



DAMES & MOORE

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**RECORDS REVIEW REPORT
PLUM BROOK ORDNANCE
WORKS
SANDUSKY, OHIO**

APRIL 1997

**235 PEACHTREE STREET, N.E.
NORTH TOWER, SUITE 2000
ATLANTA, GEORGIA 30303-1405
Job No. 04715-052-009**

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LIST OF ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
CEORN CERCLA	U.S. Army Corps of Engineers, Nashville District Comprehensive Environmental Response, Compensations, and Liability Act
COD	chemical oxygen demand
D&D DNB DNT DoD	decommissioning and decontamination dinitrobenzene dinitrotoluene Department of Defense
EA	Environmental Assessment
HMX	cyclotetramethylene tetranitramine
IT	IT Corporation
LeRC	Lewis Research Center
MK	Morrison Knudsen Corporation
NACA NASA NPDES	National Advisory Committee for Aeronautics National Aeronautics and Space Administration National Pollutant Discharge Elimination System
ODNR OEPA OHARNG	Ohio Department of Natural Resources Ohio Environmental Protection Agency Ohio National Guard
PA PBOW PBRF PBS PCBs PE PETN ppb ppm PRRWP psig	Preliminary Assessment Plum Brook Ordnance Works Plum Brook Reactor Facility Plum Brook Station polychlorinated biphenyls pentaerythritol pentaerythritol tetranitrate parts per billion parts per million Pentolite Road Red Water Ponds pounds per square inch gauge
RCRA RDX	Resource Conservation and Recovery Act cyclotrimethylene trinitramine
SAIC	Science Applications International Corporation

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

SCS	Soil Conservation Service
SI	Site Inspection
SVOCs	semivolatile organic compounds
TCLP	toxicity characteristic leaching process
TNB	trinitrobenzene
TNT	trinitrotoluene
TPC	Trojan Powder Company
TPH	total petroleum hydrocarbons
<i>ug/kg</i>	micrograms per kilogram
<i>ug/L</i>	micrograms per liter
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
VOCs	volatile organic compounds
WARWP	West Area Red Water Ponds

1.0 INTRODUCTION

1.1 BACKGROUND

Chemical contamination related to former Department of Defense (DoD) activities has been documented at the former Plum Brook Ordnance Works (PBOW) located in Sandusky, Ohio. The site location is illustrated on Figure 1-1. The PBOW was operated from 1941 to 1945 as a manufacturing plant for trinitrotoluene (TNT), dinitrotoluene (DNT), and pentolite. Some of the areas used by the DoD were decontaminated in the 1950s and 1960s; other areas have been decommissioned, but not decontaminated. The site is currently owned by the National Aeronautics and Space Administration (NASA) and is operated as the Plum Brook Station (PBS) of the Lewis Research Center (LeRC). The NASA LeRC is located in Cleveland, Ohio.

Science Applications International Corporation (SAIC) completed a Preliminary Assessment (PA) of the PBS in 1991. SAIC identified 32 potential sources of contamination (Areas of Concern [AOCs]). Seven of these AOCs are related to the former DoD activities:

- AOC 1: TNT Areas A, B, and C
- AOC 2: Red Water Ponds (Pentolite Road Red Water Ponds [PRRWP] and West Area Red Water Ponds [WARWP])
- AOC 4: Burning Grounds (Snake Road Burn Ground, Taylor Road Burn Ground, Reservoir #2 Burning Ground, and G-8 Burn Ground)
- AOC 5: Waste Water Settling Basins in the Pentolite Area
- AOC 6: Fly Ash Spoil Pits (Ash Pits #1 and #3)
- AOC 7: Toluene Storage Tanks (255, 265, 425, 435, 645, and 655)
- AOC 13: Rail Car Unloading Area/Sellite Area

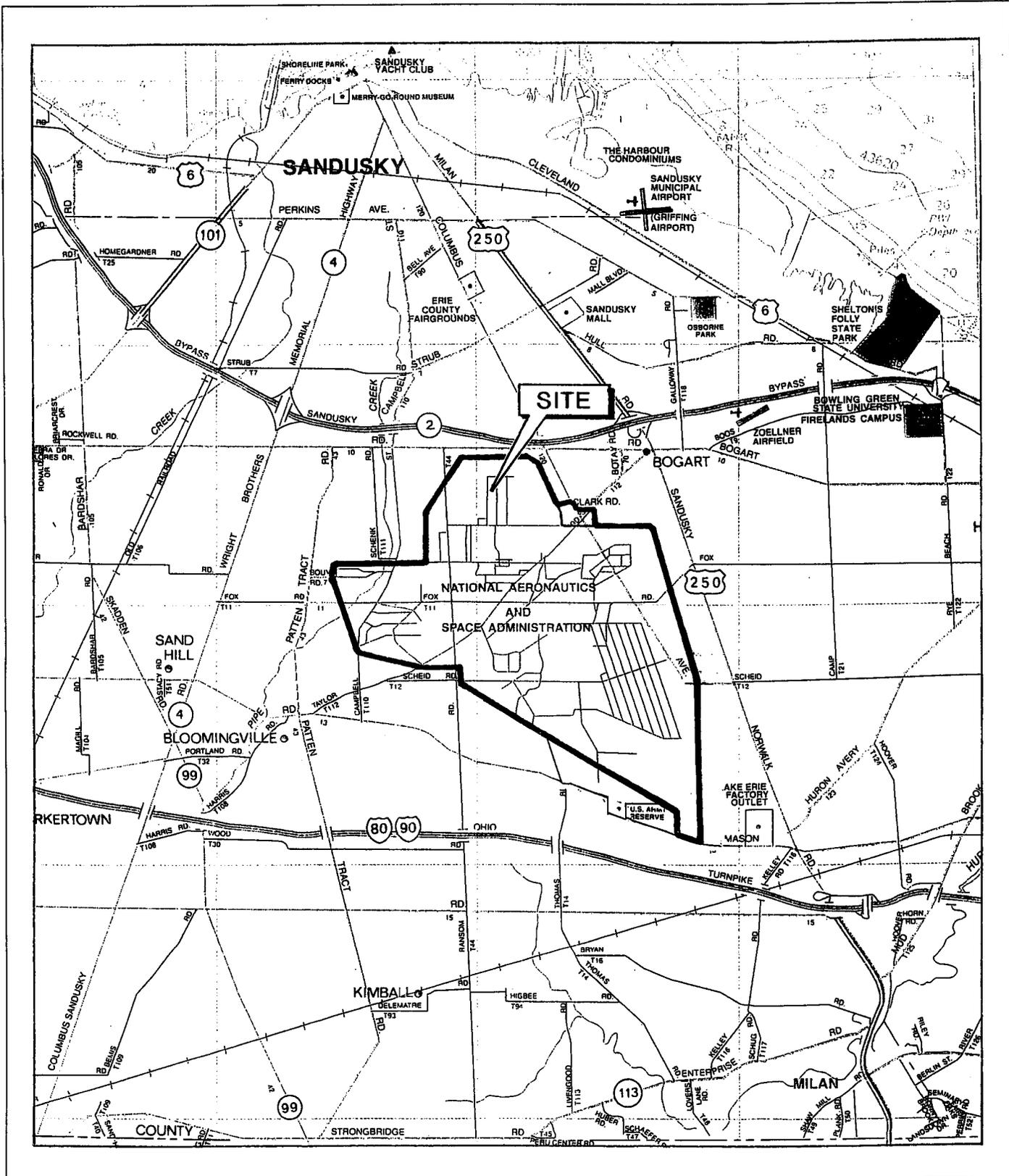


Figure 1-1

SITE LOCATION MAP

Plum Brook Ordnance Works
Sandusky, Ohio

This report summarizes information which Dames & Moore reviewed regarding these seven AOCs for the PBOW Hazardous and Toxic Waste Investigation.

1.2 PROJECT OBJECTIVE

The purpose of the records review was to document historical site use that is potentially related to former DoD activities, evaluate the environmental site setting, and assess the seven AOCs which may qualify for investigation under the Defense Environmental Restoration Program, Formerly Used Defense Sites. The records review included site walkovers, review of previous site studies, interviews with knowledgeable individuals, review of aerial photographs, and review of available maps, site plans, and drawings of the PBOW. In accordance with the provisions of the project Statement of Work for Delivery Order 0020 of Dames & Moore's contract DACA62-92-D-0015 with the U.S. Army Corps of Engineers, Nashville District (CEORN), much of the records review was conducted jointly by Dames & Moore and CEORN.

The results of the records review are summarized in this report.

1.3 SOURCES OF INFORMATION

The records reviewed for this report included:

- Historical site documents and photographs;
- Historical aerial photographs;
- Environmental investigation reports; and
- TNT manufacturing process information.

Ms. Amy Bower of PBS provided historical site photographs and aerial photographs, historical drawings of the site, files related to red water discharges, previous site investigation reports, and historical documents generated during the operation of the

PBOW (1940s) and subsequent decommissioning and decontamination (D&D) (1950s and 1960s). Files containing documentation obtained by NASA's subcontractor SAIC during their PA of the PBS were also reviewed at the NASA LeRC in Cleveland, Ohio.

Historical documents and copies of old newspapers (on microfiche) were reviewed at the Carnegie Library in Sandusky, Ohio. No information, other than major news stories regarding the start-up and shut-down of the PBOW, and removal and burning of PBOW buildings in 1963 was obtained during this review.

Historical aerial photographs at the Erie County office of the U.S. Department of Agriculture (USDA) Soil Conservation Service (SCS) for the years 1950 and 1958 were reviewed in March 1994 for preliminary information regarding the PBOW. Aerial photographs of the site for the years 1950, 1956, 1958, 1968, and 1988 were subsequently obtained from the Ohio Department of Transportation and an in-depth review of each of the AOCs shown on these photographs was performed. Coverage of the entire site was provided by the 1950 aerial photographs. Only the eastern portion of the site was provided by the 1956 aerial photographs and only the central portion of the site was provided by the 1958 aerial photographs. The scale of the 1968 photographs was large, but the photographs were taken in the winter and snow covered the ground. Buildings and structures were easily identified on these photographs. The small scale of the 1988 photographs limited the useful information which could be obtained from photographs taken in this year.

Environmental investigation reports and documents provided by CEORN and NASA were reviewed. The reports included the following:

- Information Related to WARWP, Ohio National Guard (OHARNG), approximately 1985
- *Engineering Report for the Contamination Evaluation at the Former Plum Brook Ordnance Works, Sandusky, Ohio, IT Corporation (IT), January 1991*
- *Conclusions and Recommendations for the Contamination Evaluation at the Former Plum Brook Ordnance Works, Sandusky, Ohio, IT, January 1991*

- *Plum Brook Station Preliminary Assessment, SAIC, June 1991*
- *Underground Storage Tank Corrective Actions Remedial Investigation/Feasibility Study, NASA Plum Brook Station, Ebasco Environmental, November 1991*
- *Phase I Site Characterization of Disposal Area Three, Plum Brook Station, Ohio, H+GCL, June 1992*
- *Site Inspection Report, Plum Brook Station, Sandusky, Ohio, Morrison Knudsen Corporation (MK), January 1994*

In addition to the records listed previously, additional information was obtained through site reconnaissance and interviews with NASA personnel and employees at the PBS. In March 1994, representatives of Dames & Moore and CEORN performed a site walk-over of each of AOCs which were included in the Statement of Work for this records review. Site visits to additional potential AOCs were performed in fall 1994 and spring 1995. The NASA personnel and PBS employees who were interviewed for information related to historical practices at the site include:

- Ms. Amy Bower - NASA PBS Site Manager
- Mr. Ray Ruffing - employee at PBS (provided information on burn grounds, underground pipes and flumes, etc.)
- Mr. Lynn Cherry - long-time employee at PBS (over 30 years); (provided information on burn grounds, acid areas, TNT areas, underground flume lines, etc; some of his knowledge was based upon information obtained from former employees of the PBOW)
- Mr. Jim Knoll - employee at PBS (his father was an employee at PBOW during its operation)
- Mr. Don Young - employee at PBS (provided information on NASA's use of the toluene storage tanks, underground flumes, burn areas, TNT areas, etc.)
- Mr. Gary Ponikvar - (provided information on underground flume lines, TNT areas, burn grounds, etc.)

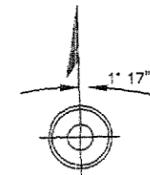
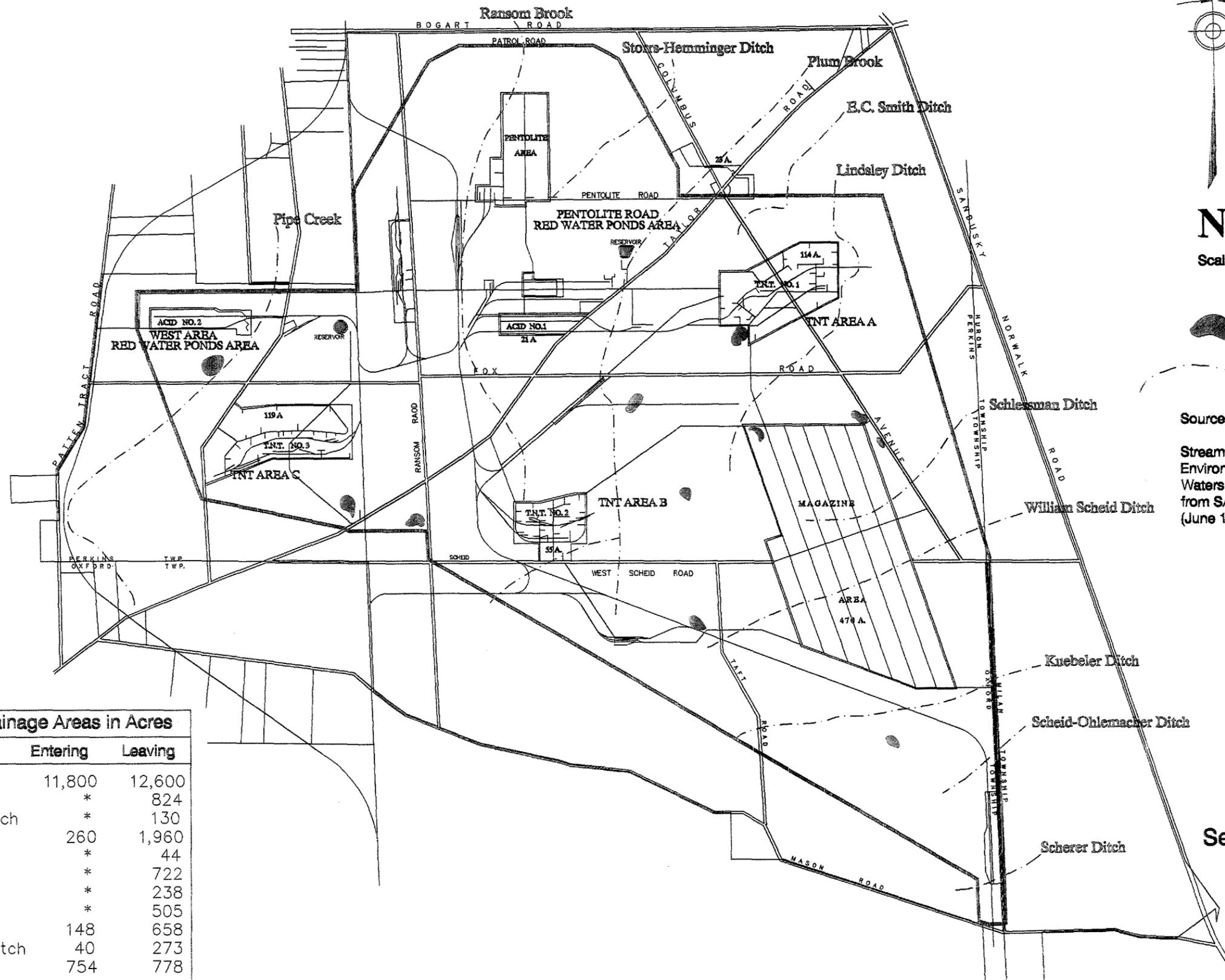
2.0 SITE HISTORY

2.1 HISTORICAL POLLUTION REPORTS

SAIC requested information from the Ohio Department of Natural Resources (ODNR) as part of their PA. This information was reviewed by Dames & Moore. The ODNR provided information from their pollution reports and records regarding pollution of Plum Brook, Erie County, Ohio, by the former Trojan Powder Company (TPC) which operated the PBOW under contract to the U.S. Army. The locations of Plum Brook and other surface water features at the former PBOW are illustrated on Figure 2-1.

The information provided in the ODNR report was limited. However, it did document two early-1940s era court cases in which fish kills and damage of the Wyandotte marsh were alleged against the TPC. A "Report of Activities of Stream Pollution Engineering Section" for the month of October 1942 documented attempts by the state agency to investigate complaints and concerns regarding pollution of Plum Brook and Sandusky Bay by the PBOW (Unknown author, Stream Pollution Engineering Section, 1942).

Another "Report of Stream Pollution Section" report for the month March 1945 documented a heavy fish killing in the east end of Sandusky Bay. The water was reportedly a red-brown in the entire east end of the bay, including the swamps from Plum Brook to the entrance to the Cedar Point property on Route 2. Plum Brook and a small creek to the west were reportedly the principal feeders of this pollution. The author reported that the color in Plum Brook and the bay had greatly increased during the 2 months prior to March 1945. The author further reported that during the previous year (ever since improved waste treatment had been implemented at the PBOW), a decided decrease in the color and turbidity of the water in Plum Brook had been observed. The author referenced a newspaper article that stated the PBOW had stepped up production of TNT and another "new explosive" (Unknown author, Stream Pollution Section, 1945).



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
Kuebler Ditch	148	658
Scheid-Ohlemacher Ditch	40	273
Scherer Ditch	754	778

* Stream originates within station boundaries

Figure 2-1
 Selected Surface Water Features
 at Plum Brook Station
 Plum Brook Ordnance Works
 Sandusky, Ohio

were detected; 2,4-DNT and 2,6-DNT were detected in small amounts); and one red water sample and one sediment sample were collected (no contaminants were indicated by analysis). The EA also presents information related to water quality studies of Pipe Creek conducted in 1986 and 1987 which provided no indication of contamination in Pipe Creek, both upstream and downstream of the WARWP.

2.2.3 1989 Contamination Evaluation by IT Corporation, 1989

Under contract to the CEORN, IT conducted a Contamination Evaluation at the PBS in 1989. The report documenting the project was finalized in 1991. The investigation consisted of a records review and evaluation, visual site inspections, and field investigations of the PRRWP (referred to as "Waste Disposal Area #1), WARWP (referred to as "Waste Disposal Area #2), Snake Road Burn Ground (referred to as "Scheid Road Burning Grounds"), and the Taylor Road Burn Ground (referred to as "Rubbish Burning Grounds"). Four groundwater monitoring wells were installed and sampled, and surface water samples from four on-site streams were collected and sampled. Twenty-one soil samples were also collected and analyzed. Samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), nitroaromatic compounds, nitrates, sulfates, pH, and metals. Some soil samples were also tested for geotechnical characteristics.

IT's investigation indicated no soil or groundwater contamination from VOCs at any of the locations investigated, limited soil and groundwater contamination from SVOCs at the PRRWP and Snake Road Burn Grounds, elevated metals, sulfates, and nitrates in soils at the PRRWP, and elevated metals in groundwater at the WARWP.

2.2.4 1992 Investigation of Burn Grounds at Snake Road by H⁺GCL

In 1992, H⁺GCL conducted an investigation of the Snake Road Burn Ground and the adjacent burn grounds used by NASA (referred to as "Disposal Area Three.") The area that was investigated included three burn areas referred to by H⁺GCL as "a fire training

pit, an Army burnable dump, and a burnable dump used under NASA operations.” The fire training pit was located on the west side of Snake Road. The Army burnable dump and the NASA burnable dump were located on the east side of Snake Road. According to the H⁺GCL report, the Army burnable dump was used from 1941 to 1963 for destruction of explosives during decommissioning of the PBOW (H⁺GCL, 1992). The purpose of the investigation was to characterize possible groundwater and surface water contamination due to the use of this area as an uncontrolled burn ground. H⁺GCL installed soil borings and groundwater monitoring wells in the area, including one background monitoring well. Based upon the results of the investigation, H⁺GCL recommended no further site characterization or remediation of the area.

2.2.5 1994 Site Investigation by Morrison Knudsen Corporation

In 1994, MK completed a SI of the PBS for NASA in order to perform a Hazard Ranking for the site. The MK investigation included records review, installation and sampling of groundwater monitoring wells, surface water sampling, sediment sampling, and surface soil sampling.

The results of the MK investigation identified limited contamination in multiple areas of the site, some of which were previously used for DoD activities. However, the Hazard Ranking Score for the site was below Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) action levels.

3.0 AOC 1 - TNT AREAS

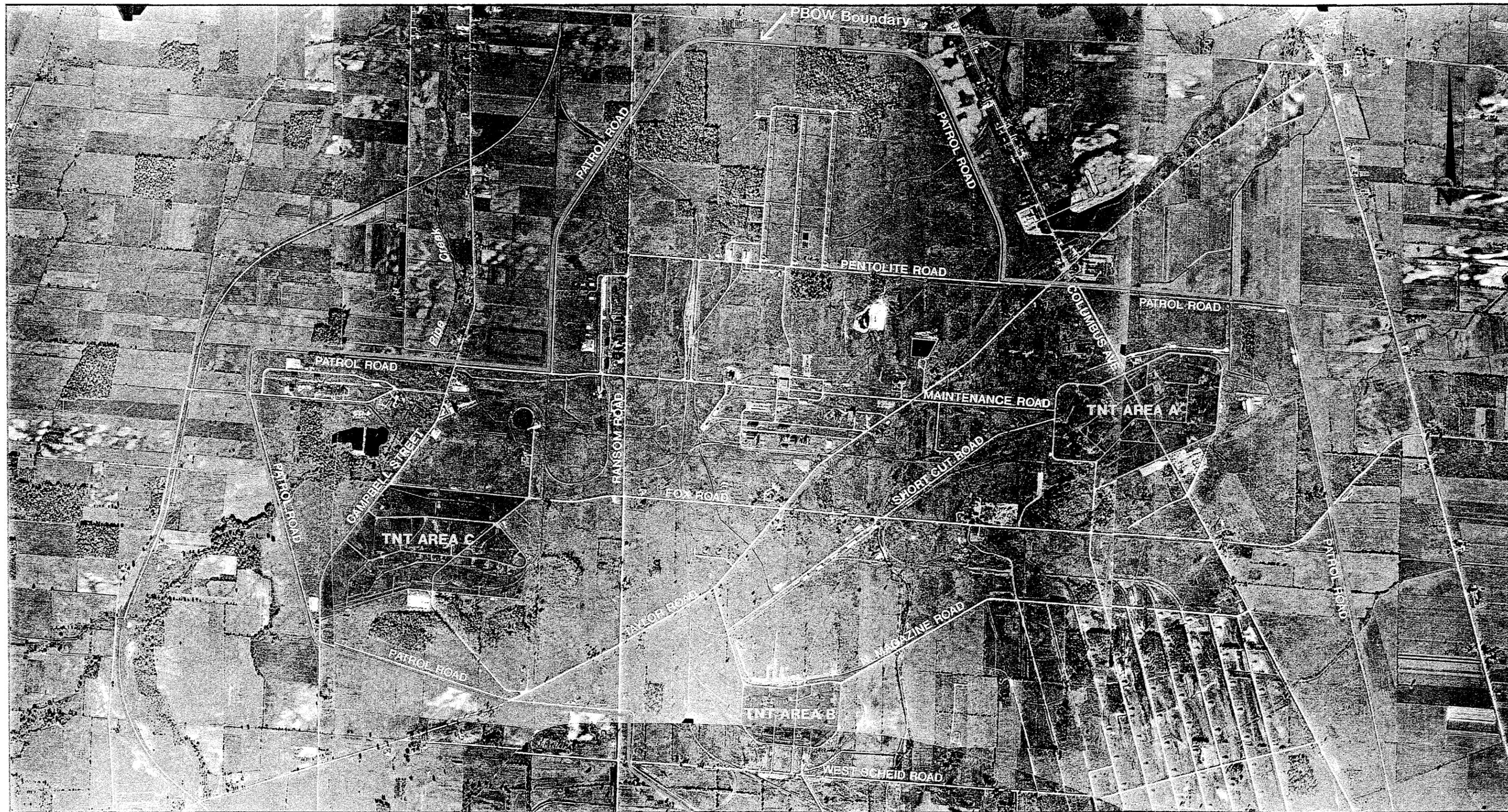
TNT was manufactured at three TNT Areas at the PBOW. The locations of TNT Areas A, B, and C are illustrated on Figure 3-1. Site plans of TNT Areas A, B, and C are provided as Figures 3-2, 3-3, and 3-4, respectively. Each TNT area consisted of widely scattered buildings of wood frame construction and asbestos and sheet metal covering. 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.

3.1 PREVIOUS DECONTAMINATION OF TNT AREAS

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 ½ 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.



2000 1000 0 2000 4000 Feet
APPROXIMATE SCALE

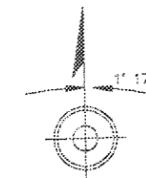
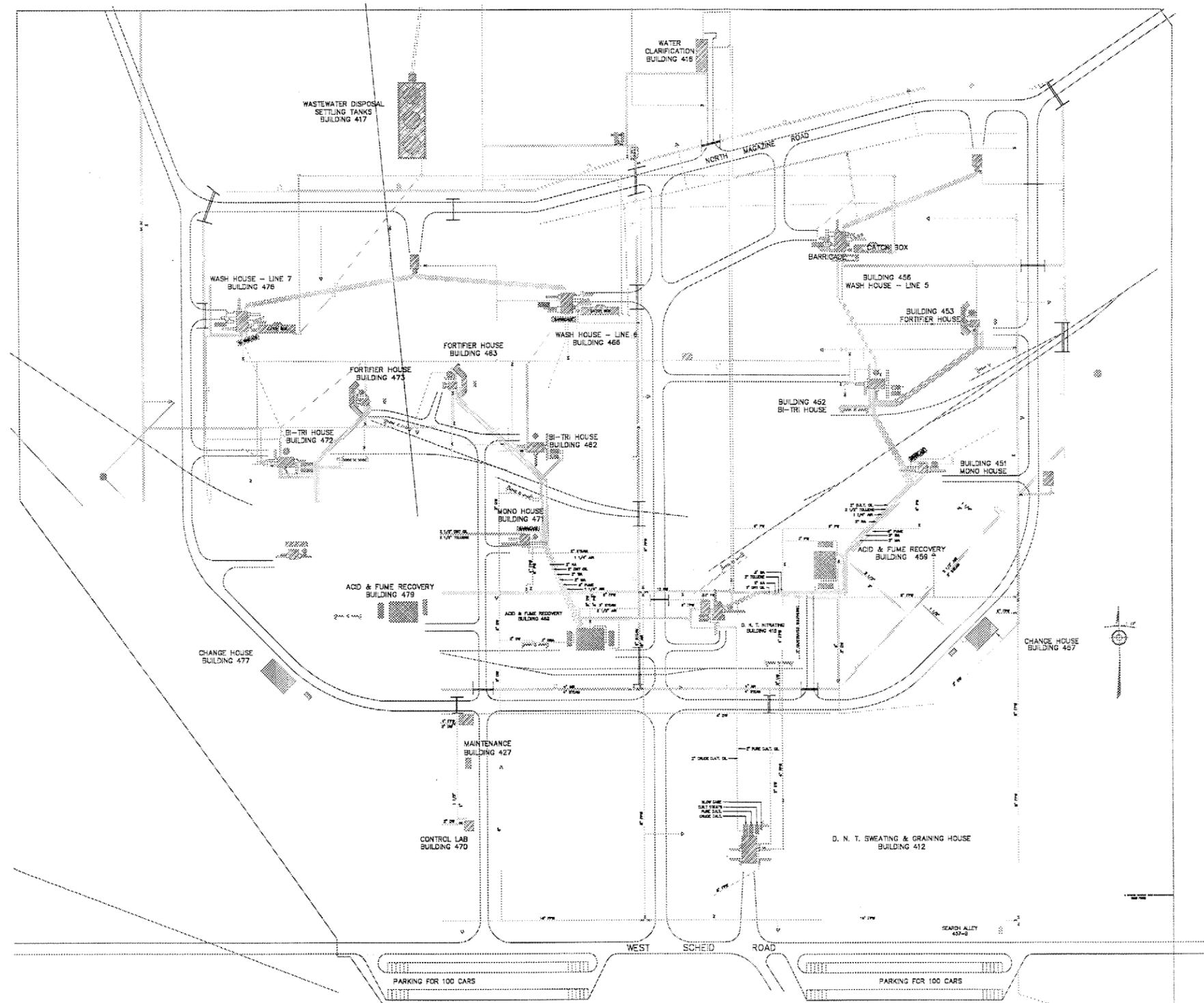
BASE PHOTOGRAPH: October 19, 1950; Photo PW-3G-62; Site - Plum Brook Ordnance Works, Sandusky, Ohio



Figure 3-1

LOCATIONS OF TNT AREAS

Plum Brook Ordnance Works
Sandusky, Ohio

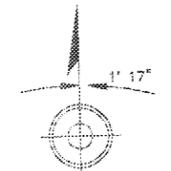
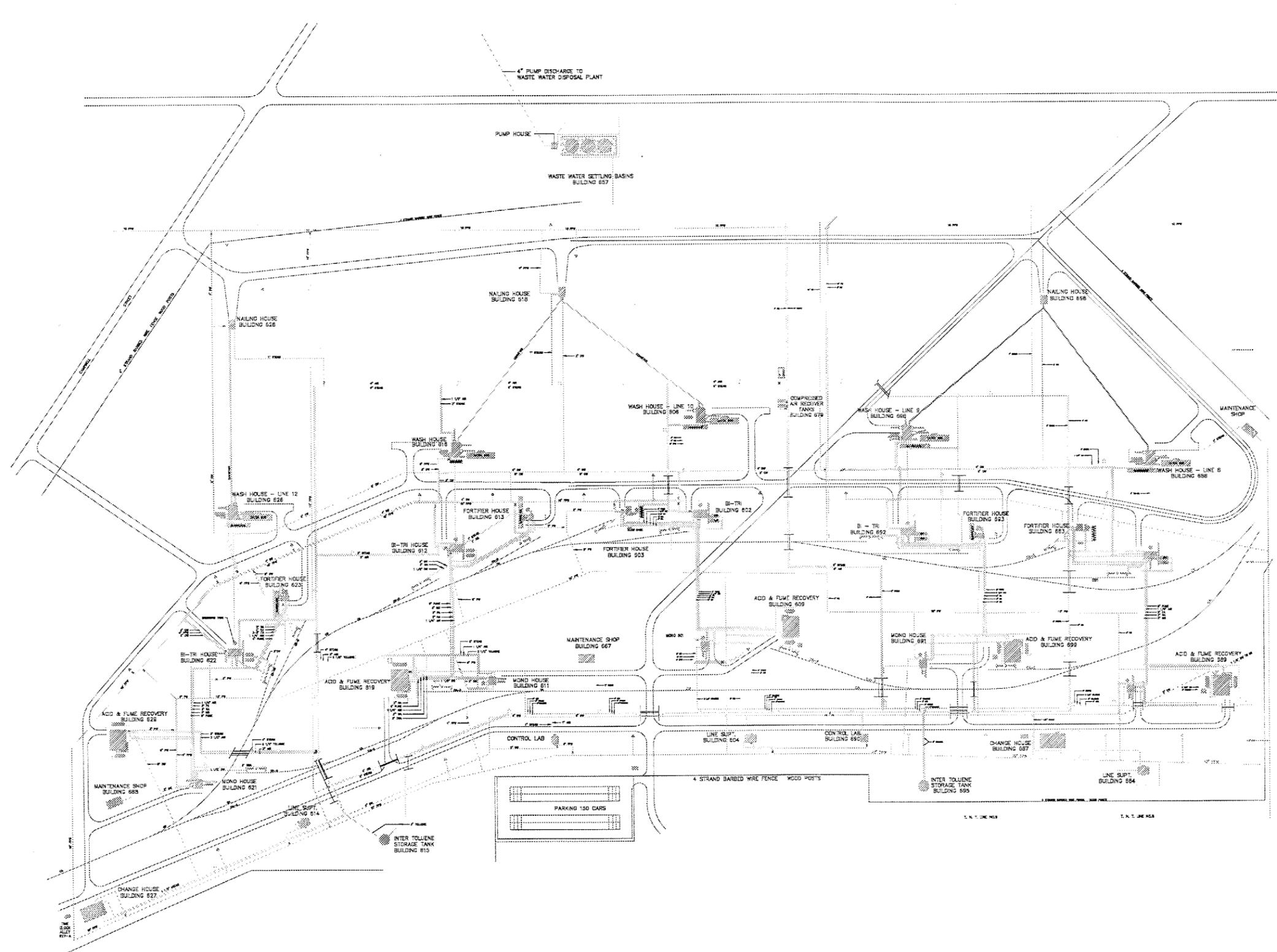


N

Scale: 1" = 250'

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





N

Scale: 1" = 300'

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



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 is indicated in Sanders' 1955 letter, underground lines were replaced during operation of the PBOW when they plugged and the locations of replacement lines were not generally documented.

3.2 ENVIRONMENTAL INVESTIGATIONS

The MK investigation was the only site investigation to include the TNT Areas. Environmental media sampled included surface water, sediment, groundwater, and surface soils.

3.2.1 TNT Area A

MK installed three monitoring wells in the vicinity of TNT Area A, MK22, MK23, and MK24. No explosives residues were detected in the groundwater at TNT Area A.

Surface water and sediment samples SW17 and SD17 were collected east of TNT Area A in Lindsley Ditch. No explosives residues were detected in these samples.

Soil sample SB23 was collected in the southwestern corner of TNT Area A. No explosives residues were detected.

3.2.2 TNT Area B

Sediment and surface water samples SD07 and SW07 were collected near the beginning of Ransom Brook north of TNT Area B. No explosives residues were detected in these surface water and sediment samples.

MK installed two monitoring wells near TNT Area B. Well MW-MK16 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. Well MW-MK17 was installed north of North Magazine Road on the downgradient side of TNT Area B. No explosives residues were detected in either well.

Surface soil samples SS13 and SB09 were also collected at TNT Area B. Toluene was detected in sample SS13 at a concentration of 33 micrograms per kilogram ($\mu\text{g}/\text{kg}$). In soil sample SB09, 2,4,6-trinitrotoluene was detected at a concentration of 12,000 $\mu\text{g}/\text{kg}$ and 2,6-dinitrotoluene was detected at a concentration of 60 $\mu\text{g}/\text{kg}$.

3.2.3 TNT Area C

MK surface water and sediment samples SW04 and SD04 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 did not install groundwater monitoring wells in the vicinity of TNT Area C.

Two surface soil samples were collected during MK's investigation. Sample SS11 was collected in the southeast corner of TNT Area C and SS12 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 AOC 2 - RED WATER POND AREAS

4.1 INTRODUCTION

During operation of the PBOW, waste water from the TNT manufacturing process was transported to two waste water disposal areas, the locations of which are shown on Figure 4-1. The PRRWP area is located northwest of Reservoir #1. The PRRWP received waste water from TNT Areas A and B. The WARWP area is located in the western portion of the PBS near Pipe Creek. The WARWP received waste water from TNT Area C.

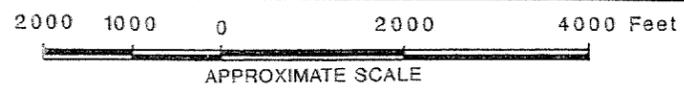
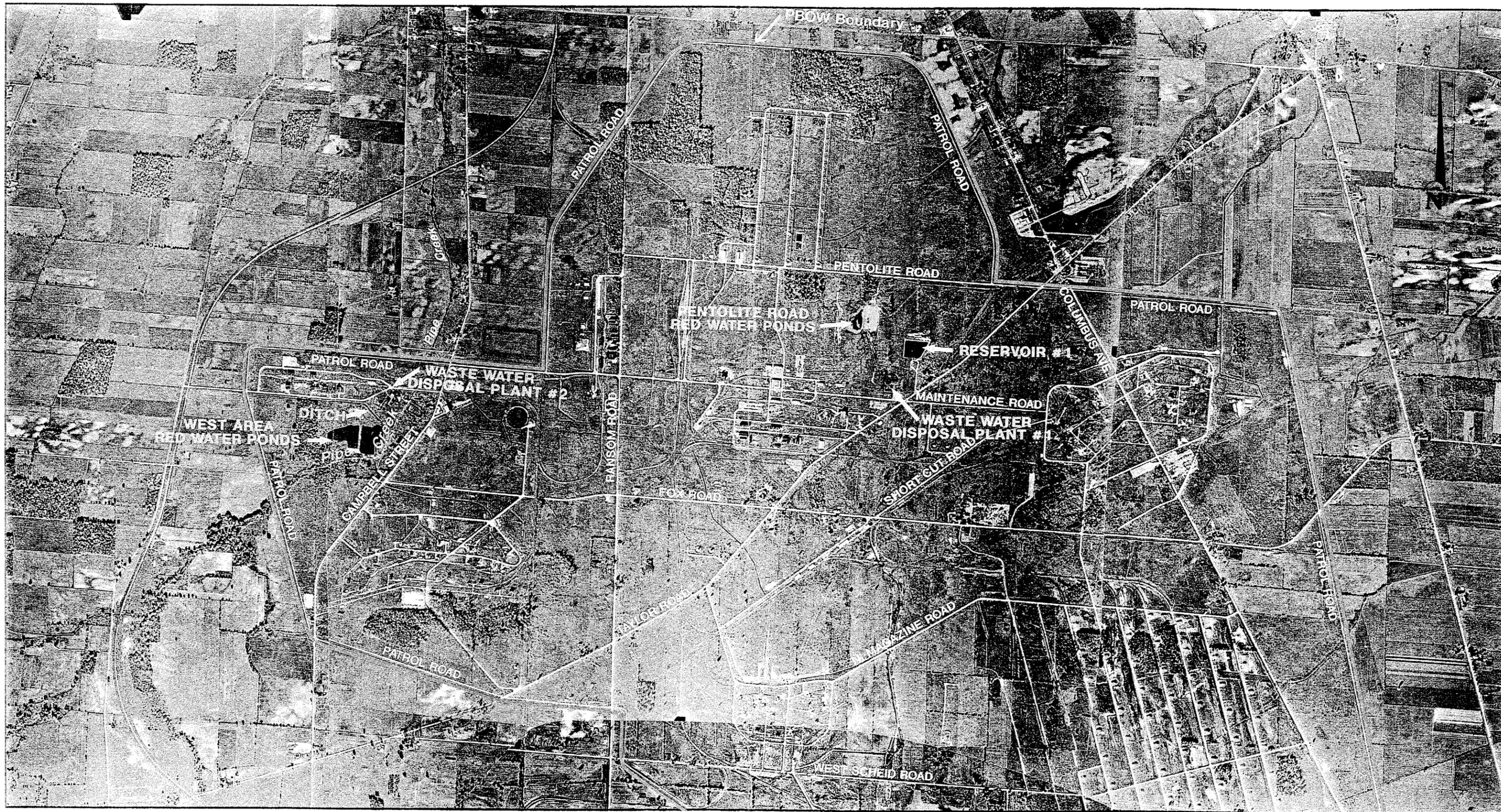
4.2 PENTOLITE ROAD RED WATER PONDS

4.2.1 Description of the Pentolite Road Red Water Ponds

The PRRWP were identified as an AOC by SAIC. This area is located between Maintenance Road and Pentolite Road, northwest of Reservoir #1 at the location shown on Figure 4-1. During field reconnaissances of the area conducted in March 1994 and fall 1994, the area consisted of thick masses of cattails with bare areas which seasonally contain ponded water, as shown on Photos 4-1 through 4-4. Ponded water within this area was observed to have a reddish tint, as shown on Photo 4-5.

An approximately 10-foot deep southwest-northeast trending ditch traverses the area to the east. This ditch flows northeasterly into another ditch which parallels Pentolite Road. According to information provided by NASA PBS employees, an underground clay pipe ("drainage tile") drains the PRRWP area and discharges into the ditch which parallels Pentolite Road. Photo 4-6 shows the drainage pipe where it discharges into this ditch.

This AOC received waste water from TNT Areas A and B from initiation of plant operations to 1945. Review of historical site drawings indicate that waste water from the waste water settling basins at the TNT areas flowed through wooden flumes and



BASE PHOTOGRAPH: October 19, 1950; Photo PW-3G-82; Site - Plum Brook Ordnance Works, Sandusky, Ohio



Figure 4-1
LOCATIONS OF RED WATER POND AREAS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE



PHOTO 4-1. Bare areas containing ponded surface water at Pentolite Road Red Water Ponds (photo taken in March 1994)



PHOTO 4-2. View looking northeast towards bare areas at Pentolite Road Red Water Ponds (photo taken in March 1994)

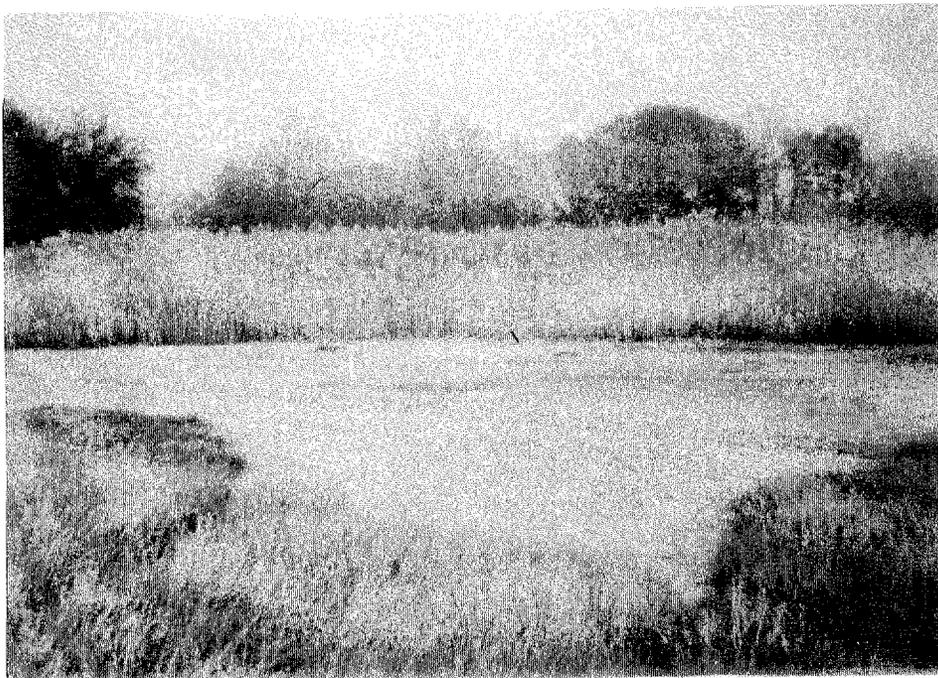


PHOTO 4-3. Dry bare area at Pentolite Road Red Water Ponds (photo taken in November 1994)



PHOTO 4-4. Ponded surface water in the same bare area as shown in Photo 4-3 (photo taken in December 1994)

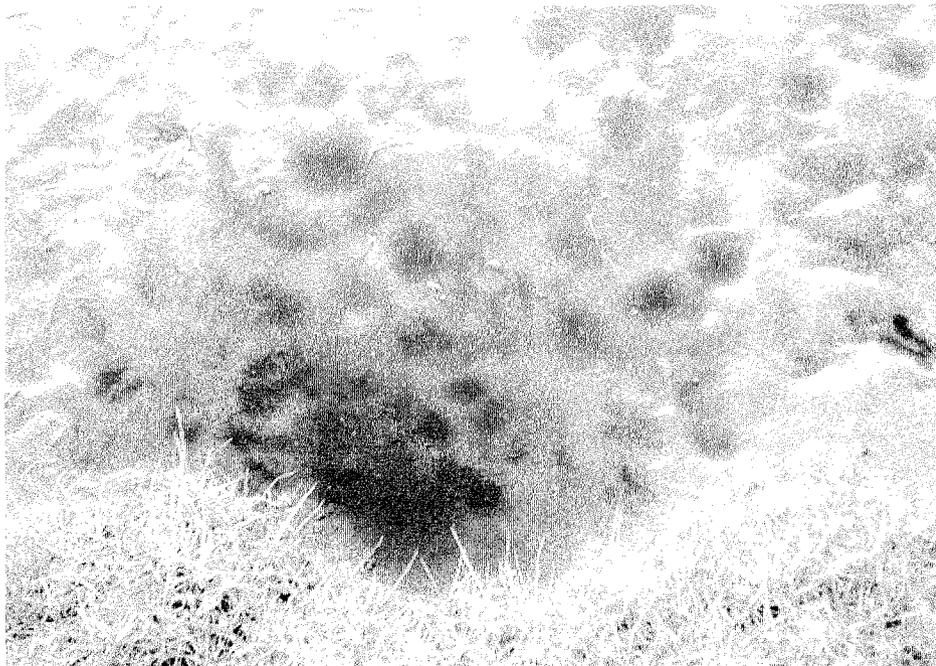


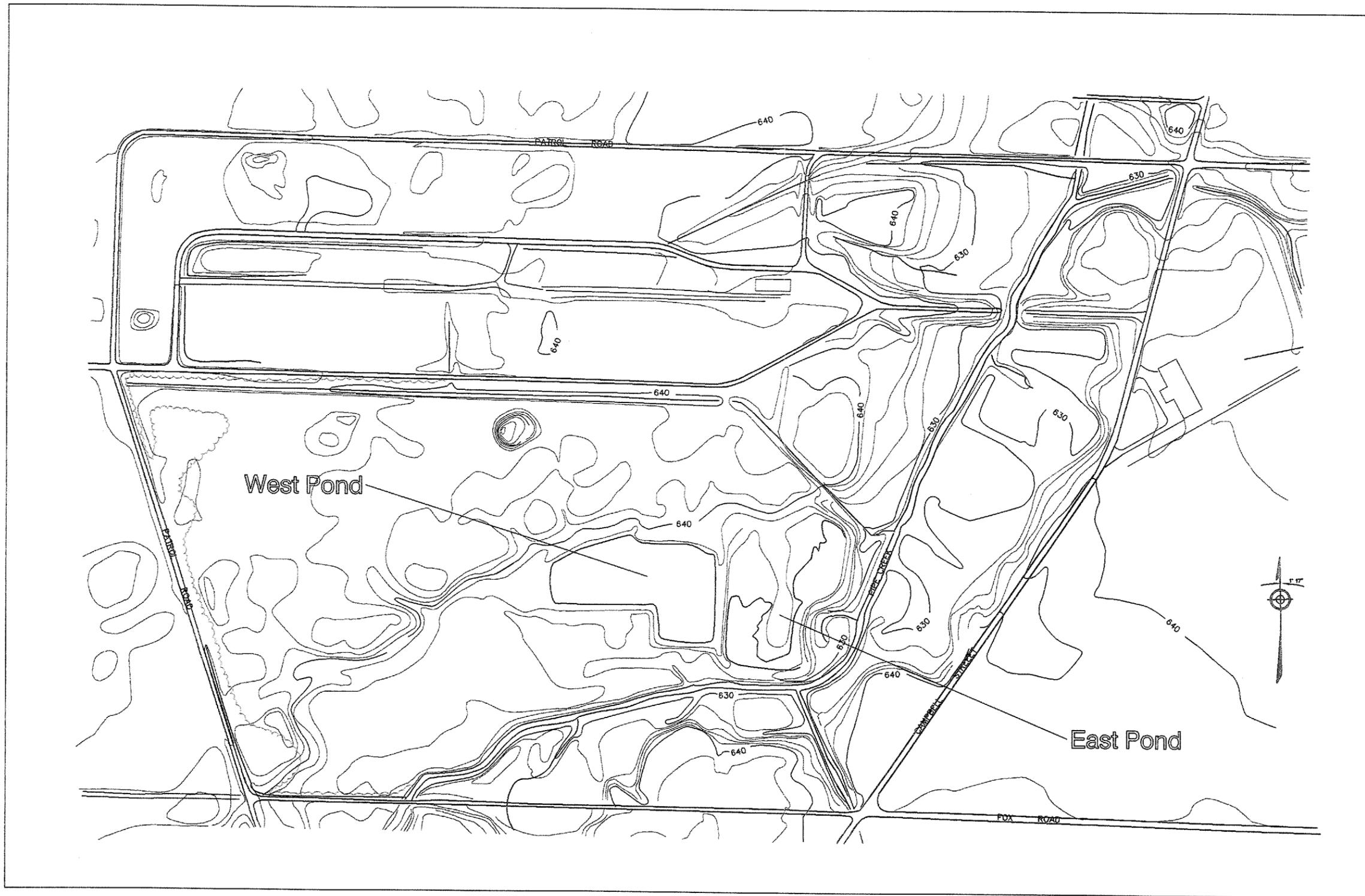
PHOTO 4-5. Close-up view showing reddish tint of ponded water at Pentolite Road Red Water Ponds (photo taken in fall 1994)



Plum Brook Ordnance Works

PHOTO 4-6. Drainage tile from Pentolite Road Red Water Ponds; tile discharges into ditch parallel to Pentolite Road (photo taken in fall 1994)

H:\CAD\PLUM\LOT\EXPRWS44 Thu Apr 03 20:00:42 1997 Dames & Moore - Atlanta, GA



Scale: 1" = 350'

Figure 4-4
Site Plan of West Area
Red Water Ponds
Plum Brook Ordnance Works
Sandusky, Ohio

pipes to a waste water treatment and incineration area (Waste Water Disposal Plant #1), then to the ponded disposal area via an elevated 12-inch diameter discharge pipe.

Drawing No. 1663-W-2 (E.B. Badger & Sons Co., October 1941) illustrates construction details of the waste disposal area. Figure 4-2 is derived from this drawing. As shown on Figure 4-2, the "pit" measured 200 feet in width, 400 feet in length, and 3 feet in depth, and was surrounded by a 1-foot high levee. A note on the drawing states that 3-foot boreholes were to be drilled at the corner of each square yard within the basin, and pop shots of dynamite were to be inserted into the holes and detonated to loosen the subsoil. Production at the PBOW actually started in December 1941 (2 months after this drawing was prepared); no information was found which verified the construction details shown on the drawing.

Figure 4-1 is an aerial photograph of the area taken in October 1950. This photograph shows a disturbed area resembling the shape of the water "pit" shown on Figure 4-2. The disturbed area appears to be predominately dry, while an approximately equally sized area adjacent to the "pit" to the west appears to contain water. Figure 4-3, which is an aerial photograph of the area taken in 1956 shows a similarly shaped disposal area. A close-up aerial photograph of the PRRWP (photograph obtained from NASA; no title or date) shows two distinct ponds in this location; the ponds appeared to be diked (in agreement with Drawing No. 1663-W-2, referenced above). The ponds in this close-up photograph resemble the shape of the ponds shown on Figure 4-3.

Review of additional historical drawings (such as Plan No. R-32, "Unit Layout Map, Waste Disposal & Water Supply Area No. 1" [E.B. Badger & Sons Co., no date] indicates that waste water was transported to the PRRWP via an elevated 12-inch discharge pipe from a raw waste water tank at Waste Water Disposal Plant #1 (the location and layout of this plant are shown on Figure 4-2). Apparently, waste water was transported from the waste water settling basins at TNT Areas A and B to a raw waste water tank at this plant prior to disposal at the PRRWP.

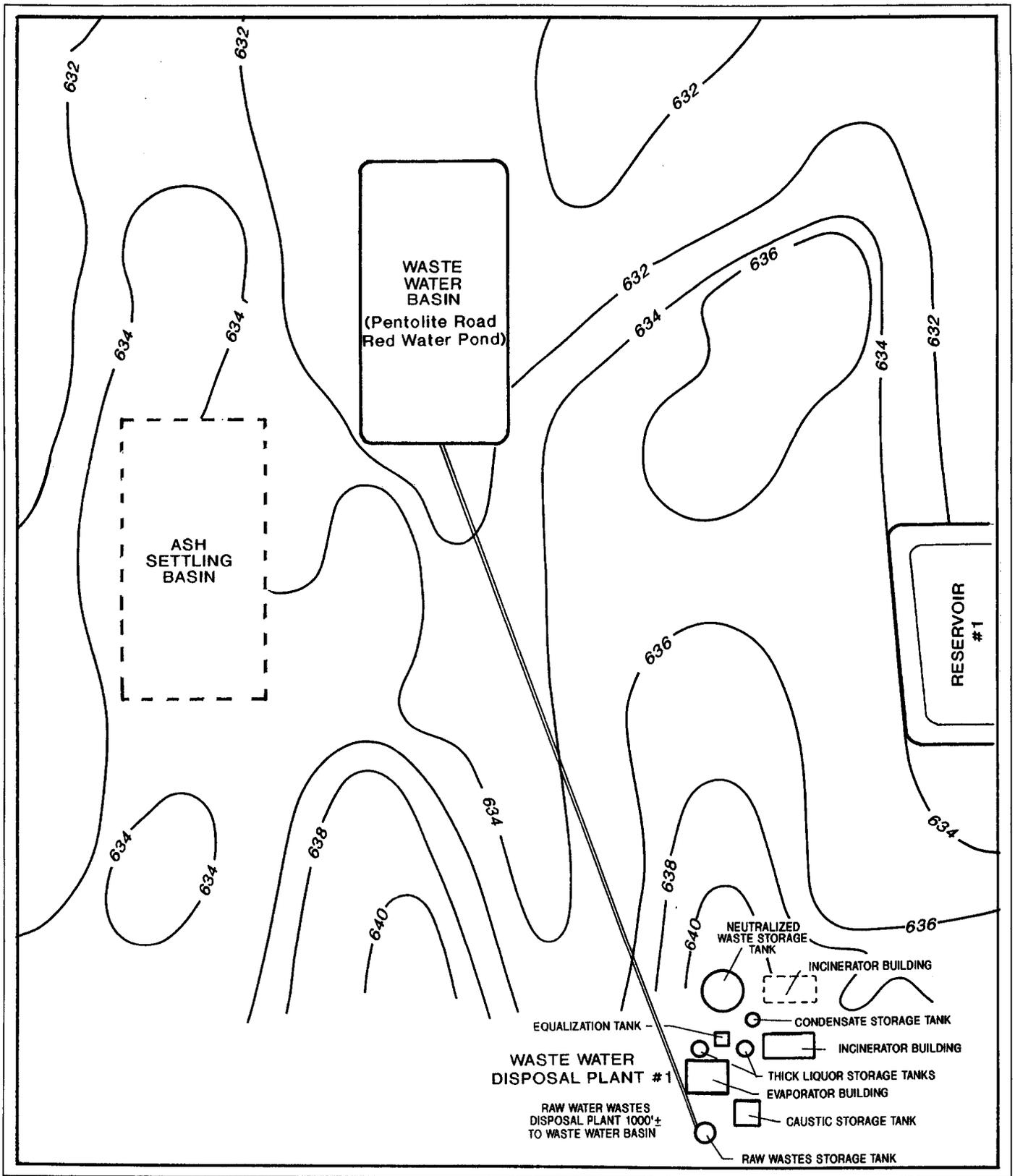


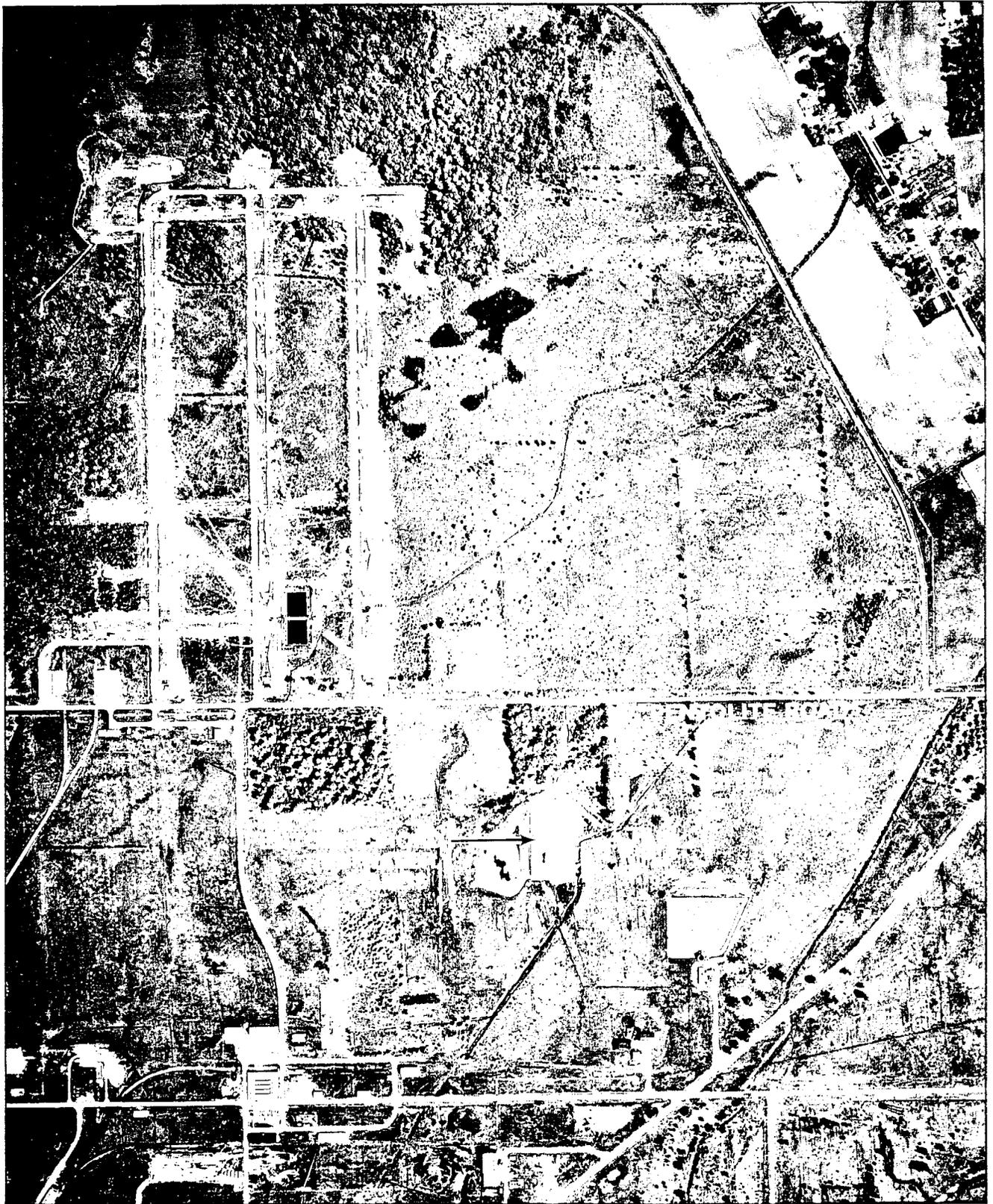
Figure 4-2

REFERENCE DRAWING No. 1663-W-2 "Temporary Storage Pit for Neutralized Waste Water", E.B. Badger & Sons, 1941

**CONSTRUCTION DIAGRAM FOR
PENTOLITE ROAD RED WATER POND
AND WASTE WATER DISPOSAL PLANT #1**

Plum Brook Ordnance Works
Sandusky, Ohio

 DAMES & MOORE



600 300 0 600 1200 FEET
(APPROX)

N



Figure 4-3

1956 AERIAL PHOTOGRAPH
SHOWING PENTOLITE ROAD
RED WATER POND AREA
Plum Brook Ordnance Works
Sandusky, Ohio

4.2.2 Post-PBOW Actions

4.2.2.1 Ravenna Arsenal, Inc. Actions in 1960s

A letter to Ravenna Arsenal, Inc. (Braig, 1963) describes work to be accomplished by Ravenna Arsenal, including apparent D&D activities. Item 2 of this letter states: "Examine leaching bed near Reservoir #1, destroy some of the contaminants and re-route drainage to reduce amount of red water flowing into Plum Brook." The leaching bed referred to in this letter may be the PRRWP.

4.2.2.2 1977 Actions

In an April 1977 memorandum (Teledyne Isotopes, June 28, 1977), PBS personnel reported an observation of localized pockets of reddish brown water in the small surface ditch east of, and adjacent to, the PRRWP area, which was referred to as a surface spoils site. The source was discovered to be a broken drain tile on the southeast corner of the "spoils area." The memorandum stated that retention dikes and sump pits were promptly excavated to prevent leakage of the material to surface streams. From April 13, 1977 to May 3, 1977, approximately 60,000 gallons of the "red" water were removed by a private disposal contractor. Grading and drainage improvements were made to the area to alter surface runoff patterns.

The memorandum further described actions being undertaken by the local Air National Guard which included backfilling the original settling basin to bring it higher in elevation than the surrounding area. The memorandum stated that a new drainage ditch would be dug approximately 300 feet east of the original ditch, which would then be backfilled. The intent of these activities was to eliminate ponding in the area, thus reducing the amount of surface water that could mix with the red water residue, thus producing red-colored water.

On April 14, 1977, one surface water sample was collected from the surface drain tile pool; on April 15, 1977, a second sample was collected from the retention trench that

was dug to prevent runoff to surface streams. The memorandum states that both samples were "deep red in color, odorless and aqueous in nature, with a pH of 7.3." Several minnows were observed in the contaminated drain tile pool of water.

"Flame tests gave a bright yellow-orange flame suggesting the presence of sodium. Sodium was subsequently verified by atomic absorption spectrophotometry to be present in a ratio of 2 to 1 to sulfate. This suggests strongly that the major inorganic constituent is Sodium Sulfate (Na_2SO_4)." (Teledyne Isotopes, January 28, 1977)

The Lewis Chemistry Lab analyzed replicate samples of these samples and reported that tannin was the prime constituent present in the samples as determined by infra red analysis.

Additionally, PBS laboratory personnel collected soil samples at different strata within the "spoils area." A thin layer (approximately 1/8-inch) of salt-like crystalline material was reported at or near the surface. About 1 foot of sand and top soil covered a clay sub-strata. The top soil samples were dispersed in water and the water turned red in color. The clay sub-strata samples did not cause discoloration of water. (Teledyne Isotopes, January 28, 1977) The memorandum further stated that the salt-like surface strata samples had the highest concentrations of sulfate and the clay sub-strata apparently did not absorb the chemical spoils.

Under a "Data Interpretation" heading in the memorandum, the author stated:

The major constituent in the spoils area is sodium sulfate probably resulting from the neutralization of acid wastes by use of caustics. The presence of significant quantities of tannin probably resulted from acid reaction with wooden vats and plumbing in the old arsenal days at Plum Brook. The presence of significant quantities of iron in the range of 20 [parts per million] ppm probably resulted from acid/chemical reaction with iron plumbing. Other trace elements identified are consistent with what could be expected to be present in soil or are consistent with process materials used 3 decades ago. The presence of phenols in two samples cannot be explained.

This red water as such does not appear to be an acute toxin to aquatic life based on abundant minnow population in the local ditches and subsequent downstream ditches and creeks (approximately 1,000 feet away).

4.2.2.3 1989 Actions

In 1989, NASA LeRC PBS personnel (Ms. Amy L. Bower and Mr. Harry McCune) observed reddish-brown water emanating from the drainage tile into Pentolite ditch (NASA LeRC PBS, 1989). Water samples were collected and analyzed for chemical oxygen demand (COD), pH, chromium, copper, lead, iron, and zinc. The iron and COD concentrations were approximately 6 to 10 times higher at the discharge pipe than at the National Pollutant Discharge Elimination System (NPDES) sampling weir located downstream.

4.2.2.4 1990 Actions

In April 1990, Ms. Amy Bower of NASA LeRC PBS noticed rust-colored water discharging into Pentolite Ditch from the drainage tile which originates in the vicinity of the PRRWP. Ms. Bower assumed the water to be "red water" which had leached into the drainage tile (NASA LeRC PBS, 1990). She notified several NASA and PBS individuals as well as the OEPA, the National Emergency Response Center, and the U.S. Environmental Protection Agency.

Water samples were collected and analyzed for total chromium, COD, total copper, total iron, total lead, total nickel, nitrate, nitrite, total phosphorus, total sodium, sulfate, total zinc, TNT, 2,4-DNT, 2,6-DNT, cyclotrimethylene trinitramine (RDX), cyclotetramethylene tetranitramine (HMX), o-nitrotoluene, m-nitrotoluene, and p-nitrotoluene. None of the NPDES limits were exceeded as a result of the discharge. However, levels of iron, nickel, nitrate, sulfate, and zinc at the outfall were significantly higher than the upstream levels as a result of the discharge. Concentrations of explosives were below the detection limit of the analytical method (NASA LeRC PBS, 1990).

4.2.2.5 1991 Actions

In April 1991, Ms. Amy Bower of NASA LeRC PBS observed another discharge of rust-colored water into Pentolite ditch from the drainage tile (NASA LeRC PBS, 1991). The OEPA was notified and incident number 2-72-0508 was assigned. The National Response Center was also notified; incident report number 60215 was assigned. Ms. Bower also notified Mr. Doug Webb of the CEORN regarding the incident.

Analysis of a NPDES sample collected 2 days later at a downstream location indicated levels for COD, suspended solids, nitrate, zinc, copper, and pH to be within daily NPDES permit levels.

4.2.3 Environmental Investigations

IT investigated the PRRWP area during their 1989 Contamination Evaluation. In their report (IT, 1991), IT refers to this area as "Waste Disposal Area #1", and stated that areas of surface contamination were evident.

Monitoring well IT-MW05 was installed in the northern portion of the area to a total depth of 21 feet. Groundwater in this well was measured at approximately 15 feet below ground surface. IT also installed six soil borings and collected soil samples (SB-13 through SB-18). Soil samples collected from either 0 to 2 feet or 4 to 6 feet were submitted for analysis. IT also collected one surface water sample (SW-04) from standing water within the AOC area.

Groundwater, surface water, and soil samples collected by IT were analyzed for VOCs, SVOCs, nitrates, metals, and nitroaromatic explosive compounds. IT reported that significant concentrations (greater than or equal to 740 parts per billion [ppb]) of 2,4-DNT and 2,6-DNT were detected in the soil samples collected from the PRRWP area. No nitroaromatic explosive compounds were reported in the groundwater sample collected from monitoring well IT-MW05 or in the surface water sample collected from this area.

MK's investigation of the PRRWP area during their SI was limited to collection of surface water and sediment samples from a drainage swale north of the PRRWP. No explosive contaminants were detected.

4.3 WEST AREA RED WATER PONDS

4.3.1 Description of the West Area Red Water Ponds

The WARWP were identified as an AOC by SAIC. The WARWP are located in the western portion of the site near Pipe Creek, as shown on Figure 4-1. Figure 4-4 provides a site plan of the WARWP using the U.S. Geologic Survey (USGS) map as a base. As illustrated on Figure 4-4, the two ponds which comprise this area are designated the "eastern pond" and the "western pond." During operation of the PBOW the ponds were separated by a berm. NASA drained the eastern pond and it is generally dry except for small areas of standing water that accumulate during periods of wet weather. Pipe Creek is located south of both ponds and east of the eastern pond. A northwest-southeast trending ditch is located to the northeast of the eastern pond (Figure 4-1); this ditch flows in a southeasterly direction and discharges into Pipe Creek. The area surrounding the ponds is predominately wooded.

The WARWP received waste water from TNT Area C areas from initiation of plant operations until 1945, when the production of ordnance ceased (SAIC, 1991). Review of historical site drawings indicate that the waste water from the waste water settling basins at the TNT production areas flowed through wooden flumes and pipes to a waste water treatment and incineration area (Waste Water Disposal Area No. 2), then to the WARWP via an elevated 12-inch vitreous pipe. Review of historic aerial photographs indicates that the western pond has existed and contained standing water from the 1940s to present. The eastern pond existed and contained standing water from the 1940s to the late 1970s. According to information provided by Mr. Jim Knoll, an employee at the PBS, the berm around the eastern pond was breached at its

southwestern corner in the late 1970s to try to drain the pond (Personal Correspondence with P. Westermann, 1994).

During field reconnaissances of the area conducted in March 1994 and fall 1994, the western pond contained standing water as shown on Photos 4-7 and 4-8. The sides of the earthen berm separating the eastern and western ponds were predominantly wooded (Photo 4-8). The eastern pond was generally dry except for small areas of standing water that appear to accumulate during periods of wet weather (Photo 4-9). Shallow red-tinted water was observed in the former eastern pond area adjacent to the earthen berm separating this area from the western pond.

4.3.2 Construction Details

Drawing R-36 "Power Hse., Waste Water Disposal Area No. 2" (E.B. Badger & Sons Co., undated) illustrates the buildings located within Waste Disposal Area No. 2 and the waste water discharge line to the western pond. The drawing indicates that an elevated 12-inch diameter line carried water from the Waste Disposal Area No. 2 Raw Waste Tank to the WARWP.

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., March 1942) illustrates construction details of the flume connecting the Raw Water Storage Tank at Waste Water Disposal Area No. 2 to the western pond. Review of the drawing indicates that the western pond was originally designed to be 200 feet wide by 400 feet long with an approximately 4 feet high earthen berm surrounding the basin. The area depicted on this drawing generally corresponds to the rectangular shaped eastern portion of the western pond. Figure 4-5 presents a historic aerial photograph (date unknown) of the western pond area. Based on the apparent absence of vegetation in the areas north and south of the pond (which were also observed on a 1944 aerial photograph of the area, but not on a 1950 aerial photograph of the same area), this photograph is believed to represent early 1940 WARWP conditions. As shown on Figure 4-5, the western pond appears to have been expanded to the



PHOTO 4-7. Northern portion of existing pond at West Area Red Water Ponds (photo taken in March 1994)

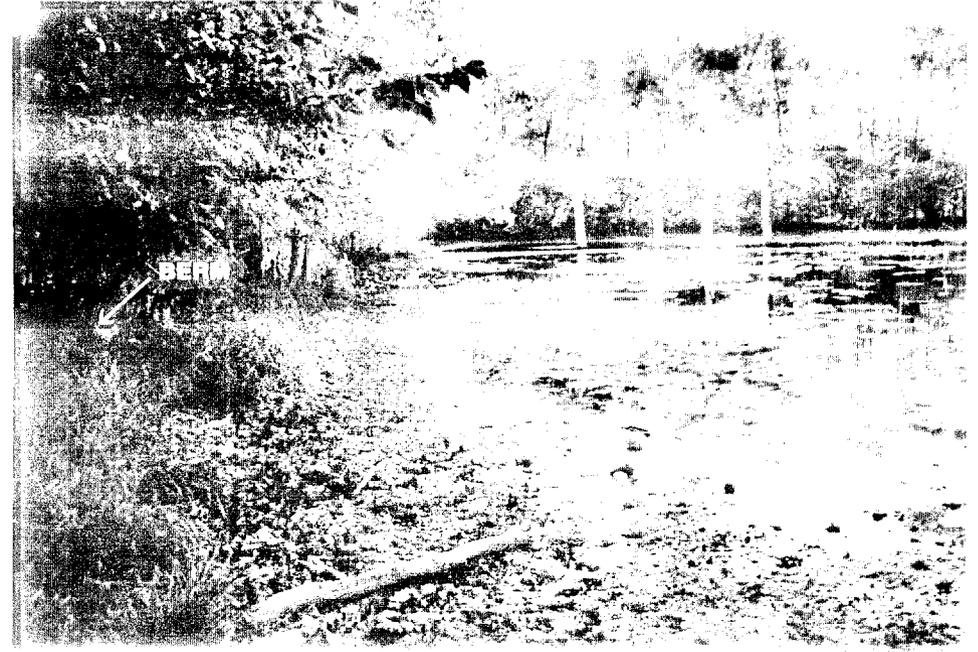


PHOTO 4-8. View looking south at berm and western portion of existing pond at West Area Red Water Ponds (photo taken in September 1994)



PHOTO 4-9. View looking south at berm and former eastern pond of the West Area Red Water Ponds; note the reddish tint of the water (photo taken in March 1994)



PHOTO 4-10. Pipe Creek south of West Area Red Water Ponds (photo taken in March 1994)



Figure 4-5

ASSUMED EARLY 1940s
AERIAL PHOTOGRAPH
SHOWING WESTERN POND
Plum Brook Ordnance Works
Sandusky, Ohio

approximate limits shown on Figure 4-1 during PBOW operation. Review of Figure 4-5 also indicates that several trees are apparent within the western pond, suggesting that extensive grading of the pond bottom was not performed during construction of the western pond.

Drawing 1763-S-954 also indicates that the elevated 12-inch diameter line from the Waste Water Disposal Area No. 2 Raw Waste Tank discharged water in the middle of the northern berm of the rectangular shaped eastern portion of the western pond. No information regarding discharge from the pond was included on the drawing.

Drawing No. 1763-T-901-2 "Waste Water Disposal No. 2 Pond No. 2" (TPC, 1943) illustrates construction details for the eastern pond. Review of the drawing indicates that the eastern pond was designed to be approximately 407 feet wide in an east-west direction at its maximum extent. The eastern pond was constructed with an approximately 10 foot high earthen berm (typical), which varied in elevation from approximately 637.1 to 640.6 feet. The lowest top of berm elevation (637.1 feet) noted on the drawing occurred in the northeast corner of the pond near the northwest-southeast trending ditch. Based on the design water level (noted on the drawing) of 637.71 feet, discharge from the pond may have occurred at this location. An 8- to 10-inch diameter pipe penetrating the earthen berm in this area of the eastern pond was observed during a fall 1994 site reconnaissance. Evidence of former concrete pedestals that may have supported a discharge pipe were also observed in the area between the eastern pond and the northwest-southeast trending ditch.

The drawing also indicates that the elevation of the bottom of the pond varied significantly, further evidence suggesting that extensive grading of the pond bottom was not performed during construction. The drawing estimates the total volume of the eastern pond to be approximately 5,400,000 gallons. No information regarding influent or effluent lines was included on the drawings.

As noted above, specific information regarding the discharge of the eastern or western ponds or the transfer of water from the western pond to the eastern pond was not documented on the available drawings. SAIC (SAIC, 1991) noted that the western

pond was constructed with an 8-inch diameter overflow tile that allows the ponds to overflow into Pipe Creek, but did not document the location of this overflow tile in their PA Report. No evidence of this reported drain tile from the western pond to Pipe Creek was observed during a site reconnaissance of Pipe Creek conducted in fall 1994. During the March 1994 site reconnaissance, Pipe Creek contained approximately 3 to 5 feet of flowing water (Photo 4-10). Seeps of reddish water into Pipe Creek south of the western pond were also observed as shown on Photo 4-11. Pipe Creek was predominantly dry, with no flowing water, during the fall 1994 site reconnaissance. A breach and overflow area in the southwestern corner of the rectangular shaped eastern portion of the western pond was also observed during the field reconnaissances (Photo 4-12).

Figure 4-6 presents a 1960 aerial photograph of the eastern and western pond area. As shown on the figure, an apparent wooden structure is located on the berm separating the eastern and western ponds. A roadway to the area of the structure is also apparent on this photograph, as well as the 1950 (Figure 4-1) and 1958 aerial photographs. Information documenting the nature of this structure was not included in the documents reviewed. However, a figure included in the OHARNG Report (OHARNG, 1985) shows an influent pipe at this location. No evidence of the former structure was observed during the 1994 and 1995 site reconnaissances of this area. However, the roadway to the former structure location apparent on the photograph was observed during the site reconnaissances.

Figure 4-7 presents a layout of the WARWP and Waste Water Disposal Area No. 2. The figure is derived from Dames & Moore's review of available information including drawings R-36, 1763-S-954, and 1763-T-901-2. The western limits of the western pond have been modified from those presented on Drawing No. 1763-S-954, and approximate those shown on Figure 4-1. Specifically, the western pond's width (east-west direction) at the center is depicted as being approximately 550 feet, rather than 200 feet. This western pond configuration was depicted based on a review of a presumed early 1940s aerial photograph (Figure 4-5) and a 1944 aerial photograph which indicate the expanded western pond configuration during PBOW operation. Figure 4-7 also illustrates the approximate location of the elevated discharge pipe from



PHOTO 4-11. Reddish water seep into Pipe Creek south of West Area Red Water Ponds (photo taken in March 1994)



PHOTO 4-12. Breach and overflow area south of existing pond at West Area Red Water Ponds (photo taken in September 1994)



PHOTO 4-13. View looking south towards western (existing) pond and berm at West Area Red Water Ponds; lime sludge was disposed of in foreground (photo taken in March 1994)

Pum Brook Ordnance Works

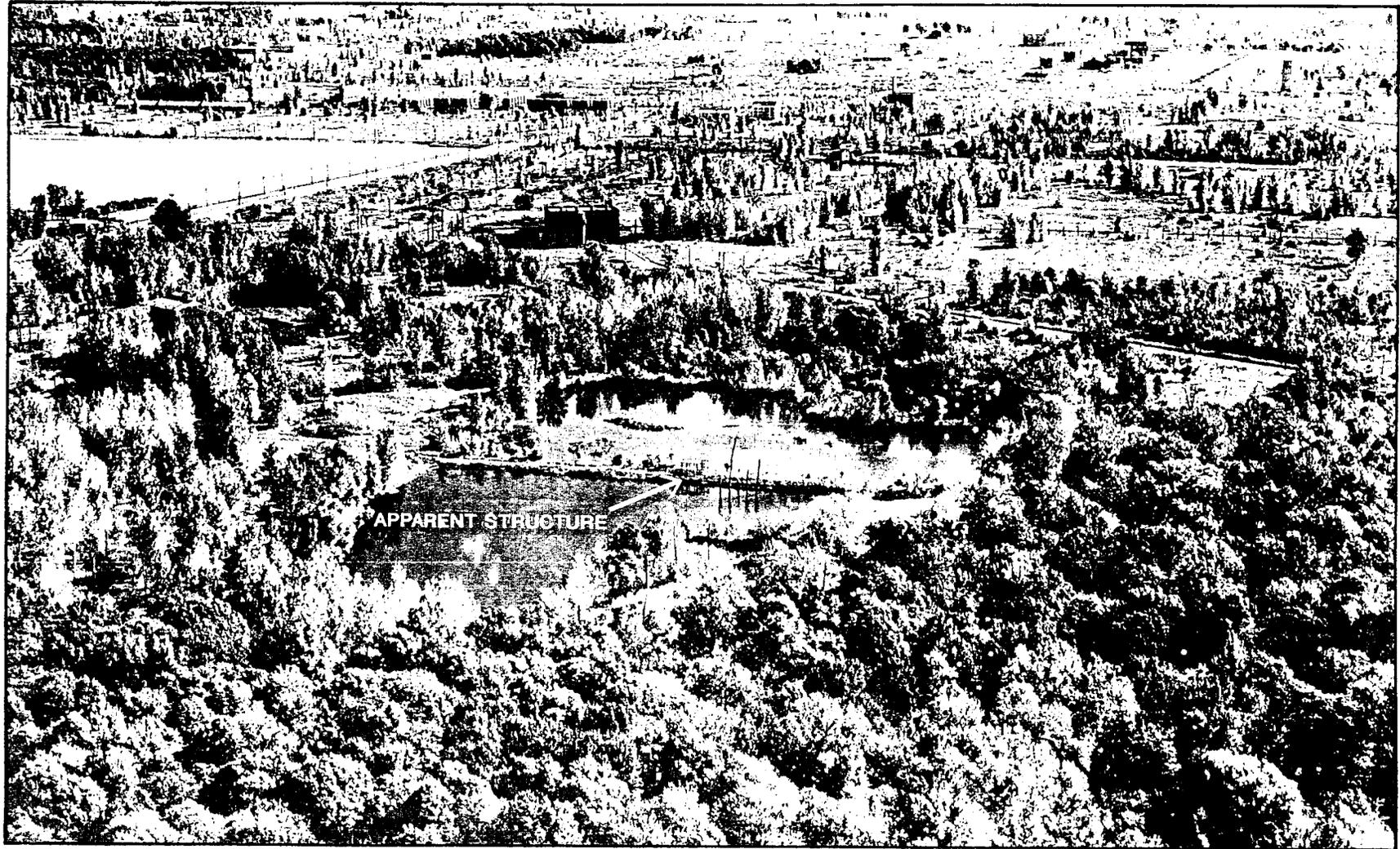
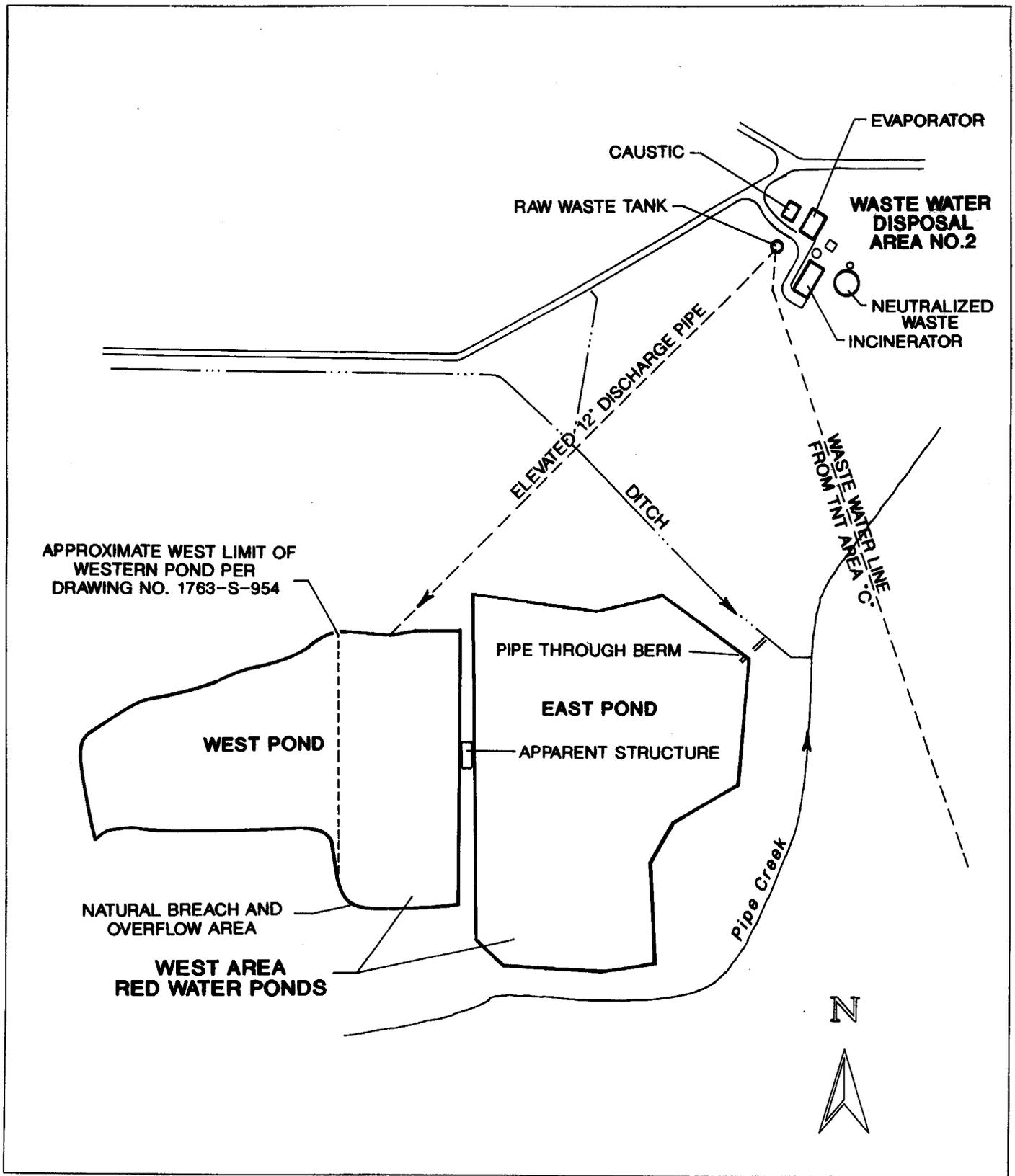


Figure 4-6

1960 AERIAL PHOTOGRAPH
SHOWING WEST AREA
RED WATER PONDS AREA
Plum Brook Ordnance Works
Sandusky, Ohio



200 100 0 200 400 FEET

Figure 4-7

REFERENCE DRAWING NUMBERS:

R-36 "POWER HSE., WASTE DISPOSAL AREA NO.2", E.B. Badger & Sons

1763-S-954 "DETAILS OF FLUME CONNECTING RAW WASTES STORAGE TANK AND WASTEWATER BASIN INCLUDING BASIN LAYOUT", E.B. Badger & Sons, 1942

1763-T-901-2 "WASTEWATER DISPOSAL NO.2 POND NO.2", Trojan Powder Company, 1943

CONSTRUCTION DIAGRAM FOR WEST AREA RED WATER PONDS

Plum Brook Ordnance Works
Sandusky, Ohio

 DAMES & MOORE

the Waste Water Disposal Area No. 2 Raw Waste Tank to the western pond and the location of the pipe penetrating the eastern pond berm observed during the 1994 field reconnaissances. The location of the apparent former structures shown on the 1960 aerial photograph and the apparent natural breach in the western pond berm observed during the 1994 field reconnaissances are also documented on Figure 4-7.

4.3.3 Post PBOW Actions

4.3.3.1 Lime Sludge Disposal

The PA (SAIC, 1991) states that 8,000 cubic yards of lime sludge was removed from the reactor settling basins and disposed at Waste Water Disposal Area No. 2. NASA personnel responsible for the lime sludge disposal indicated, however, that lime sludge was also disposed of within and immediately north of the western pond in an attempt to fill in the western pond (Personnel Correspondence with P. Westermann, 1994). The practice of on-site lime sludge disposal was discontinued in 1973 (SAIC, 1991). The 1968 aerial photograph (Figure 4-8) shows apparent disposal of materials north of and into the western pond (disturbed area within and immediately north of western pond). During the 1994 and 1995 field reconnaissances of this area, uneven ground and white material at the surface were observed (Photo 4-13).

4.3.3.2 Late 1970s Actions

According to information provided by Mr. Jim Knoll, an employee at the PBS, the berm around the eastern pond was breached at its southwestern corner in the late 1970s to attempt to drain the eastern pond (Personal Correspondence with P. Westermann, 1994). With the exception of a localized area of shallow standing water immediately adjacent to the earthen berm separating the eastern and western ponds, the eastern pond was dry during the field reconnaissance (Photo 4-9).

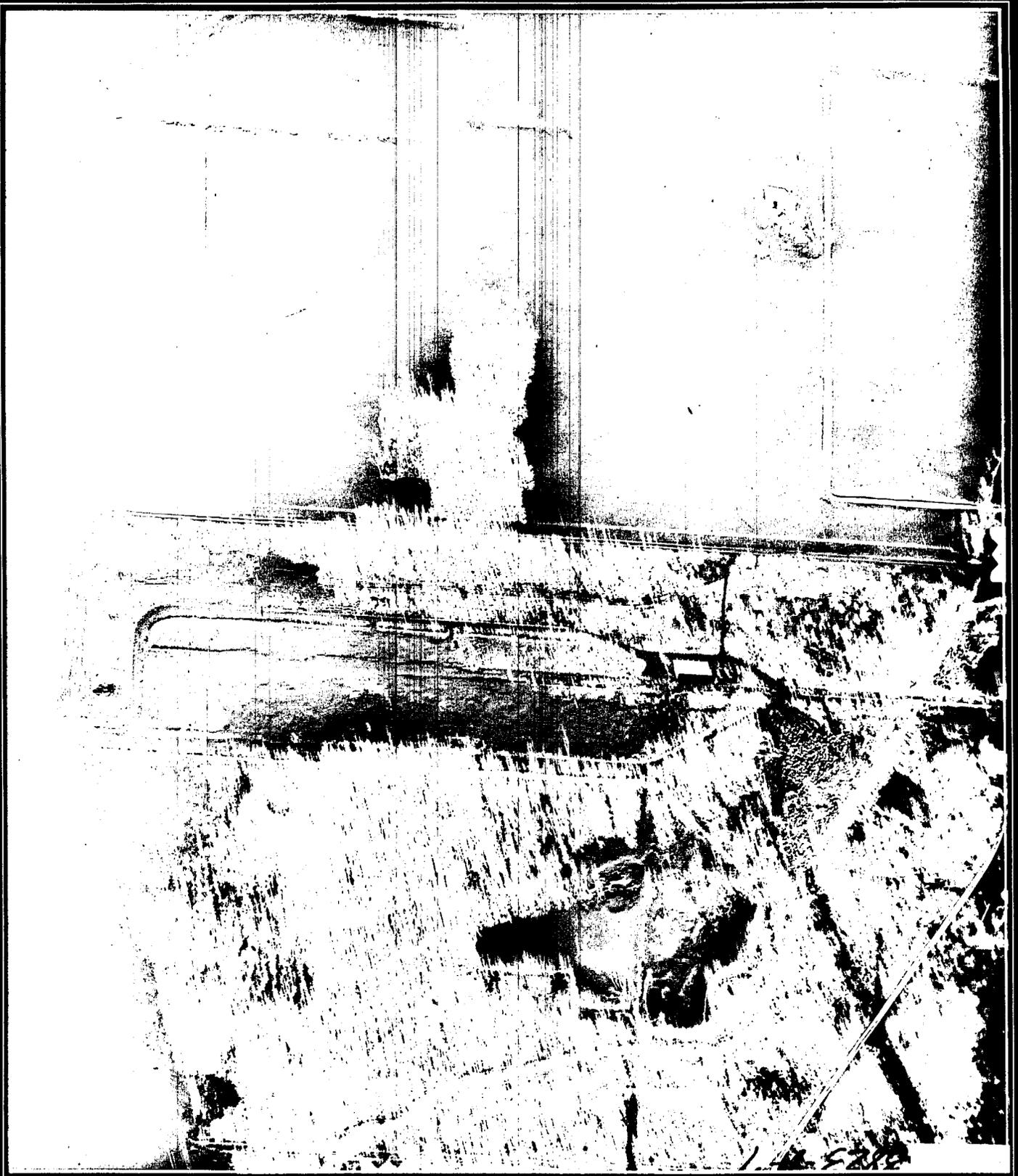


Figure 4-8

1968 AERIAL PHOTOGRAPH
SHOWING WEST AREA
RED WATER PONDS AREA
Plum Brook Ordnance Works
Sandusky, Ohio

4.3.3.3 1985 Investigations

In May 1985, the Resident Department of Interior Fisheries Research Unit placed trap nets in the western pond to evaluate the types of aquatic life present in the WARWP. Based on the results of this study, it was concluded that "the red water residue has no adverse effect on aquatic life and that there is sufficient plant life to sustain aquatic species" (NASA, 1985).

During the summer 1985, sediment sampling was performed throughout the western pond by the State of Ohio Environmental Officer and Army Trained Environmental Specialists. Sediment samples were obtained from 34 locations within the western pond and composite samples were analyzed for TNT and DNT concentrations. Selected composite samples were also analyzed for metal concentrations. The results of this study indicated that low levels of TNT and DNT were present within the western pond sediments (OHARNG, 1985).

Pipe Creek was tested for water quality in both December 1986 and January 1987. Surface water samples were obtained both upstream, downstream, and adjacent to the WARWP. Based on the results of these studies it was concluded that "comparisons between samples and between studies show very little difference in any of the samples, and the concentration of elements seemed in no way related to the distance up or downstream of the West Area Red Water Ponds" and "aquatic and terrestrial life thrive in and around Pipe Creek just as they do at the West Area Red Water Ponds" (OHARNG, 1985).

4.3.4 Environmental Investigations

IT investigated the WARWP area during their 1989 Contamination Evaluation. In their report (IT, 1991), IT refers to this area as "Waste Disposal Area #2, and stated that areas of surface contamination were evident.

Monitoring well IT-MW2 was installed at the northwestern corner of the former eastern pond to a total depth of 18.3 feet. Groundwater in this well was measured at approximately 11 feet below the top of riser. IT also installed five soil borings and collected soil samples (SB-07 and SB-09 through SB-12). SB-07 was installed south of the western pond and SB-09 through SB-12 were installed in the former eastern pond area. Soil samples collected from a depth of 0 to 2 feet were submitted for laboratory analysis.

Groundwater and soil samples collected by IT were analyzed for VOCs, SVOCs, nitrates, metals, and nitroaromatic explosive compounds. IT reported that significant concentrations of 1,3,5-trinitrobenzene (TNB), 1,3-dinitrobenzene (DNB), 2,4,6-TNT, and 2,4-DNT were detected in soil samples from the WARWP. Although no nitroaromatic explosive compounds were reported in the groundwater sample collected from monitoring well IT-MW2, 2,4-DNT and 2,6-DNT were detected as SVOCs at concentrations of 160 micrograms per liter (*ug/L*) and 27 *ug/L*, respectively.

MK's investigation of the immediate WARWP area during their SI included the installation of three monitoring wells (MK-MW9, MK-MW10, and MK-MW11) at locations north of the WARWP. The wells were installed to sample groundwater which may have been influenced by the WARWP. Surface water and sediment samples were also collected from Pipe Creek. Red water was noted seeping out of the northern bank of Pipe Creek during the sampling (summer 1993). Surface water and sediment samples (SW03 and SD03, respectively) were collected immediately below the seeps. No VOCs, SVOCs, pesticides/PCBs, or nitroaromatic compounds were detected in the groundwater, surface water, and sediment samples.

4.3.5 Current Use

The WARWP are 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. The area on the north side of the ponds is mowed by NASA on a regular basis. Otherwise the surrounding area is wooded.

5.0 AOC 4 - BURNING GROUNDS

5.1 INTRODUCTION

Four burning ground areas used during former DoD activities were identified by SAIC during their PA (SAIC, 1991). Available information regarding these burn grounds was reviewed. Figure 5-1 shows the location of the four burning grounds, referred to herein as:

- Snake Road Burn Ground
- Taylor Road Burn Ground
- Reservoir #2 Burn Ground
- G-8 Burn Ground

D&D efforts were undertaken after shut-down of the PBOW and in the mid-1950s and early 1960s. Procedures and memoranda describing the D&D efforts state that waste DNT and TNT, DNT- and TNT-contaminated building materials and flume and sewer lines were destroyed at the burning grounds during these work efforts. Contaminated putty, packing, and asbestos insulation removed from buildings at the TNT areas were burned at these burn grounds (Dykema and Lee, 1944). In their PA, SAIC states that the burning grounds were also used for the destruction of intermediate settling tanks and catch basins from the TNT areas.

NASA has also used the burn grounds at Taylor Road and Snake Road. The uses of these areas by NASA are summarized herein.

The burning grounds are considered potential sources of environmental contamination due to their historical usage as disposal sites for contaminated wastes, including explosives, waste oil, solvents, asbestos, and acids.

Environmental investigations have been performed at the Snake Road Burn Ground, the Taylor Road Burn Ground, and the G-8 Burn Ground. The investigations confirmed contamination of the soils and groundwater at the Snake Road Burn Ground.



2000 1000 0 2000 4000 Feet

APPROXIMATE SCALE

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



Figure 5-1
LOCATIONS OF PBOW BURNING GROUNDS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE

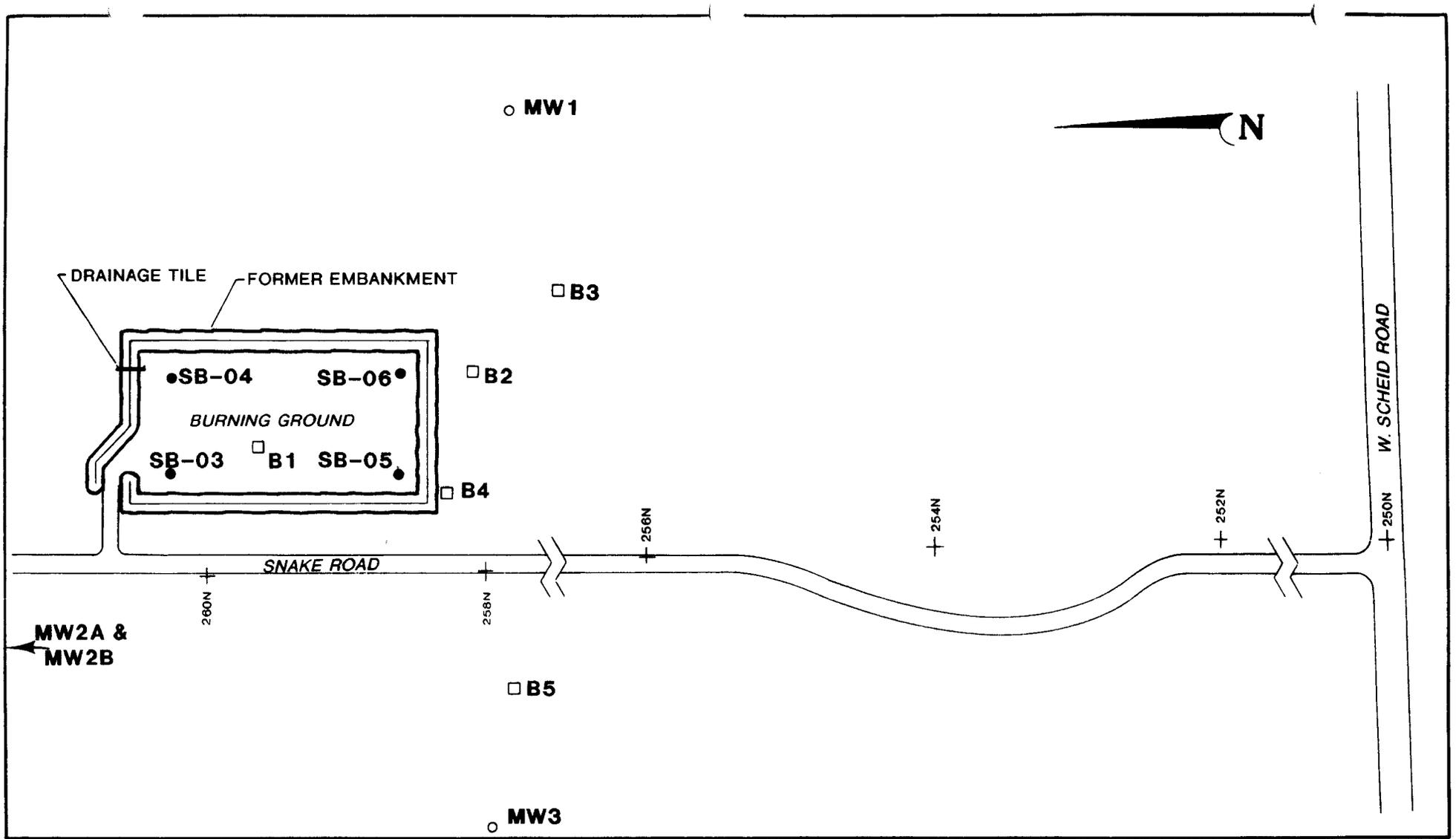
Investigation of the G-8 Burn Ground indicated the presence of coal-tar derivatives in the soils at this location. No environmental investigations have been performed at the Reservoir #2 Burn Ground.

5.2 SNAKE ROAD BURN GROUND

5.2.1 Description of the Snake Road Burn Ground

The Snake Road Burn Ground is located east of Snake Road and north of West Scheid Road at the approximate location shown on Figure 5-1. The layout of the burn ground is shown on Figure 5-2, which was derived from historical Drawing No. 1669-T-603-12 (TPC, November 22, 1944). The drawing indicates that the burn area was a "proposed" burn area for destruction of waste TNT. The drawing specified the burn ground as being 100 feet wide by 200 feet long oriented in a north-south direction. The southwest corner of the burn ground was located approximately 800 feet north of the intersection of West Scheid and Snake Roads. The drawing indicates the burn ground is accessed by a 10-foot wide driveway at its northwest corner extending 50 feet due west to (the unpaved) Snake Road. The drawing also indicates that a 4-foot berm surrounding the burn area and an 8-inch diameter drainage tile located in the northeast corner was proposed. Drainage was to a ditch flowing north from the burn area to "sufficient outlet". The drawing shows a graded slope within the burn pit of 0.4 percent south to north, and 4 percent east and west to the centerline. Proposed burning spots were specified as having a 4-inch sand base, and a 4-inch cinder top.

Review of historical aerial photographs dated October 1950 indicates a disturbed area resembling the configuration and orientation of the proposed burn ground as depicted on the design drawing referenced above. What appears to be a berm surrounds an area of disturbed soil. Two areas of disturbed ground or debris are visible just outside of the berm at the southeast and southwest corners. The southwest corner appears to have been used as the access to this area. Snake Road appears to be overgrown south of the area to West Scheid Road, and unfinished north of the area to North



KEY:

- SB-03 IT Soil Boring
- MW1 H+GCL Monitoring Well
- B3 H+GCL Soil Boring

REFERENCE DRAWING: No. 1669-T-603-12, "Scheid Road Burning Grounds between TNT Area B and Magazine Area", TPC, 1944

Figure 5-2
 LAYOUT OF
 SNAKE ROAD BURN GROUND
 Plum Brook Ordnance Works
 Sandusky, Ohio

Magazine Road. Snake Road is shown completed to North Magazine Road on the 1969 USGS 7.5-minute quadrangle topographic map for Kimball, Ohio.

During field reconnaissances of this AOC in March 1994, the area was observed to consist of recently plowed field containing pieces of brick, concrete, wood, and metal, as shown on Photo 5-1. A NASA burn pit was observed west of Snake Road.

5.2.2 Use of the Snake Road Burn Ground

Limited information was found regarding the historical use of the Snake Road Burn Ground. Sources of information are primarily undocumented, obtained from the following reports: *Phase I Site Characterization of Disposal Area Three* (H⁺GCL, 1992); *Plum Brook Station Preliminary Assessment* (SAIC, 1991); and the *Draft Engineering Report for the Contamination Evaluation at the Former Plum Brook Ordnance Works, Sandusky, Ohio* (IT, 1991).

H⁺GCL's review of IT's draft report indicated that the Army had used an area on the east side of Snake Road for the destruction of explosives during the D&D actions performed between 1941 and 1963. Historical Drawing No. 1669-T-603-12 (TPC, 1944), the proposed plan for the "Scheid Road Burning Grounds" (Snake Road Burn Ground), is dated November 22, 1944. This indicates that destruction (burning) of ordnance and other hazardous materials in this area may have been performed for several years prior to the construction of a formal containment area. It is possible that these activities extended beyond the boundaries of the burn ground as depicted on Figure 5-2. No records regarding the volume of materials destroyed at the Snake Road Burn Ground by the DoD were found. However, materials contaminated with DNT, TNT, pentolite, and asbestos were allegedly destroyed here.

According to the documents reviewed, NASA continued using the Snake Road area for burning activities. Based on information provided in the H⁺GCL report (which drew upon the IT Corporation report), it appears that NASA expanded upon the original area of the DoD's Snake Road Burn Ground. Following review of aerial photographs and



PHOTO 5-1. View looking south towards Snake Road Burn Ground (photo taken in March 1994)



PHOTO 5-2. View looking east towards Taylor Road Burn Ground (photo taken in fall 1994)



PHOTO 5-3. Debris (piping, concrete, etc.) buried behind Taylor Road Burn Ground (photo taken in fall 1994)



PHOTO 5-4. Construction debris buried behind Taylor Road Burn Ground (photo taken in fall 1994)

interviews with site personnel (not documented), H⁺GCL concluded that the burn ground had been expanded between 1964 and 1970. Figure 2-2 (Study Area Map, Disposal Area Three) of the H⁺GCL report indicates that the burn ground was expanded initially to the south, east, and west of the original area (based on review of a 1964 aerial photograph), and later to the south and east (based on a 1970 Domestic Water System Sectional Map).

NASA continued using the burn grounds during D&D activities of the former PBOW buildings and areas. Materials contaminated or potentially contaminated with explosives, acids, waste oils, solvents, and other chemicals may have been disposed of here during D&D activities. No documentation was found during the records review regarding the specific wastes and volumes destroyed at this burn ground by NASA. Bulletin No. 88-002-65 (Wright, 1965) states that this burn ground is to be used for the disposal of non-hazardous combustible waste such as plywood, discarded wooden displays, wooden shipping crates, paper, and cardboard. H⁺GCL states (without documentation) that metal, electrical equipment, wiring, and rags were reported to have been burned in this area. Dames & Moore's review of historical aerial photographs dated 1968 indicated that the Snake Road Burn Ground area was being used at this time (the snow had been plowed from a portion of the burn area.)

A fire training pit was constructed during the early 1960s on the west side of Snake Road near the former DoD burn ground. Information from PBS employees as obtained by SAIC during the PA (SAIC, 1991) indicates that this pit was used for training of on-site personnel in fire fighting by extinguishing diesel oil and waste oil fires. This pit was also allegedly used for the burning of waste oil and solvents, as well as solid and explosive waste.

No documentation was found during the records review regarding the closure date(s) for the burning ground and associated areas. H⁺GCL and SAIC cited the late 1970s as the time when ash was removed from the burn pit, buried near Line Road 16 and North Magazine Road, and the burn pit backfilled. SAIC, however, indicates in their report that the burn ground was still being used in 1991 by NASA for the destruction of combustible non-hazardous solid wastes.

Eight-inch diameter drainage tiles were installed through the embankment at natural low points. A mesh chicken wire fence was installed on top of the embankment.

Review of historical aerial photographs dated October 1950 indicates a disturbed area having the same configuration as that shown on the construction drawing and in an undated close-up aerial photograph provided by NASA. In the 1950 photograph, bare ground or debris appears to be located along the northern edge and in the southwestern corner of the area. The fire-break area around the burn ground appeared to have been cleared of trees and other materials.

During field reconnaissances of this AOC in March 1994 and fall 1994, the area was observed to consist of open field, as shown on Photo 5-2. The area encompassing the former burn ground is at a slightly higher elevation than the surrounding terrain; the former embankment referenced in the design drawing was no longer present. Buried construction debris (pieces of metal and concrete) was observed in the southwestern portion of the area, as shown on Photos 5-3 and 5-4. An apparent drainage depression was observed in the eastern portion of the area.

5.3.2 Use of the Taylor Road Burn Ground

The historical TPC drawing dated May 1944 (Figure 5-3) indicates that the burn ground was used for rubbish burning at that time. Review of an August 19, 1955 memorandum (Sanders, 1955) indicates that the Taylor Road Burn Ground was also used during D&D in 1955 by the subcontractor Ravenna Arsenal. At this time, the Taylor Road Burn Ground was noted to have been enlarged to approximately twice its former size by scraping. A 200-foot area around the burn ground was also cleared of all combustible materials as part of this work effort. The memo further details some of the materials which were burned at a burn area (presumably the Taylor Road Burn Ground). The materials included over 1,700 feet of 4-inch, 5-inch, and 6-inch wooden sewers which had been removed from TNT Area A and waste TNT which was removed during decontamination efforts at TNT Area A.

In "rough draft" of Bulletin 62: "Disposal of Industrial Wastes at PBS" (Unknown author, November 30, 1962), guidelines for disposal of industrial wastes at PBS are outlined. Item 5 states: Combustible wastes not contaminated with acids or explosives: deposit at Taylor Road Burning Area inside the revetment in the center of the burning area. Bulletin 88-002-65 (Wright, 1965) presents guidelines for disposal of industrial wastes at the PBS at that time. A map accompanying the Bulletin indicates that scrap metals, non-combustible materials, and combustible materials were disposed of in one of four other dump and salvage areas, not including the Taylor Road Burn Ground, indicating that this burn ground was not to be used after 1965.

5.3.3 Environmental Investigations

The IT Contamination Evaluation (IT, 1991) identified this burn ground as "Rubbish Burning Ground at Taylor and Ransom Roads". As part of their 1989 Contamination Evaluation, IT installed soil borings SB-01 and SB-02 within the perimeters of the burn area. Sample SB-01 was collected from 4 to 6 feet in depth on the northern side of the burn area, at the approximate location shown on Figure 5-3. Sample SB-02 was a composite of soils collected from 0 to 6 feet in depth from a boring installed on the southern side of the burn area (see Figure 5-3). Both soil samples were analyzed for VOCs, SVOCs, total metals, total sulfates, nitrates, pH, and nitroaromatic explosive compounds. Acetone was reported, but IT attributed its presence to laboratory contamination. No other contamination was indicated by the laboratory analyses.

MK did not collect any environmental samples at the Taylor Road Burn Ground during their SI.

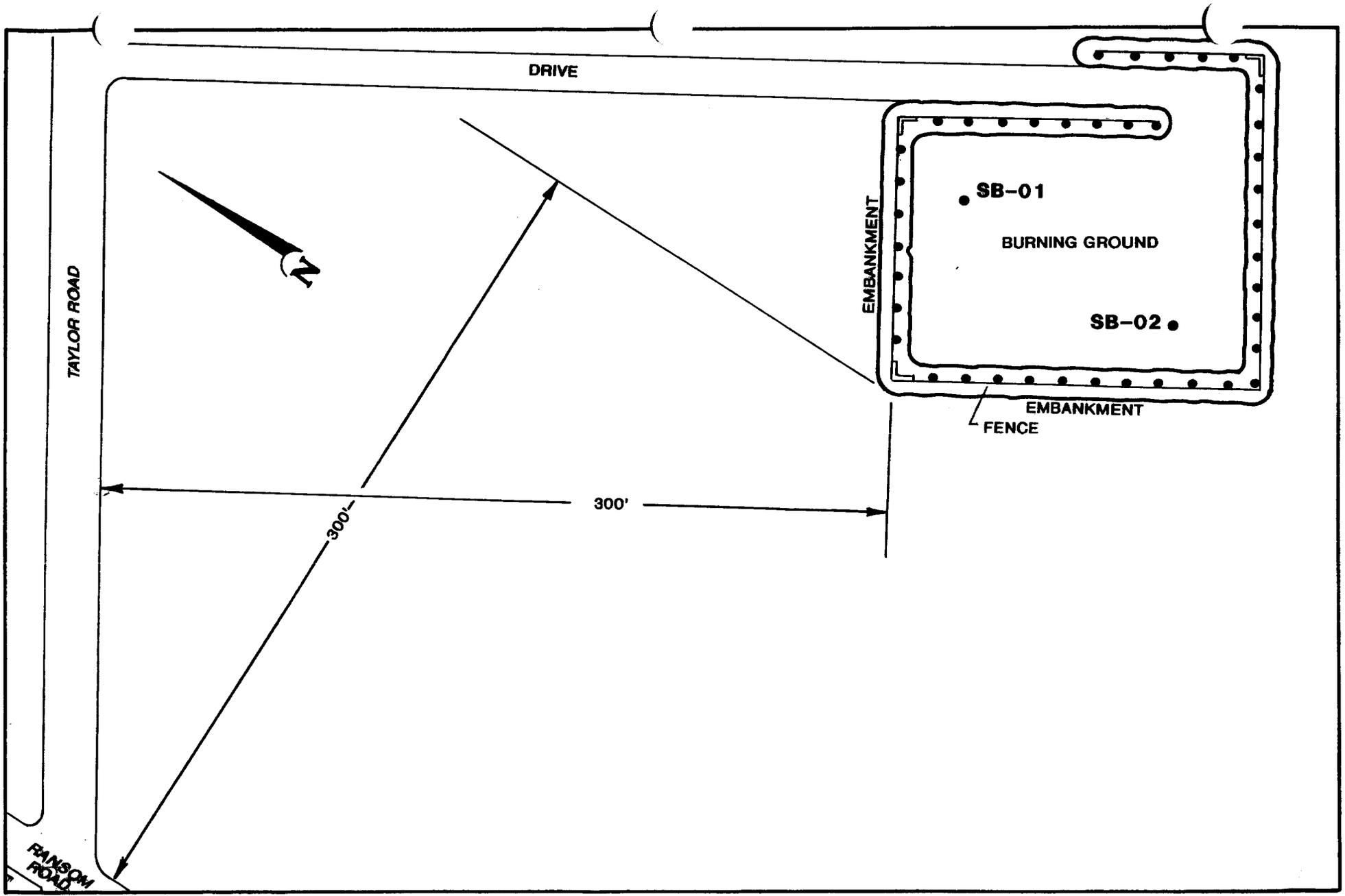
5.4 RESERVOIR #2 BURN GROUND

5.4.1 Description of the Reservoir #2 Burn Ground

The PA (SAIC, 1991) identified the presence of a burn ground west of Reservoir #2, although the location was approximated and the dimensions were stated as unknown. SAIC's project files included a copy of a letter (Braig, September 5, 1963 to the D&D subcontractor for the site, Ravenna Arsenal) which described proposed work at PBOW. The letter instructed Ravenna Arsenal to "clear the TNT burning ground near Reservoir #2 of all debris and decontaminate ground, restore ground to proper grade."

The SI (MK, 1994) refers to this area as "Burn Ground 1". It is reported as being located behind an abandoned building (Power Station #2) along Campbell Road, and having no visible limits. MK estimated the size of this area as less than 3 acres and reported that this area may also have been used for coal storage, as small mounds of coal were observed on the ground surface in the area. However, during a March 1994 Dames & Moore and CEORN field reconnaissance of the area investigated by MK, no indications of a former burn area in this location were observed. The area appeared to be used formerly for storage of coal. Review of historical drawings of this Power Station indicate that the area investigated by MK was indeed used for coal storage, and not for a burn ground.

Mr. Lynn Cherry, an employee of the PBS told Dames & Moore that a former PBOW employee reported an old burn ground south of Reservoir #2 in the location of a former NASA ballfield (Personal communication with P. Westermann, 1995). The location of this ballfield is shown on Figures 5-1 and 5-4. Review of aerial photographs taken in 1950 (Figure 5-1) indicates the presence of a disturbed area within a rectangular-shaped berm at this location. Review of aerial photographs taken in 1968 (Figure 5-4) indicates a cleared large area south of Reservoir #2 (the northern edge of the cleared area is the ballfield.) This is likely the site of the Reservoir #2 Burn Area. Review of the 1950 aerial photographs and comparison with the sizes of the Taylor Road Burn Ground and the Snake Road Burn Ground on this same set of photographs, indicates the burn ground was approximately 125 feet wide by 175 feet long. The burn ground

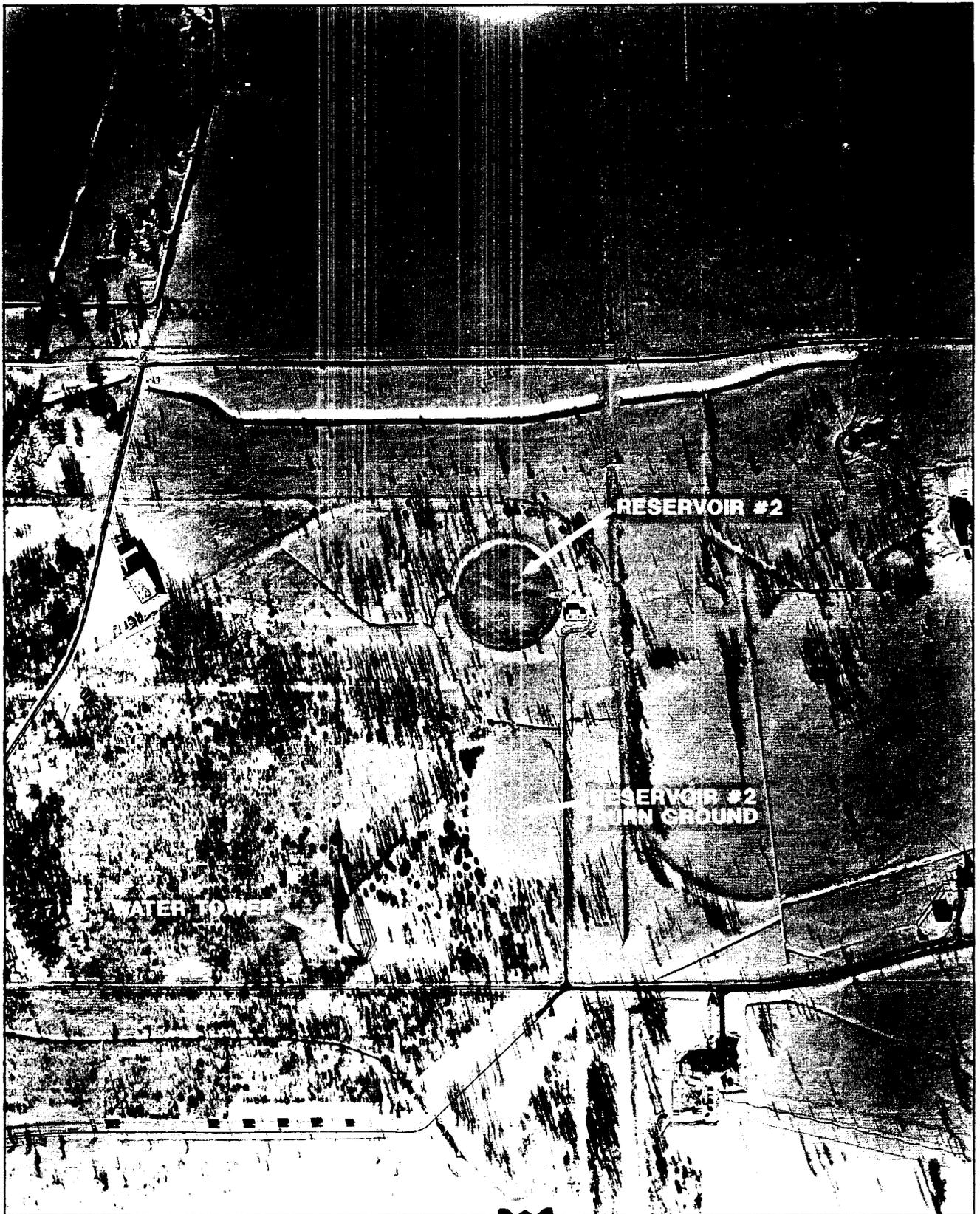


KEY:

- **SB-01** IT Soil Boring

REFERENCE DRAWING: No. 1669-T-609-1/2 "Rubbish Burning Ground at Taylor and Ransom Roads", TPC, 1944

Figure 5-3
LAYOUT OF TAYLOR ROAD BURN GROUND,
INCLUDING LOCATIONS OF IT BORINGS
 Plum Brook Ordnance Works
 Sandusky, Ohio



600 300 0 600 1200 FEET
(APPROX.)



Figure 5-4
1968 AERIAL PHOTOGRAPH
SHOWING RESERVOIR #2
BURN GROUND

Plum Brook Ordnance Works
Sandusky, Ohio



PHOTO 5-5. View looking south/southwest towards former ballfield area south of Reservoir #2 (in vicinity of Reservoir #2 Burn Ground); water tower shown in background is north of Fox Road (photo taken in March 1995)

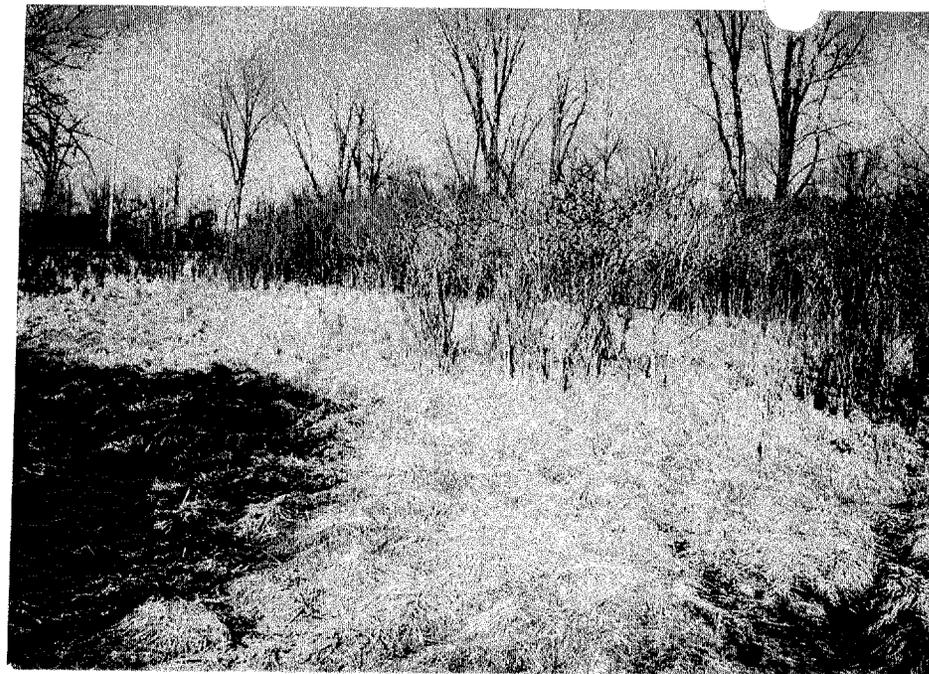


PHOTO 5-6. View looking north/northeast towards former ballfield area (vicinity of Reservoir #2 Burn Ground) (photo taken in March 1995)



PHOTO 5-7. View of June 8, 1962 burning of piping, etc.; note the water tower in the background. (PBS designation: Photo P-62-1211)

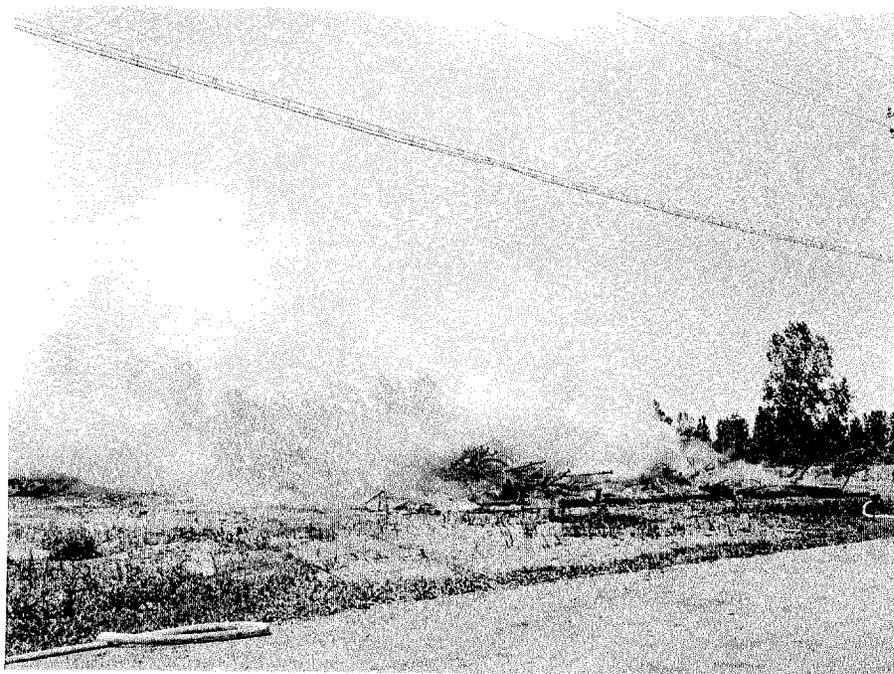


PHOTO 5-8. View of June 8, 1962 burning of piping, etc. (PBS designation: Photo P-62-1212)

is very pronounced in the 1958 aerial photograph. The size of the cleared area shown on the 1968 aerial photographs (Figure 5-4) is considerably larger, indicating that a fire-break may have been cleared around the burn ground. No other indications of other burn areas near Reservoir #2 were observed during either the review of aerial photographs or Dames & Moore's field reconnaissance of the area in March 1995.

During the March 1995 field reconnaissance of the former ballfield area, the area was observed to consist of open fields with stands of young hardwood trees and brush, as shown on Photos 5-5 and 5-6. No stressed vegetation or burned areas were observed. Former unpaved access roads traversed the area.

5.4.2 Use of the Reservoir #2 Burn Ground

This burn ground was located south of Reservoir #2. Booster Station Number 2 is associated with this reservoir. In a "rough draft" of Bulletin 62: "Disposal of Industrial Wastes at PBS" (Unknown author, November 30, 1962), guidelines for disposal of industrial wastes at Plum Brook Station are outlined. Item 6 states: "Combustible and non-combustible waste, contaminated or potentially contaminated with acids or explosives: deposit at Fox Road Burning Area inside the revetment in the center of the area." The Bulletin further states: "Fox Road Burning Area is located adjacent to Booster Pump Station Number 2." (This indicates that the "Fox Road Burning Area" referenced in this Bulletin may be the Reservoir #2 Burn Ground.) Item 7 of this Bulletin states that non-contaminated salvageable scrap is to be deposited at the "Fox Road Burning Area" outside the revetment.

Photos 5-7 and 5-8 were made from historical negatives included in a folder obtained from NASA. The handwritten title information identifies the photographs as "Decontamination of Piping etc., Burning of TNT, Sodium, and Misc. Material" and taken by H. Hoover on June 8, 1962. Review of Photo 5-7 indicates that this burn area was located in the vicinity of a water tower (the water tower shows very faintly in the center of the photograph.) The accompanying Photo 5-8 indicates that the burn ground was bermed and was located adjacent to an unpaved road with electric power

lines paralleling the road. Based upon this information, review of historical aerial photographs, and the references to this burn ground in the November 1962 Bulletin (see above), it appears that these Photos 5-7 and 5-8 were taken at the Reservoir #2 Burn Ground. Therefore, this burn ground was used from at least 1950 (based on review of the aerial photographs) to at least 1962 (per the Bulletin.)

5.4.3 Environmental Investigations

As stated in Section 5.4.1, MK investigated an area identified generally by SAIC as the former burn area. MK collected two soil samples (SS06 and SS07) in the area they identified as the Reservoir Burn Ground. Both samples were collected in an area of tall grass along the northeast side of Power Station #3, as shown on Figure 5-1. The samples were analyzed for VOCs, SVOCs, pesticides/PCBs, and inorganic compounds. In soil sample SS06, estimated values of toluene (4 $\mu\text{g}/\text{kg}$), 2-methylnaphthalene (320 $\mu\text{g}/\text{kg}$), benzo(b)fluoranthene (46 $\mu\text{g}/\text{kg}$), naphthalene (240 $\mu\text{g}/\text{kg}$), and phenanthrene (130 $\mu\text{g}/\text{kg}$) were reported. The SVOCs detected in soil sample SS06 are coal tar derivatives. In sample SS07, the VOCs acetone (estimated value of 10 $\mu\text{g}/\text{kg}$), toluene (10 $\mu\text{g}/\text{kg}$), and total xylenes (estimated value of 1 $\mu\text{g}/\text{kg}$) were reported. As previously discussed, it is likely that area investigated by MK was used for coal storage, and not as a burn ground. The compounds found in the soil samples analyzed by MK are consistent with coal yard debris.

IT did not collect any environmental samples in this area during their contamination evaluation.

No environmental investigations have been performed at the actual location of the Reservoir #2 Burn Ground.

5.5 G-8 BURN GROUND

5.5.1 Description of G-8 Burn Ground

In their PA (1991), SAIC identified the G-8 Burn Ground as an AOC with an approximate location "east of Guard House G-8". Guard House G-8 was formerly located at the corner of Campbell Street and Patrol Road in the southwestern corner of the PBOW, as shown on Figure 5-1. A memorandum entitled "Status of Decontamination Project at Plum Brook Ordnance Works" (Sanders, August 19, 1955) describes preliminary operations of decontamination, including that "a second burning ground near Building G-8 in an easterly direction was decontaminated by controlled burning and a 200-foot firebreak was cut around it." This is the only direct reference to the burn ground found in the files reviewed. None of the historical drawings reviewed at the NASA PBS appeared to be related to or mention this burn ground.

In their SI report (1994), MK identified this burn ground as "#2 Burn Ground". MK estimated the burn area to be approximately 2 acres and described it as a clearing which runs east to west with a small ditch bordering the north side. The clearing is located on the east side of Campbell Street.

Review of historical aerial photographs dated October 1950 indicates that the area described above consists of open field with few trees. No indications of a burn ground in this area were observed. It is possible that aerial photographs taken after 1955 (when the burn ground is documented to have existed) may show the burn area, although the none of the photographs obtained during the records review showed a burn ground in this location.

During a preliminary site reconnaissance by representatives of Dames & Moore and CEORN in March 1994 and follow-up reconnaissance in March 1995 by Dames & Moore, no adverse surface conditions were readily apparent. The area consisted of an open area surrounded by hardwood forest, as shown on Photos 5-9 and 5-10.



PHOTO 5-9. View looking northeast towards G-8 Burn Ground from Patrol Road (photo taken in March 1995)

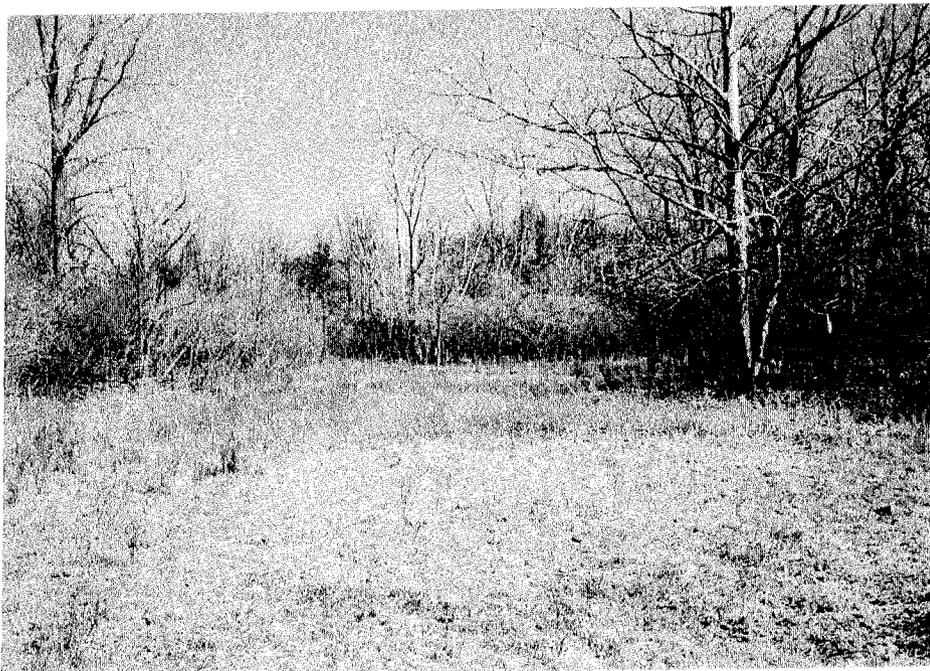


PHOTO 5-10. Cleared area at G-8 Burn Ground (photo taken in March 1995)



Pum Brook Ordnance Works

PHOTO 5-11. Photograph taken July 10, 1963 of contaminated flume lines; note the water tower in background which indicates the photograph may have been taken along Fox Road (PBS designation: Photo P63-1610)

5.5.2 Environmental Investigations

During their 1993 investigation, MK collected two shallow (0 to 2 feet in depth) soil samples (SS08 and SS09) on the east and west sides of the center of the clearing. The samples were analyzed for VOCs, SVOCs, pesticides/PCBs, and nitroaromatic compounds. In sample MK-SS09, MK reported the presence of coal-tar derivatives, mainly benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, fluoranthene, phenanthrene, and pyrene, at estimated values ranging from 61 $\mu\text{g}/\text{kg}$ to 140 $\mu\text{g}/\text{kg}$, which they reported were above the method detection limit, but below the quantitation limit.

MK also collected surface water sample SW01 and sediment sample SD01 to evaluate the release of contaminants from this burn ground into Pipe Creek. Both samples were collected on the east side of the concrete culvert between Patrol Road and the perimeter fence (southwest corner of the facility) at the head of a small stream which feeds Pipe Creek. 2-butanone was detected in the water matrix of sample SW01. In sample SD01, several SVOCs were reported as estimated concentrations ranging from 380 $\mu\text{g}/\text{kg}$ (phenanthrene) to 1,100 $\mu\text{g}/\text{kg}$ (pyrene).

5.6 ADDITIONAL BURN GROUND

Photos 5-11, 5-12, and 5-13 are photographs made from negatives included in a folder entitled "Decontamination of Flume Lines, Burning on Fox Road" by L. Trunk and dated July 10, 1963. These photographs were included in the historical information provided by Ms. Amy Bower of the NASA PBS. The photographs appear to have been taken near the intersection of Fox Road and Snake Road in the vicinity of the water tower on Fox Road as shown on Photo 5-11. One of the historical (1958) close-up aerial photographs provided by NASA showed the water tower at Fox Road to have the same coloration (black and white) and shape as the water tower shown in Photo 5-11. The general area being referenced is shown on Figure 5-1.

Review of these historical site photographs indicate the large number and lengths of pipe and the kinds of other materials that were burned at this apparent burn ground



PHOTO 5-12. Photograph taken July 10, 1963 showing extent of area used for burning of contaminated flume lines (PBS designation: Photo P63-1608)

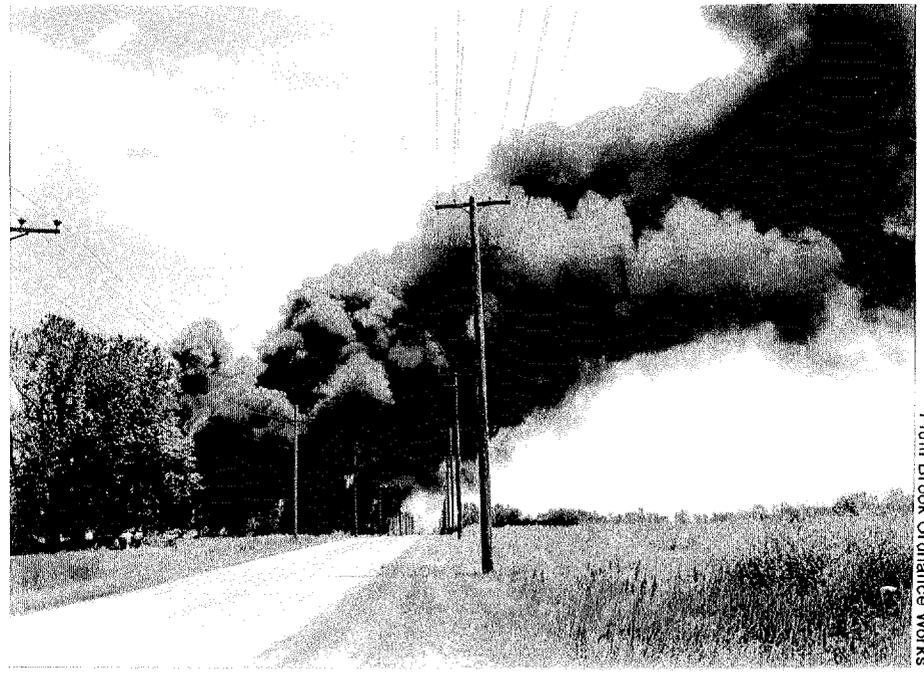


PHOTO 5-13. Photograph taken July 10, 1963 that shows burning of the contaminated flume lines (PBS designation: Photo P63-1609)

— during decontamination efforts of the 1960s. The title of the photographs indicates that the materials burned at this area included flume lines contaminated with TNT.

During an interview, Mr. Lynn Cherry, an employee at the PBS, indicated that former PBOW employees had stated that this burn ground and others across the site were used to burn the TNT-contaminated pipes that had been excavated (Personal Communication with P. Westermann, March 1995).

6.0 AOC 5 - WASTE WATER SETTLING BASINS IN THE PENTOLITE AREA

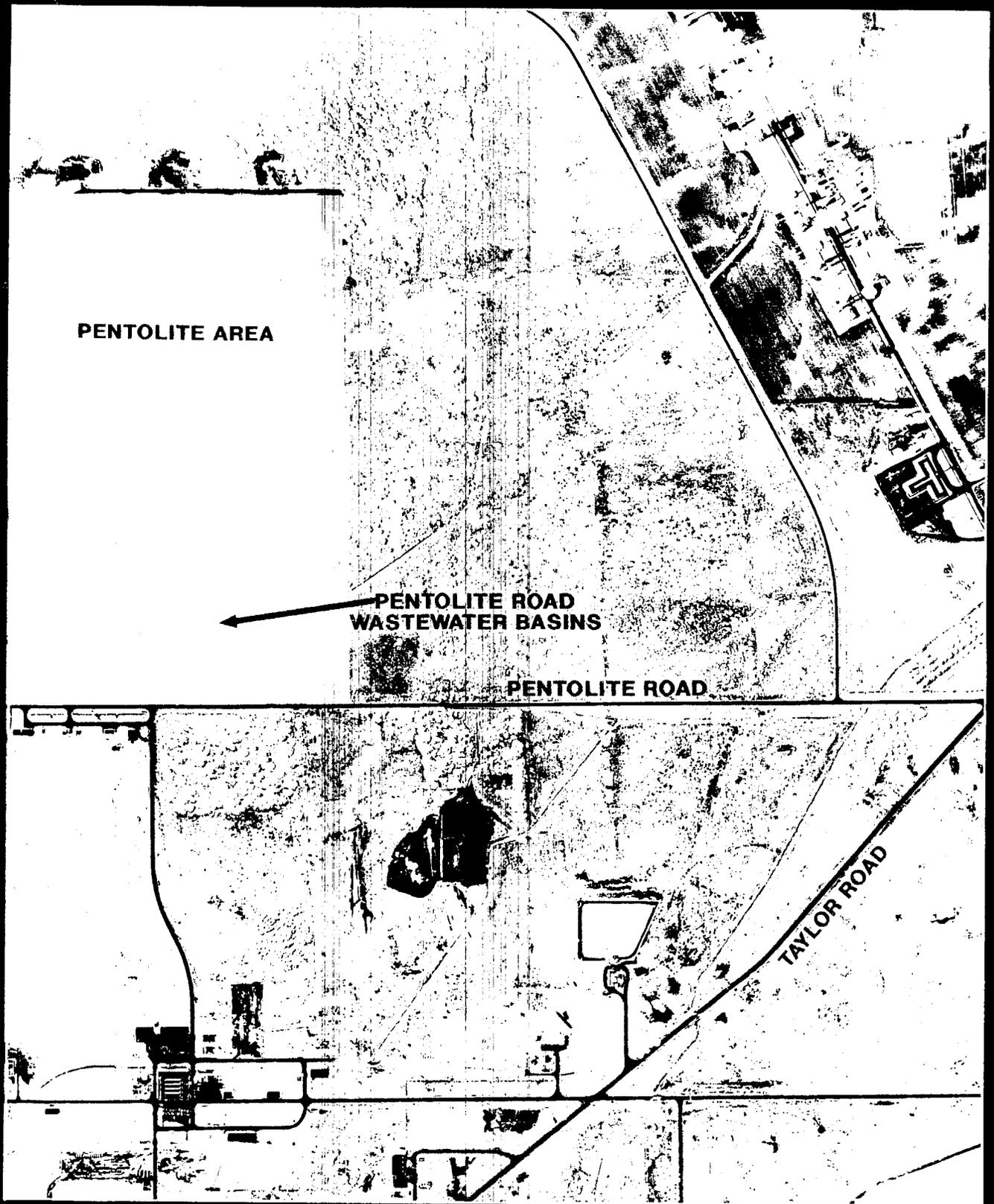
6.1 INTRODUCTION

The former Pentolite Area is located north of Pentolite Road at what is now the location of the NASA reactor. The Pentolite Area was used for production of pentolite from March 1943 through the PBOW shut-down date in August 1945 (TPC, August 1945). The area contained three pentolite lines with a designated capacity of 7,000 pounds per 24 hours. Two basins received waste water generated during the pentolite production. The volume of waste water, specific treatment details, and sludge disposal details were not found in the documents reviewed.

The PA (SAIC, 1991) states that the waste water probably contained significant concentrations of pentaerythritol (PE), PETN, acetone, and TNT. The waste water basins were removed during construction of the Plum Brook Reactor Facility (PBRF). The soils in the entire Pentolite Area was moved and the surface was filled and regraded to meet reactor site specifications. It is likely that any basin-contaminated substrata were removed or dispersed during PBRF construction (SAIC, 1991).

6.2 DESCRIPTION OF THE PENTOLITE WASTE WATER SETTLING BASINS

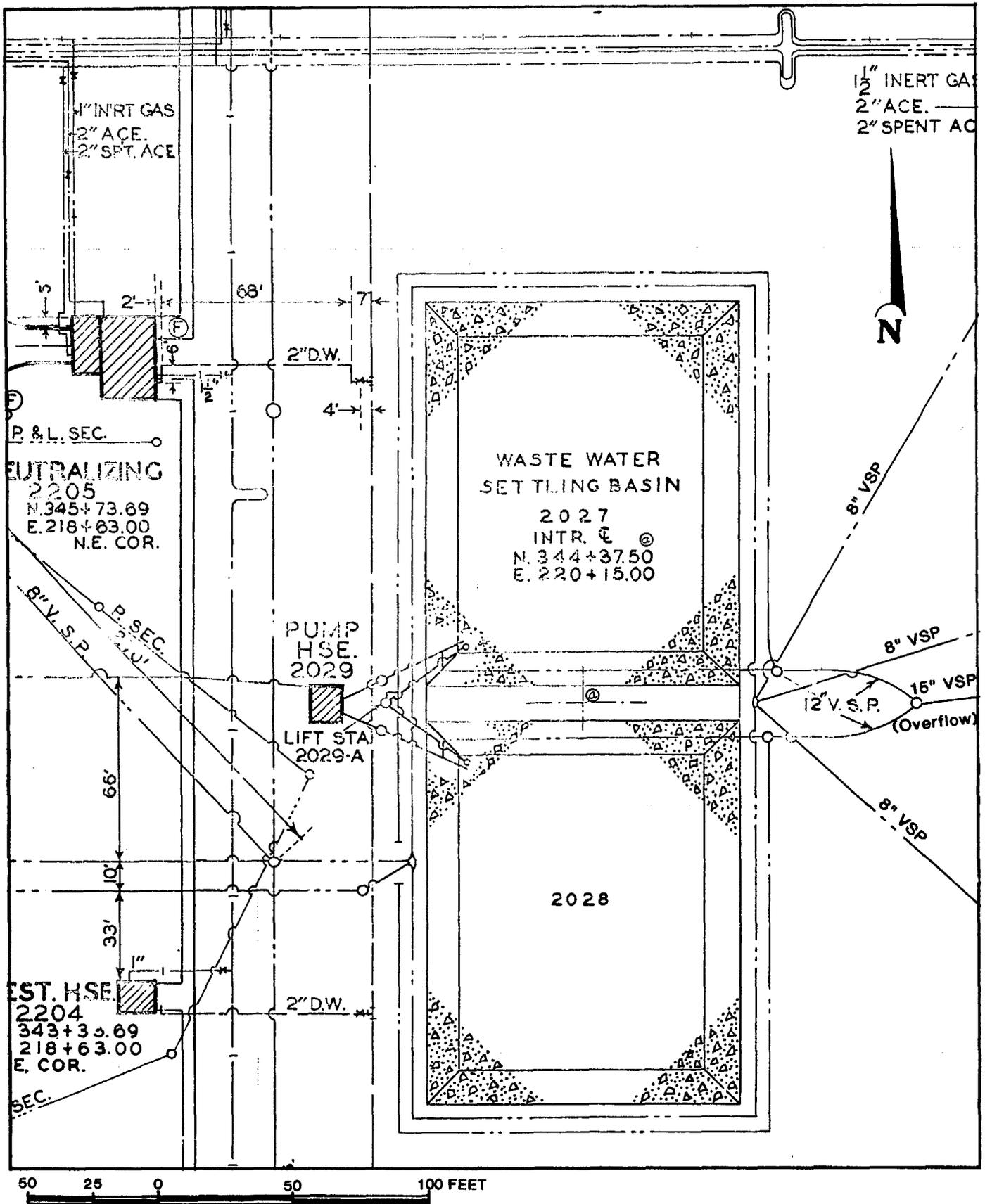
Two waste water settling basins were formerly located within the Pentolite Area at the location shown on Figure 6-1. Figure 6-2, derived from historical Plan No. R-42, "Unit Layout Map, Pentolite Area" (E.B. Badger & Sons Co., no date) shows the layout of the waste basins, which consisted of two adjacent basins, each measuring approximately 100 feet wide by 140 feet long. The PA (SAIC, 1991) stated that the basins were constructed with precast 15 by 9 foot 9 inch blocks of concrete with asphaltic-filled expansion joints. The concrete was placed on 4 to 6 inches of gravel or #4 stone. The construction details are shown on Figure 6-3.



600 300 0 600 1200 FEET
(APPROX.)

Figure 6-1
LOCATION OF PENTOLITE
WASTE WATER BASINS

Plum Brook Ordnance Works
Sandusky, Ohio



KEY:

VSP Vitreous Sewer Pipe

**Figure 6-2
LAYOUT OF
PENTOLITE WASTE WATER BASINS**

BASE: Plan No. R-42, "Unit Layout Map, Pentolite Area",
E.B. Badger & Sons (no date)

**Plum Brook Ordnance Works
Sandusky, Ohio**

DAMES & MOORE

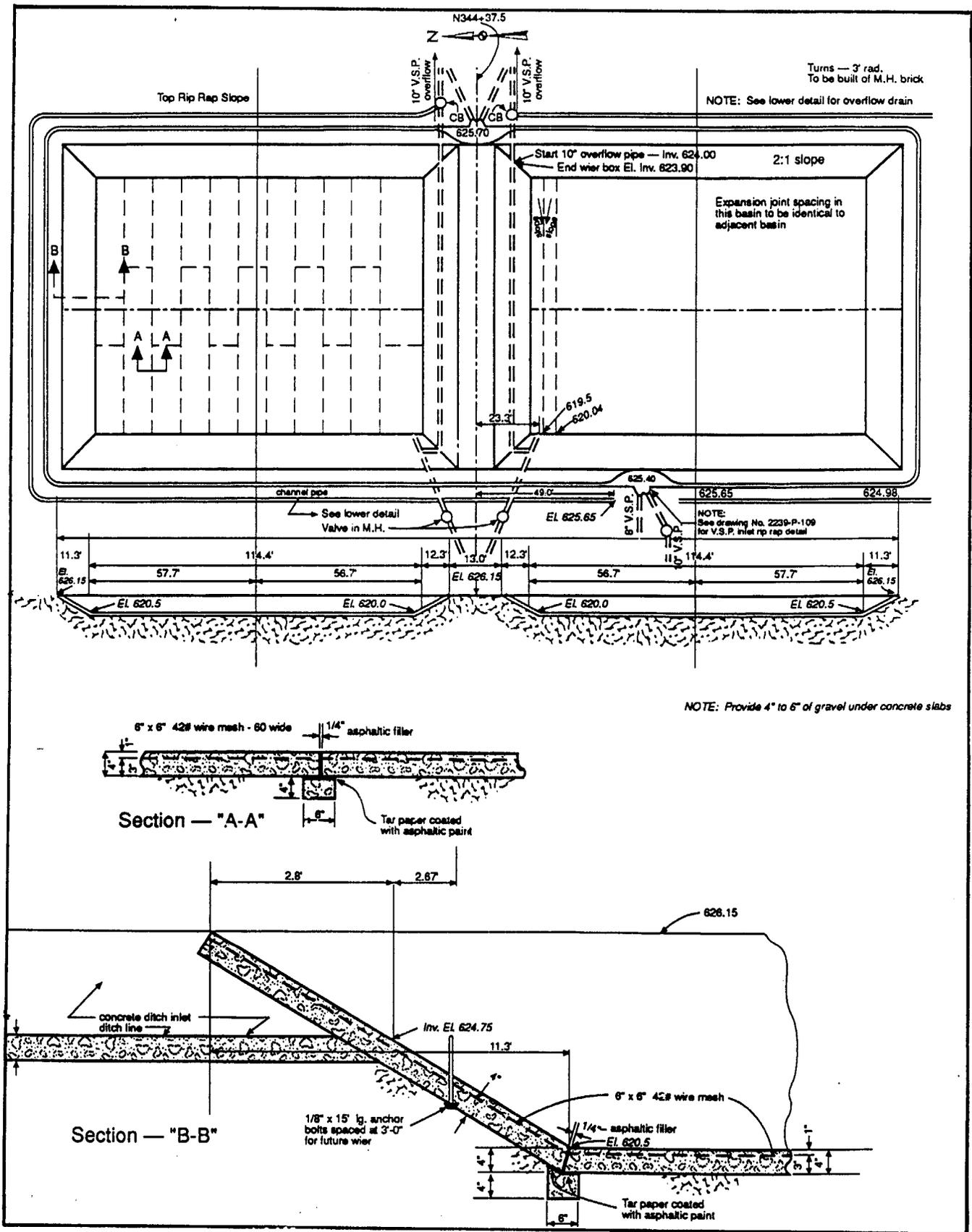


Figure 6-3
**CONSTRUCTION DETAILS OF
 PENTOLITE WASTE WATER BASINS
 Plum Brook Ordnance Works
 Sandusky, Ohio**

6.3 REMOVAL OF THE BASINS

Review of historical documents obtained from NASA indicates that in 1956 the National Advisory Committee for Aeronautics (NACA) was granted permission to use and occupy the Pentolite Area. The "Permit to Other Federal Government Department or Agency to Use Property on Plum Brook Ordnance Works, Ohio" (U.S. Department of the Army, 1956), states that decontamination of this area was to be accomplished by the Army "to a degree which in the opinion of the installation commander leaves no significant hazard remaining which will prevent the use of the area for non-military purposes or endanger the lives of individuals or the public ..."

A subsequent memo (Everett and Campbell, 1958) states that the "Pentolite Area of approximately 117.3 acres was decontaminated, demolished, and cleared for use as the site of the Lewis Laboratory Reactor Facility." The Pentolite Area was apparently chosen as the site of the reactor due to the "cleanliness" of the area.

The "Shut Down and Decontamination Procedures for Plum Brook Ordnance Works, Sandusky, Ohio," (Dykema and Lee, March 1944) state that the stand-by and storage procedures for the Pentolite settling basins shall consist of draining and flushing the limestone bed and basin with high pressure hoses, removing the limestone while it is wet, and then inspecting the basin for evidence of accumulated explosives. The "Special Instructions for Decontamination of Pentolite Area" contained in the referenced document state that all PETN would be processed. All buildings were to be considered as contaminated and burned at the burn grounds. No mention was included in this document nor in the "Decontamination Procedures" (War Department, 1945) regarding decontamination procedures for the surrounding soils in the Pentolite Area.

No environmental investigations have been performed at the former location of the Pentolite Road Waste Water Settling Basins.

7.0 AOC 6 - FLY ASH SPOIL PITS

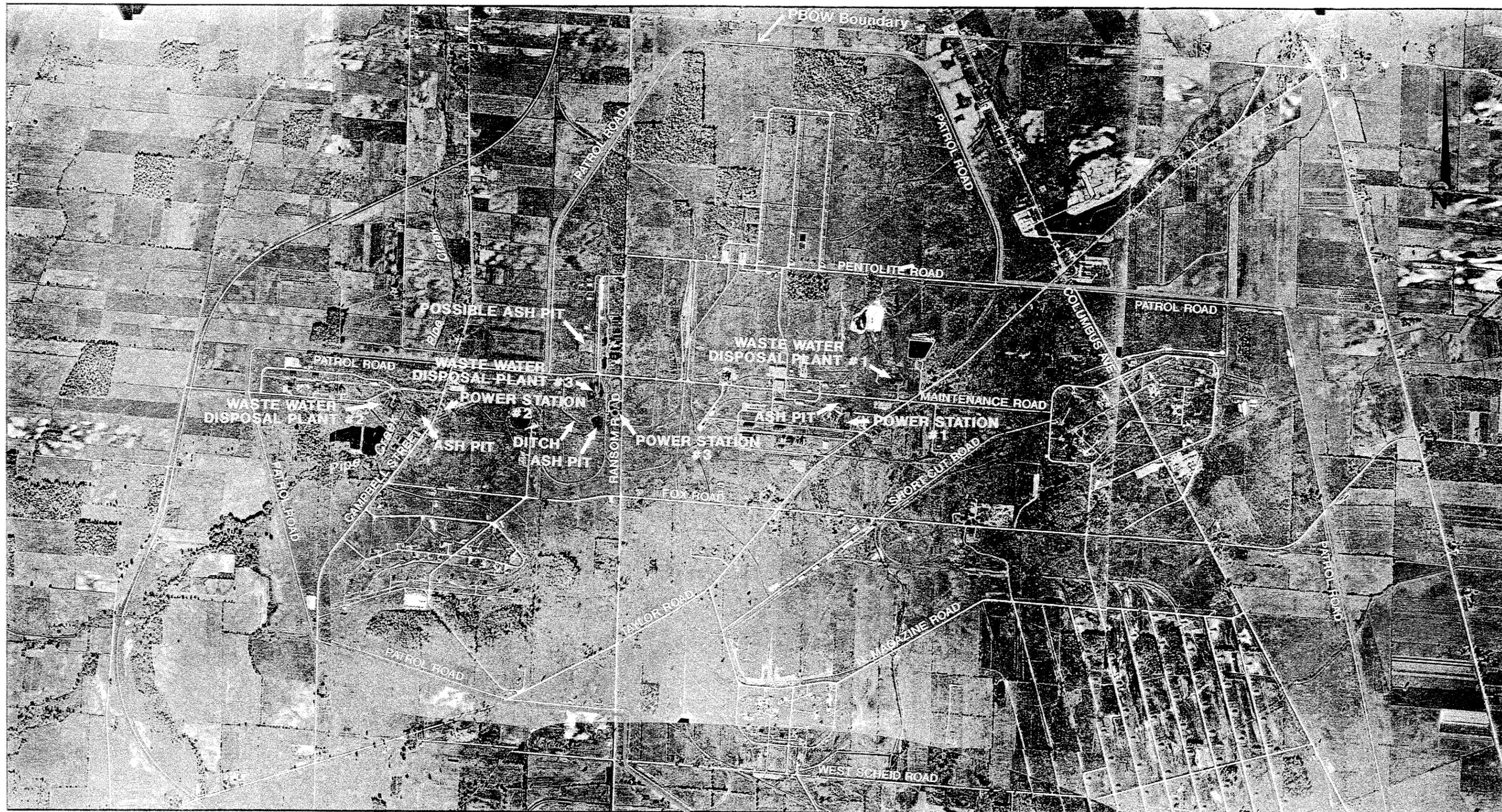
7.1 INTRODUCTION

During operation of the PBOW, fly ash was generated on-site at coal-fired power stations and in waste water incinerators. The PA (SAIC, 1991) identified two on-site ash disposal pits, one associated with the Waste Water Disposal Plant #1 and another associated with Power Station #3.

Review of a 1962 drawing (NASA, 1962) indicates that three on-site plants were used for power generation during the 1940s, as shown on Figure 7-1. Power Station #1 (Building 201) was located south of Maintenance Road and west of Taylor Road; Power Station #2 (Building 501) was located east of Campbell Street; and Power Station #3 (Building 901) was located west of Ransom Road at the current location of the NASA K Site facility. The power house buildings at Power Stations #1 and #2 are currently present but are unused.

Review of site plans of one of the power stations indicates that the stations consisted of a main power house, a coal storage area, and a diked area containing fuel oil storage tanks. A conveyor for coal and an oil tank unloading pump were located adjacent to railroad tracks which were present adjacent to each facility. The fuel oil was stored in two 11,500-gallon aboveground storage tanks located within an earthen berm next to each power house building.

The power house building consisted of a boiler house, compressor room, electrical room, filter room, and locker room. A fly ash sump was present at one end of each power house building. Each power station contained two to four large pulverized coal burning boilers, a turbo electric generator (except Power Station #3), feed water treatment system, and several steam-driven or electric-motor air compressors. The stations generated steam for space heating, process uses, driving air and ammonia compressors as well as electric power generation (historical memo, Unknown author and date).



2000 1000 0 2000 4000 Feet
 APPROXIMATE SCALE

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



Figure 7-1
 LOCATIONS OF POWER STATIONS,
 WASTE WATER DISPOSAL PLANTS AND ASH PITS
 Plum Brook Ordnance Works
 Sandusky, Ohio

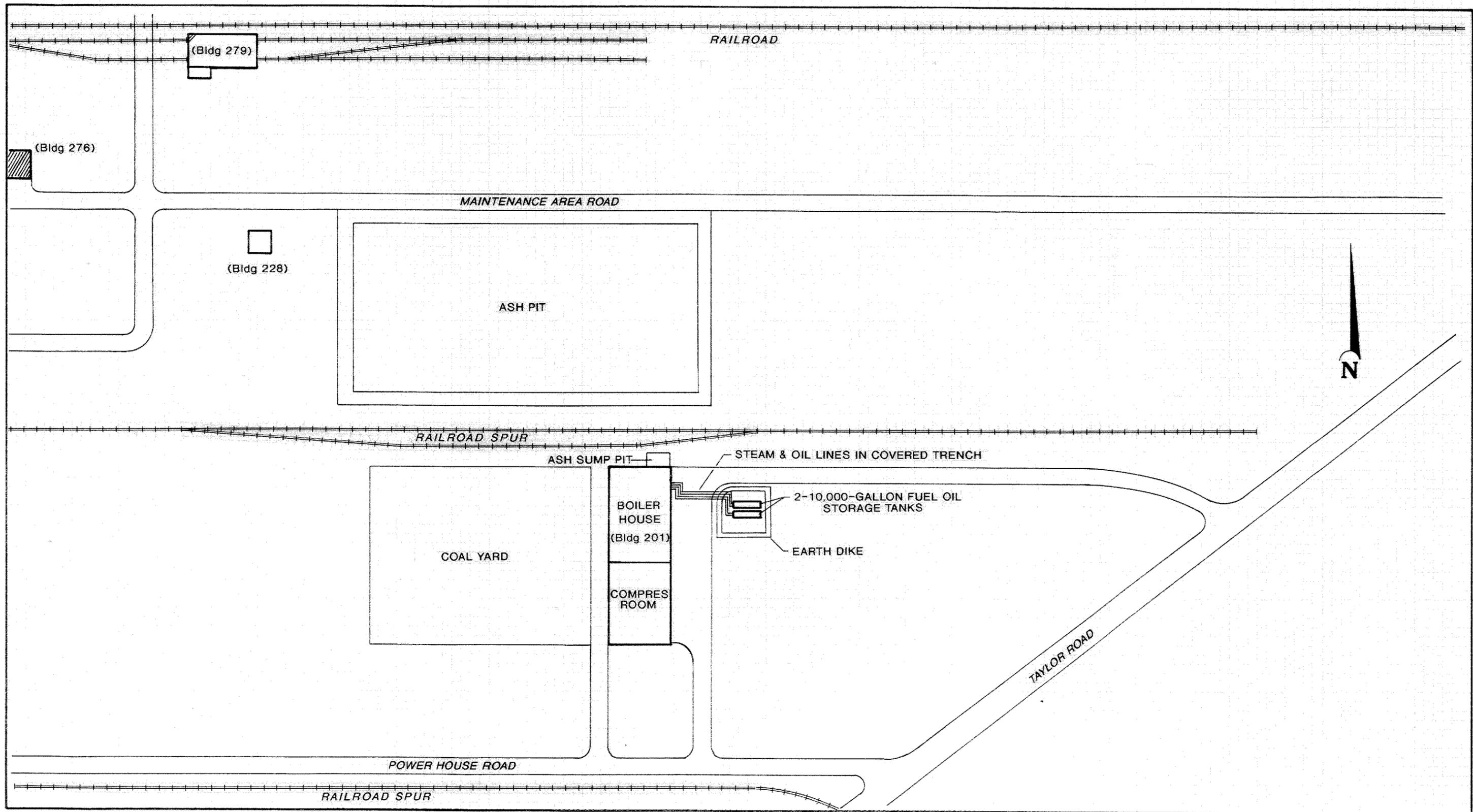
DAMES & MOORE

Review of historical drawings of the power stations indicates that fly ash from each of the boilers collected in ash pits; water was added to the ash and the water-ash slurry flowed through a sluice trench to the ash sump located at the end of the building. A 100 pounds per square inch gauge (psig) water stream carried the ash from the ash sump through a sluice pipeline to a nearby ash surface impoundment (Mullendore, written communication, 1995). Three ash pits associated with the Power Stations were identified, as described in the following sections. The years of fly ash disposal corresponded with operational years of the PBOW (1942 to 1945) [SAIC, 1991].

Three waste water disposal plants were formerly present on the PBOW, as shown on Figure 7-1. Each plant consisted of an evaporator and incinerator. Review of historical drawings indicates that waste water from the plants was disposed of into open ditches. A May 21, 1963 U.S. Army Ammunition Procurement and Supply letter states that the dismantled TNT waste water disposal plants "will be shipped to Ravenna Arsenal", indicating that these referenced plants were dismantled prior to 1963.

The fly ash is suspected to be hazardous with respect to pH, heavy metals, and possibly organic compounds (SAIC, 1991). The fly ash was disposed of and concentrated in the ash pit associated with each power station and the open ditches associated with each Waste Water Disposal Plant. Thus, the ash pits and open ditches would most likely have the highest probability for contamination at these sites. The PA (SAIC, 1991) assigned a low priority to the ash pits based upon a low hazard ranking score.

Other potential sources of contamination related to the former power stations include releases from the below-grade fly ash sump located at each power house, the aboveground fuel storage tanks, and the coal storage yards. Extent and depth of potential contamination have not been evaluated, and the possibility exists for leachate of hazardous constituents to the soil and groundwater, and runoff to surface waters.



REFERENCE DRAWINGS: Plan No.R-2, "General Layout Map, Sheet No. 2", E.B. Badger & Sons (no date) and Drawing No. 1664-300, "Key Plan Power House", E.B. Badger & Sons, 1941

Figure 7-2
 LAYOUT OF POWER STATION #1
 AND ASH PIT
 Plum Brook Ordnance Works
 Sandusky, Ohio

7.2 POWER STATION #1 ASH PIT

7.2.1 Description of Power Station #1 Ash Pit

Review of two historical drawings indicates the Power Station #1 Ash Pit was located due north of the railroad tracks which lie north of the power house building, as shown on Figure 7-2. A notation on historical Drawing No. 1663-T-503-5-¼ "Proposed Underground Water Line for Car Washing Pit from 12" Fire Protection Main" (TPC, May 19, 1943) indicates the size of the pit to measure 400 feet long (east-west orientation) by 200 feet wide (north-south orientation); a 12-inch fire protection water main is shown traversing the pit in an east-west direction. Review of aerial photographs taken in 1950 indicate the presence of a bermed rectangular-shaped depression in this location between the railroad tracks and Maintenance Road (as presented on Figure 7-1). Review of this aerial photograph indicates that the ash pit measured approximately 250 feet by 150 feet.

In March 1995, Dames & Moore conducted a field reconnaissance of the ash pit area north of Power Station #1. A depression was observed between the railroad tracks and Maintenance Road, as shown on Photos 7-1 and 7-2. The depression contained small trees, grasses, and some bare areas having black gritty soil. Drainage from this area is to a culvert under Maintenance Road. Photos 7-3 and 7-4 show the location of the ash sump pit located at the northeast corner of the power station.

7.2.2 Alleged Ash Pit Near PRRWP

The PA (SAIC, 1991) identified a second ash pit related to Power Station #1 near the PRRWP. SAIC (1991) stated that ash from incinerator buildings was also disposed of in on-site ash pits. An incinerator building associated with Waste Water Disposal Plant #1 was present northeast of Power House #1. Historical Drawing No. 1663-W-2 (E.B. Badger & Sons Co., October 1941), shows an ash settling basin in this location. Review of aerial photographs taken in 1950, however, does not indicate the presence

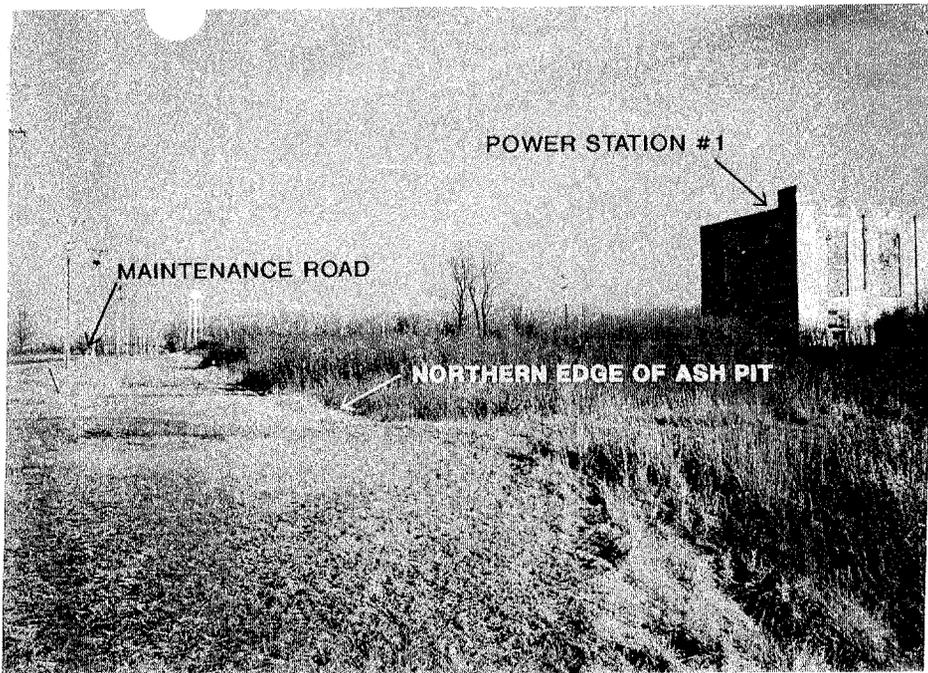


PHOTO 7-1. View looking east towards ash pit at Power Station #1 (photo taken in March 1995)

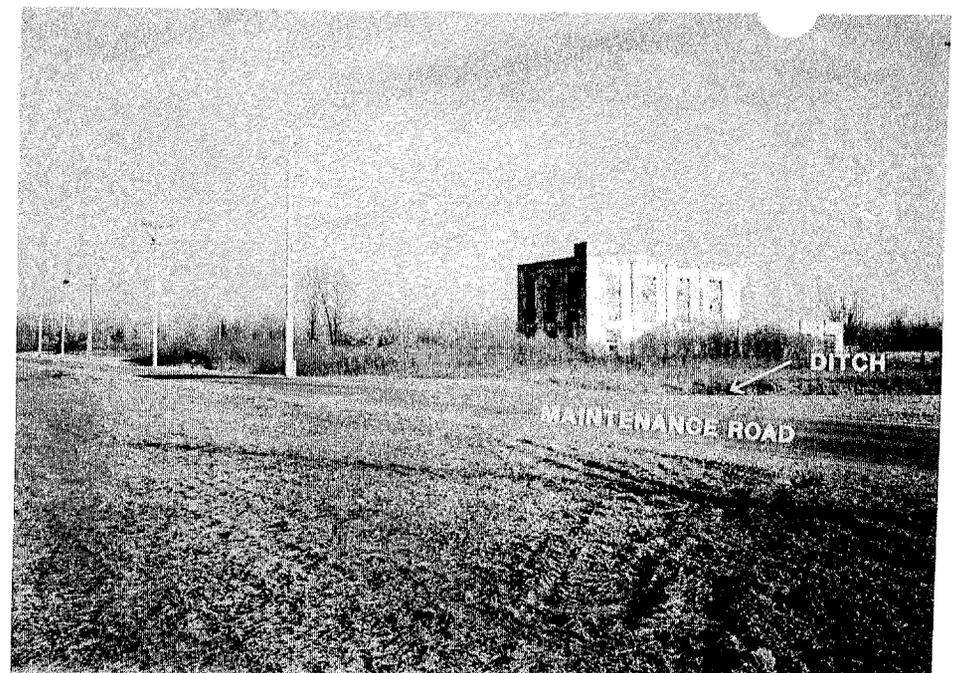


PHOTO 7-2. View looking southeast towards ash pit and Power Station #1 (photo taken in March 1995)

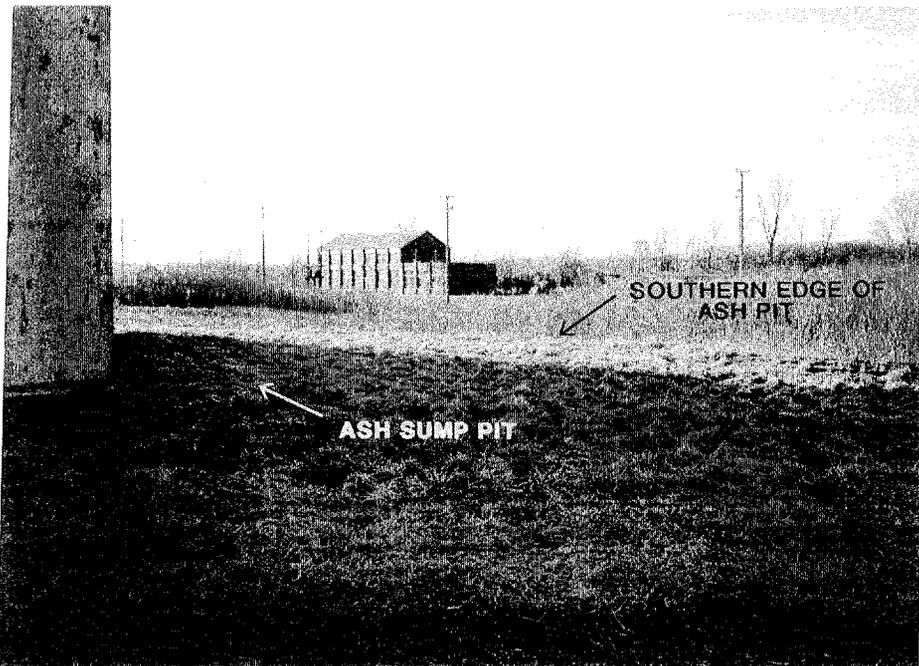


PHOTO 7-3. Northeast corner of Power Station #1 looking northwest towards ash pit (photo taken in March 1995)

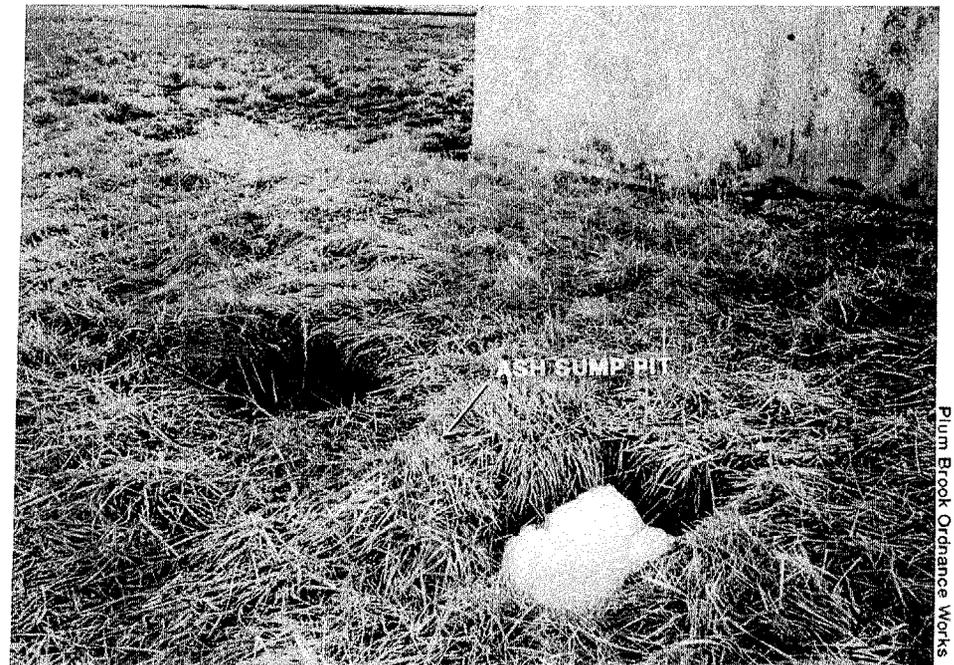


PHOTO 7-4. Ash sump pit located at northeast corner of Power Station #1 (photo taken in March 1995)

of an ash settling basin in this location, and no other documentation to verify the existence of this ash pit was found.

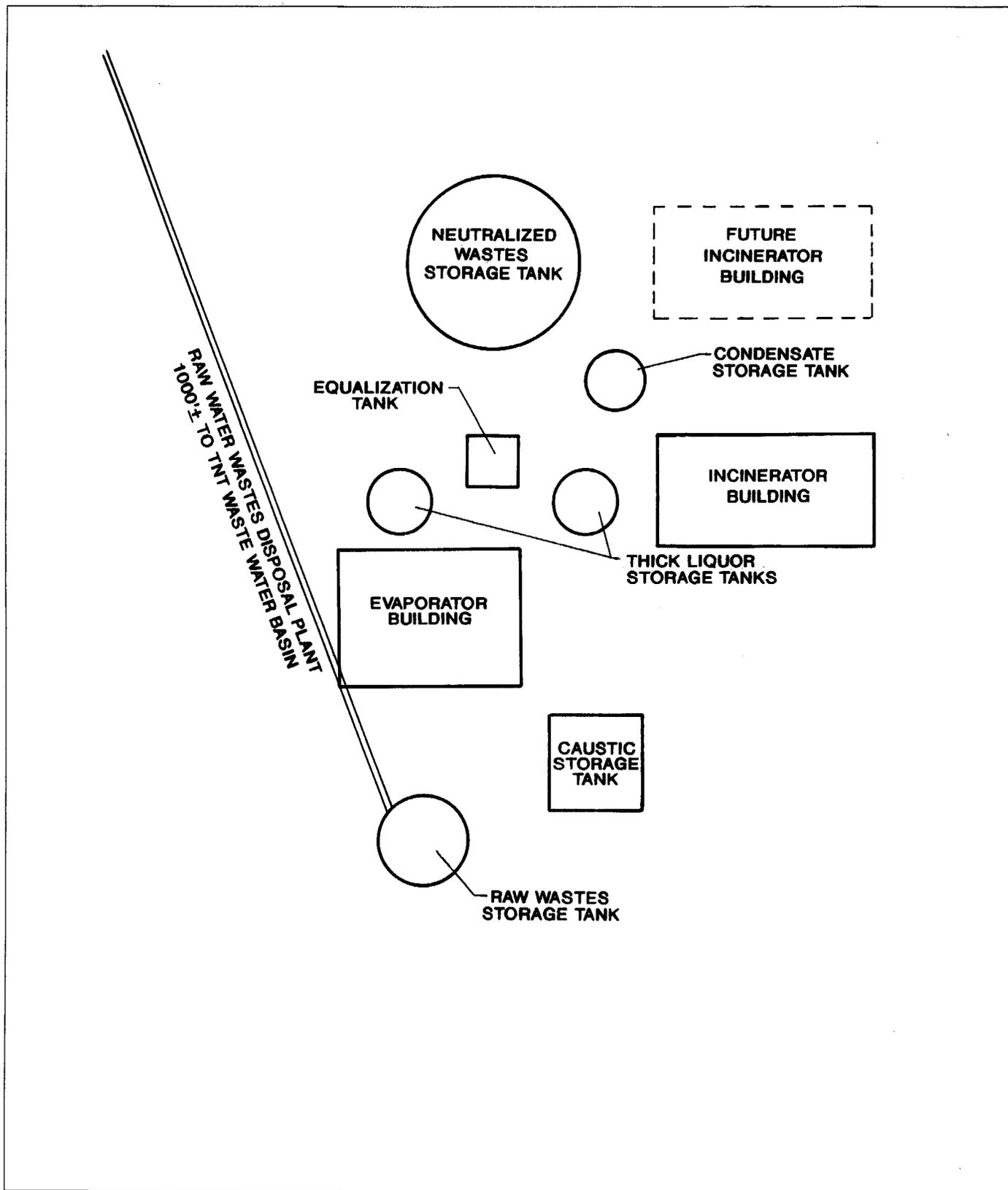
Review of historical drawings indicates that the raw waste storage tank at Waste Water Disposal Plant #1 received waste water from the settling basins at TNT Area A and TNT Area B. The layout of Waste Water Disposal Plant #1 is illustrated on Figure 7-3. The plants were connected via underground wooden pipelines.

Review of historical Drawing No. 1661-S-490 (E.B. Badger & Sons Co., 1942) of Waste Water Disposal Plant #1 indicates that waste water from the neutralized waste storage tank and the condensate storage tank was disposed of into open ditches surrounding the area. The open ditches flowed into the open ditch which trends northeast-southwest and lies east of the PRRWP. No disposal in an ash settling basin or pit was indicated by the drawing. An elevated wooden raw waste storage tank received waste water from the settling basins at TNT Area A and TNT Area B via 4-inch and 6-inch wooden pipelines. From this storage tank, the waste water was transported to the PRRWP via an elevated 12-inch discharge pipe.

During a March 1995 field reconnaissance of the former Waste Water Disposal Plant #1, bare areas were observed where the buildings or storage tanks were formerly located. Photos 7-5 through 7-8 show the area and the remains of a concrete foundation.

7.2.3 Environmental Investigations

As part of their SI, MK collected one soil sample (SS19) in an area of tall grass west of Building 8531, the former Power Station #1 building. MK also collected one soil sample (SS20) north of Maintenance Road and west of the pump station located south of Reservoir #1 near the PRRWP. Both samples were analyzed for metals; MK reported that the results of the analysis did not indicate contamination in these areas.



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Figure 7-3

REFERENCE DRAWING: No. 1663-W-2, "Temporary Storage Pit for Neutralized Waste Water", E.B. Badger & Sons Co., 1941

LAYOUT OF WASTE WATER DISPOSAL PLANT #1

Plum Brook Ordnance Works
Sandusky, Ohio



PHOTO 7-5. Bare area; location of former structure at Waste Water Disposal Plant #1; buildings in background are located at Reservoir #1 (photo taken in March 1995).

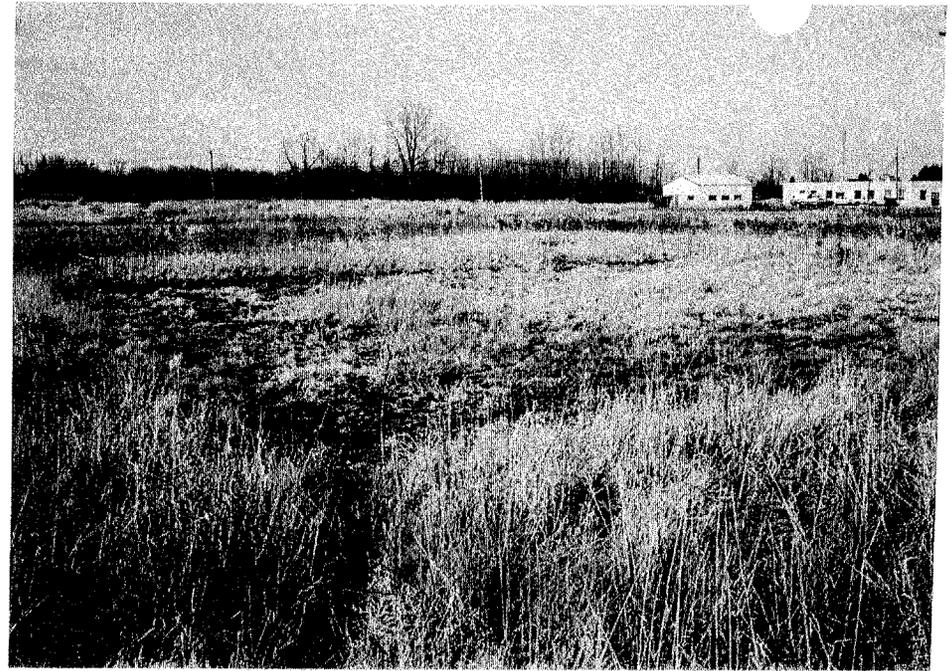


PHOTO 7-6. Bare area southwest of bare area at Waste Water Disposal Plant #1 (photo taken in March 1995)



PHOTO 7-7. Bare area at Waste Water Disposal Plant #1; NASA reactor is in background (photo taken in March 1995)



PHOTO 7-8. Remains of concrete foundation for building or storage tank at Waste Water Disposal Plant #1 (photo taken in March 1995)

Based upon the information obtained by Dames & Moore, soil sample SS19 may have been collected in the former coal storage area for Power Station #1, and not in the former ash pit, which MK intended to sample. Soil sample SS20 also may not have been collected in an ash disposal pit or basin, since historical records indicate that waste water from the incinerator at Waste Water Disposal Plant #1 was disposed of into open ditches located south of Reservoir #1.

7.3 POWER STATION #2 ASH PIT

7.3.1 Description of Power Station #2 Ash Pit

Power Station #2 is located west of Campbell Street, as shown on Figure 7-1. Historical Drawing No. 1764-653 (E.B. Badger & Sons, 1941) and Plan No. R-38 (E.B. Badger & Sons, 1941) show the layout of Power Station #2, including a surface impoundment for ash, as shown on Figure 7-4. Review of aerial photographs taken in 1950 and 1968 show an impoundment in the same location as that shown on the historical drawing dated 1941. SAIC may not have reviewed these drawings during the PA, as they reported that no surface impoundments were indicated on the maps of the area reviewed (SAIC, 1991). The PA (SAIC, 1991) states it was possible that ash from Power Station #2 was disposed of in the ash surface impoundment at Power Station #3, or that Power Station #2 used an unmapped informal disposal yard. No documentation was found by Dames & Moore which confirmed these disposal practices.

Review of the referenced 1941 E.B. Badger & Sons Co. drawing indicates that the surface impoundment was rectangular-shaped and measured 400 feet long by 200 feet wide. Review of a 1945 TPC drawing of the configuration of a proposed ash pit in this same location indicates that a cinder pile existed at the eastern end of the pit which was approximately 2 feet deep. The drawing also indicated the pit to be surrounded by a 5-foot wide and approximately 4-foot high (based upon observations made during a field reconnaissance) earthen embankment. Ash from the power house was transported to the ash pit through a 6-inch sluice pipeline and an 8-inch drain pipe was

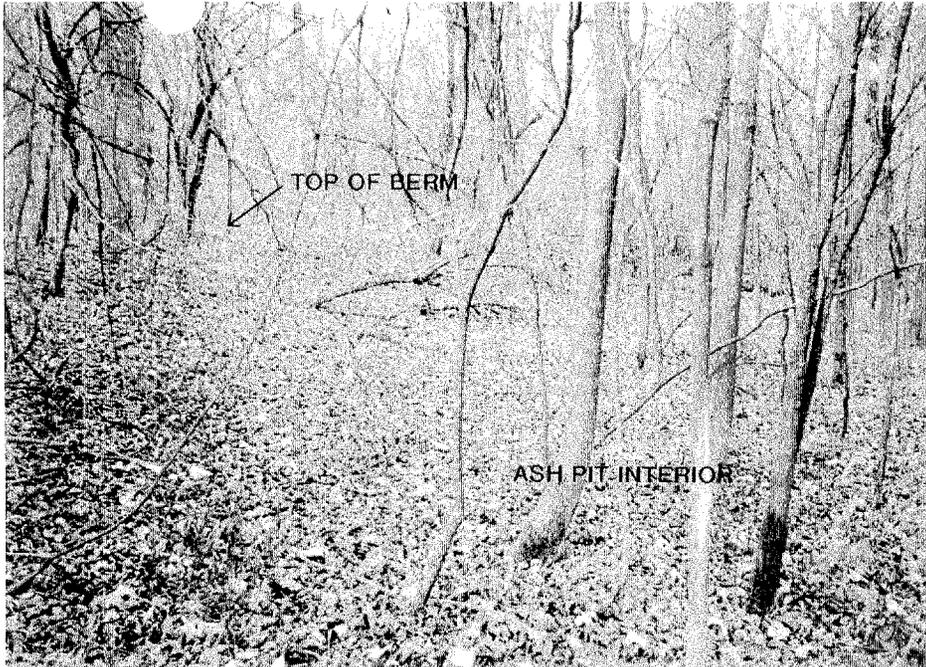


PHOTO 7-9. Berm around Power Station #2 ash pit (photo taken in fall 1994)



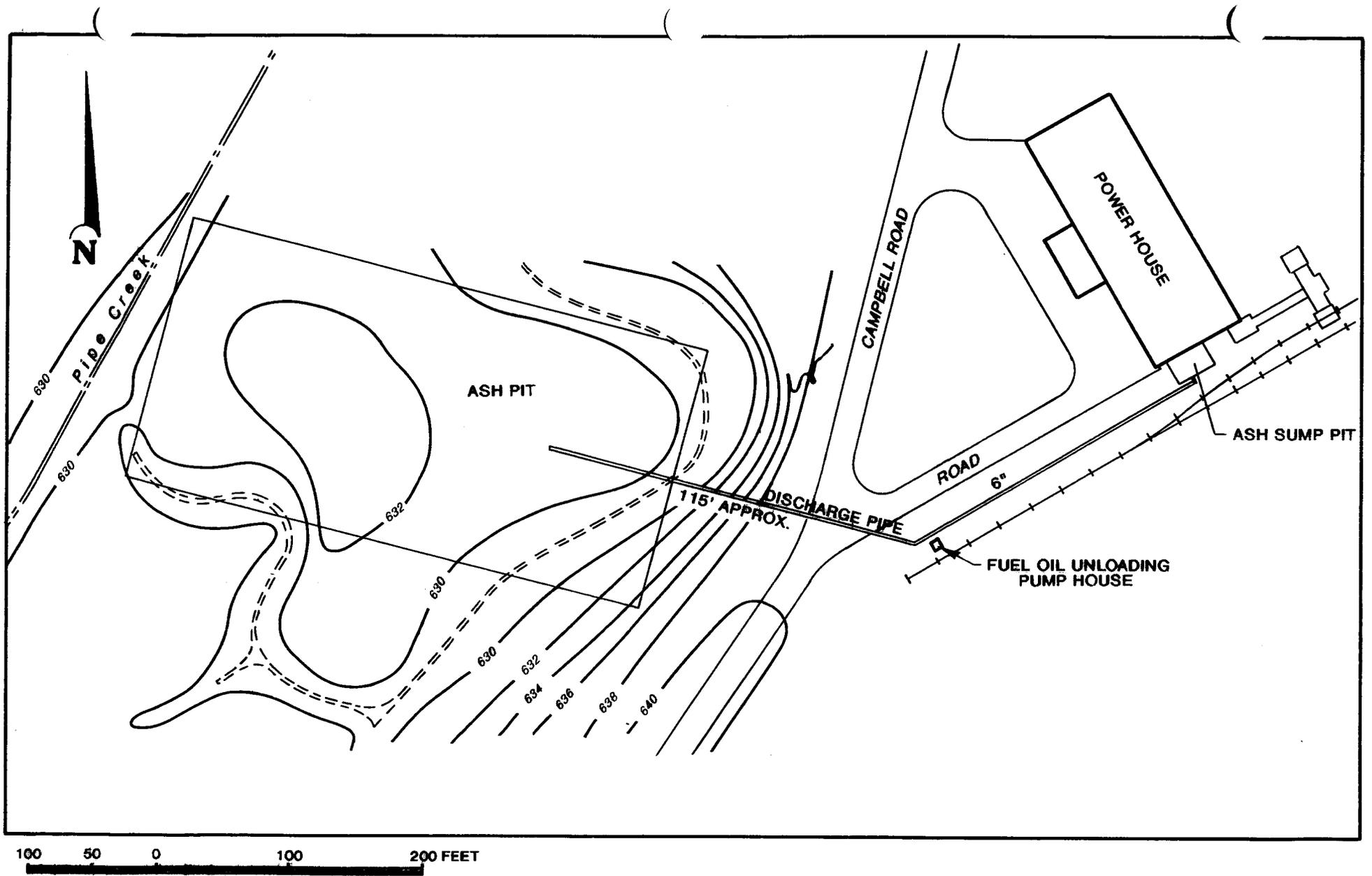
PHOTO 7-10. Black cinder-like soil at Power Station #2 ash pit (photo taken in fall 1994)



PHOTO 7-11. Cinders and slag in Power Station #2 ash pit (photo taken in fall 1994)



PHOTO 7-12. Discharge pipe through berm around Power Station #2 ash pit (photo taken in fall 1994)



REFERENCE DRAWING: No. 1763-953 "Ash Disposal System for Plum Brook Ordnance Works, Sandusky, Ohio", E.B. Badger & Sons, 1941

Figure 7-4
LAYOUT OF POWER STATION #2
AND ASH PIT

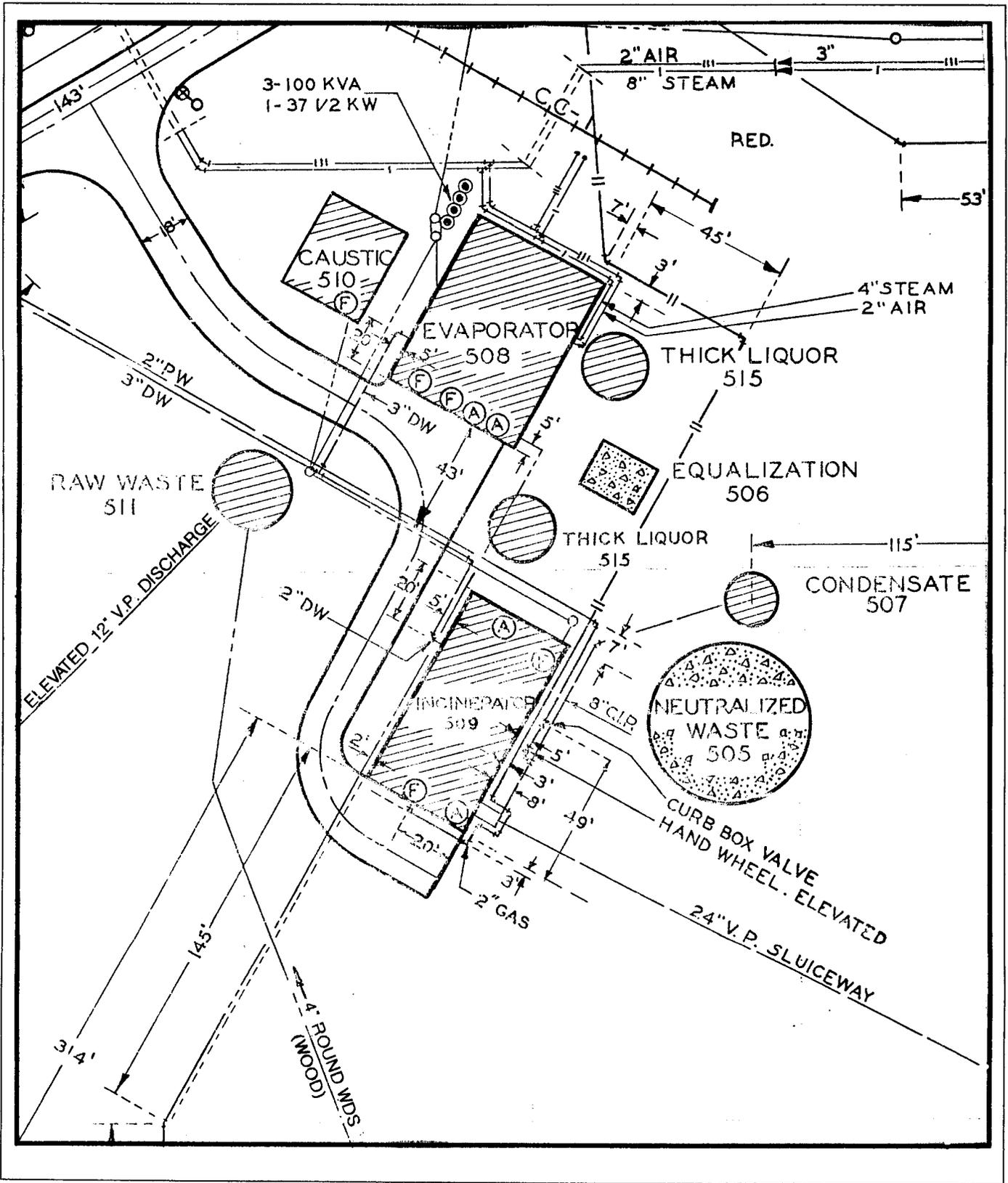
Plum Brook Ordnance Works
 Sandusky, Ohio

installed at the southwest corner of the pit. Pipe Creek is located less than 50 feet from the western edge of the ash pit embankment.

The bermed area described above was observed during the field reconnaissance of this area conducted in fall 1994 by representatives of Dames & Moore and CEORN, as shown on Photo 7-9. Black cinders up to 1 foot deep were observed inside the eastern two thirds of the bermed area and outside the bermed area (possibly near the cinder pile referenced on the 1945 TPC drawing) near the 6-inch sluice pipeline, as shown on Photos 7-10 and 7-11. The overflow pipe shown on the historical drawings was observed in the southwest corner of the impoundment, as shown on Photo 7-12. No black soil was observed in the western third of the impoundment or near the discharge pipe.

7.3.2 Waste Water Disposal Plant #2

Historical Plan No. R-36 (E.B. Badger & Sons, Co., no date) shows the layout of the Waste Disposal Plant #2, which was located due west of the Power Station #2 ash surface impoundment on the opposite side of Pipe Creek. Waste Water Disposal Plant #2 received waste water from the settling basins at TNT Area C. The layout of Waste Water Disposal Plant #2 is illustrated on Figure 7-5. Review of this drawing shows a 24-inch vitreous pipe sluiceway connecting the incinerator (Building 509) to Pipe Creek. The raw waste storage tank (Building 511) is shown receiving waste water via a 4-inch round wooden pipeline from the waste water settling basins at TNT Area C. An elevated 12-inch vitreous pipe discharged the waste water from the raw waste storage tank to the WARWP. No information was found during the records review or the site reconnaissance that indicated ash from the incinerator at this location was disposed of into the ash pit associated with Power Station #2. Rather, it appears that any waste water was disposed of into Pipe Creek.



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Figure 7-5

LAYOUT OF WASTE WATER DISPOSAL PLANT #2

Plum Brook Ordnance Works
Sandusky, Ohio

REFERENCE DRAWING: Plan No. R-36, "Unit Layout Map, Power Hse., Waste Disposal, Area No. 2", E.B. Badger & Sons Co., 1941

7.4 POWER STATION #3 ASH PIT

7.4.1 Description of Power Station #3 Ash Pit

As previously stated, NASA's K Site is currently located at the former location of Power Station #3, as shown on Figure 7-1. Figure 7-6 shows the layout of Power Station #3, the associated ash pit, and Waste Water Disposal Plant #3. During the field reconnaissance of this area in fall 1994, representatives of Dames & Moore and CEORN observed a surface water impoundment west of the NASA K Site building, as shown on Photos 7-13 and 7-14. The depth of the surface water impoundment could not be ascertained during the field reconnaissance. Water flowed into the impoundment through a steel pipe at its northeast corner and water discharged from the impoundment into an east-west trending surface water ditch which discharges into Pipe Creek. The impoundment appeared to have the same configuration as the fly ash impoundment shown on the historical drawing and aerial photographs for this area. The outflow ditch observed during the field reconnaissance is also similar to the ditch shown on the historical aerial photographs of the area taken in 1950.

Review of the information provided for this records review report indicates that no environmental investigations or studies of this ash pit have been performed.

7.4.2 Waste Water Disposal Plant #3

Waste Water Disposal Plant #3 was located north of Power Station #3 at the current location of the NASA K Site control building. PBS employees reported that the control building was formerly a storage tank (the disposal plant neutralized waste water tank was located at this same location.)

During field reconnaissance of this area in March 1994 an open ditch was observed west of the control building. Review of historical aerial photographs dated 1950 indicate that a bermed square-shaped depression was present north of Waste Water Disposal Plant #3 at the location shown on Figure 7-1. The berm was not present

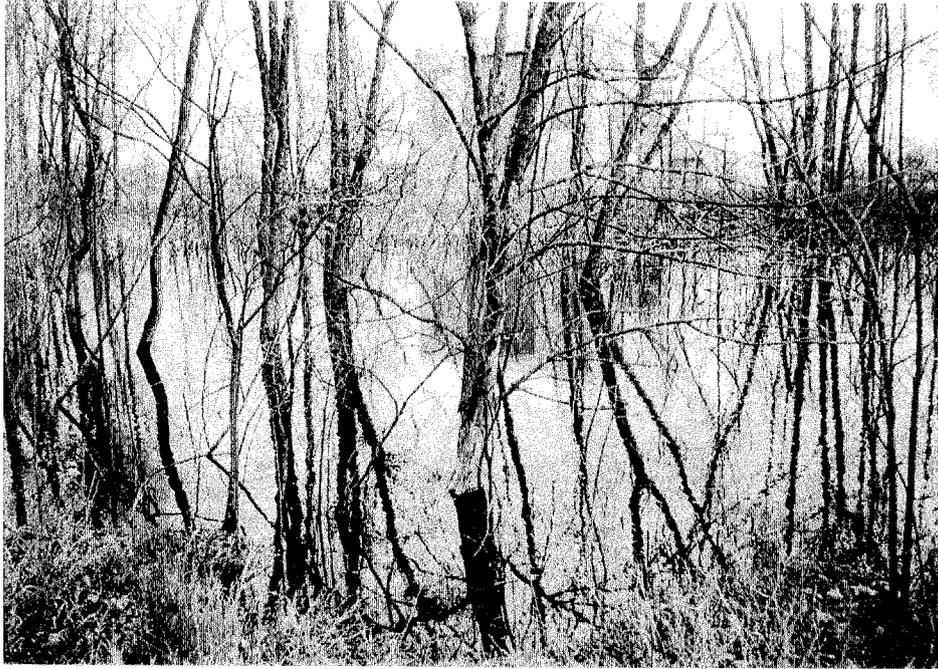


PHOTO 7-13. View looking northeast toward former Power Station #3 ash pit (currently a pond); NASA's K Site is located in background of photo (photo taken in fall 1994)



PHOTO 7-14. View looking southwest toward former Power Station #3 ash pit (photo taken in fall 1994)

during a field reconnaissance of this area in March 1995, although the depression was observed. It is possible this depression could have been used as an ash settling basin for Waste Water Disposal Plant #3.

8.0 AOC 7 - TOLUENE STORAGE TANKS

8.1 INTRODUCTION

To accommodate the large amount of toluene needed for the production of TNT, six 200,000-gallon capacity aboveground storage tanks were installed in the early 1940s at the three locations shown on Figure 8-1. Two tanks served each of the three TNT manufacturing areas; Tanks 255 and 265 provided storage for TNT Area A, Tanks 425 and 435 provided storage for TNT Area B, and Tanks 645 and 655 provided storage for TNT Area C. Smaller intermediate toluene storage tanks were located at each of the TNT Areas. Toluene was transported on-site by railroad.

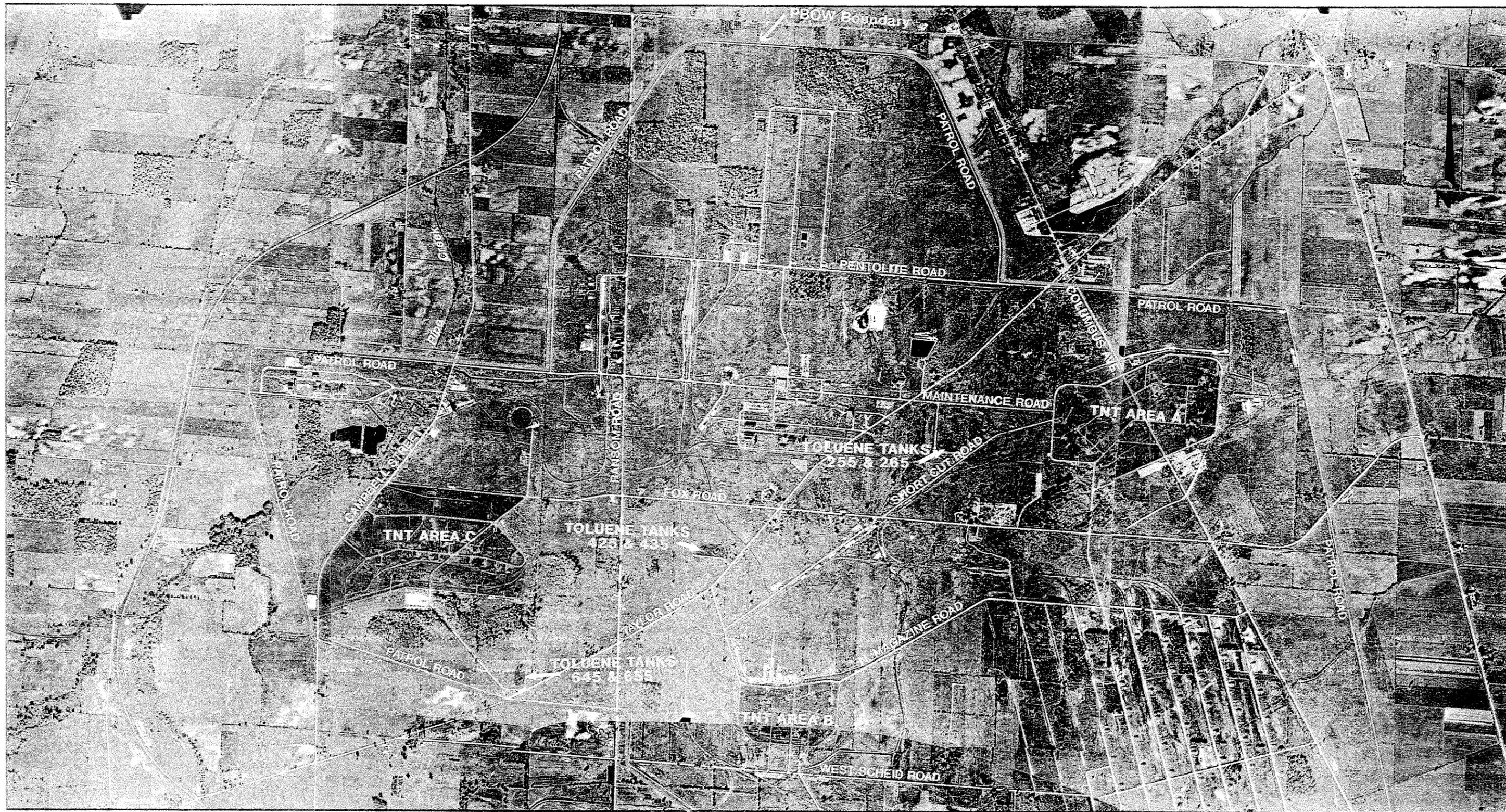
The toluene tanks are potential areas of contamination by toluene; groundwater contamination at the toluene tanks has been confirmed during previous environmental investigations.

The points of entry to soil and groundwater are at transfer stations and transfer line valves and the base of tanks. The earthen dikes would act as effective barriers to runoff to surface waters but would not preclude migration to soil, groundwater, or air (SAIC, 1991).

8.2 DESCRIPTION OF THE TOLUENE TANKS

Review of historical drawings and information provided by site personnel indicates that the tanks are 30 feet in diameter, 41 feet in height, and constructed of metal. Each tank rests on a concrete foundation and is surrounded by a 12-inch wide by 12-inch high concrete containment berm. Based upon review of a May 1989 memorandum (Young, 1989), the berm empties into a 3-foot square drain valve pit. The pump for each tank is located at ground level near the drain valve pit.

Field reconnaissance of each of the three toluene tank locations was conducted by Dames & Moore and CEORN representatives in March 1994 and March 1995.



2000 1000 0 2000 4000 Feet
 APPROXIMATE SCALE

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



Figure 8-1
 LOCATIONS OF
 BULK STORAGE TOLUENE TANKS
 Plum Brook Ordnance Works
 Sandusky, Ohio

DAMES & MOORE

Tanks 255 and 265 (Photo 8-1) were surrounded by an earthen berm, presumably built when the tanks were installed. A built-up roadbed, but no berm, was present south of Tanks 425 and 435 (Photo 8-2). No berm was present at the Tank 645 location (Photo 8-3). Tank 655 is no longer present at its original location, as NASA relocated the storage tank to the reactor area circa 1974 for use as cooling water storage. Berms around each of the tanks are indicated on historical aerial photographs dated 1950, indicating that the berms around Tanks 425, 435, and 645 have been removed since that time.

8.3 STAND BY-AND STORAGE PROCEDURES

Stand-by and storage procedures for the toluene service system are documented in the "Shut Down and Decontamination Procedures for Plum Brook Ordnance Works, Sandusky, Ohio" (Dykema and Lee, 1944). The procedures state that the intermediate and main toluene storage tanks were to be pumped out "to the lowest possible level". Transfer lines at the six main storage tanks were to be disconnected, and the tanks were to be left open for ventilation. The PA (SAIC, 1991) reported that the tanks were decommissioned in 1945 per the above procedures.

8.4 REPORTED RELEASES TO THE ENVIRONMENT

No mention of any releases from the toluene tanks while they were used by DoD was found during the records review. The PA (SAIC, 1991) stated that unplanned releases of toluene, fuel oil, and #2 diesel fuel to groundwater and soil are suspected, although they found no records of previous remedial actions related to the toluene tanks. However, as described below, leaks of fuel oil from one of the tanks has occurred during usage by NASA.

According to information provided in the PA (SAIC, 1991) and from PBS personnel, NASA has used Tanks 255 and 265 (NASA building #8951 and #8952, respectively) for storage of fuel oil. A May 18, 1989 memorandum (Young, 1989) describes a leak

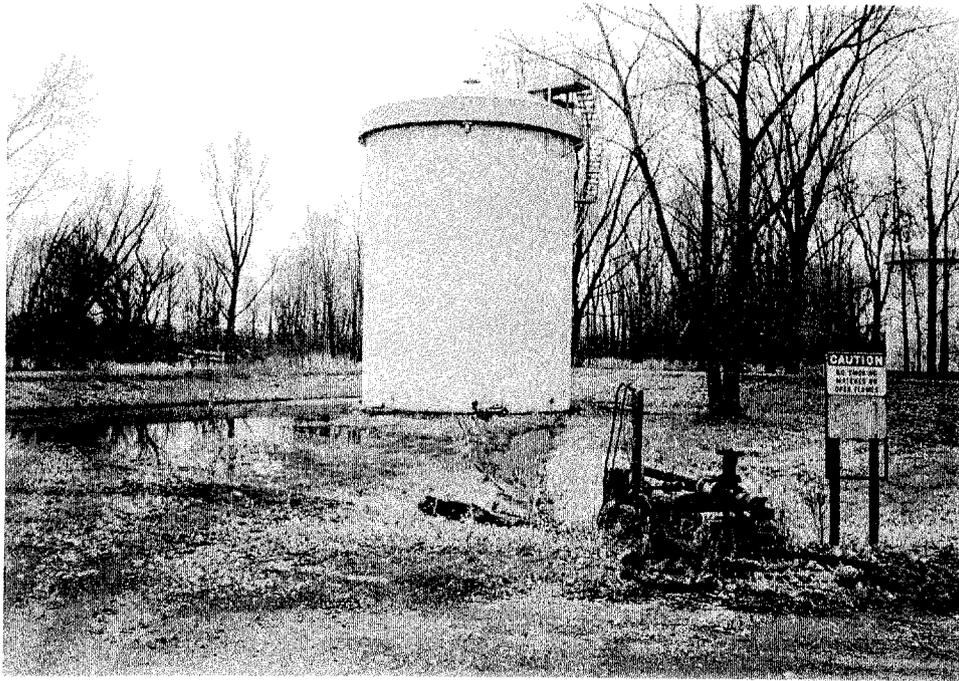


PHOTO 8-1. Toluene Tanks 255 and 265 located near TNT Area A (photo taken in fall 1994)

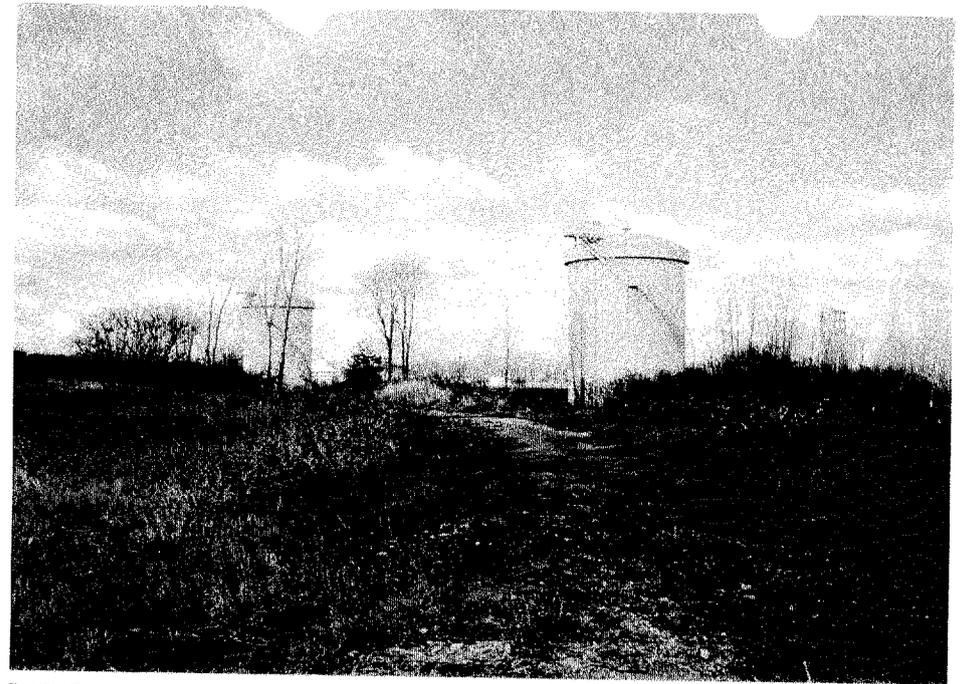


PHOTO 8-2. Toluene Tanks 425 and 435 located near TNT Area B (photo taken in fall 1994)



PHOTO 8-3. Toluene Tank 655 located near TNT Area C; Toluene Tank 645 was formerly located near the lower left-hand side of the photo (photo taken in March 1994)

Pum Brook Ordnance Works

from Tank 265 during the period of NASA's use. The memo states that in 1976, the tank contained approximately 185,000 gallons of heating oil for use at the LeRC and PBS. In January 1989 a fuel oil leak from the storage tank was observed. The ground around the tank was discolored, a fuel oil odor was noticed, and fuel oil creepage was noted up the side of the tank. Mr. Young estimated an area approximately 38 feet by 12 feet by 4 to 5 inches deep was contaminated with fuel oil on the eastern side of the tank. The soil near the valve pit on the northwestern side of the tank was also noted as being slightly contaminated up to about ½ inch deep.

In February 1989 the contaminated soil and vegetation to a depth of approximately 6 to 8 inches were removed from the impacted area on the eastern side of the tank. The soil was removed to an on-site NASA burning ground for later incineration. Approximately 190 gallons of fuel oil and sludge was also removed from the bottom drain valve of the tank. Absorbent matting was used to soak up oil which seeped from underneath the tank. In March 1989, another 40 gallons of fuel oil and sludge was removed from the drain line.

Mr. Young noted that he believed the leak was probably in the drain line running beneath the tank. He observed that it was badly rusted and bent. Mr. Young also stated that the leaking oil was confined to the inside of the berm and did not impact any streams.

8.5 ENVIRONMENTAL INVESTIGATIONS

MK installed monitoring wells and collected groundwater and soil samples at each of the three toluene tank areas (MK, 1994). Monitoring well MK-MW20 was installed at Toluene Tanks 255 and 265. Installation of a second monitoring well through the earthen dike on the north edge of Tank 255 was planned, but the borehole did not produce water and was grouted to the surface. One soil sample was collected for analysis from each of the two boreholes.

MK attempted installation of a monitoring well between Toluene Tanks 425 and 435, but shallow bedrock prevented completion of a well at this location. No soil samples were collected.

Two monitoring wells (MW14 and MW15) were installed at Toluene Tanks 645 and 655. Analysis of groundwater samples collected from each of the wells indicated the presence of VOCs and SVOCs in well MW20. Toluene was reported in the groundwater from this well at a concentration of 36,000 $\mu\text{g}/\text{L}$. Review of the boring log for well MW20 indicates that silty clay was encountered from 0.5 to 6.0 feet. A gravel lens was encountered at 6 feet and a strong chemical odor was observed from 6 to 10 feet by the field investigators. The well was completed to a total depth of 23 feet. It should be noted that a leak of fuel oil from the toluene tank located adjacent to monitoring well MW20 was reported by NASA in 1989, as described in Section 8.3.

The two soil samples (SB12 and SB13) were each collected from the upper 2 feet of the two boreholes installed at Toluene Tanks 255 and 265. Laboratory analysis indicated the presence of VOCs and SVOCs in soil sample SB13, which was collected from the borehole installed in one of the monitoring wells installed at these toluene tanks.

9.0 AOC 13 - RAIL CAR UNLOADING AREA/SELLITE AREA

9.1 INTRODUCTION

The PA (SAIC, 1991) identified the rail car unloading area as a suspected source of environmental contamination by toluene. Toluene may have spilled during the unloading operations of approximately 400 million pounds of toluene (SAIC, 1991). SAIC identified a 1-acre area on the north side of Maintenance Road as the rail car unloading area. The approximate location identified by SAIC is shown on Figure 9-1. The Sellite Area is located due west of the railcar unloading area. A site plan of the Rail Car Unloading Area and Sellite Area is provided as Figure 9-2.

9.2 DESCRIPTION OF THE RAIL CAR UNLOADING AREA AND SELLITE AREA

In their PA report (1991), SAIC stated that contamination by toluene is indicated by the lack of vegetation in the area. However, during field reconnaissance of this area in spring and fall 1994, Dames & Moore and CEORN representatives did not observe any stressed vegetation or bare areas adjacent to the railroad tracks in this vicinity. Extensive areas of bare soil and pieces of sulfur and slag were observed at the former Sellite Area, however, which is adjacent to the alleged Rail Car Unloading Area, as shown on Figure 9-1. Photos 9-1, 9-2, and 9-3, taken in 1994, show the non-vegetated bare areas adjacent to the Sellite Area. A shallow surface water ditch is present east of the Sellite Area, as shown on Photo 9-4. This ditch received run-off from the Sellite Area.

Sellite used in the TNT washing process was produced and stored in the Sellite Area. Review of Drawing No. 1691-S-2 (E.B. Badger & Sons Co., 1941) indicates that the area consisted of a sellite plant, storage area, and sulfur storage area. The bare areas observed on historical aerial photographs and during the field reconnaissance in 1994 are located topographically downgradient of the sulfur storage area.

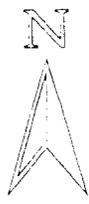
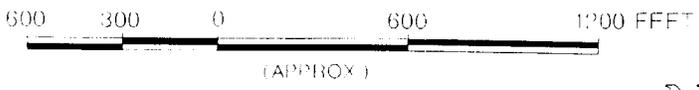
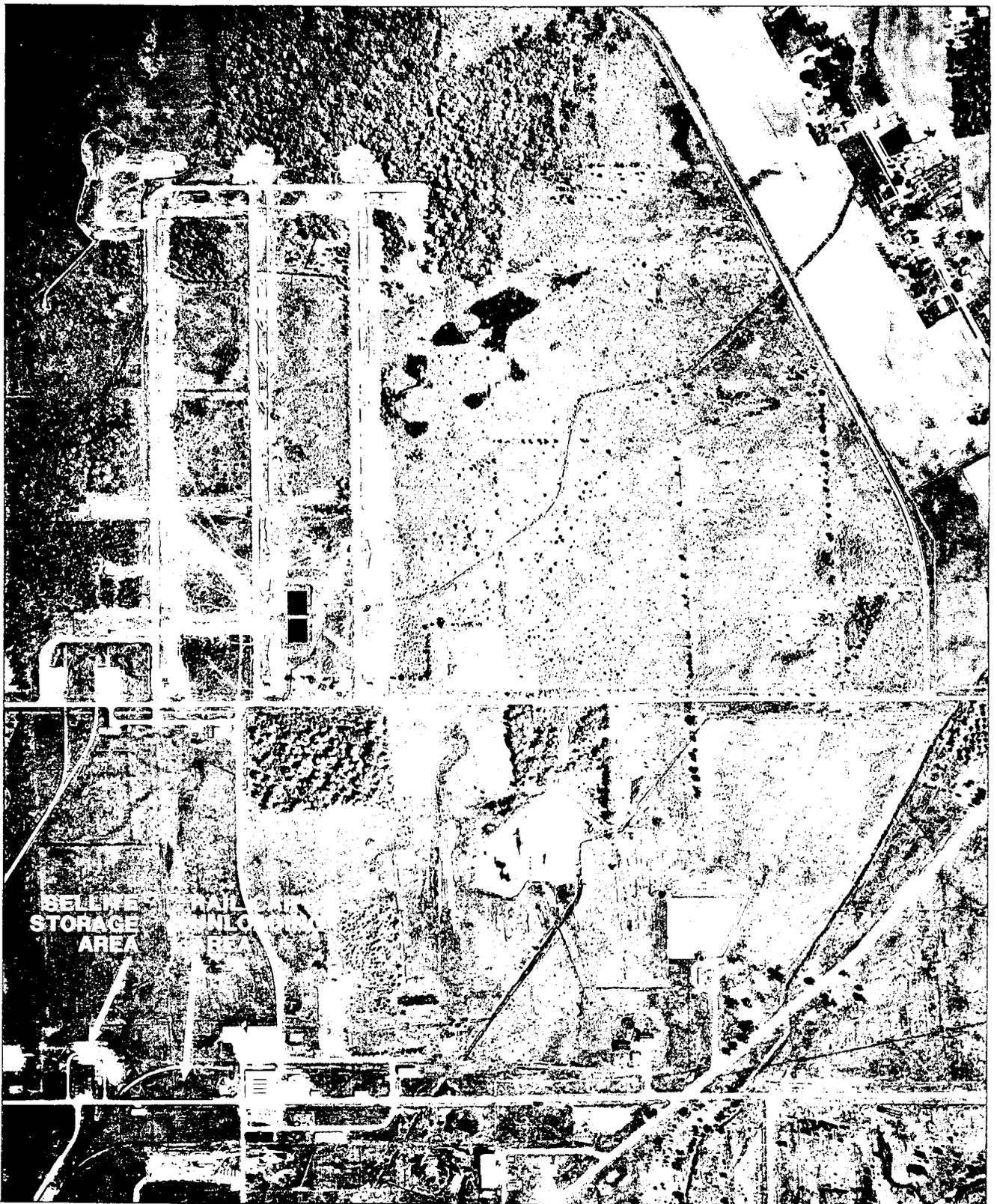
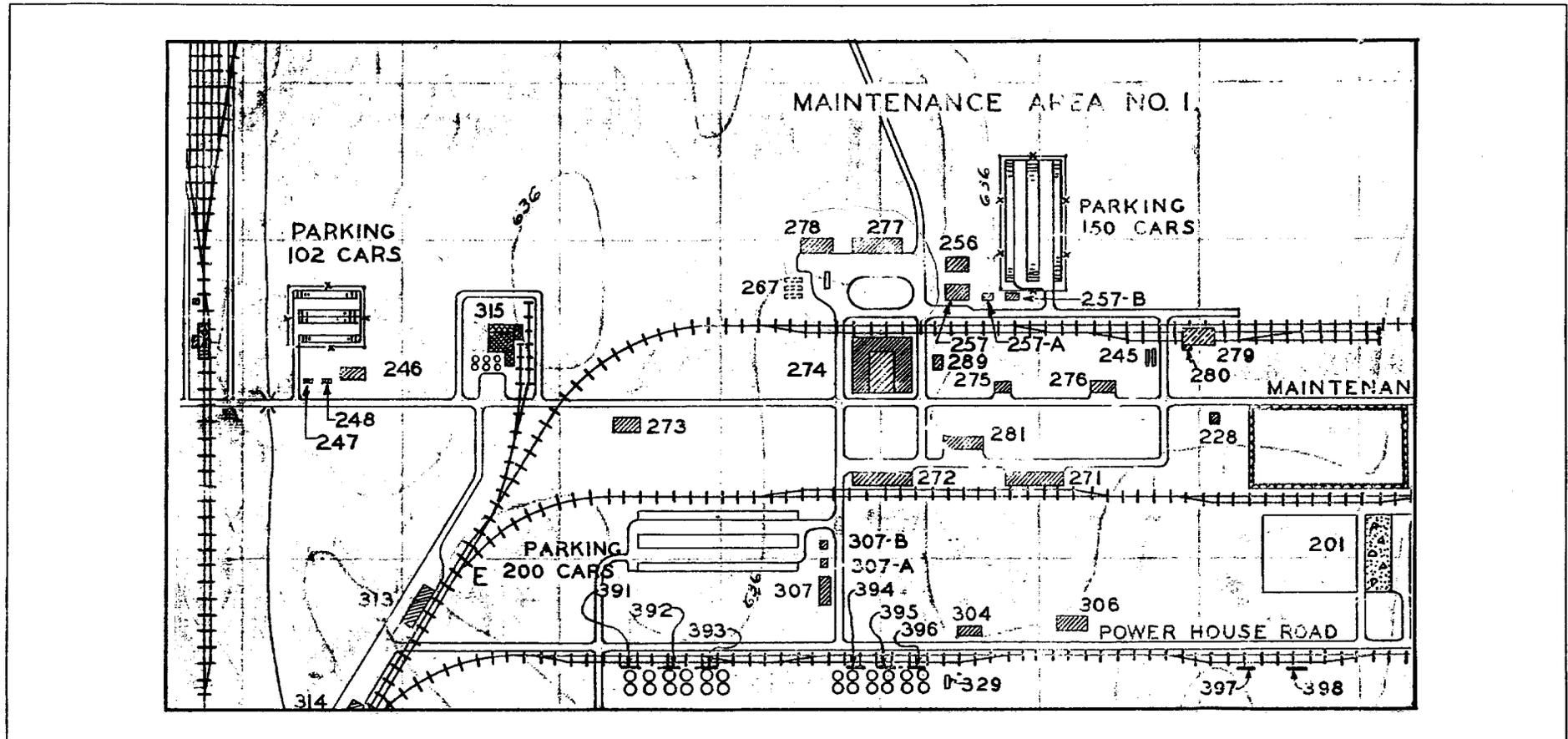


Figure 9-1
LOCATIONS OF RAIL CAR
UNLOADING AREA AND
SELLITE AREA
Plum Brook Ordnance Works
Sandusky, Ohio



REFERENCE DRAWING: Plan No. R-2, General Layout Map, Sheet No. 2,
E.B. Badger & Sons Co., 1941

LEGEND:

- | | | |
|-------------------------------|--------------------------|----------------------------------|
| 201 Power Plant | 274 Combined Shops | 329 Anti Freeze Tank |
| 228 Existing House | 275 Oil & Paint Storage | 391 Loading Dock Acid Area No. 1 |
| 245 Fuel Oil Tank & Pump | 276 Yard Tool & Storage | 392 Loading Dock Acid Area No. 1 |
| 246 Change House | 277 Garage | 393 Loading Dock Acid Area No. 1 |
| 247 Search Alley | 278 Storage Garage | 394 Loading Dock Acid Area No. 1 |
| 248 Time Clock Alley | 279 Locomotive Shop | 395 Loading Dock Acid Area No. 1 |
| 256 Change House | 280 Sand Dryer | 396 Loading Dock Acid Area No. 1 |
| 257 Change House | 281 Lumber Shed | 397 Loading Dock Acid Area No. 1 |
| 257-A Time Clock Alley | 289 Lumber Shed | 398 Loading Dock Acid Area No. 1 |
| 257-B Search Alley | 304 Supervisor's Office | |
| 267 Unlabeled | 306 Acid Control Lab | |
| 271 General Storehouse | 307 Change House | |
| 272 Heavy Materials Warehouse | 307-A Time Clock Alley | |
| 273 Laundry | 307-B Search Alley | |
| | 313 Acid Area Storehouse | |
| | 315 Sellite Storage | |



Figure 9-2

**SITE PLAN OF RAIL CAR UNLOADING
AREA AND SELLITE AREA**

Plum Brook Ordnance Works
Sandusky, Ohio

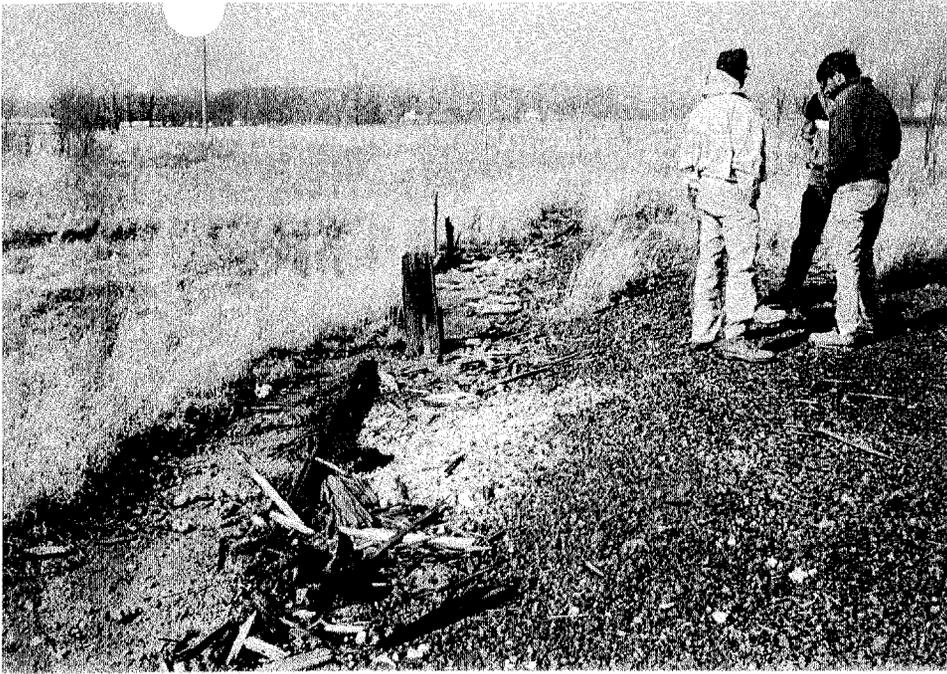


PHOTO 9-1. Bare area and pieces of slag and sulfur along former railroad tracks at Sellite Storage Area (photo taken in March 1994)

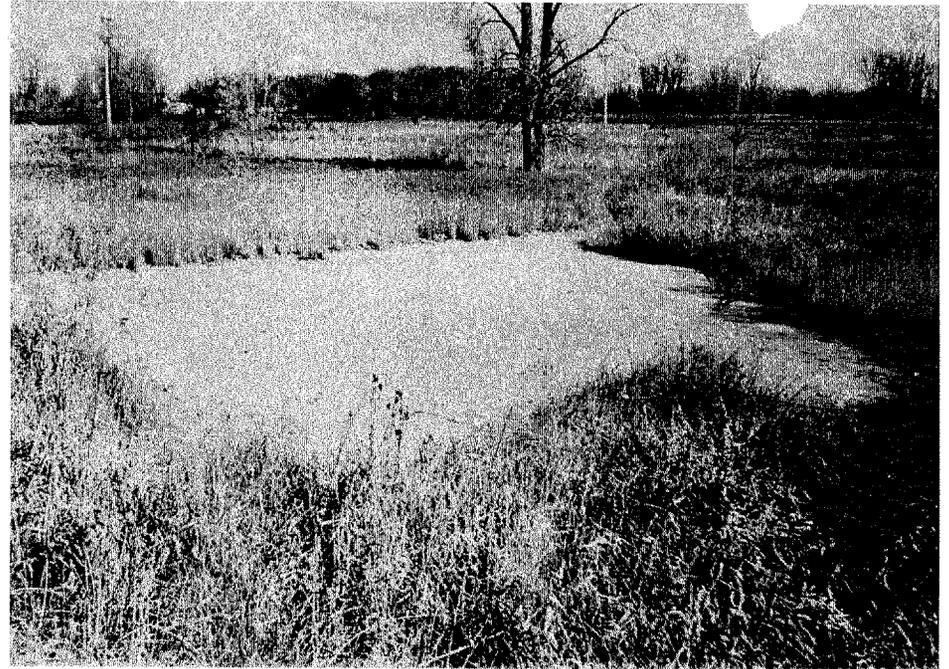


PHOTO 9-2. Denuded area east of and adjacent to the Sellite Storage Area (photo taken in fall 1994)



PHOTO 9-3. Denuded area north of and adjacent to the Sellite Storage Area (photo taken in March 1994)

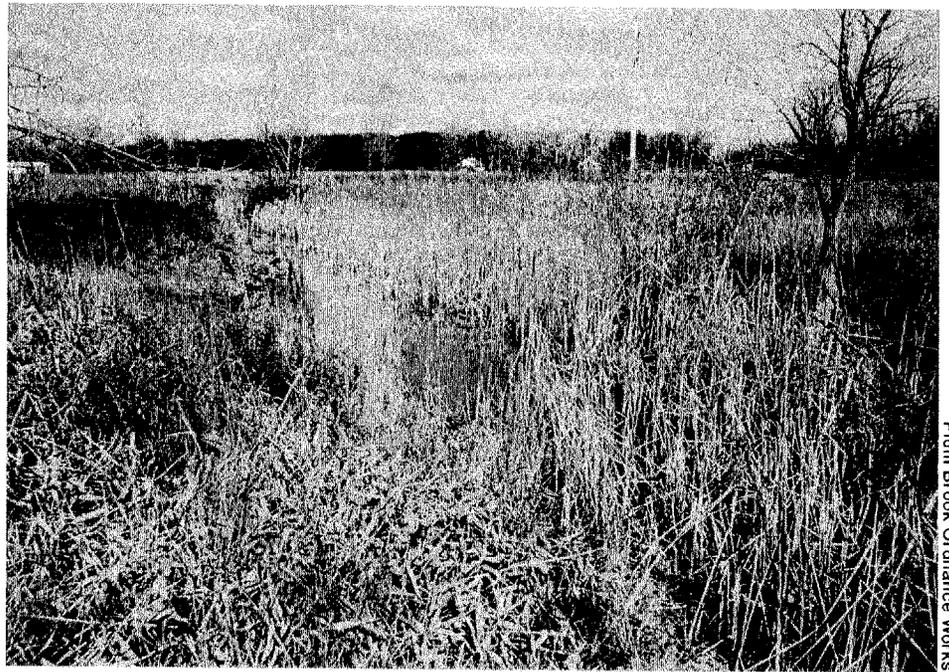


PHOTO 9-4. Drainage ditch located east of Sellite Storage Area (photo taken in fall 1994)

9.3 ENVIRONMENTAL INVESTIGATIONS

MK installed monitoring well MW-19 along the western edge of the Garage Maintenance Area between the railroad spur and Maintenance Road. The purpose of this well was to assess whether contamination was apparent due to the past rail unloading activities. This well was drilled to a depth of 13 feet and encountered groundwater at 3.5 feet (MK, 1991). VOCs were detected in the groundwater sample collected from this well. MK stated that they believed the solvents were the result of underground storage tank leakage, and not rail unloading activities. MK also collected soil samples SS11, SS15, and SS16 near the former rail unloading facility. The samples were collected approximately 50 feet apart along the rail spur entering the Maintenance Garage Area. The area was covered with tall grass. SVOCs were reported at low concentrations in soil samples SS15 and SS16.

No environmental investigations of the Sellite Area have been performed. However, the PA (SAIC, 1991) states that shallow groundwater from the surficial aquifer was encountered at approximately 4.5 feet in shallow boreholes in this area (based upon review of boring data documented by Sverdrup Technology, Inc.) The PA (SAIC, 1991) further states that any contamination present would be highly localized, as the shallow surficial aquifers across PBS are highly discontinuous.

-oOo-



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