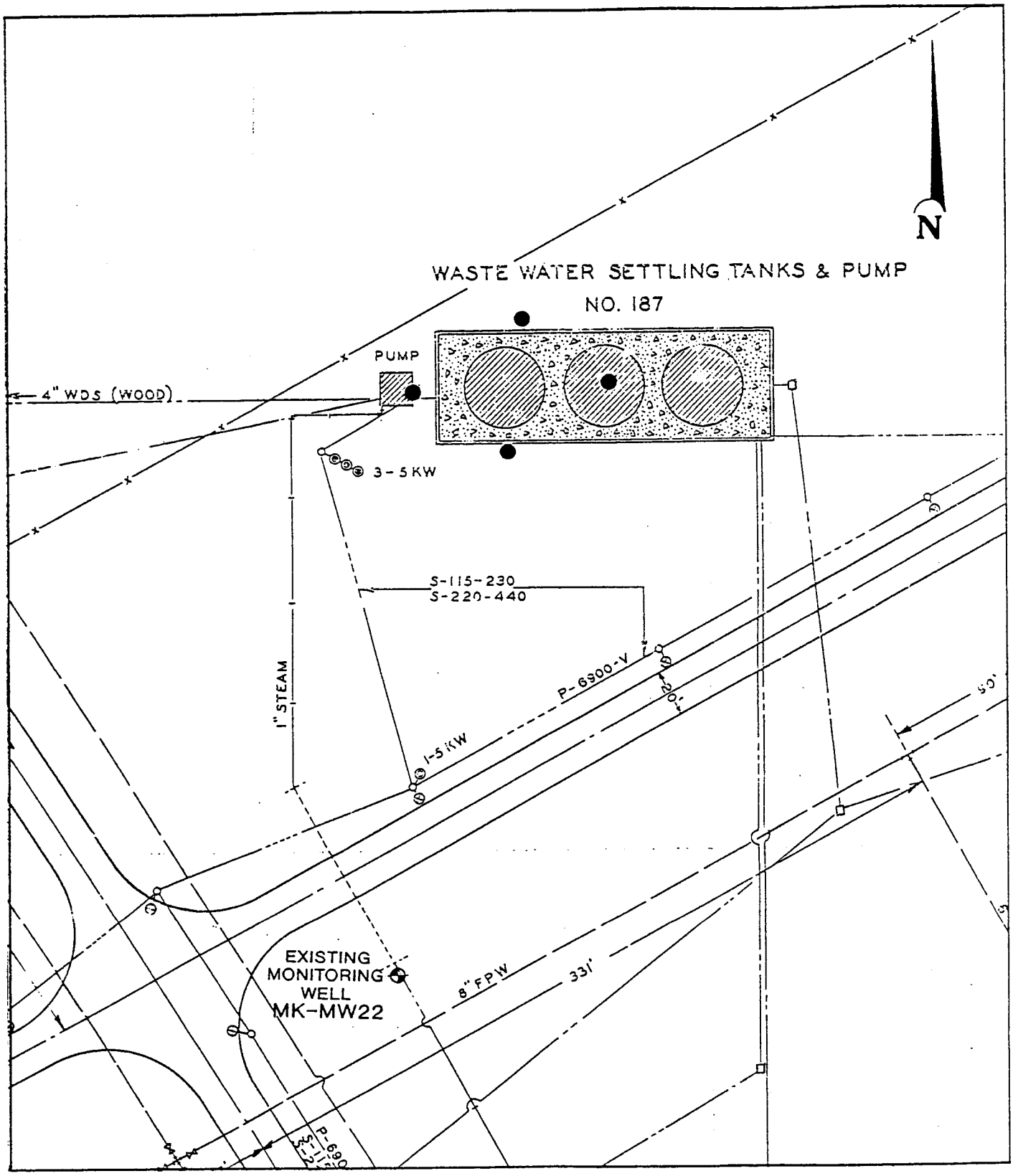
Safety: _____ Date: _____

CLEARANCE (AS APPLICABLE):

NASA PLUM BROOK REACTOR MANAGER:

_____ Date: _____

NASA P-5014 (REV. 12-12-90)



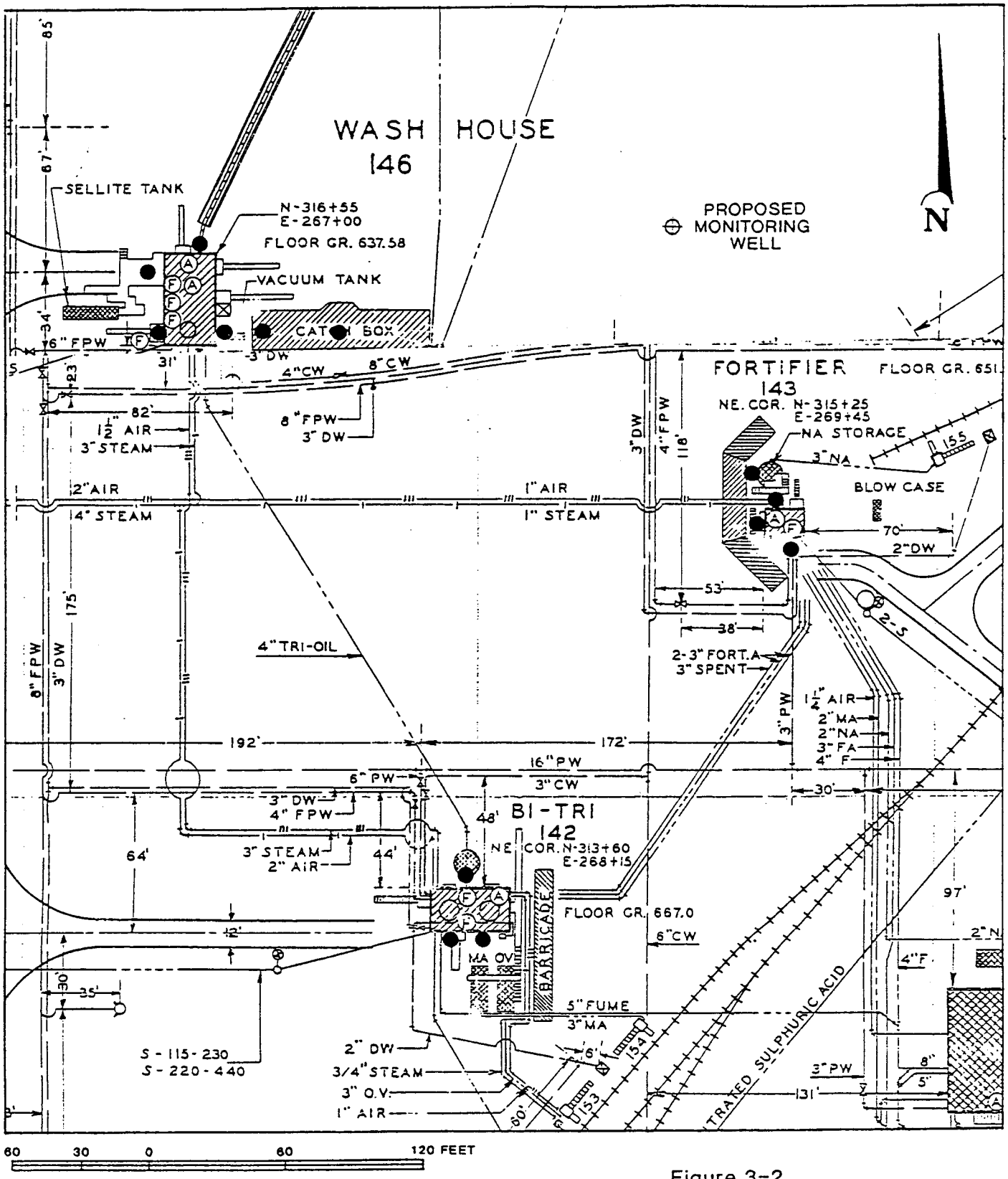
LEGEND:

- ● Proposed Soil Sampling Location
- ⊕ Existing Monitoring Well Location

Figure 3-1

PROPOSED SOIL SAMPLING LOCATIONS AT WASTE WATER DISPOSAL SETTLING TANKS AND PUMP HOUSE AND EXISTING MONITORING WELL
TNT Area A
Plum Brook Ordnance Works

DAMES & MOORE



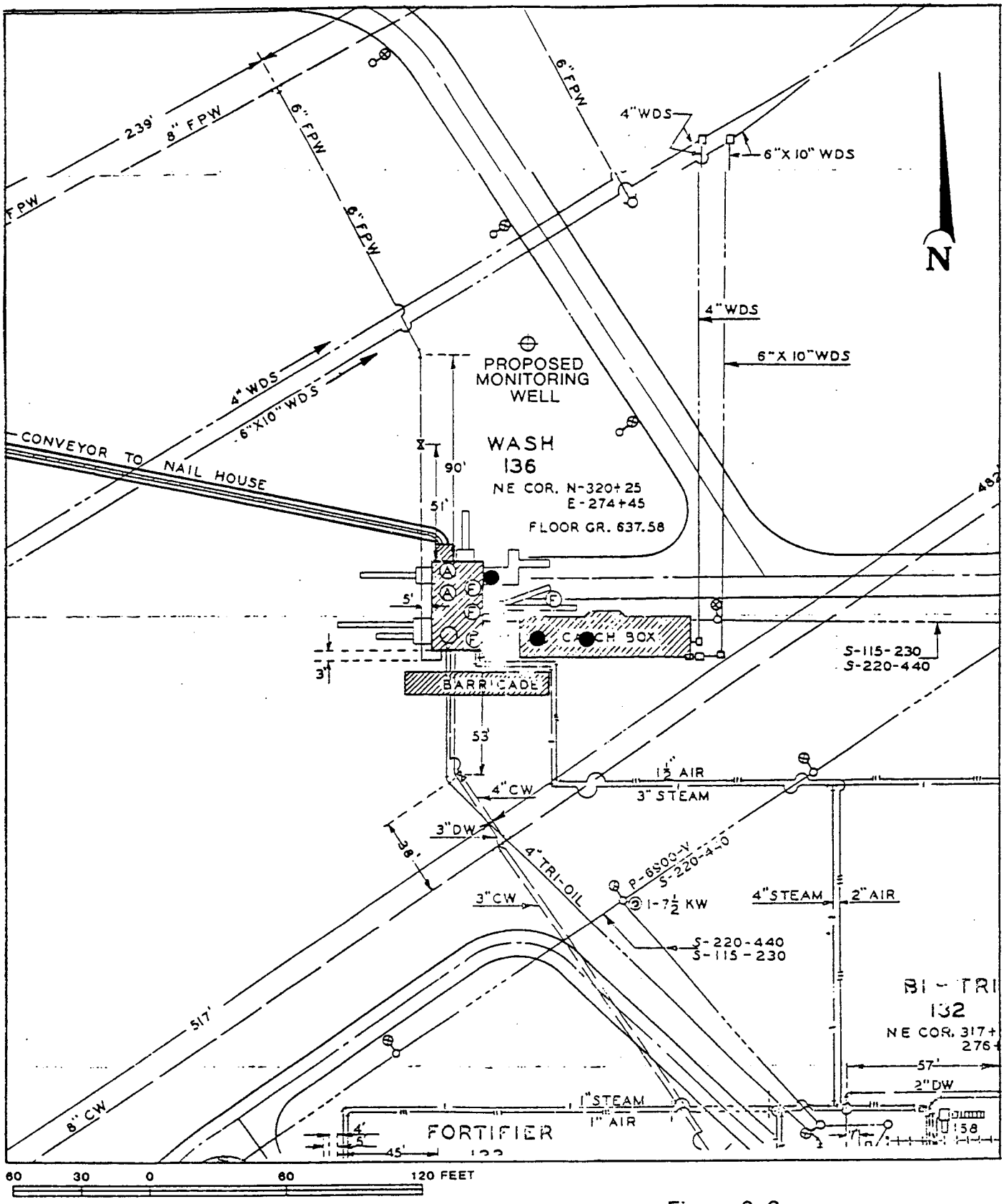
LEGEND:

- ● Proposed Soil Sampling Location
- ⊖ Proposed Monitoring Well Location

Figure 3-2

PROPOSED SOIL SAMPLING LOCATIONS AT WASH HOUSE - LINE 4, BI-TRI HOUSE AND FORTIFIER HOUSE AND PROPOSED MONITORING WELL
TNT Area A
Plum Brook Ordnance Works

DAMES & MOORE



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- ● Proposed Soil Sampling Location
- ⊖ Proposed Monitoring Well Location

Figure 3-3

PROPOSED SOIL SAMPLING LOCATIONS AT WASH HOUSE - LINE 3 AND PROPOSED MONITORING WELL

TNT Area A

Plum Brook Ordnance Works

DAMES & MOORE

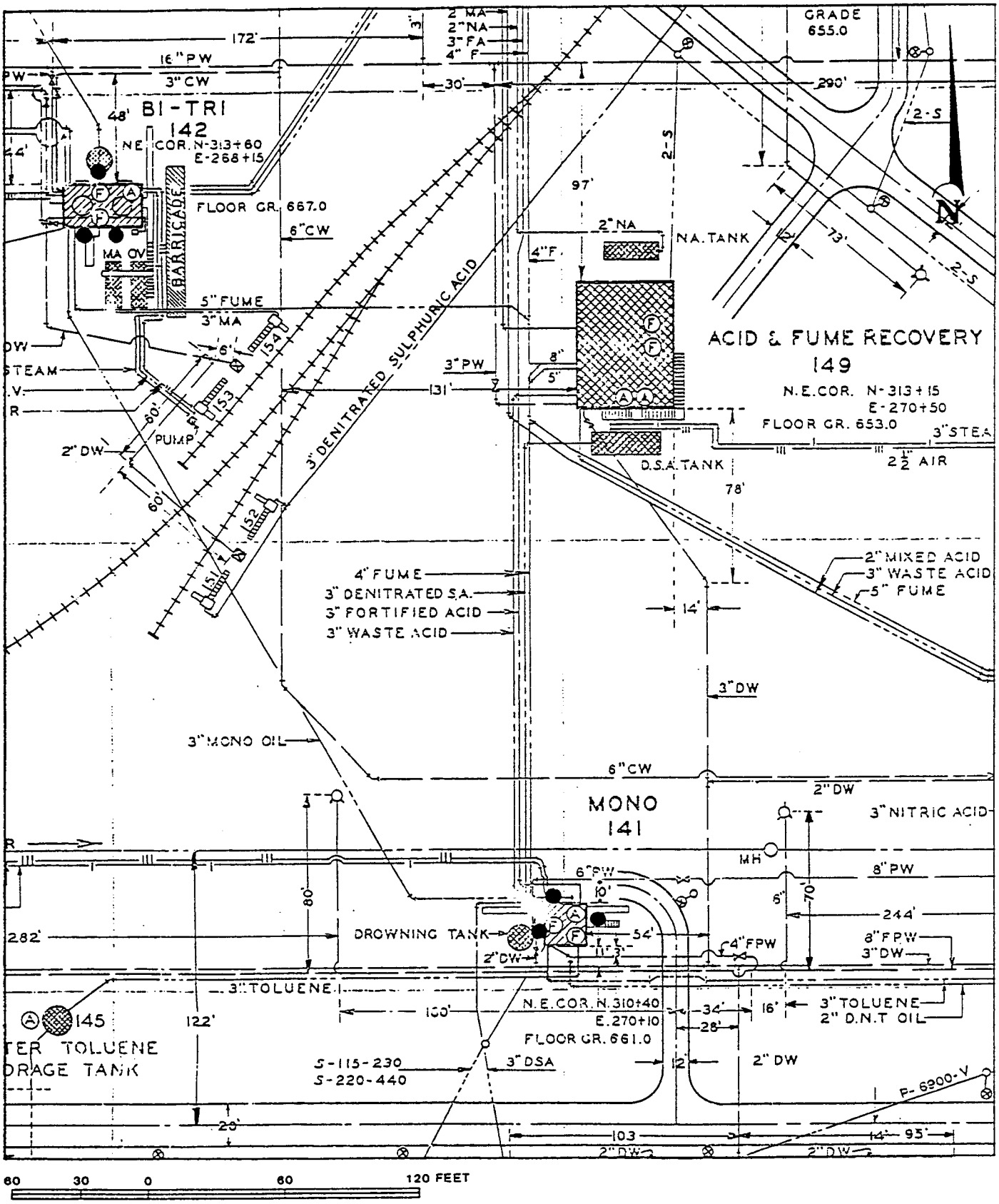

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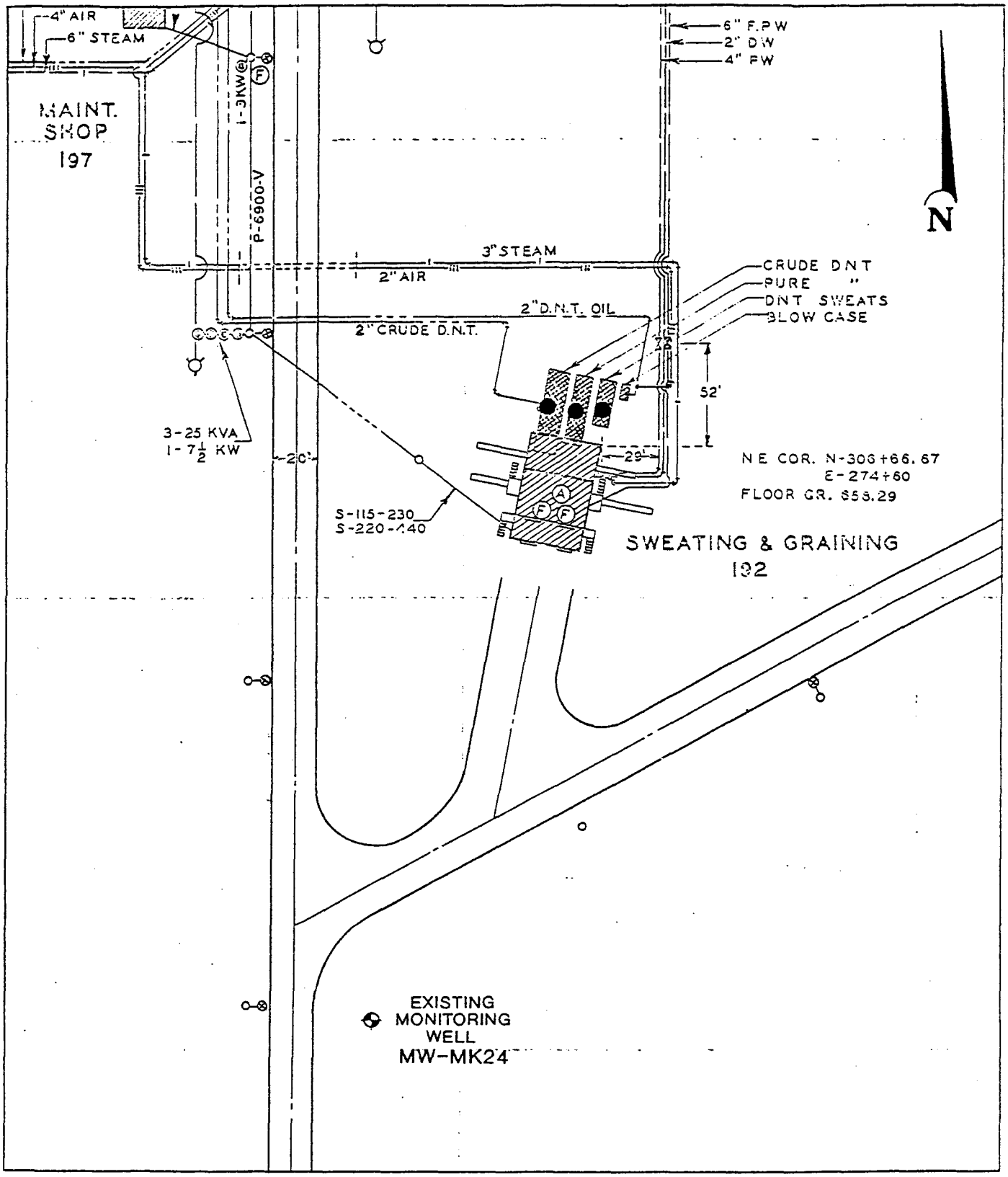
Figure 3-4

PROPOSED SOIL SAMPLING LOCATIONS AT MONO HOUSE

TNT Area A

Plum Brook Ordnance Works

DAMES & MOORE



60 30 0 60 120 FEET

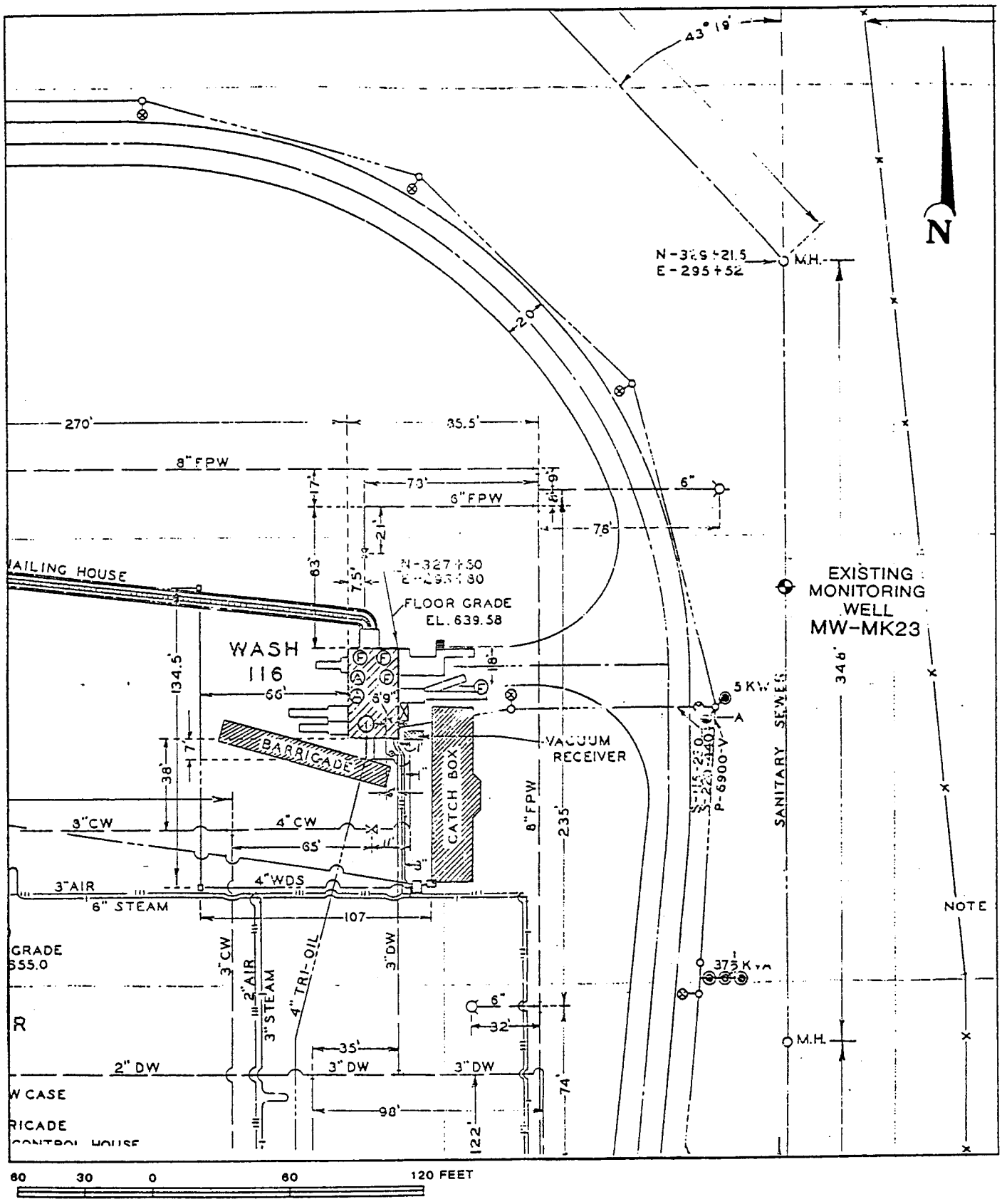
LEGEND:

- ● Proposed Soil Sampling Location
- ⊕ Existing Monitoring Well Location

Figure 3-5

PROPOSED SOIL SAMPLING LOCATIONS AT DNT SWEATING AND GRAINING HOUSE AND EXISTING MONITORING WELL LOCATION
TNT Area A
Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

Existing Monitoring Well Location

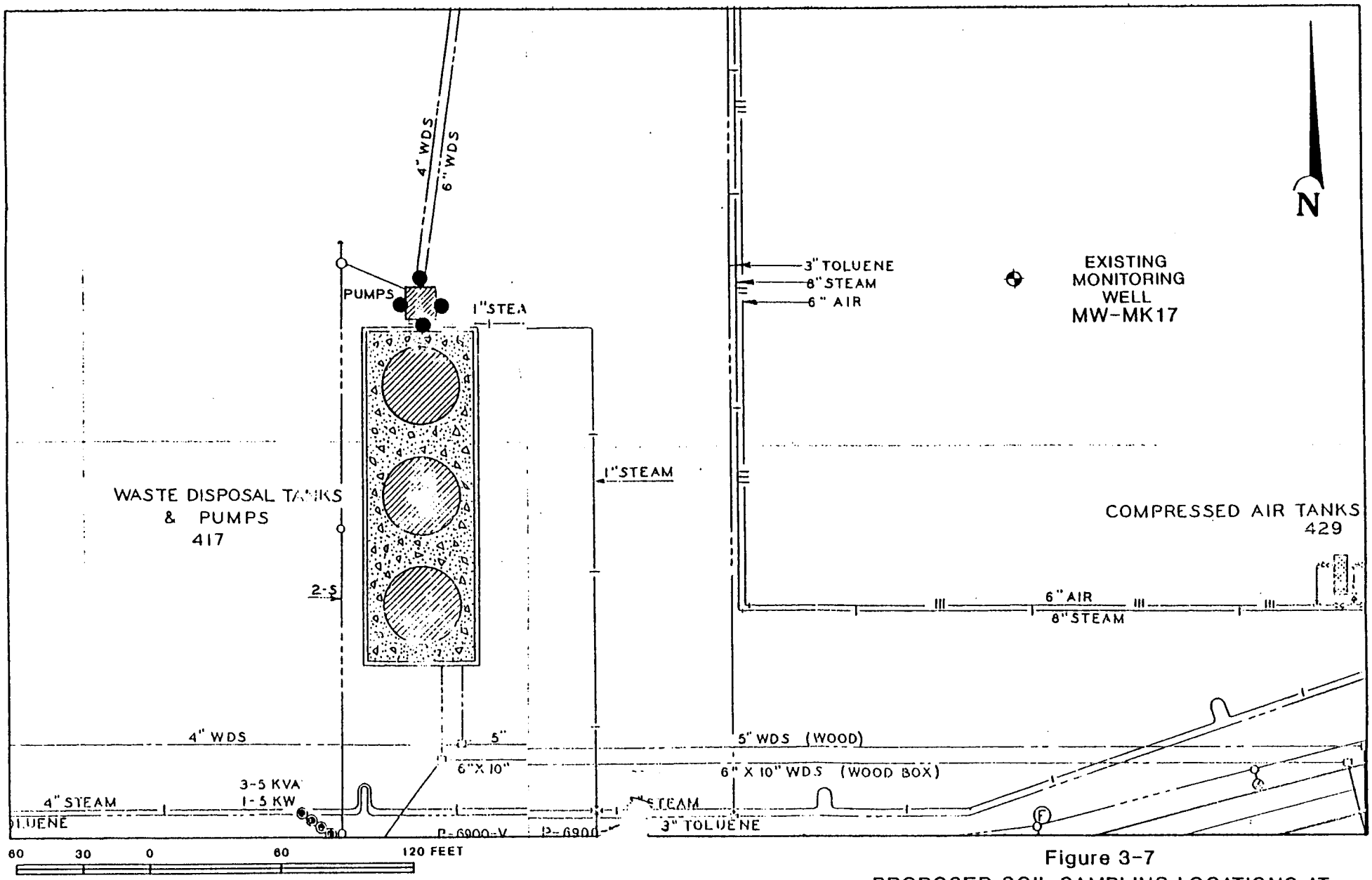
Figure 3-6

EXISTING MONITORING WELL LOCATION

TNT Area A

Plum Brook Ordnance Works

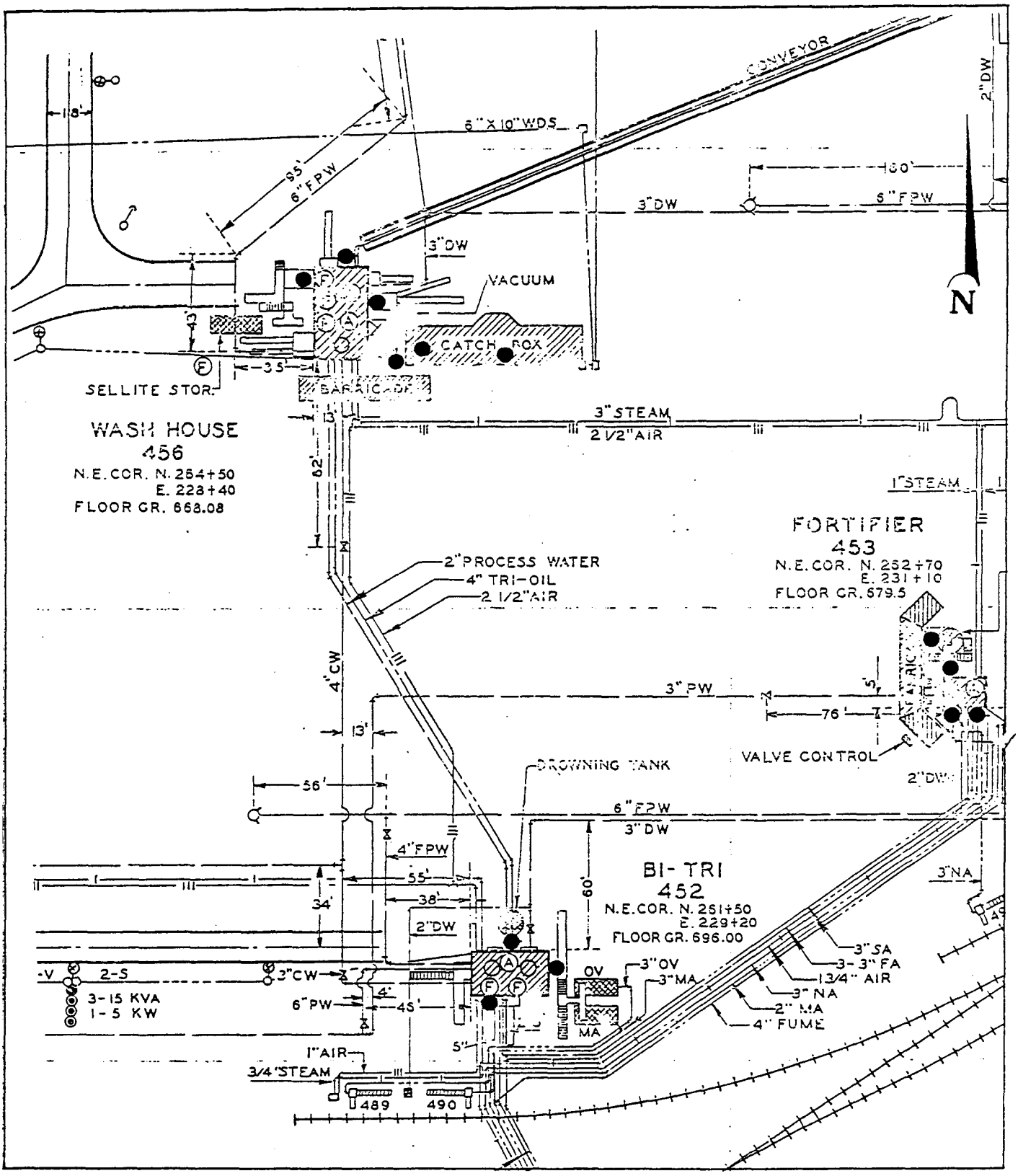
DAMES & MOORE



LEGEND:

- ● Proposed Soil Sampling Location
- ⊕ Existing Monitoring Well Location

Figure 3-7
PROPOSED SOIL SAMPLING LOCATIONS AT WASTE WATER DISPOSAL SETTLING TANK AND EXISTING MONITORING WELL LOCATION
TNT Area B
Plum Brook Ordnance Works
DAMES & MOORE



60 30 0 60 120 FEET

LEGEND:

● Proposed Soil Sampling Location

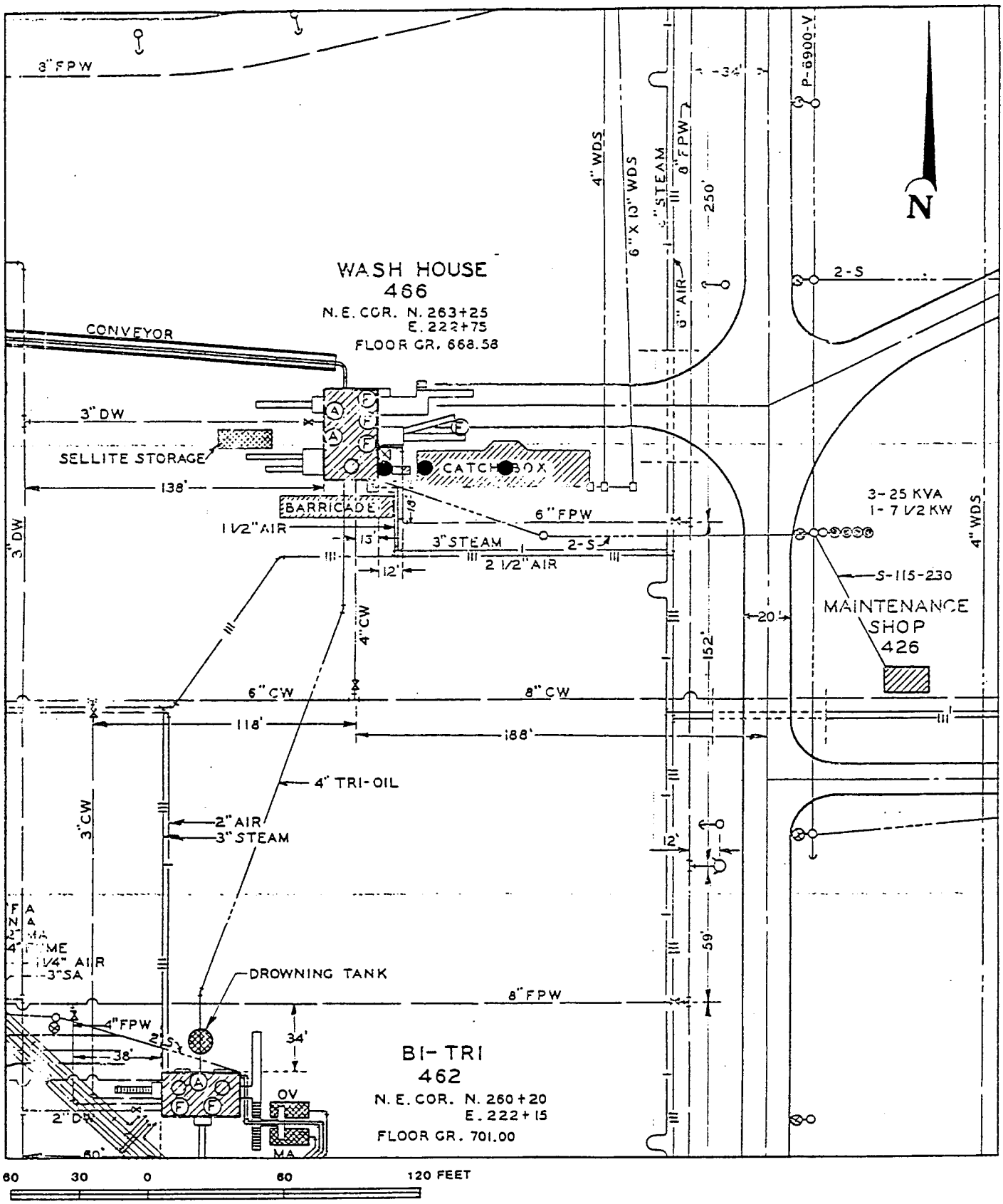
Figure 3-8

PROPOSED SOIL SAMPLING LOCATIONS AT WASH HOUSE - LINE 5 AND BI-TRI HOUSE

TNT Area B

Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

● Proposed Soil Sampling Location

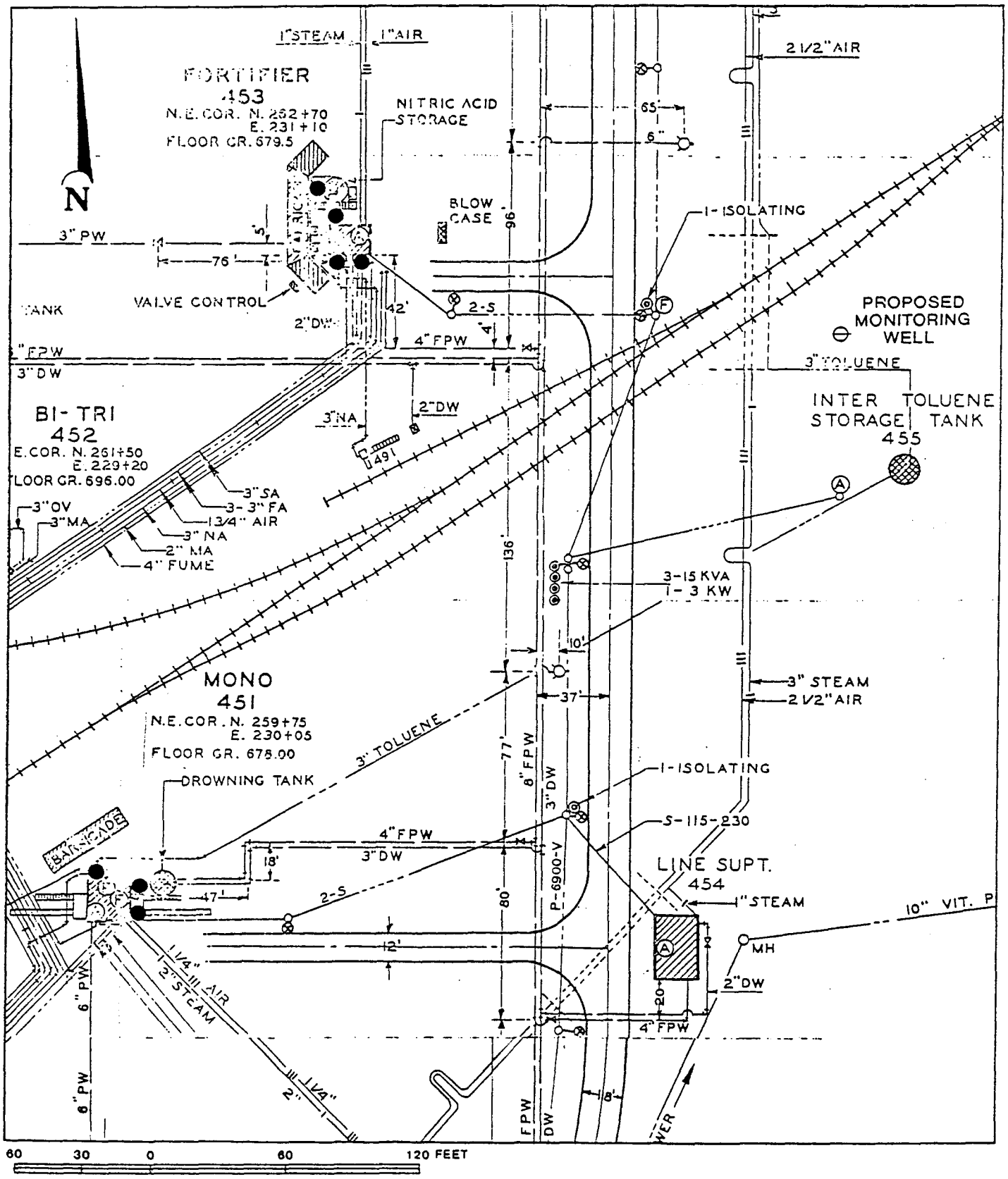
Figure 3-9

PROPOSED SOIL SAMPLING LOCATIONS AT WASH HOUSE - LINE 6

TNT Area B

Plum Brook Ordnance Works

DAMES & MOORE



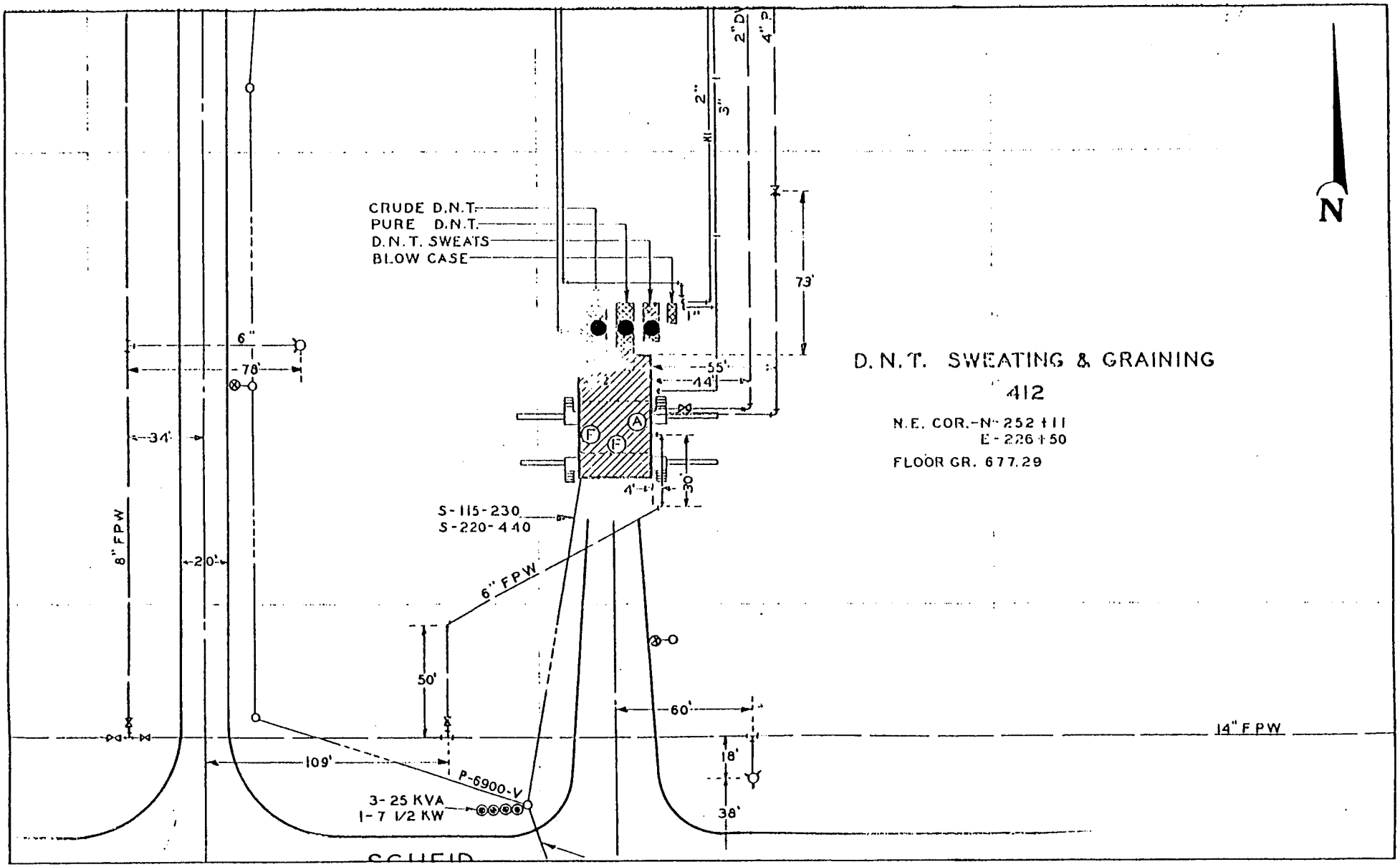
LEGEND:

- ● Proposed Soil Sampling Location
- ⊖ Proposed Monitoring Well Location

Figure 3-10

PROPOSED SOIL SAMPLING LOCATIONS AT BI-TRI HOUSE, FORTIFIER HOUSE AND MONO HOUSE AND PROPOSED MONITORING WELL
TNT Area B
Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

● Proposed Soil Sampling Location

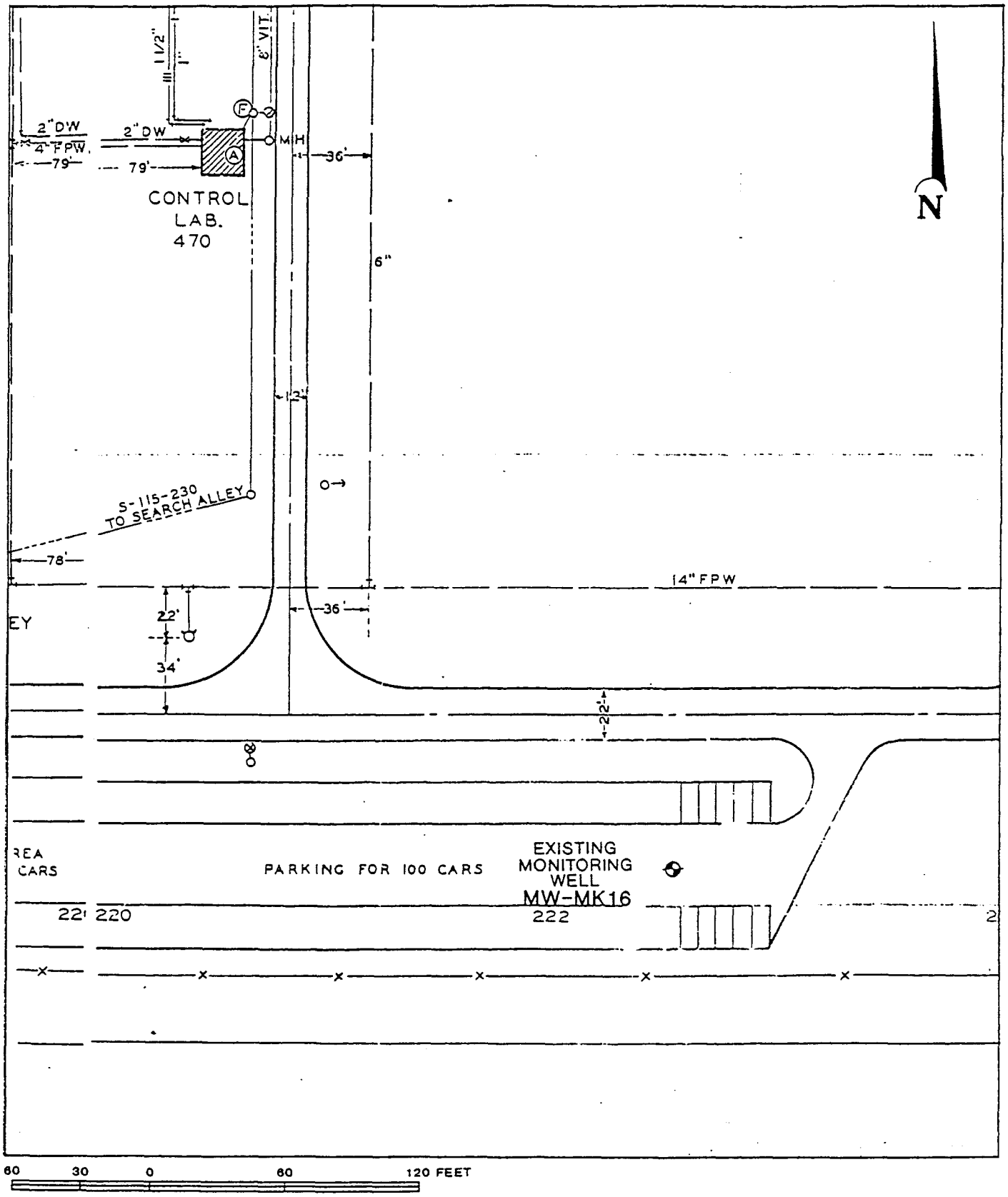
Figure 3-11

PROPOSED SOIL SAMPLING LOCATIONS AT DNT SWEATING AND GRAINING HOUSE

TNT Area B

Plum Brook Ordnance Works

DAMES & MOORE



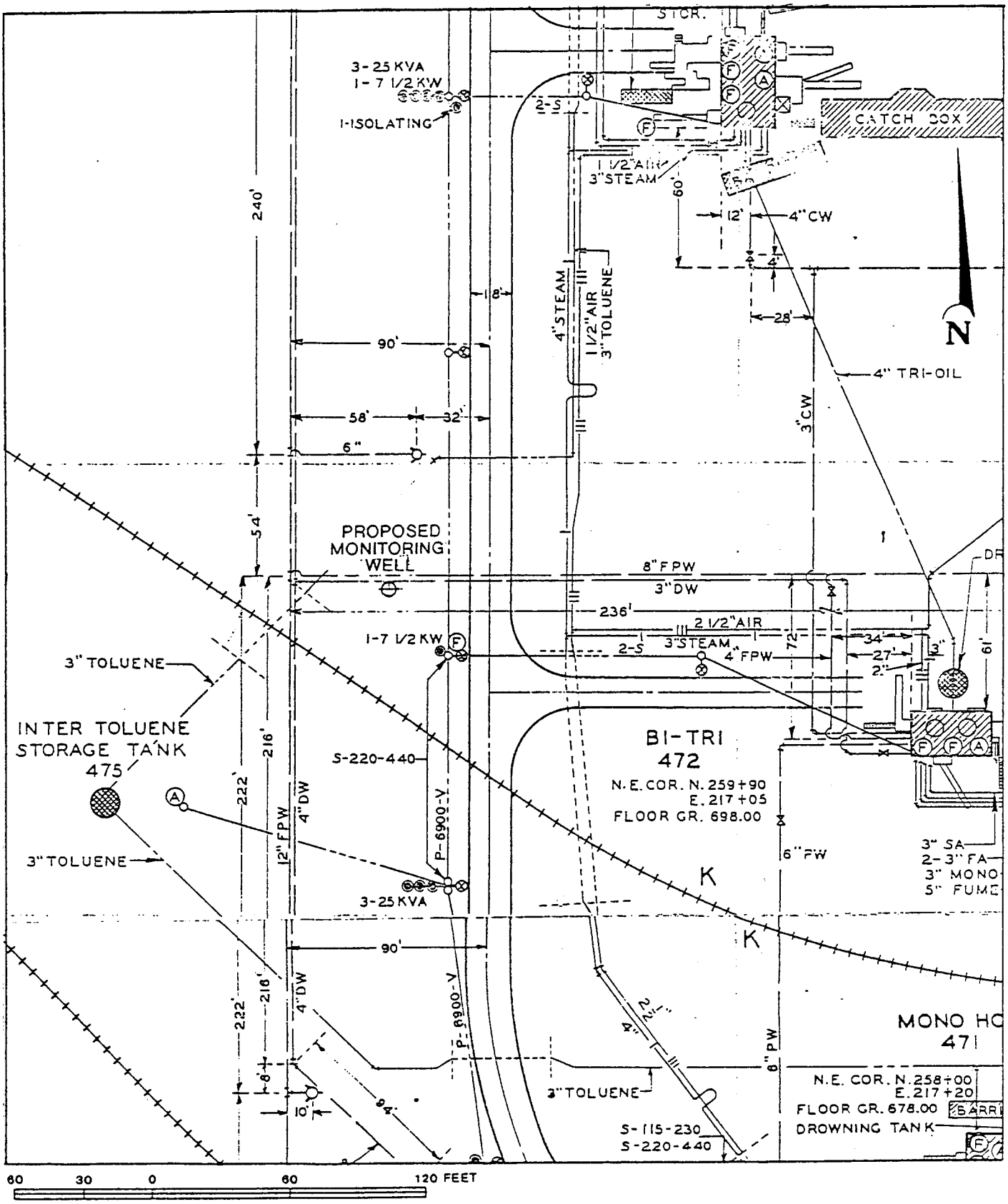
LEGEND:

Existing Monitoring Well Location

Figure 3-12

EXISTING MONITORING WELL LOCATION
TNT Area B
Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

⊖ Proposed Monitoring Well Location

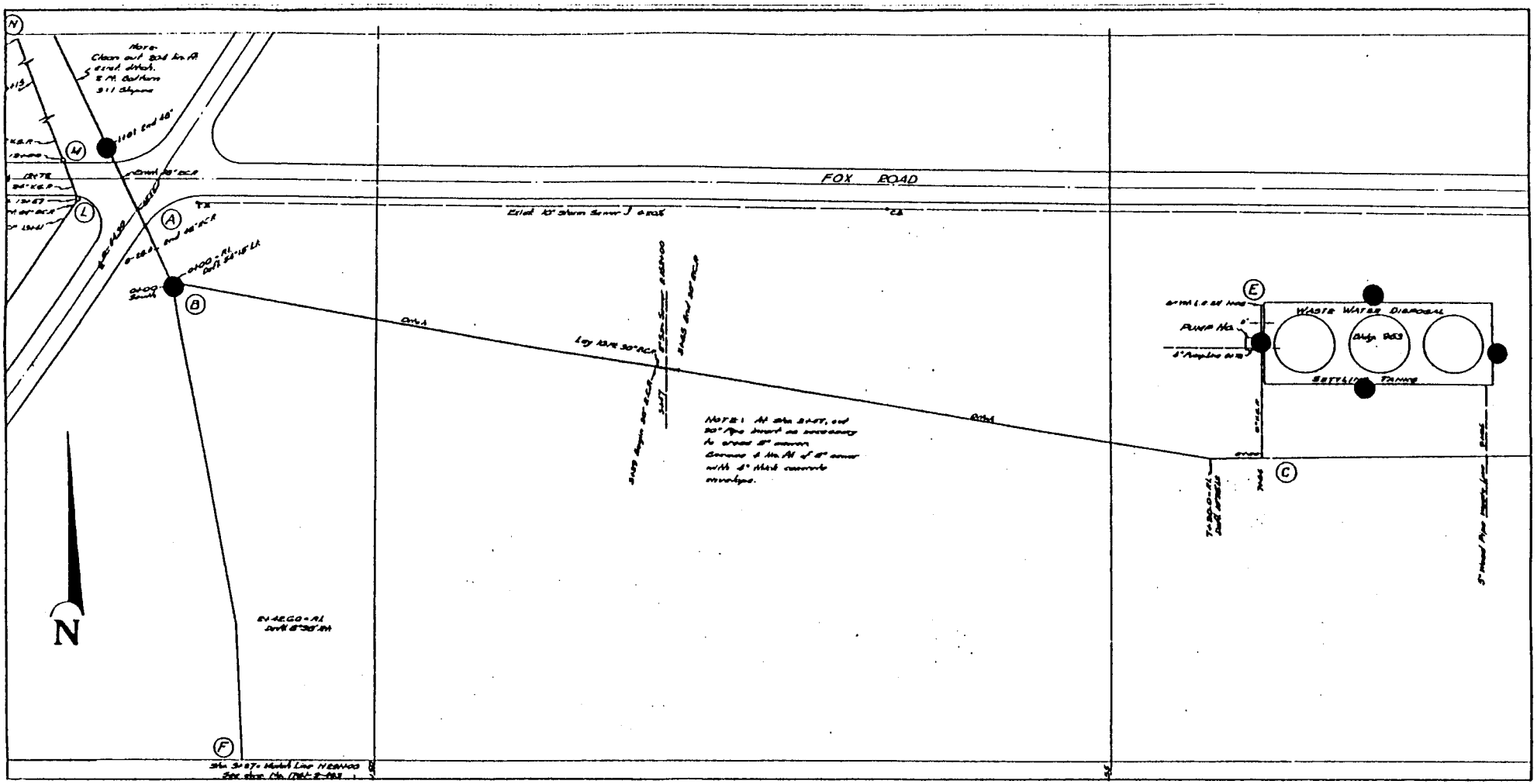
Figure 3-13

PROPOSED MONITORING WELL LOCATION

TNT Area B

Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

● Proposed Soil Sampling Location

100 50 0 100 200 FEET

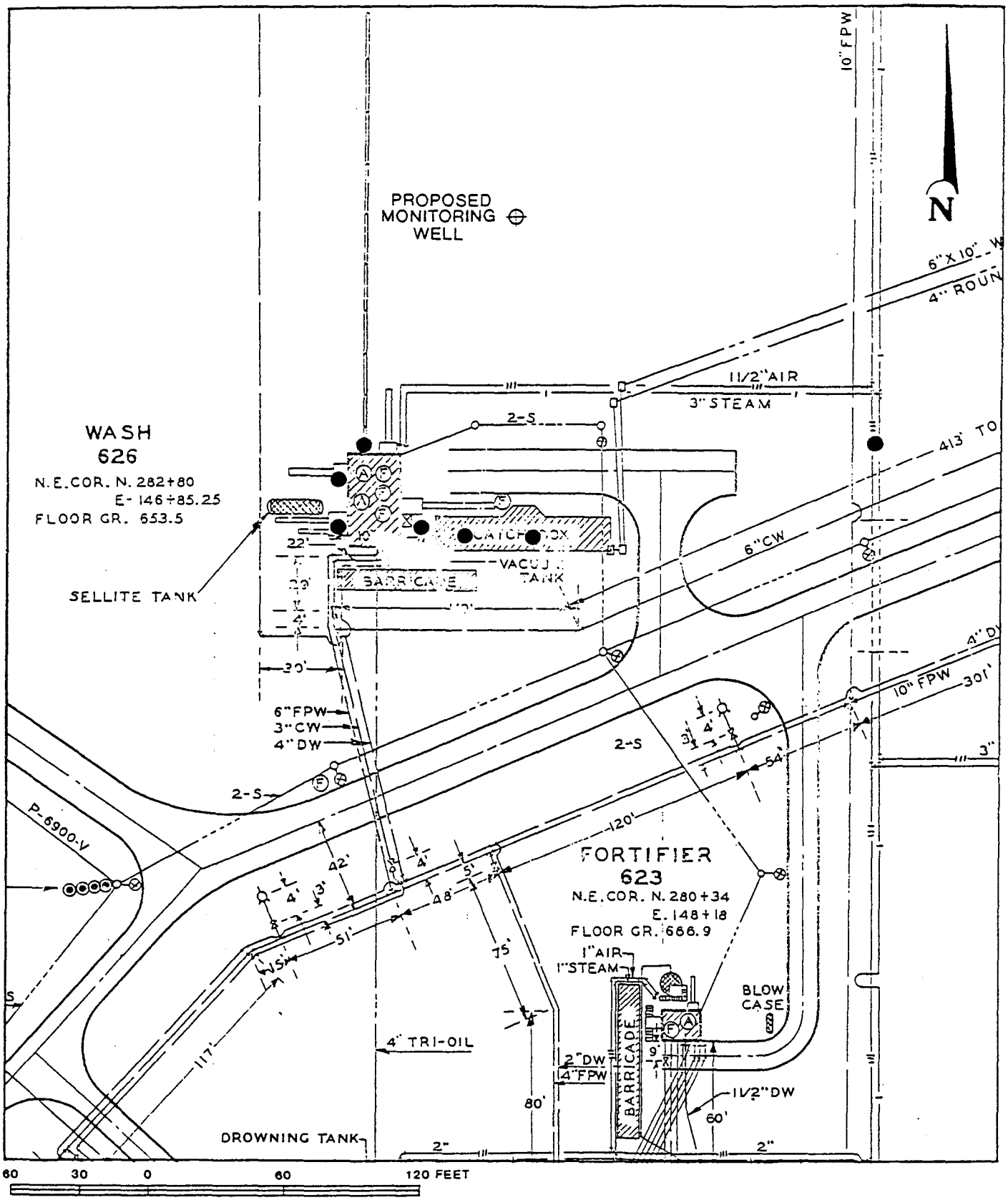
Figure 3-14

PROPOSED SOIL SAMPLING LOCATIONS AT WASTE WATER DISPOSAL SETTLING TANK AND ASSOCIATED DITCHES

TNT Area C

Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

- ● Proposed Soil Sampling Location
- ⊖ Proposed Monitoring Well Location

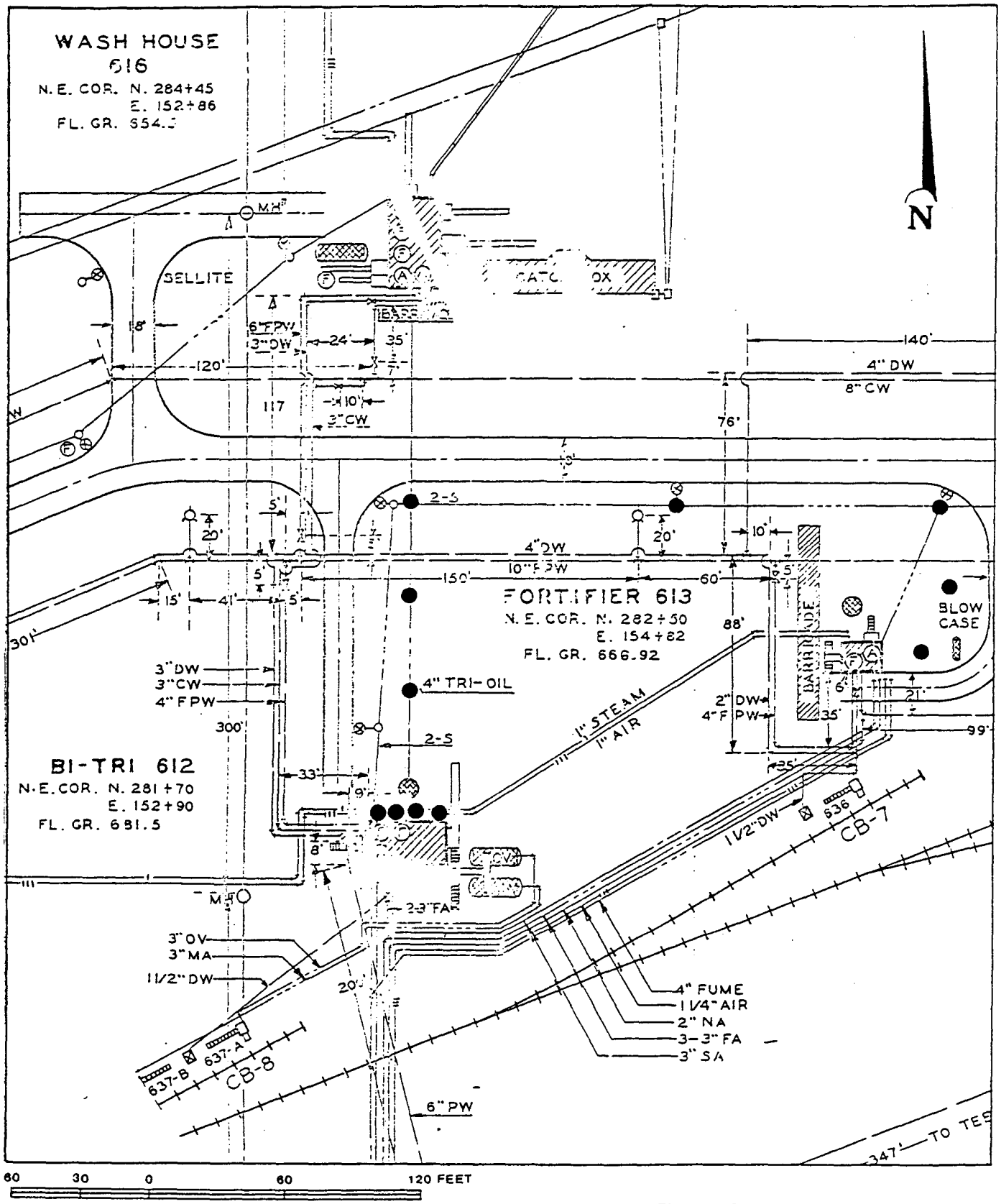
Figure 3-15

PROPOSED SOIL SAMPLING LOCATIONS AT WASH HOUSE - LINE 12 AND ASSOCIATED DITCH AND PROPOSED MONITORING WELL

TNT Area C

Plum Brook Ordnance Works

DAMES & MOORE



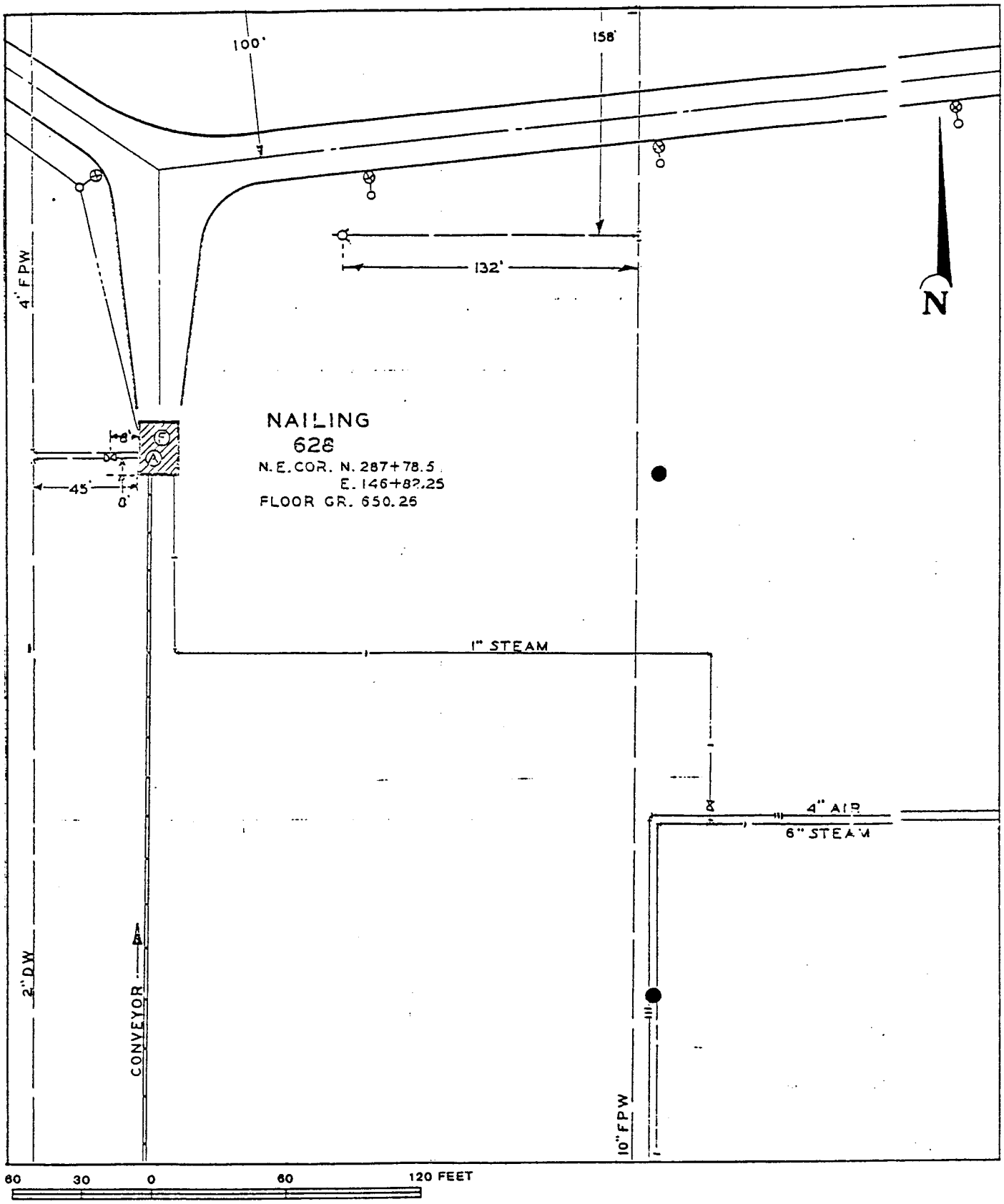
LEGEND:

● Proposed Soil Sampling Location

Figure 3-16

PROPOSED SOIL SAMPLING LOCATIONS AT BI-TRI HOUSE, FORTIFIER HOUSE AND ASSOCIATED DITCHES
TNT Area C
Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

● Proposed Soil Sampling Location

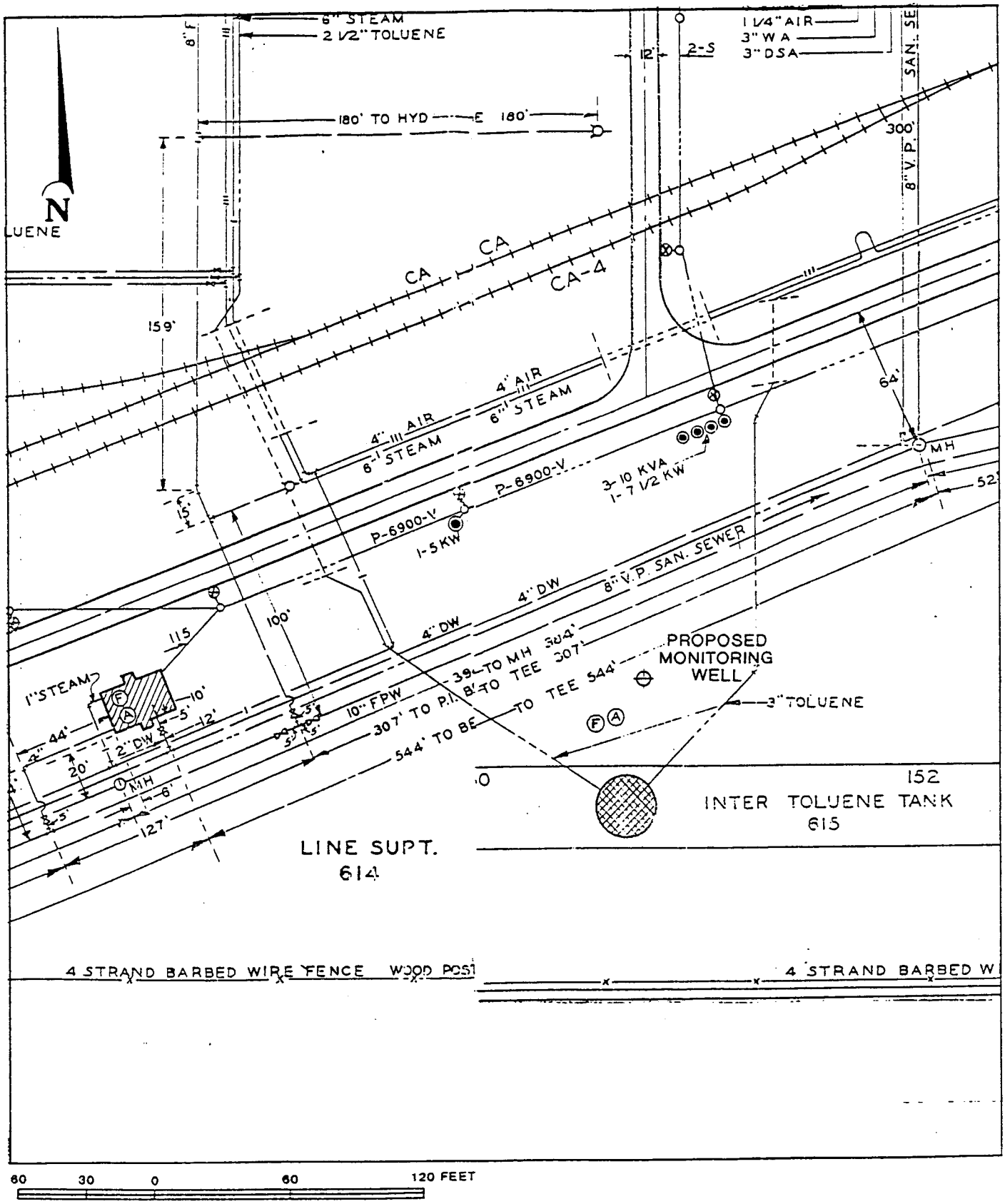
Figure 3-17

PROPOSED SOIL SAMPLING LOCATIONS AT ASSOCIATED DITCH

TNT Area C

Plum Brook Ordnance Works

DAMES & MOORE



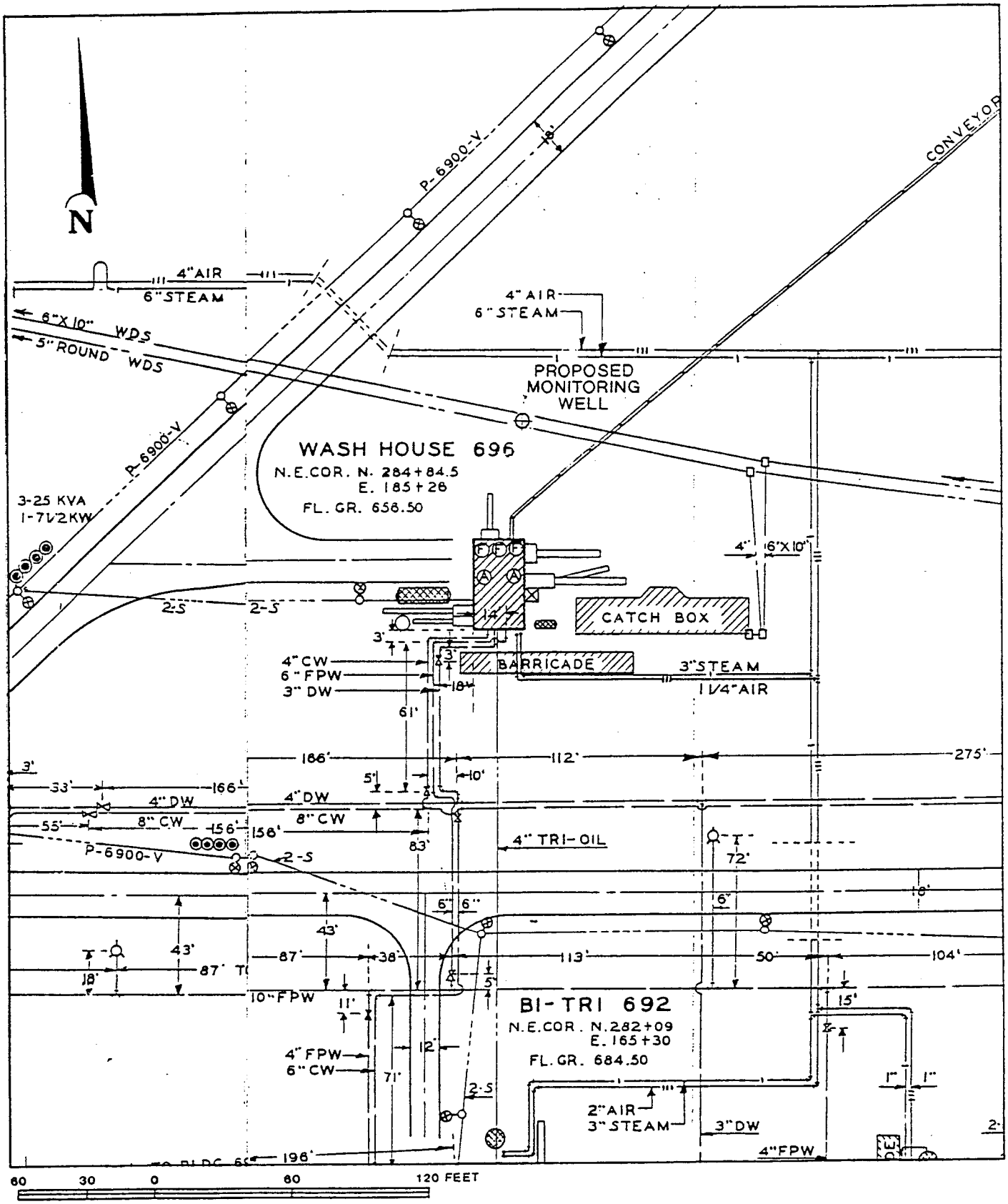
LEGEND:

⊖ Proposed Monitoring Well Location

Figure 3-18

PROPOSED MONITORING WELL LOCATION
TNT Area C
Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

⊖ Proposed Monitoring Well Location

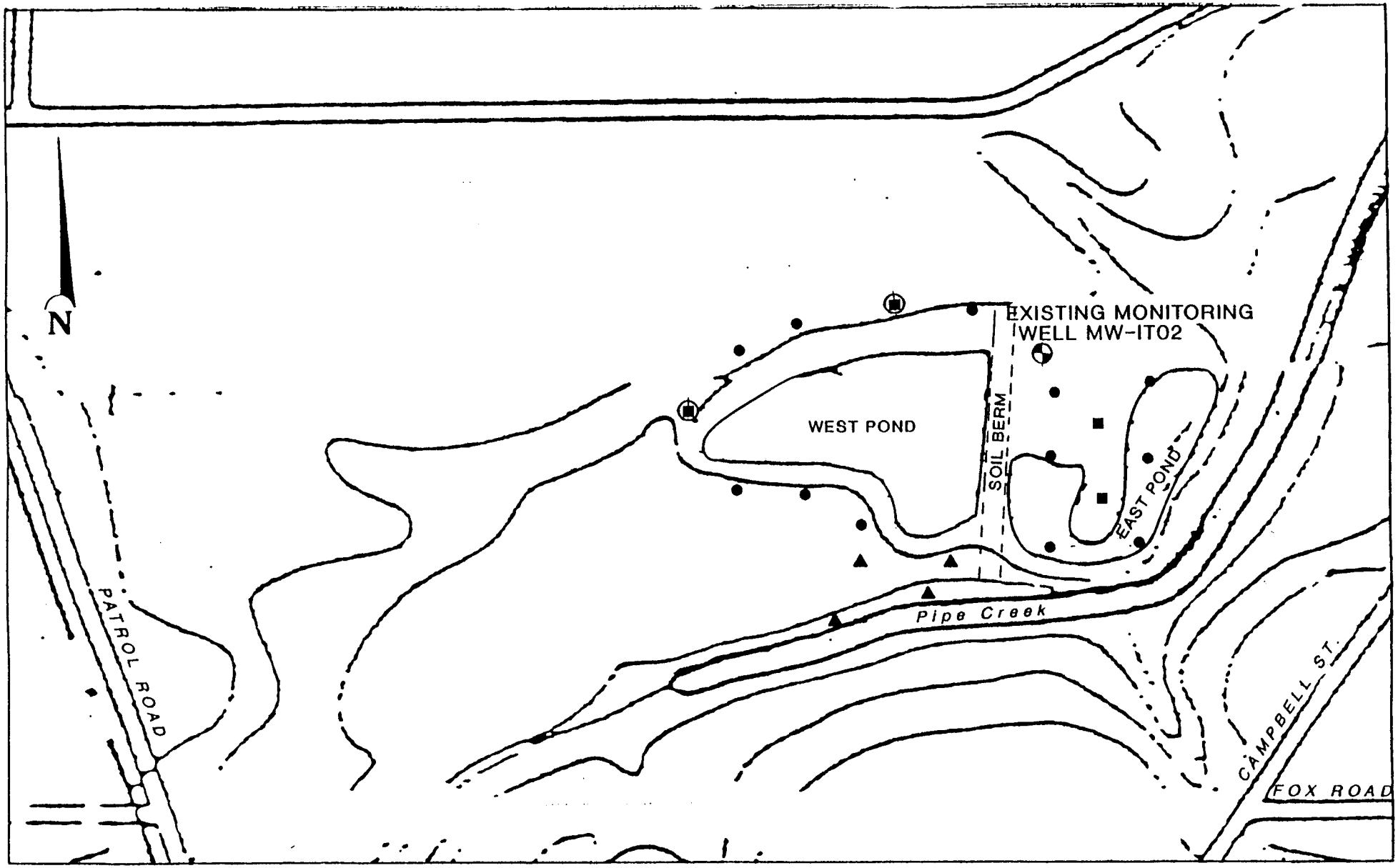
Figure 3-19

PROPOSED MONITORING WELL LOCATION

TNT Area C

Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

- ● 5-Foot Soil Boring
- ■ 10-Foot Soil Boring
- Existing Monitoring Well
- Proposed Monitoring Well
- ▲ Surface Soil Sample

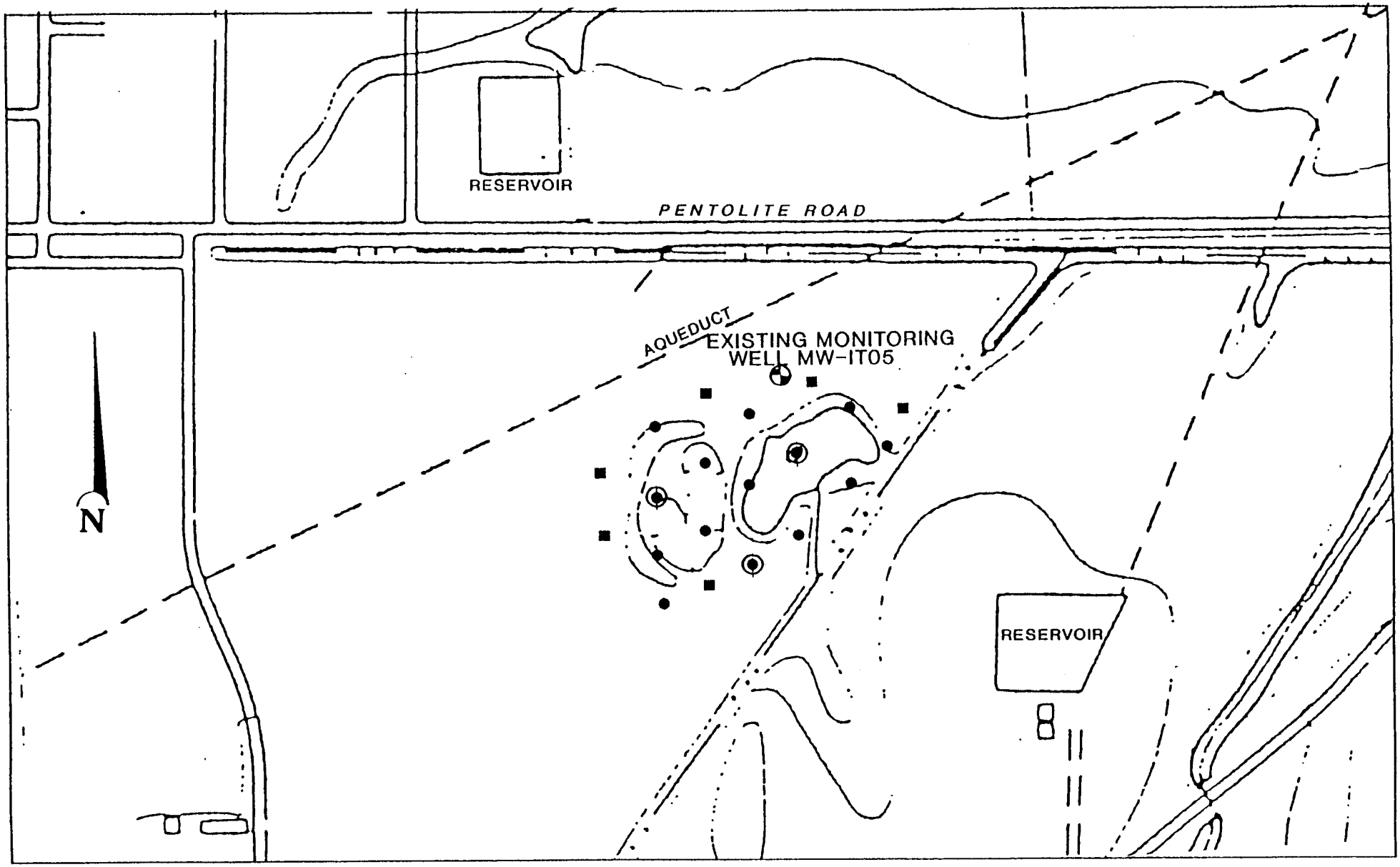
SOURCE: Base map was enlarged from a portion of the U.S.G.S. 1:24,000 scale topographic map titled: "Sandusky, Ohio", 1969

Figure 3-20

PROPOSED SOIL SAMPLING LOCATIONS AND PROPOSED AND EXISTING MONITORING WELL LOCATIONS

West Area Red Water Ponds
Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

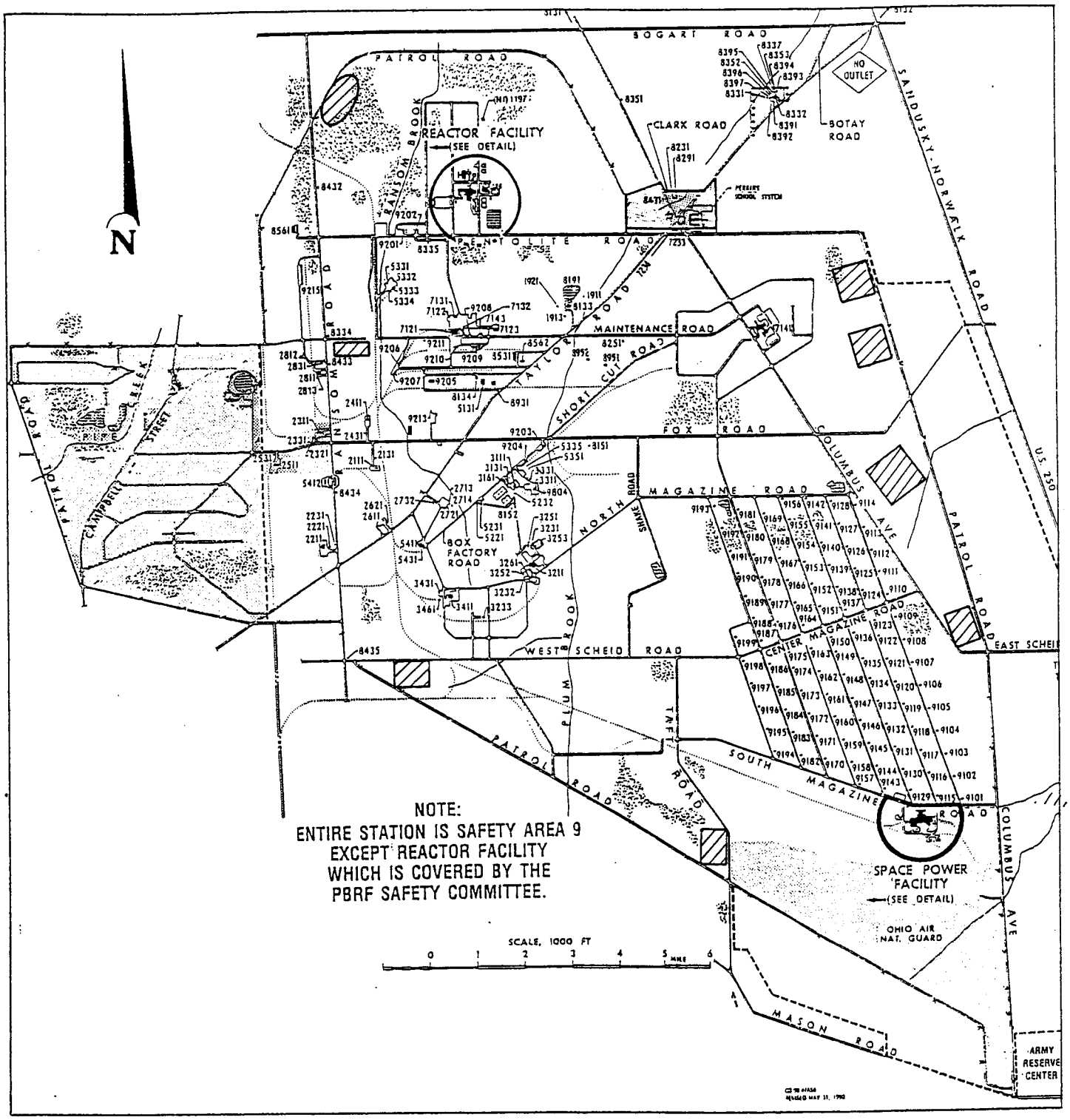
- ● 10-Foot Boring
- ■ 5-Foot Boring
- Existing Monitoring Well
- Proposed Monitoring Well

SOURCE: Base map is enlarged from a portion of the U.S.G.S. 1:24,000 scale topographic map of "Sandusky, Ohio", 1969

Figure 3-21

PROPOSED SOIL SAMPLING LOCATIONS AND EXISTING AND PROPOSED MONITORING WELL LOCATIONS
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

Potential Areas Where Soil Background Samples May Be Collected

Figure 3-22

PROPOSED BACKGROUND SOIL SAMPLING LOCATIONS
Plum Brook Ordnance Works

DAMES & MOORE

APPENDIX B

SOIL BORING LOGS

HTRW DRILLING LOG

HOLE NUMBER	
1. COMPANY NAME	Dames & Moore
2. DRILLING SUBCONTRACTOR	
SHEET	1 OF ~ SHEETS
3. PROJECT	Plum Brook Ordnance Works
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	STEVE SUSTEN
6. MANUFACTURER'S DESIGNATION OF DRILL	N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	HAND AUGER
8. HOLE LOCATION	TNT Area A
9. SURFACE ELEVATION	N/A
10. DATE STARTED	10/26/94
11. DATE COMPLETED	10/28/94
12. OVERBURDEN THICKNESS	N/A
13. DEPTH DRILLED INTO ROCK	N/A
14. TOTAL DEPTH OF HOLE	5.0 feet
15. DEPTH GROUNDWATER ENCOUNTERED	NOT ENCOUNTERED
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	N/A
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	N/A

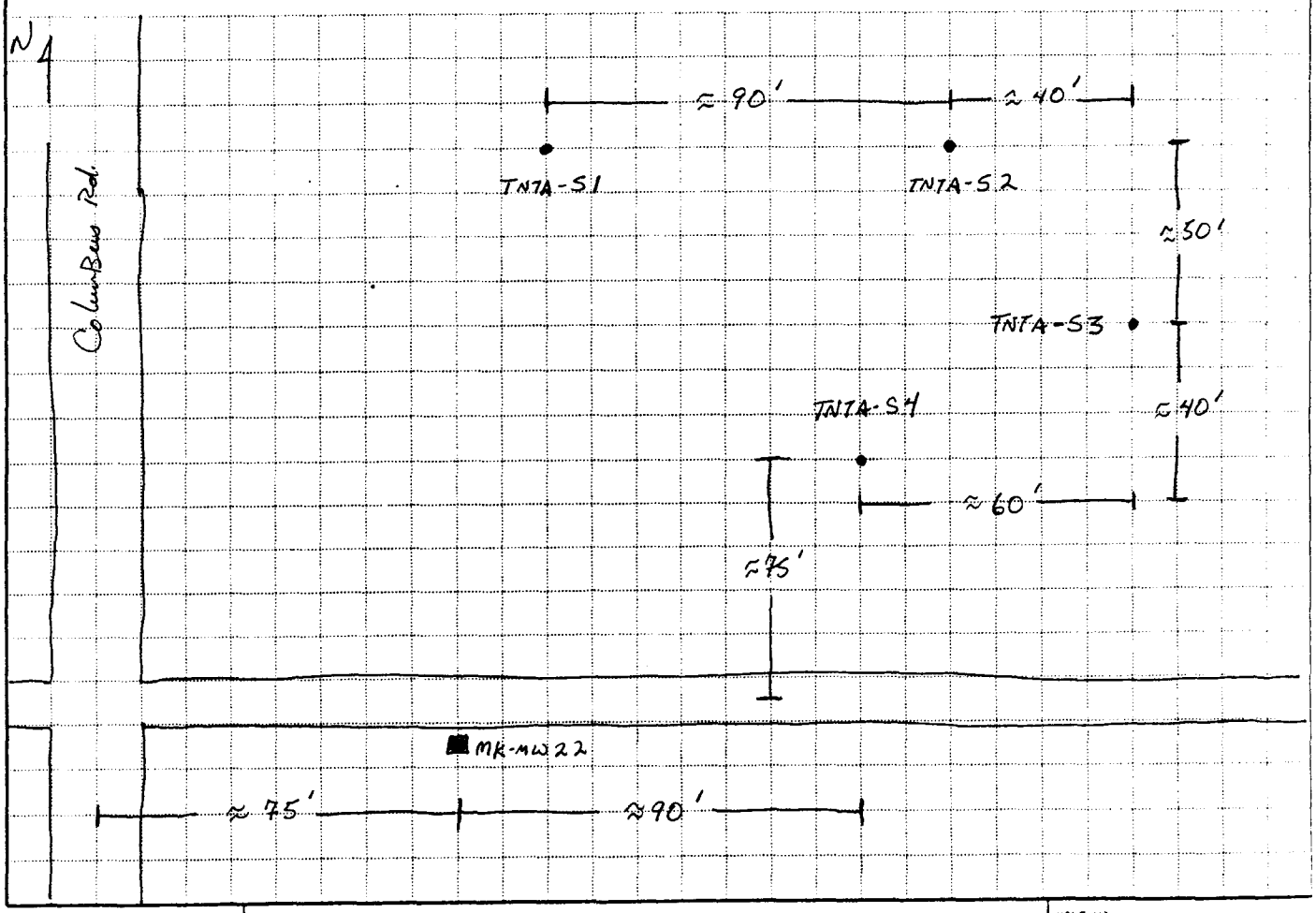
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓				

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
				Steven J Susten

LOCATION SKETCH/COMMENTS

SCALE: NOT TO SCALE



PROJECT	HOLE NO.
Plum Brook Ordnance Works	TNTA- S1 S2 S3 S4

HTRW DRILLING LOG

HOLE NUMBER: TNTA-S1

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown fine silty Sand				Vegetation on surface Some Roots
	0.5	Color grades with some Brownish yellow to Tan				Sample TNTA-S1-0.0/1.5 collected @ 1755
	1.0	Grades with some Clay lenses				
		- Grades with Mottled Brownish yellow and Gray fine sandy Clay				
	1.5					
	2.0					
		- Grades with Rock Fragment				Turning become Difficult
	2.5					
		Rock Fragments Grade out				
	3.0	Clay and Brownish yellow Mottling Grade out				Sample TNTA-S1-4.5/5.0 collected @ 1810
	3.5					
	4.0	Grades with Brownish Orange and Clay				
		Brownish yellow silty Fine sand w/ occasional Brownish Red				
	4.5	Dark Brown silty fine Sand w/ frequent Brownish yellow and Gray Clay and Trace Rounded Gravel				
		Brown yellow + Gray silty sandy Clay w/ Gravel				
	5.0					

PROJECT: Boring Terminated @ 5 feet

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER PD-TNTA-S2

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown Silty Fine Sand w/ Roots	HNU=0			Some vegetation
	0.5					Sample TNTA-S2-0.0/1.5 collected @ 1727
	1.0	Color Grades to Brownish yellow	1 ppM			
	1.5					
	2.0	Grades with some Clay				Sample TNTA-S2-1.5/3.0 collected @ 1732
	2.5	Middle Brownish Yellow + Gray Fine Sandy Clay Grades w/ Moderately weathered shale and Cobbles				Auger Turning becomes Difficult
	3.0		1 ppM			
		Auger refusal @ 3 feet @ 1730 shiplaty to moderately weathered shale				
	3.5					
	4.0					
	4.5					
	5.0					

PROJECT

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTA-S3

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown Sandy Organic w/ Roots	0 ppm			Some Vegetation on surface; some roots
		Very Fine sand (some) Clay Grades in				
	0.5					Sample TNTA-S3-0.0/1.5 collected @ 1755
		~~OFFSET Boring~~ Removed Rock From Hole + Continued Clay Grades out				
	1.0	Color Grades to Brown w/ some Brownish yellow streaks w/ small Gravel				
	1.5	Brownish yellow silty Fine Sand w/ small Gravel				
	2.0	Brown silty Fine Sand w/ large Gravel				Sample PB-TNTA-S3-1.5/3.0 collected @ 1820
	2.5	Color Grades to Brownish yellow w/ less Gravel				
	3.0	Auger Refusal @ 3 feet Boring Terminated @ 3 feet				
	3.5					
	4.0					
	4.5					
	5.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTA-54

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage / Steve Susten

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown Sandy organic material; some slag				Grassy surface.
		numerous gravel mixed				
	0.5	Gravel w/ dark brown silty sand mixed				
	1.0	Brownish yellow well graded silty sand; no gravel				Sample TNTA-54-0.0/1.5 collected at 16:50
		Yellowish red silty sand				
	1.5	Brown well graded silty sand	Hnu=0			
		Brownish yellow silty fine sand w/ yellowish red mottling				
	2.0					
	2.5	Becoming moist				
	3.0					
	3.5	Brown well graded silty sandy clay				
		Reddish brown flakes				QA/QC: TNTA-S28-1.5/5.0
	4.0	Redish brown flakes grade out				TNTA-S28-1.5/5.0-S
	4.5	gray weathered shale				Sample TNTA-54-1.5/5.0 collected at 17:15
		Olive gray mottling				
	5.0	Boring terminated at 5ft on 10-20-93	HNU=0			

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER	
1. COMPANY NAME	Dames & Moore
2. DRILLING SUBCONTRACTOR	
SHEET	1 OF 2 SHEETS
3. PROJECT	Plum Brook Ordnance Works
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	STEVE SUSTEN
6. MANUFACTURER'S DESIGNATION OF DRILL	N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	HAND AUGER
8. HOLE LOCATION	TNTA Area A
9. SURFACE ELEVATION	N/A
10. DATE STARTED	10/25/94
11. DATE COMPLETED	10/26/94
12. OVERBURDEN THICKNESS	N/A
15. DEPTH GROUNDWATER ENCOUNTERED	NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK	N/A
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	N/A
14. TOTAL DEPTH OF HOLE	3.5 feet
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	N/A

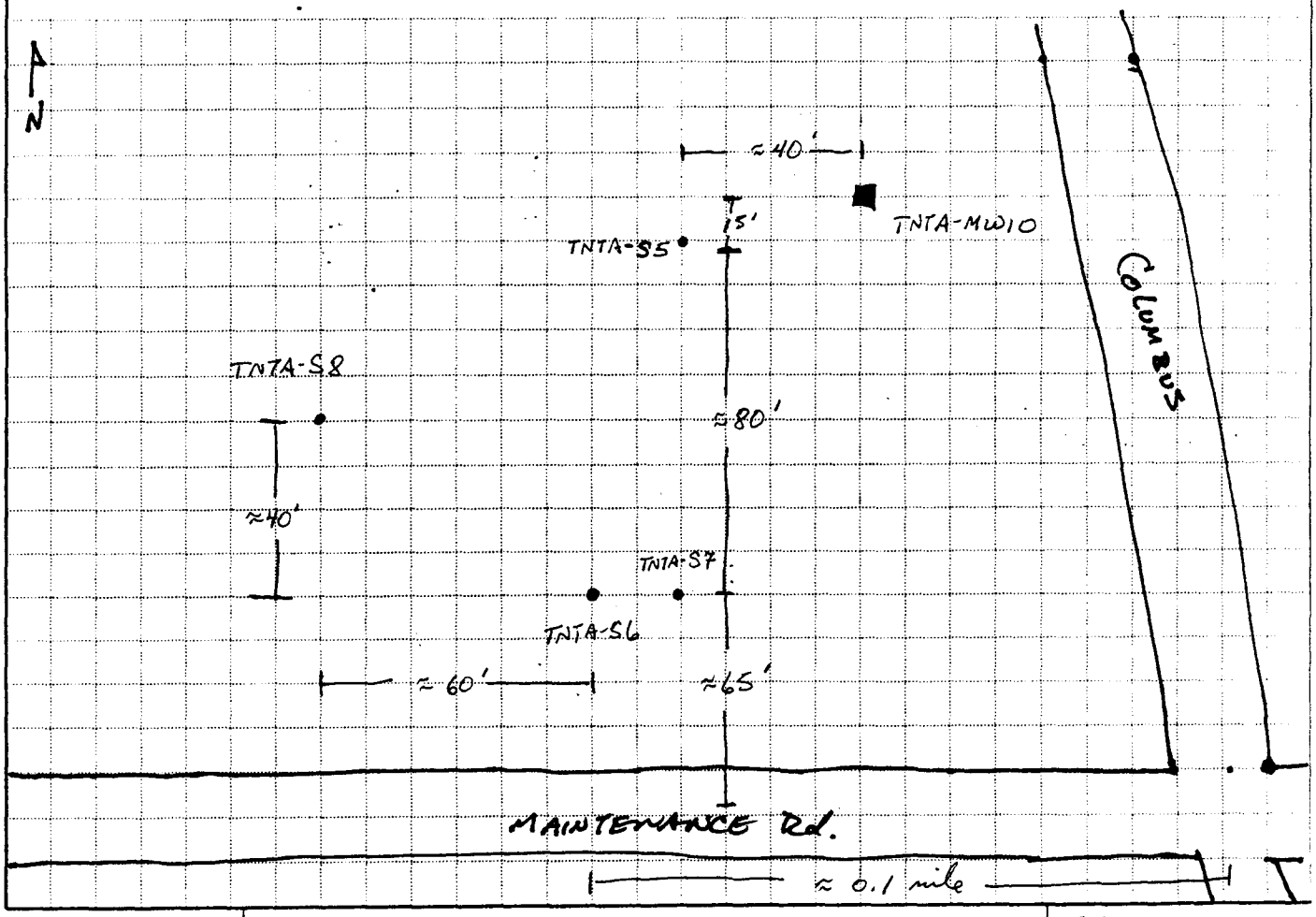
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓				

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
				Steven J. Susten

LOCATION SKETCH/COMMENTS

SCALE: NOT TO SCALE



PROJECT	HOLE NO.
Plum Brook Ordnance Works	TNTA-S5 S6 S7 S8

HTRW DRILLING LOG

HOLE NUMBER: TNTA-55

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage / Steve Susten

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown sandy organic material				Grass vegetation; some roots beneath
	0.5	Brownish yellow well graded silty fine sand				
	1.0	Nails and transite material mixed				
		Dark Brown sandy clay with shale mix and transite material				
	1.5					Auger refusal at 1.5ft
	2.0					
	2.5					
	3.0					
	3.5					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTA-SS

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage / Steve Susten

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Dark Brown sandy, silty organic material				grass & trees on surface; some roots beneath
	0.5	Gray to dark gray well graded sand w/silt				
	1.0					
	1.5					Sample TNTA-SS-1.0/2.0 collected from 1-2 ft at 10:00
	2.0	Brownish yellow well graded silty sand grades in gray mottling	Hnu=0			
	2.5					
	3.0	Brown well graded sand; moist to wet; silts and fines	Hnu=0			Sample TNTA-SS-2.5/3.5, collected from 2.5-3.5 ft at 10:15
	3.5					Boring terminated at 3.5 ft on 10-20-94

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TMTA-S6

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage / Steve Susten

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown sandy organic material: slightly moist				Grass surface; roots beneath
	0.5					
		Brownish yellow well graded silty fine sand				
	1.0					
		wood fragments mixed				
	1.5	Brown well graded silty fine sand w/ wood fragments				Sample TMTA-S6-1.0-2.0 collected from 1-2 ft at 18:05
			Hnu=0			
	2.0					Auger refusal at 2.0 ft.
	2.5					
	3.0					
	3.5					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTA-S6

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage / Steve Susten

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown sandy organic				Some Vegatation
	0.5					
	1.0	Brown silty sand				
	1.5	Dark Gray Clay w/ some sand				
	2.0					
	2.5	Some brownish yellow mottling				
	3.0	Gray and Brownish yellow mottling				Sample TNTA-S6-2.5-3.5 collected from 2.5-3.5 ft at 08:50
			Hnu = 0			
	3.5					Boring terminated at 3.5 ft on 10-26-94

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTA-57

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage / Steve Susten

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Dark Brown Sandy organic material; dry				Grass vegetation on top; Some roots beneath
	0.5	Brown well graded sand grades in				
	1.0	← Brownish yellow well graded silty sand; slightly moist				
	1.5	Brown well graded silty sand; wood fragments				Sample TNTA-57-1.0-2.0 from 1-2 ft at 5:35
			Hnu=0			
	2.0					Auger refusal at 2.0 ft.
	2.5					
	3.0					
	3.5					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTA-57

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage / Steve Suster

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Dark Brown Sandy organic material				Grass vegetation on surface; roots beneath
	0.5	Brownish yellow well graded silty sand w/gravel				
		gravel grades out				
	1.0					
	1.5					
	2.0					
	2.5	Brownish yellow well graded silty fine sand; small traces of wood				Sample TNTA-57-2.5-3.5 collected from 2.5-3.5 ft at 5:50
	3.0					
		more traces of wood	Hnu=0			
	3.5					Boring terminated at 3.5 ft. 10-25-94

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTA-58

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	DARK Brown sandy organic	open			Some Vegetation w/ Roots
	0.5					
		Auger Refusal	OFFSET Boring			
	1.0					
	1.5					
	2.0					
	2.5					
	3.0					
	3.5					
	4.0					
	4.5					
	5.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER TNTA-S8

PROJECT Plum Brook Ordnance Works | INSPECTOR | SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		DARK Brown Sandy organic				Some Vegetation w/ roots
	0.5	Brownish yellow silty Sand s.s.				
		DARK Brown patches				
	1.0	Brown silty sand w/ yellowish Brown streaks				SS 10/26/94 ~~Becomes moist~~
	1.5					
	2.0					Becomes moist
		WITH DARK Brown streaks				
	2.5					
		Gray Weathered shale w/ Brownish yellow streaks w/ Some Sand				Sample TNTA-S8-2.5/3.5 collected @ 1050
	3.0					
	3.5	Gray weathered shale/Clay	w/ Brown Mottling			
		Boring Terminated @ 3.5 feet on 10/26/94				
	4.0					
	4.5					
	5.0					

PROJECT | HOLE NO.

Plum Brook Ordnance Works

HTRW DRILLING LOG

HOLE NUMBER: TNTA-S9

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown sandy organic	0ppM			Some Vegatetion w/ Roots
	0.5	Brown to Gray silty fine sand				Sample TNTA-S9-00/1.0 Collected @ ~~15~~ 10
		Some Brownish yellow and light Brown mottling				
	1.0	Boring Terminated @ 1ft				

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

1. COMPANY NAME	Dames & Moore
2. DRILLING SUBCONTRACTOR	
HOLE NUMBER	
SHEET	OF 1 SHEETS 2
3. PROJECT	Plum Brook Ordnance Works
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	STEVE SUSTEN
6. MANUFACTURER'S DESIGNATION OF DRILL	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	HAND AUGER
8. HOLE LOCATION	
9. SURFACE ELEVATION	
10. DATE STARTED	10/26/94
11. DATE COMPLETED	12/14/94
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	S10-3.5 ft ; S11-3.5 ft S12+S13 Back Hoe to 5 0 feet
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

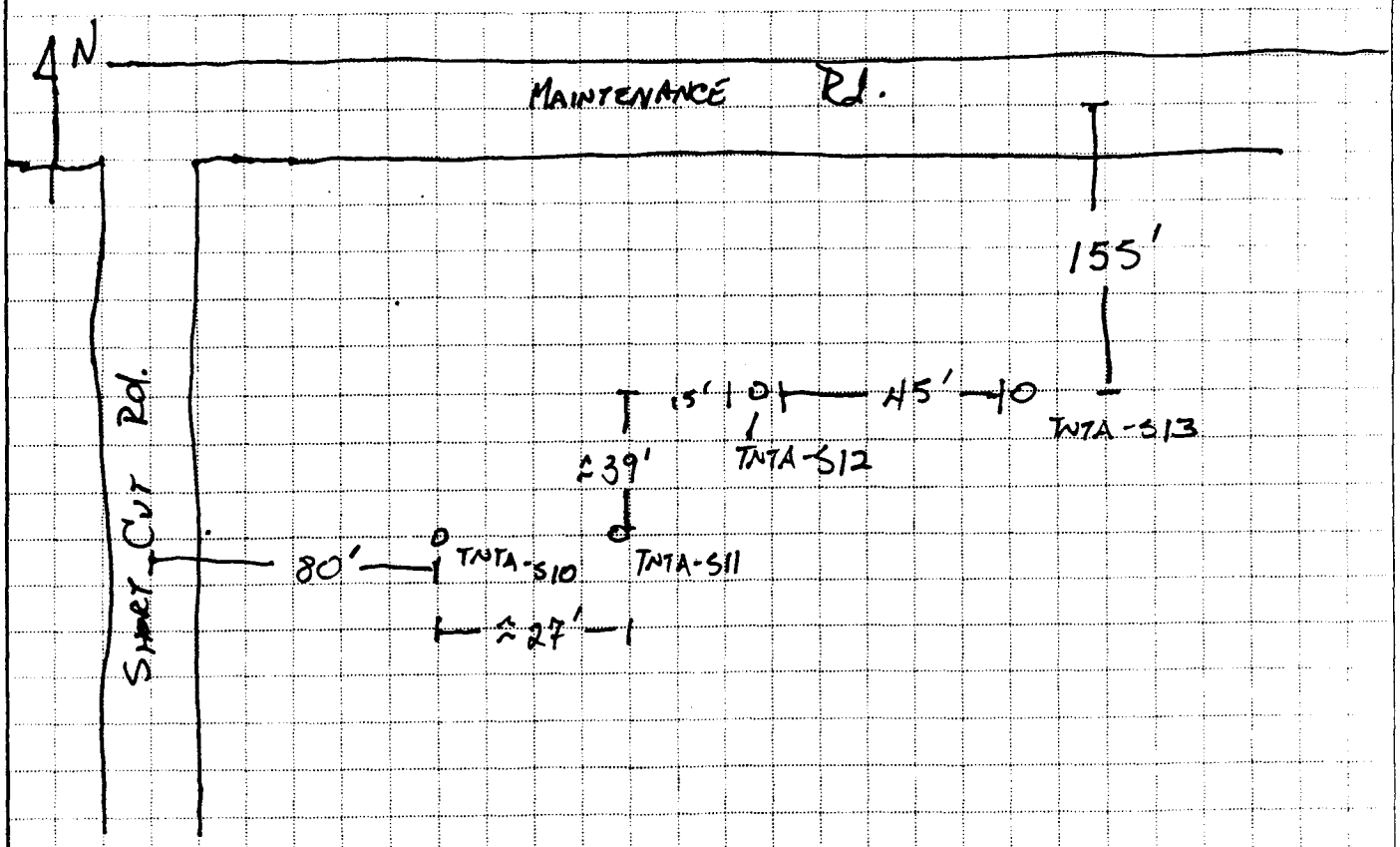
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
				Steve Susten

LOCATION SKETCH/COMMENTS

SCALE: NOT TO SCALE



PROJECT	HOLE NO.
Plum Brook Ordnance Works	TNTA- S10 S11 S12 S13

HTRW DRILLING LOG

HOLE NUMBER: TMA-S10

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage / Steve Susten

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Dark Brown sandy organic material w/ Some clay				Grass surface with roots beneath
	0.5	Clay grades out. Brown to Brownish yellow well graded Sand w/ some silts Transite mixed				
	1.0					Auger refusal at 1.0 ft.
	1.5					
	2.0					
	2.5					
	3.0					
	3.5					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: INTA-S10

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown Sandy organic material w/ some clay				Grass surface w/ roots beneath
	0.5	Brown well graded silty sand w/ shale traces				
	1.0					
	1.5	Dark Brown well graded silty sand w/ gray weathered shale & wood chips mixed				
	2.0	Dark Brown well graded silty sand w/ brownish yellow flex to streaks				
	2.5	small traces of building debris. Gray weathered shale. Organic material				
		↑ Dark Brown silty fine sand w/ shale & possibly limestone.				~~Bedrock~~ Auger refusal at 2.7 ft
	3.0					
	3.5					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTA-S10

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage/Steve Sustea

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Dark Brown sandy organic material				Grass surface w/roots beneath
	0.5	Brown silty fine sand w/ brownish yellow flecks				
		Some clay grades in				
	1.0	Dark Brown sandy layered clay				
	1.5	Gray weathered shale w/ brownish yellow flecks				
		Dark gray to gray weathered shale				
	2.0	Reddish brown ~~flecks~~ flecks				
	2.5	Reddish brown streaks				
	3.0	Gray clay w/ moderate plasticity; moist; brownish yellow mottling	Hnu=0			Sample TNTA-S10-2.5/3.5 collected at 14:37
	3.5					Boring terminated at 3.5 ft

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTA-S11

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage / Steve Susten

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown Sandy organic	0 ppm			Some Vegetation w/ Roots
		Dark Brown Well graded sand				
	0.5					
		Dark Brown to Brown silty sand w/ some Clay and Gravel				
	1.0					
	1.5	Brownish yellow streaks Less Gravel				
	2.0	Gravel Grade out Brown silty Sand Brownish yellow streaks				
		Pieces of Decayed Material (Black) Some large Gravel and small amounts of Clay				
	2.5					Sample Collected TNTA-S11-2.5/3.5 TNTA-S27-2.5/3.5 TNTA-S27-2.5/3.5-S at 1517
	3.0	olive Gray to Gray Sandy Clay w/ Brownish yellow to yellowish Red streaks				
	3.5	Dark Gray MOTTLING	0 ppm			
		Boring terminated @ 3.5 feet on 10/26/94				
	4.0					
	4.5					
	50					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER	
1. COMPANY NAME	Dames & Moore
2. DRILLING SUBCONTRACTOR	
SHEET	1 OF 2 SHEETS
3. PROJECT	Plum Brook Ordnance Works
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	STEVE SUSTEN
6. MANUFACTURER'S DESIGNATION OF DRILL	N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	HAND Auger
8. HOLE LOCATION	TNTArea A
9. SURFACE ELEVATION	N/A
10. DATE STARTED	10/29/94
11. DATE COMPLETED	10/29/94
12. OVERBURDEN THICKNESS	N/A
13. DEPTH DRILLED INTO ROCK	N/A
14. TOTAL DEPTH OF HOLE	2.0 feet
15. DEPTH GROUNDWATER ENCOUNTERED	Not Encountered
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	N/A
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	N/A

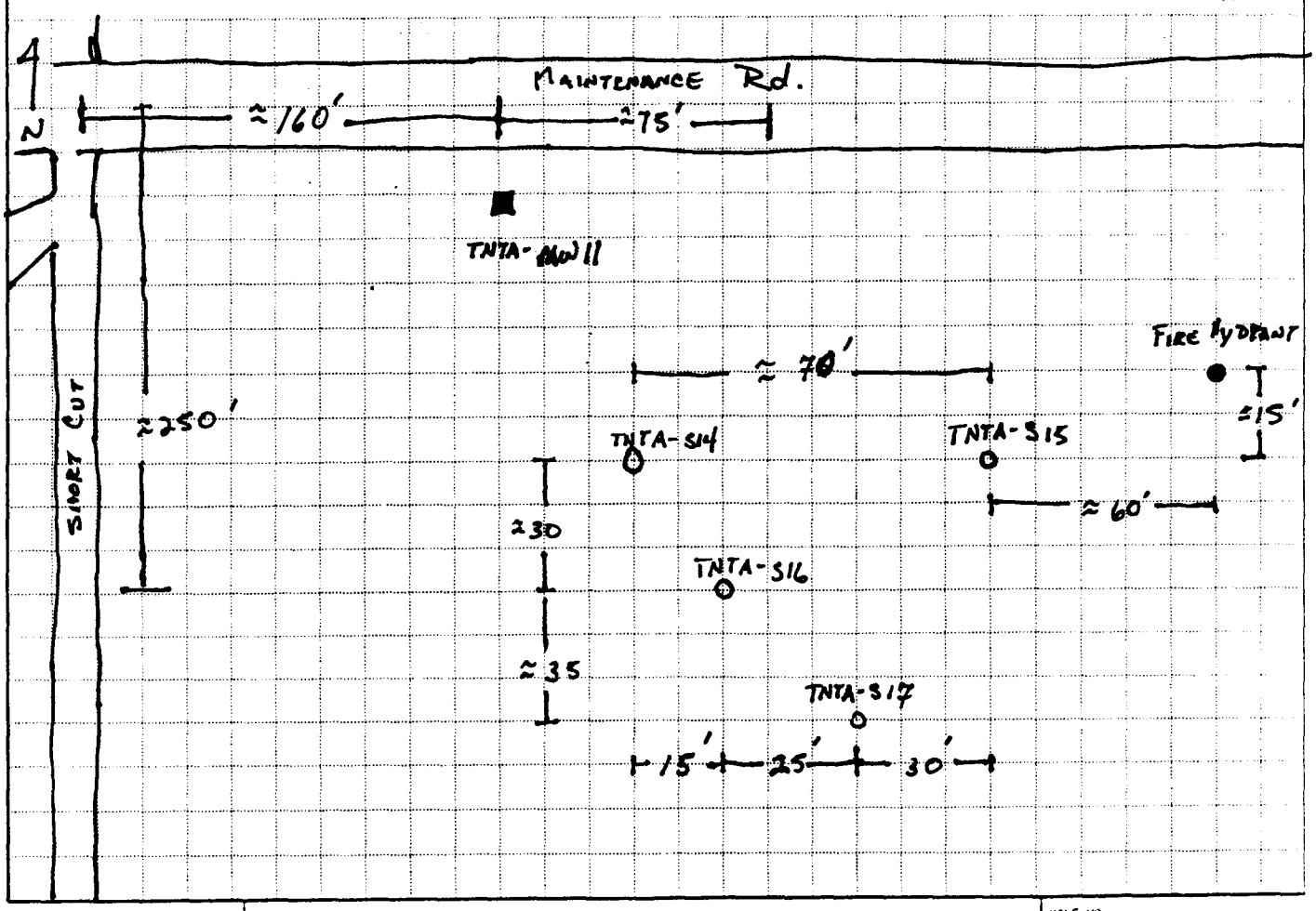
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓				

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
				Steven J. Susten

LOCATION SKETCH/COMMENTS

SCALE: Not To Scale



PROJECT	HOLE NO.
Plum Brook Ordnance Works	TNTA-S14 S15 S16 S17

HTRW DRILLING LOG

HOLE NUMBER: TNTA-S14

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown Silty Fine Sand	NHN=0			Some Vegetation Some Roots (Auger Refusal 0949)
	0.5	Grade to Brownish yellow w/ Gravel				Sample TNTA-S14-0.0/2.0 Collected @ 0956
	1.0					
	1.5	Grades to Grayish Brown w/ more Gravel	NNU=0			
	2.0	Gravel Grades out Color Grade to Brownish yellow Boring terminated @ 2.0 feet	0956			

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTA-S15

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

A
B
C
D

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown silty FINE sand				Some Vegetation Some Roots
	0.5	Grades to Brownish TAN w/ Gravel				
		Cobbles				Sample TNTA-S15-0.0/2.0 collected @ 1032
	1.0					
	1.5					
	2.0	Boring Terminated @ 2 feet 1032				

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTA-S16

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

B

C

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown Silty fine Sand				Save Vegetation surface roots
	0.0					
	0.5	(LARGE Grave Auger Refusal				Sample collected TNTA-S16-0.0/2.0 @ 0930
		Grades to Brownish yellow w/Roots				
	1.0					
	1.5					
		Transite Debris and Burnt wood				
	2.0	Grades w/ shale				
		Boring Terminated	@ 2 feet 930			

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTA-S17

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown Silty Fine Sand				Some Veg @ Surface Some Roots
	0.5	Grades to Brownish orange w/ Gravel				
	1.0					Sample TNTA-S17-0.0/2.0 collected @ 1054
	1.5	Gravel Grades out				
	2.0	Grades with occasional Gray Clay lenses				
		Boring Terminated @ 2.0 feet 1054				

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER

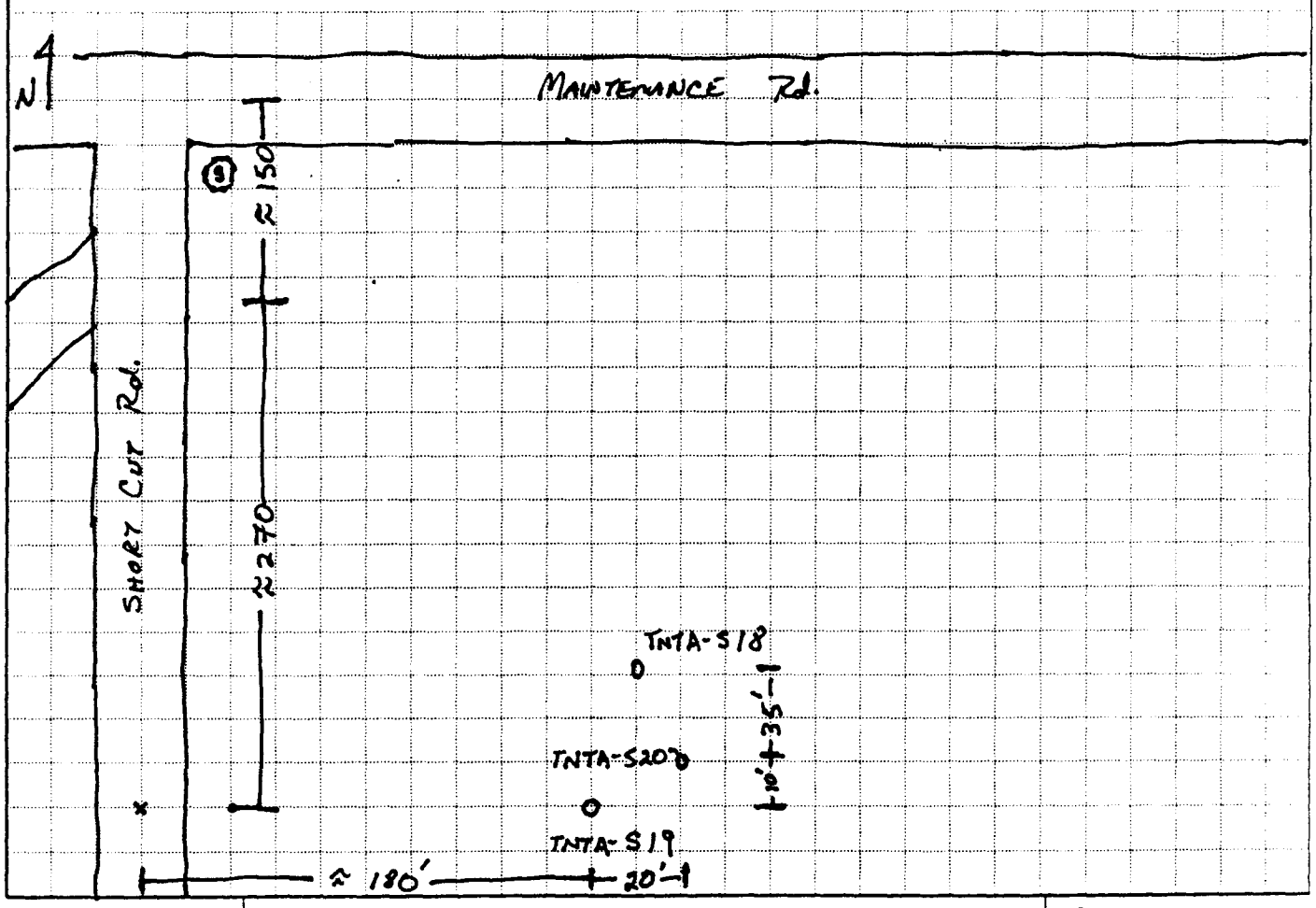
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR
SHEET 1 OF 2 SHEETS	
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVE SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND Auger	8. HOLE LOCATION: TNT Area A
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/29/94 — 11. DATE COMPLETED: 10/29/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: Not encountered
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 1.5 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	Explosives ✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
				Steven J. Susten

LOCATION SKETCH/COMMENTS — SCALE: NOT TO SCALE



PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTA-S18, S19, S20

HTRW DRILLING LOG

HOLE NUMBER: TNTA-S18

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown silty Sand w/ Roots + Gravel + Cobbles				Some Vegetation w/ Roots
	0.5	Cobbles Grade out				TNTA-S18-0.5/1.5 Sample collected @ 1735
		Brownish yellow silty Sand occasional Gravel				
	1.0	Gravel Grades out				
		Grades w/ occational Gray lenses	HNU=0			
	1.5	Boring Terminated @ 1.5 feet 1735				

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER TNTA-S19

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown Silty Sand w/ Gravel				Little Vegetation Some Roots
	0.5					Re-Bar
		Nails + Tarsite + other Building debris				
	1.0	Refusal @ 1.0 ft 16.44				
	1.5					

PROJECT Plum Brook Ordnance Works

HOLE NO.

4

HTRW DRILLING LOG

HOLE NUMBER: TNTA-S19

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown Silty Sand w/ Roots + Gravel				Some Vegetation + Root.
	0.5	Grades to Brownish yellow; Gravel Grades out				Sample TNTA-S19-0.5/1.5 Collected @ 1649
	1.0					
	1.5		HNU=0			
		Boring Terminated @ 1.5 feet 1649				
	2.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTA-S20

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown Silty Sand w/ Roots				Some Vegetation w/ Roots
	0.5	Grades to Brownish yellow w/ Occassional orange				Sample TNTA-S20-0.5/1.5 collected @ 1700
	1.0	--thin layer of construct debris				
	1.5		HNU=0			
		Boring Terminated @ 1.5 ft 1700				

PROJECT: Plum Brook Ordnance Works

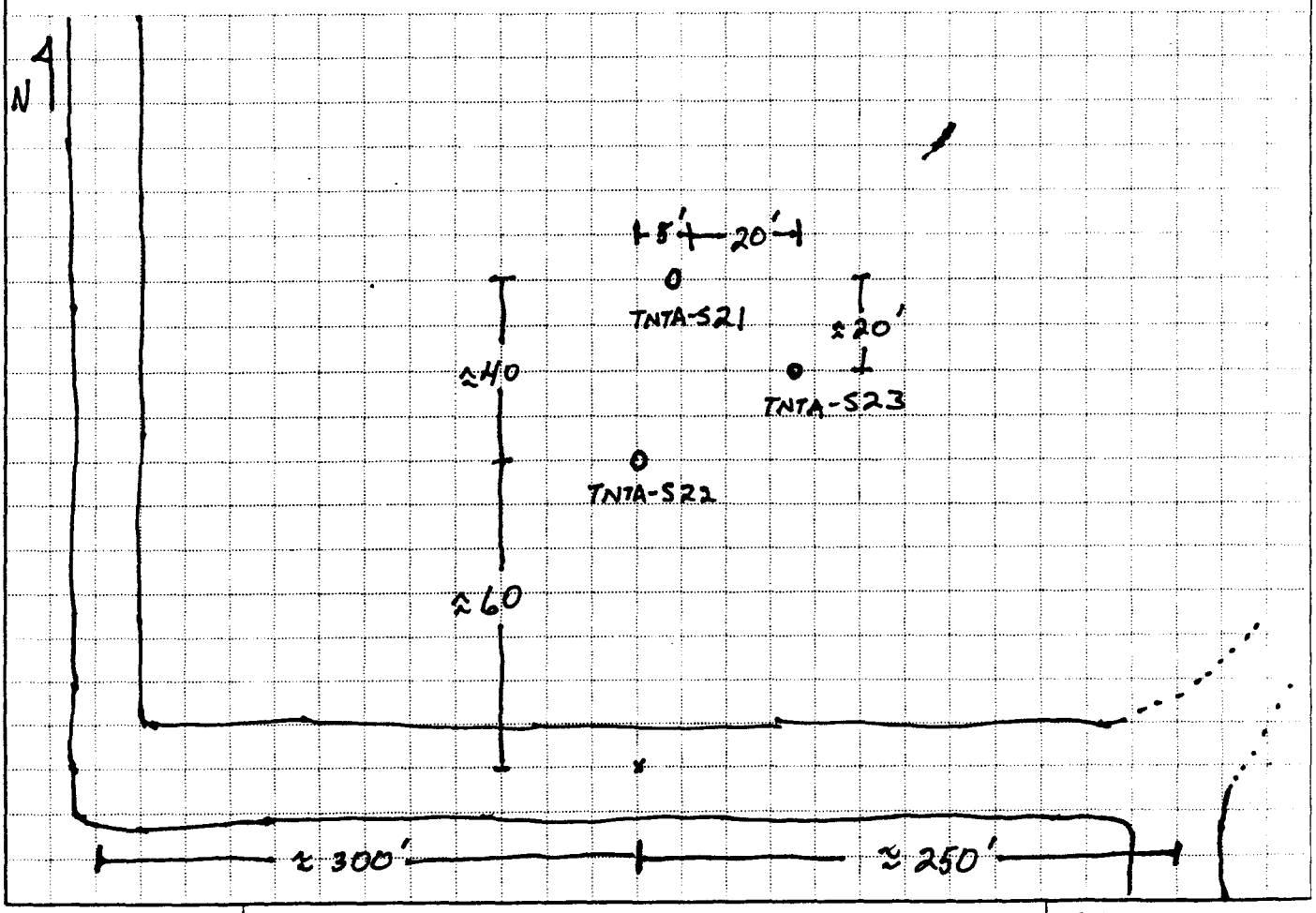
HOLE NO.

HTRW DRILLING LOG

1. COMPANY NAME	Dames & Moore
2. DRILLING SUBCONTRACTOR	
HOLE NUMBER	
SHEET	1 OF 2 SHEETS
3. PROJECT	Plum Brook Ordnance Works
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	STEVE SUSTEN
6. MANUFACTURER'S DESIGNATION OF DRILL	N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	HAND Auger
8. HOLE LOCATION	TNT. Area A
9. SURFACE ELEVATION	N/A
10. DATE STARTED	10/29/94
11. DATE COMPLETED	10/29/94
12. OVERBURDEN THICKNESS	N/A
13. DEPTH DRILLED INTO ROCK	N/A
14. TOTAL DEPTH OF HOLE	2.0 feet
15. DEPTH GROUNDWATER ENCOUNTERED	NOT Encountered
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	N/A
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	N/A
18. GEOTECHNICAL SAMPLES	None
DISTURBED	---
UNDISTURBED	
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC / METALS ✓ / ~~OTHER (SPECIFY)~~ Explosives / OTHER (SPECIFY) / OTHER (SPECIFY)
21. TOTAL CORE RECOVERY	
22. DISPOSITION OF HOLE	BACKFILLED / MONITORING WELL / OTHER (SPECIFY)
23. SIGNATURE OF INSPECTOR	Steven Susten

LOCATION SKETCH/COMMENTS

SCALE: NOT TO SCALE



PROJECT	HOLE NO.
Plum Brook Ordnance Works	TNTA-S21 S22 S23

HTRW DRILLING LOG

HOLE NUMBER 7N7A-S21

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown silty fine sand				Some vegetation and roots
	0.5	Geodes to Dark Brown w/ Gravel				
		Auger Refusal @ 0.75 ft 1530				(original hole refusal) 1530
	1.0					
	1.5					
	2.0					

PROJECT Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTA-S21

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Same as original				
	0.5					
	1.0	Grades w/ less gravel				Sample TNTA-S21-0.0/2.0 collected @ 1535
		Gravel Grades out				
	1.5	Grades to Brownish orange w/ Trace clay				
	2.0		HNU=0			
		Boring Terminated @ 2 ft 1535				

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER TN77-522

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brownish yellow silty fine sand w/ Roots				Some Vegetation w/ Roots
	6.5					* Two lines 6" + 4"
		Tarsite Debris				
						original Boring Refusal @ 1355
	1.0					
	1.5					
	2.0					

PROJECT Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER TNTA-S22

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

A
B
C

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown silty fine Sand				Some vegetation w/ roots
		Gravel grades in				
	0.5					
		Grades to Brownish yellow w/ lots Gravel				Sample TNTA-S22-0.0/2.0 collected @ 1610
	1.0					
		Gravel grade out				
	1.5					
	2.0	Boring terminated @ 2 feet 1610				

PROJECT

HOLE NO.

Plum Brook Ordnance Works

HTRW DRILLING LOG

HOLE NUMBER: TNTA-S23

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brownish yellow w/ roots + organics				some Vegetation + root
		Brownish yellow silty fine sand				
	0.5					
		3 in layer				
	1.0	Grades to Brownish Dark Brown w/ gravel				
		Brownish yellow silty fine sand				Sample TNTA-S23-00/2.0 Collected @ 1519
	1.5					
			HNU=0			
	2.0	Boring Terminated @ 2 feet 1519				

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER	
1. COMPANY NAME	Dames & Moore
2. DRILLING SUBCONTRACTOR	
SHEET 1 OF 2 SHEETS	
3. PROJECT	Plum Brook Ordnance Works
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	STEVE SUSTEN
6. MANUFACTURER'S DESIGNATION OF DRILL	N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	HAND AUGER
8. HOLE LOCATION	TNT Area A
9. SURFACE ELEVATION	N/A
10. DATE STARTED	10/29/94
11. DATE COMPLETED	10/29/94
12. OVERBURDEN THICKNESS	N/A
13. DEPTH DRILLED INTO ROCK	N/A
14. TOTAL DEPTH OF HOLE	S24 - 3.0' S25 - 1.5' S26 - 1.5'
15. DEPTH GROUNDWATER ENCOUNTERED	Not encountered
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	N/A
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	N/A

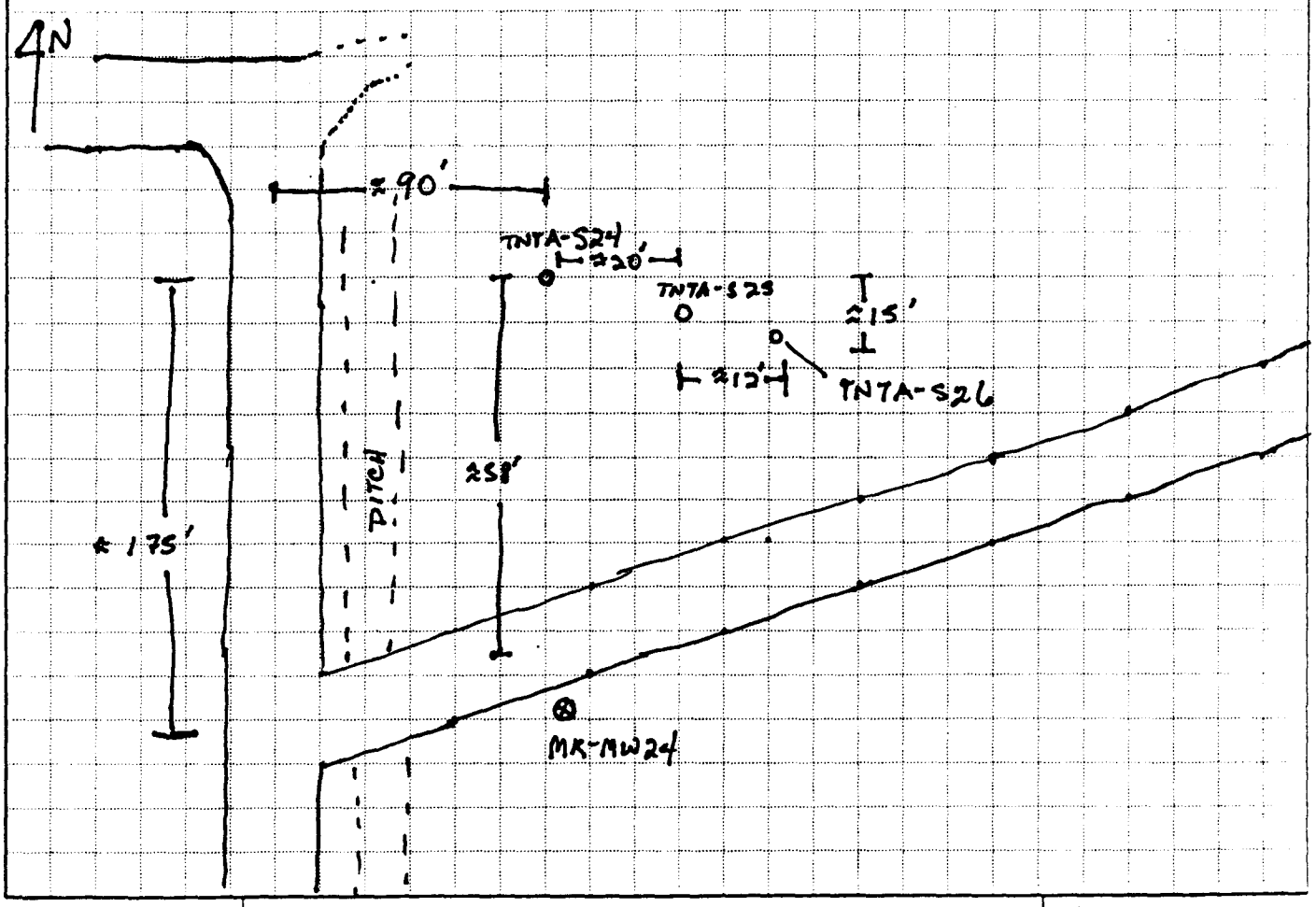
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	Explosives			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
				Steven Susten

LOCATION SKETCH/COMMENTS

SCALE: NOT to SCALE



PROJECT	HOLE NO.
Plum Brook Ordnance Works	TNTA - S24 S25 S26

HTRW DRILLING LOG

HOLE NUMBER: TNTA-S24

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown Silty Fine Sand	HNU=0			Some vegetation @ Surface w/ some roots
	0.5					Sample TNTA-S24-00/1.5 collected @ 1200
	1.0	Grades w/ Brick Fragments and other gravel				
	1.5	Grades to Tonish Brown Gravel Grades out	HNU=0			Samples TNTA-S24-1.5/3.0 TNTA-S30-1.5/3.0 TNTA-S30-1.5/3.0-S collected @ 1207
	2.0					
	2.5					
	3.0	Grades w/ Brownish yellow	HNU=0			
		Boring terminated @ 3.0 feet				1207

PROJECT: Plum Brook Ordnance Works

HOLE NO.

A

HTRW DRILLING LOG

HOLE NUMBER TNTA-S25

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown silty fine Sand				Some Vegetation @ Surface and Some Roots
	0.5	Grades w/ Gravel and Brick Fragments				Sample TNTA-S25-0.0/1.5 Collected @ 1234
	1.0	Gravel layer ≈ 3in				
		Gravel Grades out Grades to Brownish Tan	HNU=0			
	1.5	Boring Terminated @ 1.5 feet 1234				

PROJECT Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER TW7A-S26

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown silty fine Sand				Some Vegetation on surface w/ some Roots
		Gravel Grades in				
	0.5					Sample TW7A-S26-00/1.5 collected @ 1250
		Color Grades to Brownish tan				
	1.0					
			1/NO =			
	1.5	Boring terminated @ 1.5 ft 1250				

PROJECT Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER PB-TNTA-531

PROJECT Plum Brook Ordnance Works

INSPECTOR WS/ES 1715

SHEET 1 OF 1 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		olive gray fine sandy clay				
	.5					
		as above, with dark gray mottling and some shale				
	1.0					

PROJECT Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-TNTA-S32

PROJECT: Plum Brook Ordnance Works

INSPECTOR: WS/ES 1645

SHEET 1 OF 1 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		olive gray silty clay				
		[Typha roots]				
	.5	Brown V sandy clay fine				
		brown fine sandy clay with grey mottling				
	1.0	olive gray silty clay				

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-TNTB-S1→4

SHEET 1 OF SHEETS

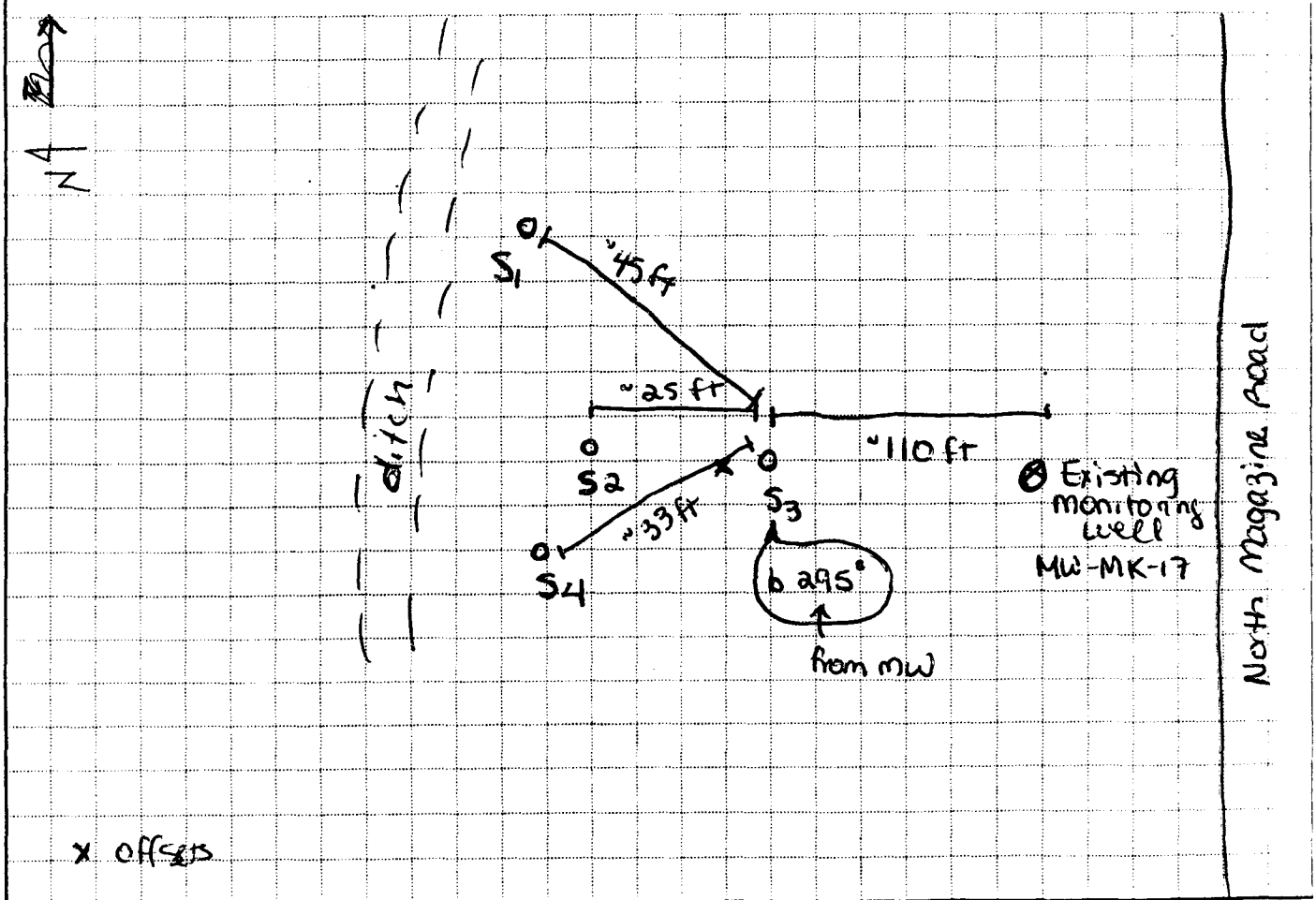
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVE SUSTEN/LYNN BOROWSKI	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: STAINLESS STEEL HAND AUGER	8. HOLE LOCATION: TNT AREA B
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10/14/94 — 11. DATE COMPLETED: 10/19/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: S1→ ≈ 2 ft NOT ENCOUNTERED IN OTHER HOLES
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: S1→3.0 ft S2→2.5 ft S3→2.0 ft S4→1.5 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
FOR EACH HOLE		✓	Explosives ✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
GROUTED				S. Susten

LOCATION SKETCH/COMMENTS — SCALE: NOT TO SCALE



PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNT B - S1, S2, S3, S4

HTRW DRILLING LOG

HOLE NUMBER: TNTB-S1

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown sandy clay with lots of shale	0 ppm			dried tall grass at surface many roots worms
	0.5	brownish-yellow flecks				soil is moist
		dark grey mottling lots of shale, roots				sample TNTB-S1 - 0.0/1.5 collected at 1520
	1.0	grades to dark gray flecks continue				
		shiny black chunks large chunks of shale continue				
	1.5					
	2.0	(water) saturated sandy Clay and shale				sample is wet slides through barrel
		shale layer begins (no soil; shale at [redacted])				sample ~~TNTB-S1~~ - 1.5/3.0 collected at 1540
	2.5					soil slides through barrel
	3.0	Auger refusal at 3 feet Boring terminated at 3.0 feet on 10/14/94	0ppm			
	3.5					
	4.0					
	4.5					
	5.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO. TNTB-S1

HTRW DRILLING LOG

HOLE NUMBER

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown clayey sand with roots and shale				grassed at surface
	0.5	red flecks slag				lg roots
	1.0	yellow color on some of the shale				sample TNTB-S2-0.0/1.0 collected at 0956
		~~Gray clay gradation~~ Gray shale increases also some coal				
	1.5	slag continues				turning is difficult worms
	2.0					sample TNTB-S2-1.0/2.5 collected at 1003 auger hitting rock
	2.5	auger refusal at 2.5 feet Boring terminated on 10/19/94	2ppm			

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-S2

HTRW DRILLING LOG

HOLE NUMBER

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown Clayey sand with orange flecks shale and roots some slag				grassed at surface
	0.5	auger refusal at 0.4 feet - boring offset				
	1.0					
	1.5					

PROJECT Plum Brook Ordnance Works

HOLE NO. TNTB-53

HTRW DRILLING LOG

PROJECT	INSPECTOR	HOLE NUMBER / SHEET OF SHEETS
Plum Brook Ordnance Works		

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown clayey fine sand with roots and shale				Some grass at surface ~~worm~~
	0.5	streaks of orange-red				Sample TNTB-S3-0.0/1.0 collected at 1025
	1.0	huge chunk of slag				
	1.5	soil becomes mostly shale	1.5 ppm			Sample TNTB-S3-1.0/2.0 collected at 1030
	2.0	auger refusal at 2ft Boring terminated at 2ft on 10/19/94				
	2.5					

PROJECT	HOLE NO.
Plum Brook Ordnance Works	TNTB-S3A

HTRW DRILLING LOG

HOLE NUMBER

PROJECT: Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown clay with some sand and lots of shale				grassed at surface roots
	0.5	reddish streaks slag grey mottling				sample TNTB-S4-0.0/1.0 collected at 1048
	1.0	shale increase				hard turning
		color grades to brown - shale (outside) is reddish				sample TNTB-S4-1.0/1.5 collected at 1057
	1.5	auger refusal at 1.5 feet - Boring terminated 10/19/94	4ppm			
	2.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO. TNTB-S4

HTRW DRILLING LOG

HOLE NUMBER: PB-TNTB-S5→7

SHEET 1 OF SHEETS

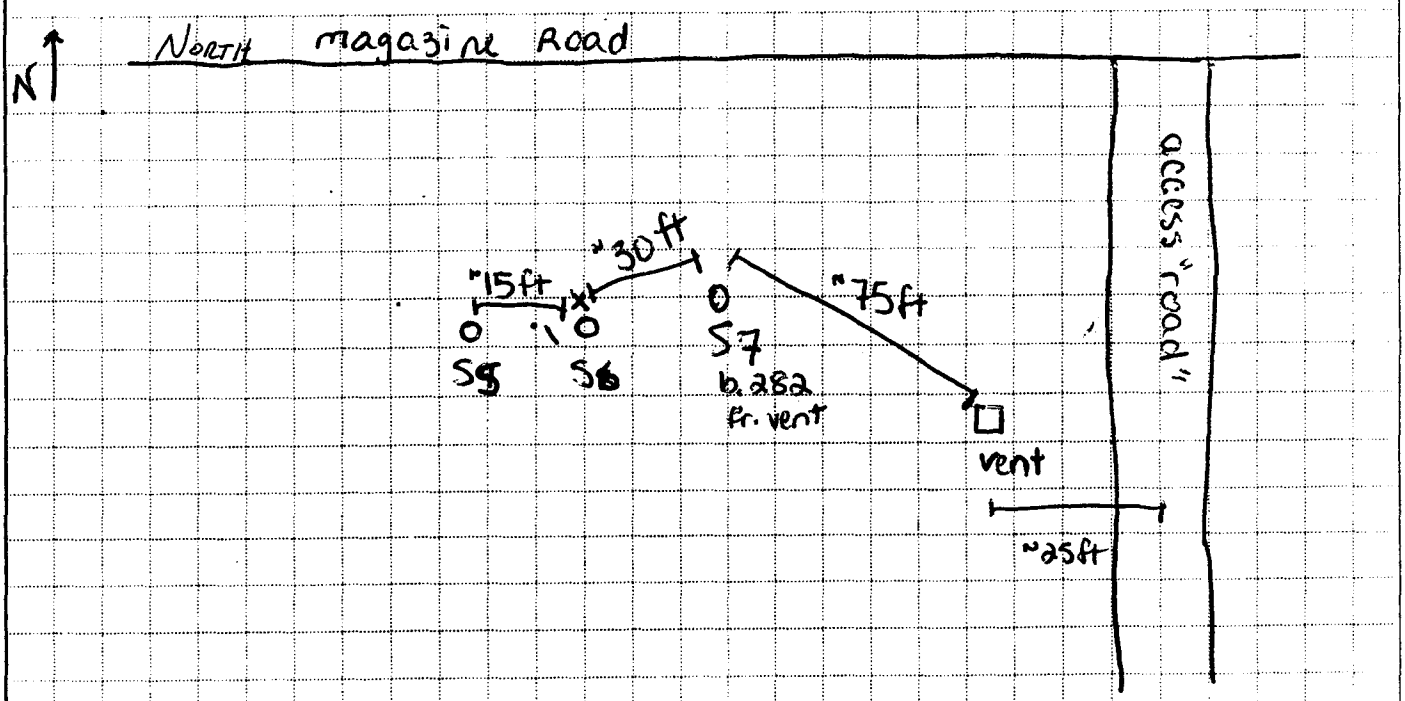
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVE SUSTEN / LYNN BOBOWSKI	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: STAINLESS STEEL HAND AUGER	8. HOLE LOCATION: TNT AREA B
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/15/94 — 11. DATE COMPLETED: 10/15/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: S5→3.0 ft S6→3.5 ft S7→3.5 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
FOR EACH HOLE		✓	Explosives			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
GROUTED				S. Susten

LOCATION SKETCH/COMMENTS — SCALE: NOT TO SCALE



PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-S5 S6 S7

HTRW DRILLING LOG

HOLE NUMBER: TNTB-S5

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown fine sand with some silt				heavily vegetated at surface some gravel roots
	0.5					
	1.0	some gravel small black flecks (coal?) auger refusal at 1 foot Offset boring				small chunk of concrete roots
	1.5					
	2.0					
	2.5					
	3.0					
	3.5					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-S5

HTRW DRILLING LOG

HOLE NUMBER: TNTB-55A

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0.0	Brown silty fine sand				heavily vegetated roots some gravel
	0.5	grades to light brown				
	1.0	small black pieces of coal(?)				
	1.5	grades to dark brown coal continues some brownish-yellow flecks				sample TNTB-55 1.0/2.0 collected at 1007
	2.0	grades to light brown				
	2.5	grades with clay brownish yellow flecks continue mottled with grey + orangish brown, shale				sample TNTB-55 2.5/3.0 collected at 1021
	3.0	Hand auger refusal at 3.0 feet on 10-15-94 shale present				
	3.5					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-55A

HTRW DRILLING LOG

HOLE NUMBER: TNTB-56

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Light brown silty fine sand				
	0.5					
	1.0	some gravel and orangeish flecks	RD ~~0~~ ppm ~~0~~	needle deflection when HNU turned on RD		
		auger refusal at 1.25 feet				
	1.5	boring offset				
	2.0					
	2.5					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-56

HTRW DRILLING LOG

HOLE NUMBER: TNTB-S6A

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		similar soils to first boring				
	0.5					
	1.0	Light brown silty sand some shale				sample TNTB-S6-1.0/2.0 collected at 1103
		orange flecks				
	1.5	grades to dark brown with some clay				
		shale continues				
	2.0					
		orange flecks continue				
	2.5	gravel				sample TNTB-S6-2.5/3.5 collected at 1113
		construction debris? (nails, white fluffy stuff)				
	3.0					
		Dark brown clayey sand some orange flecks				
	3.5	wood (flume?)				
		Boring terminated at 3.5 feet on 10/15/94				

PROJECT: Plum Brook Ordnance Works

HOLE NO. TNTB-S6A

HTRW DRILLING LOG

HOLE NUMBER: TNTB-57

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown silty sand	0ppm			grassed at surface
	0.5					
	1.0	some gravel and shale				sample TNTB-57-1.0/2.0 collected at 1144
	1.5		0ppm			
	2.0	grades to dark brown with orange flecks				
	2.5	some shale present				sample TNTB-57-2.5/3.5 collected at 1153
	3.0	shale continues clay grades in				
		Dark brown sandy clay with orange streaks				
	3.5	Boring terminated at 3.5 feet on 10/15/94	0ppm			

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-57

HTRW DRILLING LOG

HOLE NUMBER: PB-TNTB-S8→13

SHEET 1 OF SHEETS

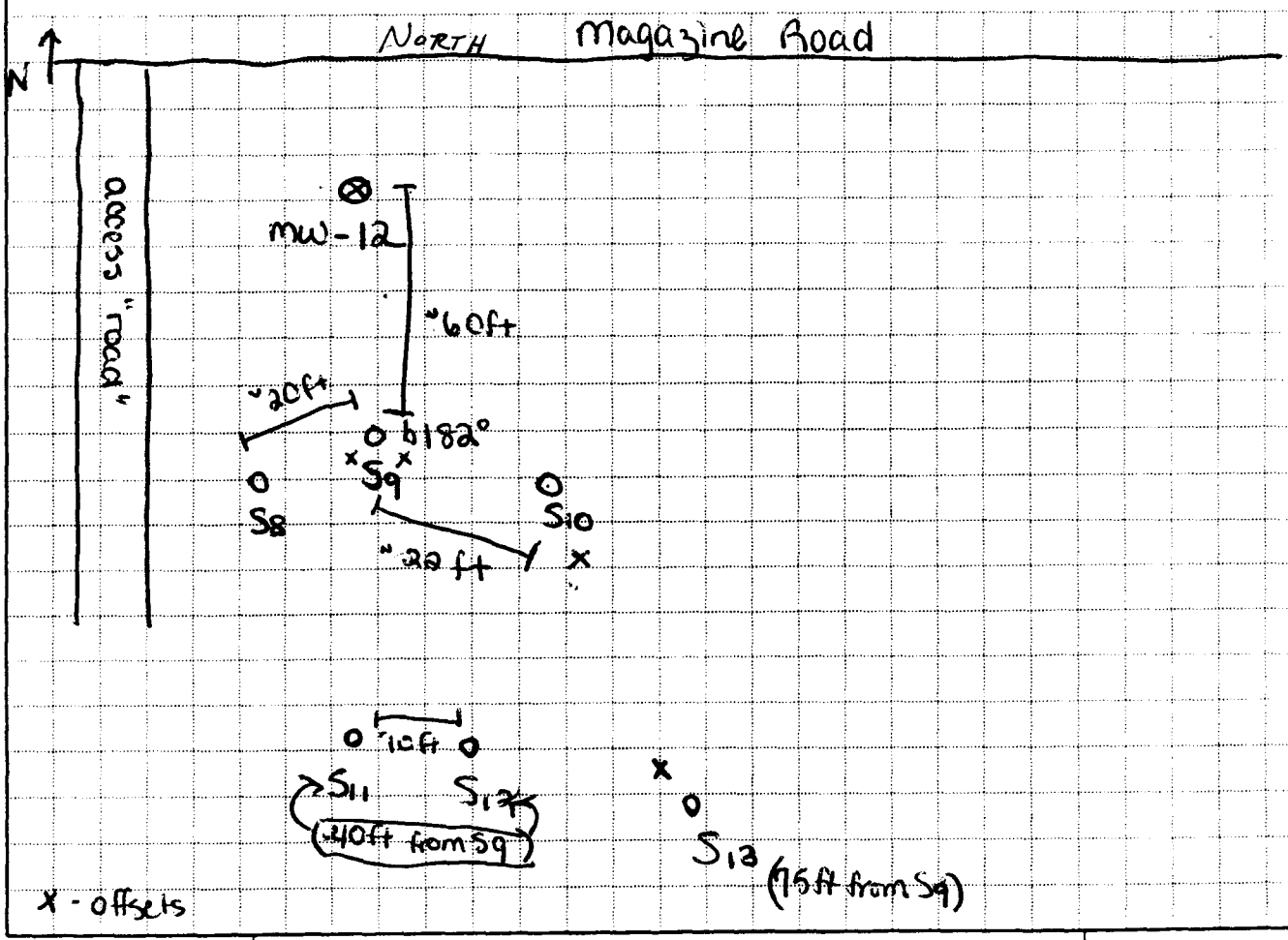
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVE SUSTEN / LYNN BOROWSKI	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: STAINLESS STEEL HAND AUGER	8. HOLE LOCATION: TNTB AREA B SOUTH OF NORTH MAGAZINE Rd
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/15/94 — 11. DATE COMPLETED: 10/15/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: N/A NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: S8→3.0 ft S9→2.75 ft S10→2.5 ft S11→3.5 ft S12→2.0 ft S13→2.0 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
FOR EACH HOLE	-	✓	✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
GROUTED				S. Susten

LOCATION SKETCH/COMMENTS — SCALE: NOT TO SCALE



PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB- S8, S9, S10, S11, S12, S13

HTRW DRILLING LOG

HOLE NUMBER: TNTB-S8

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty sand with some clay				grassed at surface
	0.5	grades to brown				
		some shale and gravel				
	1.0	some orange streaks clay grades in light grey and orange mottling				
	1.5					
	2.0					
	2.5	soil grades to dark brown, mottling continues				sample TNTB-S8-2.5|30 collected at 1450 worms
	3.0	lots of shale auger refusal at 3.0 feet Boring terminated	0ppm			
	3.5					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-S8

HTRW DRILLING LOG

HOLE NUMBER

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty sand	0ppm			grassed at surface roots
	0.5					
		grades to brown some shale				
	1.0					
	1.5					
		lt. gray and orange mottling				roots (larger)
	2.0	~~auger refusal at~~ HB				
	2.5	auger refused at 2.5 feet offset	0ppm			
	3.0					
	3.5					

PROJECT: Plum Brook Ordnance Works

HOLE NO. TNTB-S9

HTRW DRILLING LOG

HOLE NUMBER

PROJECT: Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty sand with some clay and shale				
	0.5	orange and red flecks				
	1.0	shale continues				
	1.5					
	2.0	orange and dark gray mottling				
	2.5	lots of shale				
	3.0	auger refusal at 2.75 feet offset boring	0ppm			
	3.5					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-59 A

HTRW DRILLING LOG

HOLE NUMBER: TNTB-S9B

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty sand	0ppm			
	0.5					
		some shale				
	1.0	grades to brown with orange flecks				
	1.5	orange and light gray mottling, pieces of shale ↑ (weathered shale)				sample TNTB-S9-1.5/2.7 collected at 1541
	2.0					
	2.5		0ppm			
		auger refusal at 2.7 ft Boring terminated 10/15/94				
	3.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-S9B

HTRW DRILLING LOG

HOLE NUMBER: TNTB-S10

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty sand with some clay				grassed at surface lots of roots
		some shale				
	0.5	Dark brown clayey sand with orangeish and grey ~~mot~~ streaks				
	1.0	orange and grey mottling				
	1.5	grades to brown				sample TNTB-S10-1.5/2.5 collected at 1605
		orange band				
	2.0					shale present
						↑soil is loose hard turning
	2.5	auger refusal at 2.5 feet				
	3.0	Boring terminated 10/15/94				
	3.5					

PROJECT: Plum Brook Ordnance Works

HOLE NO. TNTB-S10

HTRW DRILLING LOG

HOLE NUMBER: TNTB-S11

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty sand	0ppm			
		grades to brown				
	0.5	grades to dark brown				
		clay grades in orange flecks with some brown & gray mottling				
	1.0	grades to olive gray				
		orange mottling continues/increases				
	1.5	color grades to gray				
	2.0					turning is harder
	2.5	lt. gray streaks				sample TNTB-S11-2.5|3.5 collected at 1626
	3.0					splits taken (TNTB-S27)
	3.5	grades to brown				
		Boring terminated at 3.5 feet on 10/15/94				

HTRW DRILLING LOG

HOLE NUMBER: TNTB-S12

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty sand				
	0.5	some shale				turning difficult
	1.0	grades to brown with orange and gray mottling				turning is difficult
	1.5					sample TNTB-S12-1.0/2.0 collected at 1645
	2.0	Boring terminated at 2 feet on 10/15/94				

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-S12

HTRW DRILLING LOG

HOLE NUMBER: TNTB-313

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty sand				
		Some gravel/shale				
	0.5					
	1.0	wood	4ppm			
		auger refusal at 1.0 foot				
		boring offset				
	1.5					
	2.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO. TNTB-313

HTRW DRILLING LOG

HOLE NUMBER: TNTB-S13A

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET: OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty sand				heavily vegetated at surface
	0.5					
	1.0	grades to gray with orange-brown streaks				roots and gravel
	1.5					sample TNTB-S13-1.0/2.0 collected at 1707
	2.0	Boring terminated at 2.0 feet on 10/5/94				(wood from first boring included in this sample)

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-S13 A

HTRW DRILLING LOG

HOLE NUMBER: PB-7N7B-S14→17

SHEET 1 OF SHEETS

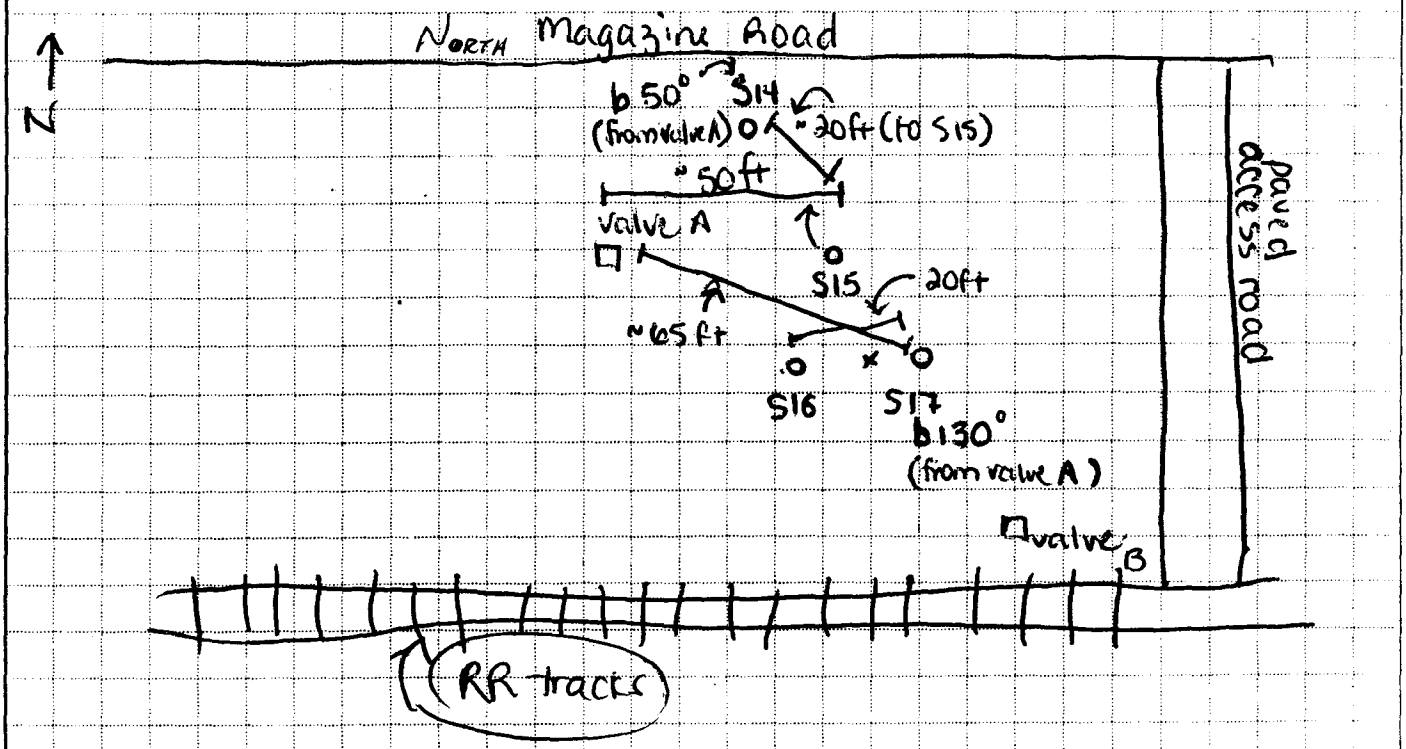
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVE SUSTEN / LYNN BOROWSKI	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: STAINLESS STEEL HAND AUGER	8. HOLE LOCATION: TNT AREA B SOUTH OF N. MAGAZINE Rd.
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/15/94 — 11. DATE COMPLETED: 10/16/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: N/A NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: S14→2.0 ft S15→2.0 ft S16→2.0 ft S17→1.5 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
FOR EACH HOLE		✓	Explosives			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
GROUTED				S. Susten

LOCATION SKETCH/COMMENTS — SCALE: NOT TO SCALE



PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB- S14, S15, S16, S17

HTRW DRILLING LOG

HOLE NUMBER TNTB-S14-0.0/2.0

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Grasses/weeds				
		Dark brown silty fine sand with roots				
		grades to brown				
	0.5	pieces of coal				Sample TNTB-S14-0.0/2.0 Collected at 1755 on 10-15-94
	1.0	yellowish red ~~brown~~ streaks				
	1.5	" " "	HNu= 0ppm			
		" " "				
		grades to light brown				
	2.0	Boring terminated at 2.0 feet on 10-15-94				

PROJECT Plum Brook Ordnance Works

HOLE NO. TNTB-S14-0.0/2.0

10/15/94

HTRW DRILLING LOG

HOLE NUMBER: TNTB-S14

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Grasses/ weeds at surface				
	0.1	Dark brown silty fine sand with roots				
	0.2					
	0.3					
	0.4					
	0.5					
	0.6					
	0.7					
	0.8					
	0.9					
	1.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO. TNTB-S14-

10/15/94

HTRW DRILLING LOG

HOLE NUMBER: TNTB-S15

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Grass/weeds				
	0.5	Dark brown silty fine sand with pieces of coal and roots	HNu = 0 ppm			Sample TNTB-S15-0.0-2.0 collected at 1808 on 10/15/94
	1.0					
	1.5	pieces of wood and gravel (≈ 2" x 1")				
	2.0	grades to gray				

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-S15

10/15/94

HTRW DRILLING LOG

HOLE NUMBER: TNTB-S16

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown silty fine sand with some gravel and shale				grassed at surface lots of roots
	0.5	auger refusal at 6 inches offset boring				
	1.0					
	1.5					
	2.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-S16

HTRW DRILLING LOG

HOLE NUMBER: TNTB-S16A

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET: OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown silty fine sand with roots				
	0.5	brown-orange mot				
		auger refusal at 6 inches (0.5 feet)				
	1.0	offset boring				
	1.5					
	2.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-S16 A

HTRW DRILLING LOG

HOLE NUMBER: TNTB-S16B

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown silty fine sand some gravel				grassed at surface roots
	0.5					
	1.0	grades to brownish-yellow				Sample TNTB-S16-0.0/2.0 Collected at 0950
	1.5					
	2.0	Boring terminated at 2 feet on 10/16/94	6ppm			

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-S16B

HTRW DRILLING LOG

HOLE NUMBER: TNTB-S17

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Light Brown to Brown Silty Fine Sand with roots	HNU 2ppm			Sample Interval 0-1.5' at 1805 Sample TNTB-S17-0.0/1.5
	1					
	2					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-S17

10/15/94

HTRW DRILLING LOG

HOLE NUMBER: PB-TNT B-S18→20

SHEET 1 OF 1 SHEETS

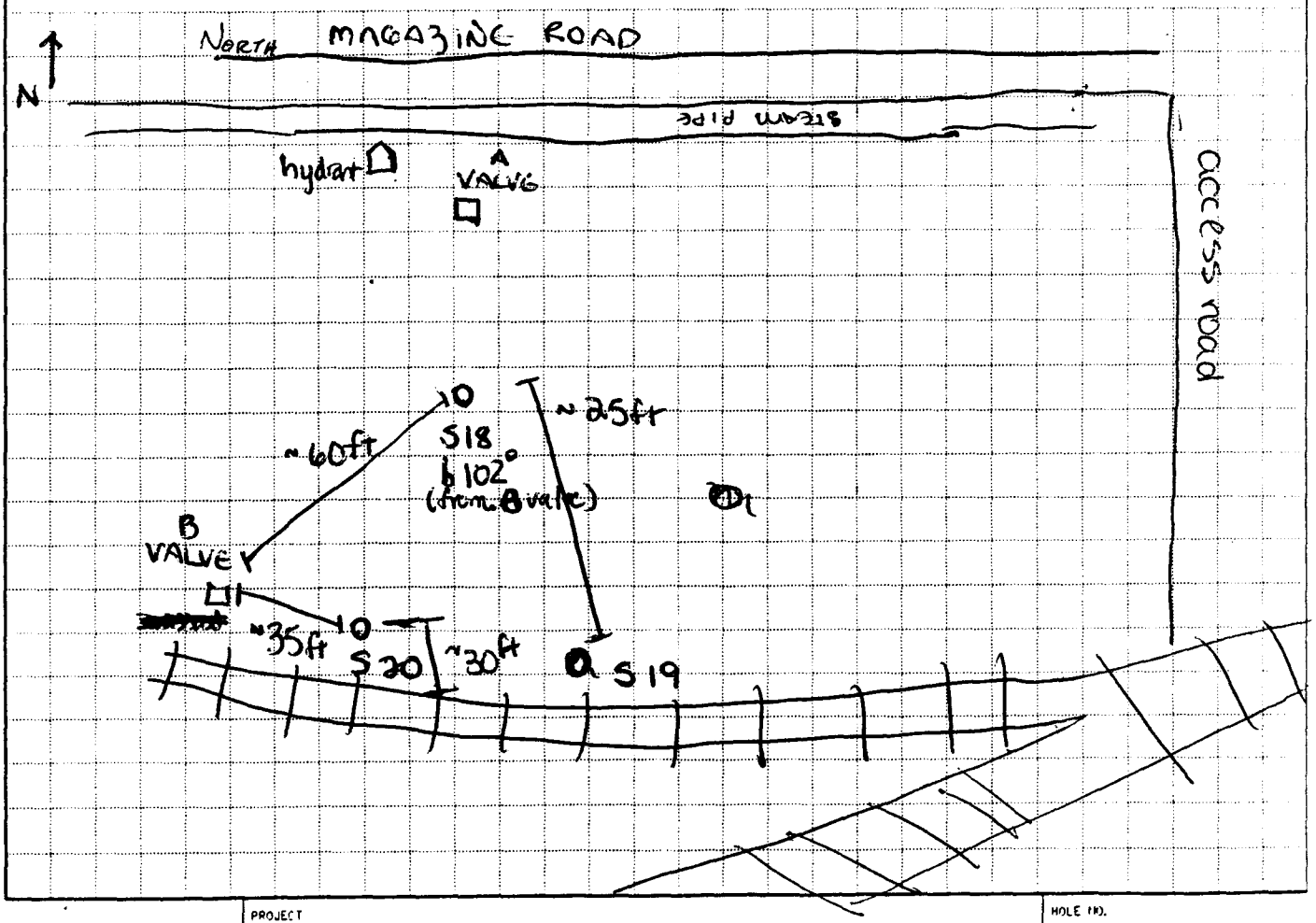
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVE SOSTEN / LYNN BOROWSKI	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: STAINLESS STEEL HAND AUGER	8. HOLE LOCATION: TNT AREA B SOUTH OF NORTH MAGAZINE Rd.
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/16/94 — 11. DATE COMPLETED: 10/16/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: S18 → 1.6 ft S19 → 2.0 ft S20 → 1.5 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
FOR EACH HOLE		✓	Explosives ✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
GROUTED				S. Sosten

LOCATION SKETCH/COMMENTS — SCALE: NOT TO SCALE



PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-S18 S19 S20

HTRW DRILLING LOG

HOLE NUMBER: TNTB-S18

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET: OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown silty fine sand with red flecks				grassed at surface many roots
	0.5					0.5
		grades to brownish-yellow				sample TNTB-S18-0.5/1.5 collected at 1012
	1.0					1.0
						turning is difficult
	1.5	color grades to dark brown with band of light brown				1.5
			0ppm			
	2.0	Boring terminated at 1.6 feet on 10/16/94				2.0
						split taken of this sample

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-S18

HTRW DRILLING LOG

HOLE NUMBER: TNTB-S19

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET: OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty fine sand with some shale				grassed at surface roots
	0.5	color grades to brown with gravel red flecks color grades to brown-yellow				roots
	1.0					sample TNTB-S19-0.5/2.0 collected at 1038
	1.5	gravel grades out				
	2.0	~~gravel~~ as crush refusal at 2 feet (concrete) Boring terminated on 10/16/94				

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-S19

HTRW DRILLING LOG

HOLE NUMBER: TNTB-S20

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty fine sand lg gravel and shale				roots - grass at surface
		color grades to brown shale gravel continue				
	0.5	color grades to light brown				
						sample TNTB-S20-0.5/1.3 collected at 1046
	1.0					
		gravel grades out				
	1.5	Boring terminated at 1.5 feet on 10/16/94	0ppm			
	2.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO. TNTB-S20

HTRW DRILLING LOG

HOLE NUMBER: PB-TNTB-S21→23

SHEET 1 OF ___ SHEETS

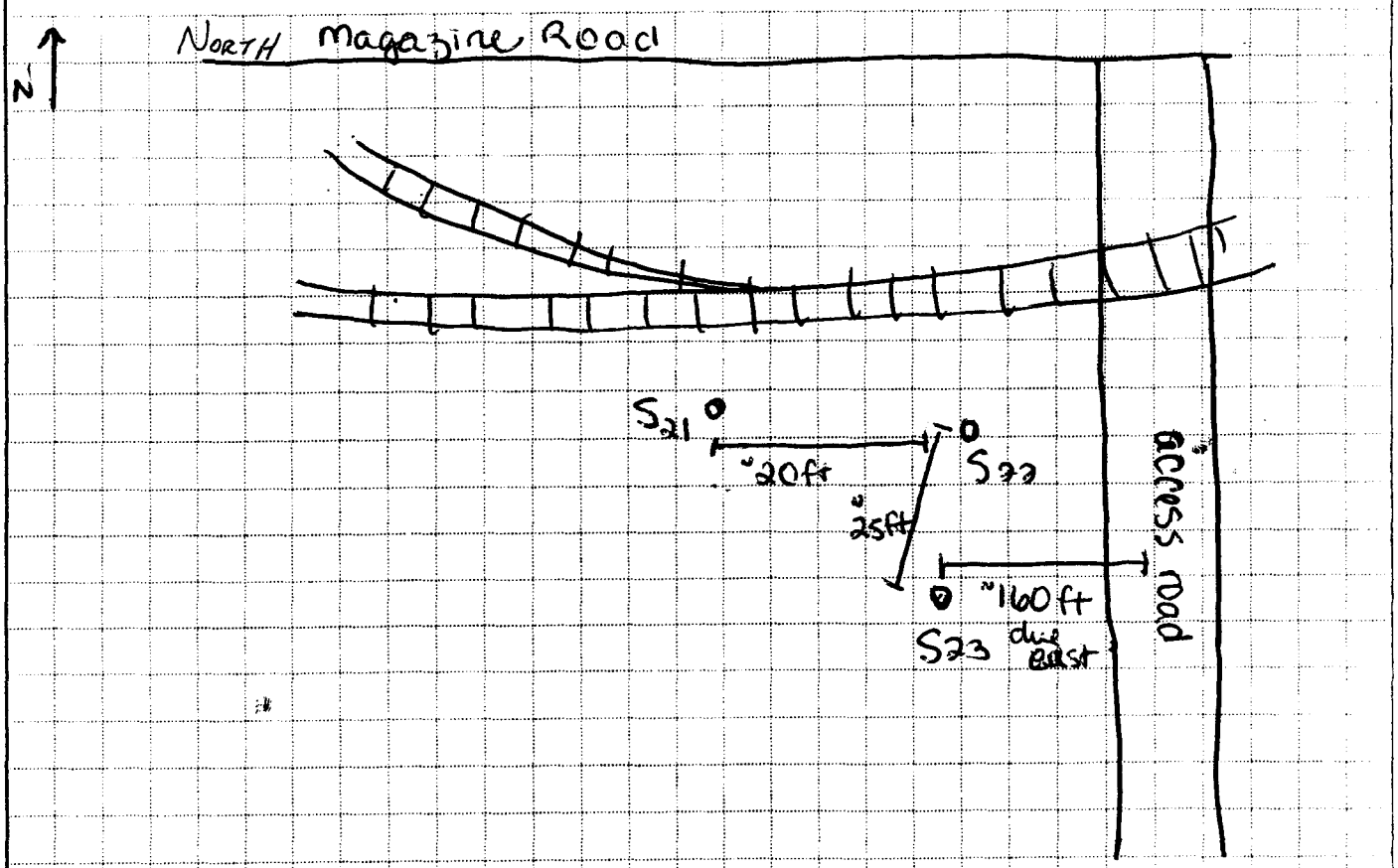
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Steve Sosien / Lynn Borowski	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Stainless Steel Hand Auger	8. HOLE LOCATION: TNT Area B South of North Magazine Rd.
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/16/94 — 11. DATE COMPLETED: 10/16/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: Not Encountered
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: S21 → 20 ft S22 → 2.2 ft S23 → 2.0 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
For Each Hole	-	✓	Explosives ✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grouted				S. Sosien

LOCATION SKETCH/COMMENTS — SCALE: Not To Scale



PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-S21, S22, S23

HTRW DRILLING LOG

HOLE NUMBER: TNTB - S21

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET: OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty fine sand				roots
	0.5	auger refusal at 0.5 foot boring offset				
	1.0					
	1.5					
	2.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-S21

HTRW DRILLING LOG

HOLE NUMBER TNTB-S21 A

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty fine sand				grassed cut surface/roots grubs
	0.5	grades to yellowish red at 0.5 feet				with small gravel
	1.0					sample TNTB-S21-0.0/2.0 collected at 1119
	1.5					
	2.0	Boring terminated at 2 feet on 10/16/94				
						split taken of this sample

PROJECT Plum Brook Ordnance Works

HOLE NO. TNTB-S21 A

HTRW DRILLING LOG

HOLE NUMBER: TNTB 32R

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty soil				grass covered surface
	0.5					
		auger refusal (auger bent - bypass repair?)				
	1.0	Boring offset				
	1.5					

PROJECT: Plum Brook Ordnance Works

HOLE NO. TNTB 32R

HTRW DRILLING LOG

HOLE NUMBER: TNTB 522A

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty sand				grass cut surface 1615
	5	grades to brown with some gravel ~~[illegible]~~				sample TNTB 522 [illegible] collected 1142
	10	wet coal rock	0 ppm			
	15	wet gray clay				
	20	clay gradation [illegible]				

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB 522A

HTRW DRILLING LOG

HOLE NUMBER TNTD S23

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown silty sand with roots				glass on surface
	0.5	angi refusal at 0.6 feet - moving offset				
	1.0					
	1.5					
	2.0					

PROJECT Plum Brook Ordnance Works

HOLE NO. TNTD S23

HTRW DRILLING LOG

HOLE NUMBER: TMTB 523A

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty sand				grassed w/ some roots
		color gradation brown				
	0.5					
						Sample TMTB 523 0.0/0.5 collected 1157
	1.0	gravel and [illegible]				
		clay gradation				
	1.5					
		clay gradation				
	2.0	[illegible]				
		[illegible]				

PROJECT: Plum Brook Ordnance Works

HOLE NO. TMTB 523A

HTRW DRILLING LOG

HOLE NUMBER: PB-TNTB-S24→26

SHEET 1 OF ___ SHEETS

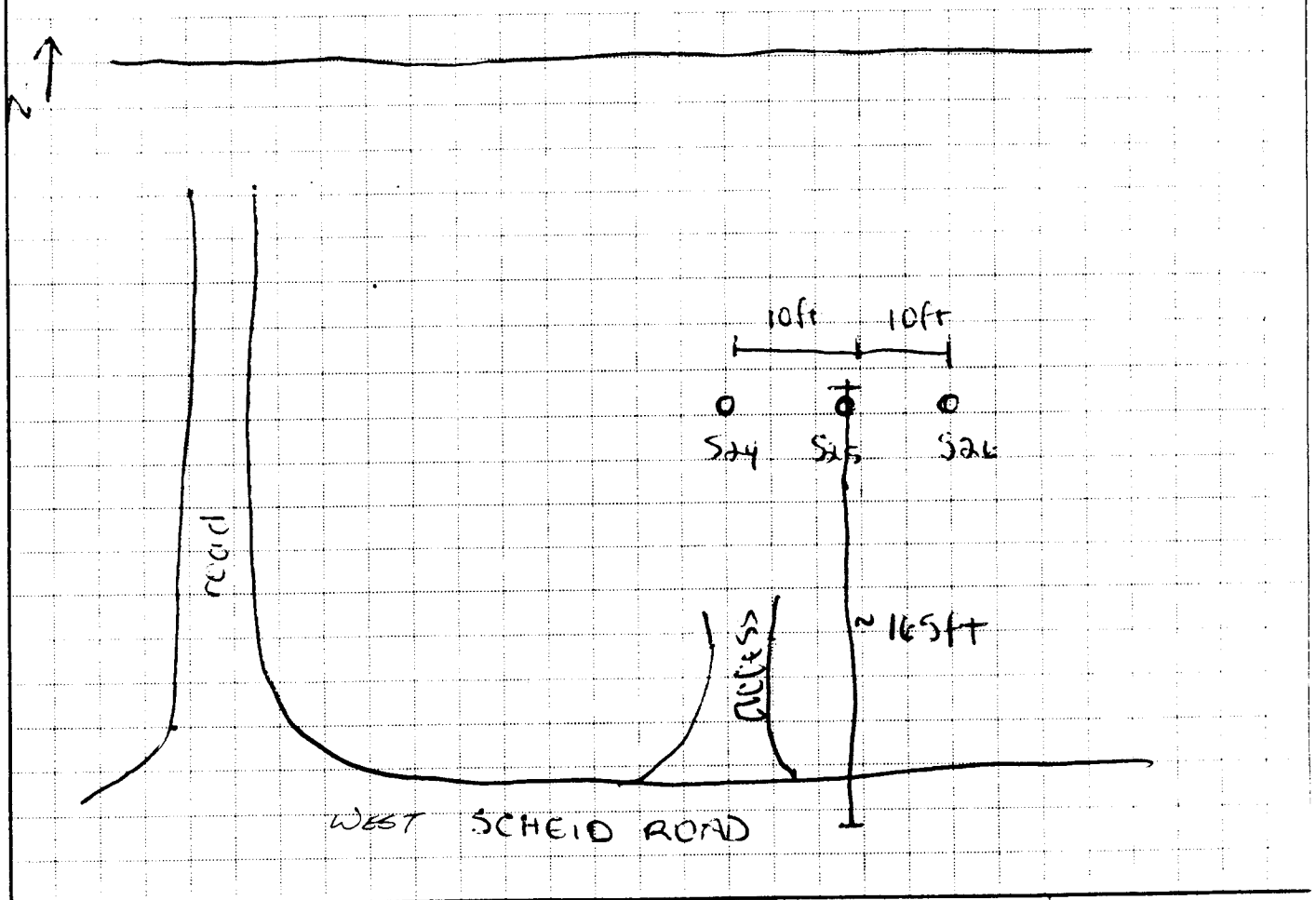
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Steve Susten / Lynn Borowski	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Stainless Steel Hand Auger	8. HOLE LOCATION: TNT Area B North of West Scheid Road
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/16/94 — 11. DATE COMPLETED: 10/16/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: Not Encountered
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: S24 → 3.0 ft, S25 → 1.0 ft, S26 → 3.5 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
For Each Hole	-	✓	Explosives ✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
GROUTED				S. Susten

LOCATION SKETCH/COMMENTS — SCALE: Not To Scale



PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB S24 S25 S26

HTRW DRILLING LOG

HOLE NUMBER TNTB-S24

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty fine sand with roots (Ig)				bare surface but trees/brush nearby
	0.5	gradus with pieces of tan silty sand				
	1.0	flecks of lt gray auger refused at 1 foot, offset boring				
	1.5					
	2.0					
	2.5					
	3.0					

PROJECT Plum Brook Ordnance Works

HOLE NO. TNTB-S24

HTRW DRILLING LOG

HOLE NUMBER: TNTB 534 A

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty fine sand with roots				trees
	0.5	gravel shale				sample TNTB-534 0.0/1.5 collected at 1420
	1.0	gravel to brown				
	1.5	orange ~~red~~ flecks and light gray silt				
	2.0					sample TNTB-534-1.5/3.0 collected at 1440
	2.5	clay gravel mixed brown and yellow				
	3.0	gravel to dark brown	6.1 ppm			
		Boring terminated at 3 feet on 10/10/91				

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB 534 A

HTRW DRILLING LOG

HOLE NUMBER: TNTB 525

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty fine sand				No vegetation present at site
	0.5	gravel and shale grades to bricks				sample TNTB-525-C/10 collected at 1455
	1.0	clay grades to bricks/building debris				
		cinder refusal at 1 feet				
		Boring terminated at 1 feet on 10/10/94				
	1.5					

PROJECT: Plum Brook Ordnance Works

HOLE NO. TNTB-525

HTRW DRILLING LOG

HOLE NUMBER: TNTB-S2K

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET: OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty fine sand with lots of gravel				no vig rather foul smell
	0.5	gradation brown clay gradation (gray in color)				sample TNTB S2K 0.0/1.5 collected at 1515
		gravel gradation				
	1.0	reddish brown streaking light gray crystals in streaks				
	1.5	crystal color turns to greenish-yellow				slight sulfur odor
	2.0					(kept chunks of crystal containing soils in separate glass vial)
	2.5					
		crystals gradation				
	3.0	Dark brown sandy clay with gray mott				
	3.5	Bentonite mineral at 3.5 feet on 10/16/94	6 ppm			distinct sulfur odor

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTB-S2K

HTRW DRILLING LOG

HOLE NUMBER: TNTC-S

SHEET 1 OF 2 SHEETS

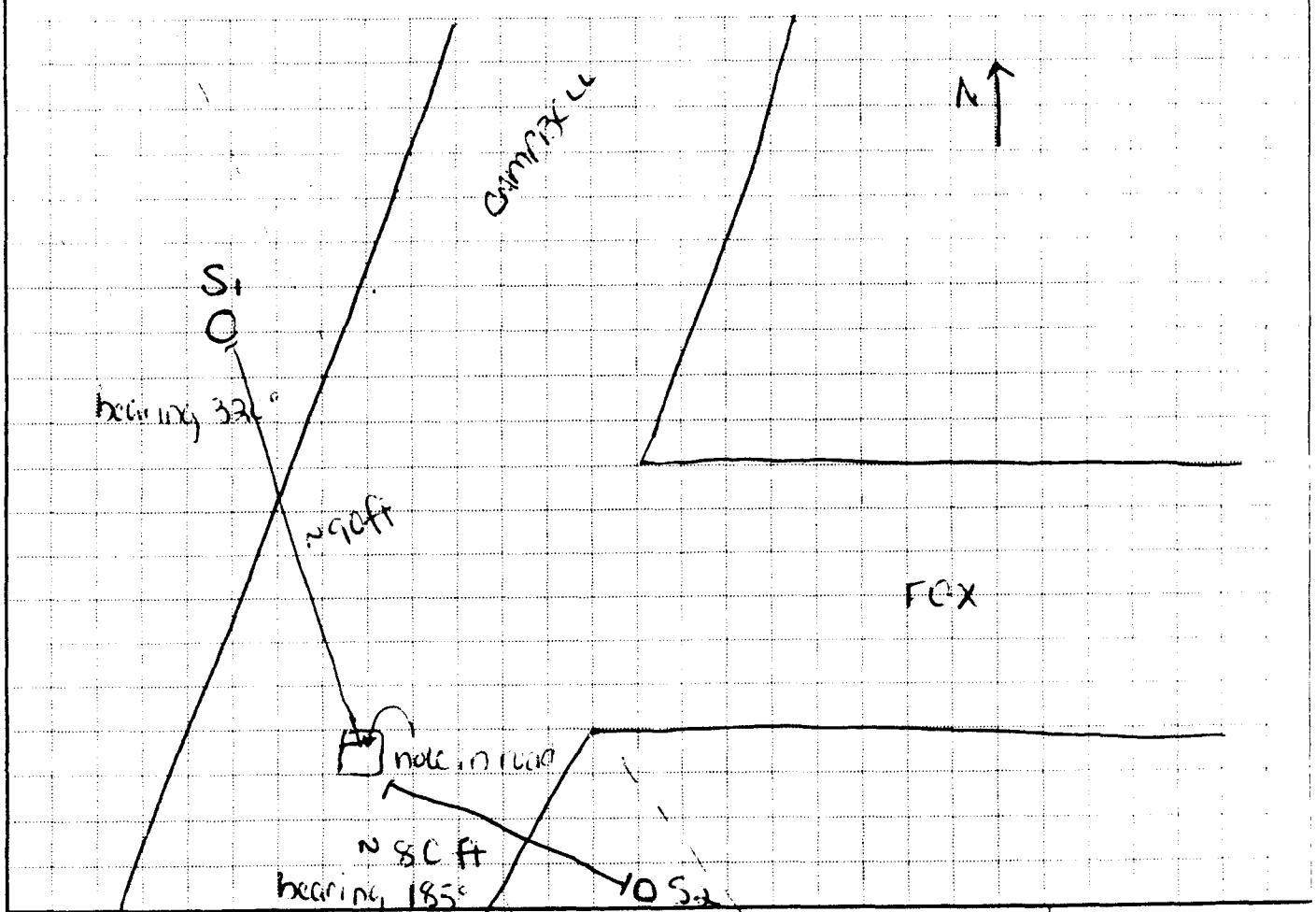
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVE SUSTEN / LYNN BOROWSKI / PATTI WESTERMANN	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION: TNT AREA C
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/12/94 — 11. DATE COMPLETED: 10/12/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: S1 - 1.0 feet S2 - 1.0 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS each	~~OTHER (SPECIFY) each~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		1x 250 ml	1x 120 ml			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
GROUTED				S. Susten

LOCATION SKETCH/COMMENTS — SCALE: not to scale



PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC-S1, TNTC-S2

HTRW DRILLING LOG

HOLE NUMBER: TRTC-S1

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Westerman

SHEET 1 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0					
	1"	Dark brown silty clay; medium stiff-	0 ppm	N/A		
	2"					
	3"					
	4"					
	5"					
	6"	shades to olive gray to light gray with some mottlings; moist				
	7"					
	8"					
	9"					Sample TRTC-S1-0.5/1.0 collected at 1503
	10"					
	11"					
	12"	Boring terminated at 1 foot on 2-12-94				

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TRTC-S1

HTRW DRILLING LOG

HOLE NUMBER: TNTC-52

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Dark brown clayey sand (fine), some rocks	0ppm	N/A		no vegetation at surface
	1'					
	2'	grades to olive gray sandy clay with some mottled				a few roots
	3'					
	4'	Olive gray clayey fine sand				
	5'					
	6'	grades to brown at six inches some greyish mottling	0ppm			
	7'					
	8'	some black flecks grades with some clay (some roots) some red flecks				Sample TNTC-52 collected at 1544
	9'					
	10'					
	11'					
	12'	boring terminated at 12 feet on 10-12-94	0ppm			

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC-52

HTRW DRILLING LOG

HOLE NUMBER

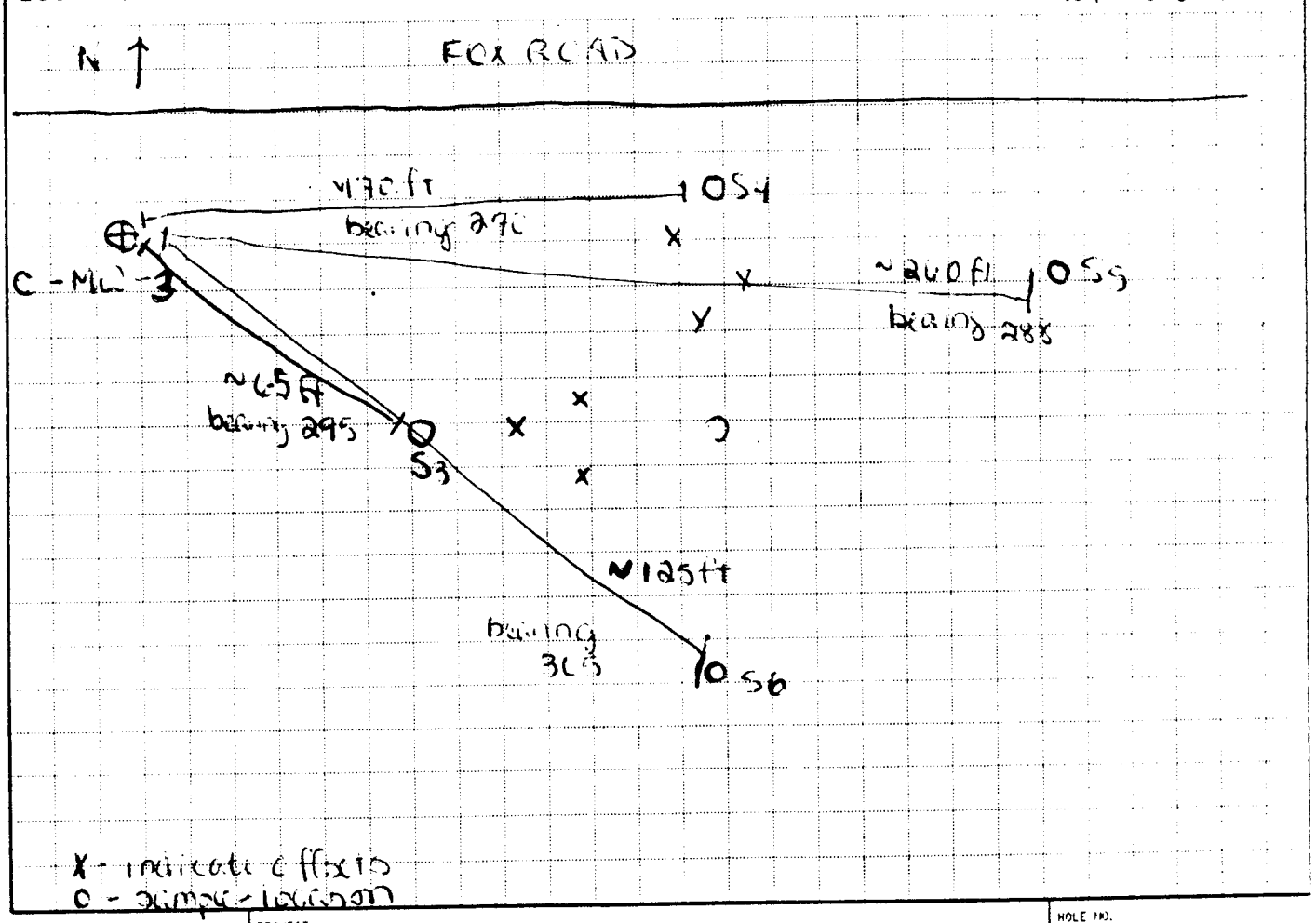
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR
SHEET 1 OF 2 SHEETS	
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVE SUSTEN / LYNN BOROWSKI	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION: TNT AREA C
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/13/94 — 11. DATE COMPLETED: 10/13/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: S3 → 3.5 ft, S4 → 5.0 ft, S5 → 5.0 ft, S6 → 4.5 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
FOR EACH HOLE	-	1 x 250 mL	Explosives 1 x 120 mL			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
GROUTED				Steve Susten

LOCATION SKETCH/COMMENTS — SCALE: not to scale



PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC-S3, TNTC-S4, TNTC-S5, TNTC-S6

HTRW DRILLING LOG

HOLE NUMBER: TNT-C3

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown clayey fine sand (some silt)		0 ppm		vegetation at surface mainly ACIS
	0.5	clay grades out at 0.7 ft				Sample TNT-C3 ~~0.5-1.0~~ 0.0/1.5 collected at 0900
	1.0	Dark brown silty fine sand, some gravel, with some chunks of chalky white substance				
	1.5					
		much more gravel				turning becomes difficult auger refusal at 2.5 feet
	2.0					
	2.5	auger refusal having offset				
	3.0					
	3.5					
	4.0					
	4.5					
	5.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO. TNTC-S3

HTRW DRILLING LOG

HOLE NUMBER TNT-C3-A

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		similar soils to first boring				
	0.5					
	1.0					
	1.5					
	2.0					soil sample TNT-C3-1.5/3.5 at 0930
	2.5	Dark brown silty fine sand, some gravel, with chunks of white chalky substance				soils similar to those in first boring
	3.0					
	3.5	auger refusal after 4 attempts boring terminated				refusal after 4 attempts
	4.0	Boring terminated at 3.5 feet on 10/13/94	0 ppm			
	4.5					
	5.0					

PROJECT Plum Brook Ordnance Works

HOLE NO. TNTC-3 A

HTRW DRILLING LOG

HOLE NUMBER TNTC-4

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown coarse sand with lots of gravel and roots (some) has white chalky chunks				vegetation at surface
	0.5					soil has gravel and chunks of white chalky substance.
		gravel chunks become smaller				sample TNT-C4-0.0/1.5 collected at 1C16
	1.0	Brown clayey coarse sand with red flecks				
	1.5	with brown-yellow mottling red flecks continued				
		auger refusal at 1.5 ft				
		Offset x 2				

PROJECT Plum Brook Ordnance Works

HOLE NO. TNTC-S4

HTRW DRILLING LOG

HOLE NUMBER TNT-C4 A

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0.5	similar soils to first boring				
	1.0					
	1.5	gravel / gravelly cut Brown clayey coarse sand with brown yellow mottling and red flecks				some rocks
	2.0					
	2.5					
	3.0	brown-yellow mottling some olive gray mottling				Sample TNT-C4 ~~2.5~~ 1.5/5.0 collected at 1047
	3.5					
	4.0					
	4.5					
	5.0	brown yellow mottling with light gray and gray mottling				boring terminated 5 ft

PROJECT Plum Brook Ordnance Works

Boring terminated at 5 feet on 10/13/94

HOLE NO. TNTC-S4 A

HTRW DRILLING LOG

HOLE NUMBER TNTC-S5

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown Clayey fine sand	0 ppm	~~0 ppm~~		Roots
	0.5					Roots continued approx 0.5 ft.
						Sample TNTC-S5 0.0/1.5 collected at 1120
	1.0	GRADES TO Brown				
		Brown Clayey ~~[illegible]~~ sand with some silty material				
	1.5					
		Clayey material below root	0 ppm			
	2.0					
		Brown Clayey fine sand				
	2.5	Clay [illegible]				
	3.0	Clayey ~~[illegible]~~ sand with Clay & Silty material	0 ppm			Sample TNTC-S5-1.5/3.0 collected at 1125
	3.5					
	4.0					
	4.5					
		Being Terminated at 5.1	0 ppm			

PROJECT 10/13/94

Plum Brook Ordnance Works

HOLE NO.

TNTC-S5

HTRW DRILLING LOG

HOLE NUMBER: TNTC-S6-

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown clayey sand	0 ppm			moss at surface roots in soil
	0.5					
						sample TNTC-S6- 0.0/1.5 collected at 1457
	1.0	red flecks and some brown mottling				
		white chalky substance in soil grades to brown				
	1.5	grades to dark gray mottling				
	2.0					
	2.5					
	3.0	mottling grades to gray				sample TNTC-S6 ~~0.0/~~ 1.5/4.5 collected at 1514
	3.5					
	4.0					
	4.5	much gravel (large chunks) auger refusal at 4.5 ft	0 ppm			
		Boring terminated at 4.5 ft on 10/13/94				
	5.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO. TNTC-S6

HTRW DRILLING LOG

HOLE NUMBER: TNTC-S 7-9

SHEET 1 OF SHEETS

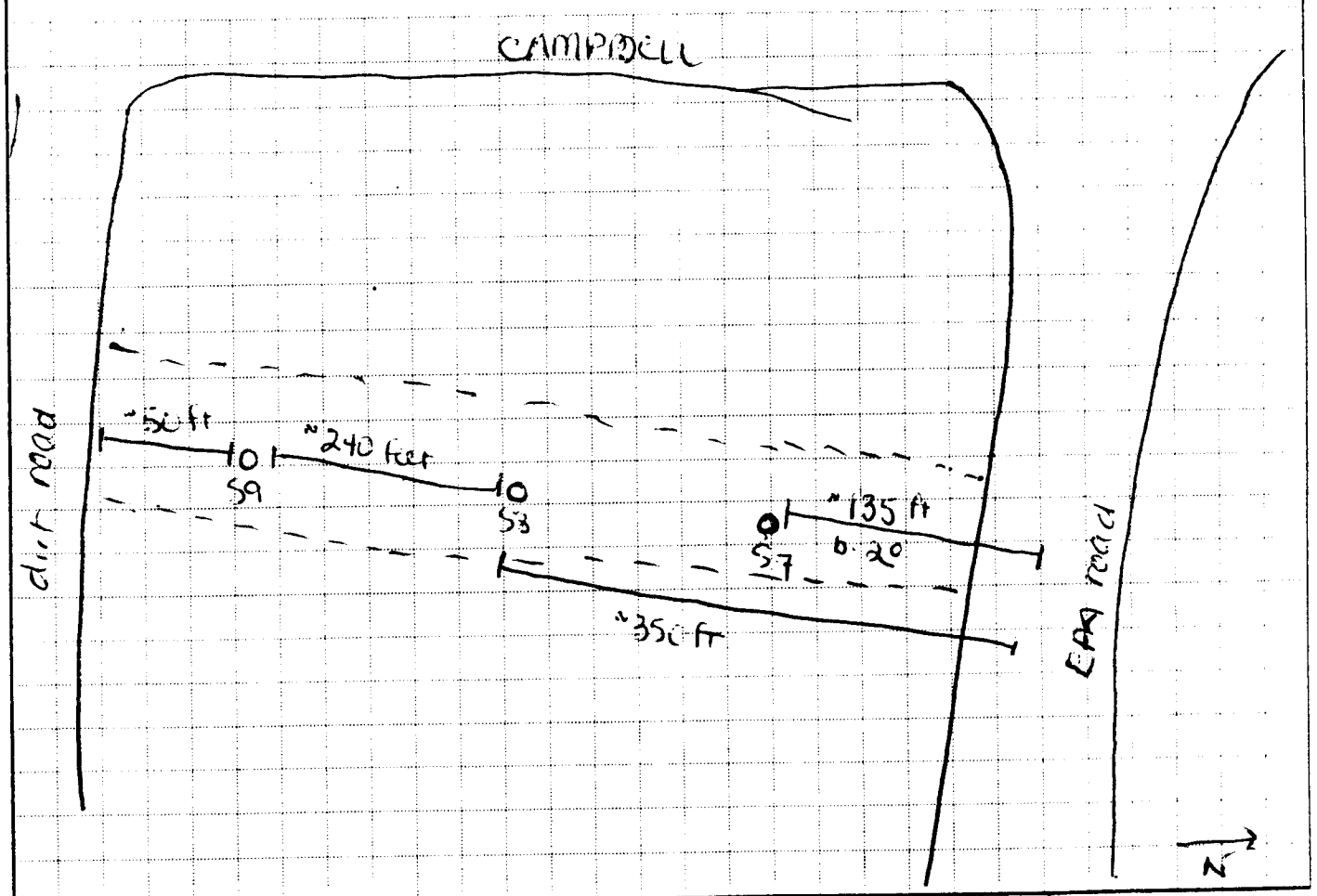
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Steve Susten / Lynn Borowski	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Hand Auger	8. HOLE LOCATION: TNT Area C
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/13/94 — 11. DATE COMPLETED: 10/13/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: Not Encountered
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE:	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
For Each Hole		✓	Explosives			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
GROUTED				Steve Susten

LOCATION SKETCH/COMMENTS — SCALE: Not To Scale



PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC-S7 S8 S9

HTRW DRILLING LOG

HOLE NUMBER: TNTC S7

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET: OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown sandy clay	0 ppm			Feeds & rootlets at surface
	0.1					
	0.2					
	0.3					
	0.4	Olive-gray clay				
	0.5	with reddish-brown mottling				roots
	0.6					
	0.7					sample TNTC-S7-0.5/1.0 collected at 1555
	0.8					
	0.9					
	1.0	Brown clayey fine sand with dark brown mottling with some shale				
			0 ppm			
		Boring terminated at 1.0 feet on 10/13/94				

PROJECT: Plum Brook Ordnance Works

HOLE NO. TNTC-S7

HTRW DRILLING LOG

HOLE NUMBER: TNTC-S8

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown sandy clay	0 ppm			heavily grassed at surface many roots
	0.1					
	0.2					
	0.3					
	0.4					
	0.5	gradis to brown with yellowish red flecks				
	0.6					sample
	0.7	gradis to brown with gray mottling				TNTC-S8-0.5/1.0 collected at 1630
	0.8					
	0.9	Some small gravel (shale (some))	0 ppm			
	1.0	Boring terminated at 1.0 feet on 10/13/94				

PROJECT: Plum Brook Ordnance Works

HOLE NO. TNTC-S8

HTRW DRILLING LOG

HOLE NUMBER: TNTC S9

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0.1	Dark brown sandy ~~clayey~~ CL with olive gray mottling.	0ppm			heavily grassed at surface many roots
	0.2					
	0.3	Brown ~~sandy~~ SM clayey fine sand with some silt				
	0.4					
	0.5	yellowish red flecks				
	0.6					
	0.7					Sample TNTC-S9 0.5/1.0 collected at 1650
	0.8	Gray sandy clay with brown mottling				
	0.9	dark brown mottling red flecks continued				
	1.0		0ppm			
		Being terminated at 1.0 feet on 10-13-94				

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC S9

HTRW DRILLING LOG

HOLE NUMBER: TNTC-S10→15

SHEET 1 OF SHEETS

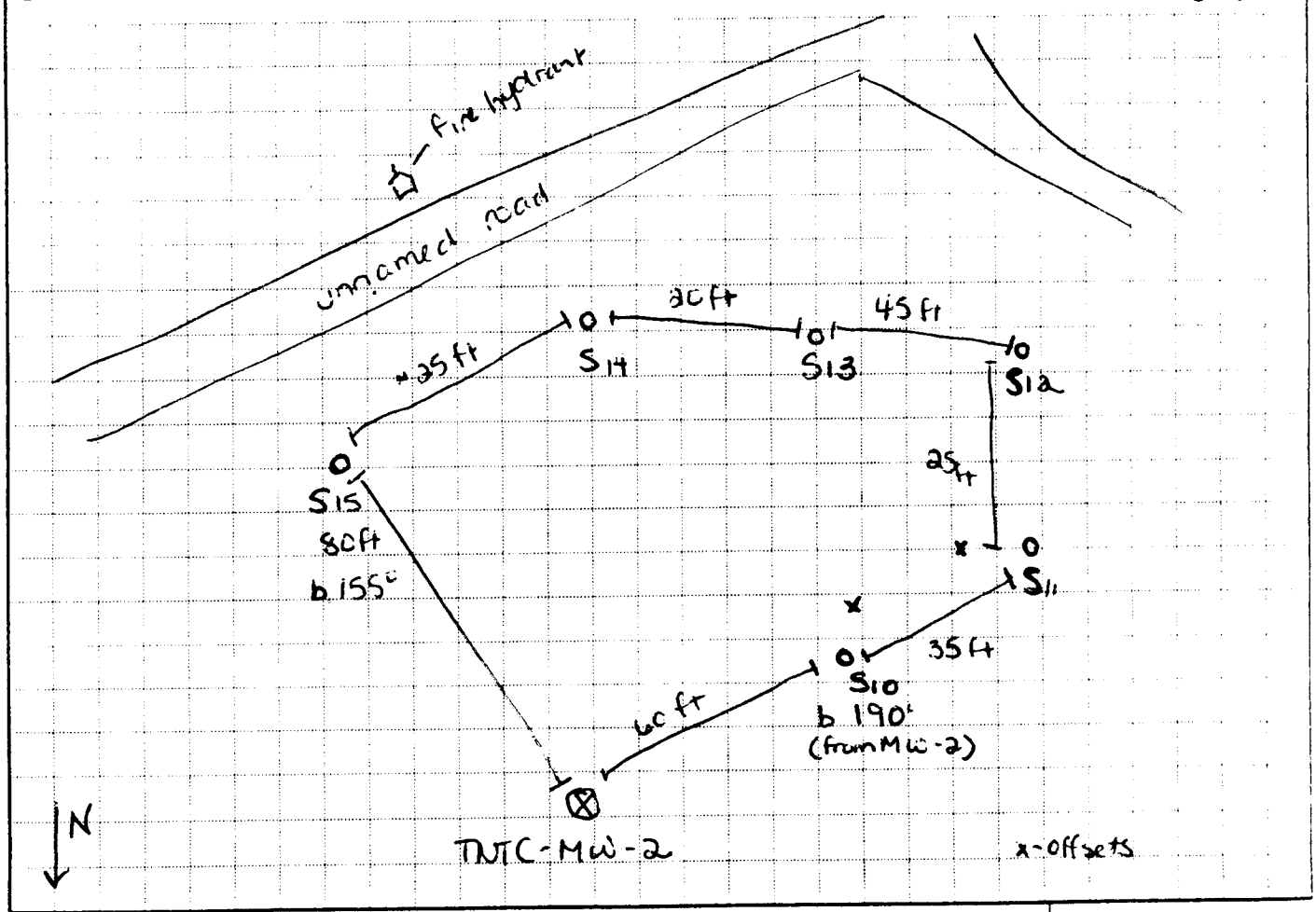
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Steve Susten/Lynn Borowski	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS Hand Auger	8. HOLE LOCATION: TNT Area C
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/14/94 — 11. DATE COMPLETED: 10/14/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: ~~N/A~~ SS. Not Encountered
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: S10→3.5 feet S11→3.5 ft S12→3.5 ft S13→3.5 ft S14→2.0 ft S15→2.2 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
For Each Hole		✓				

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grouted				Steve Susten

LOCATION SKETCH/COMMENTS — SCALE: not to scale



PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC-S10, S11, S12, S13, S14, S15

HTRW DRILLING LOG

HOLE NUMBER: TNTC-S1C

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Dark brown silty fine sand	0ppm			heavily vegetated surface roots
	0.5					
	1.0	grades to brown with some gravel auger refusal at one feet offset				
	1.5					
	2.0					
	2.5					
	3.0					
	3.5					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC-S1C

HTRW DRILLING LOG

HOLE NUMBER: TNTC-SIC A

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET: OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
						heavily vegetated at surface
	0.5	similar soils to first boring				soil is any
	1.0	grades to dark brown with some gravel				
	1.5	grades to brown gravel becomes larger				
	2.0	Brown clayey fine sand, some silt red flecks and dark brown mottling				
	2.5	gray mottling grades in				
	3.0	reddish brown bands mottling grades to light gray				sample TNTC S-10 - 2.5/3.5 collected at 0907
	3.5	Boring terminated at 3.5 feet on 10/14/94				

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC-SIC A

HTRW DRILLING LOG

HOLE NUMBER TNTC-S11

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty fine sand with roots	0 ppm			heavily vegetated at surface
						many roots
		gradate brown				
	0.5	~~gradate~~				
		Brownish yellow clayey fine sand with red flecks				
	1.0	small streaks of red with dark brown mottling				
		auger refusal at 1.0 feet				
	1.5	offset boring				
	2.0					
	2.5					
	3.0					
	3.5					

PROJECT Plum Brook Ordnance Works

HOLE NO. TNTC-S11

HTRW DRILLING LOG

HOLE NUMBER: TNTC-S11A

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET: OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		similar soils to first boring	0ppm			heavily vegetated worms
	0.5					
	1.0	Brownish-yellow clayey fine sand with small red streaks and dark brown mottling some shale some flecks of red (streaks grade out)				
	1.5	Brown clayey sand with dark gray mottling yellowish-red small streaks				
	2.0		0ppm			
	2.5	color grades to gray with brown mottling and with ~~streaks~~ of yellowish-red mottling				Sample collected at 0950 (TNTC-S11-0.5/3.5)
	3.0	distinct band of yellowish-red				band encountered at 3.1 streaks later grades with yellowish color
	3.5	some light gray mottling Boring terminated at 3.5 feet on 10-14-94				

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC-S11A

HTRW DRILLING LOG

HOLE NUMBER: TNTC-S12

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty fine sand many roots	0ppm			heavily vegetated at surface
	0.5	brown mottling				
		brownish-yellow streaks				
	1.0	Brownish-yellow clayey sand with some silt				
	1.5	dark brown and gray mottling				
		grades to brown; silt grades out, some shale, red flecks				
	2.0					
	2.5	yellow burst				
		brownish yellow flecks				Sample TNTC-S12-2.3/3.5 collected at 1045
	3.0	gray mottling				
		color grades to gray; red flecks, brownish-yellow flecks continue shale continues				
	3.5	Boring terminated at 3.5 feet on 12/14/94	0 ppm			

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC-S12

HTRW DRILLING LOG

HOLE NUMBER: TNTC-S13

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty fine sand				heavily vegetated
	0.5	grades to brown				
		reddish-brown flecks				
	1.0					
	1.5					
	2.0					
	2.5					
		Dark brown sandy clay				
	3.0	brownish yellow flecks				sample TNTC-S13-Q5/3.5 at 1110
		gray mottling				
	3.5	Boring terminated at 3.5 feet on 10/14/94				

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC-S13

HTRW DRILLING LOG

HOLE NUMBER TNTC S14

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty fine sand	5ppm			PCB's
	0.5	grades to brown				
	1.0	yellowish red streaks (small streaks)				
	1.5					Sample TNTC-S14-1.0/2.0 collected at 11:29
	2.0	Boring terminated at 2.0 feet on 10/11/94				
	2.5					
	3.0					

PROJECT Plum Brook Ordnance Works

HOLE NO. TNTC-S14

HTRW DRILLING LOG

HOLE NUMBER TNTC-S15

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty fine sand grades to brown				heavily vegetated many roots
	0.5					
		yellowish-red streak				
	1.0					
		small reddish streaks				sample TNTC-S15-1.0/2.0 collected at 1142
		streaking continues				
	1.5					
	2.0	dark grey to black chunks ↓ ↓				
		Boring terminated at 2.2 feet on 10/14/96				
	2.5		Clear			

PROJECT Plum Brook Ordnance Works

HOLE NO. TNTC-S15

HTRW DRILLING LOG

HOLE NUMBER: TNTC-S16, S21

SHEET 1 OF SHEETS

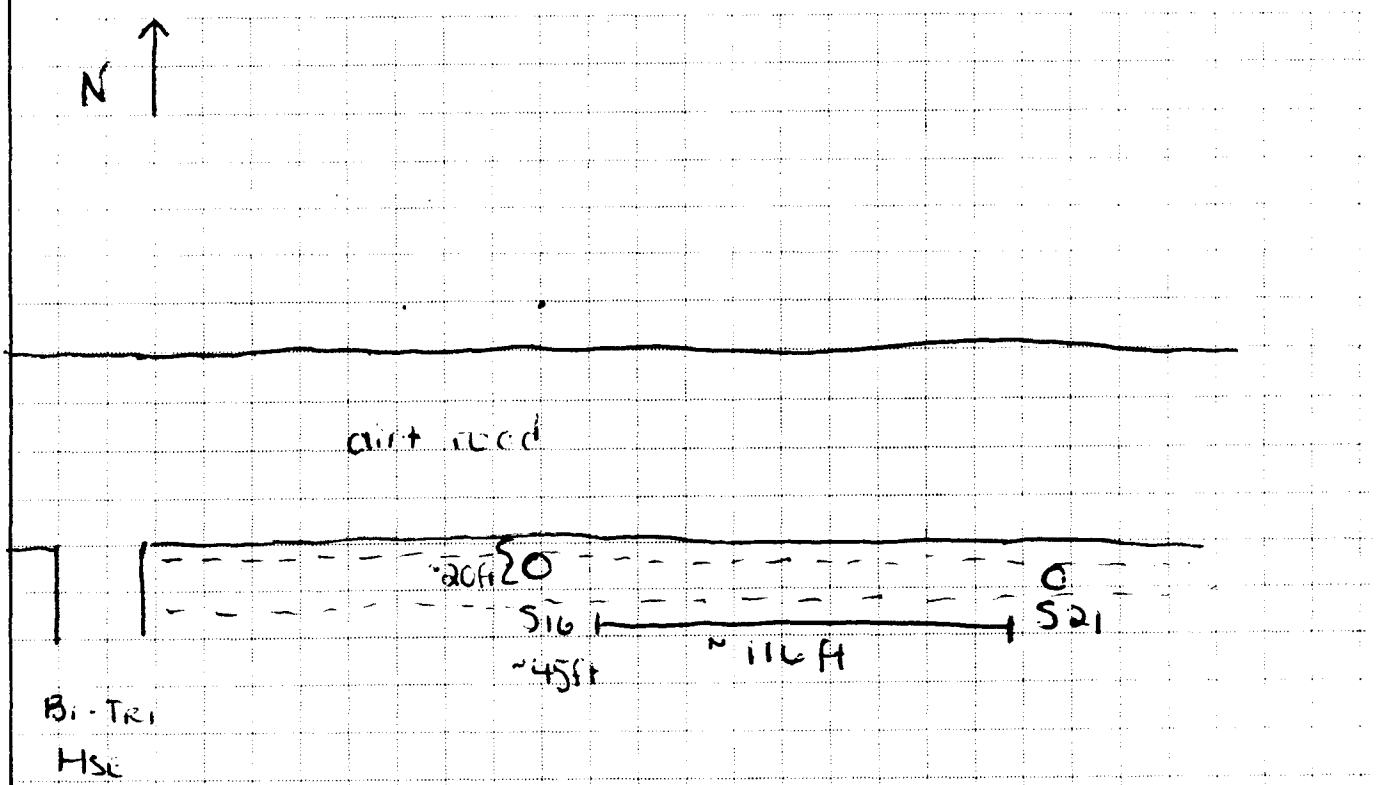
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Steve Susten / Lynn Borowski	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Stainless Steel Hand Auger	8. HOLE LOCATION: TNTC - Area C
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/16/94 — 11. DATE COMPLETED: 10/17/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: Not Encountered
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: S16 → 1.0 ft S21 → 0.75 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
For each Hole		✓	Explosives			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
GROUTED				Steve Susten

LOCATION SKETCH/COMMENTS — SCALE: not to scale



PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC-S16 -S21

HTRW DRILLING LOG

HOLE NUMBER TRIC-S16

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown sandy silty gravel and shale				greasy at surface moist
	0.1					
	0.2					
	0.3	Clayey gravel with dark brown streaks				
	0.4					
	0.5					
	0.6					Sample TRIC-S16 0.5/1.0 collected at 1637
	0.7					
	0.8					
	0.9					
	1.0	Boring terminated at 1.0 ft on 10/16/99	Clear			split collected (S27)

PROJECT Plum Brook Ordnance Works

HOLE NO. TRIC S16

HTRW DRILLING LOG

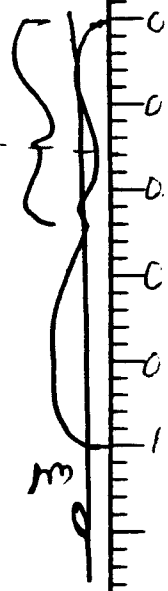
HOLE NUMBER: TNTC-S21

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown sand with roots				moss at surface
	0.1	streak of brown-red				
		streak of brown				
	0.2	olive gray sandy clay				
		light gray clayey sand grades to brown				
	0.3					
	0.4					
	0.5					sample TNTC-S21-0.5|1.0
	0.6					
		clay grades in				
	0.7	auger refusal at 0.7ft (ceramic tile)				
	0.8	Boring terminated at 0.75ft on 10/16/94	0ppm			
	0.9					
	1.0					



PROJECT: Plum Brook Ordnance Works

HOLE NO. TNTC-S21

HTRW DRILLING LOG

HOLE NUMBER: TNTC-S17→20

SHEET ___ OF ___ SHEETS

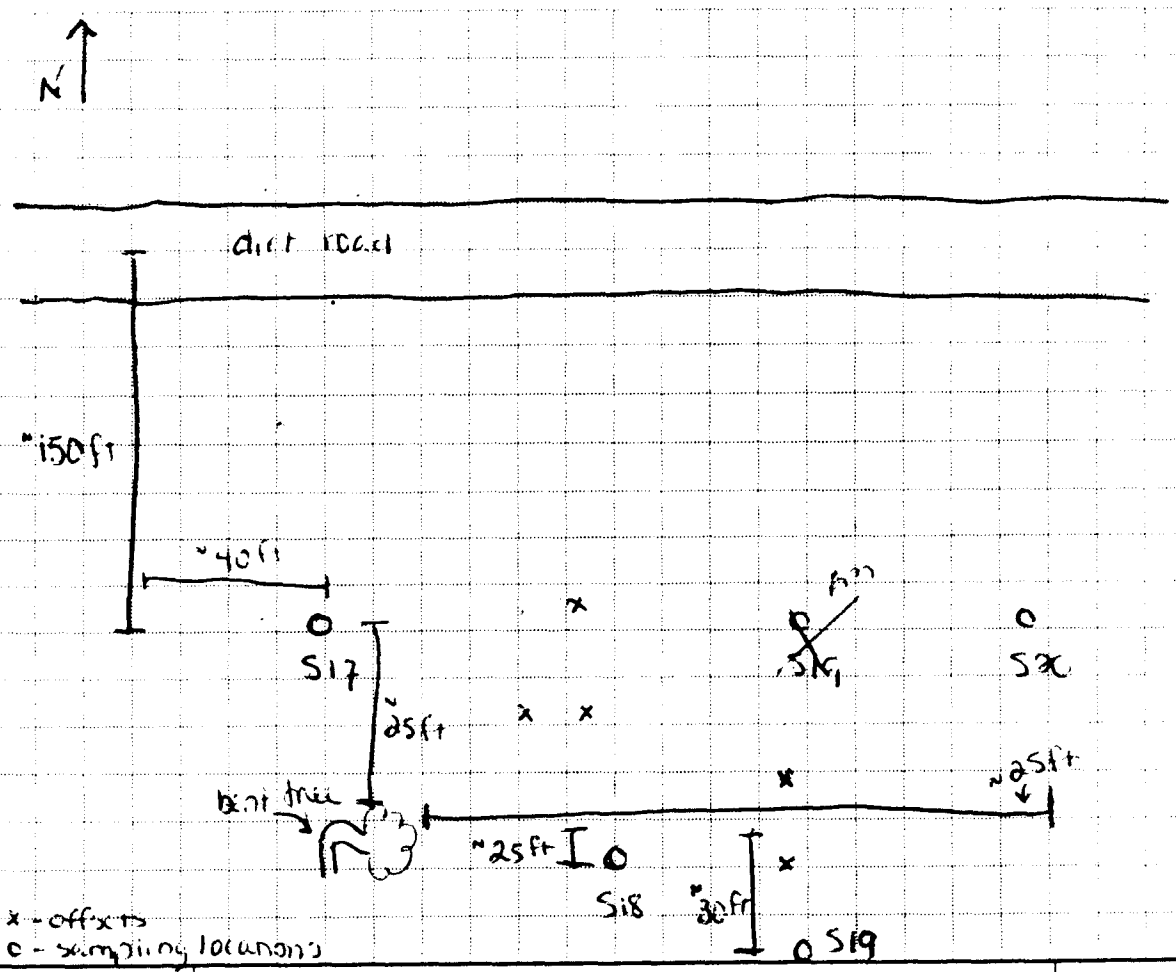
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVE SUSTEN/LYNN BOROWSKI	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: STAINLESS STEEL HAND AUGER	8. HOLE LOCATION: TNT AREA C
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/16/94 — 11. DATE COMPLETED: 10/17/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: S17→1.5 ft S18→1.5ft S19→0.5ft S20→1.25 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
FOR EACH HOLE		✓	Explosives			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
GROUTED				Steve Susten

LOCATION SKETCH/COMMENTS — SCALE: not to scale



PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC-S17, S18, S19, S20

HTRW DRILLING LOG

HOLE NUMBER: TNTC-S17

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty sand				grass at surface soil is loose and dry
		large rock				
	0.5	lgrocks continue				
						sample TNTC-S17-0.0/1.5 collected at 1729
	1.0	large gravel/bankfill				
		auger refusal at 1.5ft Boring terminated at 1.5 feet on 10/10/94				
	1.5					
	2.0					
	2.5					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC-S17

HTRW DRILLING LOG

HOLE NUMBER: TNTC - S18

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty sand				grass cut surface
		large rocks - auger refusal				
		boring offset				
	0.5					
	1.0					
	1.5					
	2.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC - S18

HTRW DRILLING LOG

HOLE NUMBER TRTC-SIS-1

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty sand				
		wires and rocks				worms
	0.5	auger refused at 0.5 foot				
		boring offset				

PROJECT Plum Brook Ordnance Works

HOLE NO. TRTC-SIS-1

HTRW DRILLING LOG

HOLE NUMBER: TNTC-S18

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty sand				
		rocks and rubble				sample TNTC-S18-00/15 collected at 1751
	0.5					
	1.0	pieces of coal or shale				
		grades to reddish brown				split taken (S 28)
	1.5	auger refusal at 1.5 ft				
		Boring terminated at 1.5 feet b/s				
	2.0	10/16/94				

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC-S18 ~~B~~ F ~~D~~ ~~E~~

HTRW DRILLING LOG

HOLE NUMBER: TNTC-S19

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0.5	Dark brown silty sand large gravel/boulders throughout gradient to brown	0 ppm			grab sample collected from 0-0.5 ft TNTC-S19-00/03 0352
	1.0	Being terminated at 0.5 feet with auger refusal on gravel				
	1.5	sample collected by hand 10/17/94				
	2.0					
		auger refusal at approximately 6 inches in 1st, 1B, 1BC boings				

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC-S19 A B C

HTRW DRILLING LOG

HOLE NUMBER: TNTC-S2C

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dk brown silty fine sand lg gravel/boulders grades to brown				no vegetation at surface roots
	0.5					
						sample TNTC-S2C 0.0/1.25 collected at 0858
	1.0					
		Being terminated at refusal 10/17/94				
	1.5					
	2.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC-S2C

HTRW DRILLING LOG

HOLE NUMBER: TNTC-S22

SHEET 1 OF SHEETS

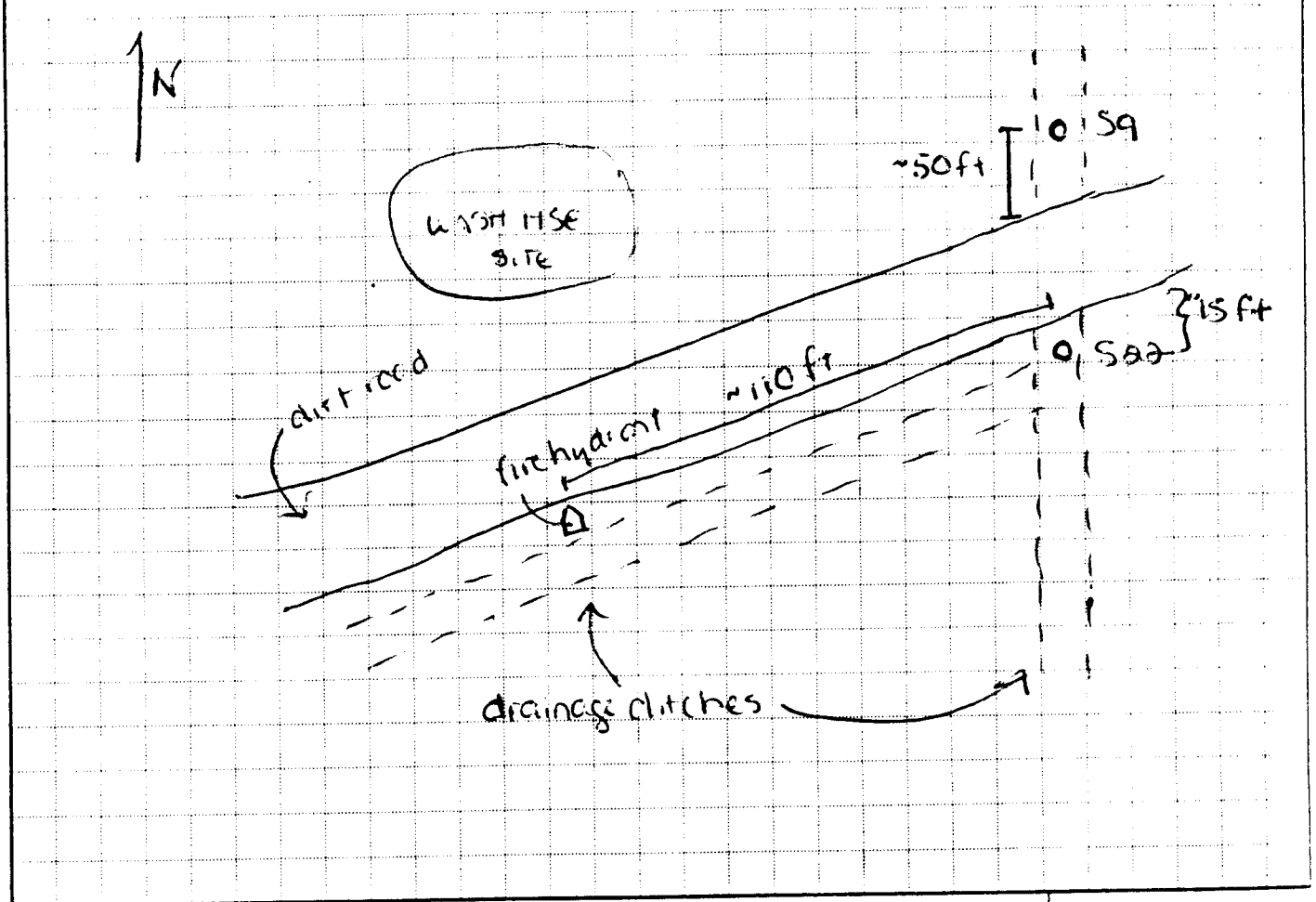
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVE SUSTEN / LYNN BOROWSKI	6. MANUFACTURER'S DESIGNATION OF DRILL: NA
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: STAINLESS STEEL HAND AUGER	8. HOLE LOCATION: TNTC - AREA C
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10/19/94 — 11. DATE COMPLETED: 10/19/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 1.0 foot	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
GROUTED				Steve Susten

LOCATION SKETCH/COMMENTS — SCALE: not to scale



PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC-S22

HTRW DRILLING LOG

HOLE NUMBER

PROJECT: Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown silty fine sand with some clay lg gravel				moss at surface
	0.1					many roots
	0.2					
	0.3					
	0.4					
	0.5	brick pieces gray clay grades in				
	0.6					sample TNTC-S22-0.5/1.0 collected at 1405
	0.7					
	0.8	large pieces of shale				
	0.9					
	1.0	Boring terminated at 1 foot on 10/19/94				

PROJECT: Plum Brook Ordnance Works

HOLE NO. TNTC-S22

HTRW DRILLING LOG

HOLE NUMBER: PB-TNTC-S23→26

SHEET 1 OF SHEETS

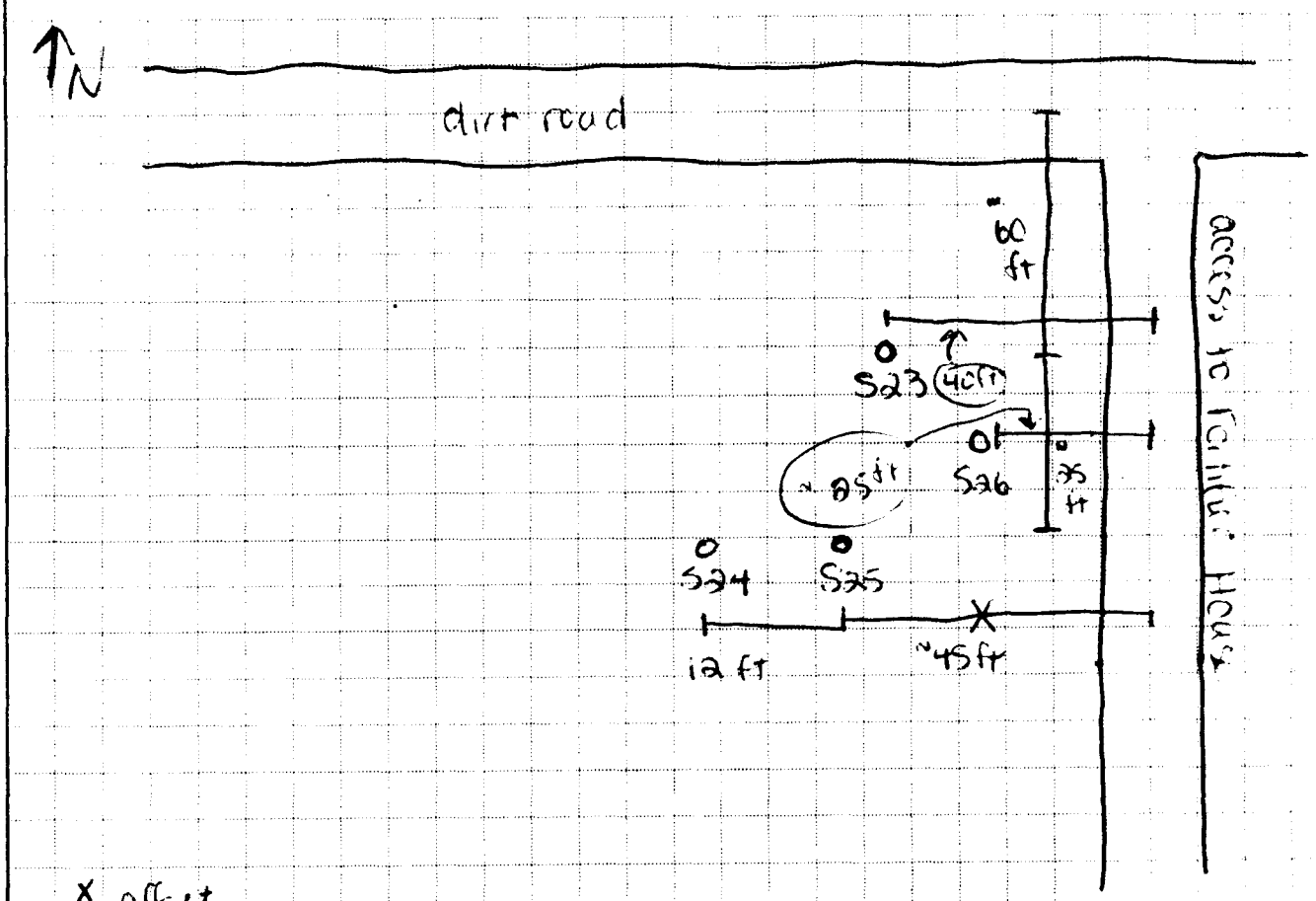
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVE SUSTEN / LYNN BOROWSKI	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: STAINLESS STEEL HAND AUGER	8. HOLE LOCATION: TNT AREA C
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/17/94 — 11. DATE COMPLETED: 10/17/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: S23 → 2.0 ft S24 → 1.75 ft S25 → 1.2 ft S26 → 1.3 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
FOR EACH HOLE	-	✓	Explosives			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
GROUTED				Steve Susten

LOCATION SKETCH/COMMENTS — SCALE: not to scale



PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC-S23, S24, S25, S26

HTRW DRILLING LOG

HOLE NUMBER: TNTC-S23

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown silty fine sand some shale				grass + brushal surface roots
	0.5	grades to brownish-yellow				
	1.0					sample TNTC-S23 0.0/2.0 collected at 0954
	1.5	orangish shale				
	2.0	band of orange	(B22)			split taken from this sample (S24)

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC-S23

HTRW DRILLING LOG

HOLE NUMBER: TNTC-S24

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty fine sand				grass at surface
	0.5	color grades to brown				sample TNTC-S24-0.0/1.75 collected at 1015
	1.0	orange flecks				
	1.5	gravel and coal at 1.75				
	2.0	auger refusal at 1.75 feet. Boring terminated at 1.75 feet on 10/17/94				

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC-S24

HTRW DRILLING LOG

HOLE NUMBER: TNTC-SA5

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET: OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty fine sand some small roots				moss at surface
	0.5	hard, refusal at 0.5 feet (light not crystal) offset boring				
	1.0					
	1.5					
	2.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC SA5

HTRW DRILLING LOG

HOLE NUMBER: TNTC 525 | 1.

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty fine sand				grass at surface
	0.5	grades to yellowish-brown				sample TNTC-525 0.0/1.2 collected at 1130
	1.0	large chunk of metal pieces of wood refusal at 1.2 feet				
	1.5	Boring terminated 10-17-94				
	2.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO. TNTC-525 A

HTRW DRILLING LOG

HOLE NUMBER: TNTC 526

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty sand with gravel				Some moss & grass at surface
	0.5	Gray sandy clay large wood chunks (roots?)				
	1.0	auger refusal at 1.8 feet				
		boring offset				
	1.5					
	2.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: TNTC 526

HTRW DRILLING LOG

HOLE NUMBER TNTC-SB6A

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown silty sand				
	0.5	grades to brown some gravel				mothballed auger
		Gray silty clay				sample TNTC-SB6-C-1.3 collected at 1147
	1.0	brown sand grades into clay	0 ppm			
	1.5	auger refusal at 1.3 ft (something inside solid)				
		Boring terminated at 1.3 feet on 10/7/90				
	2.0					

PROJECT Plum Brook Ordnance Works

HOLE NO. TNTC-SB6A

HTRW DRILLING LOG

HOLE NUMBER: PR-PG-S1

SHEET 1 OF 1 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVE SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND Auger	8. HOLE LOCATION:
	9. SURFACE ELEVATION:
	10. DATE STARTED: / 11. DATE COMPLETED:
12. OVERBURDEN THICKNESS:	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK:	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 5.0 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

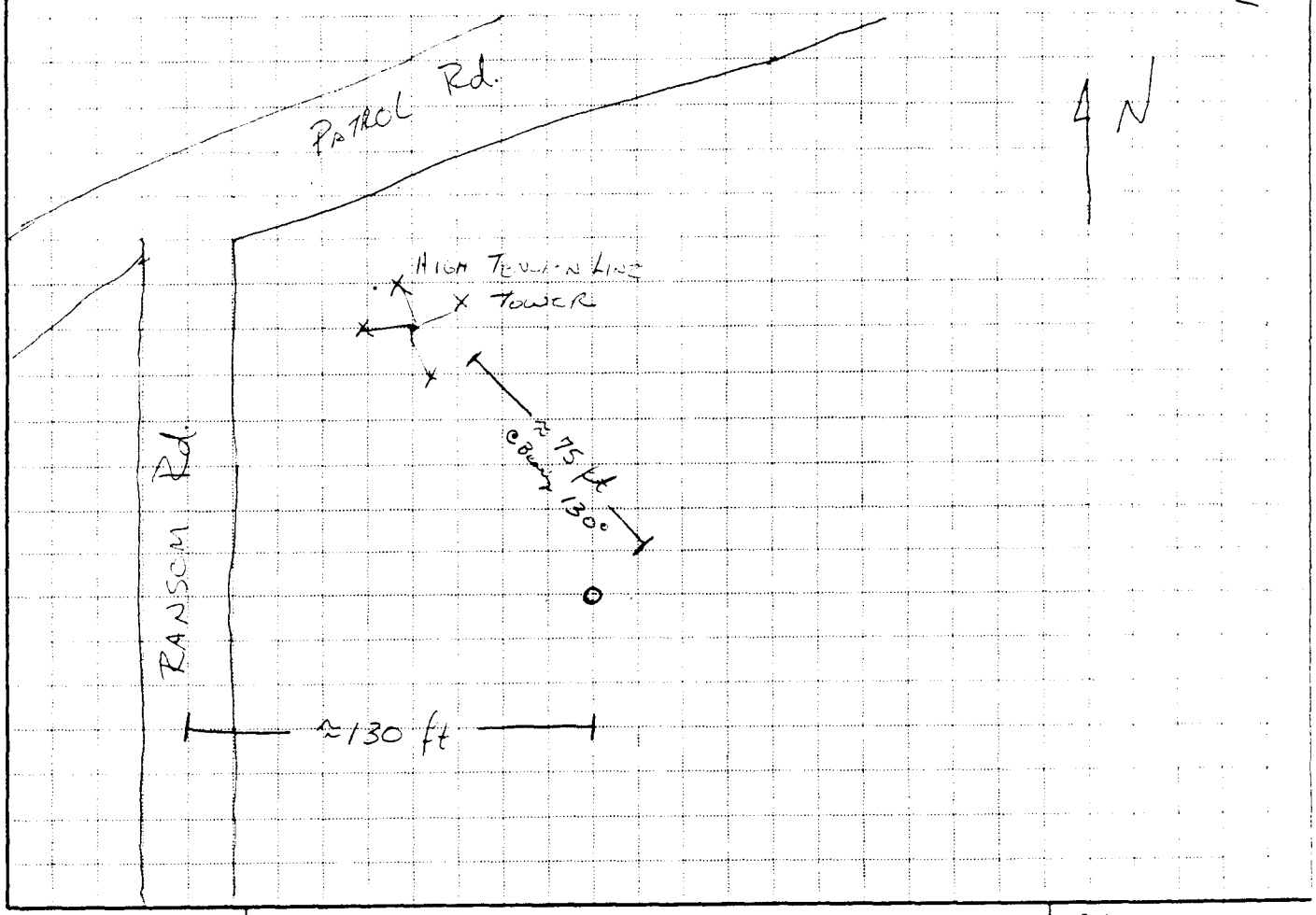
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	2 x 120 ml	1 x 250	1 x 120	BNA 1 x 250 ml		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: BGS-1

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dk brown silty fine sand with roots				with roots
	0.5					
		grades to brown .75				
	1.0					
	1.5	grades to brownish yellow				Sample BG-S1-0.5/3.0 Collected @ 1039
	2.0	grades with occasional gray clay lenses				
	2.5					
	3.0	grades with increased clay	HNU=0			
	3.5	grades with occasional brownish orange				Sample BG-S1-3.0/5.0 Collected @ 1100
	4.0					
		gray sandy clay with brown mottling & brownish-orange streaks				1st VOC
	4.5					
		grades with brownish-yellow				
	5.0		HNU=0			2nd VOC

PROJECT: Boring Terminated @ 5 feet 1100

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-BG-S2

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Steve Susten	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Hand Auger (SS)	8. HOLE LOCATION:
	9. SURFACE ELEVATION:
	10. DATE STARTED: / 11. DATE COMPLETED:
12. OVERBURDEN THICKNESS:	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK:	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 5.0 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

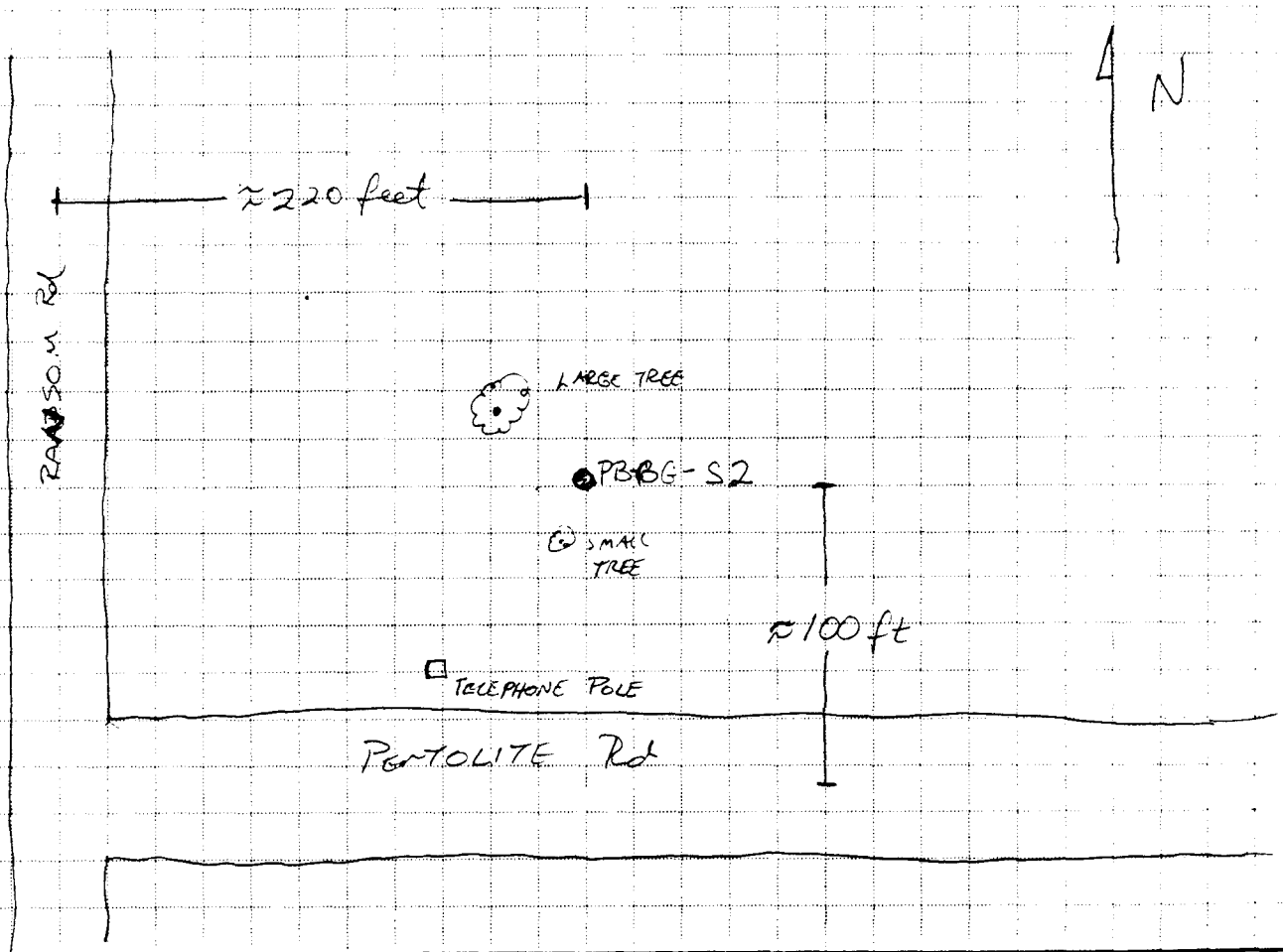
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	2 x 120 mL	1 x 250 mL	Explosives 1 x 120 mL	BNA 1 x 250 mL		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS

SCALE: Not To Scale



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: BG-S2

PROJECT: Plum Brook Ordnance Works | INSPECTOR: SS | SHEET 2 OF SHEETS 1

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown silty sand with roots	(-)			roots
	0.5					
	1.0	grades with brownish-yellow				
		grades to brownish-yellow				
	1.5	grades with occasional gray clay lenses				
	2.0					VOC 1 Sample BG-S2-0.5/3.0 Collected @ 1140
	2.5					
		grades with more clay grades to brownish-tan with brownish-orange streaks	(-)			
	3.0					
	3.5	grades to brownish-gray				
						Sample BG-S2-3.0/5.0 Collected @ 1205
	4.0					
		gray sandy clay with brownish orange mottling				
	4.5					VOC 2 sample
	5.0	grades with brownish orange	HNU=0			

PROJECT: Boring Terminated @ 5.0 feet (1205) | HOLE NO.

Plum Brook Ordnance Works

HTRW DRILLING LOG

HOLE NUMBER: PB-BG-S3

SHEET 1 OF 2 SHEETS

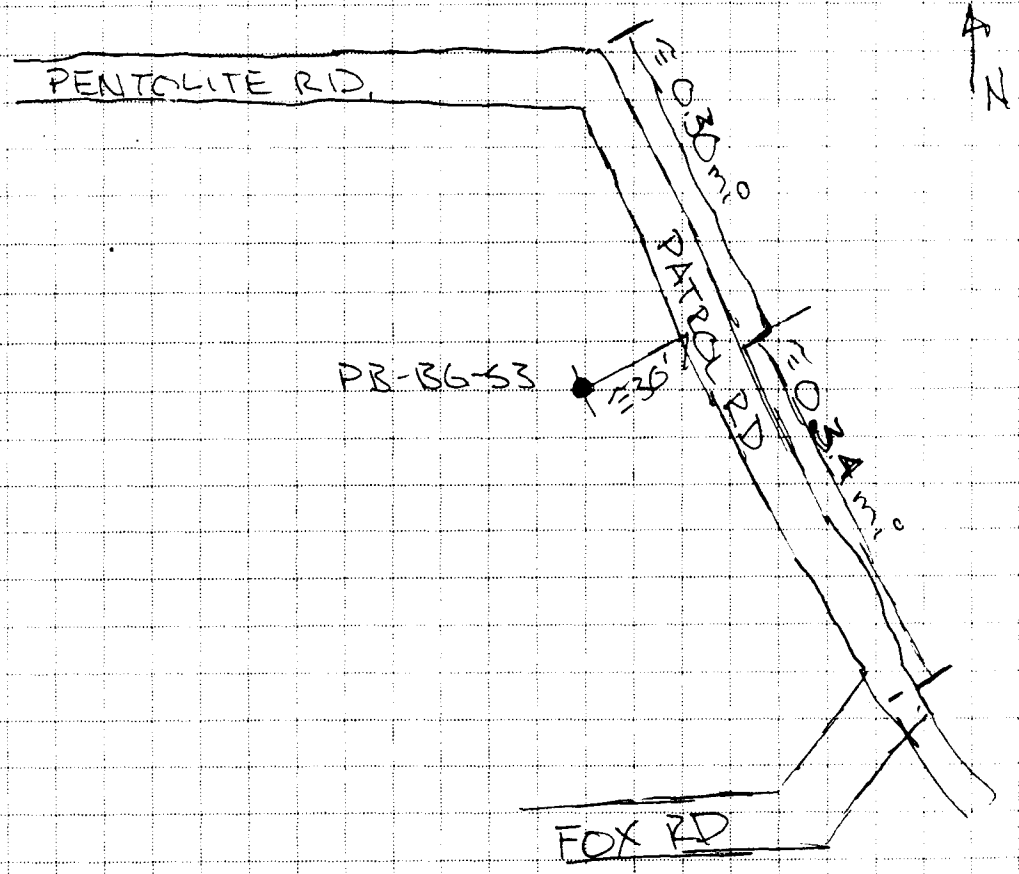
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: J Endras/S. Systen	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Hand Auger	8. HOLE LOCATION: PB-BG-S3
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 11/1/94 — 11. DATE COMPLETED: 11/1/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: Not Encountered
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 4.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	✓ Explosives	B/NA		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
				J Endras

LOCATION SKETCH/COMMENTS — SCALE: Not to scale



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER PB-BG-S3

PROJECT Plum Brook Ordnance Works | INSPECTOR | SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		DK Brown silty fine Sand w/ Gravel and Shale Fragments				Some Vegetation @ surface w/ Roots
	0.5	Gravel + Shale grade out				
		Grades to Brownish orange				
	1.0					VOCs
	1.5					
						Sample PB-PR-BG-S3-0.5/3.0 0815
	2.0					
	2.5	Grades to light Brown to tan				
		Mottled Gray + Brown Clayey Sand				
	3.0		HNU=0			
		~~Auth~~				Auging Becomes Difficult
	3.5					Sample PB-PR-BG-S3-3.0/4.0 collected @ 0900
						VOC's
	4.0	Boring Terminated @	HNU=0 4 ft			
		Auger Refusal	@ 4 feet			Shale
	4.5					
	5.0					

PROJECT Plum Brook Ordnance Works | HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-BG-S4

SHEET 1 OF 7 SHEETS

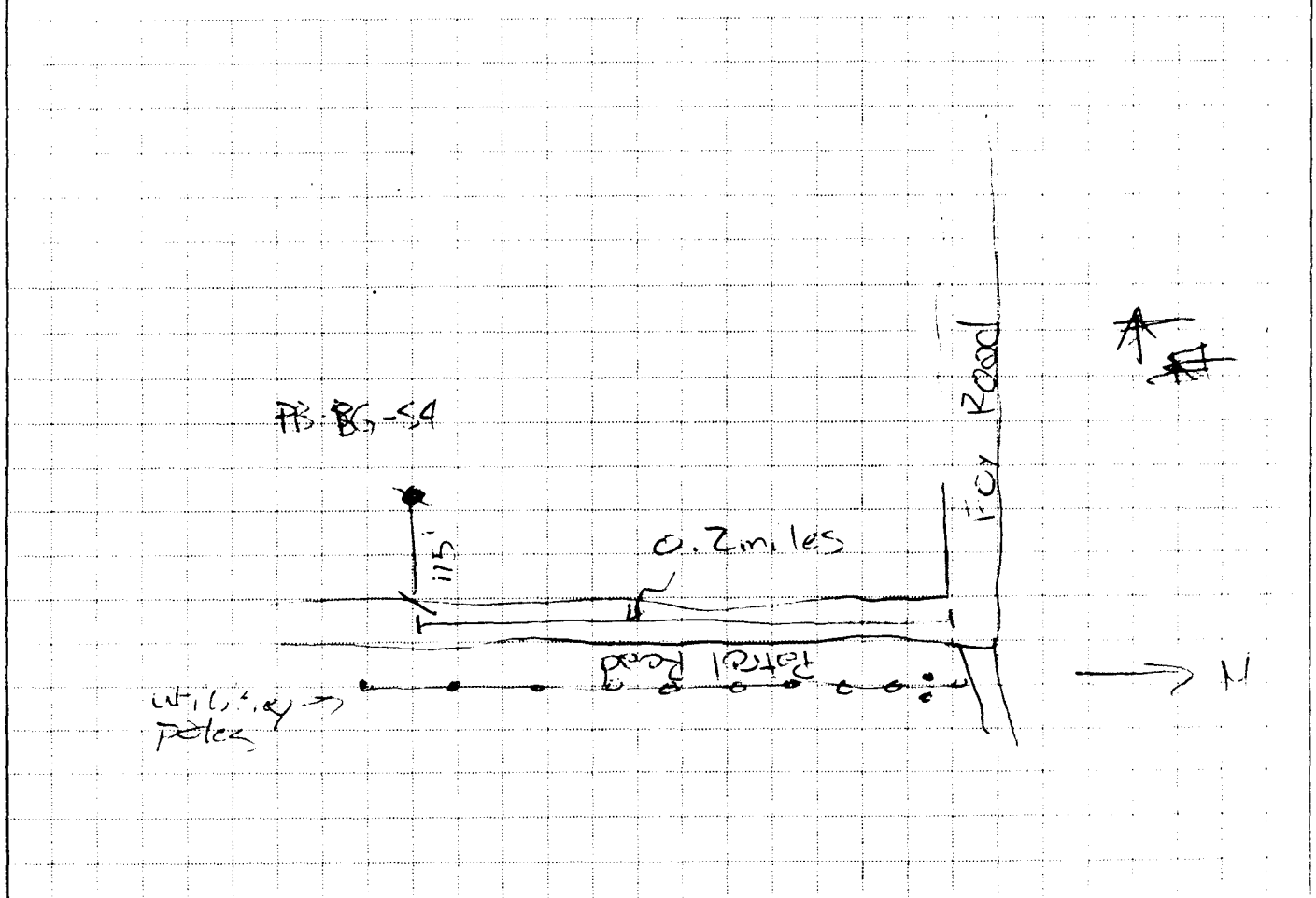
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: J Endres / B. Startel	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Hand Auger	8. HOLE LOCATION: PB-BG-S4
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/30/94 — 11. DATE COMPLETED: 10/30/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: Not encountered
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 3.3'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Explosives ✓	~~N/A~~		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grout				J Endres

LOCATION SKETCH/COMMENTS — SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PBBG-S4

PROJECT: Plum Brook Ordnance Works

INSPECTOR: J Endres / B. Stavikel

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Dk Brown ~~silty sand~~ w/roots sandy sand				
	.5	~~Brownish yellow~~				
		~~Grades~~ Brownish yellow fine sandy silt w/ roots				Sample PB-BG-S4-0.5/3.0 PB-BG-S8-0.5/3.0 PB-BG-S8-~~0.5~~/3.0-S 10/30/94 10:30
	1					
	1.5	Grades w/ gravel or organic				
	2.0					
		Grades to brown				
	2.5					
		Weathered shale				
	3.0	Refusal on weathered shale encountered @ 3.0' on 10/30/94				offset 4' west NO SAMPLE ~~PB-BG-S4-3.0~~
	3.5	Refusal encountered @ 3.3' in offset hole on 10/30/94				
	4.0					
	4.5					

5.0 E

PROJECT

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-BG-S5

SHEET 1 OF 2 SHEETS

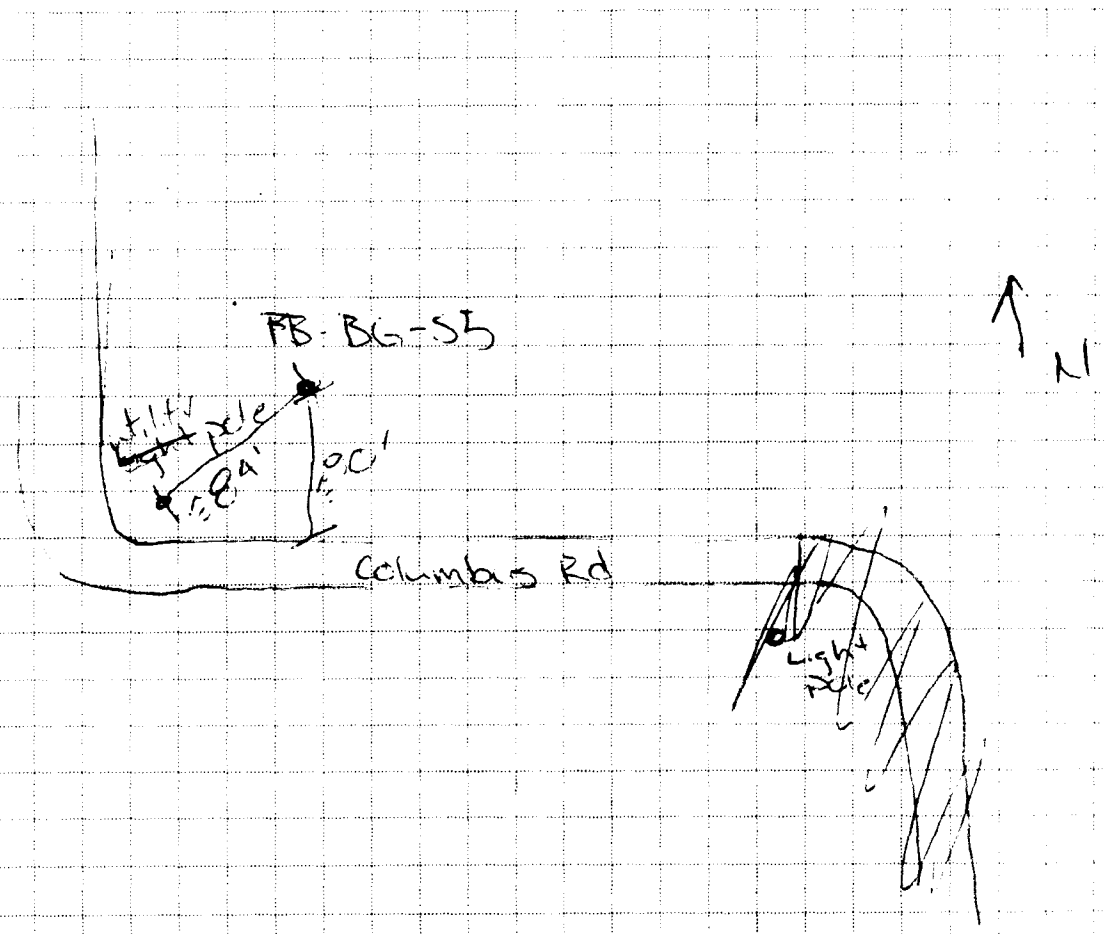
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: B. Starkel / J Eardley	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Hand Auger	8. HOLE LOCATION: PB-BG-S5
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/30/94 — 11. DATE COMPLETED: 10/30/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: Not encountered
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 5.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY) B/NA	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grout				J Eardley

LOCATION SKETCH/COMMENTS — SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER PB-BG-5.5

PROJECT Plum Brook Ordnance Works | INSPECTOR | SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Dark brown silty fine sand w/ roots				
		Grades to brown to tan				
	.5					
	1.0	Grades w/ brownish orange				
						Sample PB-BG-5-0.5/3.0 10/30/04 1200
	1.3	Grades w/ rounded gravel & shale layer				
				VOC's	@ 2.6'	
	2.0	Mottled Grey & Brown silty clay w/ trace fine sand & rare gravel				
	2.5					
	3.0	Sand				
	3.5					
						Sample PB-BG-5-3.0/6.0
	4.0					
	4.5					
	5.0	Boring term @ 5' on 10/30/04 @ 12:25				

PROJECT Plum Brook Ordnance Works | HOLE NO.

Hnu Background throughout

HTRW DRILLING LOG

HOLE NUMBER: PB-BG-S6
SHEET 1 OF 2 SHEETS

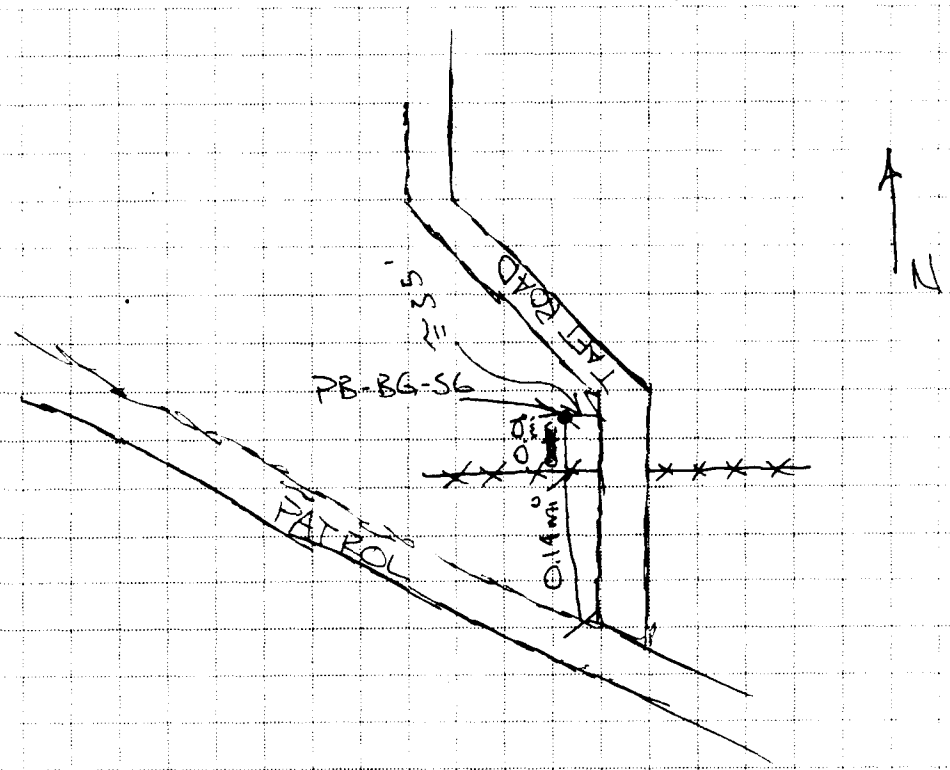
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: J Eyres/S. Susten	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Hand Auger	8. HOLE LOCATION: PB-BG-S6
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 11/1/94 — 11. DATE COMPLETED: 11/1/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: Not Encountered
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 4.5'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	✓ Explosives	B/NA		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grout				[signature]

LOCATION SKETCH/COMMENTS — SCALE: Not to Scale



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-~~BG~~-S6

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Light Brown silty sand w/ Root				Some Veg @ surface
		Roots grade out				
	0.5					
		Grades to Mottled Brownish orange brown yellow + Grey clayey sand				
	1.0					
						Sample PB-~~BG~~-S6-0.5/3.0 collected @ 0930
	1.5	Grades w/ occasional Grey Clay lenses				
	2.0					VOC's
	2.5					
		Grades w/ less Clay				
	3.0		HNU=0			
	3.5					VOC's
						Sample PB-~~BG~~-S6 3.0/4.5 collected @ 0954
	4.0	Mottled Brownish orange and Grey Clay w/ some sand				
			HNU=0			Augering Became Difficult
	4.5	Grades w/ weathered Shale	Auger Refusal @ 4.5 feet			
			Boring Terminated @ 4.5 feet 0954			
	5.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-BG-57

SHEET 1 OF 1 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVE SUETEN/JEFF ENDRES	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION:
	9. SURFACE ELEVATION:
	10. DATE STARTED: / 11. DATE COMPLETED:
12. OVERBURDEN THICKNESS:	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK:	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 3 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

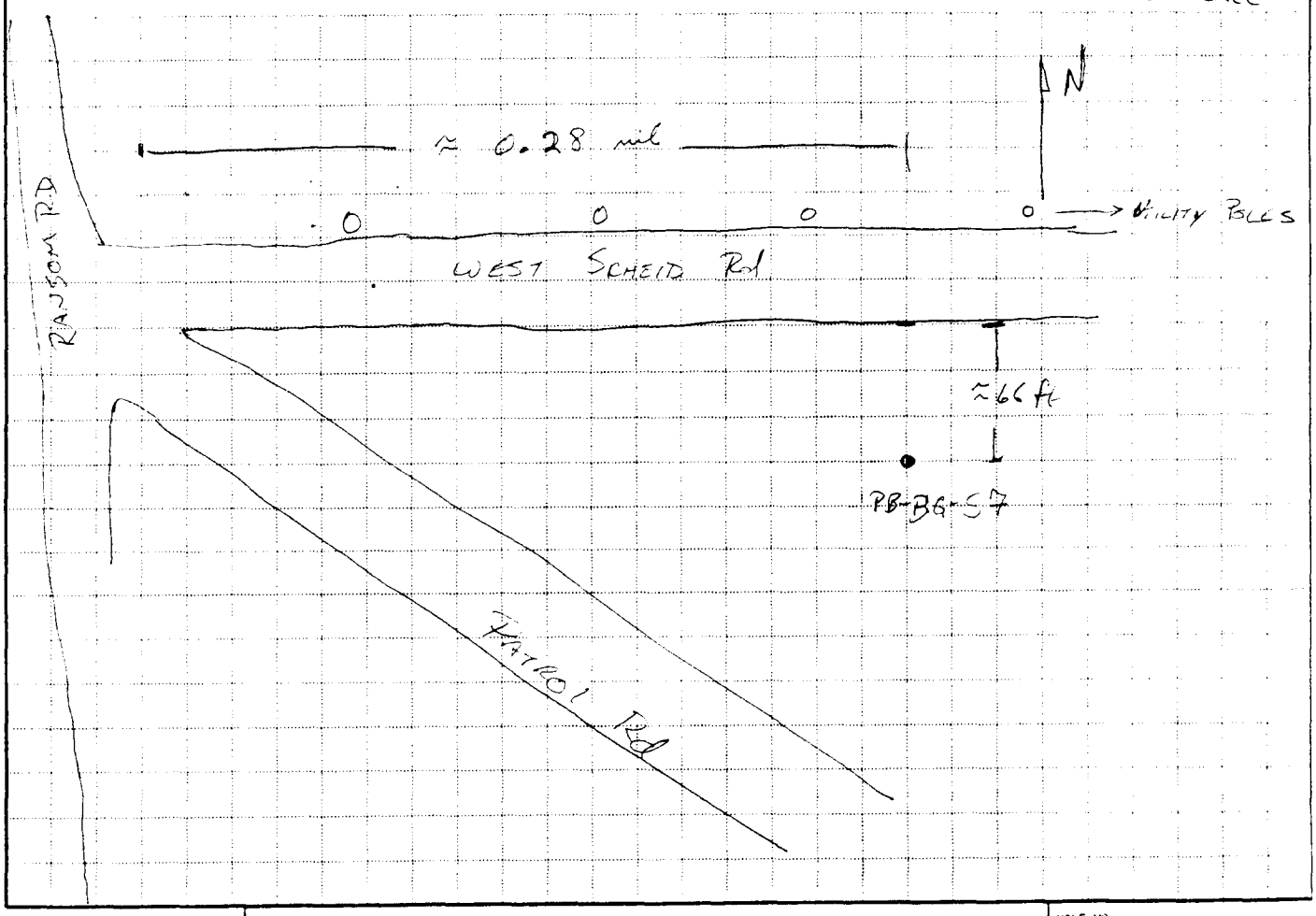
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
0.5/3.0 feet (bulk)	2 x 120 ml	1 x 250	1 x 120 ml	BNA 1 x 250 ml		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS

SCALE: NOT TO SCALE



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER PB-BB-S7

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brownish Gray silty sand w/ Roots	HNU=0			Some Vegetation @ surface w/ some Roots
	0.5					
		Root Grade out				
	1.0					weathered shale
						VOC's
	1.5	Mottled Gray and Brownish orange clayey Sand				Sample PB-~~BB~~-S7-0.5/3.0 collected @ 1020
	2.0					
						Auging Becomes Difficult
	2.5	none shale				
			HNU=0			
		HAND Auger Refusal @ 3 feet				
	3.0	Boring Terminated @ 3 feet 1035				
	3.5					
	4.0					
	4.5					
	5.0					

PROJECT Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-BG-S9

SHEET ___ OF ___ SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: JEFF ENDLES/STEVE SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION:
	9. SURFACE ELEVATION:
	10. DATE STARTED: / 11. DATE COMPLETED:
12. OVERBURDEN THICKNESS:	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK:	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 5 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

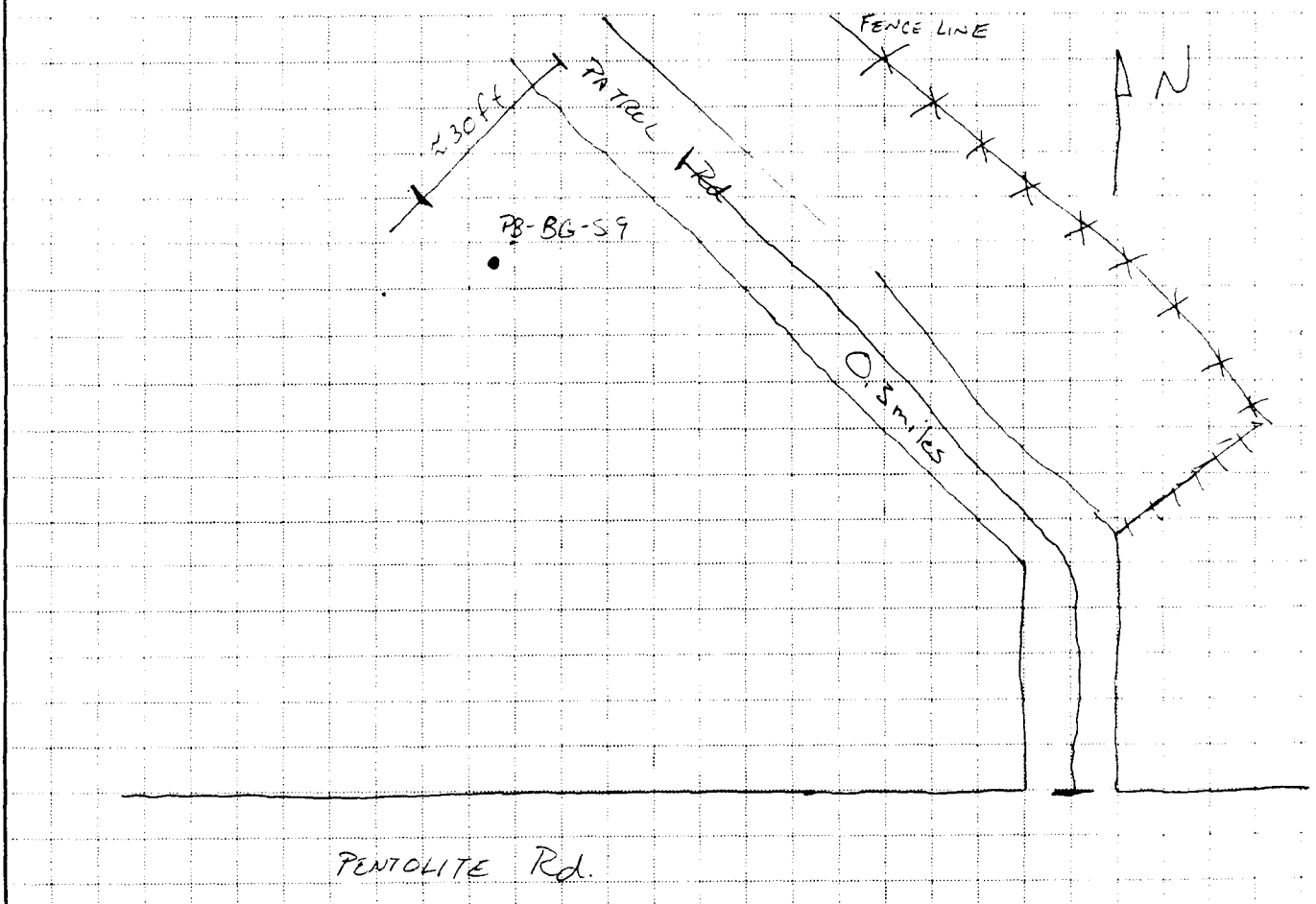
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
0.5/3.0 + 3.0/5.0 each	2 x 120 ml	1 x 250 ml	1 x 120 ml	BNA 1x250 ml		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS

SCALE: NOT TO SCALE



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER PB-BG-59

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dk Brown silty fine sand w/ roots				Some veg @ surface w/ some roots
	0.5	Roots & Grade out				
		Grades to Brownish orange				
	1.0					
	1.5					Sample PB-BG-59-0.5/3.0 collected @ 1145 VOC's
	2.0		HNU=0			
	2.5					
	3.0	MOTTLED Brownish Orange + Gray Sandy Clay				
	3.5					
	4.0					moist sample PB-BG-59-3.0/5.0 collected @ 1215 VOC's
	4.5					
		Grades w/ less sand				
	5.0		HNU=0			

PROJECT Boring Terminated @ 5 ft 1215
No GW Encountered

HOLE NO.

Plum Brook Ordnance Works

APPENDIX C

MONITORING WELL BORING LOGS

HTRW DRILLING LOG

HOLE NUMBER: TNTC-MW03

SHEET 1 OF 3 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belaska Drilling Services, Inc.
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: D-50 diesel
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4 1/4 inch Ø hollow stem auger. 24" split spoon sampler. The augers are 8 ft in length. 140 lb drop hammer dropped 30 inches	8. HOLE LOCATION: TNT Area C
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-12-94 / 11. DATE COMPLETED: 10-12-94
12. OVERBURDEN THICKNESS: 14.5ft	15. DEPTH GROUNDWATER ENCOUNTERED: Dry
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: Dry
14. TOTAL DEPTH OF HOLE: 14.5ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): Dry

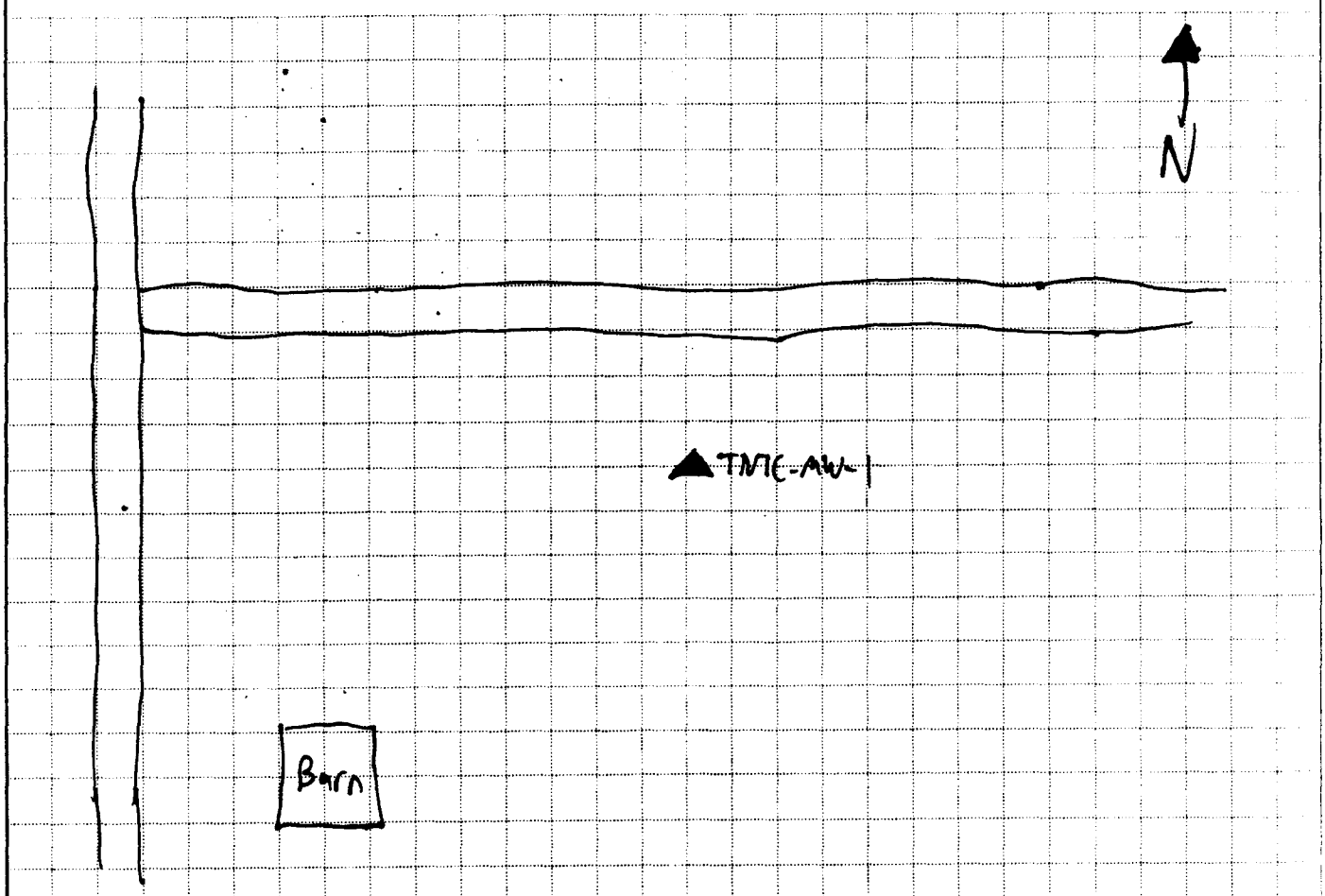
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES: N/A
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
N/A			Explosives			N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		Joe Deatherage

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTC-MW03

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	~~SPECIMEN SAMPLE OR CORE BOX NO.~~ Blow Count (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1 1.2 2	Dark Brown, well graded sandy material; dry. Shale encountered at 2 ft. ~~8 inches~~ recovery. 0.75 ft	0 (Backgrd) Hnu	6, 10, 11, 11		
	2.8 3 3.6 4	8 tenths foot recovery. Light Brown to Brown Shale; Dry; weak (crumbles easily).	0 = Backgrand Hnu	10, 16 18, 19		
	5	Brown sandy shale; dry; From 4 ft to ~~5.8~~ 5.8 ft. From 5.8 to 6 ft it is a sandy clay, dry: 1.3 ft recovery.	Hnu = 0 (Backgrand)	16, 15 23, 29		
	6 7	Brown sandy clay w/ traces of shale; dry; slightly more stiff; 1.4 ft recovery	Hnu = 0 (Backgrand)	10, 16 17, 26		
	8 9 10	Brown to yellowish brown sandy clay; ~~moist~~ wet at 8 ft, dry elsewhere. 1.1 ft recovery. Also traces of Shale	Hnu = 0 (Backgrand)	8, 17, 20, 26		

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TMTC-MW 3

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH. SAMPLE RECORD AND Blow Count	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	10	Brown to gray sandy clay w/ traces of chert; stiff; ~~moist~~ wet at 11.3 ft; moist elsewhere. 1.3 ft recovery	Hnu=0 (Background)	11, 21, 23, 28		
	11					
	12	Light brown to gray sandy clay w/ shale to 13.0 ft. Weathered light gray to gray shale from 13 ft to 13.5 ft. 1.2 ft recovery. moist.	Hnu=0 (Background)	9, 15, 50 over 5"		
	13					
	14	gray highly weathered shale; dry; 0.9 ft recovery	Hnu=0 (Background)	47, 50 over 1"		End of Drilling (refusal at 14.5 ft)
	15					
	16					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTC-MW04

SHEET 1 OF 3 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services Inc.
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: D-50 diesel
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4 1/4 inch ID hollowstem auger; 5 ft long; 24" split spoon sampler. 140 lb drop hammer.	8. HOLE LOCATION: TNT Area C
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-12-94 / 11. DATE COMPLETED: 10-13-94
12. OVERBURDEN THICKNESS: 18 ft	15. DEPTH GROUNDWATER ENCOUNTERED: approx 16 ft
13. DEPTH DRILLED INTO ROCK: 0.7 ft	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 18.7 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

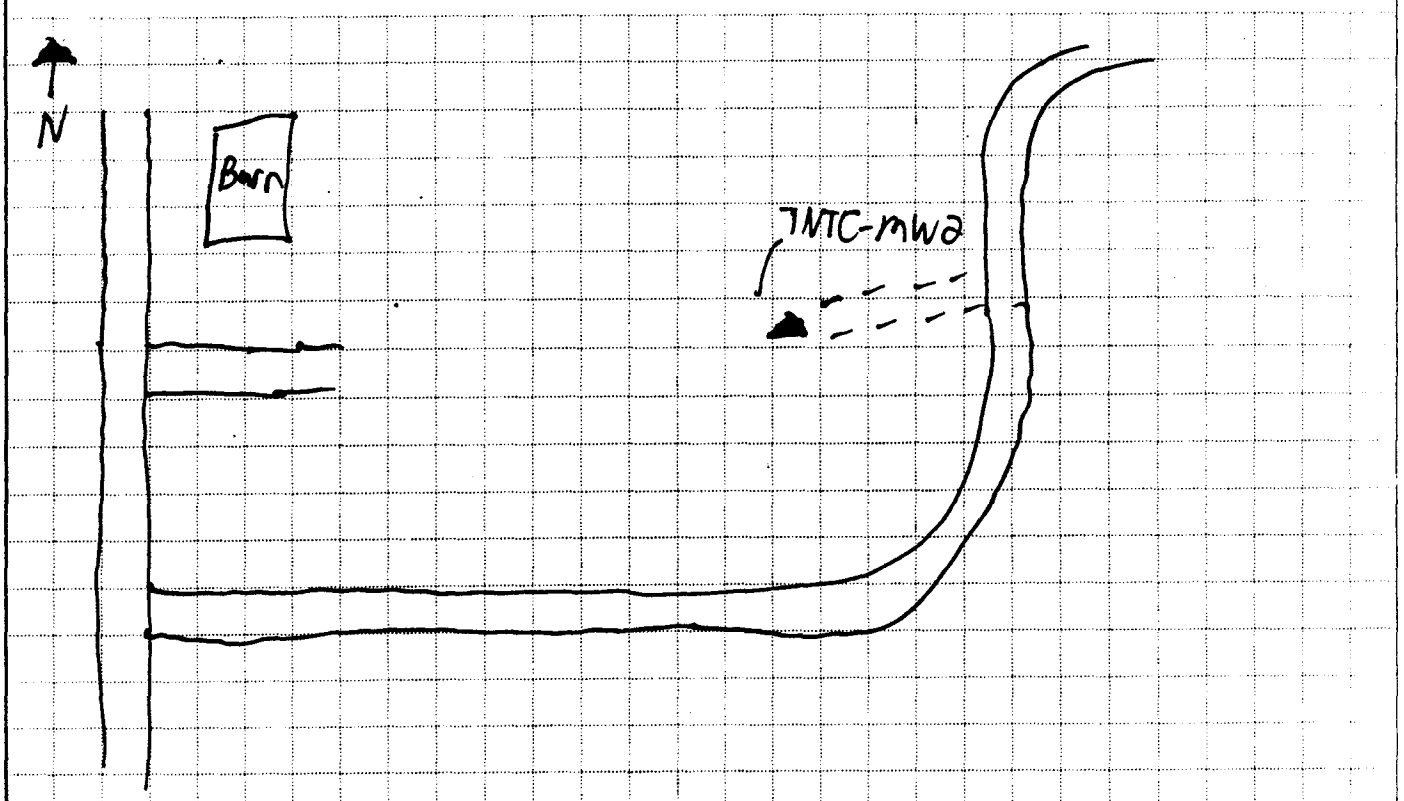
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
N/A						N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		Joe Deathrage

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTC-MW4

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH. SAMPLE BLOW COUNT	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1	Brown to Brownish yellow sandy clay; dry; 1.5 ft recovery;	Hnu=0 (Background)	9,7, 9,10 JD		
	2–3	Brown sandy clay; dry except moist at 4 ft; 0.8 ft recovery;	Hnu=0 (Background)	9,10, 10,11		
	4–5	Brown to gray sandy clay; dry; 1.6 ~~inches~~ feet recovery	Hnu=0 (Background)	12,17, 20,29		
	6–7	Brown sandy clay w/ ~~chips~~ shale mixed; dry; a bit more stiff; 1.5 ft recovery	Hnu=0 (Background) JD	10,19 25,50 overs'l		
	8–9	Olive gray to brownish yellow sandy clay; small traces of shale; dry except moist at 8 ft; 1.5 ft recovery	~~16,25~~ ~~28,29~~ Hnu=0 (Background)	16,25, 26,29		
	10					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER TNTC-mk4

PROJECT Plum Brook Ordnance Works | INSPECTOR Joe Deatherage | SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	~~SEQUENCE OF SOIL BOX HOLE~~ Blow Count	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	10	gray to olive gray sandy clay w/ traces of shale; slightly moist (damp); 1.7 feet recovery	Hnu=0 (Background)	7, 15, 21, 32		
	11					
	12	Olive gray sandy clay w/ traces of shale; very moist soil, wet spoon; stiffer; 1.3 feet recovery.	Hnu=0 (Background)	8, 17, 21, 27		
	13					
	14	Gray sandy clay w/ small traces of shale; stiff; wet at 16'; 0.2 ft recovery;	Hnu=0 (Background)	17, 20 20, 20		
	15					
	16	Gray clay; very stiff; small traces of shale; wet spoon; moist soil; 1.8 ft recovery	Hnu=0 (Background)	10, 15 21, 30		
	17					
	18	Gray weathered shale dry spoon and dry shale	Hnu=0 (Background)	50 over 4 inches,		rock at 18'
						End of drilling
	19					
	20					

PROJECT | HOLE NO.

HTRW DRILLING LOG *original location*

HOLE NUMBER: TNTC-MW5

SHEET 1 OF 2 SHEETS

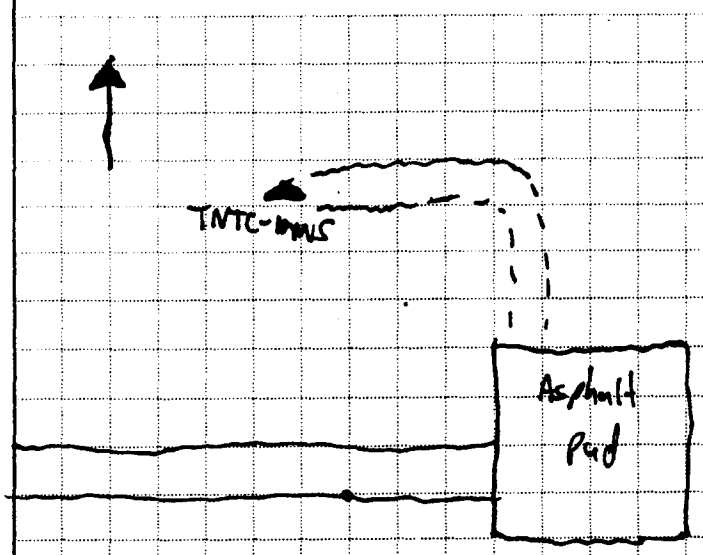
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services, Inc.
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: D-50 diesel
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4¼ inch ID hollow stem auger. 24" split spoon sampler. The augers are 5ft in length. 140# drop hammer	8. HOLE LOCATION
	9. SURFACE ELEVATION: ~~10-13-94~~
	10. DATE STARTED: 10-13-94 / 11. DATE COMPLETED: 10-14-94
12. OVERBURDEN THICKNESS: Unknown	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 3.7ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
N/A			Explosives			N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	X			Joe Deatherage

LOCATION SKETCH/COMMENTS SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG *original location

HOLE NUMBER TNTC-MWS

PROJECT Plum Brook Ordnance Works

INSPECTOR Joe Deatherage

SHEET 1 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown sand; well graded; dry	Hnu=0 (Background)			Blow Count = 4,8,7,12
		gravel (limestone?), dry				Ran: 2'
						Rec: 1.5'
	1	Brownish yellow sand, well graded, dry				lost: 0.5'
	2	Brownish yellow well graded sand; dry	Hnu=0 (Background)			Blow Count - 9,12,40) refusal
						Ran: 1.5'
	3					Rec: 1.3'
						lost: 0.2'
	4					refusal at 3.7'
	5					
	6					
	7					
	8					
	9					
	10					

PROJECT

HOLE NO.

HTRW DRILLING LOG *Offset

HOLE NUMBER: TNTC-MW5

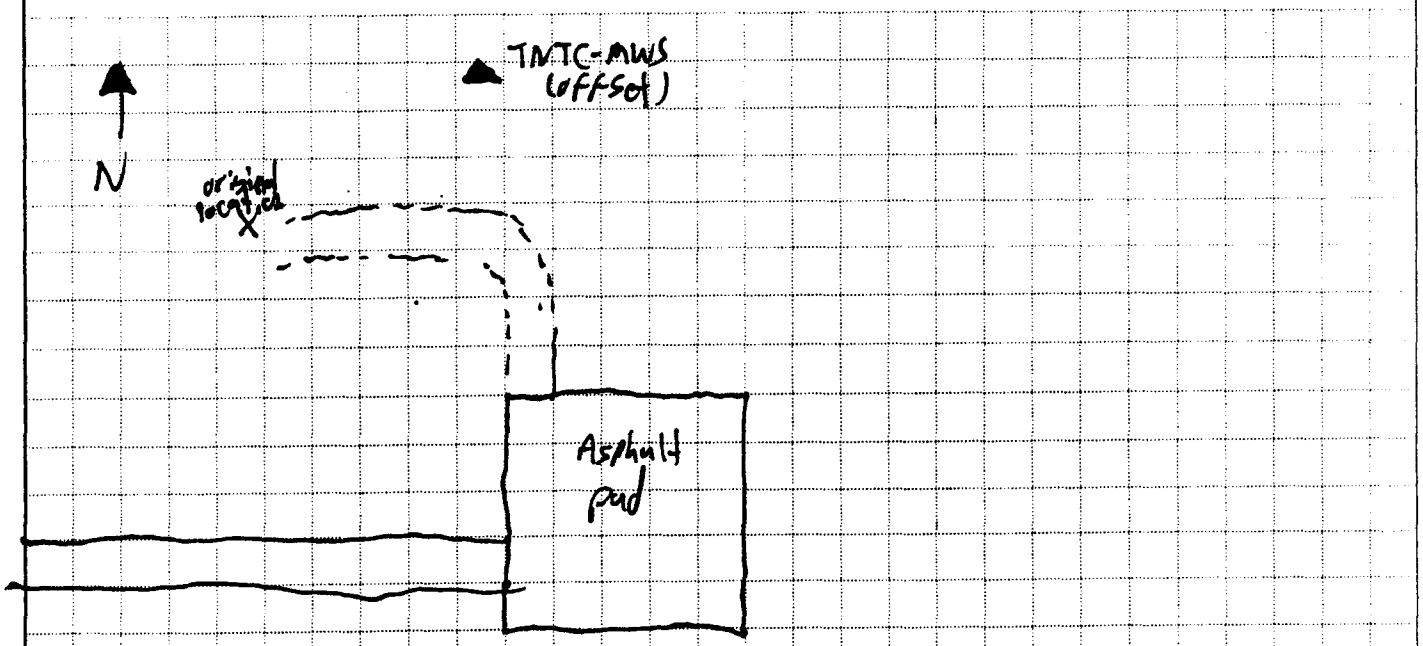
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Blue Belaxe Drilling Services Inc.
SHEET 1 OF 4 SHEETS	
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: D-50 diesel
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4¼ inch ϕ hollow stem auger, 24" split spoon sampler. The rods are 5ft in length. 140 lb drop hammer.	8. HOLE LOCATION: TNT Area C
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-13-94 / 11. DATE COMPLETED: 10-14-94
12. OVERBURDEN THICKNESS: Unknown (refusal not met)	15. DEPTH GROUNDWATER ENCOUNTERED: approx 7ft
13. DEPTH DRILLED INTO ROCK: N/A (0)	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 29.7ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
N/A			Explosives			N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		Joe Deatherage

LOCATION SKETCH/COMMENTS — SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG *Offset*

HOLE NUMBER TMC-MWS

PROJECT Plum Brook Ordnance Works | INSPECTOR Joe Deatherage | SHEET 2 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1	Dark Brown, well graded clayey sand; dry	Hnu=0 (Backgrand)			Blow Count: 5,9,11,12 Pen: 2.0' Rec: 1.7' lost: 0.3'
	2 3	Dark Brown, well graded clayey sand; dry Brown Sandy clay; dry	Hnu=0 (Backgrand)			Blow Count: 6,9,13,15 Pen: 2.0' Rec: 1.7' lost: 0.3'
	4 5	Brown well graded sand; dry Dark brown sandy clay; small traces of shale; dry	Hnu=0 (Backgrand)			Blow Count: 8,13,17,23 Pen: 2.0' Rec: 1.9' lost: 0.1'
	6 7	Dk. olive gray sandy clay; moderately stiff; slightly moist, with some wetness at 6.5 feet	Hnu=0 (Backgrand)			Blow Count: 8,12,13,17 Pen: 2.0' Rec: 1.2' lost: 0.8'
	8 9 10	Olive gray sandy clay: moderately stiff; moist; with wetness at 8.2ft; slight wetness of spoon	Hnu=0 (Backgrand)			Blow Count: 5,9,14,17 Pen: 2.0' Rec: 1.8' lost: 0.2'

PROJECT | HOLE NO.

HTRW DRILLING LOG *Offset*

HOLE NUMBER: TNTC-mw5

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 3 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	10	Olive gray sandy clay; wet; almost no recovery	Hnu=0 (Background)			Blow Count= 6,12,15,16 Run: 2.0' Rec: 0.1' lost: 1.9'
	11					
	12	Olive gray sandy clay; moderately stiff; moist with some traces of wetness within spoon,	Hnu=0 (Background)			Blow Count= 6, 10, 11, 16 Run: 2.0' Rec: 1.0' lost: 1.0'
	13					
	14	Olive gray sandy clay w/ small traces of shale; moist with spotty wetness in spoon;	Hnu=0 (Background)			Blow Count= 7,9,9,12 Run: 2.0' Rec: 1.0' lost: 0.4'
	15					
	16	Olive gray clay; moderately stiff; moist with traces of wetness in spoon	Hnu=0 (Background)			Blow Count: 5,10,13,17 Run: 2.0' Rec: 2.0' lost: 0'
	17					
	18	Olive gray clay; moderately stiff; moist with traces of wetness in spoon	Hnu=0 (Background)			Blow Count = 4,5,10,11 Run: 2.0 Rec: 0.6 lost: 1.4
	19					
	20					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTC-MW5

PROJECT: Plum Brook Ordnance Works | INSPECTOR: Joe Deatherage | SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	20 21	Olive gray clay; relatively soft; moist, with traces of wetness in the spoon	Hnu = 1 (Background)			Blow Count: 7, 8, 10, 11 Ran: 2.0' Rec: 2.0' lost: 0'
	22 23	Olive gray clay; relatively soft; moist with traces of wetness in spoon	Hnu = 1 (Background)			Blow Count: 4, 8, 13, 13 Ran: 2.0' Rec: 1.5' lost: 0.5'
	24 25	Olive gray clay; relatively soft; moist with traces of wetness in spoon	Hnu = 1 (Background)			Blow Count: ~~[illegible]~~ ~~Blow Count: Ran: 0.4' 13~~ ~~Rec: 0.4'~~ ~~lost: 0~~ Ran: 2.0' Rec: 1.6' lost: 0.4'
	26 27	Olive gray clay; relatively soft; a bit more wet; traces of shale	Hnu = 1 (Background)			Blow Count: 8, 9, 10, 13 Ran: 2.0' Rec: 1.5' lost: 0.5'
	28 29	Olive gray clay; relatively soft; moist with traces of wetness; small traces of shale.	Hnu = 1 (Background)			Blow Counts: 5, 10, 15, 12 Ran: 2.0' Rec: 1.2' lost: 0.8'
	30					End of drilling.

PROJECT | HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTC-MW6

SHEET 1 OF 3 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services, Inc.
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: D-50 Diesel
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4¼" ID 5 ft long hollow stem auger; 24". split spoon; 140 lb drop hammer	8. HOLE LOCATION: TNT Area C
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-16-94 / 11. DATE COMPLETED: 10-16-94
12. OVERBURDEN THICKNESS: 12.2 ft	15. DEPTH GROUNDWATER ENCOUNTERED: approx 3.5 feet
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 12.2 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

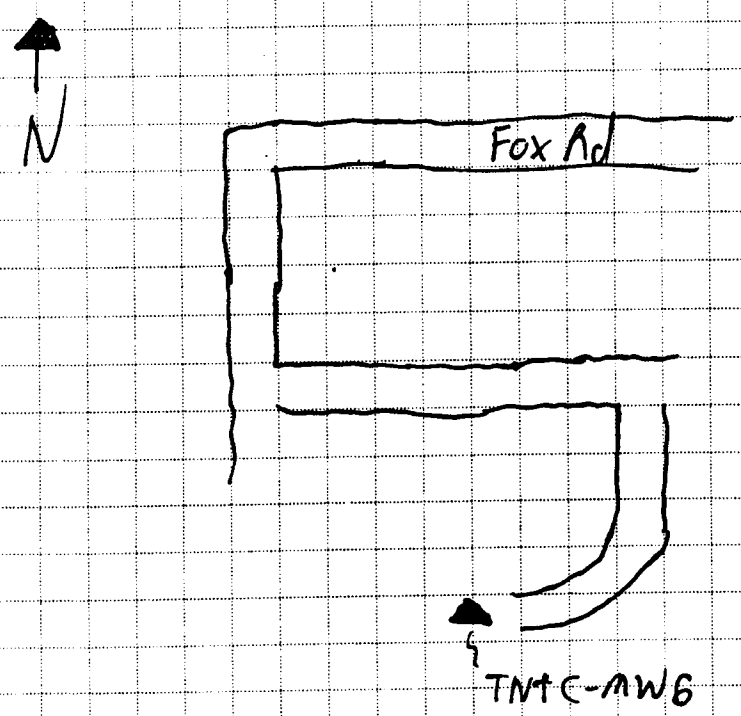
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES: N/A
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY: N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR: Joe Deatherage
		X		

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TMTC-MW6

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1	Dark Brown sandy organic material; dry ~~Hard~~ weathered rock w/ hard gravel pieces Brown to Lt. Brown well graded sand; dry	Hnu=1 (Background)			Blow Count=4,19,7,7 Ran: 2.0' Rec: 2.0' Lost: 0
	2 3	Brownish yellow well graded sand; moist	Hnu=1 (Background)			Blow Count=4,5,6,6 Ran: 2.0 Rec: 1.5 Lost: 0.5
	4	Dark gray well graded sand, wet, 1" strip of Black sand.				
	5	Dark gray well graded Sand w/ black staining mixed in; wet; no significant odor.	Hnu=1 (Background)			Blow Count=2,1,1,1 Ran: 2.0 Rec: 1.4 Lost: 0.6
	6 7	Dark Gray well graded sand w/ black staining; wet.	Hnu=1 (Background)			Blow Count=1,4,5,6 Ran=~~0.5'~~ 2.0' Rec=0.5' Lost=1.5'
	8	Gray, soft clay; wet; sandy				
	9	Gray sandy clay; very soft; wet	Hnu=1 (Background)			Blow Count=4,7,9,10 Ran: 2.0 Rec: 1.2 Lost: 0.8
	10	Gray weathered shale; moist				

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTC-MW6

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deathrage

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	10	Gray weathered shale; moist	Hnu=1 (Background)			Blow Count= 4, 7, 13, 20 Ran: 2.0 Rec: 1.2 Lost: 0.8
	11					
	12	Gray weathered shale; moist.	Hnu=1 (Background)			Blow Count= 4, 50 over 2" Ran: 0.5 Rec: 0.5 Lost: 0
	13					
	14					End of Drilling. The well is ~~[illegible]~~ 12.2 ft deep.
	15					
	16					
	17					
	18					
	19					
	20					

PROJECT

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTA-MW10

SHEET 1 OF 3 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belsaw Drilling Services, Inc.
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: D-50 Diesel
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4¼" ø hollow stem 5 ft long augers; 24" split spoons; 140 lb drop hammer	8. HOLE LOCATION: TNT Area A
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-15-94 / 11. DATE COMPLETED: 10-15-94
12. OVERBURDEN THICKNESS: 11.0 ft	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 11.0 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

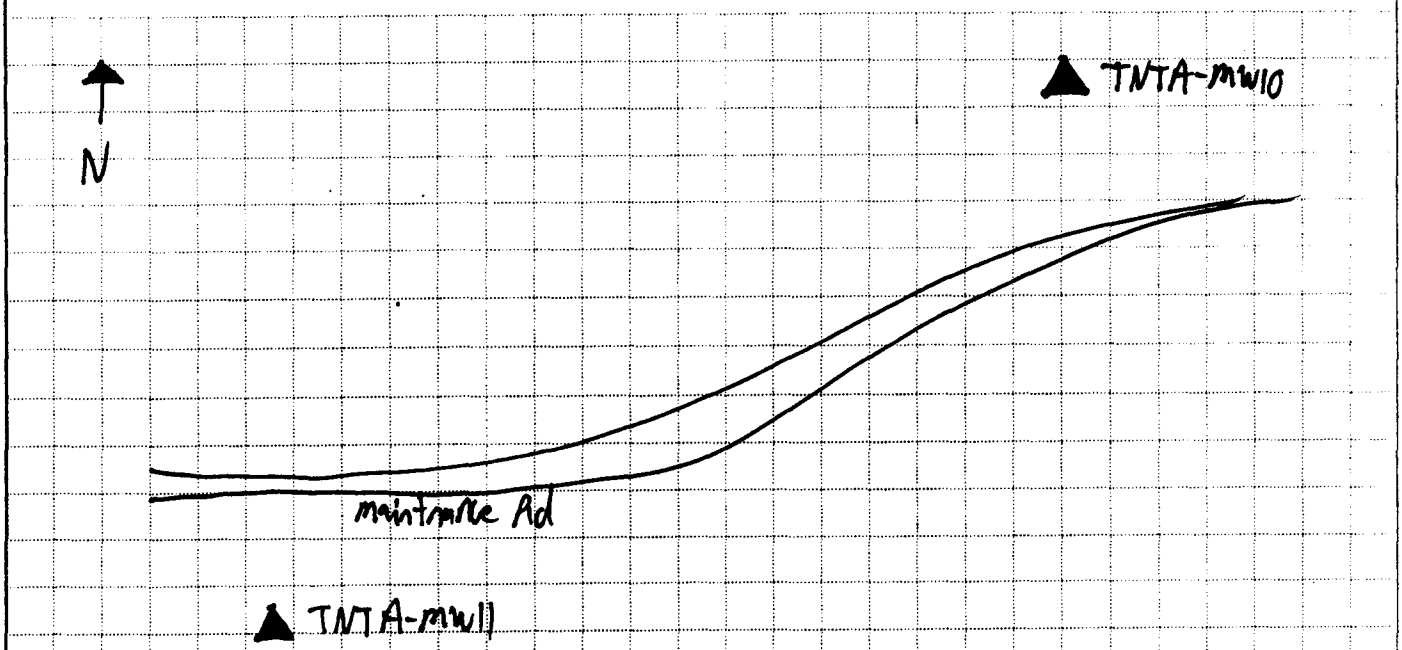
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
			Explosives			N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		Joe Deathrage

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.:

HTRW DRILLING LOG

HOLE NUMBER: TNTA-MW10

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deathrage

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1	Dark Brown Sandy organic material; dry Brownish yellow well graded sand; moist	Hnu = 1 (Background)			Blow Count: 2, 4, 7, 10 Ran: 2.0' Rec: 1.5' lost: 0.5
hole Plug	2	Dark Brown Sandy organic material; moist Brown to Brownish yellow well graded sand with fines; wet	Hnu = 1 (Background)			Blow Count = 6, 10, 9, 18 Ran: 2.0 Rec: 1.8 Lost: 0.4
0 0	3					
0 0 Sand	4	Brownish yellow well graded sand, wet Gray well graded sand, wet Gray moderately stiff clay; moist	Hnu = 1 (Background)			Blow Count: 3, 3, 5, 12 Ran: 2.0 Rec: 1.4 lost: 0.6
0 0	5					
0 0	6	Gray highly weathered Shale; Slightly moist to dry	Hnu = 1 (Background)			Blow Count: 6, 15, 26, 19 Ran: 2.0' Rec: 1.2' lost: 0.8'
0 0	7					
0 0	8	Gray highly weathered Shale; moist with traces of wetness in spoon	Hnu = 1 (Background)			Blow Count = 8, 31, 20, 35 Ran: 2.0' Rec: 1.4' lost: 0.6'
	9					
	10					

SCREEN

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER TWTA-MW20

PROJECT Plum Brook Ordnance Works

INSPECTOR Joe Deatherage

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
0 0 Sand 0 0	10	Light Gray; weathered Shale, dry to moist	Hnu=1 (Background			Blow Count= 15, 48, 50 over 3 inches. Ran=1.0 Rec=1.0 Lost=0
	11					
	12					Spoon refusal. End of Drilling, Total Depth of hole is 11.0 ft. ~~Note:~~

PROJECT Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTA-MW11

SHEET 13 OF 13 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling, Inc.
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: DSO Diesel
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4¼" hollow stem auger; 5 ft lens; 24" split spoon; 140 lb drop hammer.	8. HOLE LOCATION: TNT Area A
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-15-94 / 11. DATE COMPLETED: 10-15-94
12. OVERBURDEN THICKNESS: 10.0 ft	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
13. DEPTH DRILLED INTO ROCK: 1.4 ft	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 11.4 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

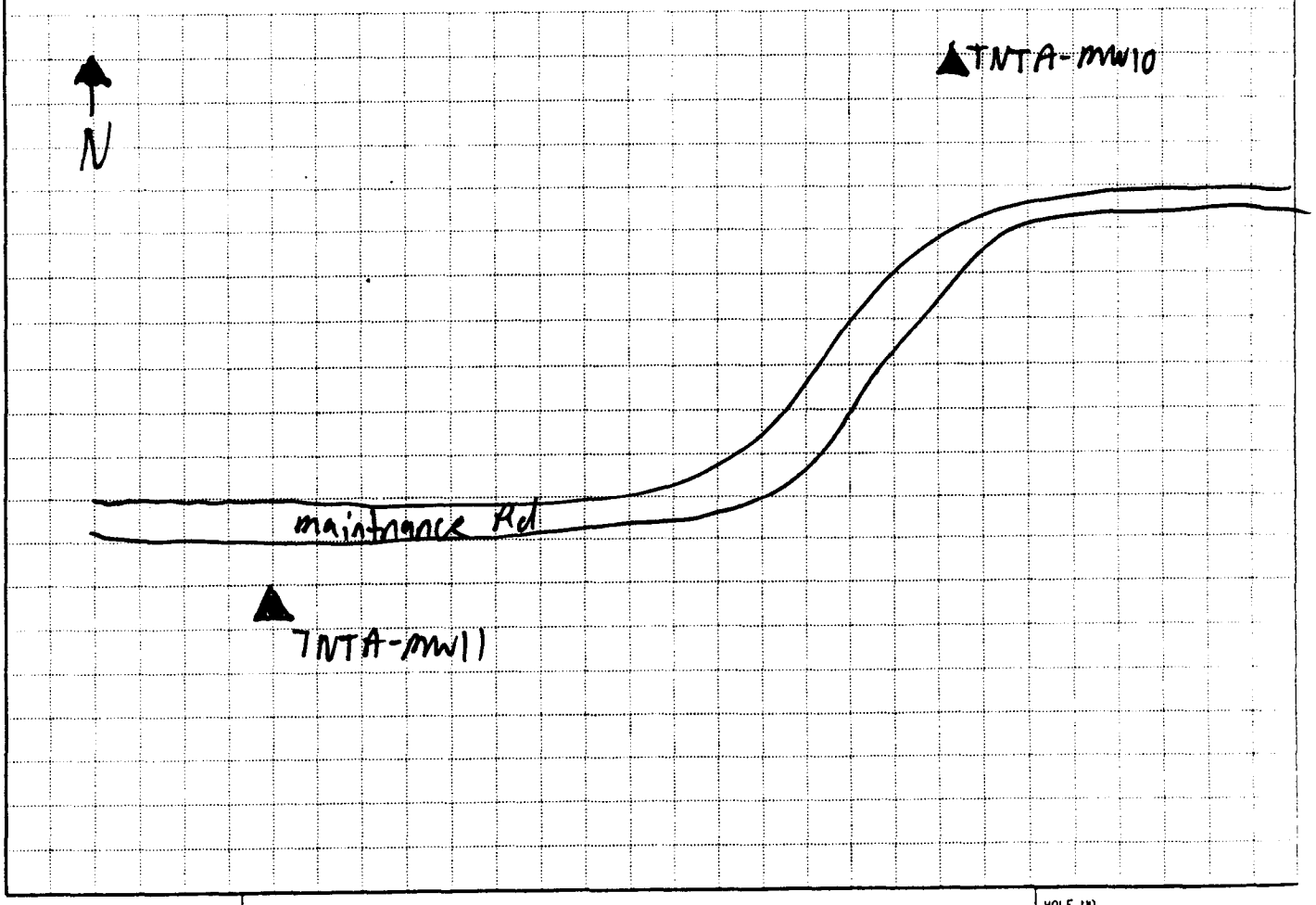
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		Joe Deatley

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TVTA-MW11

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage

SHEET 2 OF SHEETS 3

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1	Dark Brown, Sandy organic material; dry	Hnu=1 (Background)			Blow Count=3,5,10,10 Ran: 2.0' Rec: 1.7' Lost: 0.3
	2–3	Dark Brown sandy organic material; dry	Hnu=1 (Background)			Blow Count=5,8,8,9 Ran: 2.0' Rec: 1.5' Lost: 0.5'
	4–5	Dark Brown sandy organic material, Dry Olive gray clay w/ weathered Shale mix; dry	Hnu=1 (Background)			Blow Count=4,5,7,8 Ran: 2.0' Rec: 1.6' Lost: 0.4'
	6–7	Gray highly weathered Shale; dry	Hnu=1 (Background)			Blow Count=8,16,18,22 Ran: 2.0 Rec: 1.6 Lost: 0.4
	8–9	Gray highly weathered shale; dry	Hnu=1 (Background)			Blow Count=12,22,28,46 Ran: 2.0' Rec: 1.7' Lost: 0.3'
	10					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: INTA-MW11

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	10	gray shale : hard	Hnu = 1 (Background)			Blow Count = 28, 34, 50 over 4 inches. Run = 1.5 ft Rec = 1.5 Lost = 0
	11					
						Refusal at 11.4 ft.
	12					
	13					
	14					
	15					
	16					
	17					
	18					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTB-MW12

SHEET 1 OF 2 SHEETS

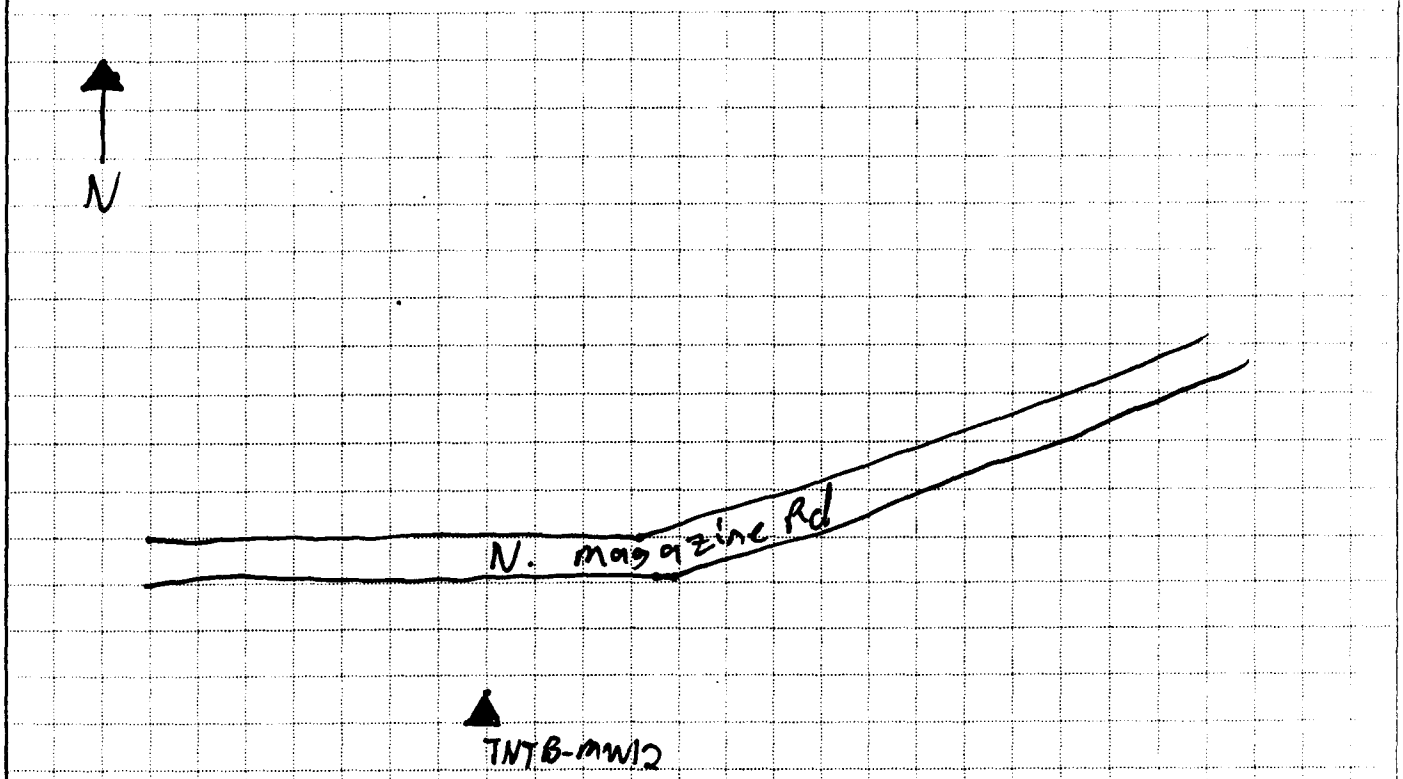
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services, Inc.
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: D-80 Diesel
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4¼" Ø hollow stem 5 foot long augers; 24" split spoons; 140 # drop hammer	8. HOLE LOCATION: TNT Area B
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-14-94 / 11. DATE COMPLETED: 10-14-94
12. OVERBURDEN THICKNESS: ~~N/A~~ 5.5ft	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
13. DEPTH DRILLED INTO ROCK: ~~N/A~~ 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 5.5ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
						N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		Joe Deatherage

LOCATION SKETCH/COMMENTS SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: TNTB-MW12

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1	Dark Brown Sandy organic material; dry	~~Hnu=2~~ ~~TB 50~~	Hnu=2 (Backgrand)		Blow Count: 3 4 4 5 Pen: 2.0 Rec: 1.3 lost: 0.7
	2 3	Dark brown weathered shale; dry; moderately hard		Hnu=2 (Backgrand)		Blow Count: 8, 17, 27, 36 Pen: 2.0' Rec: 1.3' lost: 0.7'
	4 5	Dark Brown weathered shale, dry; moderately hard		Hnu=2 (Backgrand)		Blow Count: 8, 50 over 5 inches
	6 7 8 9 10 11 12 13 14 15 16 17 18 19 20					Auger refusal at 5.5ft. We will place a 5ft screen, put sand from 5.5ft to 1ft, and put bentonite from 1ft to groundsurface. The well will then be called complete.

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW 13

SHEET 1 OF 1 SHEETS

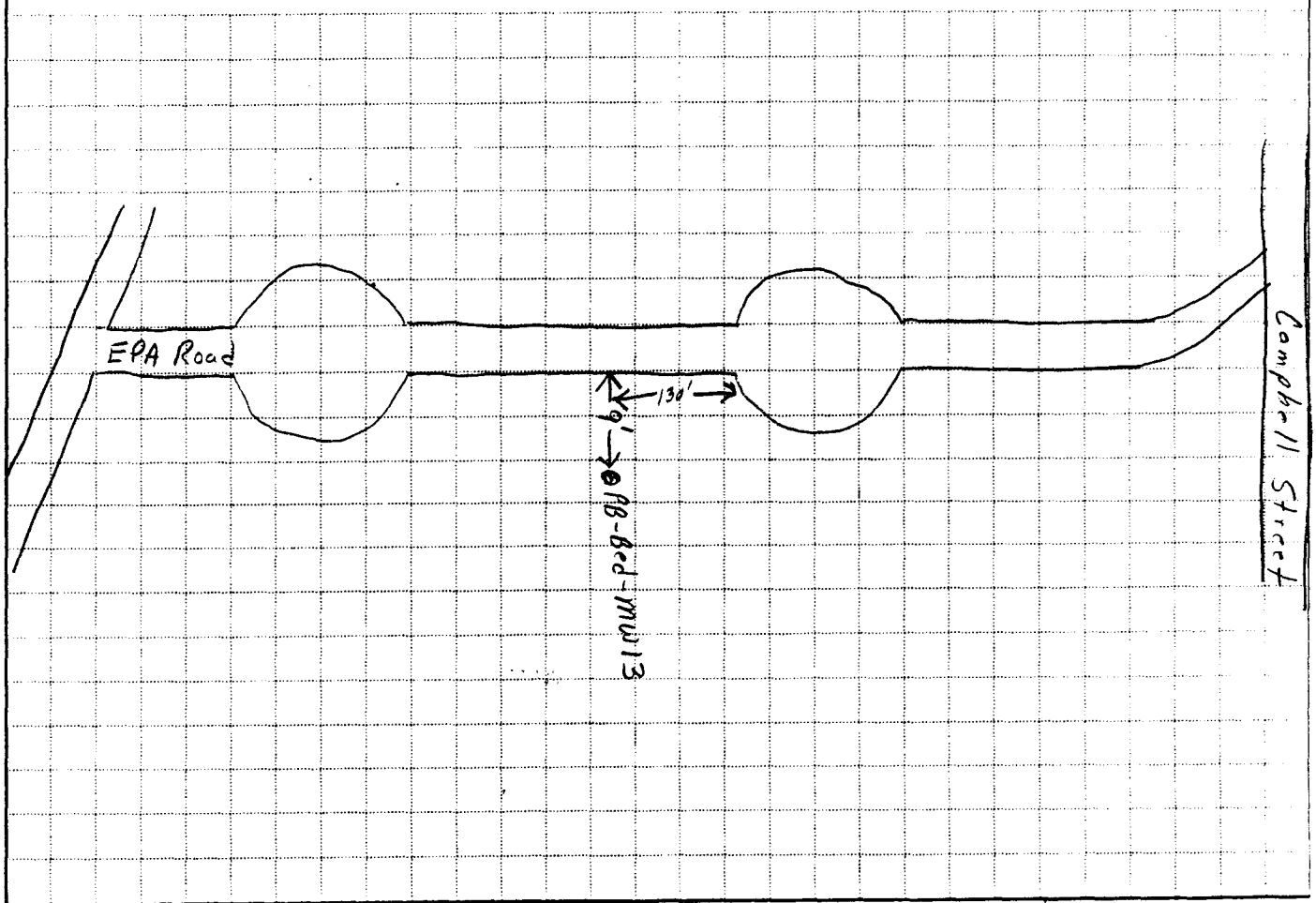
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Balasco Drilling Services, Inc
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Al Dudley	6. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-120
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4¼" ID HSA w/cont. sampling; 6¼" ID HSA, 2' Split Spoons; NX Core Equipment, 6" Roller Cone	8. HOLE LOCATION: EPA Road
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-12-94 / 11. DATE COMPLETED: 11-8-94
12. OVERBURDEN THICKNESS: 40.7' BGS	15. DEPTH GROUNDWATER ENCOUNTERED: not encountered until coring commenced
13. DEPTH DRILLED INTO ROCK: 40.7' – 75.5' BGS	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 20.41' BTOC 24hrs
14. TOTAL DEPTH OF HOLE: 75.5' BGS, 78.10' BTOC	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 43.01' 11-16-94

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES: 4
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY: 93%
None						

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		Charles Way

LOCATION SKETCH/COMMENTS — SCALE: Not to Scale



PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW13

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW13

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Dark Brown to Brownish Black Silty Fine Sand with organics		3		
				5		
		Yellow Brown to Reddish Brown Fine Sandy Silt to Silty Fine Sand Some root modeling present Dry		6		
				8		24" Recovery
	2			4		
				5		
				5		
		Tanish Brown and Gray silty Clay moist		6		24" Recovery
	4	Same as above with a couple sand zones less than ½ inch in thickness - dry		3		
				3		
				6		
				7		22" Recovery
	6	Silty Clay Grades mainly Gray - layered in thin sheets		3		
				6		
				9		
				16		24" Recovery
	8	Gray Silty Clay with a 2" Brownish Yellow med sand zone at 9.0'		4		
				9		
				12		
				18		24" Recovery
	10					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW13

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW13

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 3 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	10	Same as above, grading to very highly weathered shale layered and powdery		8		
				12		
				20		
				50/5		20" Recovery
	12			16		
				50/4		10" Recovery
				Straight Auger very Hard		13' Straight Auger, too hard to sample, not hard enough to core
	14					
	16					
	18					
	20					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW13

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW13

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 4 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	20					Continue straight Augering
	22					
						Very Hard
	24					
	26					
						27' Picking up an odor from Borehole, appears to be due to augers cutting the very hard weathered shale cuttings very hot. HNu = occasionally 3 in Breathing zone. Burnt oil odor
	28					
	30					

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW13

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 5 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	30					Straight Auger
	32					
	34					
	36					
	40					Auger Refusal 40'

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW13

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-mw13

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 6 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	40	Limestone				Auger Refusal 40.7
	Ti Break	Shaly, medium Dark Gray (N4), very thinly laminated, slightly calcareous with occasional bivalve fossils and very slight amount of pyrite, slight oil odor from shale				Run 1 40.7' - 45.8' 250 psi Down pressure Initial core recovery of 14 3/4" Have to go back in to get remaining core
	Ti Break					
		Ti Break				
		Ti Break				
	42					
		Ti Break		Box 1		
		Ti Break				
						20 min/5 ft
	43					
		Ti Break				Core 61.5" Rec 61.5"
	44					
		Ti Break				
	45					
		Ti Break				End Run 1 at 45.8'
						Roller Cone
	46	Same as above with numerous bivalves, pyrite more numerous, occasional natural fractures				Begin Run 2 at 46.0' 4" casing set to 46.0'
4.6'	Open Break					
		Ti Break				
	47	Ti Break				21 min/9.6 feet
		Ti Break		Box 1		
						Core 115" Rec 96" Lost 19"
	48	Ti Break				
		Ti Break				
	49					
		Ti Break				
		Ti Break				
		Ti Break				
	50					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-mw13

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW13

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 7 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	50					
		Ti Break		Box 1		
		Ti Break				
	51					
		Grades to pale yellowish Brown (10YR 6/2) and Medium Dark Gray with petroleum odor				
		Ti Break				
	52	Ti Break				
		Spin				
		Ti Break				
	53	Spin		Box 2		
		Spin				
		Broken up due to coring				
	54					
		Ti Break				
	55	Spin				
						End Run 2 at 55.6'
						Begin Run 3 at 55.6'
	56	Ti Break				
		Spin				
	57	Spin				20 min/10 ft
		Spin				H_2S reading 1 ppm after coring
	58	Spin				Hear gurgling sound in borehole
		Ti Break				
		Ti Break				core 120"
	59					Rec 117"
		Ti Break				Lost 3"
		Spin				
	60					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW13

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW13

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 8 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	60	Spin		Box 2		
		Ti Break				
	61	Ti Break				
		Ti Break				
	62	Ti Break		Box 3		
		Ti Break				
	63					
		Ti Break				
		Ti Break				
	64	Ti Break				
		Ti Break				
		Ti Break				
	65					
		Ti Break				End Run 3 at 65.5'
		Grades medium Dark Gray (N4) Spots of oil on				Begin Run 4 at 65.5'
	66	Ti Break Core				Lost approx 6' of core down hole, blocking borehole at 46', cant get it out, will have to roller cone it out with 3 3/4" roller cone next week.
		Ti Break				
	67					
		Ti Break				
	68	Ti Break				11-8-94 Cleared Blockage with roller cone, inserted core barrel, only able to recover 3.3' of remaining core.
		Ti Break				
		Ti Break				
		Ti Break				
	69					Core 120" Rec 75" Lost 45"
		Ti Break				
	70			Box 4		

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW13

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW13

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 9 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	70	Broken up due to coring				
	71					
	72			Box 4		
	73					
	74					
	75					End Run 4 at 75.5'
						Borehole PB-Bed-MW13 Terminated at 75.5' on 11-8-94
	76					
	77					
	78					
	79					
	80					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW13

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW17

SHEET 1 OF 1 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Al Dudley	6. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-120
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4¼" ID HSA, 6¼" ID HSA; 2' Split Spoons, 6" Roller Core; NX Core Equipment	8. HOLE LOCATION: Pentolite Road
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-26-94 / 11. DATE COMPLETED: 11-11-94
12. OVERBURDEN THICKNESS: 37.3' BGS	15. DEPTH GROUNDWATER ENCOUNTERED: Not encountered until coring commenced
13. DEPTH DRILLED INTO ROCK: 37.3' BGS - 64.4' BGS	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 28.23' BTOC 15 hrs
14. TOTAL DEPTH OF HOLE: 64.4' BGS, 67.0' BTOC	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 26.88' BTOC 11-16-94

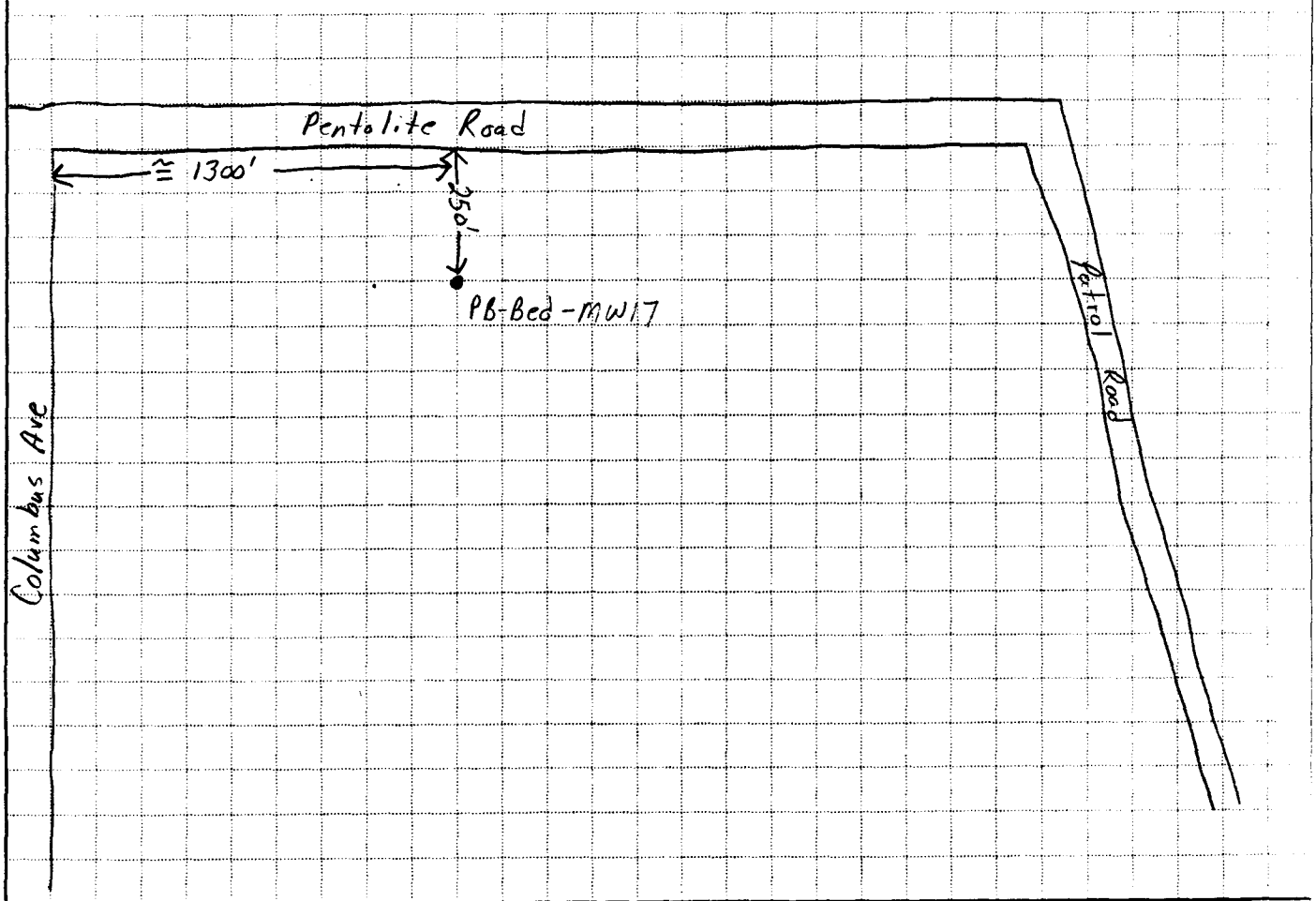
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		3

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
			Explosives			99%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		Charles Way

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW17

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW17

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Black to Dark Brown Silty Fine Sand - dry roots	HNu 0	3		22" Recovery
				4		
	1			5		
		Grades Brownish Yellow and Gray with trace Clay - dry		7		
	2	Brownish Yellow and Gray Clayey Silt with weathered shale fragments and cemented Sand fragments - dry	HNu 0	5		20" Recovery
				5		
	3			6		
				7		
	4	Grades with Brown, no cemented sand fragments Dry	HNu 0	4		24" Recovery
				6		
	5			10		
				15		
	6		HNu 0	4		24" Recovery
				12		
	7			15		
		Grades with olive gray, dry hard		20		
	8	Gray Silty Clay - dry	HNu 0	3		24" Recovery
				8		
	9			10		
				12		
	10					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW17

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW17

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 3 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	10	Same as above - dry	HNu 0	6 10		22" Recovery
	11	Gray thinly laminated highly weathered shale Dry		34 50/4		
	12	Same as above - dry	HNu 0	24 50/3		10" Recovery
	13					Straight Auger
	14					
	15					
	16					
	17					
	18					
	19					
	20					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW17

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW17

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 4 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	20	Gray weathered shale				Straight Auger
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW17

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW17

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 5 OF 5 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					Auger Refusal 37.3'
	Ti Break Ti Break 38	Limestone, medium Dark Gray (N4) to Olive Gray (5Y 4/1), finely crystalline, strong, fresh with occasional bivalve fossils Hard	Rec/Core 59/59	74"/Core 51/59 Box 1		Begin Run 1 at 37.3' with NX core barrell on 10-26-94 Natural fracture at 37.75', 37.9', 37.97', 40.0', 40.4' Core 59" Rec 59"
	39					
	40	Ti Break				

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW17

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW17

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 6 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	40					
		Ti Break				
				Box 1		
	41					
	42					End Run 1 at 42.2'
						Begin Run 2 at 42.2' 10-27-94
			35/36	35/36		
	43					
				Box 1		35 min/3ft
						350 lbs/down pressure
						core 36"
	44					Rec 35"
						Lost 1"
						44.8'-44.95' busted up with Hammer
	45					End Run 2 at 45.2'
						Roller Cone
		Fossiliferous Limestone, medium Dark Gray (N4), strong, Fresh, with numerous stylolites and a petroleum odor Finely crystalline				Begin Run 3 at 45.3' with NQ core barrell and clear water on 11-11-94
		Ti Break				
	46					
		Ti Break		Box 2		
	47					
		Ti Break				Core 109"
						Rec 108.5"
	48					
						26 min/9.1 ft
		Ti Break				
		Weathered Broken up zone + grades to yellowish gray (5Y 7/2)				
	49					
		Ti Break				
	50					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW17

HTRW DRILLING LOG

HOLENUMBER PB-Bed-mw17

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET 7 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	50					
		30° Weathered Break with mineral decomposition				
	51					
		Ti Break		Box 2		
		Ti Break				
	52					
	53					
	54	Ti Break at stylolite				End Run 3 at 54.4'
						Begin Run 4 at 54.4'
	55					
		Ti Break				core 120"
	56					Rec 120.5"
						27.5 min/10ft
	57					
	58					
	59					
		Ti Break				
	60					

PROJECT

HOLE NO.

Plum Brook Ordnance Works

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW17

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 8 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	60			Box 2		
	61	Open Break, Black Stained				
				Box 3		
	62					Losing core water 30-40 gals
		Ti Break				
	63					
		Ti Break				
	64	Ti Break				End Run 4 at 64.4'
						Borehole terminated at 64.4' on 11-12-94
	65					
	66					
	67					
	68					
	69					
	70					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-mw18

SHEET 1 OF 1 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Al Dudley	6. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-120
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4¼ HSA's, 6¼ HSA's; 2' Split Spoons; NX Core Equipment, 6" Roller Cone	8. HOLE LOCATION: East of TNT Area A
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-24-94 / 11. DATE COMPLETED: 11-2-94
12. OVERBURDEN THICKNESS: 30.8' BGS (Below ground surface)	15. DEPTH GROUNDWATER ENCOUNTERED: 8.5'
13. DEPTH DRILLED INTO ROCK: 30.8'-75.4' BGS	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 29.87' 24hrs
14. TOTAL DEPTH OF HOLE: 75.4' BGS, 78.10' BTOC	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 29.69' BTOC 11-16-94

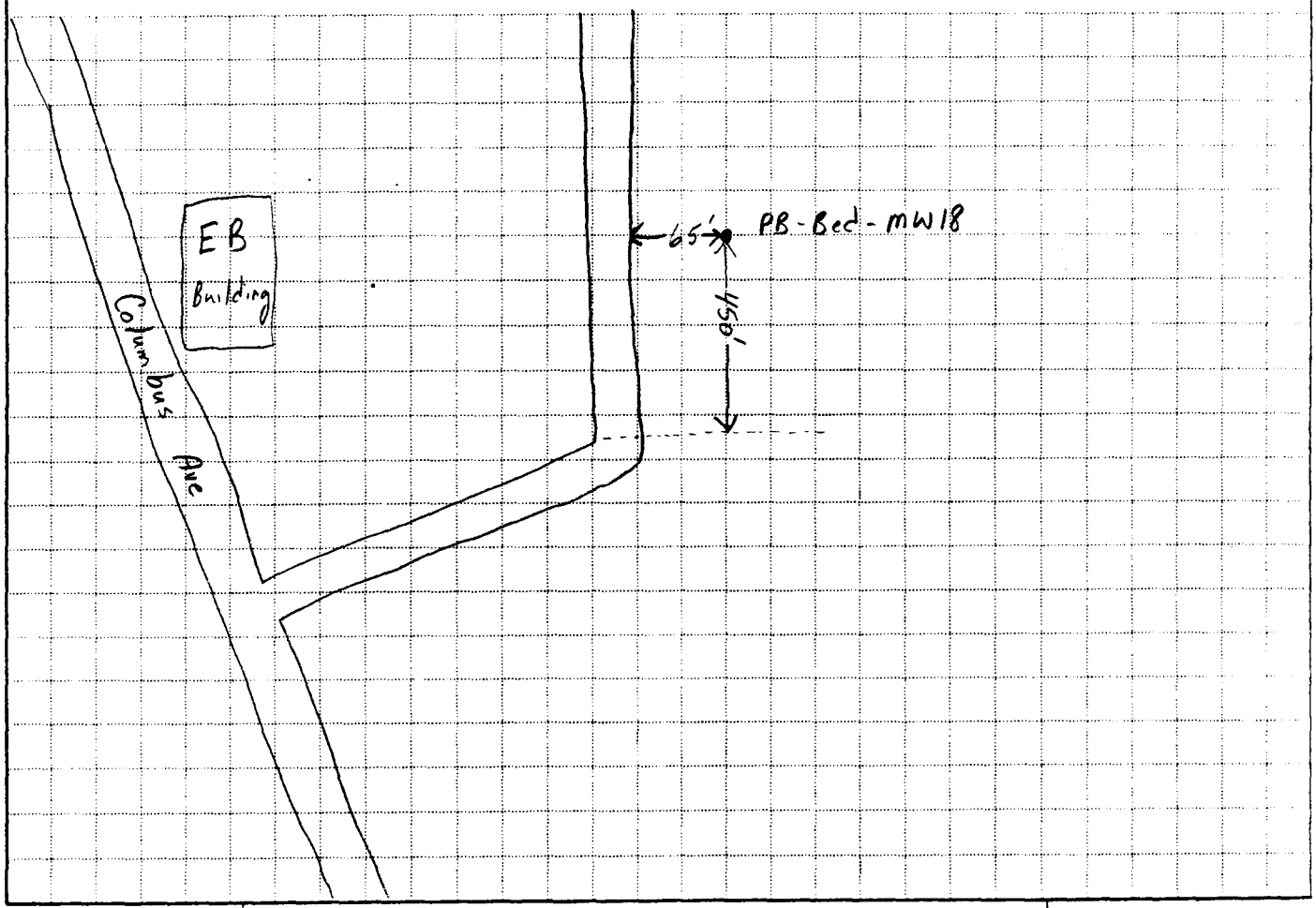
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		4

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
			Explosives			84%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		Charlie Way

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-mw18

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW18

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 2 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Dark Brown Silty Fine Sand	HNu	1		20" Recovery
		Grades to Brownish Yellow	0	3		
	1			4		
		Grades back to Dark Brown with gravels		8		
	2	Dry	HNu	5		24" Recovery
			0	6		
	3	Grades brownish Yellow		5		
				5		
	4		HNu	3		20" Recovery
		Mottled Brown, Brownish Yellow and Gray Silty Sandy Clay with gravels - Dry	0	5		
	5			4		
				6		
	6		HNu	3		24" Recovery
			0	5		
	7	Grades to Brownish Yellow and Gray Silty Clay - Dry		7		
				12		
	8		HNu	4		20" Recovery
		Gray Gravelly Clay - weathered rock fragments - wet	0	22		
	9			37		
				50/5		
	10					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW18

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW18

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 3 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	10	Weathered shale in shoe wet		23		1" Recovery
				39		
	11			39		
				50/4		
	12	Layered weathered shale & clay Hard Augering				Straight Auger
	13					
	14					
	15					
	16					
	17					
	18					
	19	Weathered shale becomes dry				
	20					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW18

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW-18

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 4 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	20	Weathered Shale dry				Straight Auger
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW18

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW18

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 5 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	30					
	31	Shale, medium Dark Gray (N4) to dark gray (N3), highly weathered, slightly calcareous	Rec/core 55"/58"	74"/core 29"/58"		Begin Run 1 at 30.8' with NX core barrell on 10-24-94
						17.75 min/5ft
	32					250 lbs downpressure
	33					Core 58" Rec 55" Lost 3"
	34			Box 1		
	35					End Run 1 at 35.7'
						Begin Run 2 at 35.7'
	36		62"/60"	55/60		
	37					18.5 min/5ft
						250 lbs/ downpressure
	38					Core 60" Rec 62" Gain 2"
	39					
	40					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW18

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW18

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 6 OF 6 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	40			Box 1		End Run 2 at 40.7'
						Begin Run 3 at 40.7'
	41		50.5/60	50.5/60		18.5 min/5ft
						250 lb down pressure
	42					Core 60"
						Rec 50.5"
	43					Lost 9.5"
	44			Box 2		
	45					End Run 3 at 45.7'
						Begin Run 4 at 45.7'
	46		64/60	60/60		24 min/5ft
						250 lb down pressure
	47					Core 60"
						Rec 64"
						Gain 4"
	48					
	49					
	50					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW18

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW18

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 7 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	50			Box 2		End Run 4 at 50.7'
	51					Roller cone set 4" PVC casing to 51.0'
	52	Same as above	40/45	20/45		Begin Run 5 at 51.7' with NX core barrell on 11-1-94
	53			Box 3		Core 45" Rec 40" Lost 5"
	54					
	55					End Run 5 at 55.4'
						Begin Run 6 at 55.4'
	56					Low recovery in this weathered shale would suggest that rock was blocking bit causing rock to be ground up rather than going into barrel
	57		51/120	0/120		
	58					Core 120" Rec 51" Lost 69"
	59					
	60					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW18

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW18

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 8 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	60					
	61					
	62					
	63			Box 3		
	64					
	65					End Run 6 at 65.4'
						Begin Run 7 at 65.4'
	66	65.9' becomes fresh to slightly weathered with pyrite present in small quantities a few bivalves present				
	67		114/120	95/120		38 min/10 ft Left 6" in borehole
	68			Box 4		Core 120" Rec 114" Lost 6"
	69	68.5 Shaley Limestone, medium Dark Gray (N4) to Dark Gray (N3), finely crystalline, fresh to slightly weathered with bivalve fossils and small amounts of pyrite				
	70					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW18

HTRW DRILLING LOG

HOLE NUMBER

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET 9 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	70					
	71					
	72			Box 4		
	73					
	74					
	75					End Run 7 at 75.4'
	76					Boring terminated at 75.4' on 11-2-94 Install 30' screen in borehole with riser to insure hole does not collapse.
	77					
	78					
	79					
	80					

PROJECT Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW18

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW20

SHEET 1 OF 1 SHEETS

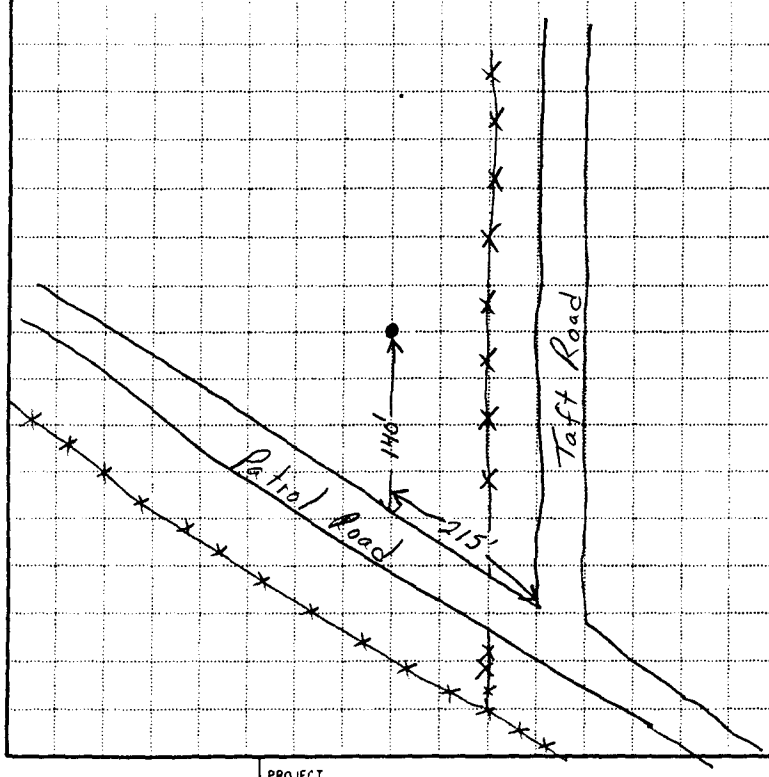
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Al Dudley	6. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-120
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4¼" ID HSA, 6¼" ID HSA; 2' Split spoons, 6" Roller cone; NX core equipment	8. HOLE LOCATION: South Patrol Road - Background
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-28-94 / 11. DATE COMPLETED: 11-13-94
12. OVERBURDEN THICKNESS: 21.5'	15. DEPTH GROUNDWATER ENCOUNTERED: Not encountered until coring commenced
13. DEPTH DRILLED INTO ROCK: 21.5' BGS - 49.5' BGS	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 17.17' BTOC 24 hrs
14. TOTAL DEPTH OF HOLE: 49.5' BGS, 52.3' BTOC	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 18.69' BTOC 11-16-94

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY: 93%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		Charles Way

LOCATION SKETCH/COMMENTS — SCALE?



PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW20

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW20

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Brownish Yellow and Gray Silty Clay with trace fine sand and roots - dry	HNu 0	3		20" recovery
				5		
	1			8		
				12		
	2	Brownish Yellow and Tanish Gray silty Fine Sand with trace clay	HNu 0	4		22" Recovery
				7		
	3			10		
				14		
	4		HNu 0	6		24" Recovery
				8		
	5	Grades Yellow Brown and Gray - moist, without clay		6		
				9		
	6			22		
		Blackish Gray weathered shale		50/2		Straight Auger
	7					
	8					
	9					
	10					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW20

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW20

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 3 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	10	Grades to Gray weathed shale				Straight Auger
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW20

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW20

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 4 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	20					
	21					Auger Refusal at 21.5'
	22	Shale, Dark Gray (N3) slightly weathered to Fresh non calcareous, with occasional zones of shale, Dark greenish gray (5GY 4/1) intermixed	Rec/Core	74"/core		Begin Run 1 at 21.5'
			16/52"	0/52"		Core 52" Rec 16"
	23	Breaks to numerous to put of log				Lost 36"
	24			Box 1		
	25					End Run 1 at 25'10"
	26	Same as above				Begin Run 2 at 25'10"
		Breaks to numerous to put on Log	88"/58	71/58		30" from core Run 1
	27			Box 1		Core 58" Rec 88" Gain 30"
	28					
	29					
	30	Becomes weathered				

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW20

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW20

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 5 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	30					
		Becomes Fresh				End Run 2 at 30.7'
		Same as above, with zones of pyrite deposition		Box 1		Begin Run 3 at 30.7'
	31		51/57	51/57		
						Left 6" in hole
	32	Ti Break				Core 57" Rec 51" Lost 6"
	33	Ti Break		Box 2		
	34					
		Ti Break				
	35					Set 4" PVC casing to 35.0'
		Ti Break				End Run 3 at 35.5'
						Roller Cone ↓
	36	Ti Break Shale, Dark Gray (N3), non calcareous, strong, Fresh with occasional zones of Shale, Dark greenish gray (5GY 4/1) intermixed				Begin Run 4 at 36.0' on 11-13-94 with NQ core barrel and clear water
	37					Core 102" Rec 84" Lost 18"
	38	38.25-38.3 PYRite deposition				31 min/8.5'
	39					
	40					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW20

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-mw20

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 6 OF SHEETS

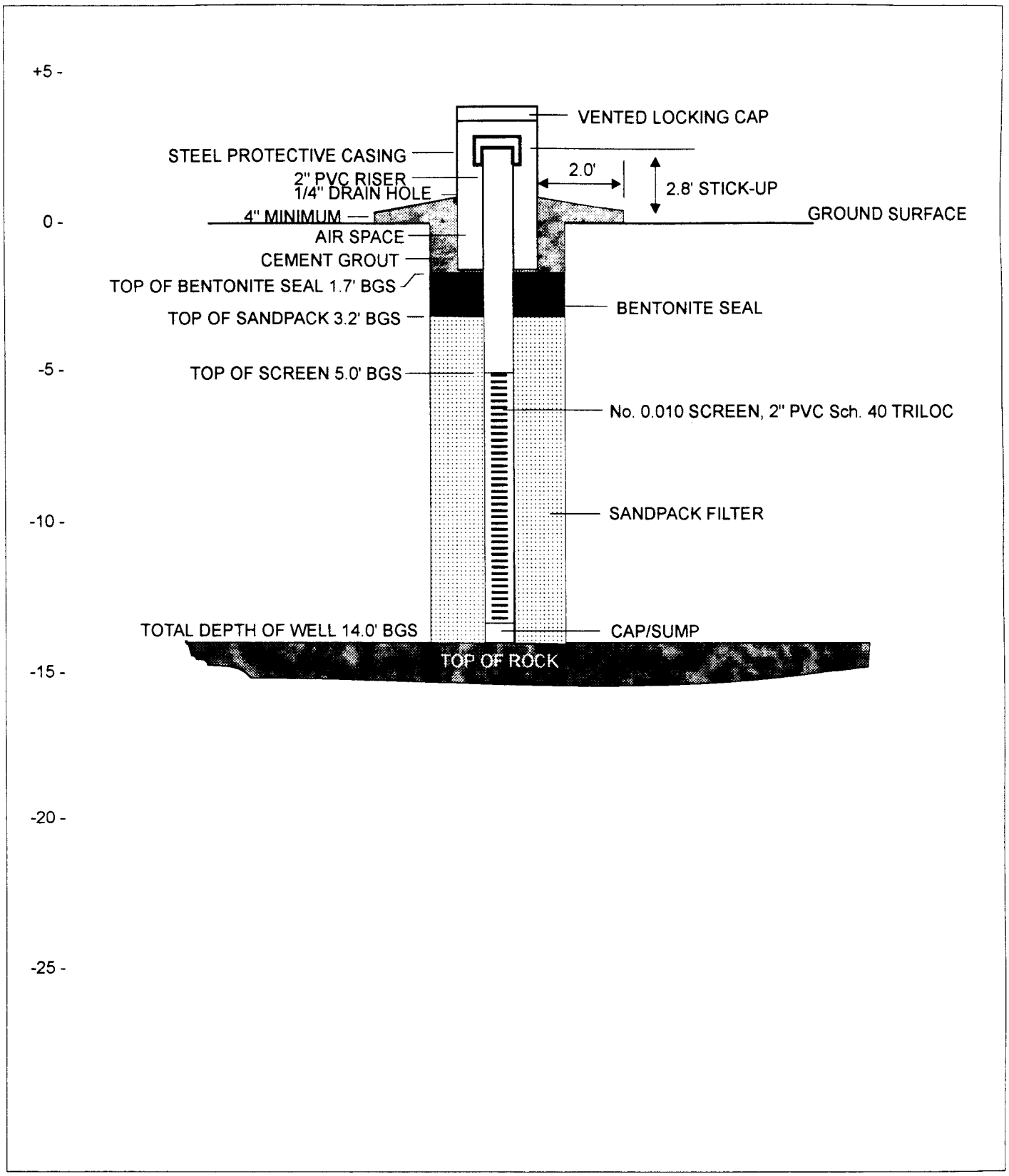
ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	40					
	41					
		Thin pyrite zone				
	42					
	43	Ti Break Becomes fissile, slightly weathered				
						Loss of 20-30 gals water
	44					
		Open Break				End Run 4 at 44.5'
						Begin Run 5 at 44.5'
	45					
						Core 60" Rec 67" Gain 7"
	46					
						22.5 min/5 ft
	47					measure H_2O at 26.42' at 11:30, take lunch, at 12:40 H_2O at 27.28'
		Open Break, black Stained				Can hear bubbling in well
	48					
						Left 1' of core in borehole making Total depth 48.6'
	49					Install 20' screen, rest riser. 2.75' Stickup
						End Run 5 at 49.5'
	50					

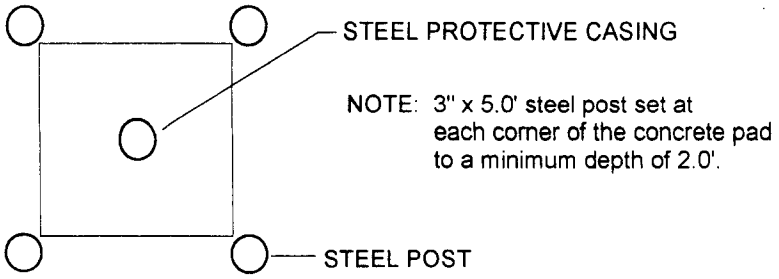
PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW20

APPENDIX D

MONITORING WELL CONSTRUCTION DIAGRAMS



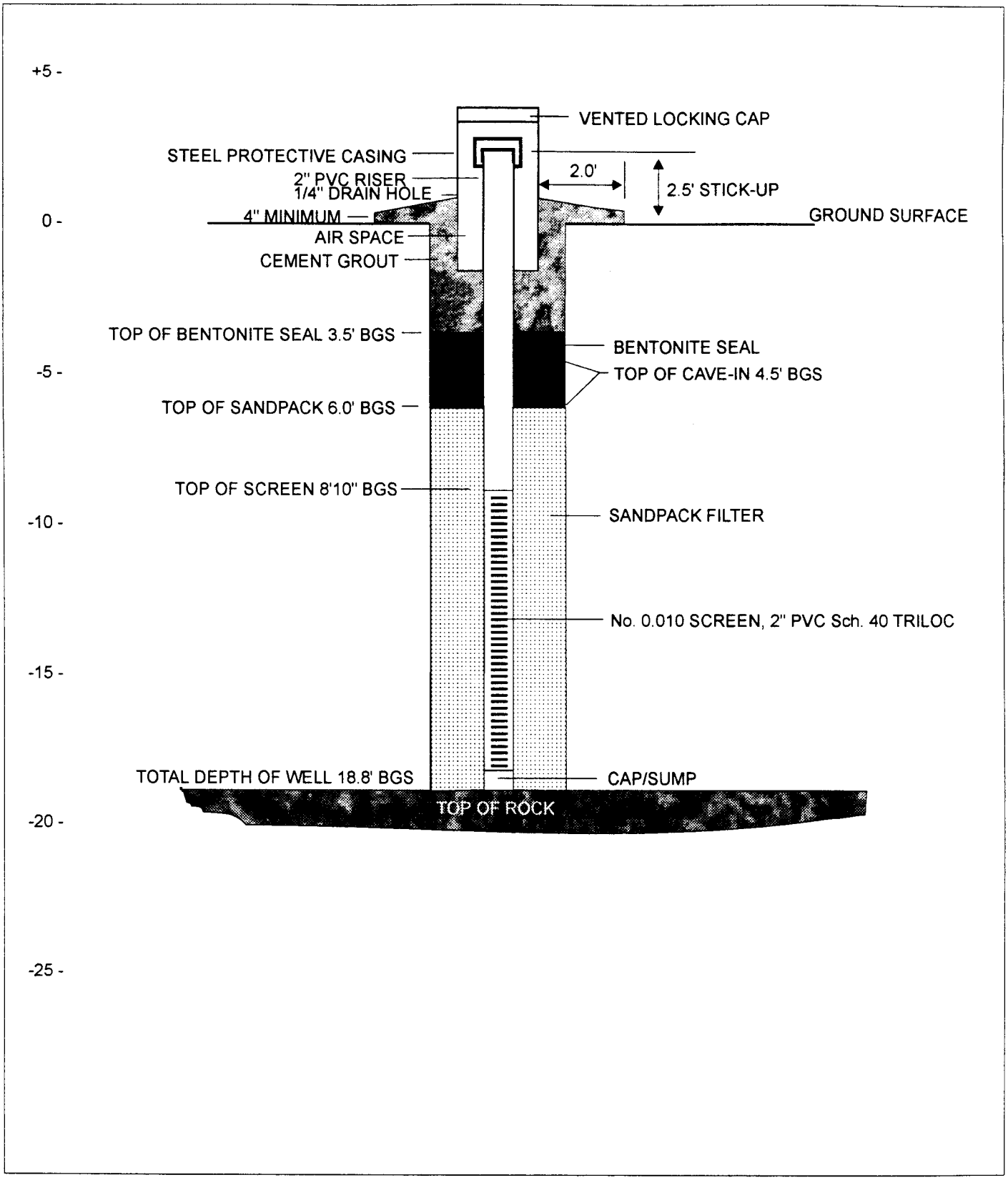


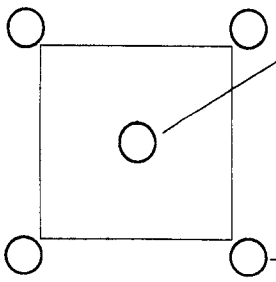
NOTE: 3" x 5.0' steel post set at each corner of the concrete pad to a minimum depth of 2.0'.

TNTC-MW3
OVERBURDEN WELL DETAILS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY



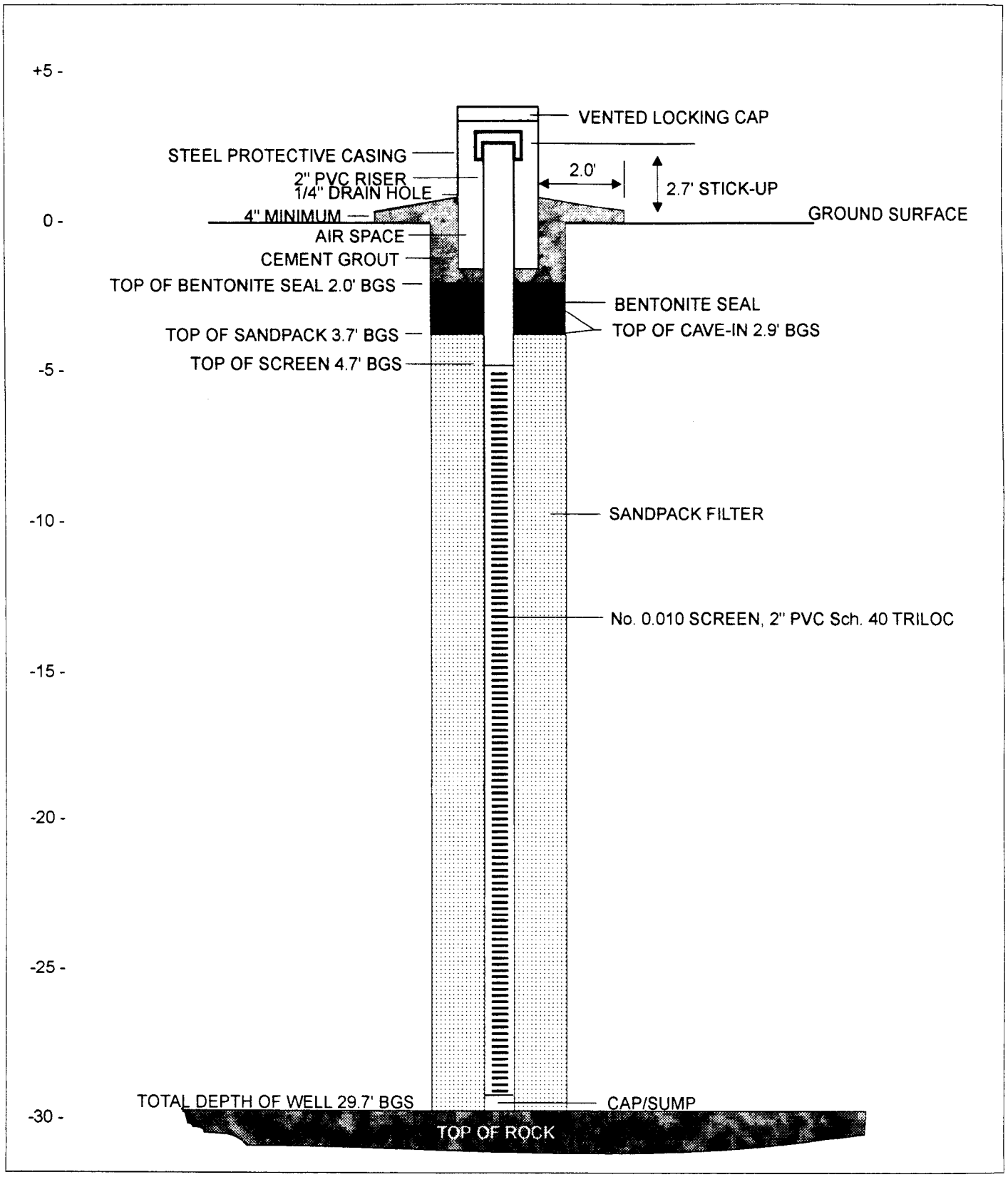


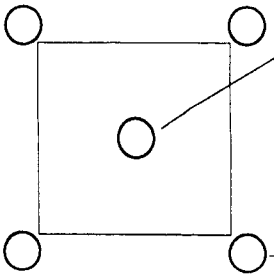
NOTE: 3" x 5.0' steel post set at each corner of the concrete pad to a minimum depth of 2.0'.

TNTC-MW4
OVERBURDEN WELL DETAILS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY



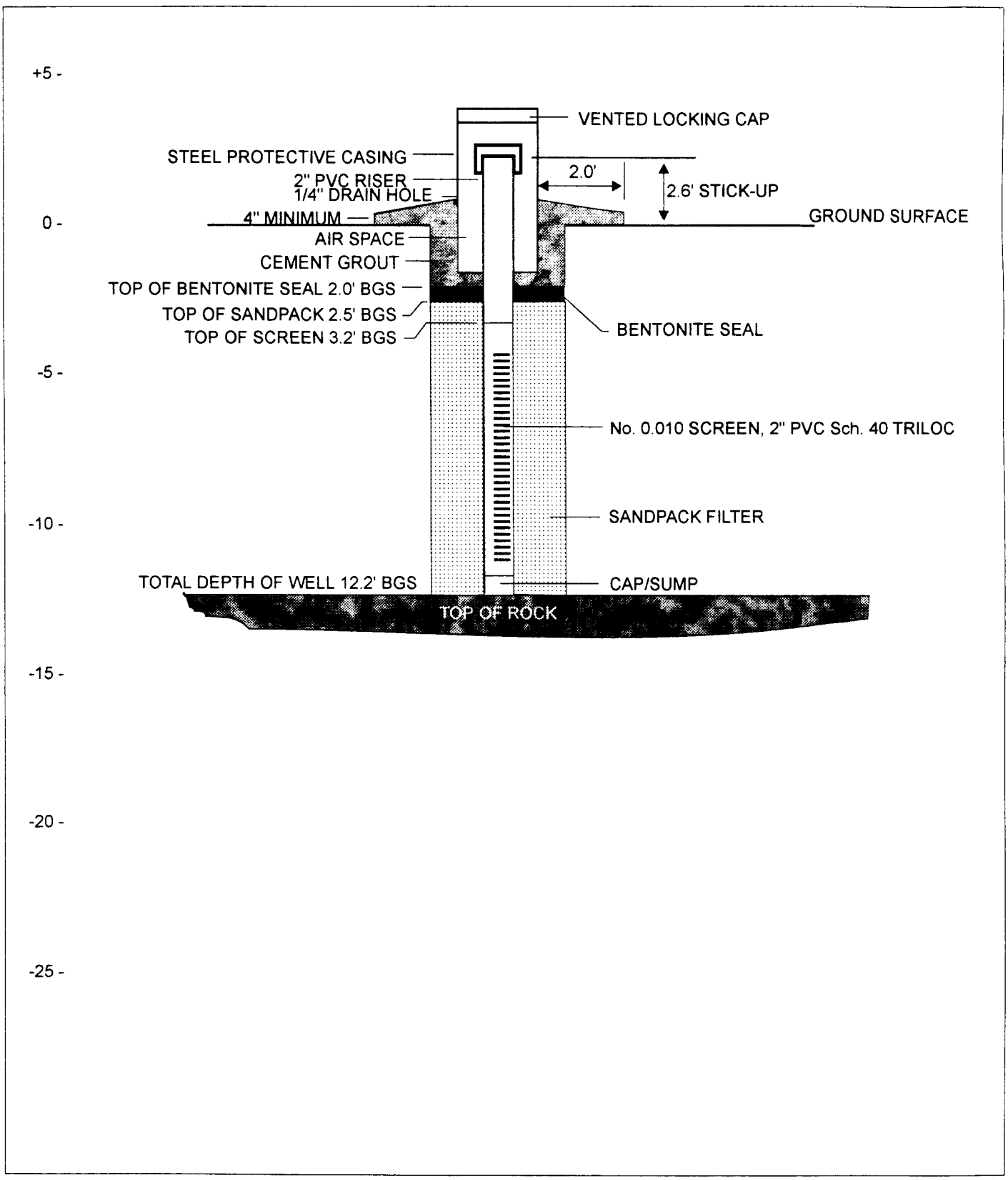


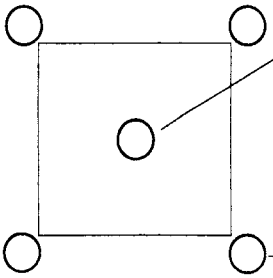
NOTE: 3" x 5.0' steel post set at each corner of the concrete pad to a minimum depth of 2.0'.

TNTC-MW5
OVERBURDEN WELL DETAILS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY



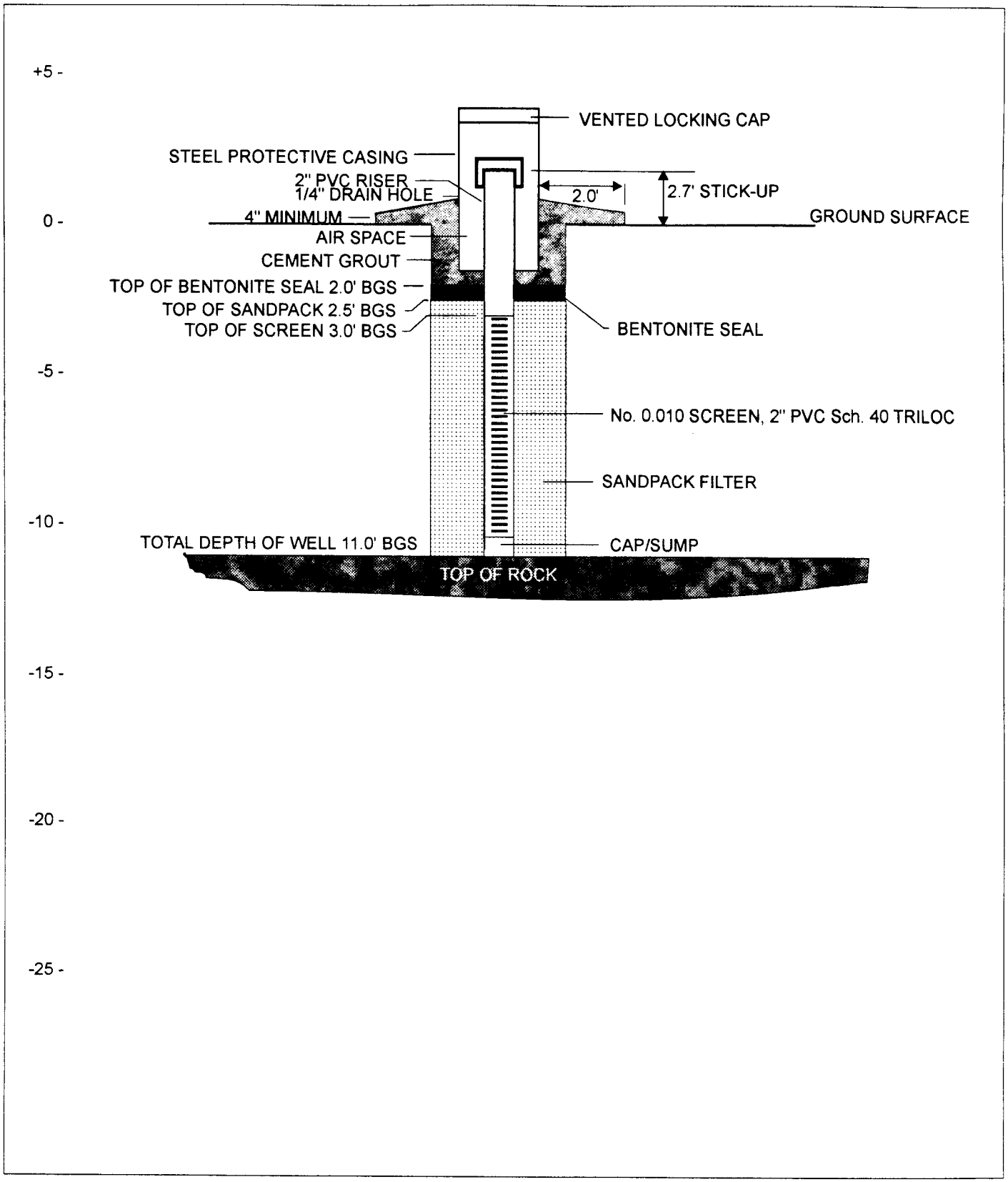


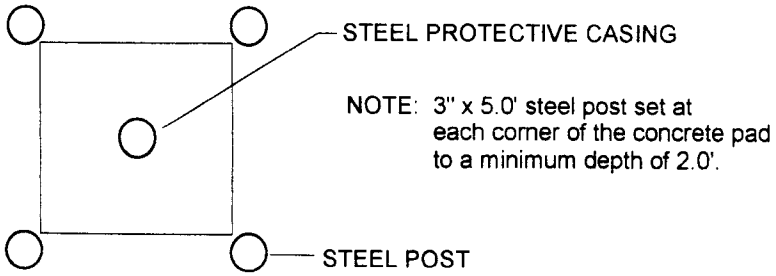
NOTE: 3" x 5.0' steel post set at each corner of the concrete pad to a minimum depth of 2.0'.

TNTC-MW6
OVERBURDEN WELL DETAILS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY



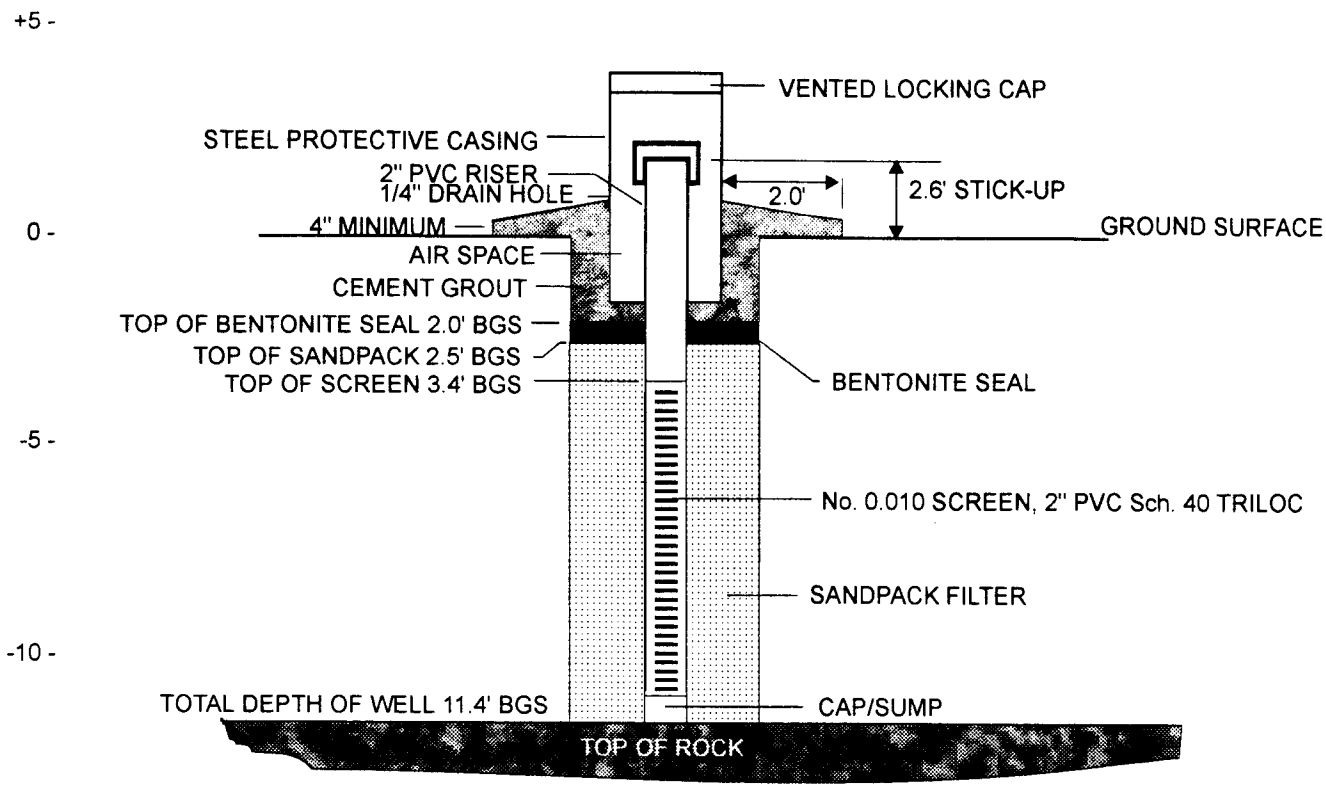


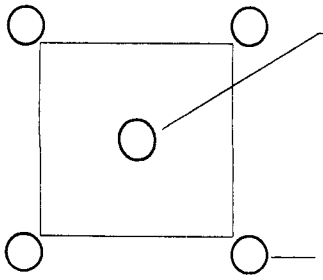
NOTE: 3" x 5.0' steel post set at each corner of the concrete pad to a minimum depth of 2.0'.

TNTA-MW10
OVERBURDEN WELL DETAILS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY



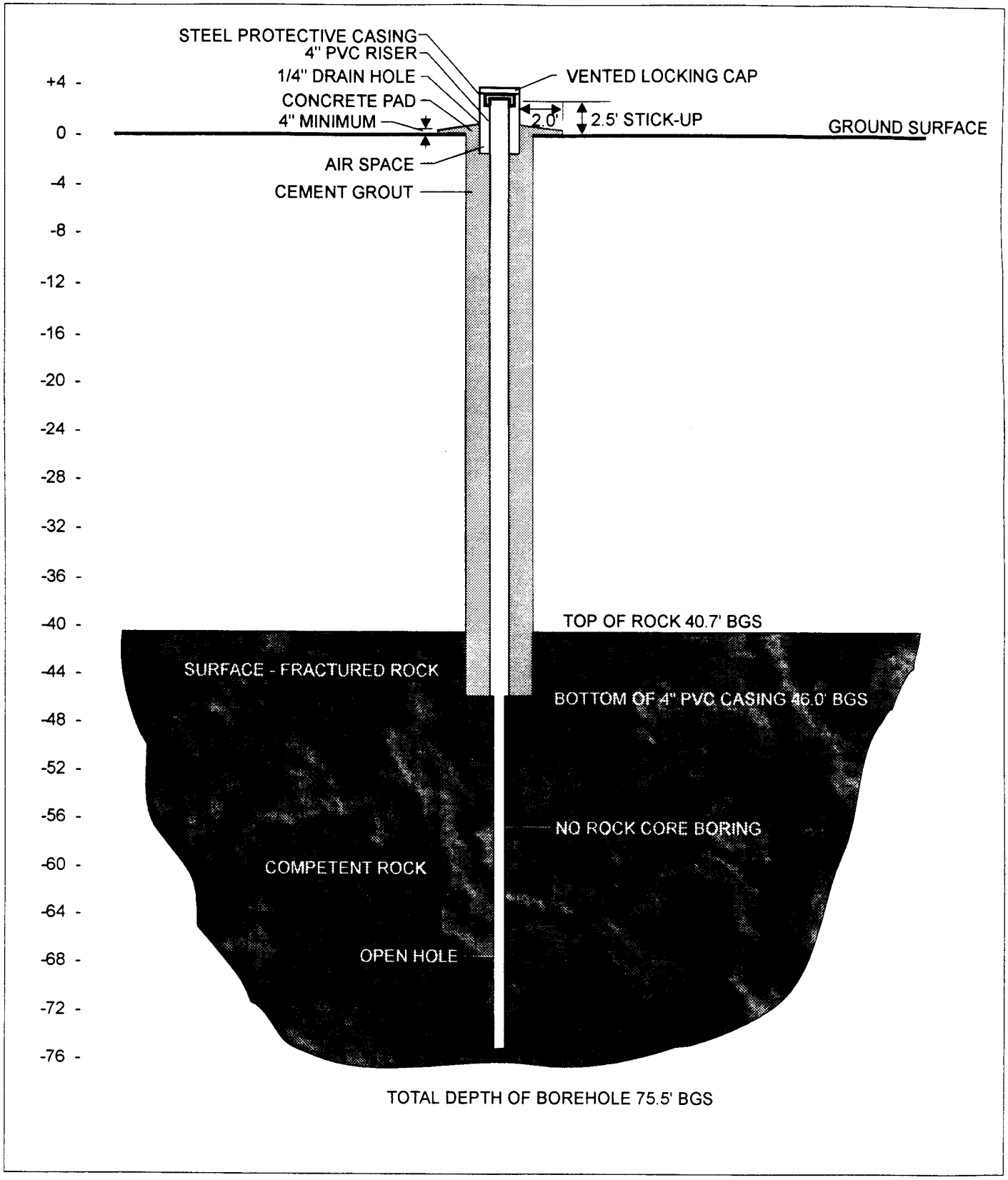


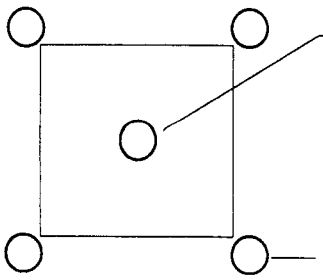
NOTE: 3" x 5.0' steel post set at each corner of the concrete pad to a minimum depth of 2.0'.

TNTA-MW11
OVERBURDEN WELL DETAILS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY



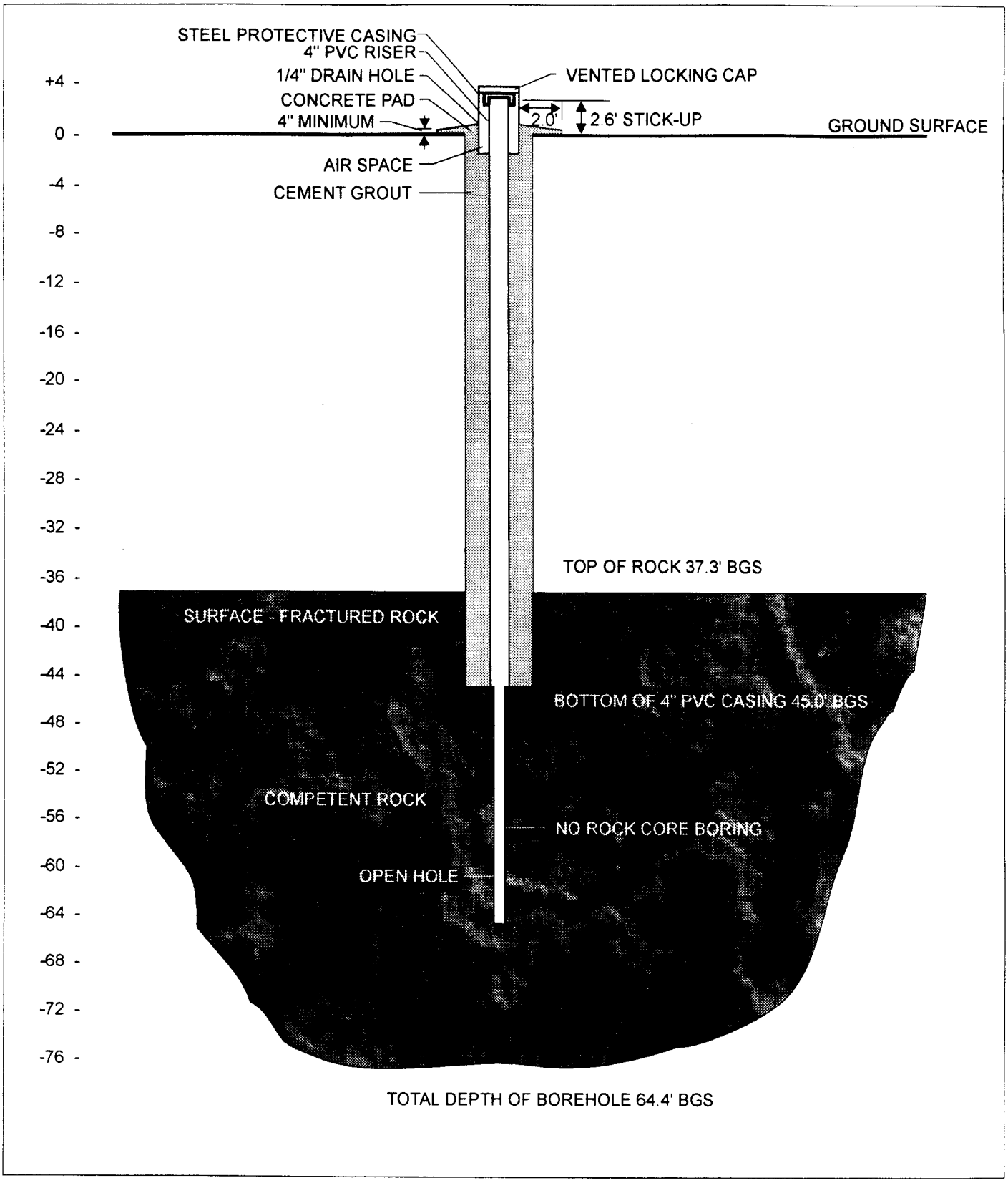


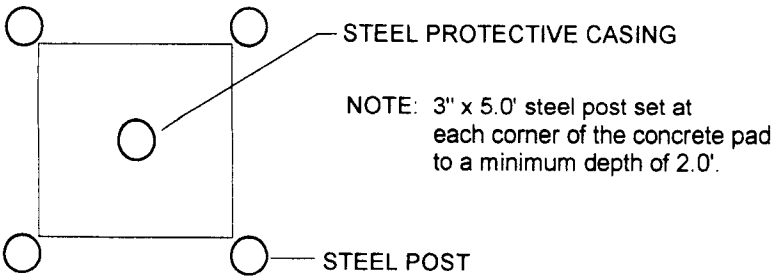
NOTE: 3" x 5.0' steel post set at each corner of the concrete pad to a minimum depth of 2.0'.

PB-Bed-MW-13
BEDROCK WELL DETAILS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY



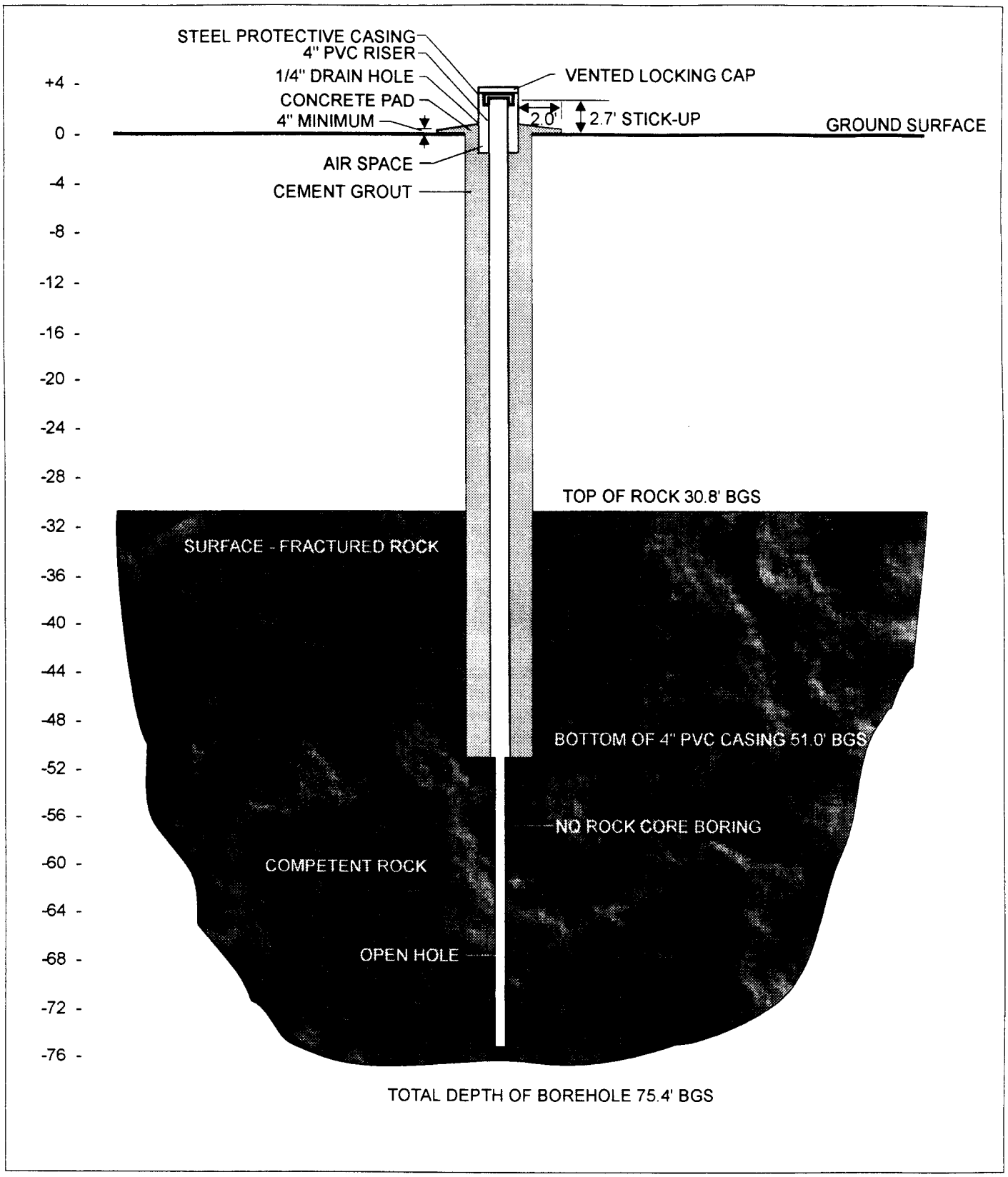


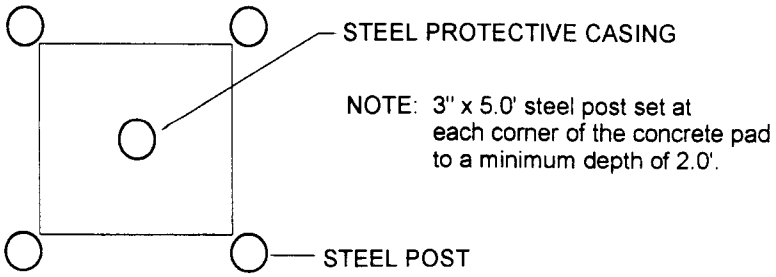
NOTE: 3" x 5.0' steel post set at each corner of the concrete pad to a minimum depth of 2.0'.

PB-Bed-MW-17
BEDROCK WELL DETAILS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY



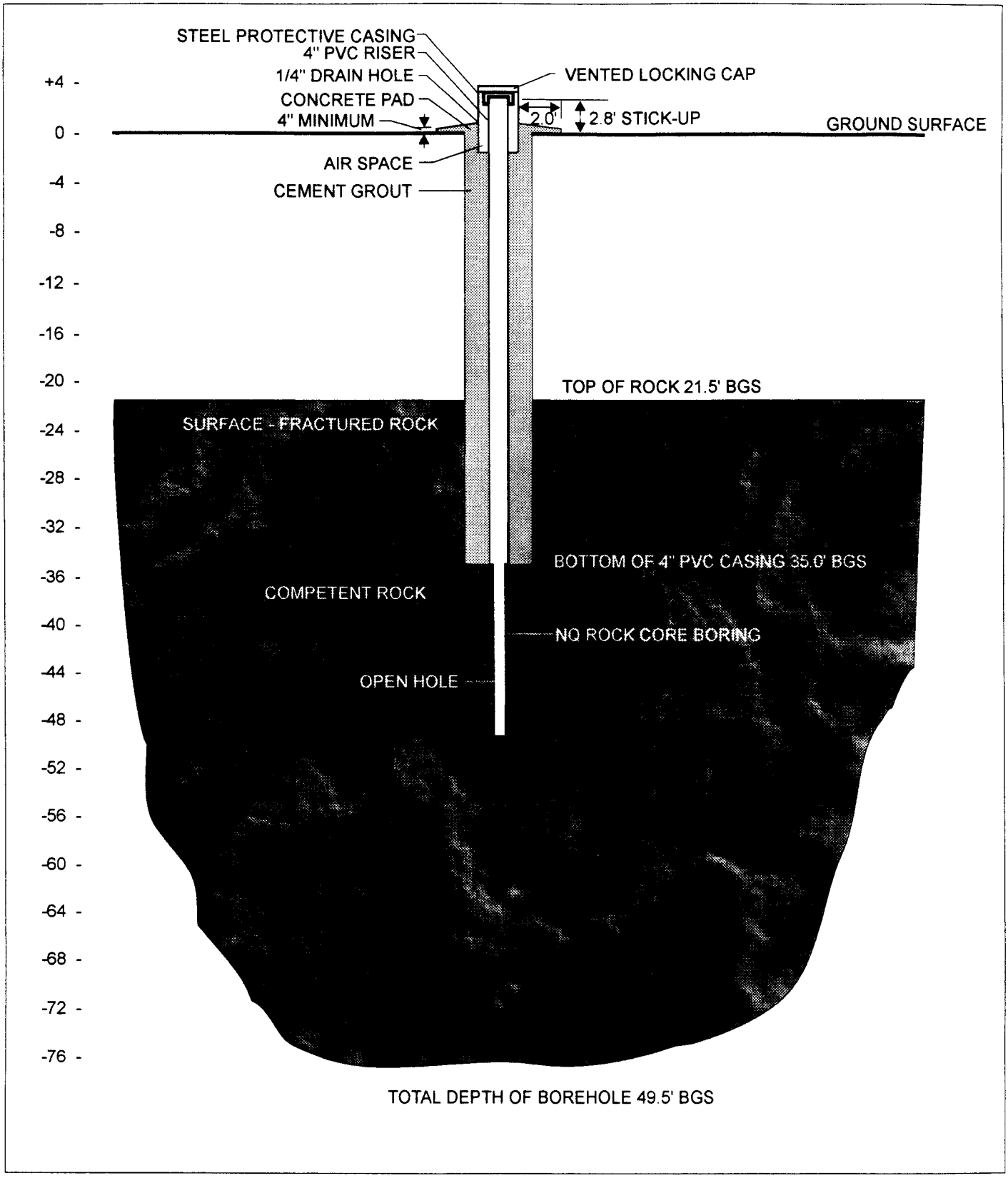


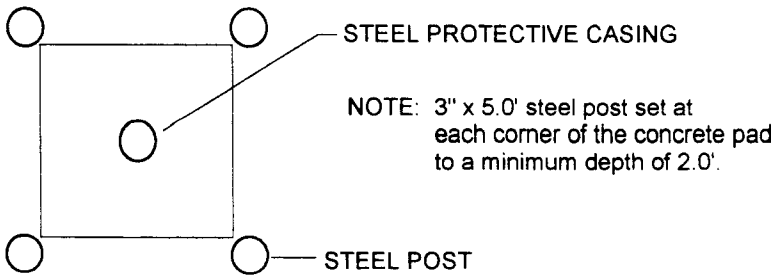
NOTE: 3" x 5.0' steel post set at each corner of the concrete pad to a minimum depth of 2.0'.

PB-Bed-MW-18
BEDROCK WELL DETAILS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY





NOTE: 3" x 5.0' steel post set at each corner of the concrete pad to a minimum depth of 2.0'.

PB-Bed-MW-20
BEDROCK WELL DETAILS

Plum Brook Ordnance Works
Sandusky, Ohio

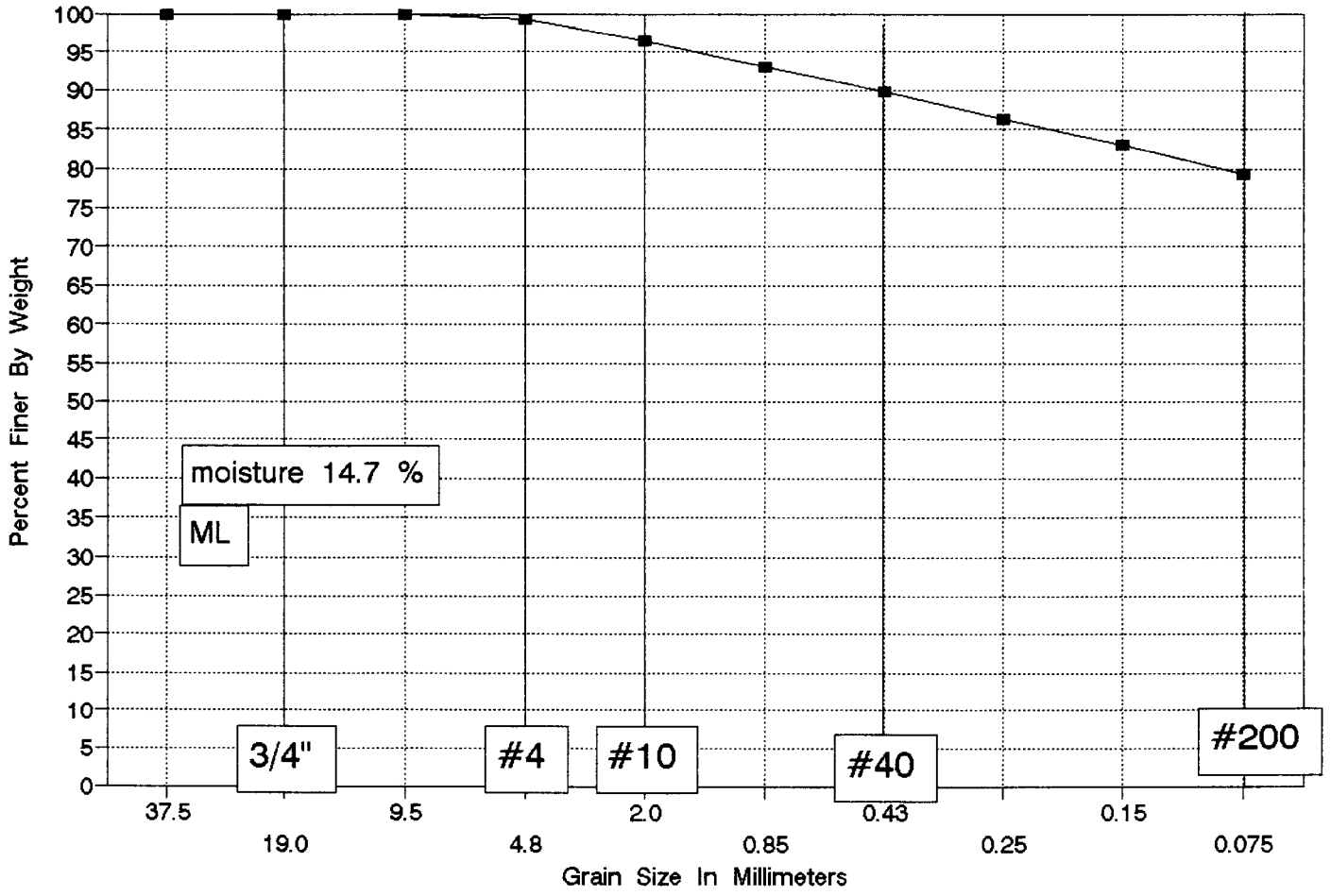
DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

APPENDIX E

SIEVE ANALYSES

GRADATION CURVE

Boring TNTC-MW3, Sample at 5-14 feet



Plum Brook Ordinance Works
Sandusky Ohio

Boring TNTC-MW3
Sample at 5-14 feet

Wet soil & dish	396
Dry soil & dish	359.4
Dish	109.7

Moisture Content = 14.7

SIEVE ANALYSIS

Dry weight of total sample= 249.7

Sieve #	weight retained	Finer	% Finer	mm
1.5 inch	0	100.00%	100.0	37.5
3/4 inch	0	100.00%	100.0	19.0
3/8 inch	0	100.00%	100.0	9.5
# 4	1.72	99.31%	99.3	4.8
# 10	8.4	96.64%	96.6	2.0
# 20	17.28	93.08%	93.1	0.85
# 40	25.6	89.75%	89.7	0.43
# 60	34.01	86.38%	86.4	0.25
# 100	42.69	82.90%	82.9	0.15
# 200	51.78	79.26%	79.3	0.075

MECHANICAL ANALYSIS (SA) HA -#200

DATE 12/3/94 BY RJH

JOB NUMBER 24637-035 OWNER/CLIENT PLUM BROOKS ORDNANCE

LOCATION

BORING TNTC-MW3 (13) ? SAMPLE DEPTH 5'-14'

NUMBER OF RINGS		DISH	ST-27
WT. OF RINGS & WET SOIL		WT. OF DISH & WET SOIL	396.0
WT. OF RINGS		WT. OF DISH & DRY SOIL	359.4
WT. OF WET SOIL		WT. OF MOISTURE	
FIELD DENSITY		WT. OF DISH	109.7
DRY DENSITY		WT. OF DRY SOIL	
		FIELD MOISTURE CONTENT	

WASH SIEVE _____ DRY SIEVE _____ WEIGHT OF OVEN DRY SOIL _____ (grams)

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUMULATIVE WEIGHT RETAINED	ACCUMULATIVE PERCENT	
					RETAINED	FINER
		3"				
		1-1/2"				
		3/4"				
		3/8"		0		
		#4		1.72		
		PAN				
		TOTAL				

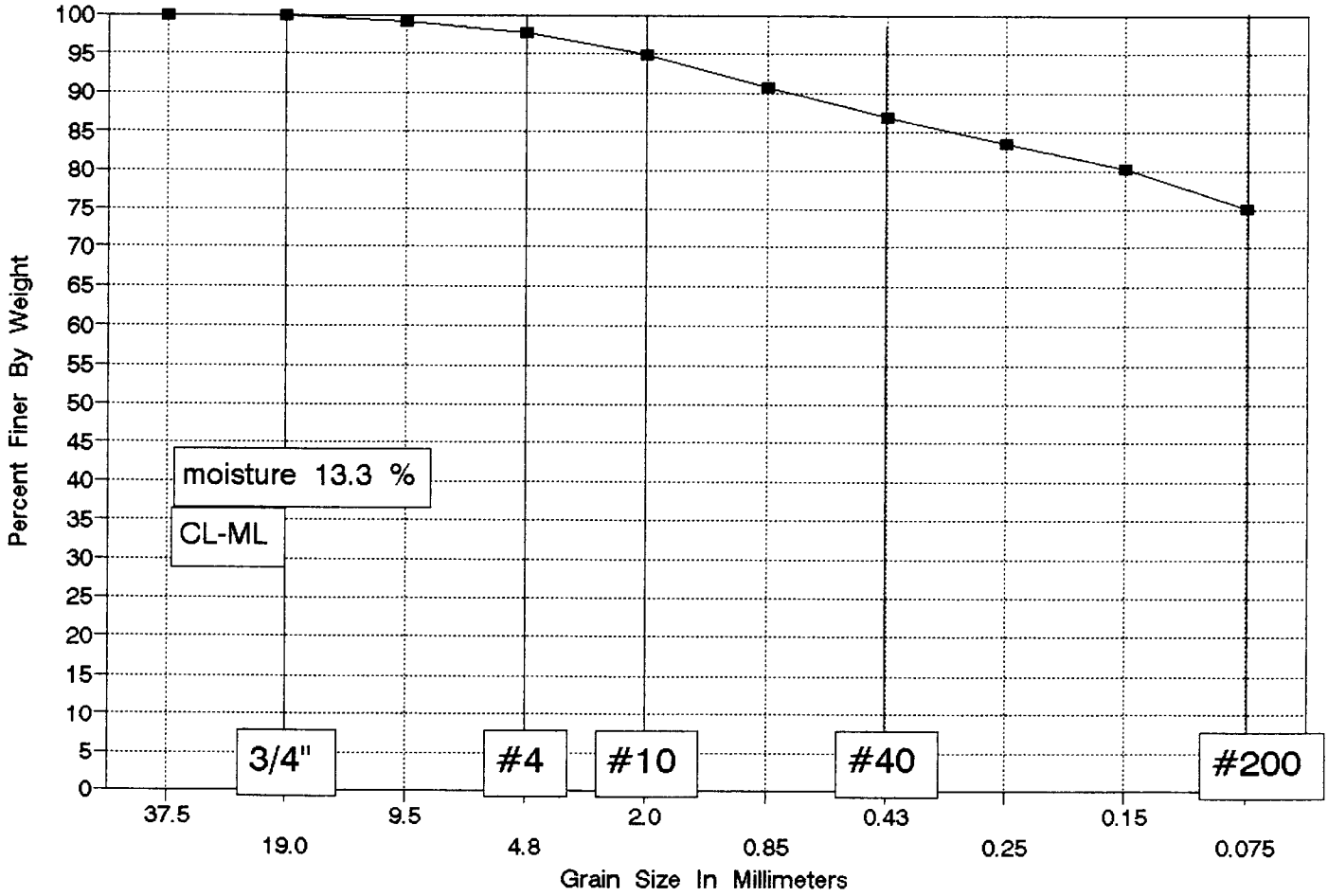
DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUM. WEIGHT RETAINED	ACCUMULATIVE PERCENT		
					PARTIAL		TOTAL
					RETAINED	FINER	FINER
		#10		8.40			
		#20		17.28			
		#40		25.60			
		#60		34.01			
		#100		42.69			
		#200		51.78			
		PAN					
		TOTAL					

ML

Dames & Moore

GRADATION CURVE

Boring TNTC-MW4, Sample at 8 to 18.5 ft



Plum Brook Ordinance Works
Sandusky Ohio

Boring TNTC-MW4
Sample at 8 to 18.8 feet

Wet soil & dish	461.1
Dry soil & dish	420.1
Dish	112

Moisture Content = 13.3

SIEVE ANALYSIS

Dry weight of total sample= 308.1

Sieve #	weight retained	Finer	% Finer	mm
1.5 inch	0	100.00%	100.0	37.5
3/4 inch	0	100.00%	100.0	19.0
3/8 inch	2.74	99.11%	99.1	9.5
# 4	7.39	97.60%	97.6	4.8
# 10	15.64	94.92%	94.9	2.0
# 20	28.61	90.71%	90.7	0.85
# 40	40.31	86.92%	86.9	0.43
# 60	50.8	83.51%	83.5	0.25
# 100	61.08	80.18%	80.2	0.15
# 200	76.58	75.14%	75.1	0.075

MECHANICAL ANALYSIS (SA) HA -#200

DATE 12/3/94 BY RH

JOB NUMBER 24637-035 OWNER/CLIENT PLUM BROOKS ORDNANCE

LOCATION

BORING TNTC-MW4 SAMPLE DEPTH 8'-18'10"

NUMBER OF RINGS		DISH	210
WT. OF RINGS & WET SOIL		WT. OF DISH & WET SOIL	461.1
WT. OF RINGS		WT. OF DISH & DRY SOIL	420.1
WT. OF WET SOIL		WT. OF MOISTURE	
FIELD DENSITY		WT. OF DISH	112.0
DRY DENSITY		WT. OF DRY SOIL	
		FIELD MOISTURE CONTENT	

WASH SIEVE _____ DRY SIEVE _____ WEIGHT OF OVEN DRY SOIL _____ (grams)

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUMULATIVE WEIGHT RETAINED	ACCUMULATIVE PERCENT	
					RETAINED	FINER
		3"				
		1-1/2"				
		3/4"		0		
		3/8"		2.74		
		#4		7.39		
		PAN				
		TOTAL				

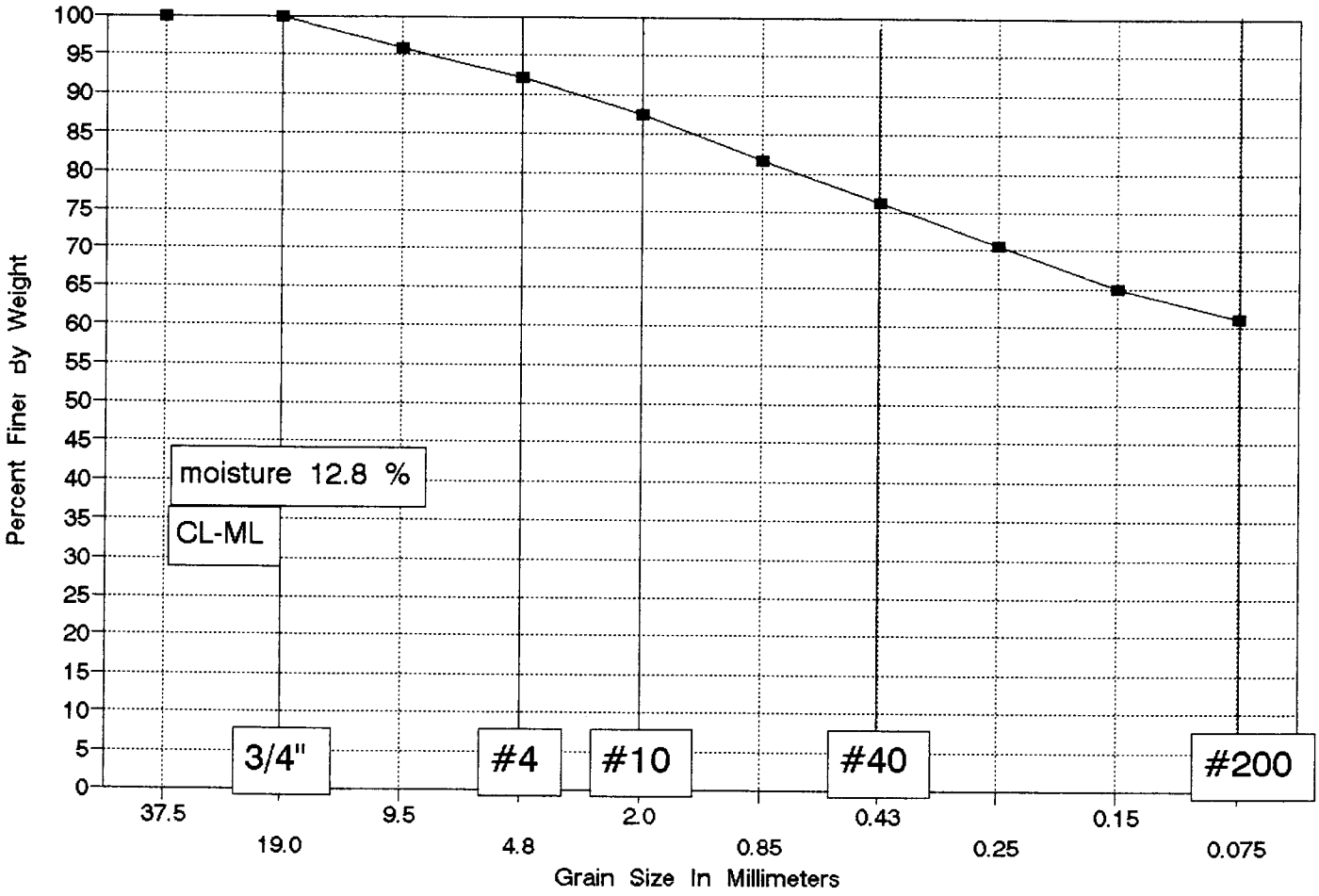
DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUM. WEIGHT RETAINED	ACCUMULATIVE PERCENT		
					PARTIAL		TOTAL
					RETAINED	FINER	FINER
		#10		15.64			
		#20		28.61			
		#40		40.31			
		#60		50.80			
		#100		61.08			
		#200		76.58			
		PAN					
		TOTAL					

CL-ML

Dames & Moore

GRADATION CURVE

Boring TNTC-MW5, Sample at 6-30 feet



Plum Brook Ordinance Works
Sandusky Ohio

Boring TNTC-MW5
Sample at 6 to 30 feet

Wet soil & dish	399.4
Dry soil & dish	366.1
Dish	106.4

Moisture Content = 12.8

SIEVE ANALYSIS

Dry weight of total sample= 259.7

Sieve #	weight retained	Finer	% Finer	mm
1.5 inch	0	100.00%	100.0	37.5
3/4 inch	0	100.00%	100.0	19.0
3/8 inch	11.08	95.73%	95.7	9.5
# 4	20.79	91.99%	92.0	4.8
# 10	32.73	87.40%	87.4	2.0
# 20	47.59	81.68%	81.7	0.85
# 40	61.89	76.17%	76.2	0.43
# 60	76.17	70.67%	70.7	0.25
# 100	91.07	64.93%	64.9	0.15
# 200	100.85	61.17%	61.2	0.075

MECHANICAL ANALYSIS (SA) HA -#200

DATE 12/3/94 BY RH

JOB NUMBER 24637-035 OWNER/CLIENT PLUM BROOKS ORDINANCE

LOCATION

BORING TNTC-MW5 SAMPLE DEPTH 6'-30'

NUMBER OF RINGS		DISH	8
WT. OF RINGS & WET SOIL		WT. OF DISH & WET SOIL	399.4
WT. OF RINGS		WT. OF DISH & DRY SOIL	366.1
WT. OF WET SOIL		WT. OF MOISTURE	
FIELD DENSITY		WT. OF DISH	106.4
DRY DENSITY		WT. OF DRY SOIL	
		FIELD MOISTURE CONTENT	

WASH SIEVE _____ DRY SIEVE _____ WEIGHT OF OVEN DRY SOIL _____ (grams)

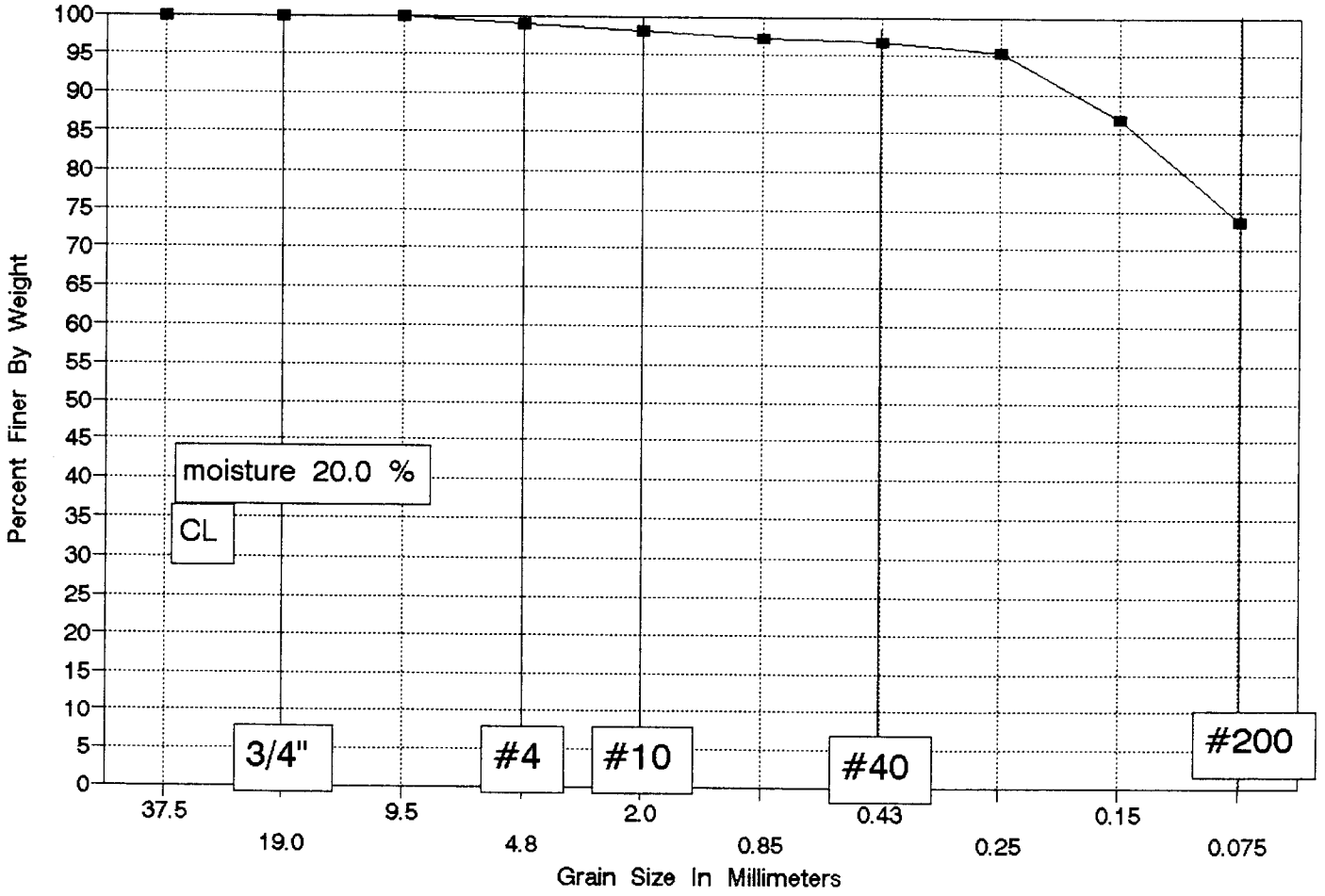
DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUMULATIVE WEIGHT RETAINED	ACCUMULATIVE PERCENT	
					RETAINED	FINER
		3"				
		1-1/2"				
		3/4"		0		
		3/8"		11.08		
		#4		20.79		
		PAN				
		TOTAL				

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUM. WEIGHT RETAINED	ACCUMULATIVE PERCENT		
					PARTIAL		TOTAL
					RETAINED	FINER	FINER
		#10		32.73			
		#20		47.59			
		#40		61.89			
		#60		76.17			
		#100		91.07			
		#200		100.85			
		PAN					
		TOTAL					

CL-ML Dames & Moore

GRADATION CURVE

Boring TNTC-MW6, at 10-16 feet



Plum Brook Ordinance Works
Sandusky Ohio

Boring TNTC-MW6
Sample at 10-16 feet

Wet soil & dish	374
Dry soil & dish	330.2
Dish	111

Moisture Content = 20.0

SIEVE ANALYSIS

Dry weight of total sample= 219.2

Sieve #	weight retained	Finer	% Finer	mm
1.5 inch	0	100.00%	100.0	37.5
3/4 inch	0	100.00%	100.0	19.0
3/8 inch	0	100.00%	100.0	9.5
# 4	2.37	98.92%	98.9	4.8
# 10	3.92	98.21%	98.2	2.0
# 20	5.84	97.34%	97.3	0.85
# 40	6.97	96.82%	96.8	0.43
# 60	9.82	95.52%	95.5	0.25
# 100	29.3	86.63%	86.6	0.15
# 200	58.03	73.53%	73.5	0.075

MECHANICAL ANALYSIS (SA) HA -#200

DATE 11/3/94 BY RH

JOB NUMBER 241037-035 OWNER/CLIENT PLUM BROOK ORDINANCE

LOCATION

BORING TNTC-MW16 SAMPLE DEPTH 10-16'

NUMBER OF RINGS		DISH	ST-29
WT. OF RINGS & WET SOIL		WT. OF DISH & WET SOIL	374.0
WT. OF RINGS		WT. OF DISH & DRY SOIL	330.2
WT. OF WET SOIL		WT. OF MOISTURE	
FIELD DENSITY		WT. OF DISH	111.0
DRY DENSITY		WT. OF DRY SOIL	
		FIELD MOISTURE CONTENT	

WASH SIEVE _____ DRY SIEVE _____ WEIGHT OF OVEN DRY SOIL _____ (grams)

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUMULATIVE WEIGHT RETAINED	ACCUMULATIVE PERCENT	
					RETAINED	FINER
		3"				
		1-1/2"				
		3/4"				
		3/8"		0		
		#4		2.37		
		PAN				
		TOTAL				

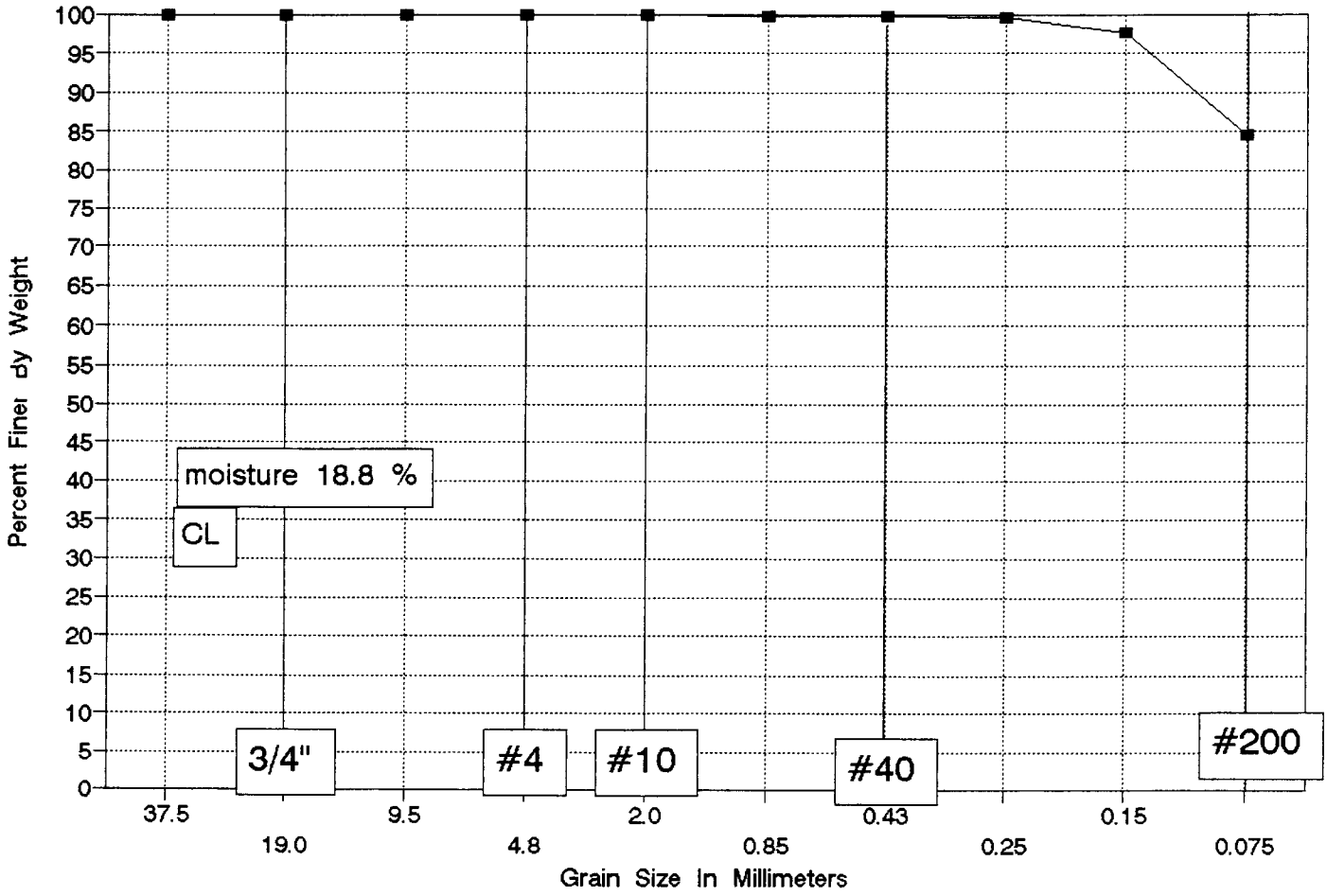
DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUM. WEIGHT RETAINED	ACCUMULATIVE PERCENT		
					PARTIAL		TOTAL
					RETAINED	FINER	FINER
		#10		3.92			
		#20		5.84			
		#40		6.97			
		#60		9.82			
		#100		29.30			
		#200		58.03			
		PAN					
		TOTAL					

CL

Dames & Moore

GRADATION CURVE

Boring TNTA-MW10, Sample at 2-11 feet



Plum Brook Ordinance Works
Sandusky Ohio

Boring TNTA-MW10
Sample at 2-11 feet

Wet soil & dish	526.3
Dry soil & dish	461
Dish	113.4

Moisture Content = 18.8

SIEVE ANALYSIS

Dry weight of total sample= 347.6

Sieve #	weight retained	Finer	% Finer	mm
1.5 inch	0	100.00%	100.0	37.5
3/4 inch	0	100.00%	100.0	19.0
3/8 inch	0	100.00%	100.0	9.5
# 4	0.3	99.91%	99.9	4.8
# 10	0.46	99.87%	99.9	2.0
# 20	0.9	99.74%	99.7	0.85
# 40	1.17	99.66%	99.7	0.43
# 60	1.69	99.51%	99.5	0.25
# 100	8.4	97.58%	97.6	0.15
# 200	53.35	84.65%	84.7	0.075

MECHANICAL ANALYSIS (SA) HA -#200

DATE 12/3/94 BY RH

JOB NUMBER _____ OWNER/CLIENT PLUM BROOKS ORDNANCE

LOCATION _____

BORING TNTA - MW-10 SAMPLE _____ DEPTH 2'-11'

NUMBER OF RINGS		DISH	209
WT. OF RINGS & WET SOIL		WT. OF DISH & WET SOIL	526.3
WT. OF RINGS		WT. OF DISH & DRY SOIL	461.0
WT. OF WET SOIL		WT. OF MOISTURE	
FIELD DENSITY		WT. OF DISH	113.4
DRY DENSITY		WT. OF DRY SOIL	
		FIELD MOISTURE CONTENT	

WASH SIEVE _____ DRY SIEVE _____ WEIGHT OF OVEN DRY SOIL _____ (grams)

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUMULATIVE WEIGHT RETAINED	ACCUMULATIVE PERCENT	
					RETAINED	FINER
		3"				
		1-1/2"				
		3/4"				
		3/8"		0		
		#4		.30		
		PAN				
		TOTAL				

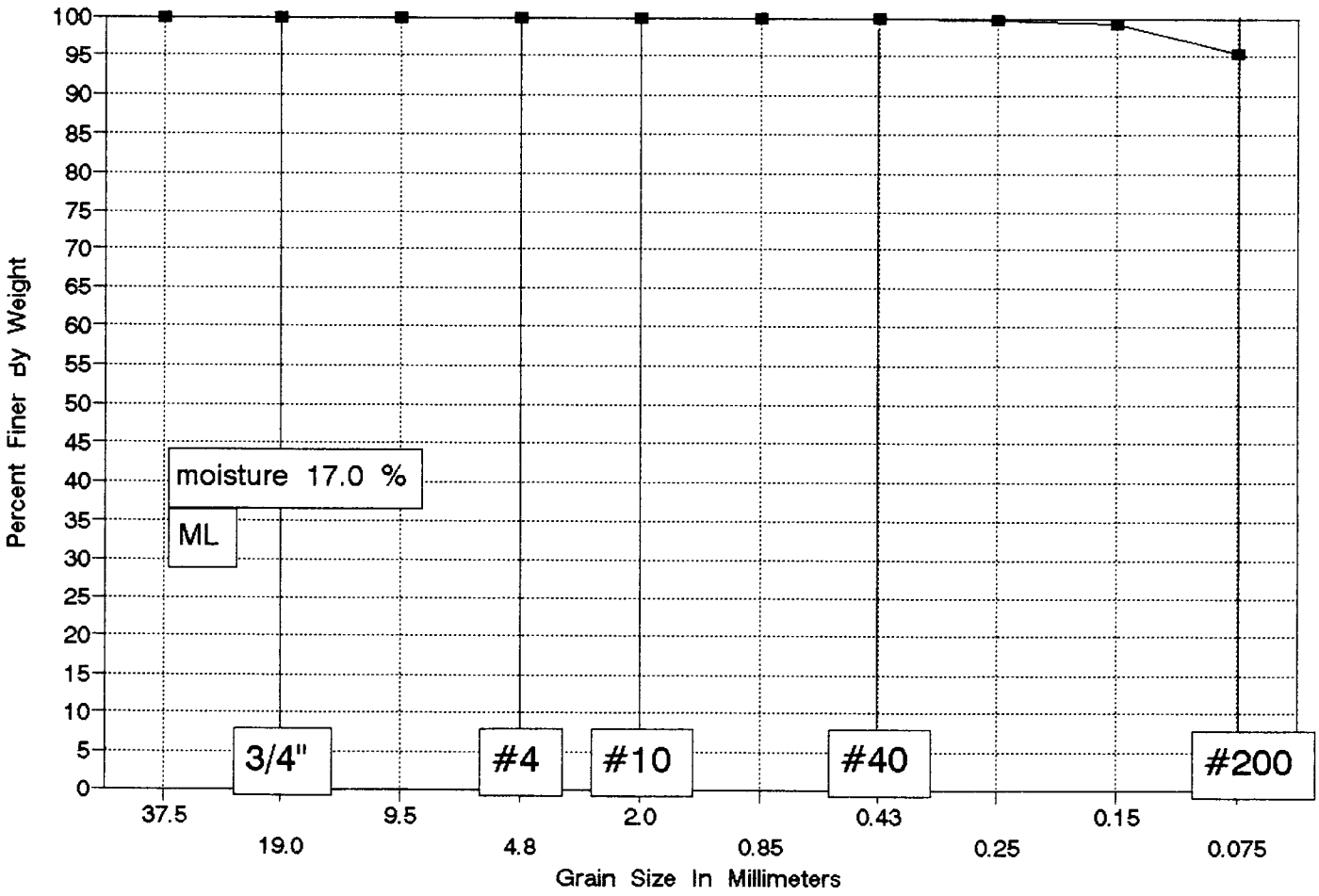
DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUM. WEIGHT RETAINED	ACCUMULATIVE PERCENT		
					PARTIAL		TOTAL
					RETAINED	FINER	FINER
		#10		.46			
		#20		.90			
		#40		1.17			
		#60		1.69			
		#100		8.40			
		#200		53.35			
		PAN					
		TOTAL					

CL

Dames & Moore

GRADATION CURVE

Boring TNTA-MW11, Sample at 6-11 feet



Plum Brook Ordinance Works
Sandusky Ohio

Boring TNTA-MW11
Sample at 6 to 11 feet

Wet soil & dish	346.5
Dry soil & dish	312.7
Dish	113.3

Moisture Content = 17.0

SIEVE ANALYSIS

Dry weight of total sample= 199.4

Sieve #	weight retained	Finer	% Finer	mm
1.5 inch	0	100.00%	100.0	37.5
3/4 inch	0	100.00%	100.0	19.0
3/8 inch	0	100.00%	100.0	9.5
# 4	0	100.00%	100.0	4.8
# 10	0	100.00%	100.0	2.0
# 20	0.1	99.95%	99.9	0.85
# 40	0.26	99.87%	99.9	0.43
# 60	0.5	99.75%	99.7	0.25
# 100	1.42	99.29%	99.3	0.15
# 200	9.13	95.42%	95.4	0.075

MECHANICAL ANALYSIS (SA) HA -#200

DATE 12/3/94 BY RH

JOB NUMBER 24637-035 OWNER/CLIENT PLUM BROOKS ORDINANCE

LOCATION

BORING TNT A - MW11 SAMPLE DEPTH 6-11'

NUMBER OF RINGS		DISH	206
WT. OF RINGS & WET SOIL		WT. OF DISH & WET SOIL	346.5
WT. OF RINGS		WT. OF DISH & DRY SOIL	312.7
WT. OF WET SOIL		WT. OF MOISTURE	
FIELD DENSITY		WT. OF DISH	113.3
DRY DENSITY		WT. OF DRY SOIL	
		FIELD MOISTURE CONTENT	

WASH SIEVE _____ DRY SIEVE _____ WEIGHT OF OVEN DRY SOIL _____ (grams)

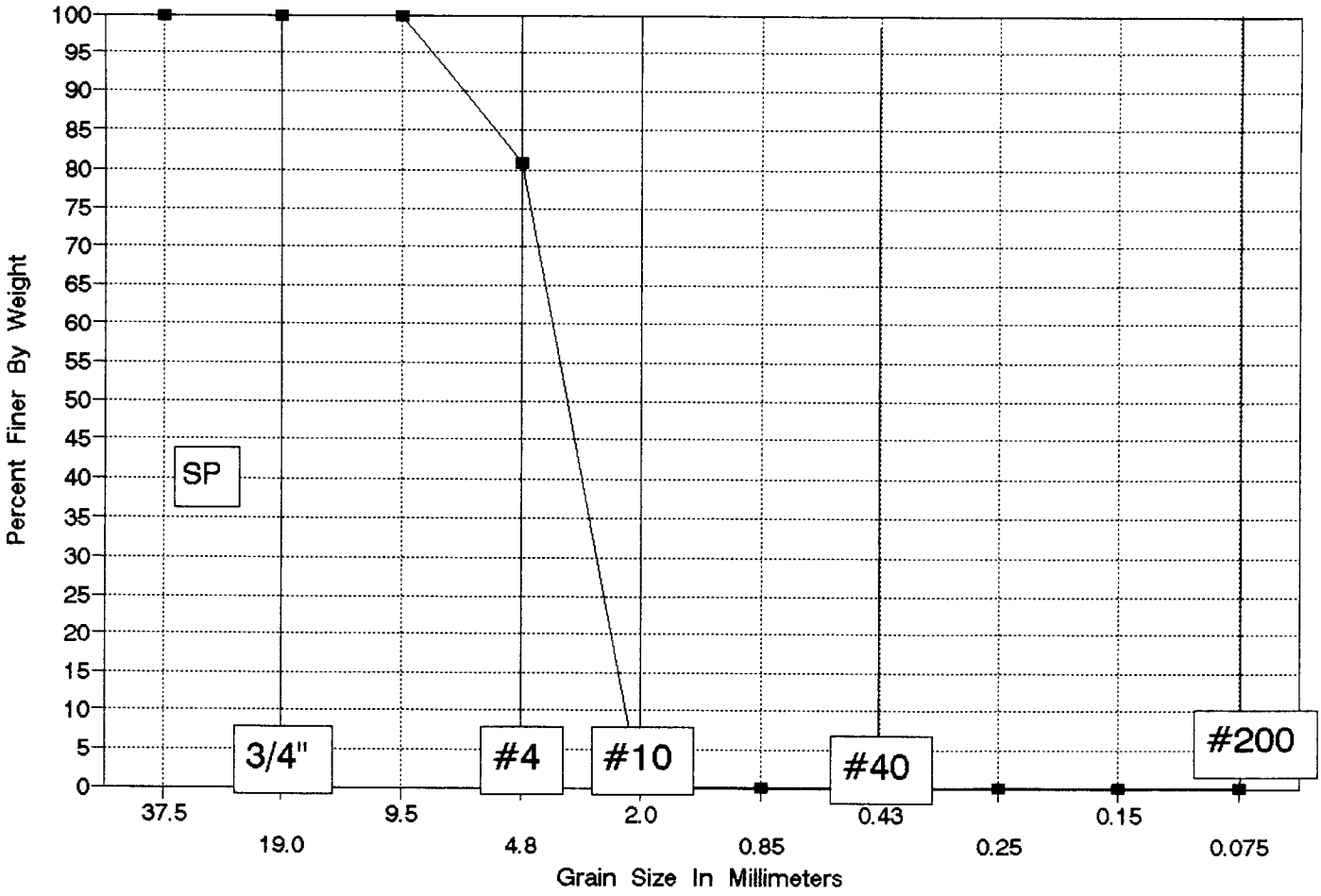
DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUMULATIVE WEIGHT RETAINED	ACCUMULATIVE PERCENT	
					RETAINED	FINER
		3"				
		1-1/2"				
		3/4"				
		3/8"				
		#4				
		PAN				
		TOTAL				

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUM. WEIGHT RETAINED	ACCUMULATIVE PERCENT		
					PARTIAL		TOTAL
					RETAINED	FINER	FINER
		#10		~~0~~			
		#20		.10			
		#40		.26			
		#60		.50			
		#100		1.42			
		#200		9.13			
		PAN					
		TOTAL					

Dames & Moore

GRADATION CURVE

Boring TNTC-MW4, Sand # 5



Plum Brook Ordinance Works
Sandusky Ohio

Boring TNTC-MW4
Sand # 5

Wet soil & dish	238.2
Dry soil & dish	238.2
Dish	111.7

Moisture Content = 0.0

SIEVE ANALYSIS

Dry weight of total sample= 126.5

Sieve #	weight retained	Finer	% Finer	mm
1.5 inch	0	100.00%	100.0	37.5
3/4 inch	0	100.00%	100.0	19.0
3/8 inch	0	100.00%	100.0	9.5
# 4	24.25	80.83%	80.8	4.8
# 10	126.3	0.16%	0.2	2.0
# 20	126.37	0.10%	0.1	0.85
# 40	126.38	0.09%	0.1	0.43
# 60	126.39	0.09%	0.1	0.25
# 100	126.44	0.05%	0.0	0.15
# 200	126.44	0.05%	0.0	0.075

MECHANICAL ANALYSIS (SA) HA -#200

DATE 11/3/94 BY RH

JOB NUMBER _____ OWNER/CLIENT PLUM BROOK ORDINANCE

LOCATION _____

BORING TNTC-MW4 SAMPLE SAND #5 DEPTH _____

NUMBER OF RINGS		DISH	316
WT. OF RINGS & WET SOIL		WT. OF DISH & WET SOIL	238.2
WT. OF RINGS		WT. OF DISH & DRY SOIL	~~237.7~~ 238.1
WT. OF WET SOIL		WT. OF MOISTURE	
FIELD DENSITY		WT. OF DISH	111.7
DRY DENSITY		WT. OF DRY SOIL	
		FIELD MOISTURE CONTENT	

WASH SIEVE _____ DRY SIEVE _____ WEIGHT OF OVEN DRY SOIL _____ (grams)

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUMULATIVE WEIGHT RETAINED	ACCUMULATIVE PERCENT	
					RETAINED	FINER
		3"				
		1-1/2"				
		3/4"				
		3/8"		0		
		#4		24.25		
		PAN				
		TOTAL				

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUM. WEIGHT RETAINED	ACCUMULATIVE PERCENT		
					PARTIAL		TOTAL
					RETAINED	FINER	FINER
		#10		126.30			
		#20		126.37			
		#40		126.38			
		#60		126.39			
		#100		126.44			
		#200		126.44			
		PAN					
		TOTAL					

Dames & Moore

APPENDIX F

WELL DEVELOPMENT DOCUMENTATION

WELL DEVELOPMENT RECORD

1. Project Name: Plum Brook Ordnance Works

   Location: Sandusky, Ohio

2. Well Designation: PB - TNTA - MW10

   Location: TNT Area A North of Maintenance Rd

3. Well Installation:
   Date(s) and Time(s): 10/15/94

4. Well Development: 11/8/94 11/12/94
   Date(s) and Time(s): 1300

5. Elevation of top of casing (if available) _____ ft msl

6. Depth from top of well casing to bottom of well: 13.5 ft

7. Static Water Level

   Before Development: 7.35 ft below top of casing
   48 ~~24~~ Hours After Development: 6.67 ft below top of casing
   11/12 6.77

8. Quantity of Water
   Added During Filter Placement: 0.0 gallons
   Added during drilling: 0.0 gallons

9. Quantity of Fluid in Well
   Prior to Development:

   a. Standing in Well: 1.05 gallons
      (6.15 ft x.17 gal)
   b. Contained in Annulus
      (assuming 30% porosity): 3.52 gallons

10. Total amount of water to be purged from well: Add amounts from 6 and 7 and multiply by 5 (4.57 gals x 5 = 22.85 gals to be purged).

11. Field Measurements of pH, Conductivity, and Temperature:

    a. Before Development:

       pH: 6.52 conductivity: 967 temperature: 58 °C/°F

b. During Development:

11/12/94 pH: 6.97 conductivity: 1090 temperature: 58 °C/°F

pH: _____ conductivity: _____ temperature: ____ °C/°F

c. After Development:

pH: _____ conductivity: _____ temperature: ____ °C/°F

12. Screen length: 8.0 ft

13. Depth from top of well casing to top of sediment inside well

a. Before development: 13.5 ft (11/8) 12.95 (11/12)

b. After development: 12.95 ft

14. Physical character of removed water

a. Clarity Surface Clear (2.5') Then Opaque

b. Color Surface Clear (2.5') Then Rusty Brown

c. Particulates Greyish Brown Fine Sand/Silt

d. Odor Sulfur

15. Type and size/capacity of pump and/or bailor used: 3' x 0.13' Disposable

16. Depth of well casing below ground surface ~~(since flush-mount)~~: 11.0 ft

17. Typical pumping rate (if applicable): _____ gpm

18. Estimated recharge rate: _____ gpm

19. Quantity of water removed: ≈3.5 gal. (11/8) 7 gal (11/12)

20. Quantity of sediment removed: ~0.5 ft ~~gal.~~

PB-TNTA-MW10

WELL DEVELOPMENT RECORD

1. Project Name: Plum Brook Ordnance Works

   Location: Sandusky, Ohio

2. Well Designation: PB-TNTA-MW11

   Location: TNT AREA A SOUTH OF MAINTENANCE Rd. EAST OF SHORT CUT Rd.

3. Well Installation:
   Date(s) and Time(s): 10/15/94

4. Well Development: 11/8/94 11/12/94
   Date(s) and Time(s): 1415

5. Elevation of top of casing (if available) _____ ft msl

6. Depth from top of well casing to bottom of well: 14.1 ft

7. Static Water Level

   Before Development: 9.26 ft below top of casing
   48 ~~24~~ Hours After Development: 9.42 ft below top of casing
   11/12 9.45

8. Quantity of Water
   Added During Filter Placement: 0.0 gallons
   Added during drilling: 0.0 gallons

9. Quantity of Fluid in Well
   Prior to Development:

   a. Standing in Well: 0.82 gallons
      (4.84 ft x.17 gal)
   b. Contained in Annulus
      (assuming 30% porosity): 2.77 gallons

10. Total amount of water to be purged from well: Add amounts from 6 and 7 and multiply by 5 (3.59 gals x 5 = 17.95 gals to be purged).

11. Field Measurements of pH, Conductivity, and Temperature:

    a. Before Development:

       pH: 6.25 conductivity: 1040 temperature: 58 °C/°F

b. During Development:

11/12/94 pH: 6.89 conductivity: 1490 temperature: 58 °C/°F

pH: _____ conductivity: _____ temperature: _____ °C/°F

c. After Development:

pH: _____ conductivity: _____ temperature: _____ °C/°F

12. Screen length: 8.0 ft

13. Depth from top of well casing to top of sediment inside well

a. Before development: 14.1 (11/8) ft 13.34 (11/12)

b. After development: 13.34 ft

14. Physical character of removed water

a. Clarity Surface 2.5' clear then Cloudy/Opaque

b. Color 2.5' surface Clear then Greyish Brown

c. Particulates Greyish Brown fine Sand/Silt

d. Odor None

15. Type and size/capacity of pump and/or bailor used: 3' x 0.13' Disposible

16. Depth of well casing below ground surface (~~since flush mount~~): 11.4 ft

17. Typical pumping rate (if applicable): _____ gpm

18. Estimated recharge rate: _____ gpm

19. Quantity of water removed: 2.5 (11/8) gal. 3 gal (11/12)

20. Quantity of sediment removed: ~~-0.77~~ (11/8) ~~gal.~~

PB-T JT4-M 11

WELL DEVELOPMENT RECORD

1. Project Name: Plum Brook Ordnance Works

   Location: Sandusky, Ohio

2. Well Designation: MK-MW22

   Location: East of Columbus Rd Between Maintenence + Pentolite

3. Well Installation:
   Date(s) and Time(s): _____

4. Well Development:
   Date(s) and Time(s): 11-10-94 / 09.00 1455 11-15-94

5. Elevation of top of casing (if available) _____ ft msl

6. Depth from top of well casing to bottom of well: 12.6 ft

7. Static Water Level

   Before Development: ~~10.07~~ 9.03 ft below top of casing
   24 Hours After Development: 9.45 ft below top of casing
   11/15 9.49

8. Quantity of Water
   Added During Filter Placement: _____ gallons
   Added during drilling: _____ gallons

9. Quantity of Fluid in Well
   Prior to Development:

   a. Standing in Well: 0.61 gallons
      (3.57 ft x.17 gal)
   b. Contained in Annulus
      (assuming 30% porosity): 2.05 gallons

10. Total amount of water to be purged from well: Add amounts from 6 and 7 and multiply by 5 (2.66 gals x 5 = 13.3 gals to be purged).

11. Field Measurements of pH, Conductivity, and Temperature:

    a. Before Development:

       pH: 6.46 conductivity: 1100 temperature: 58 °C/°F

b. During Development:

11/15 pH: 6.48 conductivity: 880 temperature: 59 °C/°F

pH: _____ conductivity: _____ temperature: _____ °C/°F

c. After Development:

pH: _____ conductivity: _____ temperature: _____ °C/°F

12. Screen length: 5 ft

13. Depth from top of well casing to top of sediment inside well

a. Before development: 11/10 11.33 ft 11/15 11.63

b. After development: 11.63 ft

14. Physical character of removed water

	UNDISTURBED	During Purging
a. Clarity	clear	Opaque
b. Color	Yellowish	Gray
c. Particulates	None	Sandy Clay
d. Odor	None	

15. Type and size/capacity of pump and/or bailor used: _____

16. Depth of well casing below ground surface (since flush-mount): N/A ft

17. Typical pumping rate (if applicable): N/A gpm

18. Estimated recharge rate: _____ gpm

19. Quantity of water removed: 11/10 ≈ 1.0 gal. 11/15 1.0

20. Quantity of sediment removed: 11/10 0.30 ft ~~gal.~~

MK-MW22

WELL DEVELOPMENT RECORD

1. Project Name: Plum Brook Ordnance Works

   Location: Sandusky, Ohio

2. Well Designation: MK-MW23

   Location: East of (Behind) Engineering Building, ON Rd

3. Well Installation:
   Date(s) and Time(s): _____

4. Well Development:
   Date(s) and Time(s): 11-10-94 / 09:00 1525 11-15-94

5. Elevation of top of casing (if available) _____ ft msl

6. Depth from top of well casing to bottom of well: 19.0' ft

7. Static Water Level

   Before Development: 10.07 ft below top of casing
   24 Hours After Development: 16.41 ft below top of casing
   11/15 16.20

8. Quantity of Water
   Added During Filter Placement: 0 gallons
   Added during drilling: 0 gallons

9. Quantity of Fluid in Well
   Prior to Development:

   a. Standing in Well: 1.52 gallons
      (8.93 ft x.17 gal)
   b. Contained in Annulus
      (assuming 30% porosity): 5.12 gallons

10. Total amount of water to be purged from well: Add amounts from 6 and 7 and multiply by 5 (6.64 gals x 5 = 33.2 gals to be purged).

11. Field Measurements of pH, Conductivity, and Temperature:

    a. Before Development:

       pH: 7.03 conductivity: 1180 temperature: 58 °C/°F

MK-MW23

b. During Development:

11/15 pH: 6.66 conductivity: 1105 temperature: 57 °C/°F

pH: _____ conductivity: _____ temperature: ____ °C/°F

c. After Development:

pH: _____ conductivity: _____ temperature: ____ °C/°F

12. Screen length: 10 ft

13. Depth from top of well casing to top of sediment inside well

a. Before development: 18.43 ft 11/10 11/10 18.44

b. After development: 18.44 ft 18.60 (11/15)

14. Physical character of removed water

a. Clarity Opaque

b. Color Gray

c. Particulates Silt

d. Odor Sulfer

15. Type and size/capacity of pump and/or bailor used: 1.1" ϕ 3' long plastic bailer

16. Depth of well casing below ground surface (since flush-mount): N/A ft

17. Typical pumping rate (if applicable): N/A gpm

18. Estimated recharge rate: _____ gpm

19. Quantity of water removed: 6 gal. 11/10 11/15 2.0

20. Quantity of sediment removed: 0.01 → 0.16 ft ~~gal.~~ ft.

WELL DEVELOPMENT RECORD

1. Project Name: Plum Brook Ordnance Works

   Location: Sandusky, Ohio

2. Well Designation: MK- [illegible] 24

   Location: [illegible] Road ([illegible]) [illegible] east of [illegible] Road

3. Well Installation:
   Date(s) and Time(s): _____

4. Well Development:
   Date(s) and Time(s): ~~11/14/94~~ 0815 11/15/94 1559

5. Elevation of top of casing (if available) _____ ft msl

6. Depth from top of well casing to bottom of well: ~~12.05~~ 12.50 s.s. ft

7. Static Water Level

   Before Development: 9.83 ft below top of casing
   24 Hours After Development: 11.23 (11/12) ft below top of casing
   11/15 10.92

8. Quantity of Water
   Added During Filter Placement: _____ gallons
   Added during drilling: _____ gallons

9. Quantity of Fluid in Well
   Prior to Development:

   a. Standing in Well: 0.45 gallons
      (2.67 ft x.17 gal)
   b. Contained in Annulus
      (assuming 30% porosity): 1.53 gallons

10. Total amount of water to be purged from well: Add amounts from 6 and 7 and multiply by 5 (1.98 gals x 5 = 9.90 gals to be purged).

11. Field Measurements of pH, Conductivity, and Temperature:

    a. Before Development:

       pH: 6.88 conductivity: 2020 temperature: 59 °C/(°F)

b. During Development:

11/15 pH: 6.42 conductivity: 2180 temperature: 58 °C/°F

pH: _____ conductivity: _____ temperature: ____ °C/°F

c. After Development:

pH: _____ conductivity: _____ temperature: ____ °C/°F

12. Screen length: 5 ft

13. Depth from top of well casing to top of sediment inside well

a. Before development: 11/11 12.05 ft 11/15 12.05

b. After development: 12.05 ft

14. Physical character of removed water

a. Clarity Cloudy

b. Color Brownish Gray

c. Particulates Brown Fine Sand/Silt

d. Odor None

15. Type and size/capacity of pump and/or bailor used: _____

16. Depth of well casing below ground surface ~~(since flush mount)~~: 9.5 ft

17. Typical pumping rate (if applicable): _____ gpm

18. Estimated recharge rate: _____ gpm

19. Quantity of water removed: 11/11 ≈2 gal. 11/15 0.25 gal

20. Quantity of sediment removed: 0 gal.

MK-MW24

WELL DEVELOPMENT RECORD

1. Project Name: Plum Brook Ordnance Works

   Location: Sandusky, Ohio

2. Well Designation: MK-MW16

   Location: South of West SCHEID Rd. ≈ 1/4 mile west of Taft Rd.

3. Well Installation:
   Date(s) and Time(s): _____

4. Well Development:
   Date(s) and Time(s): 1640 ~~11/10/94~~ 1630 11/15/94

5. Elevation of top of casing (if available) _____ ft msl

6. Depth from top of well casing to bottom of well: 11.2 ft

7. Static Water Level

   Before Development: 8.0 ft below top of casing
   24 Hours After Development: 7.94 (11/11) ft below top of casing
   11/15 7.52

8. Quantity of Water
   Added During Filter Placement: _____ gallons
   Added during drilling: _____ gallons

9. Quantity of Fluid in Well
   Prior to Development:

   a. Standing in Well: 0.54 gallons
      (3.2 ft x.17 gal)
   b. Contained in Annulus
      (assuming 30% porosity): 1.83 gallons

10. Total amount of water to be purged from well: Add amounts from 6 and 7 and multiply by 5 (2.37 gals x 5 = 11.85 gals to be purged).

11. Field Measurements of pH, Conductivity, and Temperature:

    a. Before Development:

       pH: 7.1 conductivity: 1100 temperature: 58 °C/°F

b. During Development:

11/15 pH: 6.12 conductivity: 1100 temperature: 57 °C/°F

pH: _____ conductivity: _____ temperature: ____ °C/°F

c. After Development:

pH: _____ conductivity: _____ temperature: ____ °C/°F

12. Screen length: 5 ft

13. Depth from top of well casing to top of sediment inside well

a. Before development: 11/10 10.23 ft 11/15 10.17

b. After development: 10.17 ft

14. Physical character of removed water

a. Clarity @ surface Clear then orangish Brown Opaque

b. Color Orange then orange Brown

c. Particulates Orangish Brown silt/Fine sand

d. Odor None

15. Type and size/capacity of pump and/or bailor used: _____

16. Depth of well casing below ground surface (since flush-mount): 8.0 ft

17. Typical pumping rate (if applicable): _____ gpm

18. Estimated recharge rate: _____ gpm

19. Quantity of water removed: 11/15 ≈3 gal. 11/15 2 gal 11/10/94

20. Quantity of sediment removed: - 0.06 ft ~~gal.~~

MK-MW16

WELL DEVELOPMENT RECORD

1. Project Name: Plum Brook Ordnance Works

   Location: Sandusky, Ohio

2. Well Designation: MK-02-MW-17

   Location: North of N. MAGAZINE Rd ≈ 1/4 mi east of Emergency B Rd.

3. Well Installation:
   Date(s) and Time(s): _____

4. Well Development:
   Date(s) and Time(s): 11-10-94 11/15/94 (sample)

5. Elevation of top of casing (if available) _____ ft msl

6. Depth from top of well casing to bottom of well: 6.51 ft

7. Static Water Level

   Before Development: 4.66 ft below top of casing
   24 Hours After Development: 4.76 ft below top of casing

8. Quantity of Water
   Added During Filter Placement: 0 gallons
   Added during drilling: 0 gallons

9. Quantity of Fluid in Well
   Prior to Development:

   a. Standing in Well: 0.70 gallons
      (4.14 ft x.17 gal)
   b. Contained in Annulus
      (assuming 30% porosity): 2.37 gallons

10. Total amount of water to be purged from well: Add amounts from 6 and 7 and multiply by 5 (3.07 gals x 5 = 15.35 gals to be purged).

11. Field Measurements of pH, Conductivity, and Temperature:

    a. Before Development:

       pH: 6.84 conductivity: 1160 temperature: 54 °C/°F

MK-02-MW-17

b. During Development:

pH: 7.42 conductivity: 1240 temperature: 54 °C/°F

pH: _____ conductivity: _____ temperature: _____ °C/°F

c. After Development:

pH: _____ conductivity: _____ temperature: _____ °C/°F

12. Screen length: 4 ft

13. Depth from top of well casing to top of sediment inside well

a. Before development: 8.86 ft

b. After development: _____ ft

14. Physical character of removed water

a. Clarity Opaque

b. Color Dk Brown

c. Particulates Much silt

d. Odor None

15. Type and size/capacity of pump and/or bailor used: 1.1"ϕ 3' bns plastic Bailer

16. Depth of well casing below ground surface (since flush-mount): N/A ft

17. Typical pumping rate (if applicable): N/A gpm

18. Estimated recharge rate: _____ gpm

19. Quantity of water removed: 15 gal.

20. Quantity of sediment removed: _____ gal.

WELL DEVELOPMENT RECORD

1. Project Name: Plum Brook Ordnance Works

   Location: Sandusky, Ohio

2. Well Designation: PB-TNTC-MW5

   Location: BEHIND ABANDONED BUILDING South of EPA ROAD

3. Well Installation:
   Date(s) and Time(s): 10/13 → 10/14/91

4. Well Development:
   Date(s) and Time(s): ~~11/9/94~~, 11/12/94 1055

5. Elevation of top of casing (if available) _____ ft msl

6. Depth from top of well casing to bottom of well: 32.4 ft

7. Static Water Level

   Before Development: 23.13 ft below top of casing
   48 ~~24~~ Hours After Development: 29.25 ft below top of casing
   11/12 28.35

8. Quantity of Water
   Added During Filter Placement: 0.0 gallons
   Added during drilling: 0.0 gallons

9. Quantity of Fluid in Well
   Prior to Development:

   a. Standing in Well: 1.58 gallons
      (9.27 ft x.17 gal)
   b. Contained in Annulus
      (assuming 30% porosity): 5.31 gallons

10. Total amount of water to be purged from well: Add amounts from 6 and 7 and multiply by 5 (6.89 gals x 5 = 34.45 gals to be purged).

11. Field Measurements of pH, Conductivity, and Temperature:

    a. Before Development:

       pH: 6.92 conductivity: 750 temperature: 54 °C/(°F)

b. During Development:

11/12/94 pH: 7.7 conductivity: 910 temperature: 54 °C/°F

pH: _____ conductivity: _____ temperature: _____ °C/°F

c. After Development:

pH: _____ conductivity: _____ temperature: _____ °C/°F

12. Screen length: 26 ft

13. Depth from top of well casing to top of sediment inside well

a. Before development: 11/8 32.4 ft 11/12 32.53

b. After development: 32.53 ft

14. Physical character of removed water

a. Clarity OPAQUE

b. Color Rusty Brown

c. Particulates Brown fine sand/silt

d. Odor None

15. Type and size/capacity of pump and/or bailor used: 36" x 0.11' Disposable Bailor

16. Depth of well casing below ground surface ~~(since flush mount):~~ 29.7 ft

17. Typical pumping rate (if applicable): _____ gpm

18. Estimated recharge rate: _____ gpm

19. Quantity of water removed: 11/3 8.5 gal. 11/12 4.5 gal

20. Quantity of sediment removed: 11/3 0.13 ~~ft~~ ~~gal.~~

WELL DEVELOPMENT RECORD

1. Project Name: Plum Brook Ordnance Works

   Location: Sandusky, Ohio

2. Well Designation: PB-TNTC-MW6

   Location: In The Woods South of the EAST END of EPA ROAD

3. Well Installation:
   Date(s) and Time(s): 10/16/94

4. Well Development: 11/8/94 11/12/94
   Date(s) and Time(s): @1035 1025

5. Elevation of top of casing (if available) _____ ft msl

6. Depth from top of well casing to bottom of well: 14.52 ft

7. Static Water Level

   Before Development: 7.81 ft below top of casing
   48 ~~24~~ Hours After Development: 7.87 ft below top of casing
   11/12 7.67

8. Quantity of Water
   Added During Filter Placement: 0.0 gallons
   Added during drilling: 0.0 gallons

9. Quantity of Fluid in Well
   Prior to Development:

   a. Standing in Well: 1.14 gallons
      (6.71 ft x.17 gal)
   b. Contained in Annulus
      (assuming 30% porosity): 3.85 gallons

10. Total amount of water to be purged from well: Add amounts from 6 and 7 and multiply by 5 (4.99 gals x 5 = 24.95 gals to be purged).

11. Field Measurements of pH, Conductivity, and Temperature:

    a. Before Development:

       pH: 6.68 conductivity: 680 temperature: 57 °C/°F

b. During Development:

11/12/94 pH: 7.10 conductivity: 1120 temperature: 55 °C/°F

pH: _____ conductivity: _____ temperature: _____ °C/°F

c. After Development:

pH: _____ conductivity: _____ temperature: _____ °C/°F

12. Screen length: 9 ft

13. Depth from top of well casing to top of sediment inside well

a. Before development: 14.52 (11/8) ft 14.68 (11/12)

b. After development: 14.68 ft

14. Physical character of removed water

a. Clarity Opaque

b. Color Brown

c. Particulates Brownish Grey Fine Sand/Silt

d. Odor None

15. Type and size/capacity of pump and/or bailor used: 3' x 0.13' Disposable Bailor

16. Depth of well casing below ground surface (~~since flush mount~~): 12.2 ft

17. Typical pumping rate (if applicable): _____ gpm

18. Estimated recharge rate: _____ gpm

19. Quantity of water removed: 5 (11/8) gal. 5.5 (11/12)

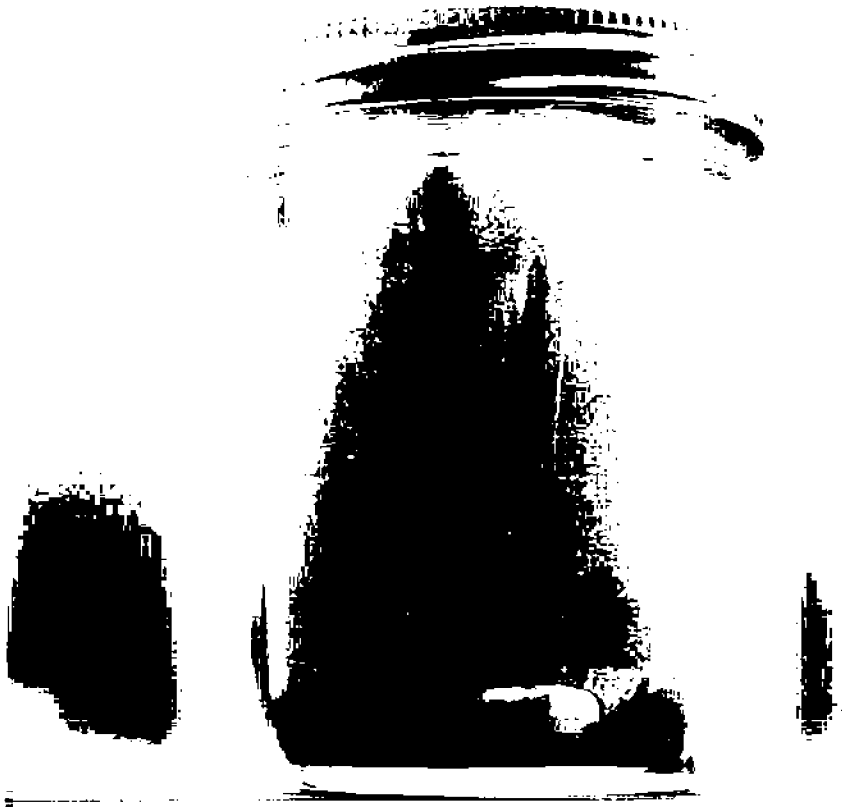
20. Quantity of sediment removed: 0.16 ft ~~gal~~.

Well ID: PB-TNTC-MW5 Collected 11-14-94

DEVELOPMENT WATER SAMPLE
Photographed December 12, 1994

PLUM BROOK ORDNANCE WORKS
Sandusky, Ohio

HTW Investigation by Dames & Moore, Inc.
for U.S. Army Corps of Engineers, Nashville District



Well ID: PB-TNTC-MW6 Collected 11-14-94

DEVELOPMENT WATER SAMPLE
Photographed December 12, 1994

PLUM BROOK ORDNANCE WORKS
Sandusky, Ohio

HTW Investigation by Dames & Moore, Inc.
for U.S. Army Corps of Engineers, Nashville District

Well ID: PB-TNTA-MW10 Collected 11-14-94

DEVELOPMENT WATER SAMPLE
Photographed December 12, 1994

PLUM BROOK ORDNANCE WORKS
Sandusky, Ohio

HTW Investigation by Dames & Moore, Inc.
for U.S. Army Corps of Engineers, Nashville District

Well ID: PB-TNTA-MW11 Collected 11-14-94

DEVELOPMENT WATER SAMPLE
Photographed December 12, 1994

PLUM BROOK ORDNANCE WORKS
Sandusky, Ohio

HTW Investigation by Dames & Moore, Inc.
for U.S. Army Corps of Engineers, Nashville District

Well ID: MK-MW16 Collected 11-15-94

DEVELOPMENT WATER SAMPLE
Photographed December 12, 1994

PLUM BROOK ORDNANCE WORKS
Sandusky, Ohio

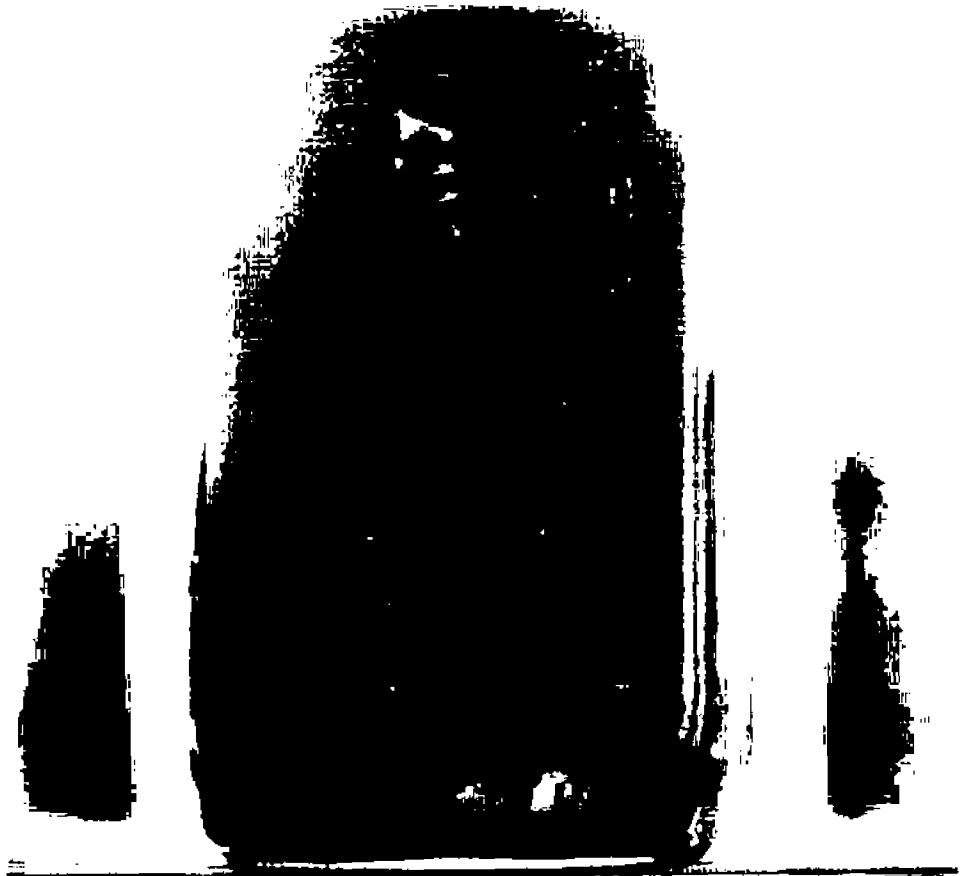
HTW Investigation by Dames & Moore, Inc.
for U.S. Army Corps of Engineers, Nashville District

Well ID: MK-MW17 Collected 11-15-94

DEVELOPMENT WATER SAMPLE
Photographed December 12, 1994

PLUM BROOK ORDNANCE WORKS
Sandusky, Ohio

HTW Investigation by Dames & Moore, Inc.
for U.S. Army Corps of Engineers, Nashville District



Well ID: MK-MW22 Collected 11-15-94

DEVELOPMENT WATER SAMPLE
Photographed December 12, 1994

PLUM BROOK ORDNANCE WORKS
Sandusky, Ohio

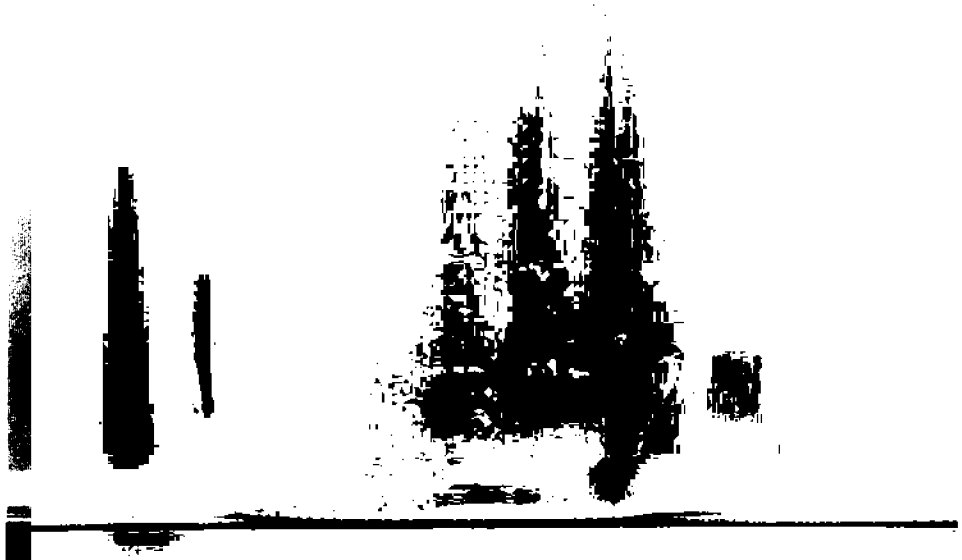
HTW Investigation by Dames & Moore, Inc.
for U.S. Army Corps of Engineers, Nashville District

Well ID: MK-MW23 Collected 11-15-94

DEVELOPMENT WATER SAMPLE
Photographed December 12, 1994

PLUM BROOK ORDNANCE WORKS
Sandusky, Ohio

HTW Investigation by Dames & Moore, Inc.
for U.S. Army Corps of Engineers, Nashville District



Well ID: MK-MW24 Collected 11-15-94

DEVELOPMENT WATER SAMPLE
Photographed December 12, 1994

PLUM BROOK ORDNANCE WORKS
Sandusky, Ohio

HTW Investigation by Dames & Moore, Inc.
for U.S. Army Corps of Engineers, Nashville District

APPENDIX G

WELL SURVEY DOCUMENTATION

File: MTNTA.PRN

POINT	NORTHING	EASTING	ELEVATION	NOTE
1000	32580.1577	27844.9668	638.0465	MK-MW22 CAS
1001	32580.3630	27844.3376	635.5575	MK-MW22 GND
1002	32935.1711	29414.2443	639.4729	MK-MW23 CAS
1003	32934.0916	29414.5169	636.9500	MK-MW23 GND
1004	30493.6231	27420.8660	657.1164	MK-MW24 CAS
1005	30494.7078	27420.4812	654.4446	MK-MW24 GND
1006	32095.2811	27479.5229	640.1783	PB-TNTA-MW10 CAS
1007	32093.1214	27478.6611	637.5025	PB-TNTA-MW10 GND
1008	31733.6648	26832.7054	640.4990	PB-TNTA-MW11 CAS
1009	31731.5058	26832.6482	637.8648	PB-TNTA-MW11 GND

File: [illegible].CRD

POINT	NORTHING	EASTING	ELEVATION	NOTE
2000	24937.4730	22260.6698	674.3227	MK-MW16 CAS
2001	24938.5128	22260.1230	671.3271	MK-MW16 GND
2002	26671.1286	22021.0026	664.6425	MK-MW17 CAS
2003	26670.7095	22019.8256	660.9672	MK-MW17 GND

File: DITNTC.CRD

POINT	NORTHING	EASTING	ELEVATION	NOTE
3000	29408.6978	15531.0263	645.4149	PB-TNTC-MW3 CAS
3001	29408.8887	15532.7451	642.5686	PB-TNTC-MW3 GND
3002	28334.5197	14635.8790	654.4254	PB-TNTC-MW4 CAS
3003	28332.1101	14634.9910	651.8891	PB-TNTC-MW4 GND
3004	28645.6081	15969.9882	651.8103	PB-TNTC-MW5 CAS
3005	28645.9387	15972.1375	649.0699	PB-TNTC-MW5 GND
3006	28411.4613	17171.1652	659.4018	PB-TNTC-MW6 CAS
3007	28413.0296	17169.5598	656.8196	PB-TNTC-MW6 GND

File: WWA WELLS.DAT

POINT	NORTHING	EASTING	ELEVATION	NOTE
4000	30428.4220	14380.0948	639.5980	IT-MW002 CASING
4001	30428.0835	14379.8283	636.6895	IT-MW002 GND
4002	30428.3357	14379.9481	639.6292	IT-MW002 MEAS PT
4003	31783.0116	14647.2616	640.8941	MK-MW10 CAS
4004	31784.0924	14646.6469	638.0600	MK-MW10 GND
4005	31782.0442	15925.8393	637.6858	MK-MW11 CAS
4006	31782.6482	15926.8071	634.7066	MK-MW11 GND
4007	30549.5032	14060.0756	644.4319	PB-WA-MW-1 CASING
4008	30549.4006	14060.5771	642.3200	PB-WA-MW-1 GND
4009	30038.2737	14301.1933	633.6505	PB-WA-MW-2 CASING
4010	30038.9137	14301.2543	631.1569	PB-WA-MW-2 GND

File: C:PEN-WELL.DAT

POINT	NORTHING	EASTING	ELEVATION	NOTE
5000	33122.3541	23074.6346	633.9861	PB-PR-MW7 CAS
5001	33122.1380	23074.6900	631.5000	PB-PR-MW7 GND
5002	33022.0426	23365.0504	635.0205	PB-PR-MW8 CAS
5003	33022.1700	23364.7000	632.5000	PB-PR-MW8 GND
5004	33229.7381	23561.4850	633.6999	PB-PR-MW9 CAS
5005	33227.1940	23564.6760	630.7000	PB-PR-MW9 GND
5006	33482.7542	23520.4311	634.9943	IT-MW05 CAS
5007	33481.1410	23518.7250	631.9147	IT-MW05 GND

POINT	NORTHING	EASTING	ELEVATION	NOTE
6000	29006.7777	16324.7729	648.2732	PB-BED-MW13 CAS
6001	29004.7448	16324.8381	645.8093	PB-BED-MW13 GND
6002	30640.9823	14567.4105	646.0366	PB-BED-MW14 CAS
6003	30640.6739	14564.9269	643.0537	PB-BED-MW14 GND
6004	34311.2880	23307.8810	631.6394	PB-BED-MW15 CAS
6005	34311.2752	23310.1041	629.0787	PB-BED-MW15 GND
6006	31463.0050	24687.7929	636.0178	PB-BED-MW16 CAS
6007	31461.0305	24688.0338	633.6826	PB-BED-MW16 GND
6008	33666.0038	28164.0776	629.9697	PB-BED-MW17 CAS
6009	33667.9151	28164.7514	627.3369	PB-BED-MW17 GND
6010	32130.3503	29563.1857	651.5041	PB-BED-MW18 CAS
6011	32128.0488	29563.0032	648.8318	PB-BED-MW18 GND
6012	31782.9542	14256.5847	643.0705	PB-BED-MW19 CAS
6013	31780.9102	14256.3225	640.5050	PB-BED-MW19 GND
6014	20646.7145	27306.6374	676.3317	PB-BED-MW20 CAS
6015	20645.1156	27305.6314	673.5732	PB-BED-MW20 GND
6016	34874.6151	21994.7173	630.1175	REACTOR1 CAS
6017	34874.7528	21994.7061	630.2061	REACTOR1 GND
6018	34762.4651	22017.2722	630.6801	REACTOR2 CAS
6019	34762.6821	22017.2191	630.7188	REACTOR2 GND
6020	34790.0318	22161.7567	630.8760	REACTOR3 CAS
6021	34790.0394	22161.8592	630.7346	REACTOR3 GND
6022	34735.1486	22161.2091	631.1532	REACTOR4 CAS
6023	34735.1918	22161.2332	630.7567	REACTOR4 GND

File: C:WA-SOIL.CR5

INT	NORTHING	EASTING	ELEVATION	NOTE
7000	30006.1890	14404.1956	631.8186	PB-WA-S1
7001	29954.2200	14345.3691	624.3863	PB-WA-S2
7002	29932.7040	14250.8353	626.0317	PB-WA-S3
7003	30183.0401	14061.7649	633.3041	PB-WA-S4
7004	30159.2497	14065.3231	633.0988	PB-WA-S5
7005	30147.6119	13844.2866	633.3705	PB-WA-S6
7006	30184.1411	13752.1463	635.3703	PB-WA-S7
7007	30354.5881	13748.0405	637.7745	PB-WA-S8
7008	30441.3753	14085.3392	639.3238	PB-WA-S9
7009	30331.5225	14694.5146	632.1665	PB-WA-S11
7010	30166.2900	14696.1580	627.5275	PB-WA-S12
7011	30066.0276	14455.5353	631.5901	PB-WA-S13
7012	30058.3731	14678.7106	629.1723	PB-WA-S14
7013	30531.8066	14752.4694	632.8720	PB-WA-S15
7014	30438.0133	14278.0708	638.2466	PB-WA-S16
7015	30334.9682	14416.1808	633.1152	PB-WA-S17
7016	30192.6733	14442.4040	631.5738	PB-WA-S18
7017	30442.8399	14461.8413	632.3120	PB-WA-S19
7018	30092.2223	14361.9554	631.3624	PB-WA-S20
7019	30105.3354	14387.2320	630.8781	E POND H2O ELEV
7020	30091.9365	14312.4992	634.9013	W POND H2O ELEV
7021	30411.8869	14299.0826	0.0000	GRID A,0
7022	30312.0487	14304.8151	0.0000	GRID 2
023	30362.2829	14301.7802	0.0000	GRID 1
7024	30263.3419	14307.5367	0.0000	GRID 3
7025	30214.0439	14310.2108	0.0000	GRID 4
7026	30164.6824	14313.1814	0.0000	GRID 5
7027	30115.9103	14315.8810	0.0000	GRID 6
7028	30089.5931	14317.2538	0.0000	GRID 7
7029	30080.1290	14267.4196	0.0000	GRID B'
7030	30084.4724	14220.4027	0.0000	GRID C'
7031	30088.0436	14168.2477	0.0000	GRID D'
7032	30106.6105	14145.6197	0.0000	GRID 6'
7033	30156.6212	14143.6142	0.0000	GRID 5'
7034	30205.4939	14112.9276	0.0000	GRID E'
7035	30202.9630	14063.6400	0.0000	GRID F'
7036	30203.0170	14014.3397	0.0000	GRID G'
7037	30203.0974	13964.5085	0.0000	GRID H'
7038	30202.7904	13915.0375	0.0000	GRID I'
7039	30197.5543	13867.1776	0.0000	GRID J'
7040	30196.9283	13817.7907	0.0000	GRID K'
7041	30201.5060	13768.7801	636.6574	GRID L' BOB
7042	30200.3993	13771.3730	0.0000	GRID 3'
7043	30280.8029	13768.3270	0.0000	GRID 2'
7044	30320.9362	13765.6018	636.8894	GRID 1' BOB
7045	30380.2808	13764.6497	0.0000	GRID 0'
7046	30410.8059	13751.3223	0.0000	GRID L
7047	30413.6969	13801.2278	0.0000	GRID K
7048	30415.0029	13851.4200	0.0000	GRID J
7049	30416.6131	13902.1923	0.0000	GRID I
7050	30418.5878	13950.5357	0.0000	GRID H
7051	30417.9195	14001.1511	0.0000	GRID G
7052	30416.4089	14050.5135	0.0000	GRID F
7053	30415.9302	14101.0651	0.0000	GRID E
7054	30415.1050	14150.6190	0.0000	GRID D
7055	30414.1[illegible]	14200.1267	0.0000	GRID [illegible]

POINT	NORTHING	EASTING	ELEVATION	NOTE
7056	30412.9637	14249.8965	0.0000	GRID B
7057	30411.3433	14231.3303	635.9779	BOB (BOT OF BANK
7058	30415.9536	14232.9379	639.3188	TOB (TOP OF BANK)
7059	30387.0836	14301.1532	637.6700	TOB
7060	30374.3088	14301.9589	634.8275	BOB
7061	30368.4182	14314.1058	635.1599	BOB
7062	30358.6547	14336.7958	637.5027	BERM
7063	30226.2309	14339.8316	638.1550	BERM
7064	30227.7183	14321.0614	635.4249	BOB
7065	30074.9673	14323.4755	638.4649	BERM
7066	30085.9520	14318.9367	636.1066	BOB
7067	30067.9813	14230.8525	637.9243	BERM
7068	30075.3576	14224.2036	635.9106	BOB
7069	30078.5948	14142.1937	638.5194	BERM
7070	30085.1195	14144.8041	636.3330	BOB
7071	30129.2379	14126.9881	637.7410	BERM
7072	30132.4814	14132.5218	635.9668	BOB
7073	30190.0450	14110.7680	638.1967	BERM
7074	30199.0133	14115.1351	635.3406	BOB
7075	30193.9837	14068.9819	636.1824	BREECH
7076	30189.3128	13957.6800	638.1029	BERM
7077	30194.4934	13956.8308	635.9451	BOB
7078	30195.9626	13763.0785	638.0533	BERM
7079	30255.0272	13748.0461	637.4130	EDGE LOW AREA
080	30266.2094	13754.2036	636.0354	BOB
081	30323.5849	13754.0661	637.2612	EDGE LOW AREA
7082	30360.1172	13798.4222	637.7170	TOB
7083	30356.4426	13802.7049	635.9964	BOB
7084	30384.3376	13851.3515	635.9836	BOB
7085	30388.2027	13847.7164	638.6041	TOB
7086	30416.7064	13937.8832	637.8301	TOB
7087	30409.4718	13943.9074	635.4179	BOB
7088	30434.4388	14035.9950	635.9225	BOB
7089	30442.5649	14040.6405	636.8063	BOB
7090	30428.0000	14047.0726	639.2780	TOB
7091	30421.8045	14046.8447	635.6744	BOB
7092	30412.0179	14130.6031	635.3740	BOB
7093	30418.6284	14129.3554	638.0894	TOB

File: C:PEN-SOIL.CR5

INT	NORTHING	EASTING	ELEVATION	NOTE
8000	33227.1240	22964.6760	633.5100	P-BH1
8001	33022.1240	22964.7000	633.0200	P-BH2
8002	32922.1240	22964.7120	633.0800	P-BH3
8003	33122.1380	23074.6900	631.4900	P-MW4
8004	32922.1670	23074.7120	631.2100	P-BH5
8005	33227.1470	23164.6770	631.3200	P-BH6
8006	33022.1470	23164.7000	631.1100	P-BH7
8007	33517.1580	23264.6430	633.6700	P-BH8
8008	33322.1580	23264.6650	631.1200	P-BH9
8009	33122.1590	23264.6880	631.1000	P-BH10
8010	32922.1610	23284.7120	632.2900	P-MW11
8011	33422.1700	23364.6540	630.4200	P-BH12
8012	33227.1700	23364.6760	632.8100	P-BH13
8013	33022.1700	23364.7000	632.4800	P-MW14
8014	33322.1830	23464.6670	633.0200	P-BH15
8015	33122.1820	23464.6880	634.5400	P-BH16
8016	32922.1820	23464.7120	631.1900	P-BH17
8017	33422.1920	23564.6540	629.8800	P-BH18
8018	33227.1940	23564.6760	630.7300	P-MW19
8019	33122.1940	23564.6880	631.6100	P-BH20
8020	33110.0910	23177.0110	630.5700	PB-PR-S21
8021	33162.1750	23394.6850	634.6300	P-BH21A
8022	33275.8650	23282.9030	630.3200	PB-PR-S22
023	33369.6920	23353.9460	629.8300	PB-PR-S23
8024	33373.7880	23447.8330	629.9700	PB-PR-S24

APPENDIX H

GROUNDWATER SAMPLING RECORDS

Volume Calculated

Casing: (.16)(6.36) = 1.02 gal

Sand: (1.91)(.30)(6.36) = 3.6 gal

PV = 4.66 gal

5xPV = 23.3 gal

pH1 = 7.50 COND1 = 1350

T1 = 53F Vol1 = 0

pH2 = 7.18 COND2 = 1350

T2 = 53F Vol2 = 3 g.

pH3 = 7.16 COND3 = 1330

T3 = 53F Vol3 = 5 g

pH4 = 7.14 COND4 = 1340

T4 = 53F Vol4 = 7

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~ Invest. Area:

DATE: 12-12-94 TIME:

WELL TYPE: Monitoring ☒ Potable ☐ Supply ☐

Other ☐

WELL NO.: INTA-MW10 WELL SIZE (I.D., inches) 2

TOP OF CASING (TOC) ELEVATION (ft., msl):

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 6.47

STATIC WATER LEVEL ELEVATION (ft., msl):

DEPTH TO BOTTOM OF WELL (ft. below TOC): 12.83

SCREENED INTERVAL (ft. below TOC): 4.83

VOLUME OF WATER TO BE EVACUATED (gallons)*: 22.3 gal

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☒

Other Disposable PVC Bailer

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable PVC Bailer

SAMPLE NO.: SAMPLE DEPTH (ft. below TOC):

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.:

FIELD TESTS:

SAMPLE TEMP. (°C): 48°F pH: 6.75

CONDUCTIVITY (µmhos/cm): 1300 PID (ppm)

LABORATORY ANALYSES: Explosives, Metals (Filtered + Unfiltered), Nitrates

NO. OF CONTAINERS AND I.D. 5; PB-INTA-DM-MW10-U
PB-INTA-DM-MW10-F

FIELD BLANK I.D.NO.: see below TRIP BLANK I.D. NO.

DUPLICATE SAMPLE I.D. NO.: See below

COMMENTS: Well dries after 7 gal removed. Water was cloudy, brown w/silts. -
Dupes = PB-INTA-DM-MW23-U+F-_+S
Equip Blank PB-E-INTA-DM-MW10-U+F-_+S

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

(5.52)

Volume Calculation

Casing: (.16)(3.30) = 0.53

Sand: (1.91)(.30)(3.30) = 1.89

PV = ~~1.54~~ JD 2.42

5xPV = ~~7.69 gal~~ JD 12.10 gal

PH1 = 6.82 Cond1 = 1850

T1 = 51F Vol = 6

PH2 = 6.83 Cond2 = 1840

T2 = 53F Vol = 2

~~PH3 = Cond3 =~~

~~T3 = Vol =~~

BCG 12-7-94

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~ Invest. Area:

DATE: 12-12-94 TIME:

WELL TYPE: Monitoring ☒ Potable ☐ Supply ☐

Other ☐

WELL NO.: TNTA-MW11 WELL SIZE (I.D., inches) 2

TOP OF CASING (TOC) ELEVATION (ft., msl):

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 9.94

STATIC WATER LEVEL ELEVATION (ft., msl):

DEPTH TO BOTTOM OF WELL (ft. below TOC): 13.24

SCREENED INTERVAL (ft. below TOC): 5.24

VOLUME OF WATER TO BE EVACUATED (gallons)*: JD ~~7.69~~ 12.1 gal

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☒

Other

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable Bailer

SAMPLE NO.: SAMPLE DEPTH (ft. below TOC):

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.:

FIELD TESTS:

SAMPLE TEMP. (°C): ~~66~~ 55 51.9 pH: 6.0

CONDUCTIVITY (µmhos/cm): 570 PID (ppm)

LABORATORY ANALYSES: Explosives, Metals (Unfiltered + Filtered), Nitrates

NO. OF CONTAINERS AND I.D. 5 ; PB-TNTA-~~DM~~MW11-U
PB-TNTA-DM-MW11-F

FIELD BLANK I.D.NO.: TRIP BLANK I.D. NO.

DUPLICATE SAMPLE I.D. NO.:

COMMENTS: WELL DRIES @ 2.5 gal REMOVAL.
BROWN COLOR w/ SEDIMENT

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

Volume Calculation

CASING = (.16)(2.46) = 0.39

SAND = (1.91)(0.39)(2.46) = 1.41

PV = 0.39 + 1.41 = 1.80

5x PV = 9.0 gal

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works Invest. Area: SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~

DATE: 12-9-94 (~~Explosives~~) 12-13-94 (Sample) TIME: 14:22

WELL TYPE: Monitoring ☒ Potable ☐ Supply ☐

Other ☐

WELL NO.: MK-MW-22 WELL SIZE (I.D., inches) 2

TOP OF CASING (TOC) ELEVATION (ft., msl):

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 9.20

STATIC WATER LEVEL ELEVATION (ft., msl):

DEPTH TO BOTTOM OF WELL (ft. below TOC): 11.66 (12.6)

SCREENED INTERVAL (ft. below TOC): 6.66

VOLUME OF WATER TO BE EVACUATED (gallons)*: 9.0

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☒

Other

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable PVC Bailer

SAMPLE NO.: PB-TNTA-MK-MW22 SAMPLE DEPTH (ft. below TOC):

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.: Mostly clear

FIELD TESTS:

SAMPLE TEMP. (°C): 5.1 pH: 6.5

CONDUCTIVITY (µmhos/cm): 700 PID (ppm)

LABORATORY ANALYSES: Explosives, METALS (FILTERED + UNFILTERED), Nitrate

NO. OF CONTAINERS AND I.D. 5; PB-TNTA-MK-MW22-U PB-TNTA-MK-MW22-F

FIELD BLANK I.D.NO.: TRIP BLANK I.D. NO.

DUPLICATE SAMPLE I.D. NO.:

COMMENTS: Well dries after 1 gal removed

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

Volume Calculation

casing = (.16)(2.88) = 0.46

Sand = (1.91)(0.3)(2.88) = 1.65

PV = 0.46 + 1.65 = 2.11

5 x PV = 10.55 gal

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~ Invest. Area:

DATE: 12-9-94 Explosives TIME: 14:50

12-13-94 metals

WELL TYPE: Monitoring ☒ Potable ☐ Supply ☐

Other ☐

WELL NO.: MK-MW-23 WELL SIZE (I.D., inches) 2

TOP OF CASING (TOC) ELEVATION (ft., msl):

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 15.59

STATIC WATER LEVEL ELEVATION (ft., msl):

DEPTH TO BOTTOM OF WELL (ft. below TOC): 18.47 (19.0)

SCREENED INTERVAL (ft. below TOC): 9.0

VOLUME OF WATER TO BE EVACUATED (gallons)*: 10.55

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☒

Other

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable PVC Bailer

SAMPLE NO.: PB-TNTA-MK-MW23-U SAMPLE DEPTH (ft. below TOC):

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.: mostly clear

FIELD TESTS:

SAMPLE TEMP. (°C): 54°F pH: 6.5

CONDUCTIVITY (µmhos/cm): 1370 PID (ppm)

LABORATORY ANALYSES: Explosives, METAL (UNFILTERED + Filtered), NITRATES

NO. OF CONTAINERS AND I.D. 5; PB-TNTA-MK-MW23-U
PB-TNTA-MK-MW23-F

FIELD BLANK I.D.NO.: TRIP BLANK I.D. NO.

DUPLICATE SAMPLE I.D. NO.:

COMMENTS: Well dries after 2.0 gal removed.

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

Volume Calculation

casing = (.16)(3.11) = 0.50 gal

borehole = (1.91)(0.3)(3.11) = 1.78 gal

PV = 2.28 gal

5xPV = 11.4 gal

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~ Invest. Area:

DATE: 12-9-94 TIME: 15:16

WELL TYPE: Monitoring ☒ Potable ☐ Supply ☐

Other ☐

WELL NO.: MK-MW-24 WELL SIZE (I.D., inches) 2

TOP OF CASING (TOC) ELEVATION (ft., msl):

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 8.81

STATIC WATER LEVEL ELEVATION (ft., msl):

DEPTH TO BOTTOM OF WELL (ft. below TOC): 11.92 (12.5)

SCREENED INTERVAL (ft. below TOC): 6.92 (7.5)

VOLUME OF WATER TO BE EVACUATED (gallons)*: 11.4

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☒

Other

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable PVC Bailer

SAMPLE NO.: SAMPLE DEPTH (ft. below TOC):

SAMPLE TREATMENT: Field Filtered ☒ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.: mostly clear

FIELD TESTS:

SAMPLE TEMP. (°C): 53°F pH: 5.93

CONDUCTIVITY (µmhos/cm): 1294 PID (ppm)

LABORATORY ANALYSES: Explosives, metals (Filtered & unfiltered) Nitrate

NO. OF CONTAINERS AND I.D. 5 PB-TNTA-MK-MW24

FIELD BLANK I.D.NO.: N/A TRIP BLANK I.D. NO.

DUPLICATE SAMPLE I.D. NO.: N/A

COMMENTS: Well dried after 1.5 gal removed

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

(8.39)

Volume Calculation

Casing: (.16)(2.87) = 0.46

Sand: (1.91)(0.3)(2.87) = 1.64

PV = 2.1

5xPV = 10.5 gal

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works Invest. Area: SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~

DATE: 12-9-94 TIME:

WELL TYPE: Monitoring ☒ Potable ☐ Supply ☐

Other ☐

WELL NO.: MK-MW16 WELL SIZE (I.D., inches) 2

TOP OF CASING (TOC) ELEVATION (ft., msl):

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 7.18

STATIC WATER LEVEL ELEVATION (ft., msl):

DEPTH TO BOTTOM OF WELL (ft. below TOC): 10.05 (11.2)

SCREENED INTERVAL (ft. below TOC): 5.05 (6.2)

VOLUME OF WATER TO BE EVACUATED (gallons)*: 10.5

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☒

Other

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable PVC Bailer

SAMPLE NO.: SAMPLE DEPTH (ft. below TOC):

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.:

FIELD TESTS:

SAMPLE TEMP. (°C): 49°F pH: 6.00

CONDUCTIVITY (µmhos/cm): 1350 PID (ppm)

LABORATORY ANALYSES: Explosives, Metals (Filtered + Unfiltered), Nitrates

NO. OF CONTAINERS AND I.D. 5; PB-TNTB-MK-MW16-U -F

FIELD BLANK I.D.NO.: TRIP BLANK I.D. NO.

DUPLICATE SAMPLE I.D. NO.:

COMMENTS: Well dries after approx 2.5 gal removed.

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

Volume Calculation

Casing: (0.16)(3.53) = 0.56

Sand: (1.91)(0.3)(3.53) = 2.02

PV = 2.22 + 0.56 = 2.58

5xPV = 12.9

$PH_1 = 6.5$ $Cond_1 = 1330$

$T_1 = -$ $Vol = 0$

$PH_2 = 6.5$ $Cond_2 = 1370$

$T_2 = -$ $Vol = 3g$

$PH_3 = 6.5$ $Cond_3 = 1400$

$T_3 = -$ $Vol = 6g$

$PH_4 = 6.2$ $Cond_4 = 1390$

$T_4 = -$ $Vol = 12g$

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works Invest. Area: SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~

DATE: 12-13-94 TIME: _____

WELL TYPE: Monitoring ☒ Potable ☐ Supply ☐

Other ☐ _____

WELL NO.: MK-MW17 WELL SIZE (I.D., inches) 2

TOP OF CASING (TOC) ELEVATION (ft., msl): _____

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 5.06

STATIC WATER LEVEL ELEVATION (ft., msl): _____

DEPTH TO BOTTOM OF WELL (ft. below TOC): 8.59 (8.80)

SCREENED INTERVAL (ft. below TOC): 4.59 (4.8)

VOLUME OF WATER TO BE EVACUATED (gallons)*: 12.9

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☒

Other _____

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable Bailer (PVC)

SAMPLE NO.: _____ SAMPLE DEPTH (ft. below TOC): _____

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.: _____

FIELD TESTS:

SAMPLE TEMP. (°C): 43.5 pH: 5.5

CONDUCTIVITY (µmhos/cm): 1520 PID (ppm) _____

LABORATORY ANALYSES: Explosives, Metals (Filtered + Unfiltered), Nitrates

NO. OF CONTAINERS AND I.D. 5; PB-7N7B-MK-MW17-U, MW17-F

FIELD BLANK I.D.NO.: _____ TRIP BLANK I.D. NO. _____

DUPLICATE SAMPLE I.D. NO.: _____

COMMENTS: 15 gal removed ... no drawdown

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

Volume Calculation

Casing = (.16)(8.80) = 1.4

Sand = (1.91)(.30/.30)(8.80) = 5.04

PV = 1.4 + 5.04 = 6.4

5xPV = 32.2 gal

Rec-

PH_1 = 6.02 $Cond_1$ = 1360

T_1 = 49°F Vol = 0 s

PH_2 = 6.21 $Cond_2$ = 1370

T_2 = 49°F Vol = 2 gal

PH_3 = 6.49 $Cond_3$ = 1260

T_3 = 50°F Vol = 6 gal

12.9.94:
WL = 29.70

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works Invest. Area: SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~

DATE: 12-12-94 TIME:

WELL TYPE: Monitoring ☒ Potable ☐ Supply ☐
Other ☐

WELL NO.: TNTC-MW5 WELL SIZE (I.D., inches) 2

TOP OF CASING (TOC) ELEVATION (ft., msl):

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 23.80

STATIC WATER LEVEL ELEVATION (ft., msl):

DEPTH TO BOTTOM OF WELL (ft. below TOC): 32.60

SCREENED INTERVAL (ft. below TOC): 6.60

VOLUME OF WATER TO BE EVACUATED (gallons)*: 32.2

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐
Positive Displacement Pump ☐ Bailer ☒
Other

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐
Stainless Steel Bailer ☐
Other ~~Disposal~~ PVC BAILER

SAMPLE NO.: SAMPLE DEPTH (ft. below TOC):

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.:

FIELD TESTS:

SAMPLE TEMP. (°C): 19°C pH: 6.5

CONDUCTIVITY (µmhos/cm): 1060 PID (ppm)

LABORATORY ANALYSES: Explosives, Metals (unfiltered + Filtered), Nitrates

NO. OF CONTAINERS AND I.D. 5; PB-TNTC-DM-MW5-U
PB-TNTC-DM-MW5-F

FIELD BLANK I.D.NO.: TRIP BLANK I.D. NO.

DUPLICATE SAMPLE I.D. NO.: N/A

COMMENTS: Well dries after 6 gal. Water was brown, cloudy w/ silts

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

Volume Calculation

Casing = (.16)(7.36) = 1.2

Sand = (1.91)(0.3)(7.36) = 4.2

PV = 5.4

5xPV = 27 gal

PH_1 = 6.12 $Cond_1$ = 1540, 0 gal

T_1 = 53°F, Vol = 0 g

PH_2 = 6.14, $Cond_2$ = 1660

T_2 = 53°F, Vol = 3 gal

PH_3 = 6.43 $Cond_3$ = 1530

T_3 = 53°F, Vol = 6 gal

12.9.94

WL = 7.06

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works Invest. Area: SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~

DATE: ~~12-6~~ 12-12-94 TIME:

WELL TYPE: Monitoring ☒ Potable ☐ Supply ☐

Other ☐

WELL NO.: INTC-MW6 WELL SIZE (I.D., inches) 2

TOP OF CASING (TOC) ELEVATION (ft., msl):

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 7.47

STATIC WATER LEVEL ELEVATION (ft., msl):

DEPTH TO BOTTOM OF WELL (ft. below TOC): 14.83

SCREENED INTERVAL (ft. below TOC): 5.83

VOLUME OF WATER TO BE EVACUATED (gallons)*: 27

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☒

Other

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable PVC Bailer

SAMPLE NO.: SAMPLE DEPTH (ft. below TOC):

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.:

FIELD TESTS:

SAMPLE TEMP. (°C): 51°F pH: 6.75

CONDUCTIVITY (µmhos/cm): 1470 PID (ppm)

LABORATORY ANALYSES: Explosives, METALS (FILTERED + UNFILTERED), NITRATES

NO. OF CONTAINERS AND I.D. 5; PB-INTC-DM-MW6-U MW6-F

FIELD BLANK I.D.NO.: TRIP BLANK I.D. NO.

DUPLICATE SAMPLE I.D. NO.:

COMMENTS: Well dries after 6 gal removed. Water is brown, cloudy w/ silts.

MS/MSD TAKEN/SUBMITTED

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works Invest. Area: SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~

DATE: 12-14-94 TIME: _____

WELL TYPE: Monitoring ☒ Potable ☐ Supply ☐

Other ☐ _____

WELL NO.: PB-Bed-MW13 WELL SIZE (I.D., inches) 4 (3" Tolerance)

TOP OF CASING (TOC) ELEVATION (ft., msl): _____

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 40.42

STATIC WATER LEVEL ELEVATION (ft., msl): _____

DEPTH TO BOTTOM OF WELL (ft. below TOC): 78.1

~~SCREENED~~ 3" INTERVAL (ft. below TOC): 46 - 78.1

VOLUME OF WATER TO BE EVACUATED (gallons)*: 80

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☒

Other _____

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable PVC Bailer

SAMPLE NO.: _____ SAMPLE DEPTH (ft. below TOC): 32.74

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.: _____

FIELD TESTS:

SAMPLE TEMP. (°C): 51 °F pH: 8.0

CONDUCTIVITY (µmhos/cm): >1990 PID (ppm) _____

LABORATORY ANALYSES: Explosives, BNAs, METALS (FILTERED + UNFILTERED), NITRATES, + VOA's

NO. OF CONTAINERS AND I.D. 10; PB-BED-MW13-U
MW13-F

FIELD BLANK I.D.NO.: _____ TRIP BLANK I.D. NO. _____

DUPLICATE SAMPLE I.D. NO.: _____

COMMENTS: Well dries after 19 gal removed. Water was slightly oily w/a strong odor.
EXTRA Bottles for MS/MSD.

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

2 V = 15.9 gal
5 x 2V = 80 gal

PH	Vol
10.07	0 g
7.09	19 g

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~ Invest. Area:

DATE: 12-15-94 TIME: _____

WELL TYPE: Monitoring ☑ Potable ☐ Supply ☐

Other ☐ _____

WELL NO.: PB-BED-MW17 WELL SIZE (I.D., inches) 4" (6" telescope)

TOP OF CASING (TOC) ELEVATION (ft., msl): _____

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 27.4

STATIC WATER LEVEL ELEVATION (ft., msl): _____

DEPTH TO BOTTOM OF WELL (ft. below TOC): 67.0

~~SCREENED~~ 3" INTERVAL (ft. below TOC): 45.0 → 67.0

VOLUME OF WATER TO BE EVACUATED (gallons)*: 99.8

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☑

Other _____

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable PVC BAILER

SAMPLE NO.: _____ SAMPLE DEPTH (ft. below TOC): _____

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.: H_2S odor

FIELD TESTS:

SAMPLE TEMP. (°C): 50 °F pH: 8.0

CONDUCTIVITY (µmhos/cm): >1990 PID (ppm) _____

LABORATORY ANALYSES: Explosives, BNAs, METALS (FILTERED + UNFILTERED), NITRATES, VOCs

NO. OF CONTAINERS AND I.D. 10; PB-BED-MW17-U
PB-BED-MW17-F

FIELD BLANK I.D.NO.: N/A TRIP BLANK I.D. NO. _____

DUPLICATE SAMPLE I.D. NO.: N/A

COMMENTS: Purging ceased due to H_2S odor high reading on CGI indicate potentialy Hazardous environment.

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

Volume Calculation

4" casing = (0.66)(24.55) = 16.2

3" hole = (0.36)(27.27) = 10.4

PV = 26.6 g

5 x PV = 133 gal

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works Invest. Area: SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~

DATE: 12-13-94 TIME:

WELL TYPE: Monitoring ☒ Potable ☐ Supply ☐

Other ☐

WELL NO.: PB-Bed-18 WELL SIZE (I.D., inches) 4" (3")

TOP OF CASING (TOC) ELEVATION (ft., msl):

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 26.45

STATIC WATER LEVEL ELEVATION (ft., msl):

DEPTH TO BOTTOM OF WELL (ft. below TOC): 78.27 (78.10)

~~SCREENED~~ 3" INTERVAL (ft. below TOC): 51.0 - 78.27

VOLUME OF WATER TO BE EVACUATED (gallons)*: 133

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☒

Other

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable PVC Bailer

SAMPLE NO.: SAMPLE DEPTH (ft. below TOC): 28.12

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.:

FIELD TESTS:

SAMPLE TEMP. (°C): [illegible] pH: 7.5

CONDUCTIVITY (µmhos/cm): >1990 PID (ppm)

LABORATORY ANALYSES: Explosives, BNAs, Metals (Filtered + Unfiltered), Nitrates, + VOAs

NO. OF CONTAINERS AND I.D.*: 10; PB-BED-MW18-U
MW18-F

FIELD BLANK I.D.NO.: See below TRIP BLANK I.D. NO.

DUPLICATE SAMPLE I.D. NO.: See below

COMMENTS: H_2S odor evident. Equip Blank Taken → PB-E-BED-MW18-U+F
Splits + Dupes Taken → PB-BED-MW21-U+F, -+S
MW18-U+F-S

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~ Invest. Area:

DATE: 12-14-94 TIME: _____

WELL TYPE: Monitoring ☑ Potable ☐ Supply ☐

Other ☐ _____

WELL NO.: PB-BED-MW20 WELL SIZE (I.D., inches) 4" (3" bedrock)

TOP OF CASING (TOC) ELEVATION (ft., msl): _____

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 14.98

STATIC WATER LEVEL ELEVATION (ft., msl): _____

DEPTH TO BOTTOM OF WELL (ft. below TOC): 52.3

~~SCREENED~~ 3" INTERVAL (ft. below TOC): 35.0 - 52.3

VOLUME OF WATER TO BE EVACUATED (gallons)*: 97.0

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☑

Other _____

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable PVC Bailer

SAMPLE NO.: _____ SAMPLE DEPTH (ft. below TOC): _____

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.: _____

FIELD TESTS:

SAMPLE TEMP. (°C): 51 °F pH: 6.0

CONDUCTIVITY (µmhos/cm): >1990 PID (ppm) _____

LABORATORY ANALYSES: Explosives, BNAs, Metals (Filtered + Unfiltered), Nitrates, VOCs

NO. OF CONTAINERS AND I.D. 10; PB-BED-MW20-U
PB-BED-MW20-F

FIELD BLANK I.D.NO.: N/A TRIP BLANK I.D. NO. _____

DUPLICATE SAMPLE I.D. NO.: N/A

COMMENTS: _____

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~ Invest. Area:

DATE: 12-14-94 TIME:

WELL TYPE: Monitoring ☒ S.S. Potable ☐ Supply ☐

Other ☒ Not Awell; Drill Water

WELL NO.: DRILL WATER WELL SIZE (I.D., inches) N/A

TOP OF CASING (TOC) ELEVATION (ft., msl): N/A

DEPTH TO STATIC WATER LEVEL (ft. below TOC): N/A

STATIC WATER LEVEL ELEVATION (ft., msl): N/A

DEPTH TO BOTTOM OF WELL (ft. below TOC): N/A

SCREENED INTERVAL (ft. below TOC): N/A

VOLUME OF WATER TO BE EVACUATED (gallons)*: N/A

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐
N/A
Positive Displacement Pump ☐ Bailer ☐
Other

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐
Stainless Steel Bailer ☐
Other FROM HOSE

SAMPLE NO.: SAMPLE DEPTH (ft. below TOC): N/A

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.: Clear, odorless

FIELD TESTS:

SAMPLE TEMP. (°C): 57 °F pH: 6.0

CONDUCTIVITY (µmhos/cm): 350 PID (ppm)

LABORATORY ANALYSES: ~~Explosives~~, BNAs, METALS (FILTERED + UNFILTERED), NITRATES, VOCs

NO. OF CONTAINERS AND I.D. 10; PB-DRILL WATER-U
PB-DRILL WATER-F

FIELD BLANK I.D.NO.: N/A TRIP BLANK I.D. NO. N/A

DUPLICATE SAMPLE I.D. NO.: N/A

COMMENTS: WATER TAKEN Directly FROM HOSE in GUARD SHACK

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

APPENDIX I

DATA QUALITY ASSESSMENT

DATA QUALITY ASSESSMENT
FORMER PLUM BROOK ORDNANCE WORKS
PLUM BROOK STATION/NASA
SANDUSKY, OHIO

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LIST OF ACRONYMS AND ABBREVIATIONS

ASI	Analytical Services, Inc.
BDL	below the laboratory detection limit
COE	U.S. Army Corps of Engineers
EPA	U.S. Environmental Protection Agency
LCS/LCSD	laboratory control sample/laboratory control sample duplicate
mg/L	milligrams per liter
MS/MSD	matrix spike/matrix spike duplicate
PQL	Practical Quantitation Limit
QC	quality control
PVC	polyvinyl chloride
RPD	relative percent difference
SVOCs	semivolatile organic compounds
TICs	Tentatively Identified Compounds
*u*g/L	micrograms per liter
*u*m	micron
VOCs	volatile organic compounds

1.0 INTRODUCTION

This report provides the Data Quality Assessment of the analytical laboratory results for samples collected from October to December 1994 for Dames & Moore's investigation of the former Plum Brook Ordnance Works in Sandusky, Ohio. The Data Quality Assessment includes:

(1) an evaluation of the laboratory performance and procedures in analyzing the samples and reporting the results of the analysis, and

(2) an assessment of the field quality control (QC) program which included collection and laboratory analysis of replicate samples, equipment blanks, and trip blanks.

All samples for this investigation were analyzed for chemical concentrations of explosives residues using U.S. Environmental Protection Agency (EPA) method 8330 and for concentrations of 14 metals, the 13 priority pollutant metals and manganese. Background soil samples and groundwater samples collected from the bedrock monitoring wells were analyzed for concentrations of volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs). All groundwater samples were analyzed for concentrations of nitrates. Selected sediment, surface water, and groundwater samples were analyzed for general chemistry parameters. Samples were analyzed by Dames & Moore's subcontracted analytical laboratory, Analytical Services, Inc. (ASI). ASI is a U.S. Army Corps of Engineers (COE) validated laboratory. Its Federal Identification Number is #58-1625655.

The Data Quality Assessment was performed in accordance with guidance provided in the "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review" (EPA, February 1993) and the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" (EPA, February 1994).

A Practical Quantitation Limit (PQL) was established for reporting of results for the analysis of explosives residues by EPA Method 8330 for water samples. A discussion of the establishment of the PQL is provided with the laboratory reports in a separate appendix.

2.0 LABORATORY PERFORMANCE AND PROCEDURES

The Statement of Work for the Plum Brook Ordnance Works Investigation provided for a Date Quality Assessment to be performed for approximately 10 percent of the samples collected for the investigation. Dames & Moore selected 13 sets of laboratory data to be reviewed for Data Quality Assessment. Each set of laboratory data was provided in a laboratory report with a unique report number. A list of the samples included in these data sets was provided to the U.S. Army Corps of Engineers, Nashville District project manager for approval prior to initiating the review.

To the extent possible, data sets which included samples from each of the four media that were sampled (soil, sediment, surface water, and groundwater). These data sets included:

- 53 soil samples, 17 from the Red Water Ponds areas, 32 from the TNT areas, and four from background locations, all of which are listed in Table 2-1;
- Five sediment samples from the West Area Red Water Ponds Area which are listed in Table 2-2;
- Four surface water samples from the West Area Red Water Ponds Area which are listed in Table 2-3; and
- Nine ground water samples including samples from two overburden wells at the West Area Red Water Ponds, five overburden wells at the TNT areas, one bedrock well at the Pentolite Road Red Water Ponds, and one bedrock well at TNT Area A, which are listed in Table 2-4.

Also, to the extent possible, data sets that included replicate samples, equipment blanks, and trip blanks were selected for review.

The laboratory review portion of the Data Quality Assessment was performed to provide a critical review of the laboratory analysis and reported chemical results. Data quality assessments of laboratory-generated data routinely identify problems associated with analytical measurements, even from the most experienced and capable laboratories. To confidently use any of the data within the data set, the data user should understand the limitations and qualifications of the data.

TABLE 2-1

SOIL SAMPLES INCLUDED IN LABORATORY DATA QUALITY ASSESSMENT

Sample I.D.	Laboratory Report Number	Analysis Requested
PB-TNTA-S5-1.0/2.0	56728-1	Total Metals, Explosives Residues
PB-TNTA-S5-2.5/3.5	56728-2	Total Metals, Explosives Residues
PB-TNTA-S6-1.0/2.0	56728-3	Total Metals, Explosives Residues
PB-TNTA-S6-2.5/3.5	56728-4	Total Metals, Explosives Residues
PB-TNTA-S7-1.0/2.0	56728-5	Total Metals, Explosives Residues
PB-TNTA-S7-2.5/3.5	56728-6	Total Metals, Explosives Residues
PB-TNTA-S8-2.5/3.5	56728-7	Total Metals, Explosives Residues
PB-TNTA-S10-2.5/3.5	56728-8	Total Metals, Explosives Residues
PB-TNTA-S11-2.5/3.5	56728-9	Total Metals, Explosives Residues
PB-TNTA-S25-0.0/1.5	56822-1	Total Metals, Explosives Residues
PB-TNTA-S26-0.0/1.5	56822-2	Total Metals, Explosives Residues
PB-TNTA-S27-2.5/3.5	56728-10	Total Metals, Explosives Residues
PB-TNTA-S31-0.0/1.0	56822-3	Total Metals, Explosives Residues
PB-TNTA-S32-0.0/1.0	56822-4	Total Metals, Explosives Residues
PB-TNTB-S16-0.0/2.0	56417-1	Total Metals, Explosives Residues
PB-TNTB-S17-0.0/1.5	56417-2	Total Metals, Explosives Residues
PB-TNTB-S18-0.5/1.5	56417-3	Total Metals, Explosives Residues
PB-TNTB-S19-0.5/2.0	56417-5	Total Metals, Explosives Residues
PB-TNTB-S20-0.5/1.5	56417-6	Total Metals, Explosives Residues
PB-TNTB-S21-0.0/2.0	56417-7	Total Metals, Explosives Residues
PB-TNTB-S27-2.5/3.5	56417-8	Total Metals, Explosives Residues
PB-TNTB-S28-0.5/1.5	56417-4	Total Metals, Explosives Residues
PB-TNTC-S17-0.0/1.5	56447-1	Total Metals, Explosives Residues
PB-TNTC-S18-0.0/1.5	56447-2	Total Metals, Explosives Residues
PB-TNTC-S19-0.5/2.0	56447-4	Total Metals, Explosives Residues
PB-TNTC-S20-0.0/1.25	56447-5	Total Metals, Explosives Residues
PB-TNTC-S21-0.5/1/0	56447-9	Total Metals, Explosives Residues
PB-TNTC-S22-0.5/1.0	56491-10	Total Metals, Explosives Residues
PB-TNTC-S23-0.0/2.0	56447-6	Total Metals, Explosives Residues
PB-TNTC-S24-0.0/1.75	56447-8	Total Metals, Explosives Residues
PB-TNTC-S28-0.0/1.5	56447-3	Total Metals, Explosives Residues
PB-TNTC-S29-0.0/2.0	56447-7	Total Metals, Explosives Residues
PB-WA-S4-0.0/0.5	56822-7	Total Metals, Explosives Residues
PB-WA-S7-0.0/2.0	56491-1	Total Metals, Explosives Residues
PB-WA-S7-2.0/5.0	56491-2	Total Metals, Explosives Residues

TABLE 2-1
(Continued)

Sample I.D.	Laboratory Report Number	Analysis Requested
PB-WA-S8-0.0/2.0	56491-3	Total Metals, Explosives Residues
PB-WA-S8-2.0/5.0	56491-4	Total Metals, Explosives Residues
PB-WA-S9-0.0/2.0	56491-6	Total Metals, Explosives Residues
PB-WA-S9-2.0/5.0	56491-7	Total Metals, Explosives Residues
PB-WA-S16-0.0/2.0	56491-8	Total Metals, Explosives Residues
PB-WA-S16-2.0/4.0	56491-9	Total Metals, Explosives Residues
PB-WA-S20-0.0/0.5	56822-5	Total Metals, Explosives Residues
PB-WA-S22-2.0/5.0	56491-5	Total Metals, Explosives Residues
PB-WA-S23-0.0/0.5	56822-6	Total Metals, Explosives Residues
PB-PR-S8-0.0/2.0	56822-8	Total Metals, Explosives Residues
PB-PR-S8-2.0/5.0	56822-9	Total Metals, Explosives Residues
PB-PR-S17-0.0/2.0	56822-10	Total Metals, Explosives Residues
PB-PR-17-2.0/5.0	56822-11	Total Metals, Explosives Residues
PB-PR-29-2.0/5.0	56822-12	Metals, Explosives Residues Total
PB-BG-S4-0.5/30	56812-1	Total Metals, Explosives Residues, Volatiles, Semivolatiles
PB-BG-S8-0.5/3.0	56812-2	Total Metals, Explosives Residues, Volatiles, Semivolatiles
PG-BG-S5-0.5/3.0	56812-3	Total Metals, Explosives Residues, Volatiles, Semivolatiles
PB-BG-S5-3.0/5.0	56812-4	Total Metals, Explosives Residues, Volatiles, Semivvolatiles

TABLE 2-2

SEDIMENT SAMPLES INCLUDED IN LABORATORY DATA QUALITY ASSESSMENT

Sample I.D.	Laboratory Report Number	Analysis Requested
PB-WA-SED1-0.2/1.7	56781-1	General Chemistry, Total Metals, Explosives Residues
PB-WA-SED1-1.7/2.5	56781-2	Total Metals, Explosives Residues
PB-WA-SED3-1.0/2.0	56781-5	Total Metals, Explosives Results
PB-WA-SED8-0.2/1.7	56781-3	General Chemistry, Total Organic Carbon
PB-WA-SED3-0.2/1.0	56781-4	Total Metals, Explosives Residues

TABLE 2-3

SURFACE WATER SAMPLES INCLUDED IN LABORATORY DATA QUALITY ASSESSMENT

Sample I.D.	Laboratory Report Number	Analysis Requested
PB-WA-SW3-F	56647-3	Dissolved Metals
PB-WA-SW3-U	56647-4	General Chemistry, Total Suspended Solids, Total Metals, Explosives Residues
PB-WA-SW7-F	56647-1	Dissolved Metals
PB-WA-SW7-U	56647-2	General Chemistry, Total Suspended Solids, Total Metals, Explosives Residues

TABLE 2-4

GROUNDWATER SAMPLES INCLUDED IN LABORATORY DATA QUALITY ASSESSMENT

Sample I.D.	Laboratory Report Number	Analysis Requested
PB-TNTA-MK-MW22-U	57935-4	Nitrate Nitrogen, Total Metals, Explosives Residues
PB-TNTA-MK-MW22-F	57935-5	Dissolved Metals
PB-TNTA-MK-MW23-U	57935-3	Nitrate Nitrogen, Total Metals, Explosives Residues
PB-TNTA-MK-MW23-F	57935-6	Dissolved Metals
PB-TNTA-DM-MW10-U	57985-1	Nitrate Nitrogen, Total Metals, Explosives Residues
PB-TNTA-DM-MW10-F	57985-2	Dissolved Metals
PB-TNTA-DM-MW23-U	57985-3	Nitrate Nitrogen, Total Metals, Explosives Residues
PB-TNTA-DM-MW23-F	57985-4	Dissolved Metals
PB-TNTB-MK-MW16-U	57935-1	Nitrate Nitrogen, Total Metals, Explosives Residues
PB-TNTB-MK-MW16-F	57935-2	Dissolved Metals
PB-WA-DM-MW2-U	57992-1	General Chemistry, Nitrate Nitrogen, Total Metals, Explosives Residues
PB-WA-DM-MW2-F	57992-2	Dissolved Metals
PB-WA-DM-MW22-U	57992-3	General Chemistry, Nitrate Nitrogen, Total Metals, Explosives Residues
PB-WA-DM-MW22-F	57992-4	Dissolved Metals
PB-BED-MW18-U	58042-1	Nitrate Nitrogen, Total Metals, Explosives Residues, Volatiles, Semivolatiles
PB-BED-MW18-F	58042-2	Dissolved Metals
PB-BED-MW15-U	58046-1	Nitrate Nitrogen, Total Metals, Explosives Residues, Volatiles, Semivolatiles
PB-BED-MW15-F	58046-2	Dissolved Metals

Overall, the quality of the data is acceptable. The data quality assessment has identified aspects of the analytical data that require qualification. Data qualifiers have been placed next to the results on the laboratory reports so that the data user can quickly assess the qualitative and/or quantitative reliability of the reported result.

2.1 EVALUATION OF DATA PACKAGE DELIVERABLES

Dames & Moore reviewed the data packages to ensure that all required deliverables were provided. The following items were included with each data package:

- Laboratory-assigned Identification Code
- Field-assigned Sample Designation
- Sample Matrix
- Date of Sampling
- Date of Receipt at the Laboratory
- Code for Applicable Chain-of-Custody Documents
- Reference to Specific Method Used
- Date of Sample Preparation
- Date of Sample Analysis
- Signature of Person(s) Authorized to Release Data
- Chain-of-Custody Documentation
- COE Cooler Receipt Forms

The following QC information was also included with each data package:

- Method Blank Data
- Method Blank Summaries (indicating which samples are associated with each method blank)
- Recovery and Precision of Matrix Spike/Matrix Spike Duplicate (MS/MSD), where applicable
- Surrogate Recoveries, where applicable
- Recovery and Precision of Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD), where applicable
- Case Narrative

2.2 ASSESSMENT OF ORGANIC PARAMETERS

The organic data in each data package was reviewed to evaluate the following parameters:

- Holding Times
- Method Blanks
- System Monitoring Compounds
- Surrogate Spikes
- MS/MSD
- LCS/LCSD
- Tentatively Identified Compounds (TICs)

The results of the review for each parameter are discussed individually below.

Explanations of the qualifiers assigned to the reported results for organic compounds based on the Data Quality Assessment are listed below.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

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

N - The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification".

NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

UJ - The analyte was not detected above the reported sample quantitation 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 the analyte in the sample.

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

2.2.1 Holding Times

Holding times were reviewed for all samples evaluated in the Data Quality Assessment. Samples that were analyzed or extracted outside the specified holding times are discussed below.

- Soil samples 56822-8 to 56822-12 collected from the Pentolite Road Red Water Ponds were analyzed for explosives residues 39 days outside the hold time criteria. Sample 56822-12 was a duplicate of sample 56823-6. Sample 56823-6 was analyzed for explosives residues within the hold time criteria. Concentrations for all compounds were reported to be below the laboratory detection limit (BDL). Professional judgement must be used when evaluating the hold times of non-aqueous matrices. Upon review of the data, the corresponding sample results are qualified. Positive results are qualified "J". Results below the method detection limits are qualified "UJ". Samples from the surrounding area and at corresponding depths exhibited similar results.

- Sample 58046-1, a groundwater sample from bedrock well BED-MW15, was re-analyzed for VOCs 2 days outside the hold time criteria. Positive results are qualified "J" and sample quantitation limits are qualified "UJ". Since this sample was properly preserved with hydrochloric acid (pH < 2), the integrity of the sample is assumed to be good.

All other samples for all matrices analyzed for explosives residues, VOCs, or SVOCs were extracted and analyzed within the hold time criteria.

2.2.2 Method Blanks

Method blanks were reported as BDL for all target compounds.

2.2.3 System Monitoring Compounds (VOCs)

All recovery values for VOCs analysis were within acceptance limits.

2.2.4 Surrogate Spikes (SVOCs and Explosives Residues)

All recovery values for explosives residues were within acceptance limits.

For sample 58046-1, a groundwater sample from bedrock well BED-MW15, SVOC surrogate recoveries for nitrobenzene-D5 and 2-fluorobiphenyl were greater than the upper acceptance limit. Detected SVOCs are qualified "J". Surrogate compounds are used as a means of evaluating laboratory performance; however, matrix effect, interferences, and high concentrations of analytes may present unique problems that are outside the control of the laboratory. Data are not qualified with respect to surrogate recovery unless two or more SVOC surrogates within the same fraction are out of specification.

2.2.5 MS/MSD

MS compounds could not be quantified for the explosives residues analysis for the three reports discussed below.

- For report 57992, the explosives residues MS recovery for 2-nitrotoluene could not be quantitated due to matrix interference. In conjunction with the LCS recovery data, the compound 2-nitrotoluene is qualified "UJ" for samples 57992-1 and 57992-3 (target compound concentration is BDL for both samples).

- For reports 58042 and 58046, the explosives residues MS compounds could not be quantitated due to matrix interference. The MS for these reports was performed on sample 58027-3MS. Even though the matrix of these three samples is considered ground water, samples 58027-3 (PB-TNTB-MK-MW17-U), 58042-1 (PB-BED-MW18-U) and 58046-1 (PB-BED-MW15-U) are from different areas on the site and are from different types of monitoring wells. Therefore, no qualification is applied based on MS results alone.

All recovery values for VOCs and SVOCs were within acceptable limits.

2.2.6 LCS/LCSD

For reports 57935, 57992, 58042 and 58046, explosives residues LCS recoveries for 2-nitrotoluene exceeded the lower acceptance limit (50 percent). Since 2-nitrotoluene is also a target compound, its values in the associated samples are qualified. Concentrations reported above the detection limit are qualified "J". Concentrations reported as BDL are qualified "UJ". Low LCS recoveries for 2-nitrotoluene are present in almost all of the ground water data packages. LCS/LCSD recovery values are used to determine laboratory performance and method accuracy. Action taken on the LCS recovery is based on both the number of compounds that are outside of the recovery criteria and the magnitude of the noncompliance.

All recovery values for VOCs and SVOCs were within acceptable limits.

2.2.7 TICs (VOCs and SVOCs)

TIC results qualified "NJ" are tentatively identified with approximate concentrations.

TIC results qualified "N" indicate the presence of an analyte for which there is presumptive evidence to make a "tentative identification".

2.3 ASSESSMENT OF INORGANIC PARAMETERS

The inorganic and general chemistry Data Quality Assessment is based upon the following parameters:

- Holding Times
- Method Blanks
- LCS/LCSD
- MS/MSD

The results of the review for each parameter are discussed individually below.

Explanations of the qualifiers assigned to the reported results for inorganic compounds based on the Data Quality Assessment are listed below.

U - The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

J - The associated value is an estimated quantity.

R - The data are unusable. (Note: Analyte may or may not be present.)

UJ - The material was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.

2.3.1 Holding Times

All samples were digested and analyzed within the required hold time criteria.

2.3.2 Method Blanks

Method blanks were reported as BDL for all target analytes.

2.3.3 LCS/LCSD

For report 56812, the LCS recovery for beryllium (72 percent) exceeded the lower acceptance limit (75 percent). Positive results are qualified "J". Results reported as BDL are qualified "UJ".

2.3.4 MS/MSD

2.3.4.1 MS/MSD Assessment for Soil and Sediment Samples

Due to the non-homogenous nature of soil and sediment samples, if qualification is appropriate based on MS/MSD results, only the unspiked sample collected from the same sample location as the spiked sample is qualified when both samples are processed in the same batch.

- Report 56417 included eight soil samples. The MS and MSD recoveries for beryllium (74 and 73 percent) exceeded the lower acceptance limit (75 percent) in sample 56417-1MS; therefore, the reported concentration for beryllium in sample 56417-1 is qualified. Since the result is reported as BDL, the qualification is "UJ". Also, the MS recovery for thallium (74 and 68 percent) exceeded the lower acceptance limit (75 percent) in sample 56417-5MS; therefore, the reported concentration for thallium in sample 56417-5 is qualified. Since the result is reported as BDL, the qualification is "UJ".

- Report 56447 included nine soil samples. The samples were analyzed for silver and antimony in batch QM3835. The MS and MSD recoveries for silver (57 and 58 percent) and antimony (66 and 67 percent) exceeded the lower acceptance limit (75 percent). Sample 56447-1 was used for the MS and MSD samples for batch QM3825. Therefore, silver and antimony results for sample 56447-1 are qualified. Results reported as BDL are qualified as estimated "UJ". Positive results are qualified as estimated "J".

  Samples included in report 56447 were analyzed for thallium in batch QM3855. The MS and MSD recoveries for thallium were low (74 and 77 percent). The MS and MSD samples were prepared from sample 56448-1. Therefore, sample 56448-1 is qualified for thallium in report 56448.

- Report 56491 included 10 soil samples. The samples were analyzed for antimony in batch QM3848 for which the MS and MSD recoveries for antimony (72 and 73 percent) were below the lower acceptance limit (75 percent). Sample 56448-1 was used to prepare the MS and MSD samples for batch QM3848. The associated soil sample 56448-1 is qualified for antimony on report 56448. No samples included in report 56491 are qualified.

- Report 56728 included 10 soil samples. The samples were analyzed for ICP metals in two batches (QM3878 and QM3885). The MS and MSD recoveries for silver (65 and 63 percent, 67 and 70 percent) and antimony (74 and 71 percent, and 71 and 71 percent) exceeded the lower acceptance limit (75 percent) for both batches. Sample 56728-6 was used for the MS and MSD in batch QM3885. Therefore, this sample was qualified. Results reported as BDL are qualified as estimated "UJ". Sample 56720-2 was used for the MS and MSD in batch QM3878. This sample is also qualified on report 56720.

- Report 56822 included 10 soil samples. The samples were analyzed for ICP metals in two batches (QM3929 and QM3930). The MS and MSD recoveries for silver (59 and 61 percent, 69 and 68 percent) and antimony (73 and 72 percent, and 62 and 62 percent) exceeded the lower acceptance limit (75 percent) for both batches. Sample 56822-2 was used for the MS and MSD in batch QM3929. Sample 56822-8 was used for the MS and MSD in batch QM3930. Both samples are qualified for silver and antimony. Results reported as BDL are qualified as estimated "UJ".

- Report 56812 included four background soil samples. MS and MSD recoveries were low for antimony (42 and 42 percent), beryllium (71 and 71 percent), and silver (53 and 54 percent). The samples were re-analyzed. In the re-analysis, beryllium MS and MSD recoveries were acceptable. The beryllium results reported in report 56812 are from the re-analysis and are not qualified. The MS and MSD recoveries for antimony (48 and 54 percent) and silver (58 and 64 percent) were low on the re-analysis. Therefore, antimony and silver results are qualified for the samples used for the MS and MSD for the original analysis (56810-1) and the re-analysis (56824-1).

2.3.4.2 MS/MSD Assessment for Groundwater and Surface Water Samples

- Report 57935 included six groundwater samples. The samples were analyzed for selenium in two batches. The MS and MSD recoveries for selenium (68 and 31 percent, 73 and 74 percent) in both batches exceeded the lower acceptance limit (75 percent). Therefore, selenium results are qualified. Results reported as BDL are qualified as estimated "UJ".

- Report 57985 included four groundwater samples. These samples were analyzed for selenium in batch QM5042. The MS and MSD recoveries for selenium (73 and 74 percent) exceeded the lower acceptance limit (75 percent). However, the MS and MSD samples for batch QM5042 were run on a sample that was not collected at the Plum Brook site. The LCS and LCSD samples which were run on reagent water were acceptable. Therefore, the selenium values for the four samples included in report 57985 were not qualified.

- Report 58042 included two groundwater samples. The MS/MSD recoveries for total selenium (35 and 32 percent) and dissolved lead (53 and 53 percent), dissolved selenium (16 and 14 percent) and dissolved thallium (56 and 59 percent) exceeded the lower acceptance limit (75 percent). Results reported as BDL are qualified "UJ". The MSs for this batch were performed on samples 58093-1MS and 58027-4MS. The selenium results would normally be considered unusable because the MS and MSD results were below 30 percent. However, since there was no MS analysis performed on a sample from sample batches 58042 or 58046 and matrix interference was credited with the low recovery, the dissolved selenium results were deemed usable with qualification.

- Report 58046 included two groundwater samples. The MS and MSD recoveries for total selenium (35 and 32 percent) and dissolved lead (53 and 53 percent),

dissolved selenium (16 and 14 percent) and dissolved thallium (56 and 59 percent) exceeded the lower acceptance limit (75 percent). Results reported as BDL are qualified "UJ". The MSs for this batch were performed on samples 58093-1MS and 58027-4MS. Since there was no MS analysis performed on a sample from sample batches 58042 or 58046 and matrix interference was credited with the low recovery, the dissolved selenium results were deemed usable with qualification.

- Report 57992 included four groundwater samples. The MS/MSD recoveries for total selenium (35 and 32 percent) exceeded the lower acceptance limit (75 percent). Therefore, total selenium results are qualified. Results reported as BDL are qualified as estimated "UJ".

- Report 56647 included four surface water samples. The MS and MSD recoveries for dissolved silver (66 and 66 percent) exceeded the lower acceptance limit (75 percent). Sample 56647-1 was used for the MS; therefore, only this sample is qualified. Results reported as BDL are qualified as estimated "UJ".

3.0 COMPARISON OF REPLICATE SAMPLE RESULTS

Replicate samples are collected for two primary reasons:

1. To evaluate the analytical laboratory's precision, defined as its ability to generate the same result in repeated tests of the same sample.
2. To evaluate the variability of the samples collected in the field; and

Replicate QC samples were collected at a rate of 10 percent of the field samples collected. Twenty-one split soil samples were collected, four from TNT Area A, three from TNT Area B, three from TNT Area C, six from the Pentolite Road Red Water Ponds, four from the West Area Red Water Ponds, and one from a background soil boring. One split sediment sample was collected at the west pond at the West Area Red Water Ponds. One duplicate surface water sample was collected at the west pond at the West Area Red Water Ponds. Three duplicate groundwater samples were collected, two from overburden wells and one from a bedrock well.

Sample variability and laboratory precision are assessed through the evaluation of the relative percent difference (RPD) between replicate samples. RPD is defined as the difference between two values divided by the average of the values, expressed as a percent. The RPD criteria are only applied to those results which were greater than five times the detection limit. Professional judgement should be employed when evaluating replicate sample RPDs. Soil and sediment matrices are generally not homogeneous even after homogenization and RPDs in excess of 100 percent are not uncommon.

For this assessment, the following RPD criteria have been used as guidelines:

	Water Matrices	Soil Matrices
Organic Parameters	100 percent	100 percent
Inorganic Parameters	50 percent	100 percent

3.1 COMPARISON OF SPLIT SOIL SAMPLE RESULTS

The 21 sample split pairs were all analyzed for 14 explosives residues analytes and 14 metals, the 13 priority pollutant metals and manganese. The one background soil split pair samples were also analyzed for concentrations of VOCs and SVOCs.

Results for those analytes/compounds which were detected at or above their detection limit for either the field or QC sample of the split sample pair are presented in Table 3-1. For analytes not listed in these tables, the result for both the field sample and the split sample were BDL.

Overall, the results for the split soil samples indicated good agreement between the field and split samples. Results that are above the acceptable criteria established for this review are discussed below.

3.1.1 Explosives Residues in Soil Samples

Twenty-one pairs of split soil samples were analyzed for 14 explosives residues analytes providing a total of 294 explosives residues data pairs for comparison. RPDs were within acceptable limits for all but two of the data pairs. The RPDs that exceeded the acceptable limit are shaded on Table 3-1.

- For sample PB-TNTA-S16-0.0/2.0 and its split PB-TNTA-S29-0.0/2.0, analysis for 2,4,6-trinitrotoluene exhibited an RPD of 110.2.
- For sample PB-TNTB-S18-0.5/1.5 and its split PB-TNTB-S28-0.5/1.5, analysis for 2,4-dinitrotoluene exhibited an RPD of 137.5.

The most likely reason for the RPDs in excess of 100 percent in these two sample pairs is the non-homogenous nature of the soil matrix.

TABLE 3-1

SUMMARY OF SOIL SPLIT SAMPLE RESULTS

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Sample Result	Split Sample Result	RPD	Detection Limit
Field: PB-TNTA-S11-2.5/3.5 Split: PB-TNTA-S27-2.5/3.5	56728	Antimony	6010A, 7000	mg/Kg	5.8	BDL	NA	5.8
		Arsenic	6010A, 7000	mg/Kg	4.8	4.8	NA	3.5
		Chromium	6010A, 7000	mg/Kg	22	18	20.0	1.2
		Lead	6010A, 7000	mg/Kg	15	13	NA	2.9
		Manganese	6010A, 7000	mg/Kg	270	590	74.4	4.7
		Nickel	6010A, 7000	mg/Kg	29	26	10.9	2.3
		Zinc	6010A, 7000	mg/Kg	60	57	5.1	2.3
Field: PB-TNTA-S4-1.5/5.0 Split: PB-TNTA-S28-1.5/5.0	56720	Chromium	6010A, 7000	mg/Kg	9.8	10.2	4.0	1.2
		Copper	6010A, 7000	mg/Kg	3.1	BDL	NA	2.4
		Lead	6010A, 7000	mg/Kg	4.8	5.3	NA	3
		Manganese	6010A, 7000	mg/Kg	349	259	29.6	4.8
		Nickel	6010A, 7000	mg/Kg	9.3	9.4	NA	2.4
		Zinc	6010A, 7000	mg/Kg	27	30	10.5	2.4
Field: PB-TNTA-S16-0.0/2.0 Split: PB-TNTA-S29-0.0/2.0	56803	2,4,6-TNT	8330	mg/Kg	19	5.5	110.2	0.25
		2,4-DNT	8330	mg/Kg	1.5	2.7	57.1	0.25
		2,6-DNT	8330	mg/Kg	1.3	1.5	14.3	0.26
		3,4-DNT	8330	mg/Kg	BDL	0.4	NA	0.25
		Chromium	6010A, 7000	mg/Kg	46	52	12.2	1.1
		Copper	6010A, 7000	mg/Kg	BDL	4.4	NA	2.2
		Lead	6010A, 7000	mg/Kg	38	55	36.6	2.7
		Manganese	6010A, 7000	mg/Kg	132	121	8.7	4.4
		Nickel	6010A, 7000	mg/Kg	6.6	6.6	NA	2.2
		Zinc	6010A, 7000	mg/Kg	209	253	19.0	2.2

BDL = Below Detection Limit
RPD = Relative Percent Difference
mg/kg = milligrams per kilogram
μ/kg = micrograms per kilogram
NA = Calculation of RPD is Not Applicable because both results (field sample and split sample) were not greater than or equal to five times the detection limit.

TABLE 3-1
(Continued)

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Sample Result	Split Sample Result	RPD	Detection Limit
Field: PB-TNTA-S24-1.5/3.0 Split: PB-TNTA-S30-1.5/3.0	56809	2,4-DNT	8330	mg/Kg	0.3	0.3	NA	0.25
		2,6-DNT	8330	mg/Kg	BDL	0.5	NA	0.26
		3,4-DNT	8330	mg/Kg	0.6	0.8	NA	0.25
		Chromium	6010A, 7000	mg/Kg	6.2	5.2	17.5	1
		Lead	6010A, 7000	mg/Kg	3.3	3.4	NA	2.6
		Manganese	6010A, 7000	mg/Kg	86	80	7.2	4.1
		Nickel	6010A, 7000	mg/Kg	5.2	5.2	NA	2.1
		Zinc	6010A, 7000	mg/Kg	19	17	11.1	2.1
Field: PB-TNTB-S11-2.5/3.5 Split: PB-TNTB-S27-2.5/3.5	56416, 56417	2,4,6-TNT	8330	mg/Kg	2.2	1.8	20.0	0.25
		4-Am-DNT	8330	mg/Kg	1.3	1.1	NA	0.25
		2-Am-DNT	8330	mg/Kg	3.8	3.3	14.1	0.25
		Antimony	6010A, 7000	mg/Kg	11	9	NA	6
		Arsenic	6010A, 7000	mg/Kg	20	16	NA	3.6
		Beryllium	6010A, 7000	mg/Kg	BDL	1.3	NA	1.2
		Cadmium	6010A, 7000	mg/Kg	1.3	BDL	NA	1.2
		Chromium	6010A, 7000	mg/Kg	13	12	8.0	1.2
		Copper	6010A, 7000	mg/Kg	46	57	21.4	2.4
		Lead	6010A, 7000	mg/Kg	25	29	14.8	3
		Manganese	6010A, 7000	mg/Kg	190	268	34.1	4.8
		Nickel	6010A, 7000	mg/Kg	61	80	27.0	2.4
		Zinc	6010A, 7000	mg/Kg	93	134	36.1	2.4
Field: PB-TNTA-S18-0.5/1.5 Split: PB-TNTA-S28-0.5/1.5	56417	2,4,6-TNT	8330	mg/Kg	20000	29000	36.7	0.25
		1,3,5-TNB	8330	mg/Kg	10	14	33.3	0.25
		2,4-DNT	8330	mg/Kg	150	810	137.5	0.25
		2,6-DNT	8330	mg/Kg	170	230	30.0	0.26
		4-Am-2-NT	8330	mg/Kg	BDL	0.3	NA	0.25

BDL = Below Detection Limit
RPD = Relative Percent Difference
mg/kg = milligrams per kilogram
μ/kg = micrograms per kilogram
NA = Calculation of RPD is Not Applicable because both results (field sample and split sample) were not greater than or equal to five times the detection limit.

TABLE 3-1
(Continued)

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Sample Result	Split Sample Result	RPD	Detection Limit
Field: PB-TNTA-S18-0.5/1.5 Split: PB-TNTA-S28-0.5/1.5 (Continued)	56417 (Continued)	3,4-DNT	8330	mg/Kg	0.3	0.6	NA	0.25
		4-Am-DNT	8330	mg/Kg	11	BDL	NA	0.25
		2-Am-DNT	8330	mg/Kg	BDL	2.5	NA	2.5
		1,3-DNB	8330	mg/Kg	0.7	1	NA	0.25
		Antimony	6010A, 7000	mg/Kg	17	18	NA	5.3
		Arsenic	6010A, 7000	mg/Kg	4.4	BDL	NA	3.2
		Chromium	6010A, 7000	mg/Kg	12	16	28.6	1.1
		Copper	6010A, 7000	mg/Kg	35	205	141.7	2.1
		Lead	6010A, 7000	mg/Kg	962	1078	11.4	2.7
		Manganese	6010A, 7000	mg/Kg	118	119	0.8	4.3
		Nickel	6010A, 7000	mg/Kg	9.3	9.7	NA	2.1
		Zinc	6010A, 7000	mg/Kg	214	873	121.3	2.1
Field: PB-TNTB-S21-0.0/2.0 Split: PB-TNTB-S29-0.0/2.0	56417, 56448	2,4,6-TNT	8330	mg/Kg	0.3	BDL	NA	0.25
		Chromium	6010A, 7000	mg/Kg	7.1	19	91.2	1.1
		Lead	6010A, 7000	mg/Kg	3.8	9.6	NA	2.7
		Manganese	6010A, 7000	mg/Kg	117	219	60.7	4.2
		Nickel	6010A, 7000	mg/Kg	9.2	13.2	NA	2.1
		Zinc	6010A, 7000	mg/Kg	138	205	39.1	2.1
Field: PB-TNTC-S16-0.5/1.0 Split: PB-TNTC-S27-0.5/1.0	56411	2,4-DNT	8330	mg/Kg	1	0.5	NA	0.25
		2,6-DNT	8330	mg/Kg	1	0.4	NA	0.26
		Chromium	6010A, 7000	mg/Kg	15	20	28.6	1.2
		Copper	6010A, 7000	mg/Kg	8	BDL	NA	2.5
		Lead	6010A, 7000	mg/Kg	15	8	NA	3.1
		Manganese	6010A, 7000	mg/Kg	642	617	4.0	4.9
		Nickel	6010A, 7000	mg/Kg	36	31	14.9	2.5
		Zinc	6010A, 7000	mg/Kg	22	23	4.4	2.5

BDL = Below Detection Limit
RPD = Relative Percent Difference
mg/kg = milligrams per kilogram
μ/kg = micrograms per kilogram
NA = Calculation of RPD is Not Applicable because both results (field sample and split sample) were not greater than or equal to five times the detection limit.

TABLE 3-1
(Continued)

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Sample Result	Split Sample Result	RPD	Detection Limit
Field: PB-TNTC-S18-0.0/1.5 Split: PB-TNTC-S28-0.0/1.5	56447	Antimony	6010A, 7000	mg/Kg	8.1	5.8	NA	5.3
		Arsenic	6010A, 7000	mg/Kg	6	4.8	NA	3.2
		Chromium	6010A, 7000	mg/Kg	5.2	5.8	NA	1.1
		Copper	6010A, 7000	mg/Kg	5.9	7	NA	2.1
		Lead	6010A, 7000	mg/Kg	35	32	9.0	2.6
		Manganese	6010A, 7000	mg/Kg	1376	1682	20.0	4.2
		Nickel	6010A, 7000	mg/Kg	8.5	10.1	NA	2.1
		Zinc	6010A, 7000	mg/Kg	72	77	6.7	2.1
Field: PB-TNTC-S23-0.0/2.0 Split: PB-TNTC-S29-0.0/2.0	56447	Chromium	6010A, 7000	mg/Kg	6.6	5.2	NA	1.4
		Lead	6010A, 7000	mg/Kg	6	5.6	NA	3.4
		Manganese	6010A, 7000	mg/Kg	164	123	28.6	5.5
		Nickel	6010A, 7000	mg/Kg	7.8	5.3	NA	2.7
		Zinc	6010A, 7000	mg/Kg	29	20	36.7	2.7
Field: PB-PR-S11-5.0/10.0 Split: PB-PR-S25-5.0/10.0	56813, 56816	Arsenic	6010A, 7000	mg/Kg	BDL	9.8	NA	3.7
		Chromium	6010A, 7000	mg/Kg	15	15	0.0	1.2
		Copper	6010A, 7000	mg/Kg	16	13	20.7	2.5
		Lead	6010A, 7000	mg/Kg	11	13	NA	3.1
		Manganese	6010A, 7000	mg/Kg	720	1100	41.8	4.9
		Nickel	6010A, 7000	mg/Kg	30	40	28.6	2.5
		Zinc	6010A, 7000	mg/Kg	58	52	10.9	2.5
Field: PB-PR-S10-5.0/10.0 Split: PB-PR-S26-5.0/10.0	56811, 56816	1,3,5-TNB	8330	mg/Kg	5.2	3.9	28.6	0.25
		2,4-DNT	8330	mg/Kg	2.2	1.1	NA	0.25
		1,3-DNB	8330	mg/Kg	2.5	2.1	17.4	0.25
		Antimony	6010A, 7000	mg/Kg	BDL	6.7	NA	6.3
		Arsenic	6010A, 7000	mg/Kg	12	13	NA	3.8
		Chromium	6010A, 7000	mg/Kg	18	19	5.4	1.3

BDL = Below Detection Limit
RPD = Relative Percent Difference
mg/kg = milligrams per kilogram
μ/kg = micrograms per kilogram
NA = Calculation of RPD is Not Applicable because both results (field sample and split sample) were not greater than or equal to five times the detection limit.

TABLE 3-1
(Continued)

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Sample Result	Split Sample Result	RPD	Detection Limit
Field: PB-PR-S10-5.0/10.0	56811, 56816	Copper	6010A, 7000	mg/Kg	9.4	7.7	NA	2.5
Split: PB-PR-S26-5.0/10.0	(Continued)	Lead	6010A, 7000	mg/Kg	11	10	NA	3.2
(Continued)		Manganese	6010A, 7000	mg/Kg	490	420	15.4	5.1
		Nickel	6010A, 7000	mg/Kg	25	29	14.8	2.5
		Zinc	6010A, 7000	mg/Kg	56	62	10.2	2.5
Field: PB-PR-S12-5.0/10.0	56813, 56816	1,3,5-TNB	8330	mg/Kg	2.8	2.8	0.0	0.25
Split: PB-PR-S27-5.0/10.0		2,4-DNT	8330	mg/Kg	1.6	0.8	NA	0.25
		2,6-DNT	8330	mg/Kg	0.3	BDL	NA	0.26
		1,3-DNB	8330	mg/Kg	1.5	0.9	NA	0.25
		Arsenic	6010A, 7000	mg/Kg	9.3	12	NA	3.6
		Chromium	6010A, 7000	mg/Kg	14	16	13.3	1.2
		Copper	6010A, 7000	mg/Kg	14	11	NA	2.4
		Lead	6010A, 7000	mg/Kg	9.2	12	NA	3
		Manganese	6010A, 7000	mg/Kg	410	530	25.5	4.8
		Nickel	6010A, 7000	mg/Kg	20	26	26.1	2.4
		Zinc	6010A, 7000	mg/Kg	47	59	22.6	2.4
Field: PB-PR-S14-5.0/10.0	57081	2,4,6-TNT	8330	mg/Kg	340	280	19.4	0.25
Split: PB-PR-S28-5.0/10.0		1,3,5-TNB	8330	mg/Kg	18	8.5	71.7	0.25
		2,4-DNT	8330	mg/Kg	19	10	62.1	0.25
		2,6-DNT	8330	mg/Kg	2.9	1.8	46.8	0.26
		3,4-DNT	8330	mg/Kg	1.7	1.1	NA	0.25
		4-Am-DNT	8330	mg/Kg	2	0.8	NA	0.25
		2-NT	8330	mg/Kg	0.9	BDL	NA	0.25
		1,3-DNB	8330	mg/Kg	6.7	3.9	52.8	0.25
		Arsenic	6010A, 7000	mg/Kg	4.3	5.6	NA	3.7
		Chromium	6010A, 7000	mg/Kg	15	20	28.6	1.2

BDL = Below Detection Limit
RPD = Relative Percent Difference
mg/kg = milligrams per kilogram
μ/kg = micrograms per kilogram
NA = Calculation of RPD is Not Applicable because both results (field sample and split sample) were not greater than or equal to five times the detection limit.

TABLE 3-1
(Continued)

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Sample Result	Split Sample Result	RPD	Detection Limit
Field: PB-PR-S14-5.0/10.0	57081	Copper	6010A, 7000	mg/Kg	7	3.6	NA	2.5
Split: PB-PR-S28-5.0/10.0	(Continued)	Lead	6010A, 7000	mg/Kg	11	9.5	NA	3.1
(Continued)		Manganese	6010A, 7000	mg/Kg	260	570	74.7	4.9
		Nickel	6010A, 7000	mg/Kg	21	20	4.9	2.5
		Zinc	6010A, 7000	mg/Kg	85	54	44.6	2.5
Field: PB-PR-S18-2.0/5.0	56823, 56822	Arsenic	6010A, 7000	mg/Kg	6.4	6.2	NA	3.6
Split: PB-PR-S29-2.0/5.0		Chromium	6010A, 7000	mg/Kg	14	13	7.4	1.2
		Copper	6010A, 7000	mg/Kg	8.6	13	NA	2.4
		Lead	6010A, 7000	mg/Kg	12	10	NA	3
		Manganese	6010A, 7000	mg/Kg	390	380	26	4.8
		Nickel	6010A, 7000	mg/Kg	17	15	12.5	2.4
		Zinc	6010A, 7000	mg/Kg	43	44	2.3	2.4
Field: PB-PR-S23-0.0/0.5	56823	2,4-DNT	8330	mg/Kg	1	0.9	NA	0.25
Split: PB-PR-S30-0.0/0.5		1,3-DNB	8330	mg/Kg	0.4	0.4	NA	0.25
		Chromium	6010A, 7000	mg/Kg	7.1	8.3	15.6	1.1
		Lead	6010A, 7000	mg/Kg	8.7	8.5	NA	2.9
		Manganese	6010A, 7000	mg/Kg	180	150	18.2	4.6
		Nickel	6010A, 7000	mg/Kg	6	5.9	NA	2.3
		Zinc	6010A, 7000	mg/Kg	26	24	8.0	2.3
Field: PB-WA-S5-0.0/2.0	56448	1,3,5-TNB	8330	mg/Kg	0.6	0.5	NA	0.25
Split: PB-WA-S21-0.0/2.0		2,4-DNT	8330	mg/Kg	0.3	BDL	NA	0.25
		Arsenic	6010A, 7000	mg/Kg	4.7	5.2	NA	3.7
		Chromium	6010A, 7000	mg/Kg	35	16	74.5	1.2
		Copper	6010A, 7000	mg/Kg	BDL	6	NA	2.5
		Lead	6010A, 7000	mg/Kg	19	15	NA	3.1
		Manganese	6010A, 7000	mg/Kg	1012	695	37.1	4.9

BDL = Below Detection Limit
RPD = Relative Percent Difference
mg/kg = milligrams per kilogram
μ/kg = micrograms per kilogram
NA = Calculation of RPD is Not Applicable because both results (field sample and split sample) were not greater than or equal to five times the detection limit.

TABLE 3-1
(Continued)

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Sample Result	Split Sample Result	RPD	Detection Limit
Field: PB-WA-S5-0.0/2.0	56448	Nickel	6010A, 7000	mg/Kg	35	29	18.8	2.5
Split: PB-WA-S21-0.0/2.0 (Continued)	(Continued)	Zinc	6010A, 7000	mg/Kg	91	72	23.3	2.5
Field: PB-WA-S8-2.0/5.0	56491	Arsenic	6010A, 7000	mg/Kg	5.3	5	NA	3.2
Split: PB-WA-S22-2.0/5.0		Cadmium	6010A, 7000	mg/Kg	1.4	1.6	NA	1.1
		Chromium	6010A, 7000	mg/Kg	13	12	8.0	1.1
		Copper	6010A, 7000	mg/Kg	2.4	14	NA	2.1
		Lead	6010A, 7000	mg/Kg	7.4	8.5	NA	2.6
		Manganese	6010A, 7000	mg/Kg	621	3300	136.6	4.2
		Nickel	6010A, 7000	mg/Kg	16	52	105.9	2.1
		Zinc	6010A, 7000	mg/Kg	34	37	8.5	2.1
Field: PB-WA-S20-0.0/0.5	56822	1,3,5-TNB	8330	mg/Kg	0.7	0.5	NA	0.25
Split: PB-WA-S23-0.0/0.5		2,4-DNT	8330	mg/Kg	0.4	0.4	NA	0.25
		1,3-DNB	8330	mg/Kg	0.3	BDL	NA	0.25
		Arsenic	6010A, 7000	mg/Kg	4.6	5	NA	3.6
		Chromium	6010A, 7000	mg/Kg	16	18	11.8	1.2
		Copper	6010A, 7000	mg/Kg	2.9	3.1	NA	2.4
		Lead	6010A, 7000	mg/Kg	12	13	NA	3
		Manganese	6010A, 7000	mg/Kg	190	290	41.7	4.8
		Nickel	6010A, 7000	mg/Kg	16	18	11.8	2.4
		Zinc	6010A, 7000	mg/Kg	45	51	12.5	2.4
Field: PB-WA-S17-5.0/10.0	56494	2,4,6-TNT	8330	mg/Kg	2.1	3	35.3	0.25
Split: PB-WA-S24-5.0/10.0		1,3,5-TNB	8330	mg/Kg	4.2	3.1	30.1	0.25
		2,4-DNT	8330	mg/Kg	3.3	3.8	14.1	0.25
		2,6-DNT	8330	mg/Kg	0.3	0.3	NA	0.26
		4-Am-DNT	8330	mg/Kg	BDL	0.3	NA	0.25
		2-Am-DNT	8330	mg/Kg	0.5	BDL	NA	0.25

BDL = Below Detection Limit
RPD = Relative Percent Difference
mg/kg = milligrams per kilogram
μ/kg = micrograms per kilogram
NA = Calculation of RPD is Not Applicable because both results (field sample and split sample) were not greater than or equal to five times the detection limit.

TABLE 3-1
(Continued)

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Sample Result	Split Sample Result	RPD	Detection Limit
Field: PB-WA-S17-5.0/10.0 Split: PB-WA-S24-5.0/10.0 (Continued)	56494 (Continued)	1,3-DNB	8330	mg/Kg	1.9	1.5	23.5	0.25
		Arsenic	6010A, 7000	mg/Kg	5.4	BDL	NA	3.6
		Chromium	6010A, 7000	mg/Kg	11.2	11.2	0.0	1.2
		Copper	6010A, 7000	mg/Kg	11.3	5.3	NA	2.4
		Lead	6010A, 7000	mg/Kg	11.4	11	NA	3
		Manganese	6010A, 7000	mg/Kg	274	198	32.2	4.8
		Nickel	6010A, 7000	mg/Kg	18	15	18.2	2.4
		Zinc	6010A, 7000	mg/Kg	50	43	15.1	2.4
Field: PB-BG-S4-0.5/3.0 Split: PB-BG-S8-0.5/3.0	56812	Toluene	8240	µg/Kg	3.5	BDL	NA	1.0
		Trichloroethene	8240	µg/Kg	BDL	4.6	NA	1.0
		Xylenes	8240	µg/Kg	3.5	BDL	NA	1.0
		Cis-1,2-dichloroethene	8240	µg/Kg	BDL	1.3	NA	1.0
		Antimony	6010A, 7000	mg/Kg	7.6	6.4	NA	6.0
		Arsenic	6010A, 7000	mg/Kg	17	19	NA	3.6
		Chromium	6010A, 7000	mg/Kg	13	10	26.1	1.2
		Copper	6010A, 7000	mg/Kg	34	27	23.0	2.4
		Lead	6010A, 7000	mg/Kg	27	23	16.0	3.0
		Manganese	6010A, 7000	mg/Kg	24	8.7	NA	4.8
		Nickel	6010A, 7000	mg/Kg	11	9.4	NA	2.4
		Zinc	6010A, 7000	mg/Kg	13	10	NA	2.4

BDL = Below Detection Limit
RPD = Relative Percent Difference
mg/kg = milligrams per kilogram
µ/kg = micrograms per kilogram
NA = Calculation of RPD is Not Applicable because both results (field sample and split sample) were not greater than or equal to five times the detection limit.

3.1.2 Metals in Soil Samples

Twenty-one pairs of split soil samples were analyzed for 14 metals providing a total of 294 metals data pairs for comparison. RPDs were within acceptable limits for all but four data pairs. The RPDs that exceeded the acceptable limit are shaded on Table 3-1.

- For sample PB-TNTB-S18-0.5/1.5 and its split PB-TNTB-S28-0.5/1.5, analysis for copper exhibited an RPD of 141.7.
- Also for sample PB-TNTB-S18-0.5/1.5 and its split PB-TNTB-S28-0.5/1.5, analysis for zinc exhibited an RPD of 121.3.
- For sample PB-WA-S8-2.0/5.0 and its split PB-WA-S22-2.0/5.0, analysis for manganese exhibited RPD of 136.6.
- Also for sample PB-WA-S8-2.0/5.0 and its split PB-WA-S22-2.0/5.0, analysis for nickel exhibited an RPD of 105.9.

The most likely reason for the RPDs in excess of 100 percent in these sample pairs is the non-homogenous nature of the soil matrix.

3.1.3 VOCs and SVOCs in Soil Samples

One pair of split soil samples from a background location was analyzed for VOCs and SVOCs. Toluene and xylenes were detected in the sample BG-S4-0.5/3.0 at concentrations of 3.5 *u*g/Kg each but were not detected in the QC split sample BG-S8-0.5/3.0. Trichloroethene and cis-1,2-dichloroethene were detected in QC sample BG-S8-0.5/3.0 at concentrations of 4.6 *u*g/Kg and 1.3 *u*g/Kg, respectively, but were not detected in sample BG-S4-0.5/3.0. RPDs cannot be calculated when the value for one sample is BDL. All four of the VOCs were detected at concentrations that are only slightly greater than the respective detection limits. Due to the non-homogeneous nature of soil samples, it is not unusual for VOCs to be detected at these low levels in one of a pair of split samples and not the other.

No SVOCs were detected in either of the two samples of the split sample pair.

3.2 COMPARISON OF SPLIT SEDIMENT SAMPLE RESULTS

One pair of split sediment samples was analyzed for 14 explosives residues analytes and 14 metals, the 13 priority pollutant metals and manganese.

No explosives residues were detected in either sample of the split sample pair.

Results for metals which were detected at or above their detection limit for either the field or QC sample of the split sample pair are presented Table 3-2. For metals not listed in these tables, the result for both the field sample and the split sample were BDL.

The results indicate good agreement between the field and split samples. RPDs were all within acceptable limits.

3.3 COMPARISON OF DUPLICATE SURFACE WATER SAMPLE RESULTS

One pair of duplicate surface water samples was analyzed for concentrations of 14 explosives residues analytes; total and dissolved concentrations of 14 metals, the 13 priority pollutant metals and manganese; and total suspended solids.

Results for those analytes/compounds which were detected at or above their detection limit for either the field or QC sample of the duplicate sample pair are presented Table 3-3. For analytes not listed in the tables, the result for both the field sample and the duplicate sample were BDL.

The results indicate good agreement between the field and duplicate samples. RPDs were all within acceptable limits.

TABLE 3-2
SUMMARY OF SEDIMENT SPLIT SAMPLE RESULTS

SAMPLE:	PB-WA-SED2-0.2/1.0	*MATRIX:*	SEDIMENT
DUPLICATE:	PB-WA-SED7-0.2/1.0	*ASI REPORT No.:*	56722

PARAMETER	UNITS	FIELD RESULT	SPLIT RESULT	RPD	DETECTION LIMIT
Metals, Total, EPA 6010A, 7000					
Chromium	mg/Kg	22	10	75.0	1.6
Lead	mg/Kg	17	16	NA	4
Manganese	mg/Kg	190	160	17.1	6.3
Nickel	mg/Kg	19	13	NA	3.2
Zinc	mg/Kg	94	63	39.5	3.2

RPD = Relative Percent Difference

mg/Kg = milligrams per Kilogram

NA = Calculations of RPD is Not Applicable because both results (field and split samples) were not greater than or equal to five times the detection limit.

TABLE 3-3
SUMMARY OF SURFACE WATER DUPLICATE SAMPLE RESULTS

SAMPLE: PB-WA-SW3-U,F			MATRIX: SURFACE WATER		
DUPLICATE: PB-WA-SW7-U,F			ASI REPORT No.: 58647		
PARAMETER	**UNITS**	**FIELD RESULT**	**DUPLICATE RESULT**	**RPD**	**DETECTION LIMIT**
Explosives, EPA 8330					
4-Amino-2-nitrotoluene (4-Am-2-NT)	µg/L	0.6	BDL	NA	0.55
3,4-Dinitrotoluene (3,4-DNT)	µg/L	0.6	BDL	NA	0.21
3-Nitrotoluene (3-NT)	µg/L	2.4	2.2	NA	1.4
Metals, Total, EPA 6010A, 7000					
Lead	µg/L	77	54	NA	25
Manganese	µg/L	230	240	4.3	40
Zinc	µg/L	43	26	NA	20
Metals, Dissolved, EPA 6010A, 7000					
Manganese	µg/L	210	230	9.1	40
Total Suspended Solids, EPA 160.2					
TSS	mg/L	21	20	NA	5

BDL = Below Detection Limit.

RPD = Relativ Percent Difference

µg/L = micrograms per liter

mg/L = milligrams per liter

NA = Calculation of RPD is Not Applicable because both results (field and duplicate samples) were not greater than or equal to five times detection limit.

3.4 COMPARISON OF DUPLICATE GROUNDWATER SAMPLE RESULTS

Three pairs of duplicate groundwater samples were analyzed. Two of the duplicate sample pairs were collected from overburden wells and were analyzed for concentrations of explosives residues, total and dissolved metals, and nitrates. One of the duplicate sample pairs was collected from a bedrock well and was analyzed for explosives residues, total and dissolved metals, nitrates, VOCs, and SVOCs. Results for those analytes/compounds which were detected at or above their detection limit for either the field or QC sample of the duplicate sample pair are presented Table 3-4. For analytes not listed in the tables, the result for both the field sample and the duplicate sample were BDL.

The results indicate good agreement between the field and duplicate samples. RPDs were all within acceptable limits.

TABLE 3-4

SUMMARY OF GROUNDWATER DUPLICATE SAMPLE RESULTS

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Result	Split Result	RPD	Detection Limit
Field: PB-WA-DM-MW2-U,F Split: PB-WA-DM-MW22-U,F	57992	2,4,6-TNT	8330	µg/L	34	26	26.7	0.64
		1,3,5-TNB	8330	µg/L	550	570	3.6	0.45
		2,4-DNT	8330	µg/L	320	250	24.6	0.1
		2,6-DNT	8330	µg/L	12	10	18.2	0.1
		3,4-DNT	8330	µg/L	75	2.6	NA	2.1
		4-Am-DNT	8330	µg/L	4.2	2.6	47.1	1.57
		2-Am-DNT	8330	µg/L	5.7	5.2	9.2	0.16
		2-Am-4-NT	8330	µg/L	4.1	4.4	7.1	0.94
		1,3-DNB	8330	µg/L	470	400	16.1	0.15
		Total Chromium	6010A,7000	µg/L	14	BDL	NA	10
		Total Copper	6010A,7000	µg/L	38	32	17.1	20
		Total Lead	6010A,7000	µg/L	10	4	85.7	3
		Total Manganese	6010A,7000	µg/L	1600	1800	11.8	40
		Total Nickel	6010A,7000	µg/L	63	47	29.1	20
		Total Thallium	6010A,7000	µg/L	BDL	0.5	NA	0.5
		Total Zinc	6010A,7000	µg/L	88	63	33.1	20
		Dissolved Copper	6010A,7000	µg/L	20	20	0.0	20
		Dissolved Manganese	6010A,7000	µg/L	1000	970	3.0	40

RPD = Relative Percent Difference
BDL = Below Detection Limit
µg/L = micrograms per liter
mg/L = milligrams per liter
NA = Calculation of RPD is Not Applicable because both result (field and duplicate samples) were not greater than or equal to five times the detection limit.

TABLE 3-4
(Continued)

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Result	Split Result	RPD	Detection Limit
Field: PB-WA-DM-MW2-U,F Split: PB-WA-DM-MW22-U,F (Continued)	57992 (Continued)	Dissolved Nickel	6010A,7000	µg/L	60	60	0.0	20
		Nitrate	353.2	mg/L	15	16	6.5	1
Field: PB-TNTA-DM-MW10-U,F Split: PB-TNTA-DM-MW23-U,F	57985	2,4,6-TNT	8330	µg/L	10	10	0.0	0.64
		1,3,5-TNB	8330	µg/L	BDL	0.5	NA	0.45
		2,4-DNT	8330	µg/L	11	10	9.5	0.1
		4-Am-2-NT	8330	µg/L	2.4	2.2	8.7	0.55
		3,4-DNT	8330	µg/L	BDL	0.3	NA	0.21
		4-Am-DNT	8330	µg/L	8.7	7.9	9.6	1.57
		2-Am-DNT	8330	µg/L	31	29	6.7	0.16
		2-Am-4-NT	8330	µg/L	1.3	1.3	0.0	0.94
		1,3-DNB	8330	µg/L	1.7	1.5	12.5	0.15
		Total Lead	6010A,7000	µg/L	7	7	0.0	3
		Total Manganese	6010A,7000	µg/L	980	880	10.8	40
		Total Zince	6010A,7000	µg/L	110	34	105.6	20
		Dissolved Manganese	6010A,7000	µg/L	960	830	14.5	40
		Nitrate	353.2	mg/L	0.3	0.3	0.0	0.1
Field: PB-BED-MW18-U,F Split: PB-BED-MW21-U,F	58042, 58029	2,6-DNT	8330	µg/L	1.4	1.2	15.4	1
		4-Am-2-NT	8330	µg/L	BLD	2	NA	5.5
		3,4-DNT	8330	µg/L	2.2	2.9	27.5	2.1

RPD = Relative Percent Difference
BDL = Below Detection Limit
µg/L = micrograms per liter
mg/L = milligrams per liter
NA = Calculation of RPD is Not Applicable because both result (field and duplicate samples) were not greater than or equal to five times the detection limit.

TABLE 3-4
(Continued)

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Result	Split Result	RPD	Detection Limit
Field: PB-BED-MW18-U,F Split: PB-BED-MW21-U,F (Continued)	58042, 58029 (Continued)	Total Copper	6010A,7000	µg/L	36	36	0.0	20
		Total Manganese	6010A,7000	µg/L	89	90	1.1	40
		Total Zinc	6010A,7000	µg/L	20	27	29.8	20
		Dissolved Manganese	6010A,7000	µg/L	80	80	0.0	40
		Dissolved Zinc	6010A,7000	µg/L	BDL	20	NA	20
		Nitrate	353.2	mg/L	0.2	0.4	66.7	0.1
		Benzene	8240	µg/L	14	16	13.3	2
		Carbon disulfide	8240	µg/L	160	90	56.0	40
		Ethylbenzene	8240	µg/L	79	120	41.2	2
		Toluene	8240	µg/L	72	93	25.5	2
		Zylenes	8240	µg/L	350	520	39.1	2
		2,4-Dimethylphenol	8240	µg/L	19	17	11.1	10
		Naphthalene	8240	µg/L	17	15	12.5	10

RPD = Relative Percent Difference
BDL = Below Detection Limit
µg/L = micrograms per liter
mg/L = milligrams per liter
NA = Calculation of RPD is Not Applicable because both result (field and duplicate samples) were not greater than or equal to five times the detection limit.

4.0 EVALUATION OF EQUIPMENT BLANKS

Seven equipment blanks were collected during the investigation. Sample results for those analytes/compounds which were detected at or above their detection limit in the equipment blanks are presented in Table 4-1.

No explosives residues analytes were detected above the PQL in any of the equipment blank samples.

For the majority of the analytes detected in the equipment blanks, the concentrations reported were $\leq$ 2X detection limit.

- Nitrates were detected in three equipment blanks, PB-E-WA-DM-MW2-U, PB-E-BED-MW18-U, and PB-E-TNTA-DM-MW10-U, at concentrations of 0.3 milligrams per liter (mg/L), 0.3 mg/L, and 0.2 mg/L, respectively. These concentrations are only slightly above the detection limit of 0.1 mg/L. All three of these equipment blanks were prepared for groundwater monitoring well sampling equipment.

- Zinc was detected in six of the seven equipment blanks including the equipment blanks for the sediment sample and surface water sample collected at the West Area Red Water Ponds; the equipment blank prepared for the background soil boring; and three equipment blanks prepared for groundwater monitoring well sampling equipment. The zinc concentrations in these samples are listed in Table 4-1.

  Equipment blank PB-E-WA-SED2 was prepared for the polyvinyl chloride (PVC) piping and sample preparation materials used to collect a sediment sample at the west pond of the West Area Red Water Ponds. It was prepared by pouring distilled water through a section of PVC pipe into the sample bowl containing the sampling spoon. The water was then poured into the required sample bottles. Zinc was detected in equipment blank PB-E-WA-SED2 at a concentration of 50 micrograms per liter (*u*g/L). It is possible that the zinc observed in the equipment blank is from the PVC pipe.

  The detection limit for zinc was 20 *u*g/L in all these samples.

- Antimony was detected in two equipment blanks, PB-E-BED-MW18-F and PB-E-WA-DM-MW2-F, at concentrations of 12 *u*g/L and 2 *u*g/L, respectively. Both of these equipment blanks were prepared for filtered samples for metals analysis. The equipment blanks for dissolved (filtered) metals were filtered through a 0.45 micron (*u*m) filter in the field and then preserved with nitric acid (pH < 2). It is possible that the antimony observed in the equipment blanks is from the 0.45 *u*m filter.

TABLE 4-1

EQUIPMENT BLANK RESULTS ABOVE DETECTION LIMIT

Sample Identification	Analyte		
	Nitrate Nitrogen mg/L	Zinc µg/L	Antimony µg/L
PB-E-WA-DM-MW2-U	0.3	37	
PB-E-WA-DM-MW2-F			2
PB-E-BED-MW18-U	0.3	28	
PB-E-BED-MW18-F			12
PB-E-TNTA-DM-MW10-U	0.2		
PB-E-WA-SW2-U		39	
PB-E-WA-SW2-F		21	
PB-E-WA-SED2		50	
PB-E-BG-S3-0.5/3.0		20	

mg/L = milligrams per liter
µg/L = micrograms per liter

- TICs were detected in equipment blanks PB-E-BED-MW18-U and PB-E-BG-S3-0.5/3.0. These were the only two equipment blanks that were analyzed for VOCs and SVOCs.

5.0 TRIP BLANKS

Three trip blanks were submitted, one with each cooler that contained water samples to be analyzed for VOCs. The trip blank identifications are T-12/13/95; T-12/14/94; and T-12/15/94. The dates in the sample identification correspond to the sample collection and shipment dates. VOCs were detected in two of the three trip blanks.

- In sample PB-T-12/13/94, tetrachloroethene was detected at a concentration of 1.2 *u*g/L. Since this sample is a trip blank, the most likely reason for the presence of tetrachloroethene is laboratory contamination, possibly carryover. This concentration is only slightly above a detection limit of 1.0 *u*g/L.

- In sample PB-T-12/14/94, toluene was detected at a concentration of 1.1 *u*g/L. The analysis of the trip blank was preceded by the analysis of sample 58094-1 during the same run/batch. Toluene was detected in sample 58094-1 at a concentration of 190 *u*g/L. The most likely reason for the presence of toluene in the trip blank is carryover from sample 58094-1. This concentration is only slightly above a detection limit of 1.0 *u*g/L.

REFERENCES

U.S. Environmental Protection Agency, 1993, USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, February 1993.

U.S. Environmental Protection Agency, 1994, USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, February 1994.

APPENDIX J

LABORATORY REPORTS

ASI

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As a part of the contracted work associated with the Plum Brook site evaluation, ASI was required to report explosives residue analysis to the method detection limit (MDL), using the CRREL modification (Special Report 92-25) of EPA method 8330.

The method detection limit study attempts to answer the question, "What is the lowest level of analyte in a sample which will result in a signal which is different than zero?" The study is based upon repetitive analysis of a interference free sample which is spiked with a known amount of the target analyte. A minimum of seven aliquotes of the spiked sample are taken through the entire sample preparation and instrument analysis protocol. The standard deviation of the results is determined, then multiplied by the one-tailed t-statistic at the 99% confidence level for the number of degrees of freedom in the study (one less than the number of repetitions used to calculate the standard deviation). For seven repetitions this is a multiplier of 3.14. The resulting value is finally compared to the spike level in the sample. If the sample spike level is within 2 to 5 times the calculated MDL then the procedure is considered successful. If not the spike level in the sample is adjusted and the study repeated.

The MDL is not a measure of the of the lowest level of analyte in the sample which can be reported with accuracy. The MDL is only a measure of the ability of the test procedure to generate a positive response within the retention time window of the target analyte in the absence of any other interferences from the sample. It is actually a determination of the precision of obtaining a response from very low levels of target analyte and has no bearing on quantitative accuracy.

When applied to methods such as 8330, use of the MDL as a reporting limit can generate some results in which there is very low confidence. The minimum level of target analyte which can be detected and <u>accurately</u> quantitated is generally some multiple of the MDL. There is no uniform procedure by which this level is determined and depending on the procedure it may from 5 to 20 times higher than the MDL. The value is frequently called the Practical Quantitation Level (PQL), although many other terms are used to present the same idea.

Real samples contribute noise to the the analytical procedure and the instrument response which is independent of the procedure and instrument. The MDL is a performance characteristic which does not take into account any contribution to analytical inaccuracy by sample noise. The use of methods, such as 8330, which generate analyte identifications through retention time matches on analytical and confirmation columns are very prone to mis-

identification of target analytes through random non-target analyte signals appearing in the appropriate retention time window. As reporting levels are lowered there is increased probability that noise signals will coincidentially appear in the target analyte retention time window on both columns. If signals are found in samples which meet the method criteria for a confirmed hit, then to be in compliance with the method, a "hit" must be reported.

These samples associated with the Plum Brook contract exhibited considerable low level noise which was not found in blanks and other quality controls. Due to the inherent low level sample interference, there is less confidence in values reported for analytes close to the MDL. ASI is suggesting that a MDL multiplier of 20 be used to generate PQL's for these samples. This results in a PQL of 5 ppb for the water samples. Results reported between the MDL and the PQL should properly be flagged with a "J" as they are estimated quantitations on tentatively identified target analytes. Results reported as "BDL" at the MDL are confident in that the identification criteria for the target analyte were not met.

Roy-Keith Smith, PhD
AMM/QAM

LABORATORY REPORTS

TNT AREA A SOIL BORINGS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 28, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56803-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S1-0.0/1.5, 10/28/94, 17:55, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.5
Total Arsenic (As) (mg/kg) (EPA 7060)	4.1	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	13	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	5.5	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	13	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	187	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	13	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	38	2.2

BDL - Below Detection Limit

Report No. 56803-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	4.9	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1.0	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	1.7	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	9	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Oliver

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ANALYTICAL SERVICES, INC.

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 28, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56803-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S1-1.5/5.0, 10/28/94, 18:10, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	4.6	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	13	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	6.9	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	10.4	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	178	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	17	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	41	2.2

BDL - Below Detection Limit

Report No. 56803-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	580	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	2.5	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	4.8	0.25
2,6-Dinitrotoluene (2,6-DNT)	5.6	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	0.3	0.25
3,4-Dinitrotoluene (3,4-DNT)	0.7	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	5.6	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	7.0	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.4	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	10	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

December 28, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56803-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S2-0.0/1.5, 10/28/94, 17:27, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	3.7	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	13	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	9.1	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	236	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.0	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	24	2.2

BDL - Below Detection Limit

Report No. 56803-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	11	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dlin

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LABORATORY REPORT

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Atlanta, GA 30305

December 28, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56803-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S2-1.5/3.0, 10/28/94, 17:32, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	7.9	5.5
Total Arsenic (As) (mg/kg) (EPA 7060)	5.9	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	14	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	5.5	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	11	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	1000	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	14	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	33	2.2

BDL - Below Detection Limit

Report No. 56803-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	9	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
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December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56720-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S3-0.0/1.5, 10/26/94, 17:55, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.5
Total Arsenic (As) (mg/kg) (EPA 7060)	9.1	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	14	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	4.4	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	15	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	473	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	19	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	47	2.2

BDL - Below Detection Limit

Report No. 56720-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	9	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56720-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S3-1.5/3.0, 10/26/94, 18:20, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.2
Total Arsenic (As) (mg/kg) (EPA 7060)	3.5	3.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.0
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.0
Total Chromium (Cr) (mg/kg) (EPA 6010A)	12	1.0
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	6.6	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	175	4.1
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	8.4	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.1
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.0
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	25	2.1

BDL - Below Detection Limit

Report No. 56720-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	3	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56720-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S4-0.0/1.5, 10/26/94, 16:50, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	5.0	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	12	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	4.7	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	138	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	8.6	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	24	2.1

BDL - Below Detection Limit

Report No. 56720-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	6	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Olier

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56720-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S4-1.5/5.0, 10/26/94, 17:15, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	9.8	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.1	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	4.8	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	349	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.3	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	27	2.4

BDL - Below Detection Limit

Report No. 56720-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	17	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dlin

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 4, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56728-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S5-1.0/2.0, 10/26/94, 10:00, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	5.3	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11.0	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	5.6	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	74	4.6
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	5.2	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.6
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	26	2.3

BDL - Below Detection Limit

Report No. 56728-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	13	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 4, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56728-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S5-2.5/3.5, 10/26/94, 10:15, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	8.2	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	5.1	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	55	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	6.3	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	25	2.4

BDL - Below Detection Limit

Report No. 56728-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.3	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	0.7	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	17	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

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Atlanta, GA 30305

January 4, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56728-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S6-1.0/2.0, 10/25/94, 18:05, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	3.9	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	53	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	13	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	91	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	7.3	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	290	2.2

BDL - Below Detection Limit

Report No. 56728-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	11	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

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January 4, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56728-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S6-2.5/3.5, 10/26/94, 08:50, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	6.6	5.9
Total Arsenic (As) (mg/kg) (EPA 7060)	6.9	3.5
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	19	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	18	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	7600	4.7
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	54	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.7
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.9
Total Zinc (Zn) (mg/kg) (EPA 6010A)	81	2.4

BDL - Below Detection Limit

Report No. 56728-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	15	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 4, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56728-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S7-1.0/2.0, 10/25/94, 17:35, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.5
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	34	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	4.7	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	240	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	6.4	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	300	2.2

BDL - Below Detection Limit

Report No. 56728-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	9	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

January 4, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56728-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S7-2.5/3.5, 10/25/94, 17:50, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL UJ	5.4
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	14	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	6.3	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	55	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	5.1	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL UJ	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.4
Total Zinc (Zn) (mg/kg) (EPA 6010A)	150	2.2

BDL - Below Detection Limit

Report No. 56728-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	7	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

January 4, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56728-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S8-2.5/3.5, 10/26/94, 10:50, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	6.8	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	20	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	9.3	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	500	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	32	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	52	2.4

BDL - Below Detection Limit

Report No. 56728-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	18	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56720-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S9-0.0/1.0, 10/26/94, 16:10, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	8.9	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	8.3	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	88	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	7.6	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	46	2.2

BDL - Below Detection Limit

Report No. 56720-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	11	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dlin

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 4, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56728-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S10-2.5/3.5, 10/26/94, 14:37, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	19	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	12	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	60	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	325	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	25	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	180	2.4

BDL - Below Detection Limit

Report No. 56728-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	17	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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ANALYTICAL SERVICES, INC.

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 4, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56728-9

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S11-2.5/3.5, 10/26/94, 15:17, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	5.8	5.8
Total Arsenic (As) (mg/kg) (EPA 7060)	4.8	3.5
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	22	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	15	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	270	4.7
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	29	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.7
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.8
Total Zinc (Zn) (mg/kg) (EPA 6010A)	60	2.3

BDL - Below Detection Limit

Report No. 56728-9

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	14	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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ANALYTICAL SERVICES, INC.

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LABORATORY REPORT

Dames & Moore - Atlanta
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January 11, 1995

P.O. No. ATL-4429

Attention: Ms. Deborah L. Raede

Report No. 58168-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S12-1.0/1.5, 12/13/94, 15:20, received 12/16/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	6.5	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	21	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	9.1	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	330	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	21	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	37	2.5

BDL - Below Detection Limit

Report No. 58168-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 11, 1995

P.O. No. ATL-4429

Attention: Ms. Deborah L. Raede

Report No. 58168-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S13-1.0/1.5, 12/13/94, 15:00, received 12/16/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	3.8	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	30	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	44	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	310	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	23	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	86	2.5

BDL - Below Detection Limit

Report No. 58168-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 28, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56803-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S14-0.0/2.0, 10/29/94, 09:56, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	3.5	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	4.3	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	8.8	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	170	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	6.4	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	51	2.1

BDL - Below Detection Limit

Report No. 56803-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	6	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A Dein

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LABORATORY REPORT

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December 28, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56803-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S15-0.0/2.0, 10/29/94, 10:32, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.2
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.0
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.0
Total Chromium (Cr) (mg/kg) (EPA 6010A)	6.2	1.0
Total Copper (Cu) (mg/kg) (EPA 6010A)	5.2	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	48	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	165	4.1
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	5.2	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.1
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.0
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	30	2.1

BDL - Below Detection Limit

Report No. 56803-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	53	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.5	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.8	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	3	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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December 28, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56803-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S16-0.0/2.0, 10/29/94, 09:30, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.5
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	46	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	38	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	132	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	6.6	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	209	2.2

BDL - Below Detection Limit

Report No. 56803-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	19	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	1.5	0.25
2,6-Dinitrotoluene (2,6-DNT)	1.3	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	9	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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December 28, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56803-9

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S17-0.0/2.0, 10/29/94, 10:54, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	7.4	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	20	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	106	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	5.3	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	26	2.1

BDL - Below Detection Limit

Report No. 56803-9

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	1.1	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.5	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	6	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Weber

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56809-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S18-0.5/1.5, 10/29/94, 17:29, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	3.3	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	8.4	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	7.4	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	9.4	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	168	4.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	6.3	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	39	2.1

BDL - Below Detection Limit

Report No. 56809-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.5	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	0.5	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	5	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Klier

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LABORATORY REPORT

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December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56809-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S19-0.5/1.5, 10/29/94, 16:49, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	7.4	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	14	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	245	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	5.3	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	28	2.1

BDL - Below Detection Limit

Report No. 56809-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.3	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	6	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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Atlanta, GA 30305

December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56809-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S20-0.5/1.5, 10/29/94, 17:00, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	7.0	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	4.1	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	28	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	489	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	1809	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	181	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	32	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	447	2.1

BDL - Below Detection Limit

Report No. 56809-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	4.3	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.6	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.7	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.7	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	1.1	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	6	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dlin

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56809-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S21-0.0/2.0, 10/29/94, 15:35, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.4
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	26	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	290	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	6.5	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.4
Total Zinc (Zn) (mg/kg) (EPA 6010A)	34	2.2

BDL - Below Detection Limit

Report No. 56809-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.3	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.6	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.7	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	7	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

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3525 Piedmont Road
Atlanta, GA 30305

December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56809-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S22-0.0/2.0, 10/29/94, 16:10, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	13	5.2
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.0
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.0
Total Chromium (Cr) (mg/kg) (EPA 6010A)	7.3	1.0
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.1	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	22	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	125	4.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	4.2	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.0
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	56	2.1

BDL - Below Detection Limit

Report No. 56809-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	45	0.25
2,6-Dinitrotoluene (2,6-DNT)	47	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	4	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dein

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LABORATORY REPORT

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December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56809-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S23-0.0/2.0, 10/29/94, 15:19, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.5
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	14	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	7.7	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	187	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	165	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	5.5	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	154	2.2

BDL - Below Detection Limit

Report No. 56809-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.4	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	9	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Olin

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December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56809-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S24-0.0/1.5, 10/29/94, 12:00, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	23	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	19	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	256	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	344	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	10.7	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	267	2.2

BDL - Below Detection Limit

Report No. 56809-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	10	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Tier

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LABORATORY REPORT

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December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56809-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S24-1.5/3.0, 10/29/94, 12:07, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.2
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.0
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.0
Total Chromium (Cr) (mg/kg) (EPA 6010A)	6.2	1.0
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	3.3	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	86	4.1
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	5.2	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.1
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.0
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	19	2.1

BDL - Below Detection Limit

Report No. 56809-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.3	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	0.6	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	3	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
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January 6, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56822-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S25-0.0/1.5, 10/29/94, 12:34, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	23	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.9	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	1400	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	130	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	8.6	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	73	2.1

BDL - Below Detection Limit

Report No. 56822-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	2.7	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.4	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	0.4	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	6	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

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January 6, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56822-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S26-0.0/1.5, 10/29/94, 12:50, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	7.4 J	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	22	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	6.2	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	130	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	140	4.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	7.5	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL UJ	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	56	2.1

BDL - Below Detection Limit

Report No. 56822-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.6	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.6	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	8.9	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	5	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 4, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56728-10

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S27-2.5/3.5, 10/26/94, 15:17, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	4.8	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	18	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	13	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	590	4.6
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	26	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.6
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	57	2.3

BDL - Below Detection Limit

Report No. 56728-10

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	13	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56720-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S28-1.5/5.0, 10/26/94, 17:15, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	10.2	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	5.3	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	259	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.4	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	30	2.5

BDL - Below Detection Limit

Report No. 56720-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Olin

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 28, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56803-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S29-0.0/2.0, 10/29/94, 09:30, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.5
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	52	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	4.4	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	55	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	121	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	6.6	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	253	2.2

BDL - Below Detection Limit

Report No. 56803-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	5.5	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	2.7	0.25
2,6-Dinitrotoluene (2,6-DNT)	1.5	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	0.4	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	9	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56809-9

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S30-1.5/3.0, 10/29/94, 12:07, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.2
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.0
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.0
Total Chromium (Cr) (mg/kg) (EPA 6010A)	5.2	1.0
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	3.4	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	80	4.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	5.2	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.0
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	17	2.1

BDL - Below Detection Limit

Report No. 56809-9

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.3	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.5	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	0.8	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	4	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 6, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56822-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S31-0.0/1.0, 10/29/94, 17:15, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.3
Total Arsenic (As) (mg/kg) (EPA 7060)	4.6	3.8
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.3
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.3
Total Chromium (Cr) (mg/kg) (EPA 6010A)	22	1.3
Total Copper (Cu) (mg/kg) (EPA 6010A)	8.6	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	34	3.2
Total Manganese (Mn) (mg/kg) (EPA 6010A)	300	5.1
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.32
Total Nickel (Ni) (mg/kg) (EPA 6010A)	23	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.1
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.3
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	63	2.5

BDL - Below Detection Limit

Report No. 56822-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.9	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	21	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 6, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56822-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-S32-0.0/1.0, 10/29/94, 16:45, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	6.8	6.8
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	4.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.4
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.4
Total Chromium (Cr) (mg/kg) (EPA 6010A)	24	1.4
Total Copper (Cu) (mg/kg) (EPA 6010A)	38	2.7
Total Lead (Pb) (mg/kg) (EPA 6010A)	31	3.4
Total Manganese (Mn) (mg/kg) (EPA 6010A)	200	5.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.34
Total Nickel (Ni) (mg/kg) (EPA 6010A)	23	2.7
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.4
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.8
Total Zinc (Zn) (mg/kg) (EPA 6010A)	64	2.7

BDL - Below Detection Limit

Report No. 56822-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	3.2	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.3	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.5	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	26	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 7, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56409-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S1-0.0/1.5, 10/14/94, 15:20, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	8.6	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	30	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	15	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	44	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	26	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	77	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	44	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	63	2.5

BDL - Below Detection Limit

Report No. 56409-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	6.9	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.5	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	0.3	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.3	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	0.5	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 7, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56409-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S1-1.5/3.0, 10/14/94, 15:40, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	20	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	12	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	25	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	24	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	61	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	25	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	60	2.4

BDL - Below Detection Limit

Report No. 56409-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	2.3	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.4	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.4	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	0.8	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	17	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Olin

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

December 22, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56495-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S2-0.0/1.0, 10/19/94, 09:56, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	7.3	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	16	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	9.6	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	42	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	29	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	940	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	60	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	95	2.4

BDL - Below Detection Limit

Report No. 56495-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	1.6	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.8	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	0.5	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.3	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	1.0	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	17	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

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December 22, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56495-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S2-1.0/2.5, 10/19/94, 10:03, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	8.5	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	9.4	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	29	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	27	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	108	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	23	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	31	2.4

BDL - Below Detection Limit

Report No. 56495-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	1.2	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.4	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	0.4	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	0.6	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	16	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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December 22, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56495-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S3-0.0/1.0, 10/19/94, 10:23, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	7.3	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	13	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	10.2	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	38	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	55	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	37	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	17	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	43	2.4

BDL - Below Detection Limit

Report No. 56495-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	1.4	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.3	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	0.3	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1.0	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	2.4	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	18	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

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December 22, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56495-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S3-1.0/2.0, 10/19/94, 10:30, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	11	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	17	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	10.3	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	48	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	34	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	77	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	36	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	159	2.3

BDL - Below Detection Limit

Report No. 56495-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	2.7	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.6	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.3	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	0.3	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.7	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	2.4	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	12	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

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December 22, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56495-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S4-0.0/1.0, 10/19/94, 10:48, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	11	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	11	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	10.2	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	35	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	37	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	87	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	24	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	43	2.4

BDL - Below Detection Limit

Report No. 56495-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	5.0	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.3	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	3.2	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.3	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	0.5	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.5	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	2.4	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.3	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	17	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

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December 22, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56495-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S4-1.0/1.5, 10/19/94, 10:57, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	7.3	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	14	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	9.8	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	40	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	28	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	55	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	23	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	30	2.3

BDL - Below Detection Limit

Report No. 56495-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	8.8	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.5	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	4.5	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.5	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	1.6	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1.2	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	4.1	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.4	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	12	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 7, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56409-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S5-1.0/2.0, 10/15/94, 10:07, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	5.4	5.4
Total Arsenic (As) (mg/kg) (EPA 7060)	6.4	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	18	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	20	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	304	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	21	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.4
Total Zinc (Zn) (mg/kg) (EPA 6010A)	51	2.2

BDL - Below Detection Limit

Report No. 56409-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	1.5	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.6	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	1.5	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	7.8	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
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December 7, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56409-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S5-2.5/3.0, 10/15/94, 10:21, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	6.5	5.5
Total Arsenic (As) (mg/kg) (EPA 7060)	7.7	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	12	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	11	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	153	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	15	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	48	2.2

BDL - Below Detection Limit

Report No. 56409-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	8.3	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

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December 7, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56409-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S6-1.0/2.0, 10/15/94, 11:03, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.4
Total Arsenic (As) (mg/kg) (EPA 7060)	6.4	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	9.4	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	18	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	21	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	161	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	16	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.4
Total Zinc (Zn) (mg/kg) (EPA 6010A)	60	2.1

BDL - Below Detection Limit

Report No. 56409-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	1.2	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.4	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	0.4	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	6.8	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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December 7, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56409-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S6-2.5/3.5, 10/15/94, 11:13, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	8.1	5.8
Total Arsenic (As) (mg/kg) (EPA 7060)	8.7	3.5
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	17	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	27	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	76	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	291	4.7
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	24	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.7
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.8
Total Zinc (Zn) (mg/kg) (EPA 6010A)	128	2.3

BDL - Below Detection Limit

Report No. 56409-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	51	2.5
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.9	0.25
Nitrobenzene (NB)	18	2.5
2,4-Dinitrotoluene (2,4-DNT)	4.9	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	7.7	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	37	4
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	1.0	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	14	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

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3525 Piedmont Road
Atlanta, GA 30305

December 7, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56409-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S7-1.0/2.0, 10/15/94, 11:44, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	5.2	5.2
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.0
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.0
Total Chromium (Cr) (mg/kg) (EPA 6010A)	5.3	1.0
Total Copper (Cu) (mg/kg) (EPA 6010A)	17	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	11	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	125	4.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	10	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.0
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	46	2.1

BDL - Below Detection Limit

Report No. 56409-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	1.9	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.4	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	0.5	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	3.8	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

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December 7, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56409-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S7-2.5/3.5, 10/15/94, 11:53, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.3
Total Arsenic (As) (mg/kg) (EPA 7060)	7.4	3.8
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.3
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.3
Total Chromium (Cr) (mg/kg) (EPA 6010A)	19	1.3
Total Copper (Cu) (mg/kg) (EPA 6010A)	26	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	725	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	288	5.0
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	28	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.0
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.3
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	238	2.5

BDL - Below Detection Limit

Report No. 56409-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	910	25
1,3,5-Trinitrobenzene (1,3,5-TNB)	25	2.5
Nitrobenzene (NB)	13	2.6
2,4-Dinitrotoluene (2,4-DNT)	18	2.5
2,6-Dinitrotoluene (2,6-DNT)	14	2.6
4-Amino-2-nitrotoluene (4-Am-2-NT)	0.5	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	4
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	30	4
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	1.6	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	1.1	0.25
1,3-Dinitrobenzene (1,3-DNB)	2.5	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	20	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dlier

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LABORATORY REPORT

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December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56416-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S8-2.5/3.0, 10/15/94, 14:50, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	8.4	5.8
Total Arsenic (As) (mg/kg) (EPA 7060)	29	3.5
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	1.4	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	13	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	53	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	31	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	326	4.7
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	77	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.7
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.8
Total Zinc (Zn) (mg/kg) (EPA 6010A)	101	2.3

BDL - Below Detection Limit

Report No. 56416-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	14	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56416-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S9-1.5/2.7, 10/15/94, 15:41, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	8.1	5.9
Total Arsenic (As) (mg/kg) (EPA 7060)	22	3.5
Total Beryllium (Be) (mg/kg) (EPA 6010A)	1.4	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	1.4	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	20	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	47	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	39	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	588	4.7
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	49	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.7
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.9
Total Zinc (Zn) (mg/kg) (EPA 6010A)	106	2.4

BDL - Below Detection Limit

Report No. 56416-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	15	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56416-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S10-1.5/2.5, 10/15/94, 16:05, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	10.5	5.8
Total Arsenic (As) (mg/kg) (EPA 7060)	19	3.5
Total Beryllium (Be) (mg/kg) (EPA 6010A)	1.3	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	1.3	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	28	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	52	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	37	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	151	4.7
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	43	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.7
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.8
Total Zinc (Zn) (mg/kg) (EPA 6010A)	70	2.3

BDL - Below Detection Limit

Report No. 56416-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.9	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.8	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	1.6	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	14	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

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3525 Piedmont Road
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December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56416-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S11-2.5/3.5, 10/15/94, 16:26, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	11.0	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	20	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	1.3	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	13	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	46	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	25	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	190	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	61	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	93	2.4

BDL - Below Detection Limit

Report No. 56416-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	2.2	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1.3	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	3.8	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	16	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

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December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56416-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S12-1.0/2.0, 10/15/94, 16:45, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	10.6	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	9.9	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	10.7	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	48	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	21	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	333	4.6
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	39	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.6
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	63	2.3

BDL - Below Detection Limit

Report No. 56416-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	13	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56416-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S13-1.0/2.0, 10/15/94, 17:07, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	9.2	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	15	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	1.3	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	16	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	31	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	32	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	1609	4.6
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	55	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.6
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	79	2.3

BDL - Below Detection Limit

Report No. 56416-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	13	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

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December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56416-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S14-0.0/2.0, 10/15/94, 17:55, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.2
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.0
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.0
Total Chromium (Cr) (mg/kg) (EPA 6010A)	26	1.0
Total Copper (Cu) (mg/kg) (EPA 6010A)	5.5	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	8.2	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	220	4.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.9	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.0
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	168	2.1

BDL - Below Detection Limit

Report No. 56416-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	4.6	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

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December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56416-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S15-0.0/2.0, 10/15/94, 18:08, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.2
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.0
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.0
Total Chromium (Cr) (mg/kg) (EPA 6010A)	30	1.0
Total Copper (Cu) (mg/kg) (EPA 6010A)	4.1	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	145	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	248	4.1
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	11	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.1
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.0
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	114	2.1

BDL - Below Detection Limit

Report No. 56416-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	3.4	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

ASI

ANALYTICAL SERVICES, INC.

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LABORATORY REPORT

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December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56417-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S16-0.0/2.0, 10/16/94, 09:50, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.2
Total Arsenic (As) (mg/kg) (EPA 7060)	3.2	3.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL UJ	1.0
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.0
Total Chromium (Cr) (mg/kg) (EPA 6010A)	5.9	1.0
Total Copper (Cu) (mg/kg) (EPA 6010A)	6.5	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	12	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	178	4.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.7	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.0
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL ~~UJ~~ BCO 1-18-95	5.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	52	2.1

BDL - Below Detection Limit

Report No. 56417-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	4.4	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dlier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56417-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S17-0.0/1.5, 10/15/94, 18:05, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	6.4	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL ~~UJ~~ BKO 1.18.95	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	10.5	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	9.0	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	25	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	201	4.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	14	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL ~~UJ~~ BKO 1.18.95	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	91	2.1

BDL - Below Detection Limit

Report No. 56417-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	390	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	1.2	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.9	0.25
2,6-Dinitrotoluene (2,6-DNT)	1.3	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	3.0	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	2.0	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	5.6	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Deier

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LABORATORY REPORT

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December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56417-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S18-0.5/1.5, 10/16/94, 10:12, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	17	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	4.4	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL ~~UJ~~ BCQ 1.18.95	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	12	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	35	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	962	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	118	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.3	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL ~~UJ~~ BCQ 1.18.95	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	214	2.1

BDL - Below Detection Limit

Report No. 56417-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	20000	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	10	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	150	0.25
2,6-Dinitrotoluene (2,6-DNT)	170	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	0.3	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	11	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	2.5
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.7	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	6.4	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

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December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56417-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S19-0.5/2.0, 10/16/94, 10:38, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.1
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL ~~UJ~~ BLQ, .1845	1.0
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	1.2	1.0
Total Chromium (Cr) (mg/kg) (EPA 6010A)	5.9	1.0
Total Copper (Cu) (mg/kg) (EPA 6010A)	5.1	2.0
Total Lead (Pb) (mg/kg) (EPA 6010A)	174	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	99	4.1
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	7.4	2.0
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.1
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.0
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL UJ	5.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	154	2.0

BDL - Below Detection Limit

Report No. 56417-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	4.2	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	2.4	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deer

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LABORATORY REPORT

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December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56417-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S20-0.5/1.5, 10/16/94, 10:49, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.1
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL ~~UJ~~ BCQ 1.18.95	1.0
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.0
Total Chromium (Cr) (mg/kg) (EPA 6010A)	3.1	1.0
Total Copper (Cu) (mg/kg) (EPA 6010A)	6.8	2.0
Total Lead (Pb) (mg/kg) (EPA 6010A)	90	2.5
Total Manganese (Mn) (mg/kg) (EPA 6010A)	36	4.1
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.25
Total Nickel (Ni) (mg/kg) (EPA 6010A)	3.4	2.0
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.1
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.0
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL ~~UJ~~ BCQ 1.18.95	5.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	51	2.0

BDL - Below Detection Limit

Report No. 56417-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.4	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	1.7	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Weir

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LABORATORY REPORT

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Atlanta, GA 30305

December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56417-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S21-0.0/2.0, 10/16/94, 11:19, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL ~~UJ~~ BCQ 1.18.95	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	7.1	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	3.8	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	117	4.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.2	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL ~~UJ~~ BCQ 1.18.95	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	138	2.1

BDL - Below Detection Limit

Report No. 56417-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.3	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	5.8	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
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December 13, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56411-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S22-0.0/2.0, 10/16/94, 11:42, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	3.6	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	18	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	4.6	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	19	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	191	4.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	10.3	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	99	2.1

BDL - Below Detection Limit

Report No. 56411-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.4	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.9	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	5.7	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Deier

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LABORATORY REPORT

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December 13, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56411-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S23-0.0/2.0, 10/16/94, 11:57, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	4.5	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	3.4	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	8.4	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	33	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	105	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	348	4.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	8.9	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	116	2.1

BDL - Below Detection Limit

Report No. 56411-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.3	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	1.1	0.25
2,6-Dinitrotoluene (2,6-DNT)	2.2	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.4	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	5.2	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dela

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 13, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56411-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S24-0.0/1.5, 10/16/94, 14:29, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.5
Total Arsenic (As) (mg/kg) (EPA 7060)	10.9	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	20	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	166	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	354	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	110	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	33	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	71	2.2

BDL - Below Detection Limit

Report No. 56411-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.8	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	1600	25
2,6-Dinitrotoluene (2,6-DNT)	BDL	5.2
4-Amino-2-nitrotoluene (4-Am-2-NT)	0.4	0.25
3,4-Dinitrotoluene (3,4-DNT)	12	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	1.1	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	0.4	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	9.5	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

December 13, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56411-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S24-1.5/3.0, 10/16/94, 14:40, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.5
Total Arsenic (As) (mg/kg) (EPA 7060)	14	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	14	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	42	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	38	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	70	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	44	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	71	2.2

BDL - Below Detection Limit

Report No. 56411-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	2.7	0.26
2,4-Dinitrotoluene (2,4-DNT)	75	0.5
2,6-Dinitrotoluene (2,6-DNT)	0.9	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	4.2	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	8.8	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

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December 13, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56411-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S25-0/1.0, 10/16/94, 14:53, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	8.0	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	10.8	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	62	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	8111	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	94	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	33	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	54	2.2

BDL - Below Detection Limit

Report No. 56411-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.7	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	11000	0.25
2,6-Dinitrotoluene (2,6-DNT)	12000	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	0.5	0.25
3,4-Dinitrotoluene (3,4-DNT)	48	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	1.8	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	10	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dein

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December 13, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56411-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S26-0/1.5, 10/16/94, 15:18, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	7.5	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	13	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	35	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	1236	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	135	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	31	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	157	2.2

BDL - Below Detection Limit

Report No. 56411-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.5	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	7700	0.25
2,6-Dinitrotoluene (2,6-DNT)	8300	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	0.7	0.25
3,4-Dinitrotoluene (3,4-DNT)	470	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25
	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	11	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
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Atlanta, GA 30305

December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56417-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S27-2.5/3.5, 10/16/94, 11:19, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	9.0	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	16	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	1.3 ~~J~~ BCQ 1.18.95	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	12	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	57	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	29	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	268	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	80	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL ~~UJ~~ BCQ 1.18.95	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	134	2.4

BDL - Below Detection Limit

Report No. 56417-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	1.8	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1.1	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	3.3	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	18	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Olin

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LABORATORY REPORT

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December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56417-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S28-0.5/1.5, 10/16/94, 10:12, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	18	5.4
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL ~~UJ~~ BKO 1.18.95	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	16	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	205	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	1078	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	119	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.7	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL ~~UJ~~ BKO 1.18.95	5.4
Total Zinc (Zn) (mg/kg) (EPA 6010A)	873	2.2

BDL - Below Detection Limit

Report No. 56417-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	29000	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	14	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	810	0.25
2,6-Dinitrotoluene (2,6-DNT)	230	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	0.3	0.25
3,4-Dinitrotoluene (3,4-DNT)	0.6	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	2.5
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	2.5	2.5
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	1.0	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	7.2	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

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December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56448-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-S29-0.0/2.0, 10/16/94, 11:19, received 10/19/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.8
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	4.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.4
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.4
Total Chromium (Cr) (mg/kg) (EPA 6010A)	19	1.4
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.7
Total Lead (Pb) (mg/kg) (EPA 6010A)	9.6	3.4
Total Manganese (Mn) (mg/kg) (EPA 6010A)	219	5.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.34
Total Nickel (Ni) (mg/kg) (EPA 6010A)	13.2	2.7
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.4
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.8
Total Zinc (Zn) (mg/kg) (EPA 6010A)	205	2.7

BDL - Below Detection Limit

Report No. 56448-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	27	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

November 25, 1994

P.O. No. ATL - 4429

Attention: Ms. Debbie Raede

Report No. 56359-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S1-0.5/1.0, 10/12/94, 15:03, received 10/14/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	10.9	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	15	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	15	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	15	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	322	4.6
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	26	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.6
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	69	2.3

BDL - Below Detection Limit

Report No. 56359-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	13	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Daniel S. Oliver

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LABORATORY REPORT

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Atlanta, GA 30305

November 25, 1994

P.O. No. ATL - 4429

Attention: Ms. Debbie Raede

Report No. 56359-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S2-0.5/1.0, 10/12/94, 15:44, received 10/14/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	10.4	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	24	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	10.0	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	23	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	310	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	36	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	76	2.4

BDL - Below Detection Limit

Report No. 56359-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	16	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

November 25, 1994

P.O. No. ATL - 4429

Attention: Ms. Debbie Raede

Report No. 56359-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S3-0.0/1.5, 10/13/94, 09:00, received 10/14/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.5
Total Arsenic (As) (mg/kg) (EPA 7060)	5.7	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	10.9	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	11	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	79	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	231	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	13	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	86	2.2

BDL - Below Detection Limit

Report No. 56359-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.8	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	9	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Oliver

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LABORATORY REPORT

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November 25, 1994

P.O. No. ATL - 4429

Attention: Ms. Debbie Raede

Report No. 56359-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S3-1.5/3.5, 10/13/94, 09:30, received 10/14/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.4
Total Arsenic (As) (mg/kg) (EPA 7060)	4.2	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	10.4	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	19	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	85	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	194	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.4	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.4
Total Zinc (Zn) (mg/kg) (EPA 6010A)	94	2.2

BDL - Below Detection Limit

Report No. 56359-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	7	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deir

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LABORATORY REPORT

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November 25, 1994

P.O. No. ATL - 4429

Attention: Ms. Debbie Raede

Report No. 56359-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S4-0.0/1.5, 10/13/94, 10:16, received 10/14/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	5.9	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	15	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	9.5	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	173	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	333	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	20	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	99	2.5

BDL - Below Detection Limit

Report No. 56359-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.6	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dein

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ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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LABORATORY REPORT

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3525 Piedmont Road
Atlanta, GA 30305

November 25, 1994

P.O. No. ATL - 4429

Attention: Ms. Debbie Raede

Report No. 56359-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S4-1.5/5.0, 10/13/94, 10:47, received 10/14/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	6.7	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	18	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	10.0	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	16	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	386	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	26	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	67	2.3

BDL - Below Detection Limit

Report No. 56359-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	12	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Ellis

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LABORATORY REPORT

Dames & Moore - Atlanta
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November 25, 1994

P.O. No. ATL - 4429

Attention: Ms. Debbie Raede

Report No. 56359-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S5-0.0/1.5, 10/13/94, 11:20, received 10/14/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	5.3	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	15	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	8.1	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	51	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	236	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	0.98	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	17	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	71	2.2

BDL - Below Detection Limit

Report No. 56359-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	11	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

November 25, 1994

P.O. No. ATL - 4429

Attention: Ms. Debbie Raede

Report No. 56359-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S5-1.5/5.0, 10/13/94, 12:05, received 10/14/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	7.4	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	22	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	8.0	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	20	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	367	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	26	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	62	2.2

BDL - Below Detection Limit

Report No. 56359-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	10	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

November 25, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56356-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S6-0.0/1.5, 10/13/94, 14:52, received 10/14/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	7.0	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	6.0	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	14	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	18	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	23	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	356	4.6
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	23	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.6
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	74	2.3

BDL - Below Detection Limit

Report No. 56356-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	13	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

November 25, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56356-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S6-1.5/4.5, 10/13/94, 15:14, received 10/14/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	7.2	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	7.4	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	19	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	6.2	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	15	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	618	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	29	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	70	2.2

BDL - Below Detection Limit

Report No. 56356-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	11	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dein

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LABORATORY REPORT

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Atlanta, GA 30305

November 25, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56356-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S7-0.5/1.0, 10/13/94, 15:58, received 10/14/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.3
Total Arsenic (As) (mg/kg) (EPA 7060)	6.2	3.8
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.3
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.3
Total Chromium (Cr) (mg/kg) (EPA 6010A)	14	1.3
Total Copper (Cu) (mg/kg) (EPA 6010A)	8.4	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	18	3.2
Total Manganese (Mn) (mg/kg) (EPA 6010A)	456	5.1
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.32
Total Nickel (Ni) (mg/kg) (EPA 6010A)	23	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.1
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.3
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	61	2.5

BDL - Below Detection Limit

Report No. 56356-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	21	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Olin

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LABORATORY REPORT

Dames & Moore - Atlanta
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November 25, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56356-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S8-0.5/1.0, 10/13/94, 16:20, received 10/14/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.9
Total Arsenic (As) (mg/kg) (EPA 7060)	7.5	4.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.4
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.4
Total Chromium (Cr) (mg/kg) (EPA 6010A)	21	1.4
Total Copper (Cu) (mg/kg) (EPA 6010A)	9.7	2.8
Total Lead (Pb) (mg/kg) (EPA 6010A)	19	3.5
Total Manganese (Mn) (mg/kg) (EPA 6010A)	472	5.6
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.35
Total Nickel (Ni) (mg/kg) (EPA 6010A)	31	2.8
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.6
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.4
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.9
Total Zinc (Zn) (mg/kg) (EPA 6010A)	79	2.8

BDL - Below Detection Limit

Report No. 56356-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	1.2	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	0.3	0.26
2,4-Dinitrotoluene (2,4-DNT)	7.6	0.25
2,6-Dinitrotoluene (2,6-DNT)	1.9	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	1.2	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	0.4	0.25
2-Nitrotoluene (2-NT)	1.1	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	28	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dein

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

November 25, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56356-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S9-0.5/1.0, 10/13/94, 16:50, received 10/14/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	9.5	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	15	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	13	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	18	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	512	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	30	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	70	2.4

BDL - Below Detection Limit

Report No. 56356-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	16	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Olier

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LABORATORY REPORT

Dames & Moore - Atlanta
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Atlanta, GA 30305

November 25, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56390-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S10-2.5/3.5, 10/14/94, 09:07, received 10/15/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	8.0	5.5
Total Arsenic (As) (mg/kg) (EPA 7060)	7.6	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	22	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	9.1	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	22	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	824	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	34	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	67	2.2

BDL - Below Detection Limit

Report No. 56390-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	9	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Blair

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

November 25, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56390-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S11-2.5/3.5, 10/14/94, 09:50, received 10/15/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	7.2	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	8.3	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	24	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	15	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	20	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	663	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	39	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	135	2.2

BDL - Below Detection Limit

Report No. 56390-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	11	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Blier

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

November 25, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56390-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S12-2.3/3.5, 10/14/94, 10:45, received 10/15/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.4
Total Arsenic (As) (mg/kg) (EPA 7060)	8.5	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	23	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	5.5	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	14	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	598	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	34	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.4
Total Zinc (Zn) (mg/kg) (EPA 6010A)	74	2.2

BDL - Below Detection Limit

Report No. 56390-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	8	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dion

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

November 25, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56390-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S13-2.5/3.5, 10/14/94, 11:10, received 10/15/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.1	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	9.2	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	244	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	14	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	39	2.2

BDL - Below Detection Limit

Report No. 56390-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	10	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

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3525 Piedmont Road
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November 25, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56390-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S14-1.0/2.0, 10/14/94, 11:29, received 10/15/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	6.0	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	4.5	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	137	4.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	5.7	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	20	2.1

BDL - Below Detection Limit

Report No. 56390-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	5	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise V. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

November 25, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56390-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S15-1.0/2.0, 10/14/94, 11:42, received 10/15/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	9.0	5.2
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.0
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.0
Total Chromium (Cr) (mg/kg) (EPA 6010A)	8.6	1.0
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	6.4	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	98	4.1
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	7.2	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.1
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.0
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	25	2.1

BDL - Below Detection Limit

Report No. 56390-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	3	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 13, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56411-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S16-0.5/~~2.0~~ 1.0 alr, 10/16/94, 16:37, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	15	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	8.0	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	15	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	642	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	36	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	22	2.5

BDL - Below Detection Limit

Report No. 56411-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	1.0	0.25
2,6-Dinitrotoluene (2,6-DNT)	1.0	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 15, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56447-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S17-0.0/1.5, 10/16/94, 17:29, received 10/19/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	13.2 J	7.4
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	4.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.5
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.5
Total Chromium (Cr) (mg/kg) (EPA 6010A)	7.8	1.5
Total Copper (Cu) (mg/kg) (EPA 6010A)	7.1	2.9
Total Lead (Pb) (mg/kg) (EPA 6010A)	75	3.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	1074	5.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.37
Total Nickel (Ni) (mg/kg) (EPA 6010A)	12.6	2.9
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL UJ	1.5
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	7.4
Total Zinc (Zn) (mg/kg) (EPA 6010A)	144	2.9

BDL - Below Detection Limit

Report No. 56447-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	32	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY • NORCROSS, GA 30092 • (404) 734-4200

FAX (404) 734-4201 • Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 15, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56447-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S18-0.0/1.5, 10/16/94, 17:51, received 10/19/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	8.1	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	6.0	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	5.2	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	5.9	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	35	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	1376	4.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	8.5	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	72	2.1

BDL - Below Detection Limit

Report No. 56447-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	5.5	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 15, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56447-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S19-0.5/2.0, 10/17/94, 08:52, received 10/19/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	5.5	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	3.2	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	5.9	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	4.5	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	90	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	925	4.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	7.8	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	80	2.1

BDL - Below Detection Limit

Report No. 56447-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	4.9	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

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6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 15, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56447-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S20-0.0/1.25, 10/17/94, 08:58, received 10/19/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.2
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.0
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.0
Total Chromium (Cr) (mg/kg) (EPA 6010A)	5.8	1.0
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	12	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	325	4.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	5.7	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.0
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	25	2.1

BDL - Below Detection Limit

Report No. 56447-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	4.5	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Daniel S. Dier

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LABORATORY REPORT

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6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 15, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56447-9

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S21-0.5/1.0, 10/16/94, 17:06, received 10/19/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	20	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	10.1	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	830	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	15	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	35	2.3

BDL - Below Detection Limit

Report No. 56447-9

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	12	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 20, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56491-10

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S22-0.5/1.0, 10/19/94, 14:05, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	7.6	5.8
Total Arsenic (As) (mg/kg) (EPA 7060)	9.0	3.5
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	21	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	13	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	22	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	756	4.7
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	45	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.7
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.8
Total Zinc (Zn) (mg/kg) (EPA 6010A)	90	2.3

BDL - Below Detection Limit

Report No. 56491-10

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	2.7	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	8.7	0.25
2,6-Dinitrotoluene (2,6-DNT)	1.0	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	0.4	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1.0	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	4.7	0.25
2-Nitrotoluene (2-NT)	2.7	0.25
3-Nitrotoluene (3-NT)	0.5	0.25
4-Nitrotoluene (4-NT)	0.4	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	0.4	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	14	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 15, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56447-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S23-0.0/2.0, 10/17/94, 09:54, received 10/19/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.8
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	4.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.4
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.4
Total Chromium (Cr) (mg/kg) (EPA 6010A)	6.6	1.4
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.7
Total Lead (Pb) (mg/kg) (EPA 6010A)	6.0	3.4
Total Manganese (Mn) (mg/kg) (EPA 6010A)	164	5.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.34
Total Nickel (Ni) (mg/kg) (EPA 6010A)	7.8	2.7
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.4
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.8
Total Zinc (Zn) (mg/kg) (EPA 6010A)	29	2.7

BDL - Below Detection Limit

Report No. 56447-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	27	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

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Atlanta, GA 30305

December 15, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56447-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S24-0.0/1.75, 10/17/94, 10:15, received 10/19/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL UJ	5.1
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.0
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.0
Total Chromium (Cr) (mg/kg) (EPA 6010A)	17	1.0
Total Copper (Cu) (mg/kg) (EPA 6010A)	26	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	19	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	123	4.1
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	6.4	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.1
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL UJ	1.0
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	71	2.1

BDL - Below Detection Limit

Report No. 56447-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	2.8	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise N. Olin

ASI

ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
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Atlanta, GA 30305

December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56448-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S25-0.0/1.2, 10/17/94, 11:20, received 10/19/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.2
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.0
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.0
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11	1.0
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	125	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	188	4.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	7.6	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.0
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	49	2.1

BDL - Below Detection Limit

Report No. 56448-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	4.2	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56448-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S26-0.0/1.3, 10/17/94, 11:47, received 10/19/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	24	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	34	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	330	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	15	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	44	2.1

BDL - Below Detection Limit

Report No. 56448-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.5	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.3	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.4	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	0.4	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	6.1	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 13, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56411-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S27-0.5/1.0, 10/16/94, 16:37, received 10/18/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	20	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	8.0	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	617	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	31	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	23	2.5

BDL - Below Detection Limit

Report No. 56411-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.5	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.4	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 15, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56447-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S28-0.0/1.5, 10/16/94, 17:51, received 10/19/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	5.8	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	4.8	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	5.8	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	7.0	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	32	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	1682	4.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	10.1	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	77	2.1

BDL - Below Detection Limit

Report No. 56447-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	4.9	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dlin

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LABORATORY REPORT

Dames & Moore - Atlanta
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December 15, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56447-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-S29-0.0/2.0, 10/17/94, 09:54, received 10/19/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.1
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.0
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.0
Total Chromium (Cr) (mg/kg) (EPA 6010A)	5.2	1.0
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	5.6	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	123	4.1
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	5.3	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.1
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.0
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	20	2.1

BDL - Below Detection Limit

Report No. 56447-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	2.6	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

LABORATORY REPORTS

BACKGROUND SOIL BORINGS

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ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56810-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S1-0.5/3.0, 10/30/94, 10:39, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.4
Total Arsenic (As) (mg/kg) (EPA 7060)	6.8	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.6	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	8.5	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	270	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	13	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.4
Total Zinc (Zn) (mg/kg) (EPA 6010A)	41	2.2

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	8	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	22
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	22
Carbon disulfide	BDL	22
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	11
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	11
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	1.4	1
Vinyl acetate	BDL	11
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	11
1,2-Dibromoethane	BDL	11

Tentatively identified compounds (EPA 8240)	Estimated Conc. (ug/kg)	
Hexacosane	10	-

Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	720
2-Chlorophenol	BDL	360
2,4-Dichlorophenol	BDL	360
2,4-Dimethylphenol	BDL	360
4,6-Dinitro-2-methylphenol	BDL	1790
2,4-Dinitrophenol	BDL	1790
2-Methylphenol	BDL	360
3-Methylphenol	BDL	360
4-Methylphenol	BDL	360

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-1

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
2-Nitrophenol	BDL	360
4-Nitrophenol	BDL	1790
Pentachlorophenol	BDL	1790
Phenol	BDL	360
2,4,5-Trichlorophenol	BDL	360
2,4,6-Trichlorophenol	BDL	360
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	360
Acenaphthylene	BDL	360
Anthracene	BDL	360
Benzoic Acid	BDL	1790
Benzo(a)anthracene	BDL	360
Benzo(b)fluoranthene	BDL	360
Benzo(k)fluoranthene	BDL	360
Benzo(ghi)perylene	BDL	360
Benzo(a)pyrene	BDL	360
Benzyl Alcohol	BDL	720
Bis(2-chloroethoxy)methane	BDL	360
Bis(2-chloroethyl)ether	BDL	360
Bis(2-chloroisopropyl)ether	BDL	360
Bis(2-ethylhexyl)phthalate	BDL	360
4-Bromophenyl phenyl ether	BDL	360
Benzyl butyl phthalate	BDL	360
4-Chloroaniline	BDL	720
2-Chloronaphthalene	BDL	360
4-Chlorophenyl phenyl ether	BDL	360
Chrysene	BDL	360
Dibenzo(a,h)anthracene	BDL	360
Dibenzofuran	BDL	360
Di-n-butylphthalate	BDL	360
1,3-Dichlorobenzene	BDL	360
1,4-Dichlorobenzene	BDL	360
1,2-Dichlorobenzene	BDL	360
3,3'-Dichlorobenzidine	BDL	720
Diethylphthalate	BDL	360

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	360
2,4-Dinitrotoluene	BDL	360
2,6-Dinitrotoluene	BDL	360
Di-n-octylphthalate	BDL	360
Fluoranthene	BDL	360
Fluorene	BDL	360
Hexachlorobenzene	BDL	360
Hexachlorobutadiene	BDL	360
Hexachlorocyclopentadiene	BDL	360
Hexachloroethane	BDL	360
Indeno(1,2,3-cd)pyrene	BDL	360
Isophorone	BDL	360
2-Methylnaphthalene	BDL	360
Naphthalene	BDL	360
2-Nitroaniline	BDL	1790
3-Nitroaniline	BDL	1790
4-Nitroaniline	BDL	720
Nitrobenzene	BDL	360
N-Nitrosodiphenylamine	BDL	360
N-Nitrosodi-n-propylamine	BDL	360
Phenanthrene	BDL	360
Pyrene	BDL	360
1,2,4-Trichlorobenzene	BDL	360

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	
n-Nonacosane (C29)	340	-
n-Hentriacontane (C31)	330	-
Diacetone alcohol (Aldol-condensation product)	250	-
n-Heptacosane (C27)	240	-
unknown natural product, BP=204	240	-
n-Pentacosane (C25)	150	-

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Ellis

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56810-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S1-3.0/5.0, 10/30/94, 11:00, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	10	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	14	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	5.2	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	9.5	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	400	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	16	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	39	2.3

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	12	1

Volatile Organics (EPA 8240)

	(ug/kg)	(ug/kg)
Acetone	BDL	23
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	23
Carbon disulfide	BDL	23
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-2

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	11
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	11
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	2.2	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	11
Vinyl chloride	BDL	0.5
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	11
1,2-Dibromoethane	BDL	11

Tentatively identified compounds (EPA 8240)	Estimated Conc. (ug/kg)	
Unknown	13	-
Decanal	11	-

Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	750
2-Chlorophenol	BDL	380
2,4-Dichlorophenol	BDL	380
2,4-Dimethylphenol	BDL	380
4,6-Dinitro-2-methylphenol	BDL	1880
2,4-Dinitrophenol	BDL	1880
2-Methylphenol	BDL	380
3-Methylphenol	BDL	380

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-2

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
4-Methylphenol	BDL	380
2-Nitrophenol	BDL	380
4-Nitrophenol	BDL	1880
Pentachlorophenol	BDL	1880
Phenol	BDL	380
2,4,5-Trichlorophenol	BDL	380
2,4,6-Trichlorophenol	BDL	380
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	380
Acenaphthylene	BDL	380
Anthracene	BDL	380
Benzoic Acid	BDL	1880
Benzo(a)anthracene	BDL	380
Benzo(b)fluoranthene	BDL	380
Benzo(k)fluoranthene	BDL	380
Benzo(ghi)perylene	BDL	380
Benzo(a)pyrene	BDL	380
Benzyl Alcohol	BDL	750
Bis(2-chloroethoxy)methane	BDL	380
Bis(2-chloroethyl)ether	BDL	380
Bis(2-chloroisopropyl)ether	BDL	380
Bis(2-ethylhexyl)phthalate	410	380
4-Bromophenyl phenyl ether	BDL	380
Benzyl butyl phthalate	BDL	380
4-Chloroaniline	BDL	750
2-Chloronaphthalene	BDL	380
4-Chlorophenyl phenyl ether	BDL	380
Chrysene	BDL	380
Dibenzo(a,h)anthracene	BDL	380
Dibenzofuran	BDL	380
Di-n-butylphthalate	BDL	380
1,3-Dichlorobenzene	BDL	380
1,4-Dichlorobenzene	BDL	380
1,2-Dichlorobenzene	BDL	380
3,3'-Dichlorobenzidine	BDL	750
Diethylphthalate	BDL	380

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-2

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	380
2,4-Dinitrotoluene	BDL	380
2,6-Dinitrotoluene	BDL	380
Di-n-octylphthalate	BDL	380
Fluoranthene	BDL	380
Fluorene	BDL	380
Hexachlorobenzene	BDL	380
Hexachlorobutadiene	BDL	380
Hexachlorocyclopentadiene	BDL	380
Hexachloroethane	BDL	380
Indeno(1,2,3-cd)pyrene	BDL	380
Isophorone	BDL	380
2-Methylnaphthalene	BDL	380
Naphthalene	BDL	380
2-Nitroaniline	BDL	1880
3-Nitroaniline	BDL	1880
4-Nitroaniline	BDL	750
Nitrobenzene	BDL	380
N-Nitrosodiphenylamine	BDL	380
N-Nitrosodi-n-propylamine	BDL	380
Phenanthrene	BDL	380
Pyrene	BDL	380
1,2,4-Trichlorobenzene	BDL	380

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	
Diacetone alcohol (Aldol-condensation product)	260	-
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	150	-

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56810-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S2-0.5/3.0, 10/30/94, 11:40, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	6.3	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	8.4	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	17	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	2.3	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	11	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	340	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	16	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	51	2.2

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	10	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	22
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	22
Carbon disulfide	BDL	22
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-3

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	11
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	11
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	11
Vinyl chloride	BDL	0.4
Xylenes	1.2	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	11
1,2-Dibromoethane	BDL	11
Tentatively identified compounds (EPA 8240)	None found	-

Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	730
2-Chlorophenol	BDL	370
2,4-Dichlorophenol	BDL	370
2,4-Dimethylphenol	BDL	370
4,6-Dinitro-2-methylphenol	BDL	1830
2,4-Dinitrophenol	BDL	1830
2-Methylphenol	BDL	370
3-Methylphenol	BDL	370
4-Methylphenol	BDL	370
2-Nitrophenol	BDL	370
4-Nitrophenol	BDL	1830

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-3

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Pentachlorophenol	BDL	1830
Phenol	BDL	370
2,4,5-Trichlorophenol	BDL	370
2,4,6-Trichlorophenol	BDL	370
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	370
Acenaphthylene	BDL	370
Anthracene	BDL	370
Benzoic Acid	BDL	1830
Benzo(a)anthracene	BDL	370
Benzo(b)fluoranthene	BDL	370
Benzo(k)fluoranthene	BDL	370
Benzo(ghi)perylene	BDL	370
Benzo(a)pyrene	BDL	370
Benzyl Alcohol	BDL	730
Bis(2-chloroethoxy)methane	BDL	370
Bis(2-chloroethyl)ether	BDL	370
Bis(2-chloroisopropyl)ether	BDL	370
Bis(2-ethylhexyl)phthalate	BDL	370
4-Bromophenyl phenyl ether	BDL	370
Benzyl butyl phthalate	BDL	370
4-Chloroaniline	BDL	730
2-Chloronaphthalene	BDL	370
4-Chlorophenyl phenyl ether	BDL	370
Chrysene	BDL	370
Dibenzo(a,h)anthracene	BDL	370
Dibenzofuran	BDL	370
Di-n-butylphthalate	BDL	370
1,3-Dichlorobenzene	BDL	370
1,4-Dichlorobenzene	BDL	370
1,2-Dichlorobenzene	BDL	370
3,3'-Dichlorobenzidine	BDL	730
Diethylphthalate	BDL	370

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-3

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	370
2,4-Dinitrotoluene	BDL	370
2,6-Dinitrotoluene	BDL	370
Di-n-octylphthalate	BDL	370
Fluoranthene	BDL	370
Fluorene	BDL	370
Hexachlorobenzene	BDL	370
Hexachlorobutadiene	BDL	370
Hexachlorocyclopentadiene	BDL	370
Hexachloroethane	BDL	370
Indeno(1,2,3-cd)pyrene	BDL	370
Isophorone	BDL	370
2-Methylnaphthalene	BDL	370
Naphthalene	BDL	370
2-Nitroaniline	BDL	1830
3-Nitroaniline	BDL	1830
4-Nitroaniline	BDL	730
Nitrobenzene	BDL	370
N-Nitrosodiphenylamine	BDL	370
N-Nitrosodi-n-propylamine	BDL	370
Phenanthrene	BDL	370
Pyrene	BDL	370
1,2,4-Trichlorobenzene	BDL	370

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	
Ethylene glycol phenyl ether	510	-
Diacetone alcohol (Aldol-condensation product)	340	-
unknown fatty aldehyde	300	-
2,2-Dimethyl-1-(2-hydroxy-1-methylethyl) propyl isobutyrate	160	-
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	160	-

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56810-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S2-3.0/5.0, 10/30/94, 12:05, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.8
Total Arsenic (As) (mg/kg) (EPA 7060)	12	3.5
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	17	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	4.0	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	9.9	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	314	4.7
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	17	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.7
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.8
Total Zinc (Zn) (mg/kg) (EPA 6010A)	45	2.3

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	14	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	23
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	23
Carbon disulfide	BDL	23
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-4

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	12
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	12
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	1.3	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	4.5	1
Vinyl acetate	BDL	12
Vinyl chloride	BDL	0.5
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	12
1,2-Dibromoethane	BDL	12

Tentatively identified compounds (EPA 8240)	Estimated Conc. (ug/kg)	
2,2,3,4,6,6-hexamethyl Heptane	26	-
3,7-dimethyl Nonane	20	-
2,2-dimethyl Heptane	15	-
Unknown	9	-
4,5-dimethyl Nonane	7	-
2,2,4-trimethyl Heptane	7	-

Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	770
2-Chlorophenol	BDL	380
2,4-Dichlorophenol	BDL	380
2,4-Dimethylphenol	BDL	380

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-4

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
4,6-Dinitro-2-methylphenol	BDL	1920
2,4-Dinitrophenol	BDL	1920
2-Methylphenol	BDL	380
3-Methylphenol	BDL	380
4-Methylphenol	BDL	380
2-Nitrophenol	BDL	380
4-Nitrophenol	BDL	1920
Pentachlorophenol	BDL	1920
Phenol	BDL	380
2,4,5-Trichlorophenol	BDL	380
2,4,6-Trichlorophenol	BDL	380
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	380
Acenaphthylene	BDL	380
Anthracene	BDL	380
Benzoic Acid	BDL	1920
Benzo(a)anthracene	BDL	380
Benzo(b)fluoranthene	BDL	380
Benzo(k)fluoranthene	BDL	380
Benzo(ghi)perylene	BDL	380
Benzo(a)pyrene	BDL	380
Benzyl Alcohol	BDL	770
Bis(2-chloroethoxy)methane	BDL	380
Bis(2-chloroethyl)ether	BDL	380
Bis(2-chloroisopropyl)ether	BDL	380
Bis(2-ethylhexyl)phthalate	BDL	380
4-Bromophenyl phenyl ether	BDL	380
Benzyl butyl phthalate	BDL	380
4-Chloroaniline	BDL	770
2-Chloronaphthalene	BDL	380
4-Chlorophenyl phenyl ether	BDL	380
Chrysene	BDL	380
Dibenzo(a,h)anthracene	BDL	380
Dibenzofuran	BDL	380
Di-n-butylphthalate	BDL	380
1,3-Dichlorobenzene	BDL	380
1,4-Dichlorobenzene	BDL	380
1,2-Dichlorobenzene	BDL	380
3,3'-Dichlorobenzidine	BDL	770
Diethylphthalate	BDL	380

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-4

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	380
2,4-Dinitrotoluene	BDL	380
2,6-Dinitrotoluene	BDL	380
Di-n-octylphthalate	BDL	380
Fluoranthene	BDL	380
Fluorene	BDL	380
Hexachlorobenzene	BDL	380
Hexachlorobutadiene	BDL	380
Hexachlorocyclopentadiene	BDL	380
Hexachloroethane	BDL	380
Indeno(1,2,3-cd)pyrene	BDL	380
Isophorone	BDL	380
2-Methylnaphthalene	BDL	380
Naphthalene	BDL	380
2-Nitroaniline	BDL	1920
3-Nitroaniline	BDL	1920
4-Nitroaniline	BDL	770
Nitrobenzene	BDL	380
N-Nitrosodiphenylamine	BDL	380
N-Nitrosodi-n-propylamine	BDL	380
Phenanthrene	BDL	380
Pyrene	BDL	380
1,2,4-Trichlorobenzene	BDL	380

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	
Ethylene glycol phenyl ether	700	-
Diacetone alcohol (Aldol-condensation product)	510	-
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	200	-
2,2-Dimethyl-1-(2-hydroxy-1-methylethyl propyl isobutyrate	190	-
unknown C6 alcohol	150	-

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Oliver

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ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56894-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S3-0.5/3.0, 11/1/94, 08:15, received 11/3/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.4
Total Arsenic (As) (mg/kg) (EPA 7060)	3.5	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	6.2	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	5.3	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	152	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.0	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.4
Total Zinc (Zn) (mg/kg) (EPA 6010A)	43	2.2

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

 Report No. 56894-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	8	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	22
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	22
Carbon disulfide	BDL	22
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1
Chloromethane	BDL	2

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	11
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	11
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	1.7	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	11
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	11
1,2-Dibromoethane	BDL	11

Tentatively identified compounds (EPA 8240) None found

Acid Extractable Organics (EPA 8270)	(ug/kg)	(ug/kg)
4-Chloro-3-methylphenol	BDL	720
2-Chlorophenol	BDL	360
2,4-Dichlorophenol	BDL	360
2,4-Dimethylphenol	BDL	360
4,6-Dinitro-2-methylphenol	BDL	1790
2,4-Dinitrophenol	BDL	1790
2-Methylphenol	BDL	360

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-1

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
3-Methylphenol	BDL	360
4-Methylphenol	BDL	360
2-Nitrophenol	BDL	360
4-Nitrophenol	BDL	1790
Pentachlorophenol	BDL	1790
Phenol	BDL	360
2,4,5-Trichlorophenol	BDL	360
2,4,6-Trichlorophenol	BDL	360
Base/Neutral Extractable Organics (EPA 8270)	**(ug/kg)**	**(ug/kg)**
Acenaphthene	BDL	360
Acenaphthylene	BDL	360
Anthracene	BDL	360
Benzoic Acid	BDL	1790
Benzo(a)anthracene	BDL	360
Benzo(b)fluoranthene	BDL	360
Benzo(k)fluoranthene	BDL	360
Benzo(ghi)perylene	BDL	360
Benzo(a)pyrene	BDL	360
Benzyl Alcohol	BDL	720
Bis(2-chloroethoxy)methane	BDL	360
Bis(2-chloroethyl)ether	BDL	360
Bis(2-chloroisopropyl)ether	BDL	360
Bis(2-ethylhexyl)phthalate	BDL	360
4-Bromophenyl phenyl ether	BDL	360
Benzyl butyl phthalate	BDL	360
4-Chloroaniline	BDL	720
2-Chloronaphthalene	BDL	360
4-Chlorophenyl phenyl ether	BDL	360
Chrysene	BDL	360
Dibenzo(a,h)anthracene	BDL	360
Dibenzofuran	BDL	360
Di-n-butylphthalate	BDL	360
1,3-Dichlorobenzene	BDL	360
1,4-Dichlorobenzene	BDL	360
1,2-Dichlorobenzene	BDL	360
3,3'-Dichlorobenzidine	BDL	720
Diethylphthalate	BDL	360

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	360
2,4-Dinitrotoluene	BDL	360
2,6-Dinitrotoluene	BDL	360
Di-n-octylphthalate	BDL	360
Fluoranthene	BDL	360
Fluorene	BDL	360
Hexachlorobenzene	BDL	360
Hexachlorobutadiene	BDL	360
Hexachlorocyclopentadiene	BDL	360
Hexachloroethane	BDL	360
Indeno(1,2,3-cd)pyrene	BDL	360
Isophorone	BDL	360
2-Methylnaphthalene	BDL	360
Naphthalene	BDL	360
2-Nitroaniline	BDL	1790
3-Nitroaniline	BDL	1790
4-Nitroaniline	BDL	720
Nitrobenzene	BDL	360
N-Nitrosodiphenylamine	BDL	360
N-Nitrosodi-n-propylamine	BDL	360
Phenanthrene	BDL	360
Pyrene	BDL	360
1,2,4-Trichlorobenzene	BDL	360

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)
unknown natural product, BP=204	870
unknown natural product, BP=189	520

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deer

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56894-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S3-3.0/4.0, 11/1/94, 09:00, received 11/3/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.5
Total Arsenic (As) (mg/kg) (EPA 7060)	15	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	13	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	35	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	24	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	154	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	33	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	187	2.2

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	9	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	22
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	22
Carbon disulfide	BDL	22
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-2

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	11
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	11
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	1.9	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	11
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	11
1,2-Dibromoethane	BDL	11

Tentatively identified compounds (EPA 8240)	Estimated Conc. (ug/kg)
1-chloro-Tetradecane	77
2-methyl-Heptane	64
3-methyl-Heptane	43
Heptane	36
Unknown	30
4-methyl-Octane	24
3-methyl-Hexane	13
1-ethyl-4-methyl-,trans-Cyclohexane	13
Unknown	13
3-methyl-Octane	12

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-2

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
4-Chloro-3-methylphenol	BDL	730
2-Chlorophenol	BDL	360
2,4-Dichlorophenol	BDL	360
2,4-Dimethylphenol	BDL	360
4,6-Dinitro-2-methylphenol	BDL	1810
2,4-Dinitrophenol	BDL	1810
2-Methylphenol	BDL	360
3-Methylphenol	BDL	360
4-Methylphenol	BDL	360
2-Nitrophenol	BDL	360
4-Nitrophenol	BDL	1810
Pentachlorophenol	BDL	1810
Phenol	BDL	360
2,4,5-Trichlorophenol	BDL	360
2,4,6-Trichlorophenol	BDL	360

Base/Neutral Extractable Organics (EPA 8270)	(ug/kg)	(ug/kg)
Acenaphthene	BDL	360
Acenaphthylene	BDL	360
Anthracene	BDL	360
Benzoic Acid	BDL	1810
Benzo(a)anthracene	BDL	360
Benzo(b)fluoranthene	BDL	360
Benzo(k)fluoranthene	BDL	360
Benzo(ghi)perylene	BDL	360
Benzo(a)pyrene	BDL	360
Benzyl Alcohol	BDL	730
Bis(2-chloroethoxy)methane	BDL	360
Bis(2-chloroethyl)ether	BDL	360
Bis(2-chloroisopropyl)ether	BDL	360
Bis(2-ethylhexyl)phthalate	BDL	360
4-Bromophenyl phenyl ether	BDL	360
Benzyl butyl phthalate	BDL	360
4-Chloroaniline	BDL	730
2-Chloronaphthalene	BDL	360
4-Chlorophenyl phenyl ether	BDL	360
Chrysene	BDL	360
Dibenzo(a,h)anthracene	BDL	360
Dibenzofuran	BDL	360
Di-n-butylphthalate	BDL	360

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-2

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
1,3-Dichlorobenzene	BDL	360
1,4-Dichlorobenzene	BDL	360
1,2-Dichlorobenzene	BDL	360
3,3'-Dichlorobenzidine	BDL	730
Diethylphthalate	BDL	360
Dimethylphthalate	BDL	360
2,4-Dinitrotoluene	BDL	360
2,6-Dinitrotoluene	BDL	360
Di-n-octylphthalate	BDL	360
Fluoranthene	BDL	360
Fluorene	BDL	360
Hexachlorobenzene	BDL	360
Hexachlorobutadiene	BDL	360
Hexachlorocyclopentadiene	BDL	360
Hexachloroethane	BDL	360
Indeno(1,2,3-cd)pyrene	BDL	360
Isophorone	BDL	360
2-Methylnaphthalene	BDL	360
Naphthalene	BDL	360
2-Nitroaniline	BDL	1810
3-Nitroaniline	BDL	1810
4-Nitroaniline	BDL	730
Nitrobenzene	BDL	360
N-Nitrosodiphenylamine	BDL	360
N-Nitrosodi-n-propylamine	BDL	360
Phenanthrene	BDL	360
Pyrene	BDL	360
1,2,4-Trichlorobenzene	BDL	360

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)
n-Undecane (C11)	850
n-Decane (C10)	850
n-Nonane (C9)	700
n-Dodecane (C12)	690
n-Tridecane (C13)	650
n-Pentadecane (C15)	570
Ethylene glycol phenyl ether	560
n-Tetradecane (C14)	500

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-2

RESULTS

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)
Methyl Carbitol + unknown C10 cycloparaffin..	460
n-Hexadecane (C16).....	420
unknown C11 isoparaffinic hydrocarbon.....	350
unknown natural product, BP=69, MW=316.....	320
unknown C13 isoparaffinic hydrocarbon.....	310
Dodecanoic acid.....	300
unknown C10 cycloparaffinic hydrocarbons.....	300
unknown C15 isoparaffinic hydrocarbon.....	300
unknown C10 isoparaffinic hydrocarbon.....	290
unknown C13 isoparaffinic hydrocarbon.....	250
unknown C18 isoparaffinic hydrocarbon.....	240
n-Heptadecane (C17).....	240

Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Deier

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110 TECHNOLOGY PARKWAY • NORCROSS, GA 30092 • (404) 734-4200

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56812-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S4-0.5/3.0, 10/30/94, 10:30, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	7.6	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	17	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL UJ	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	13	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	34	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	27	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	24	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	11	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	13	2.4

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	17	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	24
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	24
Carbon disulfide	BDL	24
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	12
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	12
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	3.5	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	12
Vinyl chloride	BDL	0.5
Xylenes	3.5	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	12
1,2-Dibromoethane	BDL	12

Tentatively identified compounds (EPA 8240)	Estimated Conc. (ug/kg)	
2-ethyl-1,3-dimethyl-Benzene	17 NJ	-
1-methyl-Naphthalene	7 NJ	-
Unknown	7 ~~NJ~~ J	-
Unknown	7 ~~NJ~~ 8.6 J	-
1-ethyl-2,4-dimethyl-Benzene	6 NJ	-

Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	800
2-Chlorophenol	BDL	400
2,4-Dichlorophenol	BDL	400
2,4-Dimethylphenol	BDL	400
4,6-Dinitro-2-methylphenol	BDL	1990

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-1

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
2,4-Dinitrophenol	BDL	1990
2-Methylphenol	BDL	400
3-Methylphenol	BDL	400
4-Methylphenol	BDL	400
2-Nitrophenol	BDL	400
4-Nitrophenol	BDL	1990
Pentachlorophenol	BDL	1990
Phenol	BDL	400
2,4,5-Trichlorophenol	BDL	400
2,4,6-Trichlorophenol	BDL	400
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	400
Acenaphthylene	BDL	400
Anthracene	BDL	400
Benzoic Acid	BDL	1990
Benzo(a)anthracene	BDL	400
Benzo(b)fluoranthene	BDL	400
Benzo(k)fluoranthene	BDL	400
Benzo(ghi)perylene	BDL	400
Benzo(a)pyrene	BDL	400
Benzyl Alcohol	BDL	800
Bis(2-chloroethoxy)methane	BDL	400
Bis(2-chloroethyl)ether	BDL	400
Bis(2-chloroisopropyl)ether	BDL	400
Bis(2-ethylhexyl)phthalate	1070	400
4-Bromophenyl phenyl ether	BDL	400
Benzyl butyl phthalate	BDL	400
4-Chloroaniline	BDL	800
2-Chloronaphthalene	BDL	400
4-Chlorophenyl phenyl ether	BDL	400
Chrysene	BDL	400
Dibenzo(a,h)anthracene	BDL	400
Dibenzofuran	BDL	400
Di-n-butylphthalate	BDL	400
1,3-Dichlorobenzene	BDL	400
1,4-Dichlorobenzene	BDL	400
1,2-Dichlorobenzene	BDL	400
3,3'-Dichlorobenzidine	BDL	800
Diethylphthalate	BDL	400

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	400
2,4-Dinitrotoluene	BDL	400
2,6-Dinitrotoluene	BDL	400
Di-n-octylphthalate	BDL	400
Fluoranthene	BDL	400
Fluorene	BDL	400
Hexachlorobenzene	BDL	400
Hexachlorobutadiene	BDL	400
Hexachlorocyclopentadiene	BDL	400
Hexachloroethane	BDL	400
Indeno(1,2,3-cd)pyrene	BDL	400
Isophorone	BDL	400
2-Methylnaphthalene	BDL	400
Naphthalene	BDL	400
2-Nitroaniline	BDL	1990
3-Nitroaniline	BDL	1990
4-Nitroaniline	BDL	800
Nitrobenzene	BDL	400
N-Nitrosodiphenylamine	BDL	400
N-Nitrosodi-n-propylamine	BDL	400
Phenanthrene	BDL	400
Pyrene	BDL	400
1,2,4-Trichlorobenzene	BDL	400

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	
1-(1,1-Dimethylethyl)-2-methyl-1,3-propanediyl isobutyrate	6870 NJ	-
unknown natural product, BP=204	3000 N	-
unknown natural product, BP=189	1130 N	-
Ethylene glycol phenyl ether	940 NJ	-
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	520 NJ	-
Diacetone alcohol (Aldol-condensation product)	390 NJ	-
2,2-Dimethyl-1-(2-hydroxy-1-methylethyl) propyl isobutyrate	340 NJ	-

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-1

RESULTS

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	Detection Limit (ug/kg)
Unknown	205 ~~N~~ BG 2645 J	-
unknown natural product, BP=245	205 N	-
n-Pentacosane (C25)	190 NJ	-
n-Hexacosane (C26)	190 NJ	-
n-Heptacosane (C27)	190 NJ	-
unknown oxygenate (Di-sec-butoxymethane?)	170 N	-
n-Pentadecane (C15)	160 NJ	-
Butyl Carbitol	160 NJ	-

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56812-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S5-0.5/3.0, 10/30/94, 12:00, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	6.7	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	17	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL UJ	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	17	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	10	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	11	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	220	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	28	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	54	2.2

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	10	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	22
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	22
Carbon disulfide	BDL	22
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-3

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	11
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	11
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	1.2 J	1
Vinyl acetate	BDL	11
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	11
1,2-Dibromoethane	BDL	11

Tentatively identified compounds (EPA 8240)	Estimated Conc. (ug/kg)
Unknown	9~~1~~ J BD 2.645

Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	730
2-Chlorophenol	BDL	370
2,4-Dichlorophenol	BDL	370
2,4-Dimethylphenol	BDL	370
4,6-Dinitro-2-methylphenol	BDL	1830

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-3

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
2,4-Dinitrophenol	BDL	1830
2-Methylphenol	BDL	370
3-Methylphenol	BDL	370
4-Methylphenol	BDL	370
2-Nitrophenol	BDL	370
4-Nitrophenol	BDL	1830
Pentachlorophenol	BDL	1830
Phenol	BDL	370
2,4,5-Trichlorophenol	BDL	370
2,4,6-Trichlorophenol	BDL	370
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	370
Acenaphthylene	BDL	370
Anthracene	BDL	370
Benzoic Acid	BDL	1830
Benzo(a)anthracene	BDL	370
Benzo(b)fluoranthene	BDL	370
Benzo(k)fluoranthene	BDL	370
Benzo(ghi)perylene	BDL	370
Benzo(a)pyrene	BDL	370
Benzyl Alcohol	BDL	730
Bis(2-chloroethoxy)methane	BDL	370
Bis(2-chloroethyl)ether	BDL	370
Bis(2-chloroisopropyl)ether	BDL	370
Bis(2-ethylhexyl)phthalate	980	370
4-Bromophenyl phenyl ether	BDL	370
Benzyl butyl phthalate	BDL	370
4-Chloroaniline	BDL	730
2-Chloronaphthalene	BDL	370
4-Chlorophenyl phenyl ether	BDL	370
Chrysene	BDL	370
Dibenzo(a,h)anthracene	BDL	370
Dibenzofuran	BDL	370
Di-n-butylphthalate	BDL	370
1,3-Dichlorobenzene	BDL	370
1,4-Dichlorobenzene	BDL	370
1,2-Dichlorobenzene	BDL	370
3,3'-Dichlorobenzidine	BDL	730
Diethylphthalate	BDL	370

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-3

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	370
2,4-Dinitrotoluene	BDL	370
2,6-Dinitrotoluene	BDL	370
Di-n-octylphthalate	BDL	370
Fluoranthene	BDL	370
Fluorene	BDL	370
Hexachlorobenzene	BDL	370
Hexachlorobutadiene	BDL	370
Hexachlorocyclopentadiene	BDL	370
Hexachloroethane	BDL	370
Indeno(1,2,3-cd)pyrene	BDL	370
Isophorone	BDL	370
2-Methylnaphthalene	BDL	370
Naphthalene	BDL	370
2-Nitroaniline	BDL	1830
3-Nitroaniline	BDL	1830
4-Nitroaniline	BDL	730
Nitrobenzene	BDL	370
N-Nitrosodiphenylamine	BDL	370
N-Nitrosodi-n-propylamine	BDL	370
Phenanthrene	BDL	370
Pyrene	BDL	370
1,2,4-Trichlorobenzene	BDL	370

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	
1-(1,1-Dimethylethyl)-2-methyl-1,3-propanediyl isobutyrate	1220 NJ	-
unknown natural product, BP=204	440 N	-
Ethylene glycol phenyl ether	370 NJ	-
n-Nonacontane (C29)	270 NJ	-
Unknown	270 J	-
n-Hentriacontane (C31)	240 NJ	-
n-Heneicosane (C21)	190 NJ	-

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-3

RESULTS

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	Detection Limit (ug/kg)
n-Docosane (C22)	190 NJ	-
n-Tricosane (C23)	190 NJ	-
unknown natural product, BP=189	180 N	-
n-Heptadecane (C17)	180 NJ	-
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	170 NJ	-
n-Eicosane (C20)	170 NJ	-
n-Nonadecane (C19)	170 NJ	-
Diacetone alcohol (Aldol-condensation product)	160 NJ	-
2,2-Dimethyl-1-(2-hydroxy-1-methylethyl) propyl isobutyrate	160 NJ	-
n-Tetracosane (C24)	140 NJ	-
unknown fatty aldehyde	140 N	

Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56812-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S5-3.0/5.0, 10/30/94, 12:10, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	5.9	5.9
Total Arsenic (As) (mg/kg) (EPA 7060)	6.1	3.5
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL UJ	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	29	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	6.7	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	13	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	330	4.7
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	33	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.7
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.9
Total Zinc (Zn) (mg/kg) (EPA 6010A)	64	2.4

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	15	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	24
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	24
Carbon disulfide	BDL	24
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-4

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	12
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	12
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	12
Vinyl chloride	BDL	0.5
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	12
1,2-Dibromoethane	BDL	12
Tentatively identified compounds (EPA 8240)	None found	-
Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	780
2-Chlorophenol	BDL	390
2,4-Dichlorophenol	BDL	390
2,4-Dimethylphenol	BDL	390
4,6-Dinitro-2-methylphenol	BDL	1940
2,4-Dinitrophenol	BDL	1940
2-Methylphenol	BDL	390
3-Methylphenol	BDL	390
4-Methylphenol	BDL	390
2-Nitrophenol	BDL	390
4-Nitrophenol	BDL	1940
Pentachlorophenol	BDL	1940

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-4

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Phenol	BDL	390
2,4,5-Trichlorophenol	BDL	390
2,4,6-Trichlorophenol	BDL	390
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	390
Acenaphthylene	BDL	390
Anthracene	BDL	390
Benzoic Acid	BDL	1940
Benzo(a)anthracene	BDL	390
Benzo(b)fluoranthene	BDL	390
Benzo(k)fluoranthene	BDL	390
Benzo(ghi)perylene	BDL	390
Benzo(a)pyrene	BDL	390
Benzyl Alcohol	BDL	780
Bis(2-chloroethoxy)methane	BDL	390
Bis(2-chloroethyl)ether	BDL	390
Bis(2-chloroisopropyl)ether	BDL	390
Bis(2-ethylhexyl)phthalate	BDL	390
4-Bromophenyl phenyl ether	BDL	390
Benzyl butyl phthalate	BDL	390
4-Chloroaniline	BDL	780
2-Chloronaphthalene	BDL	390
4-Chlorophenyl phenyl ether	BDL	390
Chrysene	BDL	390
Dibenzo(a,h)anthracene	BDL	390
Dibenzofuran	BDL	390
Di-n-butylphthalate	BDL	390
1,3-Dichlorobenzene	BDL	390
1,4-Dichlorobenzene	BDL	390
1,2-Dichlorobenzene	BDL	390
3,3'-Dichlorobenzidine	BDL	780
Diethylphthalate	BDL	390

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-4

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	390
2,4-Dinitrotoluene	BDL	390
2,6-Dinitrotoluene	BDL	390
Di-n-octylphthalate	BDL	390
Fluoranthene	BDL	390
Fluorene	BDL	390
Hexachlorobenzene	BDL	390
Hexachlorobutadiene	BDL	390
Hexachlorocyclopentadiene	BDL	390
Hexachloroethane	BDL	390
Indeno(1,2,3-cd)pyrene	BDL	390
Isophorone	BDL	390
2-Methylnaphthalene	BDL	390
Naphthalene	BDL	390
2-Nitroaniline	BDL	1940
3-Nitroaniline	BDL	1940
4-Nitroaniline	BDL	780
Nitrobenzene	BDL	390
N-Nitrosodiphenylamine	BDL	390
N-Nitrosodi-n-propylamine	BDL	390
Phenanthrene	BDL	390
Pyrene	BDL	390
1,2,4-Trichlorobenzene	BDL	390

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	
1-(1,1-Dimethylethyl)-2-methyl-1,3-propanediyl isobutyrate	1400 NJ	-
Ethylene glycol phenyl ether	800 NJ	-
n-Hexadecane (C16)	500 NJ	-
unknown C18 isoparaffinic hydrocarbon	450 N	-
n-Docosane (C22)	420 NJ	-
n-Heptadecane (C17)	410 NJ	-
n-Pentadecane (C15)	380 NJ	-
Diacetone alcohol (Aldol-condensation product)	370 NJ	-
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	370 NJ	-
n-Nonadecane (C19)	350 NJ	-

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-4

RESULTS

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	Detection Limit (ug/kg)
n-Tricosane (C23)	340 NJ	-
n-Eicosane (C20)	320 NJ	-
n-Pentacosane (C25)	310 NJ	-
n-Tetracosane (C24)	290 NJ	-
n-Heneicosane (C21)	270 NJ	-
2,2-Dimethyl-1-(2-hydroxy-1-methylethyl) propyl isobutyrate	260 NJ	-
n-Hexacosane (C26)	250 NJ	-
n-Heptacosane (C27)	240 NJ	-
unknown C17 isoparaffinic hydrocarbon	240 N	-
n-Octadecane (C18)	220 NJ	-

Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56894-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S6-0.5/3.0, 11/1/94, 09:30, received 11/3/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	6.4	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	23	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	6.0	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	14	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	15	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	78	4.6
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	15	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.6
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	56	2.3

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	13	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	23
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	23
Carbon disulfide	BDL	23
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-3

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	11
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	11
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	11
Vinyl chloride	BDL	0.5
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	11
1,2-Dibromoethane	BDL	11

Tentatively identified compounds (EPA 8240) None found

Acid Extractable Organics (EPA 8270)	(ug/kg)	(ug/kg)
4-Chloro-3-methylphenol	BDL	760
2-Chlorophenol	BDL	380
2,4-Dichlorophenol	BDL	380
2,4-Dimethylphenol	BDL	380
4,6-Dinitro-2-methylphenol	BDL	1900
2,4-Dinitrophenol	BDL	1900
2-Methylphenol	BDL	380

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-3

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection (ug/kg)
3-Methylphenol	BDL	380
4-Methylphenol	BDL	380
2-Nitrophenol	BDL	380
4-Nitrophenol	BDL	1900
Pentachlorophenol	BDL	1900
Phenol	BDL	380
2,4,5-Trichlorophenol	BDL	380
2,4,6-Trichlorophenol	BDL	380
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	380
Acenaphthylene	BDL	380
Anthracene	BDL	380
Benzoic Acid	BDL	1900
Benzo(a)anthracene	BDL	380
Benzo(b)fluoranthene	BDL	380
Benzo(k)fluoranthene	BDL	380
Benzo(ghi)perylene	BDL	380
Benzo(a)pyrene	BDL	380
Benzyl Alcohol	BDL	760
Bis(2-chloroethoxy)methane	BDL	380
Bis(2-chloroethyl)ether	BDL	380
Bis(2-chloroisopropyl)ether	BDL	380
Bis(2-ethylhexyl)phthalate	BDL	380
4-Bromophenyl phenyl ether	BDL	380
Benzyl butyl phthalate	BDL	380
4-Chloroaniline	BDL	760
2-Chloronaphthalene	BDL	380
4-Chlorophenyl phenyl ether	BDL	380
Chrysene	BDL	380
Dibenzo(a,h)anthracene	BDL	380
Dibenzofuran	BDL	380
Di-n-butylphthalate	BDL	380
1,3-Dichlorobenzene	BDL	380
1,4-Dichlorobenzene	BDL	380
1,2-Dichlorobenzene	BDL	380
3,3'-Dichlorobenzidine	BDL	760
Diethylphthalate	BDL	380

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-3

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	380
2,4-Dinitrotoluene	BDL	380
2,6-Dinitrotoluene	BDL	380
Di-n-octylphthalate	BDL	380
Fluoranthene	BDL	380
Fluorene	BDL	380
Hexachlorobenzene	BDL	380
Hexachlorobutadiene	BDL	380
Hexachlorocyclopentadiene	BDL	380
Hexachloroethane	BDL	380
Indeno(1,2,3-cd)pyrene	BDL	380
Isophorone	BDL	380
2-Methylnaphthalene	BDL	380
Naphthalene	BDL	380
2-Nitroaniline	BDL	1900
3-Nitroaniline	BDL	1900
4-Nitroaniline	BDL	760
Nitrobenzene	BDL	380
N-Nitrosodiphenylamine	BDL	380
N-Nitrosodi-n-propylamine	BDL	380
Phenanthrene	BDL	380
Pyrene	BDL	380
1,2,4-Trichlorobenzene	BDL	380

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	160
n-Octacosane (C28)	150
n-Nonacosane (C29)	150

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56894-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S6-3.0/4.5, 11/1/94, 09:45, received 11/3/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	8.3	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	9.1	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	7.5	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	11	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	21	4.6
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	20	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.6
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	34	2.3

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	13	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	23
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	23
Carbon disulfide	BDL	23
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-4

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	11
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	11
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	11
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	11
1,2-Dibromoethane	BDL	11

Tentatively identified compounds (EPA 8240) None found

Acid Extractable Organics (EPA 8270)	(ug/kg)	(ug/kg)
4-Chloro-3-methylphenol	BDL	760
2-Chlorophenol	BDL	380
2,4-Dichlorophenol	BDL	380
2,4-Dimethylphenol	BDL	380
4,6-Dinitro-2-methylphenol	BDL	1900
2,4-Dinitrophenol	BDL	1900
2-Methylphenol	BDL	380
3-Methylphenol	BDL	380

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-4

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
4-Methylphenol	BDL	380
2-Nitrophenol	BDL	380
4-Nitrophenol	BDL	1900
Pentachlorophenol	BDL	1900
Phenol	BDL	380
2,4,5-Trichlorophenol	BDL	380
2,4,6-Trichlorophenol	BDL	380
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	380
Acenaphthylene	BDL	380
Anthracene	BDL	380
Benzoic Acid	BDL	1900
Benzo(a)anthracene	BDL	380
Benzo(b)fluoranthene	BDL	380
Benzo(k)fluoranthene	BDL	380
Benzo(ghi)perylene	BDL	380
Benzo(a)pyrene	BDL	380
Benzyl Alcohol	BDL	760
Bis(2-chloroethoxy)methane	BDL	380
Bis(2-chloroethyl)ether	BDL	380
Bis(2-chloroisopropyl)ether	BDL	380
Bis(2-ethylhexyl)phthalate	BDL	380
4-Bromophenyl phenyl ether	BDL	380
Benzyl butyl phthalate	BDL	380
4-Chloroaniline	BDL	760
2-Chloronaphthalene	BDL	380
4-Chlorophenyl phenyl ether	BDL	380
Chrysene	BDL	380
Dibenzo(a,h)anthracene	BDL	380
Dibenzofuran	BDL	380
Di-n-butylphthalate	BDL	380
1,3-Dichlorobenzene	BDL	380
1,4-Dichlorobenzene	BDL	380
1,2-Dichlorobenzene	BDL	380
3,3'-Dichlorobenzidine	BDL	760
Diethylphthalate	BDL	380

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-4

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	380
2,4-Dinitrotoluene	BDL	380
2,6-Dinitrotoluene	BDL	380
Di-n-octylphthalate	BDL	380
Fluoranthene	BDL	380
Fluorene	BDL	380
Hexachlorobenzene	BDL	380
Hexachlorobutadiene	BDL	380
Hexachlorocyclopentadiene	BDL	380
Hexachloroethane	BDL	380
Indeno(1,2,3-cd)pyrene	BDL	380
Isophorone	BDL	380
2-Methylnaphthalene	BDL	380
Naphthalene	BDL	380
2-Nitroaniline	BDL	1900
3-Nitroaniline	BDL	1900
4-Nitroaniline	BDL	760
Nitrobenzene	BDL	380
N-Nitrosodiphenylamine	BDL	380
N-Nitrosodi-n-propylamine	BDL	380
Phenanthrene	BDL	380
Pyrene	BDL	380
1,2,4-Trichlorobenzene	BDL	380

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	160
4,4'-Butylidenebis[2-(1,1-dimethylethyl) -5-methyl] phenol (Santowhite antioxidant)	160
n-Nonacosane (C29)	160

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Deier

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FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56907-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S7-0.5/3.0, 11/1/94, 10:20, received 11/3/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	7.5	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	14	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	14	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	34	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	22	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	63	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	24	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	32	2.3

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	12	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	23
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	23
Carbon disulfide	BDL	23
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	11
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	11
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	11
Vinyl chloride	BDL	0.5
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	11
1,2-Dibromoethane	BDL	11

Tentatively identified compounds (EPA 8240) None found

Acid Extractable Organics (EPA 8270)	(ug/kg)	(ug/kg)
4-Chloro-3-methylphenol	BDL	750
2-Chlorophenol	BDL	380
2,4-Dichlorophenol	BDL	380
2,4-Dimethylphenol	BDL	380
4,6-Dinitro-2-methylphenol	BDL	1880
2,4-Dinitrophenol	BDL	1880
2-Methylphenol	BDL	380
3-Methylphenol	BDL	380
4-Methylphenol	BDL	380

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-1

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
2-Nitrophenol	BDL	380
4-Nitrophenol	BDL	1880
Pentachlorophenol	BDL	1880
Phenol	BDL	380
2,4,5-Trichlorophenol	BDL	380
2,4,6-Trichlorophenol	BDL	380
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	380
Acenaphthylene	BDL	380
Anthracene	BDL	380
Benzoic Acid	BDL	1880
Benzo(a)anthracene	BDL	380
Benzo(b)fluoranthene	BDL	380
Benzo(k)fluoranthene	BDL	380
Benzo(ghi)perylene	BDL	380
Benzo(a)pyrene	BDL	380
Benzyl Alcohol	BDL	750
Bis(2-chloroethoxy)methane	BDL	380
Bis(2-chloroethyl)ether	BDL	380
Bis(2-chloroisopropyl)ether	BDL	380
Bis(2-ethylhexyl)phthalate	BDL	380
4-Bromophenyl phenyl ether	BDL	380
Benzyl butyl phthalate	BDL	380
4-Chloroaniline	BDL	750
2-Chloronaphthalene	BDL	380
4-Chlorophenyl phenyl ether	BDL	380
Chrysene	BDL	380
Dibenzo(a,h)anthracene	BDL	380
Dibenzofuran	BDL	380
Di-n-butylphthalate	BDL	380
1,3-Dichlorobenzene	BDL	380
1,4-Dichlorobenzene	BDL	380
1,2-Dichlorobenzene	BDL	380
3,3'-Dichlorobenzidine	BDL	750
Diethylphthalate	BDL	380
Dimethylphthalate	BDL	380
2,4-Dinitrotoluene	BDL	380
2,6-Dinitrotoluene	BDL	380
Di-n-octylphthalate	BDL	380

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Fluoranthene	BDL	380
Fluorene	BDL	380
Hexachlorobenzene	BDL	380
Hexachlorobutadiene	BDL	380
Hexachlorocyclopentadiene	BDL	380
Hexachloroethane	BDL	380
Indeno(1,2,3-cd)pyrene	BDL	380
Isophorone	BDL	380
2-Methylnaphthalene	BDL	380
Naphthalene	BDL	380
2-Nitroaniline	BDL	1880
3-Nitroaniline	BDL	1880
4-Nitroaniline	BDL	750
Nitrobenzene	BDL	380
N-Nitrosodiphenylamine	BDL	380
N-Nitrosodi-n-propylamine	BDL	380
Phenanthrene	BDL	380
Pyrene	BDL	380
1,2,4-Trichlorobenzene	BDL	380

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)
unknown natural product, BP=204	2800
unknown natural product, BP=189	1080
n-Nonacosane (C29)	420
n-Triacontane (C30)	380
Ethylene glycol phenyl ether	350
unknown fatty aldehyde	350
unknown fatty aldehyde	260
unknown natural product, BP=191	250
unknown C18 isoparaffinic hydrocarbon	210

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-1

RESULTS

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)
unknown fatty acid	190
n-Heptacosane (C27)	190
n-Octacosane (C28)	170
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	170
Methyl Carbitol	160
n-Nonadecane (C19)	160
n-Docosane (C22)	160
n-Heptadecane (C17)	160

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56812-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S8-0.5/3.0, 10/30/94, 10:30, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	6.4	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	19	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL UJ	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	10	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	27	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	23	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	8.7	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.4	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	10	2.4

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	16	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	24
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	24
Carbon disulfide	BDL	24
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-2

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	12
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	12
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	4.6	1
Vinyl acetate	BDL	12
Vinyl chloride	BDL	0.5
Xylenes	BDL	1
cis-1,2-Dichloroethene	1.3	1
1,2-Dibromo-3-chloropropane	BDL	12
1,2-Dibromoethane	BDL	12

Tentatively identified compounds (EPA 8240)	Estimated Conc. (ug/kg)
2,2,3,4,6,6-hexamethyl-Heptane	26 NJ
4-ethyl-2,2,6,6-tetramethyl-Heptane	14 NJ
3,7-dimethyl-Nonane	11 NJ

Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	790
2-Chlorophenol	BDL	390
2,4-Dichlorophenol	BDL	390
2,4-Dimethylphenol	BDL	390
4,6-Dinitro-2-methylphenol	BDL	1960
2,4-Dinitrophenol	BDL	1960

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-2

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
2-Methylphenol	BDL	390
3-Methylphenol	BDL	390
4-Methylphenol	BDL	390
2-Nitrophenol	BDL	390
4-Nitrophenol	BDL	1960
Pentachlorophenol	BDL	1960
Phenol	BDL	390
2,4,5-Trichlorophenol	BDL	390
2,4,6-Trichlorophenol	BDL	390
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	390
Acenaphthylene	BDL	390
Anthracene	BDL	390
Benzoic Acid	BDL	1960
Benzo(a)anthracene	BDL	390
Benzo(b)fluoranthene	BDL	390
Benzo(k)fluoranthene	BDL	390
Benzo(ghi)perylene	BDL	390
Benzo(a)pyrene	BDL	390
Benzyl Alcohol	BDL	790
Bis(2-chloroethoxy)methane	BDL	390
Bis(2-chloroethyl)ether	BDL	390
Bis(2-chloroisopropyl)ether	BDL	390
Bis(2-ethylhexyl)phthalate	BDL	390
4-Bromophenyl phenyl ether	BDL	390
Benzyl butyl phthalate	BDL	390
4-Chloroaniline	BDL	790
2-Chloronaphthalene	BDL	390
4-Chlorophenyl phenyl ether	BDL	390
Chrysene	BDL	390
Dibenzo(a,h)anthracene	BDL	390
Dibenzofuran	BDL	390
Di-n-butylphthalate	BDL	390
1,3-Dichlorobenzene	BDL	390
1,4-Dichlorobenzene	BDL	390
1,2-Dichlorobenzene	BDL	390
3,3'-Dichlorobenzidine	BDL	790
Diethylphthalate	BDL	390

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-2

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	390
2,4-Dinitrotoluene	BDL	390
2,6-Dinitrotoluene	BDL	390
Di-n-octylphthalate	BDL	390
Fluoranthene	BDL	390
Fluorene	BDL	390
Hexachlorobenzene	BDL	390
Hexachlorobutadiene	BDL	390
Hexachlorocyclopentadiene	BDL	390
Hexachloroethane	BDL	390
Indeno(1,2,3-cd)pyrene	BDL	390
Isophorone	BDL	390
2-Methylnaphthalene	BDL	390
Naphthalene	BDL	390
2-Nitroaniline	BDL	1960
3-Nitroaniline	BDL	1960
4-Nitroaniline	BDL	790
Nitrobenzene	BDL	390
N-Nitrosodiphenylamine	BDL	390
N-Nitrosodi-n-propylamine	BDL	390
Phenanthrene	BDL	390
Pyrene	BDL	390
1,2,4-Trichlorobenzene	BDL	390

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	
1-(1,1-Dimethylethyl)-2-methyl-1,3-propanediyl isobutyrate	4500 NJ	-
unknown natural product, BP=204	1670 N	-
unknown natural product, BP=189	950 N	-
Ethylene glycol phenyl ether	950 NJ	-
natural oleic acid derivative, BP=218	890 NJ	-
Diacetone alcohol (Aldol-condensation product)	540 NJ	-
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	430 NJ	-
n-Pentadecane (C15)	360 NJ	-
2,2-Dimethyl-1-(2-hydroxy-1-methylethyl) propyl isobutyrate	310 NJ	-
unknown natural product, BP=218	300 N	-
unknown natural product, BP=95	290 N	-
unknown natural alcohol	270 N	-

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-2

RESULTS

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	Detection Limit (ug/kg)
n-Docosane (C22)	270 NJ	-
n-Hentriacontane (C31)	270 NJ	-
unknown C18 isoparaffinic hydrocarbon	260 N	-
n-Heptadecane (C17)	240 NJ	-
n-Tetradecane (C14)	240 NJ	-
n-Tridecane (C13)	230 NJ	-
n-Dodecane (C12)	230 NJ	-
n-Nonacontane (C29)	210 NJ	-

Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56907-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S9-0.5/3.0, 11/1/94, 11:45, received 11/3/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	9.2	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	6.6	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	133	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	7.6	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	24	2.2

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	10	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	22
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	22
Carbon disulfide	BDL	22
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-2

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	11
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	11
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	11
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	11
1,2-Dibromoethane	BDL	11

Tentatively identified compounds (EPA 8240) None found

Acid Extractable Organics (EPA 8270)	(ug/kg)	(ug/kg)
4-Chloro-3-methylphenol	BDL	730
2-Chlorophenol	BDL	370
2,4-Dichlorophenol	BDL	370
2,4-Dimethylphenol	BDL	370
4,6-Dinitro-2-methylphenol	BDL	1830
2,4-Dinitrophenol	BDL	1830
2-Methylphenol	BDL	370
3-Methylphenol	BDL	370

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-2

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
4-Methylphenol	BDL	370
2-Nitrophenol	BDL	370
4-Nitrophenol	BDL	1830
Pentachlorophenol	BDL	1830
Phenol	BDL	370
2,4,5-Trichlorophenol	BDL	370
2,4,6-Trichlorophenol	BDL	370
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	370
Acenaphthylene	BDL	370
Anthracene	BDL	370
Benzoic Acid	BDL	1830
Benzo(a)anthracene	BDL	370
Benzo(b)fluoranthene	BDL	370
Benzo(k)fluoranthene	BDL	370
Benzo(ghi)perylene	BDL	370
Benzo(a)pyrene	BDL	370
Benzyl Alcohol	BDL	730
Bis(2-chloroethoxy)methane	BDL	370
Bis(2-chloroethyl)ether	BDL	370
Bis(2-chloroisopropyl)ether	BDL	370
Bis(2-ethylhexyl)phthalate	BDL	370
4-Bromophenyl phenyl ether	BDL	370
Benzyl butyl phthalate	BDL	370
4-Chloroaniline	BDL	730
2-Chloronaphthalene	BDL	370
4-Chlorophenyl phenyl ether	BDL	370
Chrysene	BDL	370
Dibenzo(a,h)anthracene	BDL	370
Dibenzofuran	BDL	370
Di-n-butylphthalate	BDL	370
1,3-Dichlorobenzene	BDL	370
1,4-Dichlorobenzene	BDL	370
1,2-Dichlorobenzene	BDL	370
3,3'-Dichlorobenzidine	BDL	730
Diethylphthalate	BDL	370

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-2

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	370
2,4-Dinitrotoluene	BDL	370
2,6-Dinitrotoluene	BDL	370
Di-n-octylphthalate	BDL	370
Fluoranthene	BDL	370
Fluorene	BDL	370
Hexachlorobenzene	BDL	370
Hexachlorobutadiene	BDL	370
Hexachlorocyclopentadiene	BDL	370
Hexachloroethane	BDL	370
Indeno(1,2,3-cd)pyrene	BDL	370
Isophorone	BDL	370
2-Methylnaphthalene	BDL	370
Naphthalene	BDL	370
2-Nitroaniline	BDL	1830
3-Nitroaniline	BDL	1830
4-Nitroaniline	BDL	730
Nitrobenzene	BDL	370
N-Nitrosodiphenylamine	BDL	370
N-Nitrosodi-n-propylamine	BDL	370
Phenanthrene	BDL	370
Pyrene	BDL	370
1,2,4-Trichlorobenzene	BDL	370

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)
Ethylene glycol phenyl ether	660
Methyl Carbitol	510
unknown fatty amide	320
Butyl Carbitol	180

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56907-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S9-3.0/5.0, 11/1/94, 12:15, received 11/3/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	15	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	17	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	15	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	695	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	30	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	61	2.4

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	18	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	24
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	24
Carbon disulfide	BDL	24
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-3

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	12
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	12
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	2.2	1
Vinyl acetate	BDL	12
Vinyl chloride	BDL	0.5
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	12
1,2-Dibromoethane	BDL	12

Tentatively identified compounds (EPA 8240) None found

Acid Extractable Organics (EPA 8270)	(ug/kg)	(ug/kg)
4-Chloro-3-methylphenol	BDL	810
2-Chlorophenol	BDL	400
2,4-Dichlorophenol	BDL	400
2,4-Dimethylphenol	BDL	400
4,6-Dinitro-2-methylphenol	BDL	2010
2,4-Dinitrophenol	BDL	2010
2-Methylphenol	BDL	400
3-Methylphenol	BDL	400
4-Methylphenol	BDL	400

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-3

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection (ug/kg)
2-Nitrophenol	BDL	400
4-Nitrophenol	BDL	2010
Pentachlorophenol	BDL	2010
Phenol	BDL	400
2,4,5-Trichlorophenol	BDL	400
2,4,6-Trichlorophenol	BDL	400
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	400
Acenaphthylene	BDL	400
Anthracene	BDL	400
Benzoic Acid	BDL	2010
Benzo(a)anthracene	BDL	400
Benzo(b)fluoranthene	BDL	400
Benzo(k)fluoranthene	BDL	400
Benzo(ghi)perylene	BDL	400
Benzo(a)pyrene	BDL	400
Benzyl Alcohol	BDL	810
Bis(2-chloroethoxy)methane	BDL	400
Bis(2-chloroethyl)ether	BDL	400
Bis(2-chloroisopropyl)ether	BDL	400
Bis(2-ethylhexyl)phthalate	BDL	400
4-Bromophenyl phenyl ether	BDL	400
Benzyl butyl phthalate	BDL	400
4-Chloroaniline	BDL	810
2-Chloronaphthalene	BDL	400
4-Chlorophenyl phenyl ether	BDL	400
Chrysene	BDL	400
Dibenzo(a,h)anthracene	BDL	400
Dibenzofuran	BDL	400
Di-n-butylphthalate	BDL	400
1,3-Dichlorobenzene	BDL	400
1,4-Dichlorobenzene	BDL	400
1,2-Dichlorobenzene	BDL	400
3,3'-Dichlorobenzidine	BDL	810
Diethylphthalate	BDL	400

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-3

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	400
2,4-Dinitrotoluene	BDL	400
2,6-Dinitrotoluene	BDL	400
Di-n-octylphthalate	BDL	400
Fluoranthene	BDL	400
Fluorene	BDL	400
Hexachlorobenzene	BDL	400
Hexachlorobutadiene	BDL	400
Hexachlorocyclopentadiene	BDL	400
Hexachloroethane	BDL	400
Indeno(1,2,3-cd)pyrene	BDL	400
Isophorone	BDL	400
2-Methylnaphthalene	BDL	400
Naphthalene	BDL	400
2-Nitroaniline	BDL	2010
3-Nitroaniline	BDL	2010
4-Nitroaniline	BDL	810
Nitrobenzene	BDL	400
N-Nitrosodiphenylamine	BDL	400
N-Nitrosodi-n-propylamine	BDL	400
Phenanthrene	BDL	400
Pyrene	BDL	400
1,2,4-Trichlorobenzene	BDL	400

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	370
Ethylene glycol phenyl ether	350
2,2-Dimethyl-1-(2-hydroxy-1-methylethyl) propylisobutyrate	210

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Dier

LABORATORY REPORTS

GROUNDWATER SAMPLES

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY • NORCROSS, GA 30092 • (404) 734-4200

FAX (404) 734-4201 • Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57985-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-DM-MW10-U, 12/12/94, 11:47, received 12/13/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	0.3	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb)(ug/l)(EPA 7041).....	BDL	2
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Total Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Total Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Total Lead (Pb)(ug/l)(EPA 7421).....	7	3
Total Manganese (Mn)(ug/l)(EPA 6010A).....	980	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL UJ	10
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Total Zinc (Zn)(ug/l)(EPA 6010A).....	110	20

BDL - Below Detection Limit

Report No. 57985-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous](EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	10	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	11	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	2.4	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	8.7	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	31	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	1.3	0.94
1,3-Dinitrobenzene (1,3-DNB)	1.7	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57985-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-DM-MW10-F, 12/12/94, 11:47, received 12/13/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041)	BDL	2
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Dissolved Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Dissolved Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	960	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL UJ	10
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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ANALYTICAL SERVICES, INC.

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58023-3

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-DM-MW11-U, 12/12/94, 15:48, received 12/14/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	0.2	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb)(ug/l)(EPA 7041).....	BDL	2
Total Arsenic (As)(ug/l)(EPA 7060).....	10	10
Total Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Total Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Total Chromium (Cr)(ug/l)(EPA 6010A).....	29	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	21	20
Total Lead (Pb)(ug/l)(EPA 7421).....	14	3
Total Manganese (Mn)(ug/l)(EPA 6010A).....	1300	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	46	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	10
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Total Zinc (Zn)(ug/l)(EPA 6010A).....	74	20

BDL - Below Detection Limit

Report No. 58023-3

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	0.2	0.10
2,6-Dinitrotoluene (2,6-DNT)	0.2	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	1.9	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	0.2	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

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January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58023-4

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-DM-MW11-F, 12/12/94, 15:48, received 12/14/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041)	5	2
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Dissolved Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Dissolved Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	710	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL	10
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dlin

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57935-4

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-MK-MW22-U, 12/9/13/94, received 12/10/14/94

BCQ 1.20.95

BCQ 1.20.95

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	0.3	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb)(ug/l)(EPA 7041).....	BDL	2
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Total Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Total Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Total Lead (Pb)(ug/l)(EPA 7421).....	BDL	3
Total Manganese (Mn)(ug/l)(EPA 6010A).....	280	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL UJ	10
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Total Zinc (Zn)(ug/l)(EPA 6010A).....	20	20

BDL - Below Detection Limit

Report No. 57935-4

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	1.6	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	1.9	0.10
2,6-Dinitrotoluene (2,6-DNT)	1.1	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	0.43	0.16
2-Nitrotoluene (2-NT)	BDL UJ	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	0.75	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Dein

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
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January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57935-5

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-MK-MW22-F, 12/~~9~~-13/94, 14:12, received 12/~~10~~-14/94

BCG 1.20.95

BCG 1.20.95

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041)	BDL	2
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Dissolved Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Dissolved Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	190	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL UJ	10
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57935-3

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-MK-MW23-U, 12/9/13/94, received 12/10/14/94

BCG 1.20.95

BCG 1.20.95

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N) (mg/l) (EPA 353.2)	0.3	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb) (ug/l) (EPA 7041)	BDL	2
Total Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Total Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Total Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Total Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Total Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Total Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Total Manganese (Mn) (ug/l) (EPA 6010A)	460	40
Total Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Total Nickel (Ni) (ug/l) (EPA 6010A)	47	20
Total Selenium (Se) (ug/l) (EPA 7740)	BDL UJ	10
Total Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Total Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Total Zinc (Zn) (ug/l) (EPA 6010A)	53	20

BDL - Below Detection Limit

Report No. 57935-3

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL UJ	0.41
3-Nitrotoluene (3-NT)	13	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Deier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY • NORCROSS, GA 30092 • (404) 734-4200

FAX (404) 734-4201 • Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57935-6

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-MK-MW23-F, 12/~~9~~-13/94, 14:31 BLO 1-20-95
received 12/~~10~~-14/94 BLO 1-20-95

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041)	BDL	2
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Dissolved Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Dissolved Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	240	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	30	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL UJ	10
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	20	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Geier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 16, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57934-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-MK-MW24-U, 12/9/94, 15:16, received 12/10/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	0.5	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb)(ug/l)(EPA 7041).....	BDL	2
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Total Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Total Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Total Lead (Pb)(ug/l)(EPA 7421).....	BDL	3
Total Manganese (Mn)(ug/l)(EPA 6010A).....	310	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	10
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	1.0
Total Zinc (Zn)(ug/l)(EPA 6010A).....	21	20

BDL - Below Detection Limit

Report No. 57934-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Robert D. O[illegible] Jr.

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY • NORCROSS, GA 30092 • (404) 734-4200

FAX (404) 734-4201 • Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 16, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57934-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-MK-MW24-F, 12/9/94, 15:16, received 12/10/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb)(ug/l)(EPA 7041).....	BDL	2
Dissolved Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Dissolved Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Dissolved Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Dissolved Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Dissolved Lead (Pb)(ug/l)(EPA 7421).....	BDL	3
Dissolved Manganese (Mn)(ug/l)(EPA 6010A)....	220	40
Dissolved Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Dissolved Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Dissolved Selenium (Se)(ug/l)(EPA 7740).....	BDL	10
Dissolved Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Dissolved Zinc (Zn)(ug/l)(EPA 6010A).....	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Robert D. [illegible]

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57935-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-MK-MW16-U, 12/9/94, 12:15, received 12/10/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	0.2	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb)(ug/l)(EPA 7041).....	BDL	2
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Total Beryllium (Be)(ug/l)(EPA 7091).....	2	1
Total Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	35	20
Total Lead (Pb)(ug/l)(EPA 7421).....	6	3
Total Manganese (Mn)(ug/l)(EPA 6010A).....	14000	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	150	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL UJ	10
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	2.3	0.5
Total Zinc (Zn)(ug/l)(EPA 6010A).....	160	20

BDL - Below Detection Limit

Report No. 57935-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL UJ	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57935-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTB-MK-MW16-F, 12/9/94, 12:15, received 12/10/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb)(ug/l)(EPA 7041).....	BDL	2
Dissolved Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Dissolved Beryllium (Be)(ug/l)(EPA 7091).....	2	1
Dissolved Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Dissolved Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Dissolved Lead (Pb)(ug/l)(EPA 7421).....	BDL	3
Dissolved Manganese (Mn)(ug/l)(EPA 6010A)....	17000	40
Dissolved Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Dissolved Nickel (Ni)(ug/l)(EPA 6010A).....	180	20
Dissolved Selenium (Se)(ug/l)(EPA 7740).....	BDL UJ	10
Dissolved Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Thallium (Tl)(ug/l)(EPA 7841).....	2.6	0.5
Dissolved Zinc (Zn)(ug/l)(EPA 6010A).....	140	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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ANALYTICAL SERVICES, INC.

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110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58027-3

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009 PB-TNTB-MK-MW17-U, 12/13/94, 08:05, received 12/14/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	0.2	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb)(ug/l)(EPA 7041).....	BDL	2
Total Arsenic (As)(ug/l)(EPA 7060).....	13	10
Total Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Total Cadmium (Cd)(ug/l)(EPA 7131).....	2	1
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	37	20
Total Lead (Pb)(ug/l)(EPA 7421).....	9	3
Total Manganese (Mn)(ug/l)(EPA 6010A).....	2200	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	320	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	25
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	0.9	0.5
Total Zinc (Zn)(ug/l)(EPA 6010A).....	250	20

BDL - Below Detection Limit

Report No. 58027-3

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	6.5	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	1.2	0.10
2,6-Dinitrotoluene (2,6-DNT)	0.2	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	2.7	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1.6	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	2.3	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	5.3	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58027-4

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009 PB-TNTB-MK-MW17-F, 12/13/94, 08:05, received 12/14/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb)(ug/l)(EPA 7041).....	2	2
Dissolved Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Dissolved Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Dissolved Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Dissolved Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Dissolved Lead (Pb)(ug/l)(EPA 7421).....	BDL	3
Dissolved Manganese (Mn)(ug/l)(EPA 6010A)....	2300	40
Dissolved Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Dissolved Nickel (Ni)(ug/l)(EPA 6010A).....	320	20
Dissolved Selenium (Se)(ug/l)(EPA 7740).....	BDL	10
Dissolved Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Dissolved Zinc (Zn)(ug/l)(EPA 6010A).....	200	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dein

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ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58023-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project 24637-035-009, PB-TNTC-DM-MW5-U, 12/12/94, 14:50, received 12/14/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	0.2	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb)(ug/l)(EPA 7041).....	BDL	2
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Total Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Total Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Total Lead (Pb)(ug/l)(EPA 7421).....	13	3
Total Manganese (Mn)(ug/l)(EPA 6010A).....	570	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	10
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Total Zinc (Zn)(ug/l)(EPA 6010A).....	52	20

BDL - Below Detection Limit

Report No. 58023-1

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	0.1	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Dier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58023-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-DM-MW5-F, 12/12/94, 14:50, received 12/14/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb)(ug/l)(EPA 7041).....	8	2
Dissolved Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Dissolved Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Dissolved Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Dissolved Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Dissolved Lead (Pb)(ug/l)(EPA 7421).....	BDL	3
Dissolved Manganese (Mn)(ug/l)(EPA 6010A)....	460	40
Dissolved Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Dissolved Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Dissolved Selenium (Se)(ug/l)(EPA 7740).....	BDL	10
Dissolved Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Dissolved Zinc (Zn)(ug/l)(EPA 6010A).....	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Deier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY • NORCROSS, GA 30092 • (404) 734-4200

FAX (404) 734-4201 • Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57988-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-DM-MW6-U, 12/12/94, 14:10, received 12/13/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N) (mg/l) (EPA 353.2)	1.4	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb) (ug/l) (EPA 7041)	BDL	2
Total Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Total Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Total Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Total Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Total Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Total Lead (Pb) (ug/l) (EPA 7421)	5	3
Total Manganese (Mn) (ug/l) (EPA 6010A)	1400	40
Total Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Total Nickel (Ni) (ug/l) (EPA 6010A)	29	20
Total Selenium (Se) (ug/l) (EPA 7740)	BDL	10
Total Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Total Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Total Zinc (Zn) (ug/l) (EPA 6010A)	34	20

BDL - Below Detection Limit

Report No. 57988-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57988-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTC-DM-MW6-F, 12/12/94, 14:10, received 12/13/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041)	BDL	2
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Dissolved Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Dissolved Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	1300	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	20	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL	10
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Dlin

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57985-3

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-DM-MW23-U, 12/12/94, 11:47, received 12/13/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	0.3	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb)(ug/l)(EPA 7041).....	BDL	2
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Total Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Total Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Total Lead (Pb)(ug/l)(EPA 7421).....	7	3
Total Manganese (Mn)(ug/l)(EPA 6010A).....	880	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL UJ	10
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Total Zinc (Zn)(ug/l)(EPA 6010A).....	34	20

BDL - Below Detection Limit

Report No. 57985-3

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	10	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.5	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	10	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	2.2	0.55
3,4-Dinitrotoluene (3,4-DNT)	0.3	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	7.9	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	29	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	1.3	0.94
1,3-Dinitrobenzene (1,3-DNB)	1.5	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57985-4

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-TNTA-DM-MW23-F, 12/12/94, 11:47, received 12/13/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041)	BDL	2
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Dissolved Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Dissolved Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	830	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL UJ	10
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58094-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BED-MW13-U, 12/14/94, 10:39, received 12/15/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	BDL	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb)(ug/l)(EPA 7041).....	BDL	10
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Total Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Total Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Total Lead (Pb)(ug/l)(EPA 7421).....	BDL	3
Total Manganese (Mn)(ug/l)(EPA 6010A).....	BDL	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	10
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Total Zinc (Zn)(ug/l)(EPA 6010A).....	23	20

BDL - Below Detection Limit

Report No. 58094-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	2.2	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	0.1	0.10
2,6-Dinitrotoluene (2,6-DNT)	0.7	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	3.7	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	1.9	0.41
3-Nitrotoluene (3-NT)	11	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Report No. 58094-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Acetone	BDL	40
Benzene	50	2
Bromodichloromethane	BDL	2
Bromoform	BDL	2
Bromomethane	BDL	4
2-Butanone	BDL	40
Carbon disulfide	BDL	40
Carbon tetrachloride	BDL	2
Chlorobenzene	BDL	2
Chlorodibromomethane	BDL	2
Chloroethane	BDL	4
2-Chloroethylvinyl ether	BDL	4
Chloroform	BDL	2
Chloromethane	BDL	4
1,1-Dichloroethane	BDL	2
1,2-Dichloroethane	BDL	2
1,1-Dichloroethene	BDL	2
trans-1,2-Dichloroethene	BDL	2
1,2-Dichloropropane	BDL	2
cis-1,3-Dichloropropene	BDL	2
trans-1,3-Dichloropropene	BDL	2
Ethylbenzene	82	2
2-Hexanone	BDL	20
Methylene chloride	BDL	2
4-Methyl-2-pentanone	BDL	20
Styrene	BDL	2
1,1,2,2-Tetrachloroethane	BDL	2
Tetrachloroethene	BDL	2
Toluene	190	2
1,1,1-Trichloroethane	BDL	2
Trichloroethene	BDL	2
Vinyl acetate	BDL	20
Vinyl chloride	BDL	0.8
Xylenes	720	2
cis-1,2-Dichloroethene	BDL	2
1,2-Dibromo-3-chloropropane (DBCP) (ug/l) (EPA 504)	BDL	0.20
1,2-Dibromoethane (EDB) (ug/l) (EPA 504)	BDL	0.20

BDL - Below Detection Limit

Report No. 58094-1

RESULTS

Tentatively identified compounds (EPA 8240)	Estimated Conc. (ug/l)
Butane	780
Pentane	440
methyl-Cyclopentane	370
Cyclohexane	370
Cyclopentane	350
Unknown	310
Unknown	280
1,2,4-trimethyl-Benzene	98
Hexane	80
1,3,5-trimethyl-Benzene	54

Acid Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
4-Chloro-3-methylphenol	BDL	20
2-Chlorophenol	BDL	10
2,4-Dichlorophenol	BDL	10
2,4-Dimethylphenol	10	10
4,6-Dinitro-2-methylphenol	BDL	50
2,4-Dinitrophenol	BDL	50
2-Methylphenol	BDL	10
3-Methylphenol	BDL	10
4-Methylphenol	BDL	10
2-Nitrophenol	BDL	10
4-Nitrophenol	BDL	50
Pentachlorophenol	BDL	5
Phenol	BDL	10
2,4,5-Trichlorophenol	BDL	10
2,4,6-Trichlorophenol	BDL	10

BDL - Below Detection Limit

Report No. 58094-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
Acenaphthene	BDL	2
Acenaphthylene	BDL	2
Anthracene	BDL	10
Benzoic Acid	BDL	50
Benzo(a)anthracene	BDL	2
Benzo(b)fluoranthene	BDL	2
Benzo(k)fluoranthene	BDL	4
Benzo(ghi)perylene	BDL	2
Benzo(a)pyrene	BDL	3
Benzyl Alcohol	BDL	20
Bis(2-chloroethoxy)methane	BDL	10
Bis(2-chloroethyl)ether	BDL	10
Bis(2-chloroisopropyl)ether	BDL	10
Bis(2-ethylhexyl)phthalate	BDL	3
4-Bromophenyl phenyl ether	BDL	10
Benzyl butyl phthalate	BDL	2
4-Chloroaniline	BDL	20
2-Chloronaphthalene	BDL	10
4-Chlorophenyl phenyl ether	BDL	10
Chrysene	BDL	10
Dibenzo(a,h)anthracene	BDL	3
Dibenzofuran	BDL	10
Di-n-butylphthalate	BDL	2
1,3-Dichlorobenzene	BDL	10
1,4-Dichlorobenzene	BDL	10
1,2-Dichlorobenzene	BDL	10
3,3'-Dichlorobenzidine	BDL	20
Diethylphthalate	BDL	2
Dimethylphthalate	BDL	2
2,4-Dinitrotoluene	BDL	10
2,6-Dinitrotoluene	BDL	10
Di-n-octylphthalate	BDL	3
Fluoranthene	BDL	2
Fluorene	BDL	2
Hexachlorobenzene	BDL	2
Hexachlorobutadiene	BDL	10
Hexachlorocyclopentadiene	BDL	10
Hexachloroethane	BDL	10
Indeno(1,2,3-cd)pyrene	BDL	10
Isophorone	BDL	10
2-Methylnaphthalene	24	10

BDL - Below Detection Limit

Report No. 58094-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
Naphthalene	28	10
2-Nitroaniline	BDL	50
3-Nitroaniline	BDL	50
4-Nitroaniline	BDL	20
Nitrobenzene	BDL	10
N-Nitrosodiphenylamine	BDL	10
N-Nitrosodi-n-propylamine	BDL	10
Phenanthrene	BDL	10
Pyrene	BDL	10
1,2,4-Trichlorobenzene	BDL	10

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/l)
Molecular Sulfur	7300
unknown glycerol triester	47
unknown ester	41
unknown ester	40
unknown C9 aromatic hydrocarbon	34
4,4'-Butylidenebis[2-(1,1-dimethylethyl) -5-methylphenol] (Santowhite antioxidant)	34
unknown glycerol triester	33
unknown glycerol triester	29
unknown glycerol triester	27
Hexathiepane	22
unknown C9 aromatic hydrocarbon	19
unknown C9 aromatic hydrocarbon	18
Decanoic acid, octadecyl ester	17
6-Aminohexanoic acid	13
unknown C9 aromatic hydrocarbon	11
Octadecenoic acid	8
unknown C9 aromatic hydrocarbon	8
Tetrahydro-2,5-dimethyl thiophene	7
unknown (BP=174)	7
unknown C10 aromatic hydrocarbon	6

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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ANALYTICAL SERVICES, INC.

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58094-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BED-MW13-F, 12/14/94, 10:39, received 12/15/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb)(ug/l)(EPA 7041).....	14	2
Dissolved Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Dissolved Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Dissolved Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Dissolved Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Dissolved Lead (Pb)(ug/l)(EPA 7421).....	BDL	3
Dissolved Manganese (Mn)(ug/l)(EPA 6010A)....	BDL	40
Dissolved Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Dissolved Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Dissolved Selenium (Se)(ug/l)(EPA 7740).....	BDL	25
Dissolved Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Dissolved Zinc (Zn)(ug/l)(EPA 6010A).....	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Oliver

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 19, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58179-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BED-MW17-U, 12/15/94, 10:25, received 12/16/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	0.2	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb)(ug/l)(EPA 7041).....	BDL	2
Total Arsenic (As)(ug/l)(EPA 7060).....	18	10
Total Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Total Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Total Lead (Pb)(ug/l)(EPA 7421).....	BDL	3
Total Manganese (Mn)(ug/l)(EPA 6010A).....	BDL	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	10
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Total Zinc (Zn)(ug/l)(EPA 6010A).....	BDL	20

BDL - Below Detection Limit

Report No. 58179-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	1.1	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	0.4	0.10
2,6-Dinitrotoluene (2,6-DNT)	0.9	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1.7	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	2.1	0.41
3-Nitrotoluene (3-NT)	1.5	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	0.9	0.15

Volatile Organics (EPA 8240)

Acetone	150	40
Benzene	33	2
Bromodichloromethane	BDL	2
Bromoform	BDL	2
Bromomethane	BDL	4
2-Butanone	BDL	40
Carbon disulfide	BDL	40
Carbon tetrachloride	BDL	2
Chlorobenzene	BDL	2
Chlorodibromomethane	BDL	2
Chloroethane	BDL	4
2-Chloroethylvinyl ether	BDL	4
Chloroform	BDL	2

BDL - Below Detection Limit

Report No. 58179-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Chloromethane	BDL	4
1,1-Dichloroethane	BDL	2
1,2-Dichloroethane	BDL	2
1,1-Dichloroethene	BDL	2
trans-1,2-Dichloroethene	BDL	2
1,2-Dichloropropane	BDL	2
cis-1,3-Dichloropropene	BDL	2
trans-1,3-Dichloropropene	BDL	2
Ethylbenzene	98	2
2-Hexanone	BDL	20
Methylene chloride	BDL	2
4-Methyl-2-pentanone	BDL	20
Styrene	BDL	2
1,1,2,2-Tetrachloroethane	BDL	2
Tetrachloroethene	BDL	2
Toluene	160	2
1,1,1-Trichloroethane	BDL	2
Trichloroethene	BDL	2
Vinyl acetate	BDL	20
Vinyl chloride	BDL	0.8
Xylenes	420	2
cis-1,2-Dichloroethene	BDL	2
1,2-Dibromo-3-chloropropane (DBCP) (ug/l)(EPA 504)	BDL	0.20
1,2-Dibromoethane (EDB)(ug/l)(EPA 504)	BDL	0.20

Tentatively identified compounds (EPA 8240)	Estimated Concentration (ug/l)	
Butane	1200	-
Pentane	480	-
2-methyl-Butane	440	-
unknown	290	-
Cyclohexane	270	-
methyl-Cyclopentane	260	-
unknown	150	-
2-methyl-Pentane	100	-
1,2,4-trimethyl-Benzene	83	-
(methylthio)-Ethane	71	-

BDL - Below Detection Limit

Report No. 58179-1

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
4-Chloro-3-methylphenol	BDL	20
2-Chlorophenol	BDL	10
2,4-Dichlorophenol	BDL	10
2,4-Dimethylphenol	BDL	10
4,6-Dinitro-2-methylphenol	BDL	50
2,4-Dinitrophenol	BDL	50
2-Methylphenol	BDL	10
3-Methylphenol	BDL	10
4-Methylphenol	BDL	10
2-Nitrophenol	BDL	10
4-Nitrophenol	BDL	50
Pentachlorophenol	BDL	5
Phenol	BDL	10
2,4,5-Trichlorophenol	BDL	10
2,4,6-Trichlorophenol	BDL	10
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	2
Acenaphthylene	BDL	2
Anthracene	BDL	10
Benzoic Acid	BDL	50
Benzo(a)anthracene	BDL	2
Benzo(b)fluoranthene	BDL	2
Benzo(k)fluoranthene	BDL	4
Benzo(ghi)perylene	BDL	2
Benzo(a)pyrene	BDL	3
Benzyl Alcohol	BDL	20
Bis(2-chloroethoxy)methane	BDL	10
Bis(2-chloroethyl)ether	BDL	10
Bis(2-chloroisopropyl)ether	BDL	10
Bis(2-ethylhexyl)phthalate	BDL	3

BDL - Below Detection Limit

Report No. 58179-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
4-Bromophenyl phenyl ether	BDL	10
Benzyl butyl phthalate	BDL	2
4-Chloroaniline	BDL	20
2-Chloronaphthalene	BDL	10
4-Chlorophenyl phenyl ether	BDL	10
Chrysene	BDL	10
Dibenzo(a,h)anthracene	BDL	3
Dibenzofuran	BDL	10
Di-n-butylphthalate	BDL	2
1,3-Dichlorobenzene	BDL	10
1,4-Dichlorobenzene	BDL	10
1,2-Dichlorobenzene	BDL	10
3,3'-Dichlorobenzidine	BDL	20
Diethylphthalate	BDL	2
Dimethylphthalate	BDL	2
2,4-Dinitrotoluene	BDL	10
2,6-Dinitrotoluene	BDL	10
Di-n-octylphthalate	BDL	3
Fluoranthene	BDL	2
Fluorene	BDL	2
Hexachlorobenzene	BDL	2
Hexachlorobutadiene	BDL	10
Hexachlorocyclopentadiene	BDL	10
Hexachloroethane	BDL	10
Indeno(1,2,3-cd)pyrene	BDL	10
Isophorone	BDL	10
2-Methylnaphthalene	20	10
Naphthalene	21	10
2-Nitroaniline	BDL	50
3-Nitroaniline	BDL	50
4-Nitroaniline	BDL	20
Nitrobenzene	BDL	10
N-Nitrosodiphenylamine	BDL	10
N-Nitrosodi-n-propylamine	BDL	10
Phenanthrene	BDL	10
Pyrene	BDL	10
1,2,4-Trichlorobenzene	BDL	10

BDL - Below Detection Limit

Report No. 58179-1

RESULTS

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/l)	Detection Limit (ug/l)
Molecular Sulfur	4700	-
Dimethyl tetrasulfide	150	-
unknown C9 aromatic hydrocarbon	71	-
Dimethyl trisulfide	70	-
n-Tridecane (C13)	45	-
unknown C9 aromatic hydrocarbon	40	-
unknown glycerol triester	40	-
unknown glycerol triester	33	-
unknown C9 aromatic hydrocarbon	33	-
Hexathiepane	32	-
Tetrahydro-2,5-dimethyl thiophene	30	-
1,2,3,5,6-Pentathiepane	28	-
Dimethyl pentasulfide	25	-
unknown C10 aromatic hydrocarbon	23	-
Dimethyl disulfide	19	-
1-Methylnaphthalene	18	-
n-Dodecane (C12)	18	-
n-Heptacosane (C27)	16	-
6-Aminohexanoic acid	15	-
unknown C9 aromatic hydrocarbon	15	-

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 19, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58179-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BED-MW17-F, 12/15/94, 10:25, received 12/16/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb)(ug/l)(EPA 7041).....	7	2
Dissolved Arsenic (As)(ug/l)(EPA 7060).....	15	10
Dissolved Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Dissolved Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Dissolved Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Dissolved Lead (Pb)(ug/l)(EPA 7421).....	BDL	3
Dissolved Manganese (Mn)(ug/l)(EPA 6010A)....	BDL	40
Dissolved Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Dissolved Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Dissolved Selenium (Se)(ug/l)(EPA 7740).....	BDL	10
Dissolved Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Dissolved Zinc (Zn)(ug/l)(EPA 6010A).....	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 18, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58042-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BED-MW18-U, 12/13/94, 10:40, received 12/14/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	0.2	0.1

Report No. 58042-1

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Total Antimony (Sb) (ug/l) (EPA 7041)	BDL	15
Total Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Total Beryllium (Be) (ug/l) (EPA 7091)	BDL	5
Total Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Total Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Total Copper (Cu) (ug/l) (EPA 6010A)	36	20
Total Lead (Pb) (ug/l) (EPA 7421)	BDL ~~UJ~~ BLO 1.23.95	6
Total Manganese (Mn) (ug/l) (EPA 6010A)	89	40
Total Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Total Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Total Selenium (Se) (ug/l) (EPA 7740)	BDL UJ	50
Total Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Total Thallium (Tl) (ug/l) (EPA 7841)	BDL	5
Total Zinc (Zn) (ug/l) (EPA 6010A)	20	20

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	(ug/l)	(ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	6.4
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	4.5
Nitrobenzene (NB)	BDL	6.5
2,4-Dinitrotoluene (2,4-DNT)	BDL	1.0
2,6-Dinitrotoluene (2,6-DNT)	1.4	1.0
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	5.5
3,4-Dinitrotoluene (3,4-DNT)	2.2	2.1
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	16
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	1.6
2-Nitrotoluene (2-NT)	BDL UJ	4.1
3-Nitrotoluene (3-NT)	BDL	14
4-Nitrotoluene (4-NT)	BDL	6.2
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	9.4
1,3-Dinitrobenzene (1,3-DNB)	BDL	1.5

BDL - Below Detection Limit

Report No. 58042-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Acetone	BDL	40
Benzene	14	2
Bromodichloromethane	BDL	2
Bromoform	BDL	2
Bromomethane	BDL	4
2-Butanone	BDL	40
Carbon disulfide	160	40
Carbon tetrachloride	BDL	2
Chlorobenzene	BDL	2
Chlorodibromomethane	BDL	2
Chloroethane	BDL	4
2-Chloroethylvinyl ether	BDL	4
Chloroform	BDL	2
Chloromethane	BDL	4
1,1-Dichloroethane	BDL	2
1,2-Dichloroethane	BDL	2
1,1-Dichloroethene	BDL	2
trans-1,2-Dichloroethene	BDL	2
1,2-Dichloropropane	BDL	2
cis-1,3-Dichloropropene	BDL	2
trans-1,3-Dichloropropene	BDL	2
Ethylbenzene	79	2
2-Hexanone	BDL	20
Methylene chloride	BDL	2
4-Methyl-2-pentanone	BDL	20
Styrene	BDL	2
1,1,2,2-Tetrachloroethane	BDL	2
Tetrachloroethene	BDL	2
Toluene	72	2
1,1,1-Trichloroethane	BDL	2
Trichloroethene	BDL	2
Vinyl acetate	BDL	20
Vinyl chloride	BDL	0.8
Xylenes	350	2
cis-1,2-Dichloroethene	BDL	2
1,2-Dibromo-3-chloropropane (DBCP) (ug/l) (EPA 504)	BDL	0.2
1,2-Dibromoethane (EDB) (ug/l) (EPA 504)	BDL	0.2

BDL - Below Detection Limit

Report No. 58042-1

RESULTS

Tentatively identified compounds (EPA 8240)	Estimated Conc. (ug/l)
Methanethiol	600 NJ
Cyclopentane	230 NJ
Cyclohexane	140 NJ
methyl-Cyclopentane	110 NJ
1,1,2-trichloro-1,2,2-trifluoroethane	97 NJ
thiobis-Methane	86 NJ
(methylthio)-Ethane	64 NJ
1,2,4-trimethyl-Benzene	56 NJ

Acid Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
4-Chloro-3-methylphenol	BDL	20
2-Chlorophenol	BDL	10
2,4-Dichlorophenol	BDL	10
2,4-Dimethylphenol	19	10
4,6-Dinitro-2-methylphenol	BDL	50
2,4-Dinitrophenol	BDL	50
2-Methylphenol	BDL	10
3-Methylphenol	BDL	10
4-Methylphenol	BDL	10
2-Nitrophenol	BDL	10
4-Nitrophenol	BDL	50
Pentachlorophenol	BDL	5
Phenol	BDL	10
2,4,5-Trichlorophenol	BDL	10
2,4,6-Trichlorophenol	BDL	10

BDL - Below Detection Limit

Report No. 58042-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
Acenaphthene	BDL	2
Acenaphthylene	BDL	2
Anthracene	BDL	10
Benzoic Acid	BDL	50
Benzo(a)anthracene	BDL	2
Benzo(b)fluoranthene	BDL	2
Benzo(k)fluoranthene	BDL	4
Benzo(ghi)perylene	BDL	2
Benzo(a)pyrene	BDL	3
Benzyl Alcohol	BDL	20
Bis(2-chloroethoxy)methane	BDL	10
Bis(2-chloroethyl)ether	BDL	10
Bis(2-chloroisopropyl)ether	BDL	10
Bis(2-ethylhexyl)phthalate	BDL	3
4-Bromophenyl phenyl ether	BDL	10
Benzyl butyl phthalate	BDL	2
4-Chloroaniline	BDL	20
2-Chloronaphthalene	BDL	10
4-Chlorophenyl phenyl ether	BDL	10
Chrysene	BDL	10
Dibenzo(a,h)anthracene	BDL	3
Dibenzofuran	BDL	10
Di-n-butylphthalate	BDL	2
1,3-Dichlorobenzene	BDL	10
1,4-Dichlorobenzene	BDL	10
1,2-Dichlorobenzene	BDL	10
3,3'-Dichlorobenzidine	BDL	20
Diethylphthalate	BDL	2
Dimethylphthalate	BDL	2
2,4-Dinitrotoluene	BDL	10
2,6-Dinitrotoluene	BDL	10
Di-n-octylphthalate	BDL	3
Fluoranthene	BDL	2
Fluorene	BDL	2
Hexachlorobenzene	BDL	2
Hexachlorobutadiene	BDL	10
Hexachlorocyclopentadiene	BDL	10
Hexachloroethane	BDL	10

BDL - Below Detection Limit

Report No. 58042-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
Indeno(1,2,3-cd)pyrene	BDL	10
Isophorone	BDL	10
2-Methylnaphthalene	BDL	10
Naphthalene	17	10
2-Nitroaniline	BDL	50
3-Nitroaniline	BDL	50
4-Nitroaniline	BDL	20
Nitrobenzene	BDL	10
N-Nitrosodiphenylamine	BDL	10
N-Nitrosodi-n-propylamine	BDL	10
Phenanthrene	BDL	10
Pyrene	BDL	10
1,2,4-Trichlorobenzene	BDL	10

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/l)
Molecular Sulfur	6200 NJ
unknown glycerol triester	410 N
unknown glycerol triester	410 N
6-Aminohexanoic acid	370 NJ
Dimethyl trisulfide	340 NJ
Dimethyl disulfide	190 NJ
4,4'-Butylidenebis[2-(1,1-dimethylethyl) -5-methylphenol] (Santowhite antioxidant)	150 NJ
Dimethyl tetrasulfide	140 NJ
unknown C9 aromatic hydrocarbon	70 N
Hexathiepane	63 NJ
unknown C9 aromatic hydrocarbon	45 N
Thienothiophene	38 NJ
unknown glycerol triester	38 N
unknown glycerol triester	36 N
Tetrahydro-2-methyl thiophene	35 NJ
unknown C9 aromatic hydrocarbon	34 N
unknown ester	30 N
n-Octacosane (C28)	26 NJ
Tetrahydro-2,5-dimethyl thiophene	26 NJ
3-Methyl-3-pentanol	24 NJ

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Olier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 18, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58042-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BED-MW18-F, 12/13/94, 10:40, received 12/14/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041).....	BDL	20
Dissolved Arsenic (As) (ug/l) (EPA 7060).....	BDL	25
Dissolved Beryllium (Be) (ug/l) (EPA 7091).....	BDL	1.25
Dissolved Cadmium (Cd) (ug/l) (EPA 7131).....	BDL	2
Dissolved Chromium (Cr) (ug/l) (EPA 6010A).....	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A).....	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 7421).....	BDL UJ	6
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)....	80	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470).....	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A).....	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740).....	BDL ~~R BCO UJ~~ ~~R~~ UJ	25
Dissolved Silver (Ag) (ug/l) (EPA 6010A).....	BDL 0.345 BCO 1.2495	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841).....	BDL UJ	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A).....	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58096-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BED-MW20-U, 12/14/94, 11:28, received 12/15/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	0.2	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb)(ug/l)(EPA 7041).....	BDL	20
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Total Beryllium (Be)(ug/l)(EPA 7091).....	BDL	5
Total Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	5
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	54	20
Total Lead (Pb)(ug/l)(EPA 7421).....	BDL	6
Total Manganese (Mn)(ug/l)(EPA 6010A).....	140	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	50
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	5
Total Zinc (Zn)(ug/l)(EPA 6010A).....	24	20

BDL - Below Detection Limit

Report No. 58096-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.8	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	1.0
2,6-Dinitrotoluene (2,6-DNT)	BDL	1.0
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	53	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

Volatile Organics (EPA 8240)

Acetone	BDL	20
Benzene	8	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	20
Carbon disulfide	BDL	20
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit

Report No. 58096-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	10
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	10
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	4	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	10
Vinyl chloride	BDL	0.4
Xylenes	3	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane (DBCP) (ug/l)(EPA 504)	BDL	0.20
1,2-Dibromoethane (EDB)(ug/l)(EPA 504)	BDL	0.20

Tentatively identified compounds (EPA 8240)	Estimated Concentration (ug/l)	
Butane	16	-
2-methyl-2-Propanol	10	-

BDL - Below Detection Limit

Report No. 58096-1

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
4-Chloro-3-methylphenol	BDL	20
2-Chlorophenol	BDL	10
2,4-Dichlorophenol	BDL	10
2,4-Dimethylphenol	BDL	10
4,6-Dinitro-2-methylphenol	BDL	50
2,4-Dinitrophenol	BDL	50
2-Methylphenol	BDL	10
3-Methylphenol	BDL	10
4-Methylphenol	BDL	10
2-Nitrophenol	BDL	10
4-Nitrophenol	BDL	50
Pentachlorophenol	BDL	5
Phenol	BDL	10
2,4,5-Trichlorophenol	BDL	10
2,4,6-Trichlorophenol	BDL	10
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	2
Acenaphthylene	BDL	2
Anthracene	BDL	10
Benzoic Acid	BDL	50
Benzo(a)anthracene	BDL	2
Benzo(b)fluoranthene	BDL	2
Benzo(k)fluoranthene	BDL	4
Benzo(ghi)perylene	BDL	2
Benzo(a)pyrene	BDL	3
Benzyl Alcohol	BDL	20
Bis(2-chloroethoxy)methane	BDL	10
Bis(2-chloroethyl)ether	BDL	10
Bis(2-chloroisopropyl)ether	BDL	10

BDL - Below Detection Limit

Report No. 58096-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
Bis(2-ethylhexyl)phthalate	BDL	3
4-Bromophenyl phenyl ether	BDL	10
Benzyl butyl phthalate	BDL	2
4-Chloroaniline	BDL	20
2-Chloronaphthalene	BDL	10
4-Chlorophenyl phenyl ether	BDL	10
Chrysene	BDL	10
Dibenzo(a,h)anthracene	BDL	3
Dibenzofuran	BDL	10
Di-n-butylphthalate	BDL	2
1,3-Dichlorobenzene	BDL	10
1,4-Dichlorobenzene	BDL	10
1,2-Dichlorobenzene	BDL	10
3,3'-Dichlorobenzidine	BDL	20
Diethylphthalate	BDL	2
Dimethylphthalate	BDL	2
2,4-Dinitrotoluene	BDL	10
2,6-Dinitrotoluene	BDL	10
Di-n-octylphthalate	BDL	3
Fluoranthene	BDL	2
Fluorene	BDL	2
Hexachlorobenzene	BDL	2
Hexachlorobutadiene	BDL	10
Hexachlorocyclopentadiene	BDL	10
Hexachloroethane	BDL	10
Indeno(1,2,3-cd)pyrene	BDL	10
Isophorone	BDL	10
2-Methylnaphthalene	BDL	10
Naphthalene	BDL	10
2-Nitroaniline	BDL	50
3-Nitroaniline	BDL	50
4-Nitroaniline	BDL	20
Nitrobenzene	BDL	10
N-Nitrosodiphenylamine	BDL	10
N-Nitrosodi-n-propylamine	BDL	10
Phenanthrene	BDL	10
Pyrene	BDL	10
1,2,4-Trichlorobenzene	BDL	10

BDL - Below Detection Limit

Report No. 58096-1

RESULTS

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/l)	Detection Limit (ug/l)
unknown glycerol triester	24	-
unknown glycerol triester	23	-
unknown glycerol triester	16	-
unknown glycerol triester	14	-
Glycerol tricaprylate	10	-
unknown glycol derivative	9	-
6-Aminohexanoic acid	8	-
unknown glycol derivative	8	-
Decanoic acid, octadecyl ester	7	-
unknown glycol derivative	7	-
2,2'-[Ethylidenebis(oxy)]bispropane	6	-
4,4'-Butylidenebis[2-(1,1-dimethylethyl) -5-methylphenol]	5	-
(Santowhite antioxidant)		-
n-Octacosane (C28)	5	-
n-Nonacosane (C29)	4	-
unknown thiacycloalkane	4	-
n-Triacontane (C30)	4	-

Respectfully submitted,

By: Denise S. Dier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY • NORCROSS, GA 30092 • (404) 734-4200

FAX (404) 734-4201 • Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58096-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BED-MW20-F, 12/14/94, 11:28, received 12/15/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb)(ug/l)(EPA 7041).....	BDL	25
Dissolved Arsenic (As)(ug/l)(EPA 7060).....	BDL	25
Dissolved Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1.25
Dissolved Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	2
Dissolved Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Dissolved Lead (Pb)(ug/l)(EPA 7421).....	BDL	12
Dissolved Manganese (Mn)(ug/l)(EPA 6010A)....	140	40
Dissolved Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Dissolved Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Dissolved Selenium (Se)(ug/l)(EPA 7740).....	BDL	25
Dissolved Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Dissolved Zinc (Zn)(ug/l)(EPA 6010A).....	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58029-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BED-MW21-U, 12/13/94, 10:40, received 12/14/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	0.4	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb)(ug/l)(EPA 7041).....	BDL	10
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	50
Total Beryllium (Be)(ug/l)(EPA 7091).....	BDL	5
Total Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	5
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	36	20
Total Lead (Pb)(ug/l)(EPA 7421).....	BDL	6
Total Manganese (Mn)(ug/l)(EPA 6010A).....	90	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	50
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	5
Total Zinc (Zn)(ug/l)(EPA 6010A).....	27	20

BDL - Below Detection Limit

 Report No. 58029-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	1.9
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	1.4
Nitrobenzene (NB)	BDL	2.0
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.3
2,6-Dinitrotoluene (2,6-DNT)	1.2	0.3
4-Amino-2-nitrotoluene (4-Am-2-NT)	2.0	1.7
3,4-Dinitrotoluene (3,4-DNT)	2.9	0.7
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	4.7
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.5
2-Nitrotoluene (2-NT)	BDL	1.3
3-Nitrotoluene (3-NT)	BDL	4.2
4-Nitrotoluene (4-NT)	BDL	1.9
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	2.9
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.5

Volatile Organics (EPA 8240)

Acetone	BDL	40
Benzene	16	2
Bromodichloromethane	BDL	2
Bromoform	BDL	2
Bromomethane	BDL	4
2-Butanone	BDL	40
Carbon disulfide	90	40
Carbon tetrachloride	BDL	2
Chlorobenzene	BDL	2
Chlorodibromomethane	BDL	2
Chloroethane	BDL	4
2-Chloroethylvinyl ether	BDL	4
Chloroform	BDL	2
Chloromethane	BDL	4
1,1-Dichloroethane	BDL	2
1,2-Dichloroethane	BDL	2
1,1-Dichloroethene	BDL	2
trans-1,2-Dichloroethene	BDL	2
1,2-Dichloropropane	BDL	2
cis-1,3-Dichloropropene	BDL	2
trans-1,3-Dichloropropene	BDL	2
Ethylbenzene	120	2
2-Hexanone	BDL	20
Methylene chloride	BDL	2
4-Methyl-2-pentanone	BDL	20

BDL - Below Detection Limit

Report No. 58029-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Styrene	BDL	2
1,1,2,2-Tetrachloroethane	BDL	2
Tetrachloroethene	BDL	2
Toluene	93	2
1,1,1-Trichloroethane	BDL	2
Trichloroethene	BDL	2
Vinyl acetate	BDL	20
Vinyl chloride	BDL	0.8
Xylenes	520	2
cis-1,2-Dichloroethene	BDL	2
1,2-Dibromo-3-chloropropane (DBCP) (ug/l)(EPA 504)	BDL	0.2
1,2-Dibromoethane (EDB)(ug/l)(EPA 504)	BDL	0.2

Tentatively Identified Compounds (EPA 8240)	Estimated Concentration (ug/l)	
Butane	650	-
Pentane	410	-
Cyclopentane	360	-
Cyclohexane	300	-
ethyl-Cyclobutane	280	-
dimethyl Disulfide	230	-
unknown	150	-
thiobis-Methane	120	-
1,2,4-trimethyl-Benzene	79	-
(methylthio)-Ethane	71	-

Acid Extractable Organics (EPA 8270)	(ug/l)	
4-Chloro-3-methylphenol	BDL	20
2-Chlorophenol	BDL	10
2,4-Dichlorophenol	BDL	10
2,4-Dimethylphenol	17	10
4,6-Dinitro-2-methylphenol	BDL	50
2,4-Dinitrophenol	BDL	50
2-Methylphenol	BDL	10
3-Methylphenol	BDL	10
4-Methylphenol	BDL	10
2-Nitrophenol	BDL	10
4-Nitrophenol	BDL	50
Pentachlorophenol	BDL	5
Phenol	BDL	10
2,4,5-Trichlorophenol	BDL	10
2,4,6-Trichlorophenol	BDL	10

BDL - Below Detection Limit

Report No. 58029-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
Acenaphthene	BDL	2
Acenaphthylene	BDL	2
Anthracene	BDL	10
Benzoic Acid	BDL	50
Benzo(a)anthracene	BDL	2
Benzo(b)fluoranthene	BDL	2
Benzo(k)fluoranthene	BDL	4
Benzo(ghi)perylene	BDL	2
Benzo(a)pyrene	BDL	3
Benzyl Alcohol	BDL	20
Bis(2-chloroethoxy)methane	BDL	10
Bis(2-chloroethyl)ether	BDL	10
Bis(2-chloroisopropyl)ether	BDL	10
Bis(2-ethylhexyl)phthalate	BDL	3
4-Bromophenyl phenyl ether	BDL	10
Benzyl butyl phthalate	BDL	2
4-Chloroaniline	BDL	20
2-Chloronaphthalene	BDL	10
4-Chlorophenyl phenyl ether	BDL	10
Chrysene	BDL	10
Dibenzo(a,h)anthracene	BDL	3
Dibenzofuran	BDL	10
Di-n-butylphthalate	BDL	2
1,3-Dichlorobenzene	BDL	10
1,4-Dichlorobenzene	BDL	10
1,2-Dichlorobenzene	BDL	10
3,3'-Dichlorobenzidine	BDL	20
Diethylphthalate	BDL	2
Dimethylphthalate	BDL	2
2,4-Dinitrotoluene	BDL	10
2,6-Dinitrotoluene	BDL	10
Di-n-octylphthalate	BDL	3
Fluoranthene	BDL	2
Fluorene	BDL	2
Hexachlorobenzene	BDL	2
Hexachlorobutadiene	BDL	10
Hexachlorocyclopentadiene	BDL	10
Hexachloroethane	BDL	10
Indeno(1,2,3-cd)pyrene	BDL	10
Isophorone	BDL	10
2-Methylnaphthalene	BDL	10
Naphthalene	15	10
2-Nitroaniline	BDL	50
3-Nitroaniline	BDL	50
4-Nitroaniline	BDL	20
Nitrobenzene	BDL	10
N-Nitrosodiphenylamine	BDL	10

BDL - Below Detection Limit

Report No. 58029-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
N-Nitrosodi-n-propylamine	BDL	10
Phenanthrene	BDL	10
Pyrene	BDL	10
1,2,4-Trichlorobenzene	BDL	10

Tentatively Identified Compounds (EPA 8240)	Estimated Concentration (ug/l)	
Molecular Sulfur	6400	-
Dimethyl trisulfide	360	-
Dimethyl tetrasulfide	190	-
Dimethyl disulfide	160	-
unknown Glycerol triester	150	-
unknown Glycerol triester	140	-
6-Aminohexanoic acid	130	-
Hexathiepane	69	-
unknown C9 aromatic hydrocarbon	57	-
4-4'Butylidenebis[2-(1,1-dimethylethyl) -5-methylphenol] (Santowhite antioxidant)	48	-
Thienothiophene	45	-
unknown C9 aromatic hydrocarbon	39	-
unknown C9 aromatic hydrocarbon	25	-
3-Methyl-3-pentanol	22	-
Tetrahydro-2-methyl-thiophene	22	-
Ethyl isopropyl sulfide	17	-
unknown trimethylphenol	16	-
Tetrahydro-2,5-dimethyl-thiophene	15	-
unknown C9 aromatic hydrocarbon	15	-
unknown C9 aromatic hydrocarbon	15	-

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58029-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BED-MW21-F, 12/13/94, 10:40, received 12/14/94

RESULTS

PPL Metals + Mn (Groundwater)	Result (ug/l)	Detection Limit (ug/l)
Dissolved Antimony (Sb)(ug/l)(EPA 7041).....	BDL	10
Dissolved Arsenic (As)(ug/l)(EPA 7060).....	BDL	25
Dissolved Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1.25
Dissolved Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	2
Dissolved Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Dissolved Lead (Pb)(ug/l)(EPA 7421).....	BDL	6
Dissolved Manganese (Mn)(ug/l)(EPA 6010A)....	80	40
Dissolved Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Dissolved Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Dissolved Selenium (Se)(ug/l)(EPA 7740).....	BDL	25
Dissolved Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Dissolved Zinc (Zn)(ug/l)(EPA 6010A).....	20	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dia

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 18, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58171-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-REACTOR2-U, 12/15/94, received 12/16/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	0.2	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb)(ug/l)(EPA 7041).....	BDL	2
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Total Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Total Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	20	20
Total Lead (Pb)(ug/l)(EPA 7421).....	9.6	3
Total Manganese (Mn)(ug/l)(EPA 6010A).....	470	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	70	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	10
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Total Zinc (Zn)(ug/l)(EPA 6010A).....	90	20

BDL - Below Detection Limit

Report No. 58171-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.6	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	0.3	0.10
2,6-Dinitrotoluene (2,6-DNT)	1.1	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	13	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	1.2	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	23	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

Volatile Organics (EPA 8240)

Acetone	BDL	20
Benzene	1.8	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	20
Carbon disulfide	BDL	20
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit

Report No. 58171-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	1.2	1
2-Hexanone	BDL	10
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	10
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	10
Vinyl chloride	BDL	0.4
Xylenes	8	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane (DBCP) (ug/l) (EPA 504)	BDL	0.20
1,2-Dibromoethane (EDB) (ug/l) (EPA 504)	BDL	0.20

Tentatively identified compounds (EPA 8240)	Estimated Concentration	
2-methyl-Propane	9	-
Cyclohexane	6	-

BDL - Below Detection Limit

Report No. 58171-1

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
4-Chloro-3-methylphenol	BDL	20
2-Chlorophenol	BDL	10
2,4-Dichlorophenol	BDL	10
2,4-Dimethylphenol	BDL	10
4,6-Dinitro-2-methylphenol	BDL	50
2,4-Dinitrophenol	BDL	50
2-Methylphenol	BDL	10
3-Methylphenol	BDL	10
4-Methylphenol	BDL	10
2-Nitrophenol	BDL	10
4-Nitrophenol	BDL	50
Pentachlorophenol	BDL	5
Phenol	BDL	10
2,4,5-Trichlorophenol	BDL	10
2,4,6-Trichlorophenol	BDL	10
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	2
Acenaphthylene	BDL	2
Anthracene	BDL	10
Benzoic Acid	BDL	50
Benzo(a)anthracene	BDL	2
Benzo(b)fluoranthene	BDL	2
Benzo(k)fluoranthene	BDL	4
Benzo(ghi)perylene	BDL	2
Benzo(a)pyrene	BDL	3
Benzyl Alcohol	BDL	20
Bis(2-chloroethoxy)methane	BDL	10
Bis(2-chloroethyl)ether	BDL	10
Bis(2-chloroisopropyl)ether	BDL	10

BDL - Below Detection Limit

Report No. 58171-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
Bis(2-ethylhexyl)phthalate	BDL	3
4-Bromophenyl phenyl ether	BDL	10
Benzyl butyl phthalate	BDL	2
4-Chloroaniline	BDL	20
2-Chloronaphthalene	BDL	10
4-Chlorophenyl phenyl ether	BDL	10
Chrysene	BDL	10
Dibenzo(a,h)anthracene	BDL	3
Dibenzofuran	BDL	10
Di-n-butylphthalate	BDL	2
1,3-Dichlorobenzene	BDL	10
1,4-Dichlorobenzene	BDL	10
1,2-Dichlorobenzene	BDL	10
3,3'-Dichlorobenzidine	BDL	20
Diethylphthalate	BDL	2
Dimethylphthalate	BDL	2
2,4-Dinitrotoluene	BDL	10
2,6-Dinitrotoluene	BDL	10
Di-n-octylphthalate	BDL	3
Fluoranthene	BDL	2
Fluorene	BDL	2
Hexachlorobenzene	BDL	2
Hexachlorobutadiene	BDL	10
Hexachlorocyclopentadiene	BDL	10
Hexachloroethane	BDL	10
Indeno(1,2,3-cd)pyrene	BDL	10
Isophorone	BDL	10
2-Methylnaphthalene	BDL	10
Naphthalene	BDL	10
2-Nitroaniline	BDL	50
3-Nitroaniline	BDL	50
4-Nitroaniline	BDL	20
Nitrobenzene	BDL	10
N-Nitrosodiphenylamine	BDL	10
N-Nitrosodi-n-propylamine	BDL	10
Phenanthrene	BDL	10
Pyrene	BDL	10
1,2,4-Trichlorobenzene	BDL	10

BDL - Below Detection Limit

Report No. 58171-1

RESULTS

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/l)	Detection Limit (ug/l)
Molecular Sulfur	600	-
6-Aminohexanoic acid	400	-
unknown glycerol triester	360	-
unknown glycerol triester	250	-
4,4'-Butylidenebis[2-(1,1-dimethylethyl) -5-methylphenol] (Santowhite antioxidant)	140	-
unknown steroid (MW=388)	93	-
unknown steroid (MW=388)	37	-
unknown C18 isoparaffinic hydrocarbon	32	-
unknown C20 isoparaffinic hydrocarbon	29	-
unknown C18 isoparaffinic hydrocarbon	27	-
unknown C18 isoparaffinic hydrocarbon	25	-
unknown fatty acid ester	18	-
2-Ethyl-1-hexanol	14	-
unknown steroid (MW=388)	12	-
unknown isoparaffinic hydrocarbon (C28?)	12	-
n-Hentriacontane (C31)	12	-
Octadecanoic acid	12	-
unknown C14 cycloparaffinic hydrocarbon	10	-
unknown isoparaffinic hydrocarbon (C30?)	10	-
n-Pentadecane (C15)	9	-

Note: A very broad peak was observed in the BNA analysis which appears to be a fatty alcohol.

Respectfully submitted,

By: Denise A. Dier

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FAX (404) 734-4201 • Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 18, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58171-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-REACTOR2-F, 12/15/94, received 12/16/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041)	BDL	10
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Dissolved Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Dissolved Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	20	20
Dissolved Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	120	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL	10
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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ANALYTICAL SERVICES, INC.

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FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57992-3

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-DM-MW22-U, 12/12/94, 10:07, received 12/13/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	16	1.0

Report No. 57992-3

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Total Antimony (Sb) (ug/l) (EPA 7041)	BDL	2
Total Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Total Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Total Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Total Chromium (Cr) (ug/l) (EPA 6010A)	BDL	20
Total Copper (Cu) (ug/l) (EPA 6010A)	32	20
Total Lead (Pb) (ug/l) (EPA 7421)	4	3
Total Manganese (Mn) (ug/l) (EPA 6010A)	1800	40
Total Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Total Nickel (Ni) (ug/l) (EPA 6010A)	47	20
Total Selenium (Se) (ug/l) (EPA 7740)	BDL UJ	10
Total Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Total Thallium (Tl) (ug/l) (EPA 7841)	0.5	0.5
Total Zinc (Zn) (ug/l) (EPA 6010A)	63	20

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	(ug/l)	(ug/l)
		BQ 2-13-95
2,4,6-Trinitrotoluene (2,4,6-TNT)	26	~~6.4~~ 0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	570	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	250	0.10
2,6-Dinitrotoluene (2,6-DNT)	10	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	1.1
3,4-Dinitrotoluene (3,4-DNT)	2.6	2.1
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	2.6	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	5.2	0.16
2-Nitrotoluene (2-NT)	BDL UJ	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	4.4	0.94
1,3-Dinitrobenzene (1,3-DNB)	400	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57992-4

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-DM-MW22-F, 12/12/94, 10:07, received 12/13/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb)(ug/l)(EPA 7041).....	BDL	2
Dissolved Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Dissolved Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Dissolved Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Dissolved Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Copper (Cu)(ug/l)(EPA 6010A).....	20	20
Dissolved Lead (Pb)(ug/l)(EPA 7421).....	BDL	3
Dissolved Manganese (Mn)(ug/l)(EPA 6010A)....	970	40
Dissolved Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Dissolved Nickel (Ni)(ug/l)(EPA 6010A).....	60	20
Dissolved Selenium (Se)(ug/l)(EPA 7740).....	BDL	10
Dissolved Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Dissolved Zinc (Zn)(ug/l)(EPA 6010A).....	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 18, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58173-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-DRILLWATER-U, 12/15/94, 11:16, received 12/16/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	0.3	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb)(ug/l)(EPA 7041).....	BDL	2
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Total Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Total Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	20	20
Total Lead (Pb)(ug/l)(EPA 7421).....	3.1	3
Total Manganese (Mn)(ug/l)(EPA 6010A).....	BDL	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	10
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Total Zinc (Zn)(ug/l)(EPA 6010A).....	110	20

BDL - Below Detection Limit

Report No. 58173-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	13	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	1.6	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	0.4	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

Volatile Organics (EPA 8240)

Acetone	BDL	20
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	20
Carbon disulfide	BDL	20
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit

Report No. 58173-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	10
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	10
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	10
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane (DBCP) (ug/l) (EPA 504)	BDL	0.20
1,2-Dibromoethane (EDB) (ug/l) (EPA 504)	BDL	0.20
Tentatively identified compounds (EPA 8240)	None found	-

BDL - Below Detection Limit

Report No. 58173-1

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
4-Chloro-3-methylphenol	BDL	20
2-Chlorophenol	BDL	10
2,4-Dichlorophenol	BDL	10
2,4-Dimethylphenol	BDL	10
4,6-Dinitro-2-methylphenol	BDL	50
2,4-Dinitrophenol	BDL	50
2-Methylphenol	BDL	10
3-Methylphenol	BDL	10
4-Methylphenol	BDL	10
2-Nitrophenol	BDL	10
4-Nitrophenol	BDL	50
Pentachlorophenol	BDL	5
Phenol	BDL	10
2,4,5-Trichlorophenol	BDL	10
2,4,6-Trichlorophenol	BDL	10
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	2
Acenaphthylene	BDL	2
Anthracene	BDL	10
Benzoic Acid	BDL	50
Benzo(a)anthracene	BDL	2
Benzo(b)fluoranthene	BDL	2
Benzo(k)fluoranthene	BDL	4
Benzo(ghi)perylene	BDL	2
Benzo(a)pyrene	BDL	3
Benzyl Alcohol	BDL	20
Bis(2-chloroethoxy)methane	BDL	10
Bis(2-chloroethyl)ether	BDL	10
Bis(2-chloroisopropyl)ether	BDL	10

BDL - Below Detection Limit

Report No. 58173-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
Bis(2-ethylhexyl)phthalate	BDL	3
4-Bromophenyl phenyl ether	BDL	10
Benzyl butyl phthalate	BDL	2
4-Chloroaniline	BDL	20
2-Chloronaphthalene	BDL	10
4-Chlorophenyl phenyl ether	BDL	10
Chrysene	BDL	10
Dibenzo(a,h)anthracene	BDL	3
Dibenzofuran	BDL	10
Di-n-butylphthalate	BDL	2
1,3-Dichlorobenzene	BDL	10
1,4-Dichlorobenzene	BDL	10
1,2-Dichlorobenzene	BDL	10
3,3'-Dichlorobenzidine	BDL	20
Diethylphthalate	BDL	2
Dimethylphthalate	BDL	2
2,4-Dinitrotoluene	BDL	10
2,6-Dinitrotoluene	BDL	10
Di-n-octylphthalate	BDL	3
Fluoranthene	BDL	2
Fluorene	BDL	2
Hexachlorobenzene	BDL	2
Hexachlorobutadiene	BDL	10
Hexachlorocyclopentadiene	BDL	10
Hexachloroethane	BDL	10
Indeno(1,2,3-cd)pyrene	BDL	10
Isophorone	BDL	10
2-Methylnaphthalene	BDL	10
Naphthalene	BDL	10
2-Nitroaniline	BDL	50
3-Nitroaniline	BDL	50
4-Nitroaniline	BDL	20
Nitrobenzene	BDL	10
N-Nitrosodiphenylamine	BDL	10
N-Nitrosodi-n-propylamine	BDL	10
Phenanthrene	BDL	10
Pyrene	BDL	10
1,2,4-Trichlorobenzene	BDL	10

BDL - Below Detection Limit

Report No. 58173-1

RESULTS

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/l)	Detection Limit (ug/l)
unknown Dodecanoic acid ester.....	140	-
unknown Dodecanoic acid ester.....	14	-
unknown fatty acid ester.....	13	-
unknown Decanoic acid ester.....	6	-
unknown fatty acid ester.....	5	-
2-(Methylthio)-benzothiazole.....	4	-
N-Methyl-3,5-dinitrobenzeneamine.....	4	-

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 18, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58173-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-DRILLWATER-F, 12/15/94, 11:16, received 12/16/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041)	10	2
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Dissolved Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Dissolved Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	BDL	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL	10
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	240	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

February 28, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah Raede

Report No. 59627-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-Drill Water-2, 2/13/95, 11:15, received 2/14/95

RESULTS

Nitroaromatics and Nitramines by HPLC [water] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	1.1	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1.7	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise L Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

August 31, 1995

Attention: Ms. Debbie Raede

Report No. 65124-1

Sample: Potable Water, grab, USACE, Plum Brook Ordnance Works, #04, 8/15/95, 10:45, received 8/16/95

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Deer

LABORATORY REPORTS

EQUIPMENT AND TRIP BLANKS

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ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56814-2

Sample: Water, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-E-BG-S3-0.5/3.0, 10/31/94, 15:50, received 11/1/94

RESULTS

PPL Metals + Mn (Surface Water)	Result	Detection Limit
Total Antimony (Sb) (ug/l) (EPA 6010A)	BDL	50
Total Arsenic (As) (ug/l) (EPA 7060)	BDL	30
Total Beryllium (Be) (ug/l) (EPA 6010A)	BDL	10
Total Cadmium (Cd) (ug/l) (EPA 6010A)	BDL	10
Total Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Total Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Total Lead (Pb) (ug/l) (EPA 6010A)	BDL	25
Total Manganese (Mn) (ug/l) (EPA 6010A)	BDL	40
Total Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Total Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Total Selenium (Se) (ug/l) (EPA 7740)	BDL	40
Total Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Total Thallium (Tl) (ug/l) (EPA 7841)	BDL	50
Total Zinc (Zn) (ug/l) (EPA 6010A)	20	20

BDL - Below Detection Limit

Report No. 56814-2

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

Volatile Organics (EPA 8240)

Acetone	BDL	20
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	20
Carbon disulfide	BDL	20
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit

Report No. 56814-2

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	10
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	10
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	10
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	10
1,2-Dibromoethane	BDL	10

Tentatively identified compounds (EPA 8240) None found

Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	20
2-Chlorophenol	BDL	10
2,4-Dichlorophenol	BDL	10
2,4-Dimethylphenol	BDL	10
4,6-Dinitro-2-methylphenol	BDL	50
2,4-Dinitrophenol	BDL	50
2-Methylphenol	BDL	10
3-Methylphenol	BDL	10
4-Methylphenol	BDL	10
2-Nitrophenol	BDL	10
4-Nitrophenol	BDL	50
Pentachlorophenol	BDL	5
Phenol	BDL	10
2,4,5-Trichlorophenol	BDL	10
2,4,6-Trichlorophenol	BDL	10

BDL - Below Detection Limit

Report No. 56814-2

RESULTS

Base/Neutral Extactable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
Acenaphthene	BDL	2
Acenaphthylene	BDL	2
Anthracene	BDL	10
Benzoic Acid	BDL	50
Benzo(a)anthracene	BDL	2
Benzo(b)fluoranthene	BDL	2
Benzo(k)fluoranthene	BDL	4
Benzo(ghi)perylene	BDL	2
Benzo(a)pyrene	BDL	3
Benzyl Alcohol	BDL	20
Bis(2-chloroethoxy)methane	BDL	10
Bis(2-chloroethyl)ether	BDL	10
Bis(2-chloroisopropyl)ether	BDL	10
Bis(2-ethylhexyl)phthalate	BDL	3
4-Bromophenyl phenyl ether	BDL	10
Benzyl butyl phthalate	BDL	2
4-Chloroaniline	BDL	20
2-Chloronaphthalene	BDL	10
4-Chlorophenyl phenyl ether	BDL	10
Chrysene	BDL	10
Dibenzo(a,h)anthracene	BDL	3
Dibenzofuran	BDL	10
Di-n-butylphthalate	BDL	2
1,3-Dichlorobenzene	BDL	10
1,4-Dichlorobenzene	BDL	10
1,2-Dichlorobenzene	BDL	10
3,3'-Dichlorobenzidine	BDL	20
Diethylphthalate	BDL	2

BDL - Below Detection Limit

Report No. 56814-2

RESULTS

Base/Neutral Extactable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
Dimethylphthalate	BDL	2
2,4-Dinitrotoluene	BDL	10
2,6-Dinitrotoluene	BDL	10
Di-n-octylphthalate	BDL	3
Fluoranthene	BDL	2
Fluorene	BDL	2
Hexachlorobenzene	BDL	2
Hexachlorobutadiene	BDL	10
Hexachlorocyclopentadiene	BDL	10
Hexachloroethane	BDL	10
Indeno(1,2,3-cd)pyrene	BDL	10
Isophorone	BDL	10
2-Methylnaphthalene	BDL	10
Naphthalene	BDL	10
2-Nitroaniline	BDL	50
3-Nitroaniline	BDL	50
4-Nitroaniline	BDL	20
Nitrobenzene	BDL	10
N-Nitrosodiphenylamine	BDL	10
N-Nitrosodi-n-propylamine	BDL	10
Phenanthrene	BDL	10
Pyrene	BDL	10
1,2,4-Trichlorobenzene	BDL	10

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/l)
Diacetone alcohol (Aldol-condensation product)	21
unknown cycloparaffin, BP=69, MW>191	15
Unknown, BP=57, MW>171	4

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57990-3

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-E-TNTA-DM-MW10-U, 12/12/94, 10:45, received 12/13/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N) (mg/l) (EPA 353.2).....	0.2	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb) (ug/l) (EPA 7041).....	BDL	2
Total Arsenic (As) (ug/l) (EPA 7060).....	BDL	10
Total Beryllium (Be) (ug/l) (EPA 7091).....	BDL	1
Total Cadmium (Cd) (ug/l) (EPA 7131).....	BDL	1
Total Chromium (Cr) (ug/l) (EPA 6010A).....	BDL	10
Total Copper (Cu) (ug/l) (EPA 6010A).....	BDL	20
Total Lead (Pb) (ug/l) (EPA 7421).....	BDL	3
Total Manganese (Mn) (ug/l) (EPA 6010A).....	BDL	40
Total Mercury (Hg) (ug/l) (EPA 7470).....	BDL	0.5
Total Nickel (Ni) (ug/l) (EPA 6010A).....	BDL	20
Total Selenium (Se) (ug/l) (EPA 7740).....	BDL	10
Total Silver (Ag) (ug/l) (EPA 6010A).....	BDL	10
Total Thallium (Tl) (ug/l) (EPA 7841).....	BDL	0.5
Total Zinc (Zn) (ug/l) (EPA 6010A).....	BDL	20

Report No. 57990-3

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57990-4

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-E-TNTA-DM-MW10-F, 12/12/94, 10:45, received 12/13/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041)	BDL	2
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Dissolved Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Dissolved Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	BDL	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL	10
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise L. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58049-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-E-BED-MW18-U, 12/13/94, 09:30, received 12/14/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N) (mg/l) (EPA 353.2)	0.3	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb) (ug/l) (EPA 7041)	BDL	2
Total Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Total Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Total Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Total Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Total Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Total Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Total Manganese (Mn) (ug/l) (EPA 6010A)	BDL	40
Total Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Total Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Total Selenium (Se) (ug/l) (EPA 7740)	BDL	10
Total Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Total Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Total Zinc (Zn) (ug/l) (EPA 6010A)	28	20

BDL - Below Detection Limit

 Report No. 58049-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	1.3
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.9
Nitrobenzene (NB)	BDL	1.4
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.2
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.2
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	1.1
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.5
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	3.2
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.4
2-Nitrotoluene (2-NT)	BDL	0.9
3-Nitrotoluene (3-NT)	BDL	2.8
4-Nitrotoluene (4-NT)	BDL	1.3
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	1.9
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.3

Volatile Organics (EPA 8240)

Acetone	BDL	20
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	20
Carbon disulfide	BDL	20
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1

BDL - Below Detection Limit

Report No. 58049-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
2-Hexanone	BDL	10
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	10
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	10
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane (DBCP) (ug/l)(EPA 504)	BDL	0.20
1,2-Dibromoethane (EDB)(ug/l)(EPA 504)	BDL	0.20

Tentatively identified compounds (EPA 8240): None found

Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	20
2-Chlorophenol	BDL	10
2,4-Dichlorophenol	BDL	10
2,4-Dimethylphenol	BDL	10
4,6-Dinitro-2-methylphenol	BDL	50
2,4-Dinitrophenol	BDL	50
2-Methylphenol	BDL	10
3-Methylphenol	BDL	10
4-Methylphenol	BDL	10
2-Nitrophenol	BDL	10
4-Nitrophenol	BDL	50
Pentachlorophenol	BDL	5
Phenol	BDL	10
2,4,5-Trichlorophenol	BDL	10
2,4,6-Trichlorophenol	BDL	10

BDL - Below Detection Limit

Report No. 58049-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
Acenaphthene	BDL	2
Acenaphthylene	BDL	2
Anthracene	BDL	10
Benzoic Acid	BDL	50
Benzo(a)anthracene	BDL	2
Benzo(b)fluoranthene	BDL	2
Benzo(k)fluoranthene	BDL	4
Benzo(ghi)perylene	BDL	2
Benzo(a)pyrene	BDL	3
Benzyl Alcohol	BDL	20
Bis(2-chloroethoxy)methane	BDL	10
Bis(2-chloroethyl)ether	BDL	10
Bis(2-chloroisopropyl)ether	BDL	10
Bis(2-ethylhexyl)phthalate	BDL	3
4-Bromophenyl phenyl ether	BDL	10
Benzyl butyl phthalate	BDL	2
4-Chloroaniline	BDL	20
2-Chloronaphthalene	BDL	10
4-Chlorophenyl phenyl ether	BDL	10
Chrysene	BDL	10
Dibenzo(a,h)anthracene	BDL	3
Dibenzofuran	BDL	10
Di-n-butylphthalate	BDL	2
1,3-Dichlorobenzene	BDL	10
1,4-Dichlorobenzene	BDL	10
1,2-Dichlorobenzene	BDL	10
3,3'-Dichlorobenzidine	BDL	20
Diethylphthalate	BDL	2
Dimethylphthalate	BDL	2
2,4-Dinitrotoluene	BDL	10
2,6-Dinitrotoluene	BDL	10
Di-n-octylphthalate	BDL	3
Fluoranthene	BDL	2
Fluorene	BDL	2

BDL - Below Detection Limit

Report No. 58049-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
Hexachlorobenzene	BDL	2
Hexachlorobutadiene	BDL	10
Hexachlorocyclopentadiene	BDL	10
Hexachloroethane	BDL	10
Indeno(1,2,3-cd)pyrene	BDL	10
Isophorone	BDL	10
2-Methylnaphthalene	BDL	10
Naphthalene	BDL	10
2-Nitroaniline	BDL	50
3-Nitroaniline	BDL	50
4-Nitroaniline	BDL	20
Nitrobenzene	BDL	10
N-Nitrosodiphenylamine	BDL	10
N-Nitrosodi-n-propylamine	BDL	10
Phenanthrene	BDL	10
Pyrene	BDL	10
1,2,4-Trichlorobenzene	BDL	10

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/l)
Diacetone alcohol (Aldol-condensation product)	43

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY • NORCROSS, GA 30092 • (404) 734-4200

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58049-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-E-BED-MW18-F, 12/13/94, 09:30, received 12/14/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041)	12	2
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Dissolved Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Dissolved Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	BDL	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL	10
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dein

ASI

ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58049-3

Sample: Trip Blank, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-T-12/13/94, 12/13/94, received 12/14/94

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Acetone	BDL	20
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	20
Carbon disulfide	BDL	20
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit

Report No. 58049-3

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	10
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	10
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	1.2	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	10
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane (DBCP) (ug/l) (EPA 504)	BDL	0.20
1,2-Dibromoethane (EDB) (ug/l) (EPA 504)	BDL	0.20

Tentatively identified compounds (EPA 8240): None found

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Deier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY • NORCROSS, GA 30092 • (404) 734-4200

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 19, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58098-3

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-T-12/14/94, 12/14/94, received 12/15/94

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Acetone	BDL	20
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	20
Carbon disulfide	BDL	20
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	10
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	10

BDL - Below Detection Limit

Report No. 58098-3

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	1.1	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	10
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane (DBCP) (ug/l)(EPA 504)	BDL	0.20
1,2-Dibromoethane (EDB)(ug/l)(EPA 504)	BDL	0.20
Tentatively Identified Compounds (EPA 8240)	None found	-

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 19, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58179-3

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-T-12/15/94, 12/15/94, received 12/16/94

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Acetone	BDL	20
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	20
Carbon disulfide	BDL	20
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit

Report No. 58179-3

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	10
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	10
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	10
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane (DBCP) (ug/l)(EPA 504)	BDL	0.20
1,2-Dibromoethane (EDB)(ug/l)(EPA 504)	BDL	0.20
Tentatively identified compounds (EPA 8240)	None found	-

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Deier