155952

REVISED PHASE II REMEDIAL INVESTIGATION SCOPE OF WORK FORMER KOPPERS COMPANY, INC. NEWPORT SITE

August 18, 1995

For:

U.S. Environmental Protection Agency
Region 3
841 Chestnut Street
Philadelphia, Pennsylvania 19107

Prepared for:

Beazer East, Inc.
436 Seventh Avenue
Pittsburgh, Pennsylvania 15219

and

Du Pont Chemicals
Room 12224
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Prepared by:

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Project No. 4E02153F-5

Woodward-Clyde Consultants

Engineering & sciences applied to the earth & its environment

August 18, 1995
4E02153F-5

Ms. Lisa Marino
U.S. Environmental Protection Agency
Region III
841 Chestnut Building
Philadelphia, Pennsylvania 19107

Re: Submittal of Revised Phase II Remedial Investigation Scope of Work
Former Koppers Company, Inc., Newport Site
Newport, Delaware
Docket No. III-91-16-DC

Dear Ms. Marino:

On the behalf of Beazer East, Inc. (Beazer) and E. I. du Pont de Nemours and Company, Inc. (DuPont), Woodward-Clyde Consultants (WCC) is submitting herein the Revised Phase II Scope of Work (SOW) for the second phase of the Remedial Investigation (RI) at the Former Koppers Company, Inc. Newport Site, as specified in the Phase I RI Work Plan, dated January 31, 1994. This Revised SOW has been prepared based on a preliminary evaluation of the Phase I RI data and identifies data needs, data quality objectives and the rationale for the proposed Phase II RI work scope. It addresses EPA comments on the Phase II RI SOW dated April 27, 1995 which affect this stage of the RI program, and reflects EPA concerns which were discussed at our meetings of July 18 and 19, 1995.

As discussed at the July 19, 1995 meeting, any ecological field sampling (e.g., toxicity testing, tissue analyses, etc.) which is warranted based on evaluation of Phase I and II data, will be collected during Phase III. The increased database contributed by the Phase II RI will provide a better understanding of the Site and the migration pathways, allowing a more effective selection of sampling locations for ecological testing for Phase III. A Phase III RI SOW will be prepared and submitted to EPA upon completion of the Phase II RI.

In the event that the necessity for solid phase toxicity testing is identified for collection during Phase III, EPA has requested that *Hyalella azteca* be the test organism. As discussed at our meetings in July, Beazer and DuPont have reservations with respect to using *Hyalella azteca* based on previous unsuccessful testing at the adjacent DuPont-Newport Superfund Site. After reviewing the *Hyalella azteca* test results for that site, EPA, specifically the BTAG, felt that the organism was a poor choice for this system and requested that the data be eliminated from consideration in the evaluation of the site. As requested by EPA, a summary of the test results are presented in Attachment 1 to this letter. The results show that percent survivorship was lower in

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the laboratory control (SR01) than most of the test stations. Survivorship in the field reference station (RS15) sediments was also poor.

A revised RI/FS schedule has been included in the Revised Phase II RI SOW. The duration of tasks under the Phase III RI is based on an assumed work scope for ecological testing originally presented in the first draft of the Phase II RI SOW. Upon completion of the Phase II RI and identification of the work scope for Phase III, the schedule will be revised and included in the Phase III RI SOW. This schedule also assumes that Beazer and DuPont sill perform the Risk Assessment. It also assumes that EPA will provide approval of the Phase II RI SOW within 15 working days of its submittal to EPA, as previously discussed.

Beazer and DuPont are committed to the forward progress of this program and with EPA's approval, look forward to performing this work in the fall of 1995. If you have any questions, please do not hesitate to contact us.

Very truly yours,

for Ceil Mancini
Senior Project Scientist

James P. Buczala
Project Manager

cc: P. Ludzia - EPA
M. Zhang - DNREC
Faye Stocum - DESHPO
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W. Mancini - DuPont
J. Karmazyn - DuPont
N. Griffiths, Esquire - DuPont
S. Colman - Geomatrix
H.S. Laird - WCC

Table 4. Survivorship counts and percentages for *Hyalella azteca* exposed for 28 days to sediments from Christina River, Newport, Delaware.

Test Sample ID	Survivorship Count Rep 1	Rep 2	Rep 3	Rep 4	Total Survivorship Count	Percent (%) Survivorship
SR 01	-0-	2	2	1	5	6.25
AS 03	4	3	2	3	12	15.0
AS 05	10	10	14	12	46	57.5
AS 06	13	16	11	16*	56	70.0
AS 07	-0-	-0-	-0-	-0-	-0-	-0-
AS 08	1	1	-0-	-0-	2	2.5
AS 09	17	16	10	12	55	68.75
AS 12	7	9	4	9	29	36.25
RS 01	2	10	14	-0-	26	32.5
RS 07	16	17	14	17	64	80.0
RS 11	11	8	9	10	38	47.5
RS 12	-0-	-0-	-0-	-0-	-0-	-0-
RS 13	10	17	17	8	52	65.0
RS 14	7	2	13	8	30	37.5
RS 15	13	13	14	13*	53	66.25

* Winsorized data point estimates.

Source: B.A. Vittor and Associates, 1990. 28-Day Chronic Intermittent Flow-Through Screening Bioassays on Sediments from the Christina River, Newport DE.

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1.0
INTRODUCTION

1.1 BACKGROUND

Woodward-Clyde Consultants (WCC), on behalf of Beazer East, Inc. (Beazer) and E.I. du Pont de Nemours & Company, Inc. (DuPont), has completed the majority of the first phase (Phase I) of the Remedial Investigation (RI) at the Former Koppers Company, Inc. Site in Newport, Delaware (Site). The work was performed by WCC in accordance with the Revised Remedial Investigation/Feasibility Study (RI/FS) Work Plan (Phase I WP) dated January 31, 1994 which prescribed a two-phased sampling program to meet the RI objectives.

Based on an evaluation of Phase I data, a Phase II RI Scope of Work (SOW) was prepared recommending additional field investigations and submitted to the Environmental Protection Agency (EPA) on January 31, 1995 (WCC, 1995). Comments on the Phase II RI SOW were issued by the EPA on June 27, 1995 and meetings were held to resolve the comments on July 18 and 19, 1995. This revised Phase II RI SOW includes resolutions reached between Beazer and DuPont and EPA at the meetings which are relevant to this stage of the overall program. It incorporates responses in the letter to EPA dated August 2, 1995. Several of EPA concerns which were addressed in the response letter and will be incorporated into the RI and risk assessment (RA) for the Site.

This revised Phase II RI SOW hereby supplements and, where applicable, modifies the Phase I WP, the Field Sampling Plan (FSP) and the Quality Assurance Project Plan (QAPjP) dated January 31, 1994 for this Site. As stipulated in the Phase I WP, sampling protocol necessary to perform the work described herein remains the same as the Phase I WP and FSP except where specifically stated otherwise.

1.2 CONCEPTUAL SITE MODEL

A Conceptual Site Model (CSM) was developed in the Phase I WP to provide a framework for problem definition, and assist in the identification of data gaps and appropriate remedial technologies, if necessary (Figure 1-1). The specific purpose of the CSM is to direct data collection efforts to meet the RI objectives. As defined in the Phase I WP, the RI objectives are to:

- Identify and characterize the nature and extent of constituents
- Collect data that are consistent with the needs of the ecological and human health risk assessments
- Evaluate the extent of possible remediation
- Refine the conceptual Site Model

The CSM provides a conceptual understanding of the Site to direct the sampling of specific media and locations so that data gaps can be filled, and to develop reasonable exposure scenarios to focus the human and ecological risk evaluations on potential constituent sources and release mechanisms.

To meet the RI objectives, a phased sampling program is being implemented. The scope of the Phase I RI was based on information on the Site available at that time and specific requests of the EPA. The Phase I RI is complete except for one round of groundwater sampling, which is in progress. This Phase II RI SOW is designed to fill the following data gaps identified based on an evaluation of the available Phase I data:

- Lateral and vertical extent of constituents
- Provide additional data for the RAs
- Characteristics of constituent sources for the FS
- Nature of upgradient groundwater quality
- Hydrogeological characteristics and geometry of the Columbia Aquifer

Specific data gaps identified for each medium and the ecological and human health conceptual models are discussed in Section 3. The SCM will be further refined after evaluating the Phase II data.

1.3 REPORT ORGANIZATION

The remainder of this report is organized into five sections with Appendices.

Section 2.0 presents a summary of the Phase I data and describes the nature and extent of constituents identified during the Phase I RI. Section 3.0 discusses WCC's evaluation of the Phase I data and identifies data gaps for Phase II and the data quality objectives.

Section 4.0 sets forth the scope of work planned for Phase II. The scope of work is organized by the various media (soil, sediment/peat, surface water, and groundwater).

Section 5.0 identifies the schedule for completing the Phase II RI. Deliverables, separate and aside from the Draft RI Report are also identified.

Section 6.0 presents a list of technical references cited.

Section 7.0 presents a list of acronyms used in this Phase II RI SOW.

2.0
PHASE I RESULTS

2.1 SITE SETTING

2.1.1 Historical Operations

Wood treatment operations began at the Site in approximately 1929 and continued through 1971. The material used in the wood preservation processes was creosote. Throughout the Site, an elaborate structure of railroad sidings provided for the movement of wood and materials to/from the Site. Major former Site activities where creosote handling occurred at several areas including the Process Area, Wood Storage Area, Fire Pond and South Ponds. It is primarily in these areas where various forms of non-aqueous phase liquid (NAPL) and relatively higher levels of polycyclic aromatic hydrocarbons (PAHs) were identified during the Phase I RI. Figure 2-1 presents the location of each area. Discussions regarding the Site areas are provided below.

Process Area: The Process Area activities consisted of the treatment of wood. Within this area were numerous wood treating equipment and structures associated with the wood treatment process. This area provided for the storage of creosote and other process-related materials. In addition, the freshly treated wood products were temporarily allowed to cure in the area known as the drip tracks, prior to transfer to the Wood Storage Area.

Wood Storage Area: The Wood Storage Area made up the majority of the former operations area on the Site. It covered the southern two thirds of the track area shown on Figure 2-1. Within this area, creosote treated wood and untreated wood were stored and handled prior to being shipped from the Site. This area was composed of railroad tracks with lumber stacking areas between the tracks for storage of finished and unfinished wood products.

Fire Pond: West of the Process Area is a small pond of water known as the Fire Pond. The water in the pond was reportedly used for fire-fighting purposes.

South Ponds: The South Ponds Area contains two water bodies south of the Wood Storage Area. The northernmost pond contains water and NAPL and remains wet throughout the year. The southernmost pond is ephemeral and contains weathered NAPL. It holds water during rainy conditions.

2.1.2 Geology and Soils

The geology at the Site is composed of Atlantic Coastal plain unconsolidated deposits, which is composed of the Early Cretaceous Potomac formation, the Pleistocene Columbia formation and the Late Quaternary recent deposits/fill. Due to the depositional nature of the sediments in this area, individual lithologic units are often discontinuous and difficult to correlate.

A total of 80 soil borings were completed at the Site as part of the Phase I RI. Figure 2-2 presents the locations of the soil borings and the location of two geologic cross-sections. The cross-sections illustrate the stratigraphic relationship of the soil materials and hydrogeology of the Site (Figures 2-3A and 2-3B). The cross-sections also illustrate how the surface topography dips towards the wetland areas to the south and west.

Recent Deposits/Fill: Surficial soils are characterized by fill and recent Holocene deposits. Typically, in the upland areas, the fill material is composed of a dry thin layer of coarse grained sediments with miscellaneous debris (metal, brick, concrete, and plastic) and is discontinuous across the Site. Thickness ranges from 0 feet to approximately 12 feet, with thicknesses greater than 5 feet occurring primarily in the former Process Area and the Fire Pond Area (Figure 2-3A). The recent deposits at the Site are composed of dry to saturated surficial and subsurface silt and clay mixtures with some fine to medium sand and trace gravel. The fill and recent deposits at the Site do not represent a separate water bearing unit relative to the Columbia Formation that underlies it. The recent Holocene deposits occur continuously within the north section of the Site and decrease in thickness with proximity to the marsh and drainageway (Figure 2-3A). A summary of the fill and Holocene deposit thickness is presented in Table 2-1.

The recent sediment in the drainageways is composed primarily of unconsolidated, fine-grained silty clays with a small proportion of fine sand in some areas. The base of the sediment typically

occurs at the interface with the Columbia Formation. Total organic carbon (TOC) content averages about 3.4 percent. Sediment depth in the drainageways is generally less than 3 feet.

The marsh substrate is composed primarily of a peaty material mixed with fine grained silt and clay. TOC averages about 6 percent. The depth of this peaty layer above the interface with the Columbia Formation material is generally less than 5 feet.

Columbia Formation: The Columbia Formation is interpreted as having been deposited by a complex stream system, consisting of straight and meandering channels. Soils are characterized as non-glacial Pleistocene age (Quaternary Period) fluvial sedimentary deposits, composed of orange, tan, and yellow poorly sorted sand and gravel with minor silts and clays, coarsening with depth. The typical base of the Columbia Formation is identified by an erosional unconformity composed of varying amounts of gravel, or no gravel in some places. Thickness of this unit range from approximately 0.5 to 25 feet, with the depth to the top of the Columbia Formation decreasing with proximity to the marsh and drainageways.

Potomac Formation: The Potomac Formation is the deepest sedimentary geologic formation explored at the Site and directly underlies the Columbia Formation. The Potomac Formation sediments typically consist of variegated orange, yellow, red, and gray clayey sand and sandy clays with local lenses of coarse to fine sand and plastic silty clay. The lithology at the top of this unit at the Site is generally composed of dense to medium dense white to red-yellow clayey silt to silty clay with minor amounts of fine sand.

The contact between the Columbia and Potomac Formation is a sharp erosional unconformity, characterized by coarsening of the Columbia Formation with depth, typically resulting in a coarse to medium sand and gravel unit at the base of the Columbia Formation. The top of the Potomac Formation typically varies from a silty and/or clayey medium to fine sand to a sandy silt or clay. The elevation of the top of the Potomac Formation was contoured based on data collected during the Phase I RI to illustrate an interpretation of this erosional surface (Figure 2-4). There appears to be a depression or basin in the surface of the formation centered beneath the former process and Wood Storage Areas. The cross-sections presented in Figures 2-3A and 2-3B also show how the Potomac Formation's erosional surface is elevated at the western and northern boundaries of the

Site. Borings are planned for the Phase II RI to gather additional information to confirm the presence of the depression area.

2.1.3 Groundwater

Monitoring wells were installed at eleven locations at the Site during the Phase I RI (MW-1 through MW-11, see Figure 2-5). Two distinct zones of groundwater flow were evaluated during the Phase I RI. These zones of groundwater flow include the Columbia and Potomac Formations.

The Columbia Formation is characterized as a moderately permeable surficial, unconfined aquifer. However, local areas of the formation at the Site act as a semi-confined aquifer. The cross-section presented in Figures 2-3A and 2-3B show water elevations as recorded in the monitoring wells relative to the stratigraphic units. The recent deposit/fill unit is finer grained than the Columbia Formation and typically contained no groundwater. The static groundwater levels in monitoring wells MW-2S and MW-8S are representative of the groundwater levels in the Columbia Formation. During the installation of these monitoring wells, groundwater was encountered in the Columbia Formation soils and groundwater but not in the recent deposit/fill unit. At locations where the base of the recent deposit/fill unit is below the water levels presented on the cross-sections, the Columbia Formation acts as a semi-confined unit.

The average hydraulic conductivity of the Columbia Formation is dependent on the intergranular porosity (primary porosity) developed during the initial deposition of the sand and gravel units and is characterized by a wide range of transmissivity throughout Delaware. The direction of groundwater flow in the Columbia Formation at the Site is radial from the former Process Area, where topographic elevations are greatest, toward the south and west, with a gentle average horizontal gradient of 0.0045 (Figures 2-3A, 2-3B, and 2-6). Recharge of the Columbia groundwater is through precipitation and infiltration in the former Process Area, as well as upgradient areas north of the Site. Discharge of the Columbia Formation groundwater is interpreted to occur in tidal drainageways and marshes, Hershey Run, White Clay Creek, and the Christina River.

The Potomac Formation is characterized as a semi-confined aquifer because the uppermost clay/silt sediments are typically much less permeable than deeper sand units in the Formation. The vertical

permeability of the silt/clay sediments at the top of the formation range from 7×10^{-8} to 3×10^{-7} centimeters per second based on undisturbed samples analyzed during the Phase I RI. The average hydraulic conductivity of the upper Potomac Formation is also dependent on the intergranular porosity. The direction of groundwater flow in the uppermost Potomac aquifer is also to the south and west, with a similar gentle average horizontal gradient (Figure 2-7). A preliminary comparison of the Columbia and Potomac potentiometric groundwater elevations indicates a small downward vertical gradient is present. However, based on the hydrogeologic evaluation of the DuPont Newport Site, the potentiometric groundwater surface in the Potomac Formation may vary due to the tidal fluctuations in the area. Therefore, the vertical gradient between the Columbia and Potomac Formations will be more thoroughly evaluated after completion of continuous water level monitoring to be conducted during the Phase II RI.

The recent deposits, Columbia Formation, and Potomac Formation will no longer be used as a potable water supply in the Site area. The residential wells along Old Airport Road about ½-mile southeast of the Site will soon be replaced by a potable water pipeline from a non-local source of supply.

2.1.4 Aquatic Resources

Aquatic ecological resources consist of open water ponds on-Site and downgradient drainageways and streams that receive stormwater runoff and potential groundwater discharge. On-Site habitats consist of the perennially wet Fire Pond, the northernmost pond in the South Pond Area, and two ephemeral ponds (Figure 2-1). The perennial ponds collectively represent about 0.6 acres. The two ephemeral ponds are K-Area and the most southern pond in the South Pond Area. They collectively represent less than 0.5 acres.

Downgradient aquatic habitats consist of the freshwater tidal drainageways in the marshes that form the southern and western portions of the Site, and the following tidal freshwater streams and marsh that form the southern and western property boundaries (Figure 2-8):

- Christina River and Churchman's Marsh
- White Clay Creek
- Hershey Run creek and marsh

As part of the Phase I RI, a total of 147 benthic samples were collected from the surficial sediments (0-6 inches) at 49 stations in the ponds, drainageways and rivers on and adjacent to the Site. Preliminary tables showing the results of this sampling effort are presented in Appendix A. A comprehensive characterization of benthic communities which occur at the Site will be performed as part of the Ecological Risk Assessment (ERA).

The benthic biota collected represent a variety of forms and feeding types. A total of 134 different benthic taxa were collected from the study area, including two turbellarians (flatworms), one nemertean (proboscis worm), one nematode (roundworm), 32 annelids (segmented worms), six aquatic crustaceans, 80 insects and 12 mollusks.

While density (number of individuals) and richness (number of different types) varied from station to station, benthic communities were found at all stations sampled. Density ranged from a high of 23,333 indiv/m^2 (individuals per squared meter) at Station HR-7 in Hershey Run, to a low of 29 indiv/m^2 at SP-3, in the South Ponds Area. Taxa richness ranged from a high of 24 at reference station WH-1 in White Clay Creek, to a low of two taxa at station SP-3.

The occurrence and distribution of benthic macroinvertebrates throughout the southern and western tidal freshwater streams and marshes is, to a large degree, dictated by habitat features such as flow, availability of an adequate food source, and sediment grain size. The most common organisms encountered are the chironomid larvae (midges) and the tubificid worms. Both are typical dominants of freshwater tidal benthic communities such as those at the Sites. Since both are deposit feeders (organisms that ingest sediments as a source of nutrient organic matter), it is not surprising to find them so commonly at the Site where drainageway and river sediments are composed primarily of fine-grained muds and fine sands.

Healthiest communities, that is, those with the greatest numbers of taxa from the most groups, were recovered from stations with fine-grained substrates and high organic content (peat). These stations include E-1, J-2, EC-8, EC-7, WC-4 and WC-6. Some stations (SP-2, SP-4, WC-6) have healthy communities despite higher levels of constituents. At these stations, the benthic communities colonize a mat of organic material which lies on the surface of more impacted subsurface material.

Dominance by one taxon (deposit feeding oligochaetes) and low densities of organisms generally occur at stations E-2, C-1, SP-3, HR-0, HR-8, EPA-1, and KP-1. Several potential physical, chemical, and biological factors contribute to the impoverished communities at these stations which will be further evaluated in the ERA for the Site.

The remainder of the stations have relatively healthy communities, with moderate macroinvertebrate densities and a more even distribution of the dominant taxa. These stations are located throughout the Site's tidal freshwater streams and marshes and specifically located in the East Drainage, East Central Drainage, Central Drainage, portions of the West Central Drainage, Hershey Run, Christina River, Churchman's Marsh and White Clay Creek.

2.1.5 Wetland Resources

Delineated jurisdictional wetland resources cover about 136 acres or about 45 percent of the Site property and predominate in the southern and western portions (Figure 2-9). Smaller disjunct wetlands occupy low lying areas in the uplands that form the majority of the former Process and Wood Storage Areas. The following types of wetlands and their approximate acreages have been identified and mapped (Figure 2-8) at the Site:

- Freshwater Tidal Marsh - 115 acres
- Non-Tidal Emergent Wetlands - 10.7 acres
- Non-Tidal Forested Wetlands - 8.6 acres
- Non-Tidal Scrub/Shrub Wetlands - 1.5 acres

Subtotal **135.8 acres**

2.1.6 Terrestrial Resources

Upland terrestrial resources cover about 163 acres or about 54 percent of the property and consist primarily of coastal plain covertypes. The wildlife is typical of these habitats. Piedmont deciduous forest plant species are also common. The following covertypes and their approximate acreages have been identified and mapped (Figure 2-9) at the Site:

• Upland Forest	-	62 acres
• Upland Scrub/Shrub	-	13.7 acres
• Upland Herbaceous "old fields"	-	87.2 acres
Subtotal		**162.9 acres**

2.2 PHASE I ANALYTICAL RESULTS

The Phase I analytical data were summarized in two ways. A statistical evaluation was performed to provide minimum, maximum, and arithmetic mean values for each constituent per matrix detected in each Potential Area of Interest (PAOI) as defined in the Phase I WP and each drainageway area at the Site. The statistical evaluations have been used to identify the constituents that have been consistently detected across the Site, as well as those areas where constituents have been detected at higher concentrations relative to other areas of the Site. In addition, data for selected constituents (based on the statistical summary tables, on the screening process described in Section 3, and on requests from EPA) have been presented on Site maps to show the distribution of constituents. Because of the extensive volume of soil and sediment analytical data, color coding was used to highlight different concentration ranges. These analytical summary tables and accompanying maps are presented in Appendix A. The maps are organized by environmental medium. For each medium there is a set of individual maps which represent the following analytical groups:

Parameters summarized for **soil and sediment**:

- Total Potentially Carcinogenic PAHs
- Total Noncarcinogenic PAHs
- Total Phenolic Semi-volatiles (phenolics), including Pentachlorophenol (PCP)
- Total Benzene, Toluene, Ethylbenzene, Xylene (BTEX)
- Total Volatile Organic Compounds (VOCs) w/o BTEX

Soil and sediment maps are further broken down into the following depth ranges for each parameter:

- 0 - 0.5 feet (soil and sediment)
- 0 - 2 feet (soil; sediment = 0.5 - 1 foot)
- 2 - 4 feet (soil)
- 4 - 6 feet (soil)
- Greater than 6 feet (soil)

Parameters summarized for **groundwater** in the Columbia Formation and Potomac Formation include:

- Total Potentially Carcinogenic PAHs
- Total Noncarcinogenic PAHs
- Total BTEX
- Total VOCs w/o BTEX

The list of constituents utilized for each of the groundwater parameter groups are as follows:

- Potentially Carcinogenic PAHs:
    1. Benz(a)anthracene
    2. Chrysene
    3. Benzo(b)fluoranthene
    4. Benzo(k)fluoranthene

5. Benzo(a)pyrene
6. Dibenz(a,h)anthracene
7. Indeno(1,2,3-c,d)pyrene

- Noncarcinogenic PAHs:
  1. Naphthalene
  2. Acenaphthene
  3. Acenaphthylene
  4. Fluorene
  5. Phenanthrene
  6. Anthracene
  7. Benzo(g,h,i)pyrene
  8. Pyrene
  9. 2-Methylnaphthalene
  10. Fluoranthene

- Phenolics:
  1. 2,4,5-Trichlorophenol
  2. 2,4,6-Trichlorophenol
  3. 2,4-Dichlorophenol
  4. 2,4-Dimethylphenol
  5. 2,4-Dinitrophenol
  6. 2-Chlorophenol
  7. 2-Methylphenol
  8. 2-Nitrophenol
  9. 4,6-Dinitro-2-methylphenol
  10. 4-Chloro-3-methylphenol
  11. 4-Methylphenol
  12. 4-Nitrophenol
  13. Pentachlorophenol
  14. Phenol

2.2.1 Soil

Eighty soil borings were advanced for the collection of onsite soil samples during the Phase I RI. A minimum of two subsurface samples were collected from each of these locations (for a total of 162 subsurface soil samples) based on field screening in accordance with the Phase I WP. Surface soil samples were collected from approximately 48 boring locations. The soils samples were analyzed for Target Compound List (TCL) VOCs and semi-volatile organic compounds (SVOC) and Target Analyte List (TAL) metals. Twenty percent of the samples were also analyzed for TCL pesticides/polychlorinated biphenyls (PCBs) and polychlorinated-dibenzo-p-dioxins and furans (PCDDs/PCDFs). Constituents identified in the soil at the Site include PAHs, metals, BTEX, VOCs, and a few detections of PCP, pesticides/PCBs, and PCDDs/PCDFs. Review of the maps presented in Appendix A provides an understanding of the aerial distribution of these constituents.

NAPL and PAHs: Creosote containing materials are represented by surficial weathered creosote NAPL, subsurface residual NAPL, and free NAPL. Weathered and residual NAPL were observed in the Site surface and subsurface soils above the groundwater table at some locations. The weathered NAPL in the surface soils is generally of two types. For example, brittle and granular NAPL was noted in the Drip Track Area whereas the South Pond Area exhibits more plastic, tar-like weathered NAPL. Numerous samples of the various forms of creosote have been collected from the Site for chemical analysis. A summary of the chemical analyses is presented in Table 2-2. Representative concentrations of total PAHs in this type of material range up to nearly percent levels (e.g., SB-112, 0 to 2 feet; and SB-402, 2 to 4 feet). Other soil samples exhibited high concentrations of PAHs as sorbed constituents on the soil particles and no residual NAPL present.

The physical properties and chemical results are consistent with those associated with typical creosote. Typical creosote is estimated to contain 85 percent PAHs, 10 percent phenolic compounds (including phenols, cresols, xylenols, and PCP), and 5 percent N-heterocyclic, S-heterocyclic, and O-heterocyclic compounds (including carbazole, quinolines, pyridines, thiophenes, and dibenzofuran). The average or typical PAH composition of U.S. creosote, as presented by Cohen and Mercer (1993), is listed below.

PAH Compound	Weight Percent
Naphthalene	3.0
Methylnaphthalenes	2.1
Biphenyl	0.8
Acenaphthene	9.0
Fluorene	10.0
Phenanthrene	21.0
Anthracene	2.0
Pyrene	8.5
Chrysene	3.0
Methylanthracene	4.0
Fluoranthene	10.0

Source: Cohen and Mercer, 1993

The summary tables in Appendix A (Tables A3-1 to A3-6) indicate that PAHs are the predominant constituents detected in the soils at the Site. The higher concentrations of PAH compounds in the surface and subsurface soils were primarily identified in the following wood treating operations areas:

- Former Process Area (area where the wood was treated)
- Drip Track Area
- Fire Pond Area (PAOI-3)
- Wood Storage Area (central area)
- South Pond Area (PAOI-4)
- K-Area

In addition, higher concentrations of PAHs in the subsurface soils were also identified in the area of soil boring SB-213 in the central portion of the Wood Storage Area.

Other areas of high concentrations of PAH compounds were also identified in the surface soils in potentially disturbed area F, and the eastern end of the Wood Storage Area (see Figures A-1

through A-8 in Appendix A). The location of these PAH compounds appears to correlate with observations of weathered NAPL at ground surface or NAPL (residual or free-phase product) at depth.

PCP: The presence of PCP in soils is very limited. It was detected in only 9 out of 210 soil samples and detections ranged from 0.13 to 82.0 mg/kg at the K-Area and former Process Area, respectively. A summary of the analytical results is presented in Appendix A, Tables A3-1 to A3-6.

VOCs: The presence of BTEX is limited to those areas of relatively higher PAH concentrations, specifically, to the former Process Area and the South Pond Area (see Figures A-17 through A-20 in Appendix A). A summary of the analytical results are presented in Appendix A, Tables A2-1 to A2-6.

VOCs other than BTEX in the soil are scattered at the Site with no apparent spatial pattern except at shallow depths (less than two feet), where they are found primarily in the wetland areas (sediment) (see Figures A-21 through A-24 in Appendix A). The detected VOCs include:

- 1,1,1-Trichloroethane
- 2-Butanone
- Acetone
- Carbon Disulfide
- Chloroform
- Methylene Chloride
- Tetrachloroethene
- Styrene
- Trichloroethene

Pesticides/PCBs: Several organochlorine pesticides (e.g., DDT, DDD, endosulfan etc.) were detected in soils at the Site. However, they typically occur in the range of the detection limits. Only 7 detections occurred above the detection limits or were not associated with detections in the laboratory blanks (B-qualified). The presence of these constituents at the concentrations at which

they are detected is consistent with the fact that the Site was farmed in the past. Typical concentrations in soil range up to a few micrograms per kilogram (µg/kg).

PCBs were also detected infrequently in the Site soils ranging from a few micrograms per kilogram up to less than 500 µg/kg.

The pesticide/PCB analytical results in soil are summarized in Appendix A, Tables A4-1 to A4-6 for each Site area as identified in the Phase I WP.

PCDDs/PCDFs: Surface and subsurface soil samples were obtained for analysis of PCDDs/PCDFs at 5 locations in the former Process Area and Drip Tracks Area (PAOI 1); at one location in the former Wood Storage Area (PAOI 2); one location in the Fire Pond Area (PAOI 3); one location in the South Pond Area (PAOI 4); and eight other locations in the upland soil area (PAOI 1) which included the K-Area. The results are summarized in Table 2-3 in terms of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) toxicity equivalent (TE) concentrations for total PCDDs/PCDFs detected in soil expressed in µg/kg (EPA, 1989c). The summary statistics are presented in Appendix A, Tables A5-1 to A5-6. All samples were less than 5 µg/kg TE, and all except three samples (SB-114, SB-126, and SB-127; Table 2-3) exhibited TE concentrations less than 1 µg/kg.

Metals: Maps showing TAL metal concentrations are provided in Appendix A, Tables A1-1 to A1-6. The measured concentrations of metals in Site soils did not reveal any spatial distribution patterns indicative of possible "hotspots." Only several surface and subsurface samples had analyses which exceeded reference station concentrations (e.g., calcium, barium, copper, and lead).

The distributions of cadmium, lead, and mercury, as well as the four wood treating metals identified by EPA (arsenic, chromium, copper, and zinc) are presented on Figures A-47 to A-81 in Appendix A. The distribution of metals concentrations in the soils (upland areas) are consistently in the range of background concentrations across the Site. At the request of the EPA, we have provided a comparison of the 95 percent UCL concentrations of onsite metals against the 95 percent UCL concentrations of the reference metals and against the arithmetic and geometric mean

concentrations for metals in the eastern U.S. (Shacklette and Boerngen, 1984). This information is presented in Table 2-4.

2.2.2 Groundwater

Monitoring wells were installed at eleven locations at the Site during the Phase I RI (MW-1 through MW-11, see Figure 2-5). Wells were installed at the base of the Columbia Formation at all of these locations to evaluate the potential presence of DNAPL. Wells were installed into the first sandy unit below a clayey unit in the Potomac Formation at five of these locations. In addition, wells were installed to monitor the top of the water table at two of the locations (MW-2S and MW-8S) to evaluate the potential presence of light NAPL (LNAPL).

Two rounds of samples were collected from all of these wells and five existing wells located along the eastern boundary of the Site (MW-28A, MW-28B, MW-28C, MW-37A, and MW-27A) for the analysis of TCL VOCs and SVOCs, and TAL metals. In addition, twenty percent of the locations were sampled for the analysis of TCL pesticide/PCBs and PCDDs/PCDFs. The third round of samples is scheduled to be collected in September 1995.

Constituents identified in the groundwater during the first two sampling events include PAHs, BTEX, and VOCs. The figures presented in Appendix A show distribution of these constituents in the groundwater and are discussed below.

NAPL: Free-phase NAPL was identified in 2 monitoring wells at the Site; MW-2A and MW-8A, located in the center of the former Process Area, in the form of DNAPL. No LNAPL was identified at the Site. The extent of the DNAPL at the Site is undefined (see Figure 2-10). One sample of the DNAPL was collected from MW-2A for chemical analysis. The physical properties and the compounds identified in that sample are consistent with those associated with typical creosote as discussed in Section 2.2.1. The BTEX compounds are consistent with observations in other areas of the Site where higher concentrations of PAHs were detected. The results of the DNAPL analysis are summarized in Table 2-2.

PAHs: The detection of PAHs in the groundwater at the Site was limited to Columbia Formation wells in the former Process Area, Wood Storage Yard, and Fire Pond Area (MW-1A, MW-2A,

MW-8A, and MW-10A), (see Figures A-29 and A-30 and Tables A8-1 to A8-4 in Appendix A). Downgradient wells did not contain PAHs. There were no detections of PAH compounds in the Potomac Formation.

PCP: There were no detections of PCP in groundwater samples except for a single detection in MW-8A at a concentration of 24 µg/l. The detection of PCP in monitoring well MW-8A is due to the presence of NAPL within the water column and is not representative of the aquifer conditions.

VOCs: BTEX were detected in the groundwater in four Columbia Formation wells, three in the former Process Area (MW-1A, MW-2A, and MW-8A) and one to the east of the Site boundary (MW-37A). BTEX were also detected in one Potomac Formation well in the southern portion of the Site (MW-7B, at a concentration of 2 µg/l), (see Figures A-31 to A-34 and Tables A7-1 to A7-4 in Appendix A). All compounds, with the exception of benzene at two locations in the Columbia Formation, are below the Maximum Contaminant Levels (MCLs).

VOCs (other than BTEX) were detected in three Columbia Formation wells in the former Process Area (MW-1A, MW-2A, and MW-8A). VOCs were also detected in two Columbia Formation wells outside of the Process Area (MW-27A, at 21 µg/l and MW-7A, at 72 µg/l), and at low concentrations in two Potomac Formation wells (MW-4B, at 4.5 µg/l and MW-5B, at 7 µg/l), (see Figures A-31 and A-32 in Appendix A). The detected VOCs include:

- 1,1-Dichloroethane
- 1,2-Dichloropropane
- 2-Butanone
- Acetone
- Chlorobenzene
- Chloroform
- Methylene Chloride
- Tetrachloroethene
- Styrene
- Trichloroethene

Pesticide/PCBs: Three occurrences of low concentrations of pesticides (DDT, DDD, DDE, aldrin, and alpha chlordane) were detected in groundwater from the Columbia Formation. All except one of these pesticide values were "J" qualified detections at concentrations below the detection limit.

Where detected, DDT, DDD, DDE, and chlordane ranged up to about 0.1 µg/L in the former Process Area. In the areas down gradient of the former Process Area (PAOI6), concentrations ranged up to about 0.01 µg/L. Pesticides were detected in only one Potomac monitoring well (MW-5B); 4,4'-DDD and aldrin were detected just above the detection limits at 0.013 and 0.003 µg/l, respectively (see Tables A9-1 and A9-2 in Appendix A). Given the fact that few occurrences were detected in soil, the groundwater results are consistent with the soil analytical results. These results are summarized in tables in Appendix A. PCBs were not detected in any of the groundwater samples collected from the Site.

PCDD/PCDF: PCDD/PCDF compounds were not detected in any of the groundwater samples collected from the Site which are representative of the aqueous phase. HpCDD and OCDD were detected in well MW-2A at a TE of 0.015 µg/kg; however, the sample did not represent the aqueous phase (see Table A10-1 in Appendix A).

Metals: Summary statistics for detected metals are tabulated for the former Process Area (PAOI 1), Wood Storage Area (PAOI2), Fire Pond (PAOI3) and other upland areas (PAOI6) in Appendix A, Tables A6-1 to A6-5. Evaluation of dissolved metals (filtered groundwater) concentrations in groundwater show MCL (and AWQC) exceedances of only aluminum, iron, antimony, manganese, and thallium. Metals in total groundwater samples from the Columbia and Potomac Formation are likely due to suspended particulates (turbidity) that originate from the soils. The wells were developed in accordance with the Phase I WP, utilizing surging, bailing, and pumping techniques to produce the clearest possible water sample. Also, the samples were collected using low-flow rate purging and collection techniques to minimize turbidity. However, samples completely free of turbidity could not be obtained. Nevertheless, the occurrence of metals which exceed MCLs is not widespread and is limited to those wells installed within the Columbia Formation.

Aluminum, antimony, beryllium, iron, lead, manganese and thallium detections in unfiltered groundwater samples exceeded MCLs at more than one location. The presence of aluminum, calcium, iron, magnesium, sodium, and manganese appear to be related to clay minerals in slightly turbid unfiltered samples.

2.2.3 Surface Water

Among the 50 drainageway sampling locations identified for sampling in the Phase I WP, surface water samples were collected at 48 stations during the initial sampling event. Station FP-3 was dry at the time of sampling and no drainageway or surface water was present at Station J-1. The initial sampling was performed between August 16, 1994 and September 8, 1994. During the "first flush" runoff sampling event, surface water collections were repeated at 13 of the stations sampled previously. This sampling was performed on November 28, 1994.

All of the samples were analyzed for TCL VOCs and SVOCs, and TAL metals. Twenty percent of the initial round of samples were also analyzed for TCL pesticide/PCBs and PCDDs/PCDFs. These data are summarized in the statistical data tables in Appendix A.

Organics: A few organics (PAH associated compounds, toluene, chloroform, acetone, and chloromethane) were detected in surface water samples collected from the Site. The volatile organic compounds detected in the initial and "first flush" sampling events include low detections of acetone, chloromethane, bromomethane, carbon disulfide, toluene and chloroform. The semi-volatile organic compounds detected in the initial and first flush samples included PAH compounds. None of these detections exceeded EPA Chronic Ambient Water Quality Criteria (AWQCs).

Metals: The results from the drainageway sampling locations on and near the Site were compared to AWQC values. Aluminum, iron, and lead are the metals with the most frequent exceedances of the AWQC values in unfiltered water, exceeding the AWQC in 28 out of 48, 21 out of 48, and 15 out of 48 surface water samples analyzed, respectively. First flush samples had few AWQC exceedances in filtered or unfiltered samples. The aluminum criterion was exceeded in all unfiltered first flush samples; 6 out of 13 unfiltered samples for iron; and one East Drainage unfiltered sample for cadmium, chromium, iron, lead, and zinc. A summary of metal detections in the unfiltered

water samples from the initial and "first flush" sampling events are summarized in Appendix Tables A11-1 to A11-12 for each sampling area.

2.2.4 Sediment/Peat

Among the 50 drainageway sediment sampling stations and the 22 marsh peat sampling stations identified in the Phase I WP, samples were collected at all locations at two depths (0 to 0.5 feet and 0.5 to 1.0 feet) for a total of 145 samples. Station SP3 and J1 were dry at the time of sampling; however, sediment samples were collected at these locations and submitted for analysis. All of the samples were analyzed for TCL VOCs and SVOCs, and TAL metals. Twenty percent of the samples were also analyzed for TCL pesticides/PCBs and PCDD/PCDFs.

The analytical data for the onsite ponds and drainageways and the wetland marsh peat and drainageway sediment are presented in tables and maps (see Tables A16-1 to A25-5 in Appendix A) and are summarized below. The 0.5 to 1.0 foot samples are included on the soil maps (0.0 to 2.0 feet intervals) on Figures A-1, A-5, A-9, A-13, A-17, A-21, A-25, A-43, A-48, A-53, A-58, A-63, A-68, A-73, and A-78.

The onsite pond and drainageway sampling locations included the following locations (see Figure 2-1 and 2-2):

- K-Area - KP-1
- South Ponds - SP-1, SP-2, SP-3, SP-4
- Fire Pond - FP-1, FP-2, FP-3
- J-Area - J-1, J-2

A total of 20 sediment samples were collected from these 10 locations. The analytical results for these samples are summarized in Table A16-1 to A20-11. The frequency of detection, range and arithmetic average concentration are provided for the detected analytes.

Marsh peat and drainageway sediment sampling was performed in the wetland drainage areas downgradient from the former Process Area and Wood Storage Area. The results are summarized in Appendix A, Tables A16-1 to A25-5 for the following drainage areas:

- East Drainage Area
- East Central Drainage Area
- Central Drainage Area
- West Central Drainage Area
- Hershey Run Drainage Area

A total of 125 sediment/peat samples were collected in these areas.

NAPL and PAHs: NAPL was found in the drainageways and in wetland areas upland areas. It exists in the free product form in the west-central drainageway (the system that drains the South Pond Area) and in Hershey Run from the area of the Fire Pond to approximately the location of sampling station HR8 (see Figure 2-2), in the Fire Pond, and in the South Pond Area. It exists primarily in the weathered or residual forms in K-Area and the South Pond Area (see Figure 2-1).

The summary tables in Appendix A indicate that PAHs are the predominant compounds detected in sediment and peat at the Site. The higher concentrations of PAHs are associated with areas where NAPL has been identified. PAH concentrations down gradient from these areas declined to levels similar to that measured at reference locations. PAHs were also detected at levels above those found at the reference locations (see Section 2.3) in J-Area and at the head of the east central drainage area (station EC8); however, NAPL was not present at these locations. Adjacent down stream stations to these two locations had PAH concentrations consistent with the reference areas.

PAHs in most of the marsh and other drainageway sampling stations are approximately equal to or less than the concentrations detected at the reference stations identified as being representative of background concentrations for PAHs.

PCP: PCP was detected in only 3 of the 145 samples. These detections occurred in the K-Area and Fire Pond Area. PCP concentrations ranged from 8.9 to 22 mg/kg. A summary of these data are provided in Appendix A, Tables A18-1 to A18-13 and A23-1 to A23-5.

VOCs: The presence of BTEX is limited to those areas of higher PAH concentrations, primarily the South Pond Area, the West Central drainageway, the Fire Pond, and Hershey Run. The presence of VOCs other than BTEX in the sediment is scattered across the wetland areas with no apparent spatial pattern. Detected total volatile organic concentrations ranged from 0.005 to 30 mg/kg. A summary of these compounds are listed in Section 2.2.1.

Pesticide/PCBs: The detection of pesticides in sediment was widespread but these compounds were found at consistently low concentrations (most were less than 10 μg/kg). Some higher concentrations of pesticides were identified in the K-Area and the Fire Pond. These observations are consistent with the fact that the Site and the region around it were used for farming. PCBs were detected in 17 out of 37 peat and sediment samples with no apparent distribution pattern. The highest concentration of PCBs detected in sediment was 290 μg/kg.

PCDDs /PCDFs: PCDDs/PCDFs were detected primarily as octachlorodibenzodioxin (OCDD) at background concentrations. Detections of these compounds were all below 1 μg/kg TCDD TE concentrations with the exception of one sediment sample collected from the Fire Pond, which had a TE value of 1.28 μg/kg. Furthermore, 2,3,7,8-TCDD was not detected in any sediment sample.

Metals: TAL metals were detected in nearly all of these samples. The concentrations of most metals were consistent with the normalized upstream reference concentrations. Moderately elevated concentrations of the following metals were detected, mainly at downgradient marsh and drainageway stations located nearest the Christina River and White Clay Creek:

Arsenic	Copper	Lead	Nickel
Cadmium	Chromium	Mercury	Zinc

The distribution of these moderately elevated metals suggests that they may be related to ubiquitous sources associated with the White Clay Creek and Christina River.

2.3 REFERENCE DATA

This section presents a preliminary evaluation of the reference station data to assess the suitability of these locations as references for the Ecological Risk Assessment (ERA) and Human Health Evaluation (HHE). The results of this evaluation indicate that while deletion of occasional outlier values in the calculation of the mean concentration of reference station values may be necessary, these data are acceptable as reference locations. A detailed evaluation will be provided in the RI report. Additional soil and sediment will be collected from reference locations to provide additional data on reference conditions in the basin. The details of this data collection is provided in Section 4.0.

2.3.1 Soil

Reference soil samples were collected for the analysis of TCL VOCs and SVOCs, pesticide/PCBs, TAL metals, and PCDDs/PCDFs at the following soil boring locations shown on Figure 2-11:

- Onsite: BG1, BG2
- Airport Road Area: SB705, SB706
- Bread and Cheese Island: SB701, SB702, SB703, SB704
- DuPont Holly Run Plant (previously existing data, not collected during Phase I RI): TB28, TB29, MW29, HRB1, HRB2, HRB3

The selection of these reference soil sampling locations was based on a review of historical aerial photographs, site reconnaissance and proximity of adjacent properties to the Site.

Bread and Cheese Island: The locations of the reference soil samples collected on Bread and Cheese Island are characterized by dense vegetation. Based on a review of historical aerial photographs for this property, the property was primarily used for agriculture. Sample locations SB-701 and SB-702 were an area of an open field, currently overgrown with dense shrubs. Sample locations SB-703 and SB-704 were along the Hershey Run Marsh, in an area of older growth trees. Reference soil samples consisted of natural silty sands, consistent with the soils found within the Site's soil samples.

Old Airport Road: Reference locations along Old Airport Road (SB-705 and SB-706) were adjacent to the Christina River, an automobile salvage yard. Soil samples SB-705 and SB-706 consisted of fill type material with some debris.

On-Site: Reference soil samples collected on-Site (SBBG-02 and SBBG-02) were located in the southern portion of the Site. Sample location SBBG-01 was located in an area of the Site homestead, while SBBG-02 was located in a remote wooded area. Both locations are characterized by dense older growth forests that pre-date Site-related activities.

DuPont Holly Run: The reference soil data from the DuPont Holly-Run site (TB-28, TB-29, MW-29, HRB-2 and HRB-3) were evaluated due to the proximity to the Site. Soils from these samples are similar to those soil samples collected at the Site.

The analytical results from these samples are provided on Table 2-5 and are summarized below.

Metals: The concentrations of nearly all the TAL metals detected at the reference locations are representative of "clean" soils and reflect the natural geochemistry of the region. Occasional high concentration outliers occur for a few metals, primarily lead and zinc.

VOCs: Five low level detections of acetone and a single low level detection of toluene and chloroform occurred in the reference soil samples.

SVOCs: Di-n-butylphthalate and butylbenzylphthalate were detected in the onsite samples, but these detections may represent laboratory contamination or an artifact of sample collection or handling. Eleven PAH compounds were detected in onsite samples, while 3 PAHs were detected

in one of the Airport Road samples and one was found in a sample from the DuPont property. PAHs are natural compounds in soil and low levels are expected at total PAH levels generally less than 5 mg/kg (Eisler, 1987). All samples except one had total PAH levels below 5 mg/kg. The 0 to 0.5 foot interval sample from SB2 had a total PAH level of 19.4 mg/kg.

Pesticides/PCBs: Two low level detections of DDT, one of DDE, and one of Aroclor 1254 occurred in onsite soil samples. The detected pesticides are probably the result of former agricultural activities in the area. Pesticides/PCBs were not detected in the other reference location samples.

PCDDs/PCDFs: OCDD was detected at low levels (less than 20 µg/kg) in at least one soil sample from all locations except boring samples collected on the DuPont property. These low level detections are consistent with the background levels expected in urban/industrial soils exposed to combustion emissions (Eisler, 1986).

2.3.2 Groundwater

Three wells located on the DuPont Holly Run plant (MW-28A, MW-28B, and MW-28C; Figure 2-8) were sampled to represent reference groundwater quality conditions relative to the Site. These wells are located to the east of the Site, and are not representative of upgradient groundwater conditions (see Section 2.1.3 for a discussion of groundwater flow gradients).

The concentrations of metals in the reference wells are consistent with previous sampling episodes from the DuPont Newport RI/FS (WCC, 1990). The only organic constituent detected was benzene (2 µg/L) in MW-28C in the deep Potomac. These wells were less turbid than the Site wells which appear to reflect the fact that they are larger diameter wells.

2.3.3 Surface Water

Surface water sampling was performed at the following five reference stations during the initial (normal flow) sampling event:

Christina River - RS15	Hershey Run - HR0
White Clay Creek - WH1, EPA1	Churchman's Marsh - CMD1

These reference stations are described in the following paragraphs and shown on Figure 2-8:

Christina River Station RS-15: Reference station, RS-15, is located on the Christina River approximately 6 km upstream of the confluence of White Clay Creek and the Christina River. The channel of the Christina River in this area is about 30 to 40 feet wide; the depth is 5 to 6 feet. Substrate is variable from sands to fine muds which become trapped in emergent aquatic macrophytes along the river bank. Water depth is under tidal influence and was about 3 feet at the time of sampling; the water was turbid. Fish and aquatic life are present at this location, which is partially shaded. This part of the river receives drainage from land which is primarily residential, with some light commercial and industrial usage.

White Clay Creek Station WH-1: Reference station WH-1 is 4.2 km upstream of the western boundary of the Site. The channel at this point is 30 to 40 feet wide and 5 to 6 feet deep. The creek is non-tidal at this point and under normal flow conditions is about 1 foot deep. Sediments are chiefly fine-grained sands with some silt, and gravel in riffle areas. There is partial shading. At the time of sampling there were minnows present and the water was clear. This section of White Clay Creek receives drainage from urban and light industrial-use land.

White Clay Creek Station EPA-1: Reference station EPA-1 is 3.5 km downstream of Station WH-1 and 0.7 km upstream of the western edge of the Site. The channel at this point is 30 to 40 feet wide and 5 to 6 feet deep. Since this reach is under tidal influence, water depth may vary from 4 feet to 0.5 feet. Sediments are mostly fine-grained sands with some silt, and the area is partly shaded. At the time of the Phase I sampling effort, the water was slightly turbid and fish were present. Land use in the area is similar to reference station WH-1, with a greater portion of urban use.

Hershey Run Station HR-0: Reference Station HR-0 is located about 1 km upstream of the northern boundary of the Site, and approximately 2.5 km upstream of the confluence of Hershey Run and White Clay Creek. At Station HR-0, the stream channel is about 10 feet wide and 3 to 4 feet deep. Sediments are comprised of fine-grained sand with some gravel. Stream flow at this

point is non-tidal and usually less than a foot deep. The location is partially shaded and is immediately upstream of the Route 4 road bridge. At the time of sampling, there were minnows and other aquatic life present. The channel receives urban runoff from nearby apartment complexes.

Churchman's Marsh Station CMD-1: The Churchman's Marsh Drainageway reference station lies in the center of the marsh in a tidal channel which is about 15 feet wide. The marsh drainage consists of rainwater and tidal inputs. At high tide, the water depth in the channel may be as much as 3 to 4 feet. The depth decreases to about 2 feet at medium tide, while at low tide, the channel becomes exposed mud flats. The area is exposed to full sun, although surrounded by dense emergent vegetation that ranges from 3 to 10 feet high. The sediments are organic silts and mildly anaerobic. At the time of sampling, the water was turbid. Small minnows were observed in the drainageways.

Results: Both filtered and unfiltered surface water samples were submitted for analysis from the reference locations. During the "first flush" sampling event, filtered and unfiltered surface water samples were collected at Station HR0 on Hershey Run. Results from both sampling events are provided in Appendix Tables A11-1 to A15-1.

VOCs, SVOCs, pesticides/PCBs and PCDDs/PCDFs were not detected in unfiltered or filtered water samples from the reference locations during either the initial or "first flush" sampling events.

Metals: The following metal exceedances of the EPA chronic AWQCs occurred during these sampling events:

- RS15 Aluminum - Unfiltered - Initial Event
- EPA1 Aluminum - Unfiltered - Initial Event
- HR0 Aluminum - Unfiltered - Initial and First Flush Events
- RS15 Iron - Unfiltered - Initial Event
- RS15 Copper - Unfiltered and Filtered - Initial Event
- WH1 Copper - Filtered - Initial Event
- HR0 Copper - Unfiltered - Initial Event

- RS15 Lead - Unfiltered - Initial Event
- HR0 Thallium - Filtered - Initial Event

Figure 2-10 presents the location of these aquatic sampling points.

2.3.4 Sediment/Peat

Sediment sampling was performed at the same reference stations used for surface water collection (Figure 2-10). One additional station in Churchman's Marsh (CMM1) was sampled as a reference station for marsh peat. The sediment/peat reference sample locations include the following:

- Christina River - RS15
- White Clay Creek - WH1, EPA1
- Hershey Run - HR0
- Churchman's Marsh - CMD1, CMM1

Among the 5 drainageway and 1 marsh sampling locations identified for sediment sampling, samples were collected at two depths (0 to 0.5 feet and 0.5 to 1.0 feet) at all stations during the initial sampling event. The sediment and peat sampling activities were performed between August 16, 1994 and September 8, 1994. The analytical results for these samples are provided in Table 2-6.

The TOC analyses and the grain size results showed high variability among the areas sampled. Because interpretation of the sediment/peat analytical data for organics depends to a large degree on TOC, and grain size and metals distribution are closely correlated, these results are summarized here. Analytical results are summarized in the paragraphs after the discussion on TOC and grain size. A complete data evaluation will be performed as part of the RI and RA.

<u>Total Organic Carbon:</u> Since TOC plays an important role in determining the ability of a sediment to sequester constituents, it is a critical factor in the development of site-specific sediment quality criteria for non-polar organics using the sediment equilibrium approach.

TOC analysis was performed on all drainageway sediment and marsh peat samples except three, providing a total of 141 measurements. Sediment TOC at the drainageway reference stations (RS15, WH1, HR0, EPA1, and CMD1) ranged from 0.285 to 3.31 percent, and averaged 1.14 percent. Sediment TOC in the onsite ponds and drainageways (SP1, SP2, SP3, SP4, FP1, FP2, FP3, KP1, and J2) ranged from 3.04 to 49.8 percent, and averaged 18.66 percent. Sediment TOC in all the other drainageway stations ranged from 0.285 to 10.1 percent, and averaged 3.44 percent.

The TOC in the marsh peat samples was generally greater than that measured in drainageway sediment samples. Peat TOC at the Churchman's Marsh reference station (CMM1) was 3.26 percent. Peat TOC in all the other marsh sampling stations ranged from 1.09 to 15.9 percent, and averaged 5.83 percent.

In all cases where the data were pooled to calculate averages, the TOC data for sediment and peat were normally distributed and had low coefficients of variation (less than 1.0).

Grain Size Analysis: Constituents, primarily metals, have a strong affinity for fine-grained particles and tend to accumulate in sediments with a high percentage of silt and clay size fractions. Hence, the relationship between sediment grain size and naturally occurring elements such as aluminum is an important component in understanding the metals distribution in sediments.

The proportion (mass percent) of sediment contributed by particles less than 63 μm was interpreted from the grain-size distributions curves and used to compare the samples. These results are provided in Table 2-7. For convenience, the term "mud" will be used to designate this size fraction.

The percent mud at the upstream reference stations in the rivers was generally low (less than 50 percent). The steeper stream gradient, and locations at or above the head of tide, promotes higher water velocities at these stations and limits deposition of the fine-grained mud. These stations are located at or near the lower end of the fall line between the Piedmont and Coastal Plain Zones, while the downgradient locations are located in the Coastal Plain where fine-grained deposition is enhanced by lower water velocities.

The mud content of samples from the marshes and drainageways near and on the Site ranged from about 50 to 100 percent mud. Consequently, to compare the analytical results for metals between the upstream reference data and the data from the Site area, normalization to a naturally occurring element such as aluminum is applied to account for the concentration differences which are likely attributable to grain-size. Techniques and results of metal normalization for grain size variations are described below.

The metals data were normalized to aluminum concentration, a geochemically conservative element that covaries with grain size, according to the procedures described by Windom, et al. (1989), Shropp, et al. (1990), and Fikslin (1993). These data were normalized by multiplying the metals values by the ratio of the average aluminum concentration in all reference stations over the aluminum concentration at the station being normalized. The rationale for this correction is based on a statistical evaluation of the data. Although these normalized data will be used in evaluating ecological risks, un-normalized metals data will be used in evaluating human health risks.

Statistical analysis of the grain size data (percent mud) and the sediment aluminum concentrations showed both were normally distributed and were significantly positively correlated (g = 0.84 and a = 0.05). The overall sediment/peat average aluminum concentration of 20,115 mg/kg is representative of the geochemical background level in the region. This number is consistent with local soil aluminum levels and compares with the mean level for the Eastern United States soils reported by Shacklette and Boerngen (1984).

The resulting normalized sediment metal levels are provided in Table 2-8. They are generally consistent with the concentrations found in "clean" local soils, but do reflect elevated levels of zinc that is indicative of ubiquitous enrichment in the local streams from upstream anthropogenic sources. Reference station sediment chemistry for metals and other analyte groups are discussed in the following paragraphs

<u>Metals:</u> The concentrations of TAL metals in sediments from the Christina River, White Clay Creek, and Hershey Run are within an order of magnitude of regional background soil levels published by Shacklette and Boerngen (1984) with the exception of zinc, which is known to be enriched from an upstream source.

There were a number of elevated values for TAL metals in Churchman's Marsh sediments. The appropriateness of Churchman's Marsh as a reference location for metals will be further examined as part of the Phase II RI.

VOCs: There were several detections of VOCs at a few stations. Tetrachloroethene was detected at very low levels (less than 0.04 mg/kg) in several sediment samples. Several sediment samples also had low-level detections of xylenes, toluene, ethylbenzene, acetone, and 2-butanone at concentrations less than 20 mg/kg, 0.3 mg/kg, 9 mg/kg, 2 mg/kg, and 1.5 mg/kg, respectively. A complete data evaluation will be presented as part of the Phase II RI.

SVOCs: The only detections of SVOCs in reference sediments involved various PAHs and two phthalate compounds (di-n-butylphthalate and bis(2-ethylhexyl)phthalate). These two phthalate compounds are the two most abundantly produced as industrial plasticizers, and are now known to be widely distributed in the environment. A multitude of human activities, especially those involving combustion, create PAH compounds in excess of those that would exist naturally. The detection of phthalates and PAHs in sediments at low levels (94% of the detections are less than 1 mg/kg, and 100% are less than 1.5 mg/kg) reflects urban and industrial background levels. This does not preclude the use of these sites as reference locations.

Pesticides/PCBs: Detections of DDD and/or DDE (degradation products of DDT) occurred in three sediment samples. There were six detections in the chlordane group (alpha-chlordane, gamma-chlordane, and heptachlor epoxide); and one detection of dieldrin. The persistence of these chlorinated pesticides allows for their continued detection and transport through the environment.

Aroclor 1260 was detected at very low levels (less than 10 mg/kg) in three samples. A complete evaluation of these data will be performed as part of the Phase II RI.

PCDDs/PCDFs: HpCDD (as total isomers) was detected twice at very low levels (less than 0.20 μg/g). The HpCDD isomer of primary concern (1,2,3,4,6,7,8-HpCDD) was not detected

in these sediment samples. OCDD was detected six times at concentrations less than 10 μg/g), and OCDF was detected twice at levels less than 0.5 μg/g.

3.0
IDENTIFICATION OF DATA REQUIREMENTS

The discussion of constituent distribution presented in Section 2.0 indicates that additional data need to be collected to complete the RA and FS for the Site. This section identifies the type of data necessary to meet the RI objectives identified in Section 1.2 and locations where these data should be collected. Section 3.1 presents an evaluation of the constituents that need to be analyzed. Sections 3.2 and 3.3 identify data requirements necessary to complete the ERA and HHE, respectively. Data requirements necessary to conduct the FS are presented in Section 3.4. A summary of Phase II data needs is presented in Section 3.5.

3.1 EVALUATION OF CONSTITUENTS

The Phase I analytical data were evaluated in conjunction with the Site Conceptual Model (presented in Section 1.0) in order to identify the constituents in Site media that may warrant additional sampling and analysis in the Phase II RI. One of the objectives of this Phase I data evaluation was to identify which analytes, in which environmental media, require additional data collection for ecological reasons. In addition, constituents will be added based on the human health conceptual exposure evaluation performed in Section 3.3 and the FS data evaluation performed in Section 3.4. While this data evaluation is similar to the process used to identify constituents of concern (COCs) for risk assessment, that was not its intended purpose. A comprehensive screening of all analytical data, consistent with existing EPA guidance will be performed as part of the HHE and the ERA.

The following procedure was used to identify which ecologically-related constituents require additional data collection:

1. Select analytes detected in at least one matrix sample above the detection limit.

2. Omit analytes that are likely laboratory contaminants.

3. Select analytes with a frequency of detection above the detection limit greater than five percent.

4. Select analytes exceeding concentrations at local geologic reference stations and/or published regional levels.

5. Select analytes exceeding ecological toxicity benchmarks, or promulgated criteria, or guidelines.

3.1.1 Soil

Two hundred and ten soil samples were collected following the procedures specified in the Phase I FSP (January 31, 1994) at the locations shown on Figure 2-2. The Phase I analytical data were evaluated in accordance with the procedure listed above for the identification of data requirements for the Phase II RI. A summary of this evaluation is presented below. Appendix A presents a statistical summary of the analytical results for soil.

3.1.1.1 Metals

A summary of the soil metals data evaluation to identify which constituents require more data collection is provided in Table 3-1. Based on the initial evaluation shown in Table 3-1, it appears that additional manganese and thallium data may be needed. However, based on the following weight of evidence, there are sufficient data for these metals in soil:

- Neither manganese nor thallium was a wood treatment constituent at the Site.

- The Thallium Toxic Dose Low (TDLo) value was adjusted downward by a safety factor of 100 to estimate a dietary no observed apparent effects level (NOAEL) value, while the manganese TDLo was adjusted downward by a safety factor of 100 and an additional uncertainty factor of 10 (total 1000) due to the paucity of manganese toxicity literature for wildlife. Hence, the wildlife toxicity benchmarks are highly conservative dietary values and equivalent dose rates would require direct soil consumption by wildlife.

- Manganese and thallium had a low frequency of occurrence at concentrations greater than these wildlife benchmarks of 6.2 and 6.6 percent, respectively.

- Neither manganese nor thallium is reported as bioaccumulative in plants or terrestrial food chains and is unlikely to pose a risk to higher trophic levels.

- Metals concentrations in upland soil areas are in the range of background concentrations, as discussed in Section 2.2.1 and shown on Table 2-4.

Based on these findings, the number of soil TAL metal measurements performed in Phase I (n = 210) are adequate to perform the ERA. Therefore, no additional soil metal analyses are necessary for the Phase II RI.

3.1.1.2 Volatile Organic Compounds (VOCs)

BTEX: Few BTEX compounds were detected in the soil samples. In general, total BTEX concentrations were below 1.0 mg/kg. Six locations had total BTEX which were detected above 1.0 mg/kg.

Other VOCs: Only seven locations had total VOCs, excluding BTEX, which were detected above 1.0 mg/kg.

Due to the volume of data collected (210 samples), the distribution of these samples across the Site, and the low levels of detections of VOCs, including BTEX, the available data are sufficient to perform the ERA. However, at EPA's request, additional VOC data will be collected in the former Process Area, K-Area and South Pond Area.

3.1.1.3 Semi-Volatile Organic Compounds (SVOCs)

The results of the soils data evaluation for SVOCs indicate the following PAHs and frequencies of occurrence (%):

Benz(a)anthracene (29)	Ideno(1,2,3-c,d)pyrene (22)
Benzo(a)pyrene (37)	Dibenz(a,h)anthracene (20)
Benzo(k)fluoranthene (11)	Phenanthrene (31)
Benzo(b)fluoranthene (27)	2-Methylnaphthalene (9)
Benzo(g,h,i)perylene (25)	Chrysene (6)

Although other Semi-Volatile Organic compounds were detected, the above listing identifies the constituents with the highest frequency of detection. Additional PAH data in soil are needed and additional soil sampling and analyses are identified for the Phase II RI. PCP was detected at a low frequency (11 out of 210 samples analyzed). However, at EPA's request, additional PCP data will be collected in the former Process Area, K-Area, and South Pond Area. A summary of the PAH compounds and the frequency of occurrence is presented in Table 3-2.

3.1.1.4 Pesticides/PCB

Pesticides/PCBs were not process-related constituents. The frequency of detection in soil samples was low (less than 5 percent). Pesticides were detected in the range of the detection limits. PCBs were not detected or were below 0.5 mg/kg in all soil samples. All concentration levels of the detected compounds were generally below the dietary wildlife benchmarks reported by Opreska et al. (1994). Based on this and the distribution of existing pesticides/PCB data at the Site, the available data on pesticides/PCB are adequate to perform the ERA and no additional soil analysis for these compounds are specified in the Phase II RI.

3.1.1.5 PCDDs/PCDFs

The analytical results from soil samples for PCDD/PCDF had detectable levels of the following compound groups:

- HpCDD/HpCDF
- OCDD/OCDF
- HxCDD/HxCDF

No TCDD/TCDF isomers were detected in the soil samples.

The detected compounds in the soil samples were multiplied by their respective 2,3,7,8-TCDD Toxicity Equivalency Factor (TEF) (USEPA, 1989c) and are presented in Table 2-3 and Appendix Figure A-25 to A-28.

The surface soil (0 to 0.5 feet) TE results were compared to the Agency for Toxic Substance and Disease Registry (ATSDR) surface soil guidelines of 1 µg/kg, while the subsurface soil TE results (greater than 0.5 feet) were compared to the ATSDR guideline for subsurface soils of 10 µg/kg. The comparison showed that 100 percent of all of the soil TE values were below 2 µg/kg, with 79 percent of the surface soil TE values below the surface soil guidelines of 1 µg/kg.

In addition:

- Although there is little background data for PCDD/PCDF concentrations in the literature, it is known that their distribution in the environmental has become ubiquitous due to activities which include thermal combustion and industrial processes. In addition, PCDDs/PCDFs may be formed by natural processes in the soil, sediment, and water by microbes acting on natural chlorophenols (Gribble, 1994).

- PCDD/PCDF data from site-specific reference areas showed detections of OCDD only in 13 out of 28 samples, including all 8 Bread and Cheese Island samples. Detections ranged up to 0.017 µg/kg, when expressed as the Toxicity Equivalent (TE) to 2,3,7,8-TCDD.

- Onsite soil TE values ranged from not-detected to a maximum of 1.67 µg/kg. There is a distinct pattern of decreasing concentration with increasing depth in the soil column. Sixty-six percent of the soil values were below 0.017 µg/kg, and 93 percent were less than 1.0 µg/kg. Maximum TE values occurred primarily near the former Process Area.

Based on the items discussed above in conjunction with the number (41 on-Site samples) and the distribution of data across the Site, the available data from Phase I sampling are adequate to perform the ERA. No additional soil sampling for PCDDs/PCDFs analyses are specified for the Phase II RI.

3.1.1.6 Soil Constituent Summary

Based on the soil data evaluation, additional PAH data need to be collected during the Phase II RI. At the request of EPA, additional VOC and PCP data will be collected in the former Process Area, K-Area, and South Pond Area.

3.1.2 Groundwater

The results from the first episode of Columbia and Potomac groundwater monitoring well samples, collected at the locations shown in Figure 2-5 and 2-6, were evaluated to identify data needs. Data from both unfiltered and filtered water samples were evaluated. The results are summarized on Site maps presented in Appendix A.

Upon completion of the Phase I RI program, there will be three complete rounds of groundwater data collected from the Site. These data provide a sufficient database to perform the ERA and HHE. However, as discussed in Section 4.4, additional monitoring wells will be installed during the Phase II RI to further define the extent of constituents present in the groundwater, and to provide data on upgradient groundwater quality relative to the Site. Additional TAL metals, TCL VOCs, TCL SVOC, TCL pesticides/PCBs and PCDD/PCDF data will be collected from wells on the Site during the Phase II RI as discussed in Section 4.4.

3.1.3 Surface Water

3.1.3.1 Evaluation Procedures

Phase I surface water quality data were primarily compared to USEPA AWQC (EPA, 1992b) to identify constituents requiring additional data collection. EPA criteria were used in this screening because they are equal to or more conservative than DNREC AWQC. Both EPA and DNREC AWQC will be used in the ERA.

For constituents without AWQC, published aquatic toxicity test results were obtained from the literature. No observed effects levels (NOEL) were developed to evaluate the data. The NOELs were derived by dividing the reported chronic or acute toxicity values by safety factors. Lowest observed effects levels (LOEL) were divided by a factor of ten, and acute effect levels (e.g., LC50) were divided by 100, to estimate the NOEL. Analytes without appropriate toxicity information were retained in the screening evaluation if they exceeded the detection limit.

The AWQC values for 5 metals (Cd, Cu, Pb, Ni, and Zn) were adjusted for Site-specific mean water hardness. For purposes of this evaluation, data from 45 locations sampled during the initial sampling event were used to calculate the mean water hardness. The hardness data ranged from 36 to 166 mg $CaCO_3$/L. The standard deviation was 26 mg$CaCO_3$/L and the data were normally distributed. Therefore, the arithmetic mean, 96.5 mg$CaCO_3$/L, was the best unbiased estimate of mean water hardness.

For purposes of this screening evaluation, the AWQC value for PCP was adjusted for Site-specific pH, based on a mean pH estimate derived from the mean hydrogen ion concentration in the water samples. Forty-four values were converted to H^+ concentrations and used to estimate mean pH. The pH values ranged from 6.32 to 8.40. The H^+ concentration values were normally distributed. Therefore, the arithmetic mean H^+ concentrations was expressed as the - log $[H^+]$ to estimate a mean pH of 7.0 for the surface water samples.

3.1.3.2 Analytical Results

There were no exceedances of the AWQCs/LOELs for VOCs, SVOCs, pesticides/PCBs and PCDDs/PCDFs in the initial and "first flush" surface water data. Hence, no additional surface water sampling for these analyte groups are needed in the Phase II RI.

There were exceedances of AWQCs for TAL metals in unfiltered initial surface water samples. The metals with high (> 5 percent) frequencies of exceedances among the 48 samples are as follows:

Aluminum (58%)	Copper (10%)	Mercury (6%)
Arsenic (12.5%)	Iron (44%)	Thallium (12.5%)
Manganese (4%)	Lead (31%)	Zinc (10%)

Filtration of the water samples reduced the concentrations and frequency of detection of metals. Aluminum, lead, mercury, and zinc were not detected at concentrations exceeding their respective AWQC values in the filtered water samples. Arsenic and manganese were only detected once. Thallium was detected twice at onsite stations, and once at the upstream reference station HR-0. Copper was detected at all upstream reference stations (RS-15, WH-1, and HR-0) and appears to be an ubiquitous constituent in White Clay Creek, Hershey Run and the Christina River.

The surface water analytical results from the 13 "first flush" samples had high frequencies of exceedances of the AWQCs for the following TAL metals in unfiltered water samples:

Aluminum (100%)	Iron (46%)
Cadmium (7%)	Lead (7%)
Chromium (7%)	Zinc (7%)

Aluminum, cadmium, chromium, and iron were not detected at concentrations exceeding their respective AWQC values in the filtered water samples. Lead and zinc in the filtered water samples were detected in excess of the AWQC value at one location (E-2).

Inspection of the "first flush" analytical data for unfiltered water samples collected at the major points of Site runoff (SP3, FP3, and EC8) shows that only aluminum exceeds the AWQC value. Filtration of these samples eliminated the aluminum exceedance of the AWQC value in the dissolved sample results.

Based on the following weight of evidence, TAL metals in surface water require no further data collection:

- There is no historical evidence of metal use at the Site.
- Metal exceedances of AWQC occur primarily in the tidal downgradient reaches of the drainageways and in White Clay Creek, Hershey Run, and the Christina River (i.e. away from potential Site source areas).
- There is a low frequency of occurrence of metal concentrations exceeding AWQC values in the worst-case Site runoff water ("first flush") samples.
- There is a low frequency of occurrence of metals elevated above Site-specific soil background data and local geologic reference levels in soil samples from the former Process Area and the Wood Storage Area.
- Metals were not identified for additional data collection for Site soils or sediment/peat samples.

Based on the items listed above in conjunction with the number (63 surface water samples) and distribution of data across the Site, surface water data collected in Phase I are adequate to perform the ERA.

3.1.3.3 Surface Water Constituent Summary

The available surface water data from the Phase I sampling are sufficient to perform the ERA. Limited additional analyses will be performed on surface water from the Fire Pond, South Ponds, and K-Area for input to the FS as part of Phase II.

3.1.4 Sediment/Peat

The sediment/peat analytical data were compared to decision criteria as specified in the Phase I WP to identify the presence and spatial distribution of any constituents requiring additional Phase II data collection. The decision criteria consist of local geochemical reference levels, Effects Range-Low (ER-L) and Medium (ER-M) Values (Long et al. 1995), and USEPA proposed Sediment Quality Criteria (SQC). Detection limits were used for constituents with no available decision criteria; analytes in excess of the detection limits were retained for further Phase II data collection, if their frequency of detection exceeded 5 percent.

3.1.4.1 Metals

Based on a low frequency of exceedance (less than 5 percent) of the local geologic reference level, no additional sediment/peat data are needed for the ERA for the following metals:

Aluminum	Iron	Sodium
Antimony	Manganese	Vanadium
Cobalt	Silver	

Regarding berillium and thallium, nearly every detection exceeded the values for northern Delaware (from Shacklette and Boerngen, 1984); since they are so low (<1 mg/kg for both beryllium and thallium). When the Site-specific reference sediments were used as a screening tool; however, the frequency of exceedance dropped below 5 percent (beryllium = 2.3 percent, thallium = 4.5 percent). In addition, for both elements, the 95 percent UCLs for the onsite sediment values were less than the 95 percent UCL values for the reference sediments.

Additional data are not needed for the following metals because they are either non-toxic or essential nutrients for normal growth and metabolism of biota:

Calcium	Magnesium
Potassium	Barium

Metals remaining at this stage of the evaluation were then compared to risk-based aquatic toxicity benchmarks. The metals were compared initially to the ER-M values reported by Long et al. (1995). The resulting metals and their frequency of exceedance of the ER-M values are as follows:

Cadmium 9/144 (6.2%)	Mercury 10/144 (6.9%)
Lead 6/144 (4.1%)	Nickel 1/144 (0.7%)
	Zinc 99/144 (69%)

The same group of metals was also compared to the ER-L values reported by Long et al. (1995). The metals and their frequency of exceedance of the ER-L values are as follows:

Arsenic 68/144 (47%)	Mercury 85/144 (59%)
Cadmium 83/144 (58%)	Nickel 97/144 (67%)
Copper 101/144 (70%)	Zinc 122/144 (85%)
Lead 103/144 (71.5%)	

A summary of these comparisons is provided in Tables 3-3 and 3-4. The results of this dual risk-based screening eliminated chromium, but selected the following metals for further consideration:

Arsenic	Mercury	Lead
Cadmium	Nickel	Selenium
Copper	Zinc	

However, based on the following weight of evidence, there are sufficient data to perform the ERA and additional sediment metals data are not needed:

- There is no historical evidence of use of these metals at the Site.

- The metal exceedances of the ER-L and ER-M values occur primarily in the tidal down gradient reaches of the drainageways and in White Clay Creek, Hershey Run and the Christina River. They appear to be related to offsite sources of metals that are transported and deposited in the Site marshes via river flow and daily tidal currents.

- There is a low frequency of occurrence of these metals elevated above the local geologic reference levels in soil samples from the former Process Area and the Wood Storage Area.

3.1.4.2 Volatile Organic Compounds (VOCs)

Eleven VOCs were detected above the detection limit in sediment/peat samples and were therefore, considered for additional Phase II data collection (Table 3-5). Of these, chloroform, methylene chloride, 2-butanone, and acetone were detected in samples and laboratory blanks at low concentrations, and benzene, chloromethanes and styrene were detected in less than or equal to 2 percent of the samples. Although sediment samples will not be analyzed for these parameters during the Phase II RI, they will be included in the data evaluation for the RA.

Ethylbenzene, toluene, tetrachloroethene, and xylene occurred at a frequency between 6 and 12 percent of the samples and were retained for further consideration. Sediment quality benchmark values or SQCs are not available for these compounds. Therefore, Site-specific sediment benchmarks were calculated according to the equilibrium partitioning techniques (EPA, 1991). The K_{ow} values were obtained from Hull and Suter (1993) and Montgomery and Welkom (1990). An average TOC of 5 percent from Site sediment samples was utilized in the calculations. The final chronic values (FCV) were derived from EPA AWQC-LOEL values that were adjusted downward (more conservatively) by a factor of 100 for acute LOEL values and a factor of 10 for chronic LOEL values.

The maximum concentrations in sediment/peat of these four VOCs were compared to the derived Site-specific benchmarks. The results are provided in Table 3-5. Because none of these four compounds exceeded the benchmarks, no further data collection is required.

Based on these findings in conjunction with the number and distribution of data across the Site, the available data from the Phase I sampling are sufficient to perform the ERA and additional sediment analyses during the Phase II RI for VOCs is not needed.

3.1.4.3 Semi-Volatile Organic Compounds (SVOCs)

Among the complete list of analytes, seventeen PAH compounds were detected at concentrations exceeding their detection limits and at a frequency of detection exceeding 5 percent. These compounds were selected for additional data collection during the Phase II RI while the remaining SVOC compounds were removed from further consideration for Phase II data collection.

The maximum concentrations of the PAHs detected were compared to benthic biota toxicity benchmarks as screening criteria. The concentrations of acenaphthene, phenanthrene, and fluoranthene were compared to EPA Proposed SQC (EPA, 1991) that were adjusted for the mean concentration of TOC in the peat and the sediment samples. The other remaining PAHs were compared to the ER-L and ER-M values (Long et al, 1995).

The results of this comparison showed that PAH compounds were present at concentrations exceeding the toxicity benchmarks (Table 3-6). Further sediment sampling and analysis for PAHs is planned to delineate the nature and extent of these compounds. The rationale and design of this effort is provided in Section 4.0.

3.1.4.4 Pesticides/PCBs

Pesticides and PCBs were infrequently detected above the decision criteria in sediment/peat samples from the Site. None of the detected compounds had a frequency of occurrence greater than 5 percent and therefore, no additional pesticide/PCB analysis is necessary. The available data are sufficient to perform the ERA.

3.1.4.5 PCDDs/PCDFs

No TCDD/TCDF were detected in sediment/peat. The detected isomers were converted to TE values and the results are provided in Table 3-7. The results were compared to the ATSDR value of 1 µg/kg. The comparison showed that 97 percent of the results are below 1 µg/kg and the majority of the results are in the natural background range of about 0.010 µg/kg TE. Therefore, no additional PCDD/PCDF analyses are proposed for Phase II.

3.1.4.6 Sediment/Peat Constituent Summary

In summary, the sediment/peat data evaluation in conjunction with the number (145 for VOCs, SVOCs, and metals; 31 for PCDDs/PCDFs and pesticides/PCBs) and distribution of data across the Site, indicated that no additional data collection for TAL metals, pesticides/PCBs, TCL VOCs, and PCDDs/PCDFs are needed. The Phase II RI will focus on PAH compounds for sediment and peat.

3.2 ECOLOGICAL CONCEPTUAL MODEL

The rationale for additional field investigations at the Site focuses primarily on acquisition of the data to perform the ERA. The DQO process (EPA, 1993) was employed in conjunction with current and pending guidance for performance of ERAs to develop the objectives and design the sampling to be performed during the Phase II RI. Data needs for the Phase II RI focus on areas where higher concentrations of PAHs exist. Areas identified for further investigation are shown in Figure 3-1.

The Phase I RI identified ecological resources at the Site that may be exposed to Site-related constituents. The results of the Phase I data evaluation identified soil as the primary exposure medium in terrestrial habitats and sediment/peat as the primary exposure medium the aquatic habitats. Biota in both terrestrial and aquatic habitats may directly contact concentrations of constituents in these exposure media and/or they may be exposed via consumption of prey species that have accumulated constituents from the food chain. These opportunities for contact with constituents present potential ecological exposure pathways for the Site.

3.2.1 Assessment Endpoints

Based on the ecological reconnaissance and field observations performed during the Phase I RI by Ecological Society of America (ESA) certified ecologists, specific groups of biota were identified as the critical receptors that may potentially be exposed to constituents. Preliminary assessment endpoints were identified for these receptors and are listed below as explicit expressions of the ecological resource that will be considered in the ERA. The final selection of assessment endpoints will be performed as part of the ERA.

Aquatic Community Assessment Endpoints:

- Protect benthic community structure.
- Protect water fowl from direct toxicity and chronic effects of constituent exposure.
- Protect fish from direct toxicity and chronic effects of constituent exposure.

Terrestrial Community Assessment Endpoints:

- Protect soil invertebrates, ground-feeding song birds, herpetiles and small mammals from direct toxicity and chronic effects of constituent exposure.
- Protect carnivorous mammals and raptorial birds, such as the red fox and American kestrel from direct toxicity and chronic effects of constituent exposure.

Coupling of the Phase I data evaluation results with the exposure pathways evaluation and the identified assessment endpoints provided the information for development of the Ecological Conceptual Site Model (ECSM, Figure 3-2). The ECSM provides the basis for the identification and selection of the appropriate measurement endpoints that will be used to characterize the potential risks to the receptor biota. Comparison of the available data with data requirements to address the assessment and measurement endpoints showed that there are data gaps associated with location and size of exposure areas, toxicity levels, and bioaccumulation potential. While

some data gaps (e.g., constituent extent) can be addressed in the Phase II effort, others will be addressed after evaluation of Phase II data.

3.2.2 Measurement Endpoints

The Phase II RI approach is designed to fill the following data gaps to address the measurement endpoints. The following aquatic and terrestrial measurement endpoints are expressed as testable hypotheses:

Aquatic Community Measurement Endpoints:

- There is no significant difference in the tissue concentrations of constituents in fish sample collected at on-Site and at reference areas.
- There is no qualitative difference in the fish community on-Site and at reference areas.
- In some portions of the Site, marsh sediment accumulation has produced a "clean" surficial layer of peat since operations at the Site ceased, that limits the exposure of biota to NAPL in deeper marsh peats.

Terrestrial Community Measurement Endpoints:

- There is no qualitative difference in the community structure or relative abundance of soil invertebrates, birds, herptiles and mammals between onsite and reference areas with the same habitat type.
- On-site soil constituent concentrations do not exceed toxicity-based wildlife benchmark values.
- Modeled bioaccumulation levels of constituents in prey species do not exceed dietary NOAEL values for wildlife.

- Concentrations of constituents in sediment/peat from the Site do not exceed sediment quality benchmarks and/or EPA's Proposed SQCs.

- The toxic effects of Site-related sediment/peat samples in bioassay tests are not significantly different from results obtained in reference area samples.

While some of the measurement endpoints listed above will be addressed in the Phase II RI, others associated with more sophisticated ecological testing will be deferred to Phase III. The increased data base contributed by the Phase II RI will provide a better understanding of the Site and the migration pathways, allowing a more effective selection of sampling locations for ecological testing for Phase III. The following measurement endpoints will be considered for data collection as part of Phase III, if warranted, based on evaluation of Phase I and Phase II data:

- There is no significant difference in the benthic macroinvertebrate community structure variables measured onsite and those obtained from reference areas.

- There is no significant difference in the level of bioaccumulation of constituents in a benthic macroinvertebrate species exposed to onsite sediment/peat and that obtained from reference areas.

- There is no significant difference in small mammal tissue constituent levels on-Site and off-Site.

Statistical tests will be performed to test Phase II and Phase III hypotheses. Analysis of variance (ANOVA and F-Tests; $\alpha = 0.05$), Students T-Test ($\alpha = 0.05$), and Duncan's Multiple Range Test ($\alpha = 0.05$) will likely be utilized to test for significant differences between onsite and reference area results. Other appropriate statistical tests will be considered if they add to the understanding of the data. This approach will ensure that the effort is focused on issues representing the greatest potential risk.

3.2.3 Ecological Investigation Tasks

The following tasks correspond to the aquatic community measurement endpoints for Phase II:

- Perform fish tissue analysis for constituents on samples from drainageways receiving Site-related input, and at a reference location with comparable habitat.

- Perform reconnaissance-level fish survey in drainageways and at a reference location with comparable habitat.

- Perform isotope dating (Cs^{137} and Pb^{210}) to estimate sedimentation rates and age structure stability of marsh peat.

The following tasks correspond to the terrestrial community measurement endpoints which will be addressed in Phase II:

- Perform semi-quantitative wildlife and soil macroinvertebrate surveys in upland habitats on Site and at reference locations.

- Perform additional soil PAH analyses in surface soil (0 to 0.5 feet) to document nature and extent of exposure areas on Site.

- Conduct a literature search for toxicity data and develop benchmark dietary NOAEL values for key receptor species.

- Develop food chain models for both terrestrial and aquatic feeding wildlife species and perform bioaccumulation modeling of constituents in prey species for comparison to dietary NOAELs.

Additional tasks that will be considered to address measurement endpoints as part of the Phase III effort include the following:

- Toxicity testing for sediment/peat and additional sediment/peat analyses to document nature and extent of exceedances of toxicity benchmarks for invertebrates.

- Additional benthic macroinvertebrate analyses on samples from drainageways and at reference locations with comparable habitat.

- Bioaccumulation testing for sediment/peat.

3.3 HUMAN HEALTH CONCEPTUAL MODEL

The potential exists for human exposure to Site constituents through a variety of potential activities. Based on the current understanding of the Site and the surrounding areas, three receptor groups are likely to be addressed in the HHE, based on potential exposure pathways. There are no plans to sell or develop the Site and, therefore, the future use of the Site is anticipated to remain unchanged. Regarding potential human exposure pathways to constituents in groundwater, it is anticipated that they will be eliminated by the installation of a water supply line on old Airport during the fall of 1995. The potential receptor groups and exposure pathways are illustrated in a Human Health Conceptual Exposure Model, presented on Figure 3-3. The current receptors and pathways are:

- Potential upland trespassers
  - Ingestion of surface soil
  - Dermal contact with soil

- Potential upland workers
  - Ingestion of surface soil
  - Dermal contact with soil

- *Potential recreational receptors*
  - Incidental ingestion of surface water
  - Dermal contact with surface water
  - Incidental ingestion of exposed sediments
  - Dermal contact with exposed sediments
  - Ingestion of aquatic biota
  - Ingestion of water fowl and other animals targeted in sports hunting

The availability of data to adequately address these potential exposure pathways, as well as groundwater as a potential exposure pathway, is considered in this section.

3.3.1 Assessment Endpoints

The assessment endpoints to be considered in the HHE are anticipated to be the conventional endpoints typically addressed: potentially carcinogenic and non-carcinogenic (systemic toxicity) effects. The risk assessment methodology used to assess these endpoints requires input in three forms:

- Adequate constituent characterization of the Site to enable estimation of exposure point concentrations

- Plausible exposure descriptors

- Description of the potential toxicity of constituents at the Site

The first factor, adequate Site characterization, is the primary factor that will influence the scope of the Phase II sampling, and is discussed in more detail in a subsequent section. The second factor, exposure descriptors, can be obtained from readily available EPA sources, as well as supplemented/modified by Site-specific information on land and water use, seasonal characteristics, etc. No additional Site sampling activities are needed to provide information for this factor. The third factor, description of the potential toxicity of constituents at the Site, is also obtained from

EPA sources or the scientific literature. No additional Site sampling activities are needed to provide information for this factor.

3.3.2 Data Sufficiency Evaluation

The data objectives or needs for the HHE are as follows:

- Characterization of potentially contacted media.
- A number of acceptable analyses sufficient to support the desired degree of effectiveness and confidence for the risk assessment.
- Quantitation limits that are adequately sensitive to detect levels of potential concern.
- Data of acceptable quality.
- Data that adequately describe the lateral and vertical extent of constituents at the Site.

The available data from the Phase I RI were examined to identify additional data needs that will be addressed in the Phase II sampling. These are discussed below.

In some areas of the Site, boundaries of weathered NAPL and DNAPL "hotspots" in the subsurface have not been delineated. Consequently, a data need of the Phase II sampling is to further define the boundaries of these areas.

The following data needs have been targeted in Phase II activities to evaluate whether exposure to groundwater is an exposure pathway of consequence for the HHE:

- Whether constituents are migrating in the Columbia Formation aquifer from the former Process Area to Hershey Run and the West Central Drainageway.
- Whether constituents are migrating in the Potomac Formation.

- Whether constituents are present in the Columbia Formation immediately downgradient from the South Ponds Area.

- Whether VOCs found in the background well and the former Process Area wells are migrating onto the Site from the area upgradient of the Site.

Exposure to Site constituents that have bioaccumulated in commonly consumed fish, waterfowl, and terrestrial game is a potential occurrence for some recreational users of the waterways surrounding the Site. Consequently, exposure point concentrations of fish species, consumed by humans, which are resident near the Site are a key data requirement for Phase II.

3.4 FEASIBILITY STUDY DATA NEEDS

Based on the results of the Phase I RI, additional Site characterization during Phase II requires obtaining the following information to refine the understanding of the Site and better evaluate remedial alternatives during the FS:

- Better delineation of NAPL areas and the three-dimensional concentration gradient of constituents around these areas. Data to develop estimates of the quantities of weathered and subsurface NAPLs in the former Process Area, Drip Track Area, Fire Pond, South Ponds, K-Area, and the marshes and drainageways are needed.

- Characterization of physical and chemical characteristics of the media to evaluate the feasibility of remediation. Specifically, additional analyses of PAHs are needed in weathered NAPL in surface soils and NAPL in the marshes and drainageways, and analyses of PCDDs/PCDFs and TAL metals in DNAPL plus general physical and chemical lab analyses of the NAPL to evaluate potential remedial technologies. A bail-down test of DNAPL in a monitoring well will provide direct data regarding its flow capacity.

- Additional borings are needed to evaluate the geometry of the Columbia Formation aquifer to verify the potential for natural containment of the DNAPL found in the former Process

Area. Hydrogeologic characteristics of the Columbia and Potomac aquifers as well as the range of influence that tidal fluctuation has on groundwater flow in the Site aquifers. Also, the potential buried drain pipe and underground storage tanks need to be verified and characterized.

- Further evaluation of background surface water quality is needed to perform the FS.

This information is necessary to evaluate remedial technologies and develop potential remedial action alternatives for the FS.

3.5 SUMMARY OF PHASE II RI DATA NEEDS

As discussed in Section 1.2, the objectives of the RI are to collect data sufficient to characterize the nature and extent of constituents at the Site to perform the FS and RA. The discussion on the distribution of constituents in Section 2 and the evaluations of data to perform the ERA, HHE, and FS presented in Section 3 indicate that additional data are needed. The data needs including Site areas, media, and constituents, are summarized below.

- Horizontal and vertical delineation of NAPL in the former Process Area, Wood Storage Area, Drip Track area, Fire Pond, South Ponds, K-Area, near boring SB616, West Central Marsh and drainageway, East Central Marsh and drainageway (at the head of the drainageway), and Hershey Run (upstream from HR3). In addition, characterization of DNAPL for TAL metals and PCDDs/PCDFs.

- Determine whether recoverable DNAPL is present.

- PAH concentration gradient around the surficial NAPL areas to 100 mg/kg in soil and to 10 mg/kg in sediment/peat.

- Further evaluation of potential migration pathways from the former Process Area, and of background groundwater quality upgradient of the Site.

- Hydrogeologic characteristics of the Columbia and Potomac aquifers and the geometry of the Columbia Formation aquifer.

- Range of influence of tidal fluctuations on groundwater.

- Further evaluation of background surface water quality in the area of the Site.

- Analysis of whole body and fillet fish tissue.

- Verification of a potential buried drain pipe and underground storage tanks.

There are sufficient soil and sediment/peat quality data distributed across the Site for metals, VOCs, PCP, pesticides/PCBs, PCDDs/PCDFs, PAHs at concentrations below 100 mg/kg in soil and below 10 mg/kg in sediment/peat to perform the RA and FS. However, at EPA's request, additional PCP and VOC data will be collected in soil from the former Process Area, K-area, and South Ponds in conjunction with the NAPL delineation program.

There are sufficient surface water data throughout the Site, and sufficient sediment/peat data in the East Marsh and drainageway, East Central Marsh and drainageways downstream from EC4, the Central Marsh and drainageway, Christina River, White Clay Creek upstream from WC7, and Hershey Run Marsh and drainageway downstream from HR4 to perform the RA and FS.

There are sufficient data regarding groundwater at Phase I RI monitoring well locations to perform the RA and FS. However, groundwater quality data will be collected from these wells along with the new Phase II wells during the Phase II RI to provide complete data sets.

After the Phase II RI, all data will be evaluated to identify if and where additional ecological sampling and analyses may be required. Ecological parameters that will be considered include toxicity testing, bioaccumulation testing, histopathological analyses, and small mammal tissue analyses. These data will be used to assess potential ecological effects and provide Site-specific toxicological data for the ERA.

Although the preliminary data evaluation presented in Section 3 was similar to a screening level ERA, the intent was to identify data gaps to focus the Phase II RI. During the RA and FS, all data, for all media, and for all areas of the Site will be evaluated.

4.0
PHASE II SCOPE OF WORK

In planning the scope of the Phase II RI, data quality objectives (DQOs) for the ERA, HHE, and FS were considered in accordance with the DQO process (USEPA, 1993) and in conjunction with current and pending guidance on performance of ERAs and HHEs. The Phase II RI will be performed to address the assessment and measurement endpoints identified in Sections 3.2, 3.3, and 3.4, and the data needs identified in Section 3.5.

Based on evaluation of the Phase I data, the primary media requiring further evaluation during the Phase II RI at the Site are soil and sediment. For soil and sediment, the primary constituents requiring further evaluation are PAHs. There is sufficient data available for other constituents and other media to perform the RA. All data will be considered in the RA.

Elevated concentrations of PAHs appear to be limited to areas where NAPL (surface and subsurface weathered NAPL, residual NAPL, and free-product NAPL) has been identified; concentrations of PAHs decline quickly with increasing distance away from these areas. Constituents, such as BTEX and PCP, are associated with locations with elevated concentrations of PAH compounds. Other constituents for which additional data will be collected during the Phase II RI, such as VOCs (other than BTEX), do not appear to have a distribution pattern associated with them. Soil and sediment data collection for the Phase II RI will focus primarily on delineating those areas where NAPL has been observed at the surface and subsurface.

Surface water data will be collected from the Fire Pond, K-Area, and the South Ponds for FS-related objectives during Phase II; otherwise, surface water data collected from the surface water bodies during the Phase I RI are considered sufficient to meet the needs of the RA and FS.

In addition, data will be collected from the Columbia and Potomac Formations. Additional wells will be installed to provide data on groundwater quality in areas immediately downgradient to the former Process Area and the South Pond Area, and to provide data on upgradient groundwater

quality. Aquifer characteristics will be evaluated to determine hydraulic conductivities and the effect of tidal fluctuations on groundwater gradients.

Finally, the possible presence of underground storage tanks (USTs) onsite will be verified, and their contents identified. The field sampling associated with these data requirements are described in this section, and summarized in Tables 4-1, 4-2, and 4-3.

4.1 SOIL

4.1.1 Soil Investigation

The surface soil investigation will focus on delineation of the vertical and horizontal extent of surficial weathered NAPL. The first step in delineation of these areas will be reconnaissance of the upland soils area to identify as many of the surficial weathered NAPL areas as possible. During the reconnaissance each area will be flagged and its approximate size noted. Weathered NAPL areas will be placed into two groups for the Phase II RI, those larger than 50 feet in length and those with lengths less than 50 feet. Areas having lengths greater than 50 feet will be evaluated with field screening and laboratory analyses to characterize the gradient of PAH concentrations beyond the area of visual NAPL.

The rationale for separating surficial NAPL areas for delineation is to focus the delineation of areas using analytical methods on larger areas. A 50-foot area is sufficient for the delineation of surficial NAPL areas because, with the 100-foot triangular grid spacing (discussed below), it allows a 95 percent chance of detecting a 50-foot radius "hot spot." Delineation data collected from the larger areas will be utilized to make assumptions about the concentration gradient around the smaller areas. This approach is sufficient to provide information to evaluate potential remedial alternatives in the FS and to delineate potential exposure areas for the RA.

Immunoassay sample field screening will be used to determine the approximate concentration of total PAHs at a certain distance from the visible NAPL. Soil samples will then be collected for laboratory analyses. The approximate number of samples for field screening and laboratory analysis was estimated for scheduling and budgeting purposes; the sampling program is dynamic and may actually result in more or less samples for analysis than indicated in this Phase II RI SOW.

The purpose of investigating these areas is to determine the extent of the areas for RA (ERA and HHE), evaluate the volume of each area for the FS, provide information on fill thickness, and to determine the composition of the soils and material in each area for the FS. Investigation of these areas is discussed in further detail below.

Weathered NAPL Areas Greater Than 50 Feet in Length: For scheduling purposes, it is estimated that five weathered NAPL areas will have lengths greater than 50 feet, and that the material in each of them will encompass the different types of weathered NAPL at the Site. Chemical evaluation of the soil in these areas will provide data for other weathered NAPL areas at the Site. Data collection in these areas will focus on both the horizontal and the vertical extent of PAHs. Several samples will be collected in both directions with the goal of determining the PAH concentration gradient leading from these areas. As such, the data collected will be primarily qualitative, based on field observations, with confirmatory analyses utilizing formalized analytical methodologies, including CLP analytical protocol. Laboratory analyses will include TCL SVOCs using CLP (to provide data for PAHs and for phenolics such as pentachlorophenol), as well as TCL VOCs using CLP to provide some additional data for BTEX and other VOCs. In addition, two samples will be collected from the weathered NAPL material and analyzed for physical properties and chemical content to provide additional data (to that collected during Phase I) to support the FS. The scope of the data collection in these areas is as follows:

Visual Identification and Mapping:

- Perform reconnaissance of the Site and document the location of the surficial weathered NAPL by referencing 3 points at the visible boundary of each area using the GPS surveying methods presented in the Phase I WP.

- Map areas (estimated to be 5) of weathered NAPL and identify locations for the collection of analytical samples.

- Establish a 100-foot triangular grid spacing across the weathered NAPL area. The grid will be extended beyond the visible weathered NAPL boundary and adjusted to include as many Phase I soil borings as possible as node points within the grid.

Evaluation of Horizontal PAH Concentration Gradient:

- Collect soil samples utilizing hand augers from the 0 to 0.5-foot depth at the first set of grid nodes outside, but closest to, the visible boundary of the weathered NAPL, and screen these samples using visual, olfactory, and organic vapor analysis (according to Project Technical Guidance (PTG) No. 5 presented in the FSP, using an Organic Vapor Analyzer (OVA) with a flame ionization detector (FID) and/or photo-ionization detector (PID)). These field screening tools were shown to correlate well with PAH analyses performed during the Phase I RI (see Table 4-4).

- For locations where PAHs are not identified based on visual, olfactory, and organic vapor analysis, screen selected samples from each area for total PAHs using the immunoassay method (Ensys PAH RIS^{C}; EPA Draft Method 4035) set for a threshold sensitivity of 100/10 mg/kg. The 100 mg/kg concentration was selected as the delineation boundary for total PAHs in soil because it is a reasonable level to delineate the relatively higher concentrations of PAHs associated with the surficial NAPL areas from the relatively lower concentrations of PAHs generally found across the surface of the Site (typically in the 10s of mg/kg). (See Section 2.2.1 regarding the distribution of PAHs in soil.) The immunoassay analytical method is described in PTG No. 17 in Appendix B.

  - If the PAH RIS^{C} samples are less than 100 mg/kg, then one of the locations will be selected for laboratory analysis of TCL SVOCs using CLP.

  - If the first immunoassay sample exceeds the 100 mg/kg threshold, another sample will be collected half the distance from the original node to the next node out from the center of the area.

- If the second immunoassay sample also exceeds the 100 mg/kg threshold, then a sample will be collected from the nearest grid node to that location outward from the center of the area, and analyzed for TCL SVOCs using CLP. Some of these locations will include TCL VOC analysis using CLP in order to provide some additional data for BTEX and other VOCs.

For budgeting and scheduling purposes, it is estimated that 33 surface soil samples will be collected for immunoassay analysis and 22 surface soil samples will be collected for confirmatory TCL SVOC analysis using CLP. A minimum of 10 percent of the immunoassay samples will have confirmatory analyses performed by a laboratory; the number of confirmatory samples may be greater if every immunoassay sample location has a corresponding laboratory sample. Table 4-1 provides a summary of the estimated number of samples and the areas where sampling is anticipated.

Evaluation of Vertical PAH Concentration Gradient:

- Four soil borings will be completed within the weathered NAPL to determine its thickness. Soil samples will be collected for analysis from a depth below the visibly identified weathered NAPL (based on field observations including visual, olfactory, and organic vapor analysis) and analyzed for total PAHs utilizing immunoassay testing (ENSYS PAH RIS^{C}; EPA Draft Method 4035) with a threshold sensitivity of 100/10 mg/kg.

- If the samples exceed the 100 mg/kg immunoassay threshold, a second sample will be collected from 2 feet below one of the locations where the result was greater than 100 mg/kg and analyzed for TCL SVOCs using CLP. Some of these locations will include TCL VOC analysis using CLP in order to provide additional data for BTEX and other VOCs.

It is estimated that a total of 22 subsurface soil samples will be collected for confirmation of immunoassay concentrations of less than 100 mg/kg and analyzed for SVOCs using CLP protocol to define the vertical boundary. Table 4-1 presents the frequency of soil samples anticipated to be collected from these borings for each of the areas selected for evaluation

during the Phase II RI. Borings will be advanced using a geoprobe to the top of the Potomac Formation to provide additional stratigraphic information such as the top of the Potomac Formation unless DNAPL is encountered. At locations that contain residual or free product NAPL, soil borings will be terminated upon reaching the base of the NAPL at locations where it does not extend to the base of the Columbia Formation. Alternatively, where the NAPL extends to the top of the Potomac Formation (i.e., the base of the Columbia Formation), the soil boring will be terminated upon identification of the top of the Potomac. This approach will be used to reduce the potential for creating a pathway for downward migration of NAPL.

Physical and Chemical Characterization of Weathered NAPL: The following analyses will be performed on weathered NAPL samples collected from two of the areas to provide additional data for the FS:

- SVOCs using CLP
- RCRA Characteristics: Ingitability, Corrosivity, Reactivity
- Percent Organics
- Heating Value
- Organic Phosphorus
- Total Organic Carbon (TOC)
- Flash Point
- Cations / Anions
- Oil and Grease
- Redox Potential

Analytical methods for the parameters listed above are presented in Table 4-3.

Areas of Less than 50 feet Length Containing Weathered NAPL: The following scope of work will be performed for the NAPL areas with a length of less than or equal to 50 feet:

- Perform reconnaissance of the Site and document the location of the surficial weathered NAPL by referencing 3 points at the visible boundary of each area using the GPS surveying methods presented in the Phase I WP.

- Collect soil samples from one location using hand augers within the center of the weathered NAPL to determine its thickness. Delineation will be based on field observation (visual, olfactory, and organic vapor analysis). No immunoassay or analytical samples will be collected to define the size of these areas.

4.1.2 DNAPL Investigation

The vertical and horizontal extent of DNAPL identified during Phase I will be further evaluated to define the boundaries of the free-product DNAPL zone in the groundwater, as well as the unsaturated soil column. The objectives of this program are to:

- Determine the extent of the DNAPLs.

- Evaluate the surface of the Potomac Formation to verify whether a topographic basin at the contact with the Columbia Formation underlying the Process Area, as interpreted based on Phase I data, may be preventing migration of the DNAPL in the Columbia Formation.

- Provide information on fill thickness at the Site.

The extent of DNAPL will be visually delineated by advancing soil borings with a geoprobe at the locations shown on Figure 4-1. These areas include:

- Fire Pond
- Former Process Area
- Drip Tracks
- Wood Storage Area
- South Ponds
- Area around soil boring SB-616 (for residual NAPL)

Selection of these areas was based on the presence of DNAPL (or residual NAPL at boring SB-616) identified in the Phase I soil and groundwater RI.

In the areas listed above, a 100-foot triangular grid (approximately 115 grid locations) will be established to provide data on the extent of the DNAPL as shown on Figure 4-1 and to gather additional data points for the top of the Potomac Formation to establish the geometry of the basin present under the former Process Area. At the proposed boring locations, soils above and below the watertable will be evaluated for the presence/absence of DNAPL by visual and olfactory observations and organic vapor analysis. These field screening tools were shown to correlate well with PAH analyses performed during the Phase I RI (see Table 4-4). Lithologic logs will be completed for each of the borings to define the hydrogeologic conditions which exist. Soil borings will be completed to the top of the Potomac Formation except where DNAPL is present. For locations that contain residual or free product NAPL, soil borings will be terminated upon reaching the base of the NAPL at locations where it does not extend to the base of the Columbia Formation, or upon identification of the Potomac Formation where the NAPL extends to the top of the Potomac Formation (the base of the Columbia Formation).

The borings will be advanced using the Geoprobe system. The Geoprobe boring system allows for the sampling of soils with limited soil cuttings being generated during the investigation. No analytical or immunoassay samples are planned for these locations because the purpose of the program is to determine the extent of the gross NAPL presence for the FS. The field screening program is sufficient to meet this goal. If gravel layers within the Columbia Formation prevent Geoprobe advancement to the desired depth, standard drilling equipment will be used to complete the boring. Certain nodes of the grid system may be by-passed during the drilling program if the area of DNAPL is found to be extensive. However, the sampling grid will be extended as necessary to delineate the bounds of subsurface DNAPL.

To evaluate the vertical permeability of the top of Potomac Formation, an attempt will be made to collect four undisturbed samples with Shelby Tubes from sandy locations at or near the top of (but within) the Potomac Formation. These samples will be collected from borings advanced outside of areas containing DNAPL to limit the potential for creating a downward migration pathway. The samples will be analyzed for vertical permeability and grain-size.

In addition, six additional soil borings will be advanced to the top of the Potomac Formation using a Geoprobe to collect additional data on the top of the Potomac Formation for evaluation of the basin below the former Process Area (Figure 4-1). These borings will be placed solely for the purpose of logging stratigraphy; no analytical samples will be collected.

4.1.3 Drainage Pipe Investigation

The objective of this investigation is to evaluate the presence/absence of a possible buried drain pipe connected to an existing drainage pipe near the South Pond as shown on Figure 4-1. Due to the presence of NAPL found at the southern outfall of the T-shaped drain pipe, the presence of a drain pipe connecting the "T" under the Wood Storage Area is suspected. This could represent a possible NAPL migration pathway to the marsh areas. The investigation will proceed from the area south of the known pipe to the north using the following procedure:

- An initial excavation will occur in the area of the known pipe using a hand shovel (Figure 4-1). If no pipe connection is found, the investigation will be terminated. If a pipe junction is located, the investigation will proceed to trace the pipe location using a combination of hand probes ("T" Bar) and/or shallow soil excavations using a backhoe to push aside the soil, whichever is most effective and efficient. Upon completion of this task, the soil will be pushed back into any depressions caused by pushing the soil.

- Investigation of the drain pipe will proceed at 100 feet increments along its length from its junction with the "T" shaped drain pipe.

- During the investigation, the soil will be evaluated for the presence of NAPL using visual, olfactory, and organic vapor observations.

4.2 SURFACE WATER

Surface water sampling in the Fire Pond, K-Area, and South Ponds will be performed to provide information for use in the FS. A total of four samples (one in Fire Pond, one in K-Area, and one in

each of the two South Ponds) will be analyzed for hardness, BOD, COD, cations (Na, K, Ca, and Mg) and anions (Cl, SO_4, SiO_3, NO_3, F).

4.3 MARSHES AND DRAINAGEWAYS

Based on the measurement endpoints identified in Section 3.2.2, specific data will be needed to perform the ERA. Because available data from the Phase I RI are not sufficient to evaluate the extent of the ecological exposure at the Site, these data requirements will be addressed in the Phase II RI. Since the selection of locations for site-specific bioaccumulation, toxicity, or other ecological effects, testing can be more effectively made after the contribution of Phase II RI data to the database, these endpoints have been deferred until Phase III. Upon completion of the Phase II RI, a Phase III RI SOW will be prepared and submitted to EPA, focusing on these endpoints.

The two-step Phase II RI effort is designed to acquire the data necessary to define the extent of PAHs in sediments of the marshes, drainageways, and on-Site ponds. In step one, a field survey will be conducted to document the spatial extent of the exposure area. In step two, the survey information will be used to optimize the selection of sediment sampling locations to submit for PAH analysis and core dating. The scope and approach for each step is detailed below. Figure 4-2 provides a schematic diagram of the scope of this two step sampling program.

4.3.1 Step I: NAPL Distribution Screening

A sampling grid will be started at the probable points of Site-related constituent input to the marshes and/or drainageways. These points include former discharge points from Fire Pond, Hershey Run, South Ponds, and in the West Central Drainageway. The head of the East Central Drainageway will also be sampled (see Figure 2-1 for location). At these points, a 100-foot triangular grid spacing will be established in the marshes and a 200-foot linear spacing will be established along the centerline going downstream in the drainageways. The actual extent of this grid spacing will depend on the distribution of NAPL in the marshes and drainageways.

At each grid node and drainageway sampling point, sediment/peat hand coring will be performed to document the occurrence and depth distribution of NAPL by visual, olfactory, and organic vapor techniques. Coring will be performed to the interface between the sediment/peat and the top of the

Columbia Formation. The thickness and depth of the NAPL layer will be recorded. In the drainageways, the cross-sectional distribution of NAPL will be documented at regular intervals across the channel. The marsh grid spacing and drainageway linear spacing will be extended downgradient as necessary to evaluate the extent of the NAPL area. No samples will be collected for laboratory analyses during this initial field survey step.

At the downgradient terminus of the NAPL, new points will be selected in the sediment/peat where NAPL is not detectable (based on visual observations) at points closest to each 100-foot grid node where NAPL was identified. Based on field observations and the Phase I data, these new points will likely correspond to a total PAH level of about 100 mg/kg. Each new point will be staked and flagged at about 100 feet intervals and the locations will be established by GPS surveying. The GPS data will be used to map a downgradient line showing the extent of the NAPL area at the Site.

4.3.2 Step II: Sediment/Peat Sampling

In Step II, the downgradient extent of the NAPL area (identified in Step I) represents the starting points for the sampling and PAH analysis as follows:

1. Initially, sediment/peat samples from the 0 to 0.5 foot depth interval will be collected at six points along the NAPL contour line in Hershey Run Marsh and six in West Central Marsh, and at three points in East Central Marsh. One drainageway point will be selected in each area. An estimated 18 points will be sampled.

2. These samples will be returned to the field laboratory and tested for total PAHs using the PAH RIS^{C} immunoassay test (EPA Draft Method 4035) at a threshold sensitivity of 100/10 mg/kg. The methods are described in PTG No. 17 in Appendix B. One marsh and one drainageway location with a total PAH concentration between 100 mg/kg and 10 mg/kg will be identified (6 estimated locations).

3. Samples from locations with total PAH concentrations less than 10 mg/kg will be retested using the immunoassay test kit within a threshold sensitivity of 10/1 mg/kg.

4. If no locations with total PAH concentrations less than 10 mg/kg are identified initially, the grid spacing will be extended downgradient in a direction likely to encounter concentrations less than 10 mg/kg, and resampled to identify one marsh location and one drainageway location with a total PAH concentration less than 10 mg/kg (6 estimated locations). If it is determined that the concentration of PAHs are not decreasing with distance from the NAPL, delineation work will cease. In addition, one marsh and one drainageway location will be identified in Churchman's Marsh to be used as a reference (total equals 2 locations).

Sediment samples will be collected from these perimeter locations (immunoassay, results of 10 mg/kg or less) and analyzed for SVOCs by an analytical laboratory for confirmation purposes. As described in Section 3.2.3 Pb^{210} and Cs^{137} dating will be performed on six selected depth interval samples from cores collected at the high concentration sampling locations in the Hershey Run and West Central Marshes, and at the Churchman's Marsh reference location to evaluate sedimentation rates. This sampling represents a total of 18 samples.

This process identifies an array of three locations in the marshes and three in the drainageways of each area that likely span the exposure range from low levels of PAHs (less than 10 mg/kg), where toxic effects to indigenous biota are unlikely, up to concentration levels where toxic effects on sediment/peat macroinvertebrate biota may occur. Along with the reference locations, this array represents a total of twenty locations. A summary of this marsh and drainageway sampling plan is provided in Table 4-2.

In addition, 3 drainageway locations in the West Central Marsh will be sampled to evaluate the presence of PAHs in a portion of the marsh not sampled during the Phase I RI. Sampling stations WC7, WC8, and WC9 are identified in the small drainageway, in the western portion of the West Central Marsh on Figure 4-1. Sediment cores will be collected at these 3 locations, sectioned into the depth intervals (0 to 0.5 feet, 0.5 to 1.0 feet, and composite samples from 1.0 foot to the top of

the Columbia Formation), and a total of 9 samples will be submitted for SVOC analysis by CLP protocols.

4.3.3 Sediment Survey

Sediment data gaps identified as a result of the Phase I data evaluation include analyses of sediment metals and semi-volatiles using CLP at seven new river and drainageway stations shown on Figure 2-8. In addition to this off-site sediment data collection, the Fire Pond, South Pond area and K-Area will be investigated for extent of NAPL as described in the following paragraph.

The Phase I RI identified the presence of NAPL in the Fire Pond, both ponds in the South Ponds area, and in the K-Area. Sufficient data are available to address the ecological assessment endpoints for these areas and no additional sampling is necessary for the risk assessment. However, the full depth distribution of NAPL in these three areas was not delineated in the Phase I RI. Therefore, one additional sediment core will be performed at the center of each of these ponds to document the extent of NAPL in the sediment. However, if measurable amounts of free phase NAPL are present at the base of the pond, a sediment core will <u>not</u> be collected as to do so may create a downward migration pathway into the coarse material of the Columbia Formation. Where free product is not present, depth to the surface of the Columbia Formation will be measured and the depth distribution of field detectable NAPL within the sediment and soil will be recorded at one location in each of the four ponds on Site. In addition, areal dimensions of the ponds will be measured and a GPS survey of the perimeter of each pond will be performed. These results will be used in conjunction with the NAPL distribution data to estimate the pond area, volumes of surface water, and NAPL volume in sediment, for use in the ERA and the FS.

4.3.4 Ecological Sampling

Ecological sampling for Phase II includes a fish survey, wildlife survey, and plant survey to address ecological assessment endpoints. Observations of biological abnormalities during ecological data collection will be documented. Additional ecological and toxicological data collection will be considered once Phase II analytical data have been analyzed. The increased database contributed by the Phase II RI will provide a better understanding of the Site and the migration pathways, allowing a more effective selection of sampling locations for ecological testing for Phase III.

4.3.4.1 Fish Survey

Fish sampling will be performed by seining, electrofishing, or trap netting to document the community structure and relative abundance of fish species at onsite and reference locations. Whole body samples of a small locally abundant forage fish species will be collected and submitted for TCL organics, TAL inorganics, and PCDD/PCDFs analyses using CLP protocols. Lipid content and moisture content will also be measured. Forage fish samples will be collected at locations in the following areas for the ERA:

- Hershey Run between HR2 and HR3
- West Central Drainageway between WC2 and WC5
- East Central Drainageway between EC3 and EC4
- Upstream reference location in similar habitat in Churchman's Marsh

Edible fillet samples of a popular sport panfish (e.g. White Perch) will be collected and submitted for TCL organics, TAL inorganics, and PCDD/PCDFs analyses for use in the HHE. Panfish samples will be collected at the following locations:

- White Clay Creek between WC6 and WC1
- Upstream reference area in similar habitat in Churchman's Marsh

Triplicate fish samples from all locations will be submitted for laboratory analyses. Attachment A provides PTG 15 for the fish collection and preparation for laboratory submittal.

4.3.4.2 Wildlife Survey

Wildlife surveys will be performed by an ESA Certified Senior Ecologist for the upland and wetland habitat types and at reference locations in similar habitats. The occurrence of wildlife species will be based on field observation made along belt transects and at fixed observation points. Observations will be made during early morning and evening hours on three consecutive days for each covertype. Birds, mammals and herpetiles will be identified and counted to yield an index of species relative abundance. In each covertype, soil from the 0 to 1-foot depth will be examined for the presence and relative abundance of visible soil invertebrates (e.g., annelids, insects). In addition, observed tracks, scat, and raptor pellets will be documented.

Field observations will be recorded in the field log book and supplemented with field tape recordings that will be transcribed and included with the survey documentation. Wildlife identification record sheets, as presented in the FSP, will be prepared as formal documentation of animal sightings. The field survey techniques are described in the Attachment A, PTG No. 16. They will provide semi-quantitative results based on the same level of survey effort in the on-Site and reference areas.

Based on the available analytical data from field samples of soil and sediment/peat, and field observations of the covertypes, useful reference areas for wetland covertypes are available in Churchman's Marsh, while upland covertypes are available on Bread and Cheese Island. Field reconnaissance of these areas will be performed to establish appropriate transects and the selected areas will be surveyed by GPS to document the transect locations.

4.3.4.3 Plant Survey

A plant community structure evaluation was performed during the Phase I RI and covertypes throughout the Site have been mapped (Section 2.1.6). In the Phase II RI, plant community structure will be documented in each covertype at offsite reference locations on Bread and Cheese Island and in Churchman's Marsh. The quantitative vegetative survey techniques described in the FSP will be utilized. Reference area sampling locations will be surveyed using GPS and the results mapped on a Site plan.

Preliminary identifications and the locations of plants of special status were made during the Phase I RI. The locations of special status species observed during the Phase II RI effort will be surveyed with GPS and mapped. Special status plants that are in areas likely to be disturbed during the Phase II RI will be identified with flagging as a indicator that offsetting of the activity may be necessary.

4.4 GROUNDWATER

4.4.1 Monitoring Well Installation

Based on the results of the Phase I RI, the principal focus of the Phase II groundwater RI is further evaluation of potential exposure pathways related to the Columbia Formation. Phase II monitoring well installation will occur after completion of the DNAPL delineation program. This approach will allow data gathered during the DNAPL delineation program to be utilized for placement of the wells close to, but not in, the DNAPL areas, and will also limit the potential for creating a pathway for downward migration of DNAPL.

Four additional monitoring wells will be installed into the Columbia Formation to assess the groundwater quality along potential pathways between the former Process Area and Hershey Run (MW-13A), between the South Ponds and the West Central Drainage Area (MW-12A), between the former Process Area and the West Central Drainage Area (MW-15A), and upgradient to the Site (MW-14A) (Figure 4-1). Two Potomac Formation wells will be installed to evaluate groundwater quality downgradient of the former Process Area (MW-15B), and to evaluate upgradient groundwater quality in the Potomac Formation (MW-14B). In addition, one well (MW-13F) will be installed adjacent to MW-13A to evaluate potential groundwater discharge to Hershey Run unless the top of the water table is within the Columbia Formation. These wells will be installed using the same methods specified in the Phase I WP.

- Monitoring well MW-12A will be installed at the South Pond Area to evaluate the possible presence of Site-related constituents downgradient of the South Ponds.

- Monitoring well MW-13A will be installed downgradient of the former Process Area and Drip Tracks within the former Wood Storage Yard near Hershey Run Creek. The purpose

of this well is to evaluate whether a pathway exists for possible migration of dissolved constituents from the former Process Area toward the creek.

- Monitoring wells MW-14A and MW-14B will be installed to the north of the rail line that runs along the north boundary of the Site.

- Monitoring wells MW-15A and MW-15B will be installed to the south of the former Process Area.

4.4.2 Groundwater Data Collection

Single borehole (slug) permeability testing and analysis will be completed on existing Phase I and proposed Phase II monitoring wells to assess the local hydraulic characteristics of the Columbia and Potomac aquifers and to evaluate the potential flow rates in Site groundwater. Slug tests will provide data on hydraulic characteristics of the water-bearing units at the Site that will allow sufficient evaluation of remedial alternatives without generating a large volume of water that potentially will require offsite disposal as a hazardous waste. Appendix B presents the procedures for the performance of the single borehole permeability testing and analysis.

Water levels will also be collected from the monitoring wells utilizing data loggers coupled to pressure transducers set in wells close to the wetland boundaries to evaluate the amount of groundwater level fluctuation due to potential influence of tidal cycles evident in the surface water bodies of the area. The wells are as follows:

MW-7A/7B	MW-9A
MW-11A/11B	MW-12A

The loggers will be set to collect data on a linear scale at 15 minute intervals for three complete days. A Stevens Recorder or an anchored pressure transducer coupled with a data logger will be utilized to monitor water level fluctuations in the surface water bodies at the Site (Hershey Run). It is anticipated that this data will allow evaluation of changes to horizontal and vertical flow

gradients due to tidal changes. This data will also allow planning for the collection of groundwater samples at a specific stage of the tide.

Groundwater samples will be collected from all of the Phase I and Phase II monitoring wells at the Site during the Phase II RI, with the exception of MW-2A and the 5 residential wells along Old Airport Road. Groundwater sample collection from Columbia Formation wells whose water levels are affected by the tides will be sampled within a few hours of each other so that it corresponds with the low groundwater level in the area of those wells. The purpose of these samples will be to collect the groundwater quality samples at a time when the horizontal flow gradient from the Site is higher than at other stages of the tide. A second round of groundwater data collection will be performed in a similar manner during approximately three to four months after the first Phase II round. MW-2A will not be sampled because the amount of DNAPL present in this well does not allow for the collection of a representative aqueous sample using standard methods of well purging prior to sampling. However, NAPL from MW-2A will be sampled for PCDD/PCDF and TAL metals analyses to provide data for the FS regarding the NAPL, provided that the laboratory is willing to run these analyses on NAPL.

Groundwater samples collected from Phase I wells during the Phase II RI will be analyzed for the following parameters, based on the findings of the Phase I RI and the data requirements identified in Section 3.0:

- SVOCs using CLP protocols due to the detection of these parameters in the former Process Area and one detection of PCP (at MW-8A)

- VOCs using CLP due to scattered detections of these parameters across the Site

- PCP using EPA Method 515.1 (drinking water method for regulated herbicides) to provide lower detection limits for this compound and identify its potential presence

- TAL metals (filtered and unfiltered)

- TSS to evaluate total metal concentrations relative to suspended material

- General water chemistry (i.e., BOD, hardness, etc.) to provide data on basic natural groundwater characteristics potentially useful in conducting the FS

Groundwater samples collected from Phase II wells during the Phase II RI will be sampled for TCL organics and TAL metals using CLP protocols, and PCDDs/PCDFs. The thickness of DNAPL will continue to be measured (where present) in monitoring wells during the groundwater sampling program in accordance with procedures specified in the Phase I WP and FSP. In addition, a bail-down test will be performed at a well containing DNAPL to evaluate the feasibility of extracting NAPL. The test will involve removal of DNAPL followed by measurement of its rate of recovery into the well. The procedures are presented in PTG-20 (Appendix B).

Sampling will be performed in accordance with the procedures defined in the Phase I WP and FSP for the Phase I RI.

4.5 UNDERGROUND STORAGE TANKS

The Phase II RI will address the potential presence or absence of USTs within the former Process Area based on anomalous terrain conductivity readings obtained during the Phase I geophysical survey, and an evaluation of the Site fire insurance documents. Figure 4-1 presents the location of the areas of potential USTs.

The UST investigative procedure will determine the presence/absence of USTs and evaluate the nature of the contents of any USTs found based on visual characterization. Appendix B presents the Project Technical Guidance for the investigation and closure of USTs. The presence/absence of UST's will be determined using the following steps:

- "Soft Dig Technology" (SDT) will be used to assess the presence/absence of USTs at the areas having the highest probability of containing USTs based the geophysical and Site data reviews. This technology will allow for the evaluation of a USTs presence/absence, while not affecting the structural stability of USTs. Appendix B provides PTG No. 19 for the proposed SDT evaluation.

- Following confirmation of the presence of an UST, additional soil will be removed by hand or with excavating equipment to allow for the visual identification and sampling for chemical analysis. One sample will be collected from each of the USTs and analyzed for TCL VOCs, TCL SVOCs, and TAL metals. Procedures to determine the contents of the UST are presented in the Project Technical Guidance provided in Appendix B.

4.6 QUALITY ASSURANCE

Work performed, and data collected and analyzed during the Phase II RI will be in accordance with the Phase I WP, FSP, and QAPjP unless stated otherwise in this Phase II RI SOW. To support DQOs, samples collected during the Phase II RI will be analyzed at the analytical levels listed below. These analytical levels are defined in the Phase I WP:

- **Level 5:** Analysis of Pb-210 and Cs-137 isotopes for the dating of sediments are specialty analyses and will be performed at Level 5. Other Phase II analyses included in this level are pentachlorophenol using EPA Method 515.1 and fish tissue for bioaccumulation.

- **Level 4:** All soil, sediment, surface water, and groundwater samples collected and sent to a laboratory for analysis for the purpose of chemical characterization, or for confirmation of field analyses or observations will be analyzed at Level 4 (CLP).

- **Level 3:** Samples sent to laboratories for the analysis of parameters for which there is no CLP protocol will be analyzed at Level 3. These include:

  - Total Organic Carbon
  - Percent Organic Matter
  - Hardness
  - BOD/COD
  - Redox Potential
  - Oil and Grease
  - Cations/Anions

- Flash Point
- Ignitability
- Corrosivity
- Reactivity
- BTU
- Organic Phosphorous

- **Level 2:** Soil and sediment samples collected for field analysis of PAH compounds using Immunoassays, dissolved oxygen, and specific conductivity will be analyzed at Level 2.

- **Level 1:** Field data collected with instruments such as Hnu or OVA meters will be collected at Level 1.

Analytical methodologies for work to be performed during the Phase II RI are summarized in Table 4-4.

5.0 SCHEDULE

The project schedule provided herein (Figures 5-1A and 5-1B) addresses the basic components of the RI/FS programs governed by the Administrative Order on Consent. It includes the Phase II scope of work and implementation start-up and delivery for milestone field work, written reports, and meetings with the EPA. In addition the schedule identifies the critical path items in the program timeline. Scheduling can only be provided for these RI activities as described in this scope of work.

These schedules are subject to revision depending on conditions at the Site during field activities, review and approval of the required documents, and other situations not defined at this time. In addition, Beazer and DuPont may revise this schedule if, during the implementation of the RI, any of the following assumptions are incorrect or become incorrect:

- Beazer and DuPont will receive written approval from EPA of this Revised Phase II RI SOW within 15 working days of submittal to EPA.

- EPA will not halt or delay any field work tasks regarding issues including, but not limited to requiring additional time providing input to Beazer and DuPont regarding decisions for any of the field activities including additional station locations or types of data collection.

- EPA will not request that Beazer and DuPont collect any additional samples or data of any type not specified herein.

Upon completion of Phase II data collection, the data will be evaluated and a Phase III work scope will be prepared. The Phase III SOW will be submitted to EPA within 3 months from completion of data validation of sediment and soil data collected during the Phase II RI. The Phase III RI will focus on collecting ecological data for analyses such as toxicity testing, benthic macroinvertebrate community analyses, and bioaccumulation. The scope and placement of these data collection points will be based on the data collected during the Phase I and II RIs. An assumed time frame

for the Phase III RI has been presented based on the work scope for ecological testing originally presented in the first draft of the Phase II RI SOW, but will be adjusted in the Phase III SOW once the actual work scope has been defined.

The Risk Assessment will be performed concurrently with the RI Report preparation, assuming that it is performed by Beazer and DuPont. A draft of the RI report and Risk Assessment will be submitted to the U.S. EPA within 5 months from completion of data validation of data collected during the Phase III RI. The FS will be initiated within one month of EPA's approval of the Risk Assessment.

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7.0
LIST OF ACRONYMS

ATSDR	=	Agency for Toxic Substance and Disease Registry
AWQC	=	EPA Chronic Ambient Water Quality Criteria for Protection of Aquatic Life
BOD/COD	=	Biological Oxygen Demand/Chemical Oxygen Demand
BTEX	=	Benzene, Toluene, Ethylbenzene and Xylenes
BTU	=	British Thermal Unit
CLP	=	Contract Laboratory Program
COC	=	Contaminant of Concern
DL	=	Detection Limit
DNAPL	=	Dense Non-Aqueous Phase Liquid
DQO	=	Data Quality Objectives
ECSM	=	Ecological Conceptual Site Model
EPA	=	U.S. Environmental Protection Agency
ERA	=	Ecological Risk Assessment
ER-L	=	Effects Range - Low [from Long et al. 1994]
ER-M	=	Effects Range - Medium [from Long et al. 1994]
FID	=	Flame Ionization Detector
FSP	=	Field Sampling Plan
FCV	=	Final Chronic Value
GPS	=	Global Positioning System
HDPE	=	High Density Polyethylene
HHE	=	Human Health Evaluation
K_{ow}	=	Octanol-Water Equilibrium Partition Coefficient
LC_{50}	=	Lethal Concentration (for 50% Lethality)
LNAPL	=	Light Non-Aqueous Phase Liquid
LOEL	=	Lowest Observed Effects Level
MW	=	Monitoring Well

NAPL	=	Non-Aqueous Phase Liquid
NA	=	Not Analyzed
ND	=	Non-Detect
NOAEL	=	No Observed Apparent Effects Level
NOEL	=	No Observed Effects Level
OCDD	=	Octylchlorinated dibenzodidioxin
OVA	=	Organic Vapor Analyzer
PAHs	=	Polycyclic Aromatic Hydrocarbons
PAOI	=	Potential Area of Interest
PCBs	=	Polychlorinated Biphenyls
PCDD/PCDFs	=	Polychlorinated dibenzo-p-dioxins/polychlorinated dibenzofurans
PCP	=	Pentachlorophenol
Phase I WP	=	Phase I RI/FS Work Plan prepared by WCC, dated January 31, 1994
PID	=	Photoionization Detector
PTG	=	Project Technical Guidance
QAPjP	=	Quality Assurance Project Plan
RCRA	=	Resource Conservation and Recovery Act of 1976
RI/FS	=	Remedial Investigation/Feasibility Study
SDT	=	Soft Dig Technology
SOW	=	Scope of Work
SQC	=	Sediment Quality Criteria
SVOC	=	Semi-Volatile Organic Compound
TAL	=	Target Analyte List
TCDD/TCDF	=	2,3,7,8-Tetrachlorodibenzo-p-dioxin/2,3,7,8-Tetrachlorodibenzofuran
TCL	=	Target Compound List
TDLo	=	Toxic Dose Low
TE	=	Toxicity Equivalent
TEF	=	Toxicity Equivalency Factor
TOC	=	Total Organic Carbon
TPAH	=	Total Polycyclic Aromatic Hydrocarbons

USTs	=	Underground Storage Tanks
VOCs	=	Volatile Organic Compounds
WCC	=	Woodward-Clyde Consultants
WP	=	Work Plan

Tables

Ta. 2-1
Summary of Fill/Recent Deposit Thickness
Former Koppers Company, Inc. Site
Newport, Delaware

Boring	Total Fill/Recent Deposit Thickness	Fill Thickness (ft.)	Holocene Deposits Thickness (ft.)
SB-101	7.5	0.0	7.5
SB-102	9.5	3.0	6.5
SB-103	8.0	8.0	0.0
SB-104	4.0	2.5	1.5
SB-105	9.0	0.0	9.0
SB-106	8.0	0.0	8.0
SB-107	8.0	0.0	8.0
SB-108	12.0	0.0	12.0
SB-109	8.0	2.0	6.0
SB-110	6.0	0.5	5.5
SB-111	6.0	4.0	2.0
SB-112	7.0	2.0	5.0
SB-113	10.0	3.5	6.5
SB-114	8.0	2.0	6.0
SB-115	6.0	0.0	6.0
SB-116	11.0	6.0	5.0
SB-117	6.0	3.5	2.5
SB-118	10.0	5.0	5.0
SB-119	12.0	12.0	0.0
SB-120	17.0	12.0	5.0
SB-121	11.0	2.0	9.0
SB-122	8.0	3.5	4.5
SB-123	7.5	0.0	7.5
SB-124	9.0	2.0	7.0
SB-125	12.5	2.0	10.5
SB-126	7.5	0.0	7.5
SB-127	8.0	0.5	7.5
SB-128	6.0	2.0	4.0
SB-201	10.5	2.0	8.5
SB-202	7.0	1.5	5.5
SB-203	17.5	0.5	17.0
SB-204	12.0	2.0	10.0
SB-205	8.0	0.5	7.5

AR308508

Table 2-1
Summary of Fill/Recent Deposit Thickness
Former Koppers Company, Inc. Site
Newport, Delaware

Boring	Total Fill/Recent Deposit Thickness	Fill Thickness (ft.)	Holocene Deposits Thickness (ft.)
SB-206	4.0	0.5	3.5
SB-207	5.5	5.5	0.0
SB-208	5.5	5.5	0.0
SB-209	11.0	0.0	11.0
SB-210	8.5	2.0	6.5
SB-211	7.5	0.0	7.5
SB-212	7.5	0.3	7.3
SB-213	12.0	0.0	12.0
SB-214	8.0	0.0	8.0
SB-215	8.0	0.0	8.0
SB-216	5.5	0.0	5.5
SB-217	6.0	6.0	0.0
SB-301	8.0	8.0	0.0
SB-302	6.0	0.0	6.0
SB-303	8.0	0.5	7.5
SB-304	13.5	0.0	13.5
SB-305	5.5	0.0	5.5
SB-306	12.0	12.0	0.0
SB-401	5.5	5.5	0.0
SB-402	10.0	0.0	10.0
SB-403	6.0	0.0	6.0
SB-404	10.0	0.0	10.0
SB-405	10.0	0.0	10.0
SB-601	8.0	0.0	8.0
SB-602	5.0	0.3	4.8
SB-603	11.0	0.3	10.8
SB-604	4.0	0.0	4.0
SB-605	8.0	0.0	8.0
SB-606	7.0	2.0	5.0
SB-607	7.0	4.0	3.0
SB-608	0.0	0.0	0.0
SB-609	3.5	3.0	0.5
SB-610	5.5	2.0	3.5

AR308509

Table 2-1
Summary of Fill/Recent Deposit Thickness
Former Koppers Company, Inc. Site
Newport, Delaware

Boring	Total Fill/Recent Deposit Thickness	Fill Thickness (ft.)	Holocene Deposits Thickness (ft.)
SB-611	12.0	0.0	12.0
SB-612	10.5	0.0	10.5
SB-613	7.0	0.0	7.0
SB-614	3.5	0.3	3.3
SB-615	12.0	0.0	12.0
SB-616	8.0	4.5	3.5
SB-617	9.0	5.0	4.0
SB-618	6.0	6.0	0.0
SB-619	6.0	6.0	0.0
SB-620	5.0	0.0	5.0
SB-621	4.5	0.0	4.5
SB-622	10.0	0.0	10.0
SB-623	6.0	0.3	5.8
SB-701	1.0	0.0	1.0
SB-702	5.0	0.0	5.0
SB-703	2.5	0.0	2.5
SB-704	0.5	0.0	0.5
SB-705	4.0	4.0	0.0
SB-706	10.0	10.0	0.0
SBBG-01	6.0	0.0	6.0
SBBG-02	4.0	4.0	0.0
Fill: Dry surficial soils characterized by discontinuously occuring			
thin veneer of coarse grained sediments with miscellaneous			
debris(metal, brick, concrete and plastic).			
Recent Deposits: Dry to saturated continuously occuring			
surficial or subsurface silt , clay mixtures with some sand			
and trace gravel.			

AR308510

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Summary of NAPL Chemical Analyses
Former Koppers Co., Inc., Newport Site
Newport, Delaware

	Residual NAPL						***Free NAPL***
	SB-119 (6.0-8.0)	SB-120 (7.0-9.0)	SB-124 (7.5-9.5)	SB-201 (8.0-10.0)	SB-213 (8.0-10.0)	SB-616 (6.5-8.5)	MW-2A
Metals (mg/kg)							
Aluminum	**10100.00**	**11100.00**	**20700.00**	**16400.00**	**12000.00**	**7960.00**	NA
Antimony	**0.48**	0.49U	3.9UL	**0.54**	0.51R	**0.72**	NA
Arsenic	**3.10**	**4.90**	**3.50**	0.52UJ	0.51UJ	**2.00**	NA
Barium	**170.00**	**118.00**	**68.00**	**93.50**	**68.40**	**54.70**	NA
Beryllium	**1.80**	**0.89**	**0.69**	**0.59**	**0.81**	**0.54**	NA
Cadmium	**0.38**	0.24U	0.40U	0.26U	0.26J	**0.06**	NA
Calcium	**16900.00**	**14400.00**	**1570.00**	**612.00**	**1310.00**	**310.00**	NA
Chromium	**22.00**	**17.10**	**28.20**	**37.80**	**26.60**	**20.40**	NA
Cobalt	**4.60**	**5.60**	**9.90**	**9.20**	**7.40**	**8.80**	NA
Copper	**14.80**	**9.20**	**8.40**	**17.70**	**14.00**	**7.10**	NA
Iron	**13700.00**	**18500.00**	**25300.00**	**18100.00**	**11200.00**	**39400.00**	NA
Lead	**23.20**	**16.50**	**9.50**	**9.60**	**9.50**	**3.50**	NA
Magnesium	**4320.00**	**4970.00**	**2420.00**	**4120.00**	**3400.00**	**1620.00**	NA
Manganese	**518.00**	**526.00**	**692.00**	**146.00**	**104.00**	**596.00**	NA
Mercury	**0.11**	**0.07**	**0.04**	0.06U	0.06U	0.06U	NA
Nickel	**10.70**	**10.20**	**10.90**	**17.90**	**24.10**	**8.60**	NA
Potassium	**838.00**	**835.00**	**1180.00**	**2610.00**	**1440.00**	**1060.00**	NA
Selenium	0.95UL	**1.20**	**0.94**	1.0UL	1.0UL	0.9U	NA
Sodium	**222.00**	**239.00**	**49.40**	**73.30**	**123.00**	**217.00**	NA
Thallium	1.70J	**3.10**	0.31U	1.8U	1.80U	2.0U	NA
Vanadium	**39.80**	**53.40**	**45.70**	**53.70**	**39.10**	**34.70**	NA
Zinc	**44.70**	**46.30**	**39.60**	**47.80**	**40.90**	**20.50**	NA

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Summary of NA. Chemical Analyses
Former Koppers Co., Inc., Newport Site
Newport, Delaware

	Residual NAPL						***Free NAPL***
	SB-119 (6.0-8.0)	SB-120 (7.0-9.0)	SB-124 (7.5-9.5)	SB-201 (8.0-10.0)	SB-213 (8.0-10.0)	SB-616 (6.5-8.5)	MW-2A
Semivolatiles (mg/kg)							
2-methylnaphthalene	510.00J	390.00J	0.40U	0.20U	0.97J	0.75UJ	**42000.00**
Acenaphthene	**790.00**	**440.00**	**3.10**	**0.63**	**1.50**	**0.20**	**37000.00**
Acenaphthylene	400.00U	160.00U	**0.07**	0.43U	0.85U	0.75U	9900.00U
Anthracene	**860.00**	**200.00**	**0.94**	**3.50**	**5.00**	**0.29**	**8200.00**
Benzo(a)anthracene	**180.00**	**81.00**	**1.10**	**0.55**	**0.44**	**0.60**	**6300.00**
Benzo(a)pyrene	400.00U	160.00U	**0.48**	**0.16**	**0.22**	**0.26**	9900.00U
Benzo(b)fluoranthene	400.00U	160.00U	**1.30**	**0.35**	**0.32**	**0.52**	9900.00U
Benzo(g,h,i)perylene	400.00U	160.00U	**0.18**	0.43U	0.85U	0.75U	9900.00U
bis(2-Ethylhexyl)phthalate	400.00UJ	160.00UJ	**0.21**	0.43U	0.85UJ	0.75UJ	9900.00U
Benzo(k)fluoranthene	400.00U	**44.00**	0.40U	**0.13**	0.85U	**0.20**	9900.00U
Chrysene	**200.00**	**110.00**	**0.98**	**0.71**	**1.50**	**0.60**	9900.00U
Dibenz(a,h)anthracene	400.00U	160.00U	**0.08**	0.43U	0.85U	0.75U	9900.00U
Di-n-butylphthalate	400.00UJ	160.00UJ	0.40U	**0.19**	0.85UJ	0.75UJ	9900.00U
Dibenzofuran	**580.00**	**290.00**	**2.80**	**0.69**	**1.10**	**0.20**	9900.00U
Fluoranthene	**880.00**	**530.00**	**3.60**	**3.00**	**2.30**	**1.70**	**38000.00**
Fluorene	**720.00**	**350.00**	**2.00**	**1.10**	**1.60**	**0.24**	**31000.00**
Indeno(1,2,3-c,d)pyrene	400.00U	160.00U	**0.28**	0.43U	0.85U	0.75U	9900.00U
Naphthalene	**1400.00**	**1000.00**	**0.11**	**0.14**	**2.40**	0.75UJ	**140000.00**
Phenanthrene	**1800.00**	**950.00**	**5.20**	**3.60**	**4.60**	**1.10**	**72000.00**
Pyrene	**640.00**	**390.00**	**2.90**	**1.90**	**1.60**	**1.30**	**24000.00**
Volatiles (mg/kg)							
2-Butanone	1.50U	1.50U	**0.01**	0.01U	0.01UJ	0.01U	0.02U
Acetone	**1.30**	1.50U	**0.24**	0.01U	**0.03**	0.01U	310.00U
4-Methyl-2-Pentanone	**1.50**	**1.50**	0.01U	0.01U	0.01U	0.01U	310.00U
Carbon Disulfide	1.50U	1.50U	0.01U	0.01U	0.01U	0.01U	31.00U
Benzene	**0.49**	**0.53**	0.01U	0.01U	**0.03**	0.01U	**66.00**
Ethylbenzene	**2.80**	**4.30**	0.01U	0.01U	**0.07**	0.01U	**170.00**
Styrene	**1.80**	**3.10**	0.01U	0.01U	**0.04**	0.01U	**160.00**
Methylene Chloride	1.50U	1.50U	**0.01**	0.01B	**0.01**	0.01U	62.00U
Tetrachloroethene	1.50U	1.50U	0.01U	0.01U	0.01U	0.01U	31.00U
Toluene	**2.40**	**5.70**	0.01U	0.01J	**0.11**	0.01U	**280.00**
Xylenes (total)	**10.50**	**24.30**	0.01U	**0.01**	**0.39**	0.01U	**790.00**

AR308512

Summary of NAPL Chemical Analyses
Former Koppers Co., Inc., Newport Site
Newport, Delaware

	Residual NAPL						***Free NAPL***
	SB-119 (6.0-8.0)	SB-120 (7.0-9.0)	SB-124 (7.5-9.5)	SB-201 (8.0-10.0)	SB-213 (8.0-10.0)	SB-616 (6.5-8.5)	MW-2A
Dioxins (ng/g)							
1,2,3,4,6,7,8-HpCDD	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-HpCDF	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HxCDF	NA	NA	NA	NA	NA	NA	NA
37Cl-2,3,7,8-TCDD	NA	NA	NA	NA	NA	NA	NA
HpCDDs (total)	NA	NA	NA	NA	NA	NA	NA
HpCDFs (total)	NA	NA	NA	NA	NA	NA	NA
HxCDFs (total)	NA	NA	NA	NA	NA	NA	NA
OCDD	NA	NA	NA	NA	NA	NA	NA
OCDF	NA	NA	NA	NA	NA	NA	NA
Pesticides/PCBs (mg/kg)							
4,4'-DDD	NA	NA	NA	0.01U	NA	NA	1.00U
Dieldrin	NA	NA	NA	0.01U	NA	NA	1.00U
Endosulfan II	NA	NA	NA	0.01U	NA	NA	1.00U
Beta-BHC	NA	NA	NA	0.01U	NA	NA	**1.30**
Endosulfan Sulfate	NA	NA	NA	0.01U	NA	NA	**1.20**
Physical Parameters							
Specific Gravity	NA	NA	NA	NA	NA	NA	1.09
Viscosity	NA	NA	NA	NA	NA	NA	54 SUS at 100 ° F
							32 SUS at 210 ° F
Notes:							
NA: Not Analyzed							
J:Analyte present; value may not be accurate.							
B: Not detected, substantially above the level reported in laboratory or field blanks.							
K: Analyte present; reported value may be biased high, actual value is expected to be lower.							
U: Not detected.							
UJ: Not detected, Quantitiation limit may be inaccurate or imprecise.							
UL: Not detected, Quantitiation limit may be biased low and is expected to be higher.							

AR308513

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Summary of NA. Chemical Analyses
Former Koppers Co., Inc., Site
Newport, Delaware

	Weathered Creosote NAPL						
	SB-113 (0-0.5)	SB-116 (0-2.0)	SB-127 (0-0.5)	SB-202 (0-0.5)	SB-402 (0-0.5)	SB-403 (0-2.0)	SB-614 (0-0.5)
Metals (mg/kg)							
Aluminum	35900.00	11800.00	13800.00	10000.00	9690.00	9190.00	5670.00
Antimony	1.30	1.00	0.68UL	0.97	0.82	0.74U	1.10
Arsenic	1.90	6.90	5.60	14.00	9.60	4.30	5.30
Barium	944.00	356.00	383.00	227.00	497.00	163.00	259.00
Beryllium	2.00	1.30	1.30	1.10	1.20	1.00	0.62
Cadmium	0.24U	0.28	0.35	0.49	0.27U	0.75U	0.51
Calcium	161000.00	38900.00	30900.00	14700.00	3710.00	1380.00	9780.00
Chromium	25.50	24.50	13.00	35.80	17.30	17.90	11.70
Cobalt	7.90	10.10	4.50	7.10	5.30	4.10	3.80
Copper	11.40	59.30	17.70	528.00	23.60	11.40	35.00
Iron	10500.00	17600.00	13500.00	19500.00	13000.00	12400.00	12700.00
Lead	18.80	61.20	17.20	137.00	68.20	25.70	65.80
Magnesium	49000.00	10900.00	8650.00	3780.00	1930.00	1490.00	2680.00
Manganese	7160.00	1300.00	642.00	745.00	610.00	90.60	493.00
Mercury	0.06U	0.012B	2.00	0.07B	0.07U	0.08	1.60
Nickel	4.00	26.50	4.70	10.10	11.10	10.00	6.10
Potassium	2100.00	918.00	1140.00	862.00	567.00	449.00	714.00
Selenium	2.30	0.94U	0.94UL	0.94UL	1.10	0.99U	1.10
Sodium	2740.00	376.00	336.00	173.00	59.00	53.80	644.00
Thallium	44.40	2.70	2.80	2.0UL	2.40U	2.20U	2.30U
Vanadium	295.00	33.90	34.90	39.20	52.60	32.60	20.00
Zinc	35.10	71.30	75.90	311.00	165.00	57.50	109.00

AR308514

T 2-2
Summary of NA[illegible] Chemical Analyses
Former Koppers Co., Inc., Site
Newport, Delaware

	Weathered Creosote NAPL						
	SB-113 (0-0.5)	SB-116 (0-2.0)	SB-127 (0-0.5)	SB-202 (0-0.5)	SB-402 (0-0.5)	SB-403 (0-2.0)	SB-614 (0-0.5)
Semivolatiles (mg/kg)							
2-methylnaphthalene	40.00U	0.78UJ	76.00UJ	2.00UJ	22.00U	8.20U	5.30J
Acenaphthene	40.00U	0.78U	76.00U	2.00U	22.00U	8.20U	12.00
Acenaphthylene	88.00	0.78U	76.00U	2.00U	22.00U	8.20U	4.10
Anthracene	48.00	0.16	27.00	0.47	11.00	8.20U	52.00
Benzo(a)anthracene	170.00	0.53	170.00	7.90	120.00	24.00	440.00
Benzo(a)pyrene	54.00	0.15	240.00	4.80	150.00	9.40	200.00
Benzo(b)fluoranthene	39.00	0.64	370.00	7.00	300.00	44.00	290.00
Benzo(g,h,i)perylene	55.00	0.78U	94.00	1.60	160.00	2.80	98.00
bis(2-Ethylhexyl)phthalate	40.00UJ	0.79	76.00UJ	2.00UJ	22.00U	8.20U	8.40U
Benzo(k)fluoranthene	19.00	0.78U	110.00	5.90	110.00	12.00	160.00
Carbazole	40.00U	0.78U	76.00U	2.00U	22.00U	8.20U	21.00
Chrysene	77.00	0.61	260.00	6.50	130.00	34.00	270.00
Dibenz(a,h)anthracene	52.00	0.78U	22.00	1.20	28.00	8.20U	19.00
Di-n-butylphthalate	40.00UJ	0.26	76.00UJ	2.00UJ	22.00U	8.20U	8.40U
Dibenzofuran	40.00UJ	0.78UJ	76.00UJ	2.00UJ	22.00U	8.20U	8.90
Fluoranthene	77.00	0.82	370.00	14.00	270.00	56.00	440.00
Fluorene	40.00U	0.07	76.00U	2.00U	22.00U	8.20U	11.00
Indeno(1,2,3-c,d)pyrene	8.90	0.78U	110.00	5.10	140.00	8.20U	110.00
Naphthalene	40.00UJ	0.78UJ	76.00UJ	2.00UJ	22.00U	8.20U	15.00
Phenanthrene	90.00	0.39	76.00U	2.30	22.00	4.00	79.00
Pyrene	0.06	0.72	190.00	12.00	250.00	8.20U	550.00
4-Bromofluorobenzene	0.02	0.06	0.05	0.05	0.05	0.05	0.06
Volatiles (mg/kg)							
2-Butanone	0.01UJ	0.01U	0.01UJ	0.01U	0.01U	0.01U	0.01U
Acetone	0.01UJ	0.02	0.01UJ	0.01U	0.01U	0.01U	0.01U
4-Methyl-2-Pentanone	0.01UJ	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U
Carbon Disulfide	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01
Benzene	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U
Ethylbenzene	0.01J	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U
Styrene	0.01UJ	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U
Ethylbenzene	0.02	0.01U	0.01U	0.01U	0.01U	0.01U	0.01U
Methylene Chloride	0.01	0.01U	0.01	0.01U	0.01	0.01	0.01B
Tetrachloroethene	0.08	0.01U	0.01	0.01	0.01	0.01U	0.01U
Toluene	0.03	0.01U	0.01U	0.01U	0.09	0.01U	0.01U
Xylenes (total)	0.03J	0.01U	0.01U	0.01U	0.01U	0.01U	0.09

AR308515

Summary of NA. Chemical Analyses
Former Koppers Co., Inc., Site
Newport, Delaware

	Weathered Creosote NAPL						
	SB-113 (0-0.5)	SB-116 (0-2.0)	SB-127 (0-0.5)	SB-202 (0-0.5)	SB-402 (0-0.5)	SB-403 (0-2.0)	SB-614 (0-0.5)
Dioxins (ng/g)							
1,2,3,4,6,7,8-HpCDD	NA	NA	**68.00J**	**1.30**	0.29U	NA	**26.00**
1,2,3,4,6,7,8-HpCDF	NA	NA	**3.70**	**0.27**	0.28U	NA	2.40UJ
1,2,3,4,7,8-HxCDF	NA	NA	**6.50**	0.18U	0.68U	NA	2.10UJ
37Cl-2,3,7,8-TCDD	NA	NA	**6.50**	**60.00**	**28.00**	NA	**2.70**
HpCDDs (total)	NA	NA	250.00J	**3.10**	1.00U	NA	**200.00**
HpCDFs (total)	NA	NA	**250.00**	**1.10**	1.20U	NA	12.00UJ
HxCDFs (total)	NA	NA	**19.00**	0.59U	0.57U	NA	5.70UJ
OCDD	NA	NA	**930.00**	**26.00**	13.00J	NA	**250.00**
OCDF	NA	NA	**19.00**	**0.92**	7.40UJ	NA	9.70UJ
Pesticides/PCBs (mg/kg)							
4,4'-DDD	NA	NA	NA	NA	NA	NA	**0.03**
Dieldrin	NA	NA	NA	NA	NA	NA	**0.03**
Endosulfan II	NA	NA	NA	NA	NA	NA	0.01J
Beta-BHC	NA	NA	NA	NA	NA	NA	0.01UJ
Endosulfan Sulfate	NA	NA	NA	NA	NA	NA	0.02UJ
Physical Parameters							
Specific Gravity	NA	NA	NA	NA	NA	NA	NA
Viscosity	NA	NA	NA	NA	NA	NA	NA
Notes:							
NA: Not Analyzed							
J:Analyte present; value may not be accurate.							
B: Not detected, substantially above the level reported in laboratory or field blanks.							
K: Analyte present; reported value may be biased high, actual value is expected to be lower.							
U: Not detected.							
UJ: Not detected, Quantitiation limit may be inaccurate or imprecise.							
UL: Not detected, Quantitiation limit may be biased low and is expected to be higher.							

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TABLE 2-3

PCDDs/PCDFs DETECTION SUMMARY (WITH TOXICITY EQUIVALENT CONCENTRATIONS) FOR SOILS
FORMER KOPPERS COMPANY - NEWPORT SITE

	SAMPLING LOCATION AND DEPTH (FT)														
Detected PCDD	SB114					SB121					SB123				
Congener (µg/kg)	0-0.5	0-2	2-4	4-6	> 6	0-0.5	0-2	2-4	4-6	> 6	0-0.5	0-2	2-4	4-6	> 6
1,2,3,6,7,8-HxCDD	1.2	ND	NS	NS	ND	ND	NS	NS	ND	ND	ND	ND	NS	NS	ND
TE (TEF = 0.1)	0.12														
1,2,3,7,8,9-HxCDD	0.52	ND	NS	NS	ND	ND	NS	NS	ND	ND	ND	ND	NS	NS	ND
TE (TEF = 0.1)	0.052														
Other HxCDDs	3.78	ND	NS	NS	ND	ND	NS	NS	ND	ND	22	ND	NS	NS	ND
TE = 0 (TEF = 0)	0										0				
1,2,3,4,6,7,8-HpCDD	47	ND	NS	NS	ND	3.9	NS	NS	0.18	ND	45	3.3	NS	NS	ND
TE (TEF = 0.01)	0.47					0.039			0.0018		0.45	0.033			
Other HpCDDs	44	0.82	NS	NS	ND	6.0	NS	NS	0.29	ND	155	10.7	NS	NS	ND
TE = 0 (TEF = 0)	0	0				0			0		0	0			
OCDD	610	20	NS	NS	4.3	48	NS	NS	12	1.3	470	43	NS	NS	1.9
TE (TEF = 0.001)	0.610	0.020			0.0043	0.048			0.012	0.0013	0.470	0.043			0.0019
Detected PCDF Congener (µg/kg)															
1,2,3,4,7,8-HxCDF	0.4	ND	NS	NS	ND	ND	NS	NS	ND	ND	ND	ND	NS	NS	ND
TE (TEF = 0.1)	0.04														
1,2,3,7,8,9-HxCDF	ND	ND	NS	NS	ND	ND	NS	NS	ND	ND	ND	ND	NS	NS	ND
TE (TEF = 0.1)															
Other HxCDFs	7.9	ND	NS	NS	ND	ND	NS	NS	ND	ND	3	ND	NS	NS	ND
TE = 0 (TEF = 0)	0										0				
1,2,3,4,6,7,8-HpCDF	6.2	ND	NS	NS	ND	0.47	NS	NS	ND	ND	2	ND	NS	NS	ND
TE (TEF = 0.01)	0.062					0.0047					0.02				
1,2,3,4,7,8,9-HpCDF	0.61	ND	NS	NS	ND	ND	NS	NS	ND	ND	ND	ND	NS	NS	ND
TE (TEF = 0.01)	0.0061														
Other HpCDFs	35.19	ND	NS	NS	ND	2.23	NS	NS	ND	ND	10	ND	NS	NS	ND
TE = 0 (TEF = 0)	0					0					0				
OCDF	28	ND	NS	NS	ND	2.5	NS	NS	ND	ND	13	0.74	NS	NS	ND
TE (TEF = 0.001)	0.028					0.0025					0.013	0.0007			
Total TE for sample	1.3881	0.020	NS	NS	0.0043	0.0942	NS	NS	0.0138	0.0013	0.953	0.0767	NS	NS	0.0019

ND = Not Detected
NS = Not Sampled
TEF = Toxicity Equivalency Factor
TE = Equivalent (to 2,3,7,8-TCDD)

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TABLE 2-3 (continued)

PCDDs/PCDFs DETECTION SUMMARY (WITH TOXICITY EQUIVALENT CONCENTRATIONS) FOR SOILS
FORMER KOPPERS COMPANY - NEWPORT SITE

	SAMPLING LOCATION AND DEPTH (FT)														
Detected PCDD	SB126					SB127					SB202				
Congener (µg/kg)	0-0.5	0-2	2-4	4-6	> 6	0-0.5	0-2	2-4	4-6	> 6	0-0.5	0-2	2-4	4-6	> 6
1,2,3,6,7,8-HxCDD	0.83	NS	NS	ND	ND	ND	NS	ND	ND	NS	ND	NS	ND	NS	ND
TE (TEF = 0.1)	**0.083**														
1,2,3,7,8,9-HxCDD	ND	NS	NS	ND	ND	ND	NS	ND	ND	NS	ND	NS	ND	NS	ND
TE (TEF = 0.1)															
Other HxCDDs	7.97	NS	NS	ND	ND	ND	NS	ND	ND	NS	ND	NS	ND	NS	ND
TE = 0 (TEF = 0)	**0**														
1,2,3,4,6,7,8-HpCDD	37	NS	NS	ND	ND	68	NS	ND	ND	NS	1.3	NS	ND	NS	ND
TE (TEF = 0.01)	**0.37**					**0.68**					**0.013**				
Other HpCDDs	93	NS	NS	ND	ND	182	NS	ND	ND	NS	1.8	NS	ND	NS	ND
TE = 0 (TEF = 0)	**0**					**0**					**0**				
OCDD	650	NS	NS	2.8	1.1	930	NS	0.38	0.97	NS	26	NS	4.2	NS	4.1
TE (TEF = 0.001)	**0.650**			**0.0028**	**0.0011**	**0.930**		**0.00038**	**0.00097**		**0.026**		**0.0042**		**0.0041**
Detected PCDF Congener (µg/kg)															
1,2,3,4,7,8-HxCDF	0.95	NS	NS	ND	ND	ND	NS	ND	ND	NS	ND	NS	ND	NS	ND
TE (TEF = 0.1)	**0.095**														
1,2,3,7,8,9-HxCDF	0.21	NS	NS	ND	ND	ND	NS	ND	ND	NS	ND	NS	ND	NS	ND
TE (TEF = 0.1)	**0.021**														
Other HxCDFs	2.44	NS	NS	ND	ND	ND	NS	ND	ND	NS	ND	NS	ND	NS	ND
TE = 0 (TEF = 0)	**0**														
1,2,3,4,6,7,8-HpCDF	3.6	NS	NS	ND	ND	3.7	NS	ND	ND	NS	0.27	NS	ND	NS	ND
TE (TEF = 0.01)	**0.036**					**0.037**					**0.0027**				
1,2,3,4,7,8,9-HpCDF	0.34	NS	NS	ND	ND	ND	NS	ND	ND	NS	ND	NS	ND	NS	ND
TE (TEF = 0.01)	**0.0034**														
Other HpCDFs	17.06	NS	NS	ND	ND	15.3	NS	ND	ND	NS	0.83	NS	ND	NS	ND
TE = 0 (TEF = 0)	**0**					**0**					**0**				
OCDF	19	NS	NS	ND	ND	19	NS	ND	ND	NS	0.92	NS	ND	NS	ND
TE (TEF = 0.001)	**0.019**					**0.019**					**0.00092**				
Total TE for sample	**1.2774**	**NS**	**NS**	**0.0028**	**0.0011**	**1.666**	**NS**	**0.00038**	**0.00097**	**NS**	**0.04262**	**NS**	**0.0042**	**NS**	**0.0041**

ND = Not Detected
NS = Not Sampled
TEF = Toxicity Equivalency Factor
TE = Toxic Equivalent (to 2,3,7,8-TCDD)

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TABLE 2-3 (continued)

PCDDs/PCDFs DETECTION SUMMARY (WITH TOXICITY EQUIVALENT CONCENTRATIONS) FOR SOILS
FORMER KOPPERS COMPANY - NEWPORT SITE

	SAMPLING LOCATION AND DEPTH (FT)														
Detected PCDD	SB301					SB402					SB607				
Congener (µg/kg)	0-0.5	0-2	2-4	4-6	> 6	0-0.5	0-2	2-4	4-6	> 6	0-0.5	0-2	2-4	4-6	> 6
1,2,3,6,7,8-HxCDD	ND	ND	ND	NS	NS	ND	NS	ND	ND	NS	ND	NS	ND	ND	NS
TE (TEF = 0.1)															
1,2,3,7,8,9-HxCDD	ND	ND	ND	NS	NS	ND	NS	ND	ND	NS	ND	NS	ND	ND	NS
TE (TEF = 0.1)															
Other HxCDDs	ND	ND	ND	NS	NS	ND	NS	ND	ND	NS	ND	NS	ND	ND	NS
TE = 0 (TEF = 0)															
1,2,3,4,6,7,8-HpCDD	2	2.9	1.1	NS	NS	ND	NS	ND	ND	NS	ND	NS	ND	ND	NS
TE (TEF = 0.01)	0.02	0.029	0.011												
Other HpCDDs	3	3.8	1.8	NS	NS	ND	NS	ND	ND	NS	ND	NS	ND	ND	NS
TE = 0 (TEF = 0)	0	0	0												
OCDD	29	37	18	NS	NS	13	NS	0.6	ND	NS	0.27	NS	0.43	0.33	NS
TE (TEF = 0.001)	0.029	0.037	0.018			0.013		0.0006			0.00027		0.00043	0.00033	
Detected PCDF															
Congener (µg/kg)															
1,2,3,4,7,8-HxCDF	ND	ND	ND	NS	NS	ND	NS	ND	ND	NS	ND	NS	ND	ND	NS
TE (TEF = 0.1)															
1,2,3,7,8,9-HxCDF	ND	ND	ND	NS	NS	ND	NS	ND	ND	NS	ND	NS	ND	ND	NS
TE (TEF = 0.1)															
Other HxCDFs	0.6	1.3	ND	NS	NS	ND	NS	ND	ND	NS	ND	NS	ND	ND	NS
TE = 0 (TEF = 0)	0	0													
1,2,3,4,6,7,8-HpCDF	0.43	0.57	0.26	NS	NS	ND	NS	ND	ND	NS	ND	NS	ND	ND	NS
TE (TEF = 0.01)	0.0043	0.0057	0.0026												
1,2,3,4,7,8,9-HpCDF	ND	ND	ND	NS	NS	ND	NS	ND	ND	NS	ND	NS	ND	ND	NS
TE (TEF = 0.01)															
Other HpCDFs	1.77	2.23	1.04	NS	NS	ND	NS	ND	ND	NS	ND	NS	ND	ND	NS
TE = 0 (TEF = 0)	0	0	0												
OCDF	1.5	1.6	0.95	NS	NS	ND	NS	ND	ND	NS	ND	NS	ND	ND	NS
TE (TEF = 0.001)	0.0015	0.0016	0.00095												
Total TE for sample	0.0548	0.0733	0.03255	NS	NS	0.013	NS	0.0006	ND	NS	0.00027	NS	0.00043	0.00033	NS

ND = Not Detected
NS = Not Sampled
TEF = [illegible]icity Equivalency Factor
TE = [illegible]Equivalent (to 2,3,7,8-TCDD)

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TABLE 2-3 (continued)
PCDDs/PCDFs DETECTION SUMMARY (WITH TOXICITY EQUIVALENT CONCENTRATIONS) FOR SOILS
FORMER KOPPERS COMPANY - NEWPORT SITE

Detected PCDD Congener (µg/kg)	SAMPLING LOCATION AND DEPTH (FT)														
	SB614					SB615					SB618				
	0-0.5	0-2	2-4	4-6	> 6	0-0.5	0-2	2-4	4-6	> 6	0-0.5	0-2	2-4	4-6	> 6
1,2,3,6,7,8-HxCDD	ND	ND	ND	NS	NS	ND	NS	ND	ND	NS	ND	NS	ND	NS	NS
TE (TEF = 0.1)															
1,2,3,7,8,9-HxCDD	ND	ND	ND	NS	NS	ND	NS	ND	ND	NS	ND	NS	ND	NS	NS
TE (TEF = 0.1)															
Other HxCDDs	ND	ND	ND	NS	NS	ND	NS	ND	ND	NS	ND	NS	ND	NS	NS
TE = 0 (TEF = 0)															
1,2,3,4,6,7,8-HpCDD	26	1.6	ND	NS	NS	ND	NS	ND	ND	NS	ND	NS	23	NS	NS
TE (TEF = 0.01)	0.26	0.016											0.23		
Other HpCDDs	174	11.4	ND	NS	NS	ND	NS	ND	ND	NS	ND	NS	50	NS	NS
TE = 0 (TEF = 0)	0	0											0		
OCDD	250	35	ND	NS	NS	1.5	NS	ND	ND	NS	1.5	NS	450	NS	NS
TE (TEF = 0.001)	0.250	0.035				0.0015					0.0015		0.0450		
Detected PCDF Congener (µg/kg)															
1,2,3,4,7,8-HxCDF	ND	ND	ND	NS	NS	ND	NS	ND	ND	NS	ND	NS	ND	NS	NS
TE (TEF = 0.1)															
1,2,3,7,8,9-HxCDF	ND	ND	ND	NS	NS	ND	NS	ND	ND	NS	ND	NS	ND	NS	NS
TE (TEF = 0.1)															
Other HxCDFs	ND	ND	ND	NS	NS	ND	NS	ND	ND	NS	ND	NS	ND	NS	NS
TE = 0 (TEF = 0)															
1,2,3,4,6,7,8-HpCDF	ND	ND	ND	NS	NS	ND	NS	ND	ND	NS	ND	NS	2.1	NS	NS
TE (TEF = 0.01)													0.021		
1,2,3,4,7,8,9-HpCDF	ND	ND	ND	NS	NS	ND	NS	ND	ND	NS	ND	NS	ND	NS	NS
TE (TEF = 0.01)															
Other HpCDFs	ND	ND	ND	NS	NS	ND	NS	ND	ND	NS	ND	NS	10.9	NS	NS
TE = 0 (TEF = 0)													0		
OCDF	ND	ND	ND	NS	NS	ND	NS	ND	ND	NS	ND	NS	15	NS	NS
TE (TEF = 0.001)													0.015		
Total TE for sample	**0.510**	**0.051**	**ND**	**NS**	**NS**	**0.0015**	**NS**	**ND**	**ND**	**NS**	**0.0015**	**NS**	**0.311**	**NS**	**NS**

ND = Not Detected
NS = Not Sampled
TEF = Toxicity Equivalency Factor
TE = Toxic Equivalent (to 2,3,7,8-TCDD)

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TABLE 2-3 (continued)

PCDDs/PCDFs DETECTION SUMMARY (WITH TOXICITY EQUIVALENT CONCENTRATIONS) FOR SOILS
FORMER KOPPERS COMPANY - NEWPORT SITE

	SAMPLING LOCATION AND DEPTH (FT)									
Detected PCDD	SB621					SB623				
Congener (µg/kg)	0-0.5	0-2	2-4	4-6	> 6	0-0.5	0-2	2-4	4-6	> 6
1,2,3,6,7,8-HxCDD	ND	ND	NS	NS	ND	ND	NS	ND	NS	ND
TE (TEF = 0.1)										
1,2,3,7,8,9-HxCDD	ND	ND	NS	NS	ND	ND	NS	ND	NS	ND
TE (TEF = 0.1)										
Other HxCDDs	ND	ND	NS	NS	ND	ND	NS	ND	NS	ND
TE = 0 (TEF = 0)										
1,2,3,4,6,7,8-HpCDD	ND	ND	NS	NS	ND	ND	NS	ND	NS	ND
TE (TEF = 0.01)										
Other HpCDDs	ND	ND	NS	NS	ND	ND	NS	ND	NS	ND
TE = 0 (TEF = 0)										
OCDD	4.2	4.3	NS	NS	ND	2.7	NS	8.2	NS	1.1
TE (TEF = 0.001)	0.0042	0.0043				0.0027		0.0082		0.0011
Detected PCDF Congener (µg/kg)										
1,2,3,4,7,8-HxCDF	ND	ND	NS	NS	ND	ND	NS	ND	NS	ND
TE (TEF = 0.1)										
1,2,3,7,8,9-HxCDF	ND	ND	NS	NS	ND	ND	NS	ND	NS	ND
TE (TEF = 0.1)										
Other HxCDFs	ND	ND	NS	NS	ND	ND	NS	ND	NS	ND
TE = 0 (TEF = 0)										
1,2,3,4,6,7,8-HpCDF	ND	ND	NS	NS	ND	ND	NS	ND	NS	ND
TE (TEF = 0.01)										
1,2,3,4,7,8,9-HpCDF	ND	ND	NS	NS	ND	ND	NS	ND	NS	ND
TE (TEF = 0.01)										
Other HpCDFs	ND	ND	NS	NS	ND	ND	NS	ND	NS	ND
TE = 0 (TEF = 0)										
OCDF	ND	ND	NS	NS	ND	ND	NS	ND	NS	ND
TE (TEF = 0.001)										
Total TE for sample	0.0042	0.0043	NS	NS	ND	0.0027	NS	0.0082	NS	0.0011

ND = Not Detected
NS = Not Sampled
TEF = T[illegible]icity Equivalency Factor
TE = [illegible]quivalent (to 2,3,7,8-TCDD)

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TABLE 2-4
PRELIMINARY SOIL METALS EVALUATION
FORMER KOPPERS COMPANY- NEWPORT SITE

Metal	On Site Samples 95% UCL (mg/kg)	Reference Samples 95% UCL (mg/kg)	Shacklette and Boerngen, 1984 Eastern USA	
			Arithmetic Mean (mg/kg)	Geometric Mean (mg/kg)
Aluminum	13262	13310	57000	33000
Antimony	2.2	5.1	0.76	0.52
Arsenic	4.2	5.3	7.4	4.8
Barium	108	195	420	290
Beryllium	0.9	1	0.85	0.55
Cadmium	0.6	0.44	<1*	
Calcium	5881	14876	63000	34000
Chromium	27.7	30.9	52	33
Cobalt	9	11.1	9.2	5.9
Copper	15.5	22.6	22	13
Iron	21171	21690	25000	14000
Lead	21.4	74.2	17	14
Magnesium	3963	9596	4600	2100
Manganese	540	525	640	240
Mercury	0.28	0.24	0.12	0.081
Nickel	13.5	16.5	18	11
Potassium	1441	2091	12000	12000
Selenium	1	2	0.45	0.3
Silver	0.9	ND	<1	
Sodium	227	346	7800	2500
Thallium	2.4	ND	<1	
Vanadium	48.5	46.1	66	43
Zinc	82.2	136	52	40

Notes: * Dragun, 1988
None of the above data were normalized for any parameter

TABLE 2-5 SUMMARY OF ANALYTE CONCENTRATIONS IN SOIL AT REFERENCE LOCATIONS
FORMER KOPPERS COMPANY - NEWPORT SITE

	ON-SITE															
	BG-1				BG-2				SB705				SB706			
	0-0.5'		1.5-3.5'		0-0.5'		5.0-7.0'		0-0.5'		6-8'		0-0.5'		4-6'	
ANALYTE																
VOCs ug/kg																
1,1,1-Trichloroethane	13	UJ	12	U	12	U	10	U	61	U	54	U	11	U	60	U
1,1,2,2-Tetrachloroethane	13	UJ	12	U	12	UJ	10	U	61	U	54	U	11	U	60	U
1,1,2-Trichloroethane	13	UJ	12	U	12	U	10	U	61	U	54	U	11	U	60	U
1,1-Dichloroethane	13	U	12	U	12	U	10	U	61	U	54	U	11	U	60	U
1,1-Dichloroethene	13	U	12	U	12	U	10	U	61	U	54	U	11	U	60	U
1,2-Dichloroethane	13	U	12	U	12	U	10	U	61	U	54	U	11	U	60	U
1,2-Dichloroethene (total)	13	U	12	U	12	U	10	U	61	U	54	U	11	U	60	U
1,2-Dichloropropane	13	UJ	12	U	12	U	10	U	61	U	54	U	11	U	60	U
2-butanone	13	U	12	U	12	U	10	U	61	U	54	U	11	U	60	U
2-Hexanone	13	UJ	12	U	12	UJ	10	U	61	U	54	U	11	U	60	U
4-Methyl-2-Pentanone	13	UJ	12	U	12	UJ	10	U	61	U	54	UJ	11	U	60	U
Acetone	7	B	12	U	12	U	10	U	580		1300	J	11	U	570	B
Benzene	13	UJ	12	U	12	U	10	U	61	U	54	U	11	U	60	U
Bromodichloromethane	13	UJ	12	U	12	U	10	U	61	U	54	U	11	U	60	U
Bromoform	13	UJ	12	U	12	U	10	U	61	U	54	U	11	U	60	U
Bromomethane	13	U	12	U	12	U	10	U	61	U	54	U	11	U	60	U
Carbon disulfide	13	U	12	U	12	U	10	U	61	U	54	U	11	U	60	U
Carbon tetrachloride	13	UJ	12	U	12	U	10	U	61	U	54	U	11	U	60	U
Chlorobenzene	13	UJ	12	U	12	UJ	10	U	61	U	54	U	11	U	60	U
Chloroethane	13	U	12	U	12	U	10	U	61	U	54	UJ	11	UJ	60	UJ
Chloroform	13	U	12	U	12	U	10	U	61	U	54	U	11	U	60	U
Chloromethane	13	U	12	U	12	U	10	UJ	61	U	54	U	11	U	60	U
cis-1,3-Dichloropropene	13	UJ	12	U	12	U	10	U	61	U	54	U	11	U	60	U
Dibromochloromethane	13	UJ	12	U	12	U	10	U	61	U	54	U	11	U	60	U
Ethylbenzene	13	UJ	12	U	12	UJ	10	U	61	U	54	U	11	U	60	U
Methylene chloride	13	U	12	U	12	U	10	U	61	U	54	U	11	U	60	U
Styrene	13	UJ	12	U	12	UJ	10	U	61	U	54	U	11	U	60	U
Tetrachloroethene	13	UJ	12	U	5	J	10	U	61	U	54	U	11	U	60	U
Toluene	13	UJ	12	U	8	J	10	U	15	J	54	U	7	J	60	U
trans-1,3-Dichloropropene	13	UJ	12	U	12	U	10	U	61	U	54	U	11	U	60	U
Trichloroethene	13	UJ	12	U	12	U	10	U	61	U	54	U	11	U	60	U
Vinyl Chloride	13	U	12	U	12	U	10	U	61	U	54	U	11	U	60	U
Xylenes	13	UJ	12	U	12	UJ	10	U	61	U	54	U	11	U	60	U

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TABLE 2-5 SUMMARY OF ANALYTE CONCEN ATIONS IN SOIL AT REFERENCE LOCATIONS
FORMER KOPPERS COMPANY - NEWPORT SITE

	ON-SITE															
	SB701				SB702				SB703				SB704			
	0-0.5'		7-9'		0-0.5'		7-9'		0-0.5'		10-12'		0-0.5'		1.5-3.5'	
ANALYTE																
VOCs ug/kg																
1,1,1-Trichloroethane	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
1,1,2,2-Tetrachloroethane	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	UJ	63	U
1,1,2-Trichloroethane	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
1,1-Dichloroethane	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
1,1-Dichloroethene	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
1,2-Dichloroethane	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
1,2-Dichloroethene (total)	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
1,2-Dichloropropane	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
2-butanone	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
2-Hexanone	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	UJ	63	U
4-Methyl-2-Pentanone	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	UJ	63	U
Acetone	12	U	1600	J	22	B	1700	J	19	U	3200	UJ	26	B	3400	J
Benzene	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
Bromodichloromethane	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
Bromoform	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
Bromomethane	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
Carbon disulfide	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
Carbon tetrachloride	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
Chlorobenzene	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	UJ	63	U
Chloroethane	12	U	56	UJ	14	U	60	UJ	19	UJ	3200	UJ	16	U	63	UJ
Chloroform	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
Chloromethane	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
cis-1,3-Dichloropropene	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
Dibromochloromethane	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
Ethylbenzene	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	UJ	63	U
Methylene chloride	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
Styrene	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	UJ	63	U
Tetrachloroethene	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	UJ	63	U
Toluene	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	UJ	63	U
trans-1,3-Dichloropropene	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
Trichloroethene	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
Vinyl Chloride	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	U	63	U
Xylenes	12	U	56	UJ	14	U	60	U	19	U	3200	UJ	16	UJ	63	U

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TABLE 2-5 SUMMARY OF ANALYTE CONCENTRATIONS IN SOIL AT REFERENCE LOCATIONS
FORMER KOPPERS COMPANY - NEWPORT SITE

	DUPONT																							
	TB 28				TB 29				MW 29				HRB 1				HRB 2				HRB 3			
	2-4'		8-10'		2-4'		8-10'		2-4'		8-10'		2-4'		8-10'		2-4'		8-10'		2-4'		8-10'	
ANALYTE																								
VOCs ug/kg																								
1,1,1-Trichloroethane	—		—		—		—		—		—		—		NA		—		NA		—		—	
1,1,2,2-Tetrachloroethane	—		—		—		—		—		—		—		NA		—		NA		—		—	
1,1,2-Trichloroethane	—		—		—		—		—		—		—		NA		—		NA		—		—	
1,1-Dichloroethane	—		—		—		—		—		—		—		NA		—		NA		—		—	
1,1-Dichloroethene	—		—		—		—		—		—		—		NA		—		NA		—		—	
1,2-Dichloroethane	—		—		—		—		—		—		—		NA		—		NA		—		—	
1,2-Dichloroethene (total)	—		—		—		—		—		—		—		NA		—		NA		—		—	
1,2-Dichloropropane	—		—		—		—		—		—		—		NA		—		NA		—		—	
2-butanone	12	BJ	15	B	12	U	13	U	11	U	20	U	4	BJ	NA		11	U	NA		11	U	5	BJ
2-Hexanone	—		—		—		—		—		—		—		NA		—		NA		—		—	
4-Methyl-2-Pentanone	13	U	11	U	12	U	13	U	11	U	20	U	11	U	NA		11	U	NA		11	U	11	U
Acetone	86	B	160	B	23	B	24	B	19	B	17	BJ	7	BJ	NA		26	B	NA		25	B	33	B
Benzene	—		—		—		—		—		—		—		NA		—		NA		—		—	
Bromodichloromethane	—		—		—		—		—		—		—		NA		—		NA		—		—	
Bromoform	—		—		—		—		—		—		—		NA		—		NA		—		—	
Bromomethane	—		—		—		—		—		—		—		NA		—		NA		—		—	
Carbon disulfide	—		—		—		—		—		—		—		NA		—		NA		—		—	
Carbon tetrachloride	—		—		—		—		—		—		—		NA		—		NA		—		—	
Chlorobenzene	—		—		—		—		—		—		—		NA		—		NA		—		—	
Chloroethane	—		—		—		—		—		—		—		NA		—		NA		—		—	
Chloroform	2	J	1	J	6	U	6	U	6		10	U	6	U	NA		6	U	NA		6	U	6	U
Chloromethane	—		—		—		—		—		—		—		NA		—		NA		—		—	
cis-1,3-Dichloropropene	—		—		—		—		—		—		—		NA		—		NA		—		—	
Dibromochloromethane	—		—		—		—		—		—		—		NA		—		NA		—		—	
Ethylbenzene	6	U	6	U	6	U	6	U	5	U	10	U	6	U	NA		6	U	NA		6	U	6	U
Methylene chloride	65	B	41	B	17	B	24	B	37	B	8	BJ	6	B	NA		80	B	NA		13	B	25	B
Styrene	—		—		—		—		—		—		—		NA		—		NA		—		—	
Tetrachloroethene	—		—		—		—		—		—		—		NA		—		NA		—		—	
Toluene	—		—		—		—		—		—		—		NA		—		NA		—		—	
trans-1,3-Dichloropropene	—		—		—		—		—		—		—		NA		—		NA		—		—	
Trichloroethene	6	U	6	U	6	U	6	U	5	U	10	U	6	U	NA		6	U	NA		6	U	6	U
Vinyl Chloride	—		—		—		—		—		—		—		NA		—		NA		—		—	
Xylenes	6	U	6	U	6	U	6	U	5	U	10	U	2	J	NA		6	U	NA		6	U	6	U

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TABLE 2-5 SUMMARY OF ANALYTE CONCE... ..ATIONS IN SOIL AT REFERENCE LOCATIONS
FORMER KOPPERS COMPANY - NEWPORT SITE

	ON-SITE															
	BG-1				BG-2				SB705				SB706			
	0-0.5'		1.5-3.5'		0-0.5'		5.0-7.0'		0-0.5'		6-8'		0-0.5'		4-6'	
ANALYTE																
SVOCs ug/kg																
1,2,4-Trichlorobenzene	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
1,2-Dichlorobenzene	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
1,3-Dichlorobenzene	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
1,4-Dichlorobenzene	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
2,2'-oxybis(1-chloropropane)	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
2,4,5-Trichlorophenol	2200	UJ	960	UJ	2000	UJ	860	UJ	1000	U	8900	U	14000	U	2000	U
2,4,6-Trichlorophenol	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
2,4-Dichlorophenol	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
2,4-Dimethylphenol	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
2,4-Dinitrophenol	2200	UJ	960	UJ	2000	UJ	860	UJ	1000	U	8900	U	14000	U	2000	U
2,4-Dinitrotoluene	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
2,6-Dinitrotoluene	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
2-Chloronaphthalene	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
2-Chlorophenol	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
2-Methylnaphthalene	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
2-Methylphenol	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
2-Nitroaniline	2200	UJ	960	UJ	2000	UJ	860	UJ	1000	U	8900	U	14000	U	2000	U
2-Nitrophenol	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
3,3'-Dichlorobenzidine	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
3-Nitroaniline	2200	UJ	960	UJ	2000	UJ	860	UJ	1000	U	8900	U	14000	U	2000	U
4,6-Dinitro-2-methylphenol	2200	UJ	960	UJ	2000	UJ	860	UJ	1000	U	8900	U	14000	U	2000	U
4--Bromophenyl-phenylether	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
4-Chloro-3-methylphenol	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
4-Chloroaniline	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
4-Chlorophenyl-phenylether	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
4-Methyl phenol	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
4-Nitroaniline	2200	UJ	960	UJ	2000	UJ	860	UJ	1000	U	8900	U	14000	U	2000	U
4-Nitrophenol	2200	UJ	960	UJ	2000	UJ	860	UJ	1000	U	8900	UJ	14000	UJ	2000	UJ
Acenaphthene	880	U	390	U	780	U	340	U	410	U	3600	U	5700	U	800	U
Acenaphthylene	880	U	390	U	780	U	340	U	410	U	3600	U	5700	U	800	U
Anthracene	880	U	390	U	210	J	340	U	410	U	3600	U	5700	U	800	U

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TABLE 2-5 SUMMARY OF ANALYTE CONCENTRATIONS IN SOIL AT REFERENCE LOCATIONS
FORMER KOPPERS COMPANY - NEWPORT SITE

	ON-SITE															
	SB701				SB702				SB703				SB704			
	0-0.5'		7-9'		0-0.5'		7-9'		0-0.5'		10-12'		0-0.5'		1.5-3.5'	
ANALYTE																
SVOCs ug/kg																
1,2,4-Trichlorobenzene	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
1,2-Dichlorobenzene	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
1,3-Dichlorobenzene	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
1,4-Dichlorobenzene	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
2,2'-oxybis(1-chloropropane)	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
2,4,5-Trichlorophenol	1000	U	930	U	1200	U	1000	U	1500	U	1100	U	1300	U	1100	U
2,4,6-Trichlorophenol	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
2,4-Dichlorophenol	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
2,4-Dimethylphenol	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
2,4-Dinitrophenol	1000	U	930	U	1200	U	1000	U	1500	U	1100	U	1300	U	1100	U
2,4-Dinitrotoluene	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
2,6-Dinitrotoluene	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
2-Chloronaphthalene	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
2-Chlorophenol	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
2-Methylnaphthalene	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
2-Methylphenol	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
2-Nitroaniline	1000	U	930	U	1200	U	1000	U	1500	U	1100	U	1300	U	1100	U
2-Nitrophenol	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
3,3'-Dichlorobenzidine	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
3-Nitroaniline	1000	U	930	U	1200	U	1000	U	1500	U	1100	U	1300	U	1100	U
4,6-Dinitro-2-methylphenol	1000	U	930	U	1200	U	1000	U	1500	U	1100	U	1300	U	1100	U
4--Bromophenyl-phenylether	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
4-Chloro-3-methylphenol	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
4-Chloroaniline	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
4-Chlorophenyl-phenylether	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
4-Methyl phenol	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
4-Nitroaniline	1000	U	930	U	1200	U	1000	U	1500	U	1100	U	1300	U	1100	U
4-Nitrophenol	1000	U	930	U	1200	U	1000	U	1500	U	1100	U	1300	U	1100	U
Acenaphthene	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
Acenaphthylene	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
Anthracene	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U

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TABLE 2-5 SUMMARY OF ANALYTE CONCE..ATIONS IN SOIL AT REFERENCE LOCATIONS
FORMER KOPPERS COMPANY - NEWPORT SITE

	DUPONT																							
	TB 28				TB 29				MW 29				HRB 1				HRB 2				HRB 3			
	2-4'		8-10'		2-4'		8-10'		2-4'		8-10'		2-4'		8-10'		2-4'		8-10'		2-4'		8-10'	
ANALYTE																								
SVOCs ug/kg																								
1,2,4-Trichlorobenzene	---		---		---		---		---		---		---		---		---		---		---		---	
1,2-Dichlorobenzene	---		---		---		---		---		---		---		---		---		---		---		---	
1,3-Dichlorobenzene	---		---		---		---		---		---		---		---		---		---		---		---	
1,4-Dichlorobenzene	---		---		---		---		---		---		---		---		---		---		---		---	
2,2'-oxybis(1-chloropropane)	---		---		---		---		---		---		---		---		---		---		---		---	
2,4,5-Trichlorophenol	---		---		---		---		---		---		---		---		---		---		---		---	
2,4,6-Trichlorophenol	---		---		---		---		---		---		---		---		---		---		---		---	
2,4-Dichlorophenol	---		---		---		---		---		---		---		---		---		---		---		---	
2,4-Dimethylphenol	---		---		---		---		---		---		---		---		---		---		---		---	
2,4-Dinitrophenol	---		---		---		---		---		---		---		---		---		---		---		---	
2,4-Dinitrotoluene	---		---		---		---		---		---		---		---		---		---		---		---	
2,6-Dinitrotoluene	---		---		---		---		---		---		---		---		---		---		---		---	
2-Chloronaphthalene	---		---		---		---		---		---		---		---		---		---		---		---	
2-Chlorophenol	---		---		---		---		---		---		---		---		---		---		---		---	
2-Methylnaphthalene	420	U	360	U	380	U	430	U	350	U	640	U	370	U	290	J	380	U	400	U	360	U	370	U
2-Methylphenol	---		---		---		---		---		---		---		---		---		---		---		---	
2-Nitroaniline	---		---		---		---		---		---		---		---		---		---		---		---	
2-Nitrophenol	---		---		---		---		---		---		---		---		---		---		---		---	
3,3'-Dichlorobenzidine	---		---		---		---		---		---		---		---		---		---		---		---	
3-Nitroaniline	---		---		---		---		---		---		---		---		---		---		---		---	
4,6-Dinitro-2-methylphenol	---		---		---		---		---		---		---		---		---		---		---		---	
4-Bromophenyl-phenylether	---		---		---		---		---		---		---		---		---		---		---		---	
4-Chloro-3-methylphenol	---		---		---		---		---		---		---		---		---		---		---		---	
4-Chloroaniline	---		---		---		---		---		---		---		---		---		---		---		---	
4-Chlorophenyl-phenylether	---		---		---		---		---		---		---		---		---		---		---		---	
4-Methyl phenol	---		---		---		---		---		---		---		---		---		---		---		---	
4-Nitroaniline	---		---		---		---		---		---		---		---		---		---		---		---	
4-Nitrophenol	---		---		---		---		---		---		---		---		---		---		---		---	
Acenaphthene	---		---		---		---		---		---		---		---		---		---		---		---	
Acenaphthylene	---		---		---		---		---		---		---		---		---		---		---		---	
Anthracene	---		---		---		---		---		---		---		---		---		---		---		---	

AR308528

TABLE 2-5 SUMMARY OF ANALYTE CONCEN...ATIONS IN SOIL AT REFERENCE LOCATIONS
FORMER KOPPERS COMPANY - NEWPORT SITE

	ON-SITE															
	BG-1				BG-2				SB705				SB706			
	0-0.5'		1.5-3.5'		0-0.5'		5.0-7.0'		0-0.5'		6-8'		0-0.5'		4-6'	
ANALYTE																
Benzo(a)anthracene	880	U	390	U	2100	J	340	U	110	J	780	J	5700	U	500	J
Benzo(a)pyrene	880	U	390	U	1800		340	U	410	U	3600	U	5700	U	270	J
Benzo(b)fluoranthene	880	U	390	U	4100		340	U	170	J	730	J	5700	U	540	J
Benzo(g,h,i)perylene	880	U	390	U	1300		340	U	410	U	3600	UJ	5700	UJ	380	J
Benzo(k)fluoranthene	880	U	390	U	890		340	U	410	U	3600	U	5700	U	170	J
bis(2-Chloroethoxy)methane	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
bis(2-Chloroethyl)ether	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
bis(2-Ethylhexyl)phthalate	880	UJ	390	UJ	780	UJ	340	UJ	190	J	3600	U	5700	U	800	U
Butylbenzylphthalate	880	UJ	390	UJ	180	J	340	UJ	120	J	3600	U	5700	U	800	U
Carbazole	880	U	390	U	780	U	340	U	410	U	3600	U	5700	U	800	U
Chrysene	880	U	390	U	1800		340	U	410	U	3600	U	5700	U	370	J
Di-n-butylphthalate	220	J	150	J	260	J	230	J	280	J	3600	U	5700	U	800	U
Di-n-octylphthalate	880	UJ	390	UJ	780	UJ	340	UJ	410	UJ	3600	U	5700	U	800	U
Dibenzo(a,h)anthracene	880	U	390	U	780	U	340	U	410	U	3600	UJ	5700	UJ	800	UJ
Dibenzofuran	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
Diethylphthalate	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
Dimethylphthalate	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
Fluoranthene	200	J	390	U	2600		340	U	170	J	1300	J	1500	J	1000	
Fluorene	880	U	390	U	780	U	340	U	410	U	3600	U	5700	U	800	U
Hexachlorobenzene	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
Hexachlorobutadiene	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
Hexachlorocyclopentadiene	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
Hexachloroethane	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
Indeno(1,2,3-c,d)pyrene	880	U	390	U	1400		340	U	410	U	3600	UJ	5700	UJ	240	J
Isophorone	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
N-Nitroso-di-n-propylamine	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
N-Nitrosodiphenylamine	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
Naphthalene	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
Nitrobenzene	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
Pentachlorophenol	2200	UJ	960	UJ	2000	UJ	860	UJ	1000	U	8900	U	14000	U	2000	U
Phenanthrene	880	U	390	U	680	J	340	U	110	J	1100	J	5700	U	870	
Phenol	880	UJ	390	UJ	780	UJ	340	UJ	410	U	3600	U	5700	U	800	U
Pyrene	210	J	390	U	2500		340	U	170	J	1200	J	1300	J	910	

AR308529

TABLE 2-5 SUMMARY OF ANALYTE CONCE ATIONS IN SOIL AT REFERENCE LOCATIONS
FORMER KOPPERS COMPANY - NEWPORT SITE

	ON-SITE															
	SB701				SB702				SB703				SB704			
	0-0.5'		7-9'		0-0.5'		7-9'		0-0.5'		10-12'		0-0.5'		1.5-3.5'	
ANALYTE																
Benzo(a)anthracene	420	U	370	U	480	U	400	U	190	J	420	U	220	J	420	U
Benzo(a)pyrene	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
Benzo(b)fluoranthene	420	U	370	U	480	U	400	U	240	J	420	U	230	J	420	U
Benzo(g,h,i)perylene	420	U	370	U	480	U	400	U	620	U	120	J	110	J	420	U
Benzo(k)fluoranthene	420	U	370	U	480	U	400	U	620	U	420	U	190	J	420	U
bis(2-Chloroethoxy)methane	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
bis(2-Chloroethyl)ether	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
bis(2-Ethylhexyl)phthalate	420	U	160	J	480	U	400	U	620	U	420	U	530	U	420	U
Butylbenzylphthalate	420	U	370	U	480	U	400	U	620	U	420	U	210	J	420	U
Carbazole	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
Chrysene	420	U	370	U	480	U	400	U	320	J	420	U	180	J	420	U
Di-n-butylphthalate	150	J	98	J	170	J	190	J	240	J	170	J	400	J	130	J
Di-n-octylphthalate	420	U	370	U	480	U	400	U	620	U	420	U	530	UJ	420	U
Dibenzo(a,h)anthracene	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
Dibenzofuran	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
Diethylphthalate	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
Dimethylphthalate	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
Fluoranthene	420	U	370	U	480	U	400	U	170	J	420	U	330	J	420	U
Fluorene	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
Hexachlorobenzene	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
Hexachlorobutadiene	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
Hexachlorocyclopentadiene	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
Hexachloroethane	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
Indeno(1,2,3-c,d)pyrene	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
Isophorone	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
N-Nitroso-di-n-propylamine	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
N-Nitrosodiphenylamine	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
Naphthalene	420	U	370	U	480	U	400	U	620	U	420	U	210	J	420	U
Nitrobenzene	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
Pentachlorophenol	1000	U	930	U	1200	U	1000	U	1500	U	1100	U	1300	U	1100	U
Phenanthrene	420	U	370	U	480	U	400	U	620	U	420	U	200	J	420	U
Phenol	420	U	370	U	480	U	400	U	620	U	420	U	530	U	420	U
Pyrene	420	U	370	U	480	U	400	U	180	J	420	U	270	J	420	U

AR308530

TABLE 2-5 SUMMARY OF ANALYTE CONCENTRATIONS IN SOIL AT REFERENCE LOCATIONS
FORMER KOPPERS COMPANY - NEWPORT SITE

	DUPONT																							
	TB 28				TB 29				MW 29				HRB 1				HRB 2				HRB 3			
	2-4'		8-10'		2-4'		8-10'		2-4'		8-10'		2-4'		8-10'		2-4'		8-10'		2-4'		8-10'	
ANALYTE																								
Benzo(a)anthracene	—		—		—		—		—		—		—		—		—		—		—		—	
Benzo(a)pyrene	420	U	630		380	U	430	U	350	U	640	U	370	U	800	U	380	U	400	U	360	U	370	U
Benzo(b)fluoranthene	—		—		—		—		—		—		—		—		—		—		—		—	
Benzo(g,h,i)perylene	—		—		—		—		—		—		—		—		—		—		—		—	
Benzo(k)fluoranthene	—		—		—		—		—		—		—		—		—		—		—		—	
bis(2-Chloroethoxy)methane	—		—		—		—		—		—		—		—		—		—		—		—	
bis(2-Chloroethyl)ether	—		—		—		—		—		—		—		—		—		—		—		—	
bis(2-Ethylhexyl)phthalate	420	U	37	J	200	J	93	J	90	J	460	J	200	BJ	210	BJ	50	J	400	U	270	BJ	200	BJ
Butylbenzylphthalate	—		—		—		—		—		—		—		—		—		—		—		—	
Carbazole	—		—		—		—		—		—		—		—		—		—		—		—	
Chrysene	—		—		—		—		—		—		—		—		—		—		—		—	
Di-n-butylphthalate	—		—		—		—		—		—		—		—		—		—		—		—	
Di-n-octylphthalate	—		—		—		—		—		—		—		—		—		—		—		—	
Dibenzo(a,h)anthracene	—		—		—		—		—		—		—		—		—		—		—		—	
Dibenzofuran	—		—		—		—		—		—		—		—		—		—		—		—	
Diethylphthalate	—		—		—		—		—		—		—		—		—		—		—		—	
Dimethylphthalate	—		—		—		—		—		—		—		—		—		—		—		—	
Fluoranthene	—		—		—		—		—		—		—		—		—		—		—		—	
Fluorene	—		—		—		—		—		—		—		—		—		—		—		—	
Hexachlorobenzene	—		—		—		—		—		—		—		—		—		—		—		—	
Hexachlorobutadiene	—		—		—		—		—		—		—		—		—		—		—		—	
Hexachlorocyclopentadiene	—		—		—		—		—		—		—		—		—		—		—		—	
Hexachloroethane	—		—		—		—		—		—		—		—		—		—		—		—	
Indeno(1,2,3-c,d)pyrene	—		—		—		—		—		—		—		—		—		—		—		—	
Isophorone	—		—		—		—		—		—		—		—		—		—		—		—	
N-Nitroso-di-n-propylamine	—		—		—		—		—		—		—		—		—		—		—		—	
N-Nitrosodiphenylamine	—		—		—		—		—		—		—		—		—		—		—		—	
Naphthalene	—		—		—		—		—		—		—		—		—		—		—		—	
Nitrobenzene	—		—		—		—		—		—		—		—		—		—		—		—	
Pentachlorophenol	—		—		—		—		—		—		—		—		—		—		—		—	
Phenanthrene	—		—		—		—		—		—		—		—		—		—		—		—	
Phenol	—		—		—		—		—		—		—		—		—		—		—		—	
Pyrene	—		—		—		—		—		—		—		—		—		—		—		—	

AR308531

TABLE 2-5 SUMMARY OF ANALYTE CONCE. ATIONS IN SOIL AT REFERENCE LOCATIONS
FORMER KOPPERS COMPANY - NEWPORT SITE

	ON-SITE															
	BG-1				BG-2				SB705				SB706			
	0-0.5'		1.5-3.5'		0-0.5'		5.0-7.0'		0-0.5'		6-8'		0-0.5'		4-6'	
ANALYTE																
METALS mg/kg																
Aluminum	9660		11600		6820		4990		9720		8780		3300		9440	
Antimony	0.92	L	60	UL	60	UL	60	UL	60	UL	60	UL	60	UL	60	UL
Arsenic	4.5		4.3		3.6		1.7	B	5.6	K	3.5	K	2.2	B	5.3	K
Barium	221		33.4		317		24.4		72.2		141		42.6		95.8	
Beryllium	0.61		0.38		0.49		5	U	0.47	K	0.35	K	0.2	K	0.53	K
Cadmium	0.47		0.1		0.16		5	U	5	U	5	U	5	U	5	U
Calcium	1600		659		1070		149		1940		14500		74400		1800	
Chromium	21.1		25.2		14.7		9.7		18.4		50.1		7.4		21.1	
Cobalt	9.6	K	6.9	K	7	K	3.4	K	6.6		8.5		3		7.4	
Copper	32.1		10.6		15	B	1.8	B	11.6		31.1		10.6		17.2	
Iron	16200		18000		10700		6890		19300		20100		8320		18100	
Lead	176		7.5		107		4.3		18.3		44		78.6		72.3	
Magnesium	1820		2820		1060		708		1930		7780		40200		1680	
Manganese	366	K	106	K	322	K	161	K	163		244		147		187	
Mercury	0.2	U	0.2	U	0.07		0.2	U	15	U	15	U	15	U	0.11	K
Nickel	11.3		10.4		7		4.8		8.1	B	21.3	B	5.1	B	8.6	B
Potassium	1250		1360		889		697		647		2060		878		581	
Selenium	1.6	L	5	U	5	UL	5	UL	5	UL	5	UL	5	UL	5	UL
Silver	10	U	10	UL	10	U	10	U	10	U	10	U	10	U	10	U
Sodium	716	B	653		668	J	573	B	86.5	B	203	B	51.3	B	81	B
Thallium	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Vanadium	34.9		41.5		27.3		18.5	K	32.4		32.7		17.3		33.6	
Zinc	141		30.1		74.2		13.4		38.7		48.5		125		86.5	

AR308532

TABLE 2-5 SUMMARY OF ANALYTE CONCEN .ATIONS IN SOIL AT REFERENCE LOCATIONS
FORMER KOPPERS COMPANY - NEWPORT SITE

	ON-SITE															
	SB701				SB702				SB703				SB704			
	0-0.5'		7-9'		0-0.5'		7-9'		0-0.5'		10-12'		0-0.5'		1.5-3.5'	
ANALYTE																
METALS mg/kg																
Aluminum	9910		13100		12300		16100		19300		17800		13300		14500	
Antimony	60	UL	60	UL	60	UL	60	UL	60	UL	3.7	L	4.3	L	60	UL
Arsenic	4.9	K	1.2	B	7.3	K	2.4	K	6.7	K	4.3	K	7.4	K	6	K
Barium	131		107		226		113		345		137		296		57.4	
Beryllium	0.87	K	0.6	K	0.83	K	0.65	K	1.1	K	0.8	K	0.82	K	0.54	K
Cadmium	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Calcium	720		341		799		633		2850		927		1690		549	
Chromium	17.4		39.4		20		34.6		39.6		34.9		26.6		30.6	
Cobalt	8.1		16		8.4		14.2		15.3		13.8		11.4		8.4	
Copper	21.3		19.8		14.5		22.1		34.3		15.7		24.4		13.2	
Iron	13800		29200		15600		26200		27100		26400		19600		24100	
Lead	41.1		7.7		37.9		7.3		111		13.9		100		8.5	
Magnesium	1660		4270		2110		5570		4250		3910		2710		2890	
Manganese	635		331		583		267		1060		326		706		133	
Mercury	15	U	15	U	15	U	15	U	0.25		15	U	0.21	K	15	U
Nickel	10.7	B	18.9	B	12.4	B	21.4	B	26.4	B	17.1	B	19.3	B	14.1	B
Potassium	699		4560		749		4520		1860		1790		1090		993	
Selenium	5	UL	5	UL	5	UL	0.92	L	2.1	L	0.98	L	5	UL	5	UL
Silver	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Sodium	60.4	B	98.4	B	60	B	68.8	B	172	B	134	B	66.6	B	62.4	B
Thallium	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Vanadium	25.1		59.8		35.1		60.1		62.8		53.6		53.2		47.3	
Zinc	63		44.6		56.6		56.6		420		89.7		149		47.7	

AR308533

TABLE 2-5 SUMMARY OF ANALYTE CONCENTRATIONS IN SOIL AT REFERENCE LOCATIONS
FORMER KOPPERS COMPANY - NEWPORT SITE

	DUPONT																							
	TB 28				TB 29				MW 29				HRB 1				HRB 2				HRB 3			
	2-4'		8-10'		2-4'		8-10'		2-4'		8-10'		2-4'		8-10'		2-4'		8-10'		2-4'		8-10'	
ANALYTE																								
METALS mg/kg																								
Aluminum	13200		15100		11200		21300		16200		12200		8860		12000		7970		10100		16900		17300	
Antimony	9.8	U	9.4	U	6.4	U	7.4	U	8.5	U	9.7	U	8.8	U	9.1	U	8.9	U	9	U	8.5	U	8.9	U
Arsenic	10.5	U	10.1	U	4.3		2.5	U	9.7		10.4	U	12.8		9.8	U	12.8		9.7	U	10.7		15	
Barium	41.9	B	119		500		79.4		72		45.9	B	28.3	B	56.8		25	B	96.4		322		98.3	
Beryllium	5.6	B	0.53	B	0.54	B	0.49		0.28	B	0.49	B	0.64	B	0.91	B	0.49	B	1.1	B	1	B	0.93	B
Cadmium	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
Calcium	600	B	758	B	3980		971	B	879	B	418	B	685	B	520	B	432	B	460	B	1110		1100	B
Chromium	20.7		37.3		15.6		33.5		18.8		20.5		15.7		25.9		14.3		23.5		31		36.6	
Cobalt	4.8	B	22.4		5.3	B	3.7	B	4.7	B	5.9	B	6.5	B	5.3	B	4.8	B	15.4		10.9	B	109	B
Copper	9.7		15.8		17.7		15.4		5.6		6.2	B	6.3		10.9		7.1		10.7		23		13.3	
Iron	12300		14400		14600		18500		14500		17600		21200		15900		19200		18200		30000		29000	
Lead	12.2		16.9		61.4		11.5		12.3		11.9	U	10.9	U	12.4		11	U	11	U	124		18.4	
Magnesium	1970		4360		1720		1650		1390		2670		1280		1660		1050	B	3520		2750		4210	
Manganese	53.6		117		165		59.2		120		140		199		51.6		114		153		212		164	
Mercury	0.12	U	0.15		0.1	U	0.12	U	0.11	U	0.12	U	0.11	U	0.11	U	0.1	U	0.1	U	0.11	U	0.1	U
Nickel	13.4		26.6		8.9		9.6		9		11.8		7.7	U	8.6	B	7.8	U	13.3		13		17.4	
Potassium	994	U	1380		941	B	801	U	863	U	989	U	1330		929	U	1200		914	U	1350		991	B
Selenium	23.5	U	22.7	U	0.67	U	3.8	U	20.4	U	23.4	U	21.3	U	22	U	21.6	U	21.6	U	20.6	U	21.4	U
Silver	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
Sodium	96.2	B	234	B	149	B	173	B	96.2	B	83.4	B	90.9	B	82.4	B	58.3	U	285	B	166	B	238	B
Thallium	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
Vanadium	21.9		43.7		24.4		49.6		26.8		33.1		37.6		30.4		29.9		24		47.3		44.3	
Zinc	35.3		78		95.4		30.3		27.9		39.9		36.7		48.7		32.9		60.2		110		62.4	

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TABLE 2-5 SUMMARY OF ANALYTE CONCEN...ATIONS IN SOIL AT REFERENCE LOCATIONS
FORMER KOPPERS COMPANY - NEWPORT SITE

	ON-SITE															
	BG-1				BG-2				SB705				SB706			
	0-0.5'		1.5-3.5'		0-0.5'		5.0-7.0'		0-0.5'		6-8'		0-0.5'		4-6'	
ANALYTE																
PEST/PCB ug/kg																
4,4'-DDD	24	U	3.8	U	30	U	3.4	U	4.1	U	3.8	J	0.54	J	3.1	J
4,4'-DDE	1.1	J	3.8	U	16	J	3.4	U	0.31	J	3.5	U	3.5	UJ	3.9	U
4,4'-DDT	4.3	B	6.4	B	41	B	0.42	B	4.1	U	3.5	U	3.5	UJ	3.9	U
Aldrin	0.97	B	0.61	B	16	U	0.39	B	2.1	U	1.8	U	1.8	UJ	2	U
alpha-BHC	12	U	2	U	16	U	0.59	J	0.79	J	1.8	U	1	J	2	U
alpha-Chlordane	12	U	2	U	0.68	B	1.8	U	0.7	J	0.22	J	1.8	J	0.27	J
beta-BHC	12	U	2	U	16	U	1.8	U	2.1	U	1.8	U	1.8	UJ	2	U
delta-BHC	12	U	2	U	16	U	1.8	U	0.54	J	1.8	U	1.8	UJ	2	U
Dieldrin	24	U	1.1	B	2.3	B	0.09	B	0.5	J	3.5	U	3.6	J	3.9	U
Endosulfan I	12	U	2	U	16	U	1.8	U	2.1	U	1.8	U	1.8	UJ	2	U
Endosulfan II	24	U	3.8	U	30	U	3.4	U	4.1	U	3.5	U	3.5	UJ	3.9	U
Endosulfan sulfate	24	U	3.8	U	30	U	3.4	U	4.1	U	3.5	U	3.5	UJ	3.9	U
Endrin	24	U	3.8	U	30	U	3.4	U	4.1	U	3.5	U	3.5	UJ	3.9	U
Endrin aldehyde	24	U	3.8	U	30	U	3.4	U	4.1	U	3.5	U	3.5	UJ	3.9	U
Endrin ketone	24	U	3.8	U	30	U	3.4	U	4.1	U	3.5	U	3.5	UJ	3.9	U
gamma-BHC (Lindane)	12	U	2	U	16	U	0.13	J	0.29	J	1.8	U	0.56	J	2	U
gamma-Chlordane	12	U	2	U	16	U	1.8	U	0.77	J	0.94	J	6.7	J	0.84	J
Heptachlor	12	U	2	U	16	U	1.8	U	2.1	U	1.8	U	4	J	2	U
Heptachlor epoxide	12	U	2	U	16	U	1.8	U	2.1	U	0.58	J	2.4	J	0.47	J
Methoxychlor	120	U	3.9	B	160	U	1.3	B	21	U	18	U	18	UJ	20	U
Aroclor-1016	240	U	38	U	300	U	34	U	41	U	35	U	35	UJ	39	U
Aroclor-1221	490	U	78	U	610	U	69	U	83	U	72	U	72	UJ	80	U
Aroclor-1232	240	U	38	U	300	U	34	U	41	U	35	U	35	UJ	39	U
Aroclor-1242	240	U	38	U	300	U	34	U	41	U	35	U	35	UJ	39	U
Aroclor-1248	240	U	38	U	300	U	34	U	41	U	35	U	35	UJ	39	U
Aroclor-1254	240	U	38	U	120	J	34	U	41	U	35	U	35	UJ	39	U
Aroclor-1260	82	J	38	U	300	U	34	U	41	U	10	J	220	J	13	J
Toxaphene	1200	U	200	U	1600	U	180	U	210	U	180	U	180	UJ	200	U

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TABLE 2-5 SUMMARY OF ANALYTE CONCEN...ATIONS IN SOIL AT REFERENCE LOCATIONS
FORMER KOPPERS COMPANY - NEWPORT SITE

	ON-SITE															
	SB701				SB702				SB703				SB704			
	0-0.5'		7-9'		0-0.5'		7-9'		0-0.5'		10-12'		0-0.5'		1.5-3.5'	
ANALYTE																
PEST/PCB ug/kg																
4,4'-DDD	4.1	U	3.7	U	4.7	UJ	4	U	6.1	U	4.2	U	5.2	UJ	4.2	U
4,4'-DDE	4.1	U	3.7	U	4.7	UJ	4	U	6.1	U	4.2	U	0.5	J	4.2	U
4,4'-DDT	4.1	U	3.7	U	4.7	UJ	4	U	6.1	U	4.2	U	5.2	UJ	4.2	U
Aldrin	0.52	J	1.9	U	2.4	UJ	2	U	3.1	U	2.2	U	2.7	UJ	2.1	U
alpha-BHC	2.1	U	1.9	U	2.4	UJ	0.46	J	0.43	J	0.31	J	2.7	UJ	0.3	J
alpha-Chlordane	2.1	U	1.9	U	2.4	UJ	2	U	3.1	U	2.2	U	2.7	UJ	2.1	U
beta-BHC	2.1	U	1.9	U	2.4	UJ	2	U	3.1	U	2.2	U	2.7	UJ	2.1	U
delta-BHC	2.1	U	1.9	U	2.4	UJ	2	U	3.1	U	2.2	U	2.7	UJ	2.1	U
Dieldrin	4.1	U	3.7	U	4.7	UJ	4	U	6.1	U	4.2	U	5.2	UJ	4.2	U
Endosulfan I	2.1	U	1.9	U	2.4	UJ	2	U	3.1	U	2.2	U	2.7	UJ	2.1	U
Endosulfan II	4.1	U	3.7	U	4.7	UJ	4	U	6.1	U	4.2	U	5.2	UJ	4.2	U
Endosulfan sulfate	4.1	U	3.7	U	4.7	UJ	4	U	6.1	U	4.2	U	5.2	UJ	4.2	U
Endrin	4.1	U	3.7	U	4.7	UJ	4	U	6.1	U	4.2	U	5.2	UJ	4.2	U
Endrin aldehyde	4.1	U	3.7	U	4.7	UJ	4	U	6.1	U	4.2	U	5.2	UJ	4.2	U
Endrin ketone	4.1	U	3.7	U	4.7	UJ	4	U	6.1	U	4.2	U	5.2	UJ	4.2	U
gamma-BHC (Lindane)	2.1	U	1.9	U	2.4	UJ	2	U	3.1	U	2.2	U	2.7	UJ	2.1	U
gamma-Chlordane	2.1	U	1.9	U	2.4	UJ	2	U	3.1	U	2.2	U	2.7	UJ	2.1	U
Heptachlor	2.1	U	1.9	U	2.4	UJ	2	U	3.1	U	2.2	U	2.7	UJ	2.1	U
Heptachlor epoxide	2.1	U	1.9	U	2.4	UJ	2	U	3.1	U	2.2	U	2.7	UJ	2.1	U
Methoxychlor	21	U	19	U	24	UJ	20	U	31	U	22	U	27	UJ	21	U
Aroclor-1016	41	U	37	U	47	UJ	40	U	61	U	42	U	52	UJ	42	U
Aroclor-1221	84	U	74	U	95	UJ	80	U	120	U	85	U	110	UJ	85	U
Aroclor-1232	41	U	37	U	47	UJ	40	U	61	U	42	U	52	UJ	42	U
Aroclor-1242	41	U	37	U	47	UJ	40	U	61	U	42	U	52	UJ	42	U
Aroclor-1248	41	U	37	U	47	UJ	40	U	61	U	42	U	52	UJ	42	U
Aroclor-1254	41	U	37	U	47	UJ	40	U	61	U	42	U	52	UJ	42	U
Aroclor-1260	41	U	37	U	47	UJ	40	U	61	U	42	U	52	UJ	42	U
Toxaphene	210	U	190	U	240	UJ	200	U	310	U	220	U	270	UJ	210	U

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TABLE 2-5 SUMMARY OF ANALYTE CONCENTRATIONS IN SOIL AT REFERENCE LOCATIONS
FORMER KOPPERS COMPANY - NEWPORT SITE

	DUPONT											
	TB 28		TB 29		MW 29		HRB 1		HRB 2		HRB 3	
	2-4'	8-10'	2-4'	8-10'	2-4'	8-10'	2-4'	8-10'	2-4'	8-10'	2-4'	8-10'
ANALYTE												
PEST/PCB ug/kg												
4,4'-DDD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aldrin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
alpha-Chlordane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin ketone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
gamma-Chlordane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1016	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1221	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1232	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1242	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1248	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1254	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1260	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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TABLE 2-5 SUMMARY OF ANALYTE CONCEN...ATIONS IN SOIL AT REFERENCE LOCATIONS
FORMER KOPPERS COMPANY - NEWPORT SITE

	ON-SITE															
	BG-1				BG-2				SB705				SB706			
	0-0.5'		1.5-3.5'		0-0.5'		5.0-7.0'		0-0.5'		6-8'		0-0.5'		4-6'	
ANALYTE																
DIOXIN/FURANS ng/g																
1,2,3,4,6,7,8-HpCDD	0.27	U	0.28	U	0.25	U	0.39	U	0.16	U	0.11	UJ	0.69	UJ	0.14	U
1,2,3,4,6,7,8-HpCDF	0.23	U	0.29	U	0.2	U	0.27	U	0.074	U	0.13	UJ	0.92	UJ	0.15	U
1,2,3,4,7,8,9-HpCDF	0.3	U	0.39	U	0.26	U	0.35	U	0.089	U	0.17	UJ	1.2	UJ	0.18	U
1,2,3,4,7,8-HxCDD	0.24	U	0.21	U	0.16	U	0.26	U	0.15	U	0.18	UJ	1.3	UJ	0.23	U
1,2,3,4,7,8-HxCDF	0.14	U	0.12	U	0.087	U	0.16	U	0.086	U	0.11	UJ	0.81	UJ	0.21	U
1,2,3,6,7,8-HxCDD	0.19	U	0.16	U	0.12	U	0.2	U	0.13	U	0.16	UJ	1.1	UJ	0.2	U
1,2,3,6,7,8-HxCDF	0.12	U	0.098	U	0.074	U	0.13	U	0.078	U	0.099	UJ	0.73	UJ	0.19	U
1,2,3,7,8,9-HxCDD	0.22	U	0.19	U	0.14	U	0.23	U	0.14	U	0.17	UJ	1.2	UJ	0.22	U
1,2,3,7,8,9-HxCDF	0.17	U	0.14	U	0.1	U	0.19	U	0.1	U	0.13	UJ	0.98	UJ	0.26	U
1,2,3,7,8-PeCDD	0.26	U	0.23	U	0.2	U	0.26	U	0.13	U	0.34	UJ	1.6	UJ	0.33	U
1,2,3,7,8-PeCDF	0.15	U	0.12	U	0.11	U	0.18	U	0.089	U	0.26	UJ	1.4	UJ	0.22	U
2,3,4,6,7,8-HxCDF	0.14	U	0.11	U	0.086	U	0.15	U	0.089	U	0.11	UJ	0.83	UJ	0.22	U
2,3,4,7,8-PeCDF	0.17	U	0.14	U	0.12	U	0.2	U	0.099	U	0.27	UJ	1.4	UJ	0.24	U
2,3,7,8-TCDD	0.12	U	0.12	U	0.15	U	0.45	U	0.13	U	0.15	UJ	0.68	UJ	0.14	U
2,3,7,8-TCDF	0.18	U	0.14	U	0.13	U	0.14	U	0.15	U	0.43	UJ	1.8	UJ	0.24	U
HpCDDs (total)	0.27	U	0.28	U	0.25	U	0.39	U	0.16	U	0.11	UJ	0.69	UJ	0.14	U
HpCDFs (total)	0.23	U	0.29	U	0.2	U	0.27	U	0.074	U	0.13	UJ	0.92	UJ	0.15	U
HxCDDs (total)	0.19	U	0.16	U	0.12	U	0.2	U	0.13	U	0.16	UJ	1.1	UJ	0.2	U
HxCDFs (total)	0.12	U	0.098	U	0.074	U	0.13	U	0.078	U	0.099	UJ	0.73	UJ	0.19	U
OCDD (TEF=0.001)	2.9	J	3.6	J	3.2	J	0.73	U	3.2	J	0.4	UJ	1.6	UJ	4.6	J
OCDD TE*	0.0029		0.0036		0.0032				0.0032						0.0046	
OCDF	0.46	U	0.24	U	0.28	U	0.25	U	0.16	U	0.23	UJ	0.99	UJ	0.34	U
PeCDDs (total)	0.26	U	0.23	U	0.2	U	0.26	U	0.13	U	0.34	UJ	1.6	UJ	0.33	U
PeCDFs (total)	0.15	U	0.12	U	0.11	U	0.18	U	0.089	U	0.26	UJ	1.4	UJ	0.22	U
TCDDs (total)	0.12	U	0.12	U	0.15	U	0.45	U	0.13	U	0.15	UJ	0.68	UJ	0.14	U
TCDFs (total)	0.18	U	0.14	U	0.13	U	0.14	U	0.15	U	0.43	UJ	1.8	UJ	0.24	U

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TABLE 2-5 SUMMARY OF ANALYTE CONCENTRATIONS IN SOIL AT REFERENCE LOCATIONS
FORMER KOPPERS COMPANY - NEWPORT SITE

	ON-SITE															
	SB701				SB702				SB703				SB704			
	0-0.5'		7-9'		0-0.5'		7-9'		0-0.5'		10-12'		0-0.5'		1.5-3.5'	
ANALYTE																
DIOXIN/FURANS ng/g																
1,2,3,4,6,7,8-HpCDD	0.16	U	0.11	U	0.21	U	0.16	U	0.11	Uw	0.34	U	0.44	U	0.13	U
1,2,3,4,6,7,8-HpCDF	0.12	U	0.074	U	0.13	U	0.11	U	0.16	U	0.16	U	0.16	U	0.052	U
1,2,3,4,7,8,9-HpCDF	0.15	U	0.089	U	0.15	U	0.13	U	0.18	U	0.18	U	0.18	U	0.058	U
1,2,3,4,7,8-HxCDD	0.2	U	0.14	U	0.14	U	0.18	U	0.11	U	0.22	U	0.14	U	0.089	U
1,2,3,4,7,8-HxCDF	0.12	U	0.11	U	0.078	U	0.1	U	0.076	U	0.14	U	0.096	U	0.074	U
1,2,3,6,7,8-HxCDD	0.18	U	0.13	U	0.12	U	0.16	U	0.1	U	0.19	U	0.12	U	0.078	U
1,2,3,6,7,8-HxCDF	0.11	U	0.096	U	0.071	U	0.084	U	0.063	U	0.12	U	0.08	U	0.062	U
1,2,3,7,8,9-HxCDD	0.19	U	0.14	U	0.13	U	0.17	U	0.11	U	0.2	U	0.13	U	0.082	U
1,2,3,7,8,9-HxCDF	0.15	U	0.13	U	0.094	U	0.11	U	0.082	U	0.15	U	0.1	U	0.08	U
1,2,3,7,8-PeCDD	0.19	U	0.2	U	0.16	U	0.24	U	0.16	U	0.26	U	0.23	U	0.13	U
1,2,3,7,8-PeCDF	0.11	U	0.093	U	0.089	U	0.16	U	0.1	U	0.18	U	0.15	U	0.082	U
2,3,4,6,7,8-HxCDF	0.13	U	0.11	U	0.081	U	0.095	U	0.072	U	0.13	U	0.091	U	0.07	U
2,3,4,7,8-PeCDF	0.13	U	0.1	U	0.099	U	0.16	U	0.1	U	0.18	U	0.15	U	0.084	U
2,3,7,8-TCDD	0.086	U	0.076	U	0.076	U	0.19	U	0.063	U	0.15	U	0.1	U	0.11	U
2,3,7,8-TCDF	0.22	U	0.18	U	0.18	U	0.15	U	0.19	U	0.24	U	0.22	U	0.18	U
HpCDDs (total)	0.16	U	0.11	U	0.21	U	0.16	U	0.24	Uw	0.34	U	0.44	U	0.13	U
HpCDFs (total)	0.12	U	0.074	U	0.13	U	0.11	U	0.16	U	0.16	U	0.16	U	0.052	U
HxCDDs (total)	0.18	U	0.13	U	0.12	U	0.16	U	0.1	U	0.19	U	0.12	U	0.078	U
HxCDFs (total)	0.11	U	0.096	U	0.071	U	0.084	U	0.063	U	0.12	U	0.08	U	0.062	U
OCDD (TEF=0.001)	2.5	J	1.3	J	3.3	J	1.9	J	5		9.5		3.1	J	17	
OCDD TE*	0.0025		0.0013		0.0033		0.0019		0.005		0.0095		0.0031		0.017	
OCDF	0.18	U	0.1	U	0.19	U	0.1	U	0.12	Uw	0.13	U	0.39	U	0.085	U
PeCDDs (total)	0.19	U	0.2	U	0.16	U	0.24	U	0.16	U	0.26	U	0.23	U	0.13	U
PeCDFs (total)	0.11	U	0.093	U	0.089	U	0.16	U	0.1	U	0.18	U	0.15	U	0.082	U
TCDDs (total)	0.086	U	0.076	U	0.076	U	0.19	U	0.063	U	0.15	U	0.1	U	0.11	U
TCDFs (total)	0.22	U	0.18	U	0.18	U	0.15	U	0.19	U	0.24	U	0.22	U	0.18	U

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TABLE 2-5 SUMMARY OF ANALYTE CONCE...ATIONS IN SOIL AT REFERENCE LOCATIONS
FORMER KOPPERS COMPANY - NEWPORT SITE

	DUPONT											
	TB 28		TB 29		MW 29		HRB 1		HRB 2		HRB 3	
	2-4'	8-10'	2-4'	8-10'	2-4'	8-10'	2-4'	8-10'	2-4'	8-10'	2-4'	8-10'
ANALYTE												
DIOXIN/FURANS ng/g												
1,2,3,4,6,7,8-HpCDD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-HpCDF	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-HpCDF	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HxCDD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HxCDF	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-HxCDD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-HxCDF	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-HxCDD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-HxCDF	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-PeCDD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-PeCDF	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6,7,8-HxCDF	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,7,8-PeCDF	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDF	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HpCDDs (total)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HpCDFs (total)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HxCDDs (total)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HxCDFs (total)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OCDD (TEF=0.001)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OCDD TE*												
OCDF	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PeCDDs (total)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PeCDFs (total)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TCDDs (total)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TCDFs (total)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
NA: Not Analyzed
J:Analyte present; value may not be accurate.
B: Not detected, substantially above the level reported in laboratory or field blanks.
K: Analyte present; reported value may be biased high, actual value is expected to be lower.
U: Not detected.
UJ: Not detected, Quantitiation limit may be inaccurate or imprecise
UL: Not detected, Quantitiation limit may be biased low and is expected to be higher.
"— ": Not detected, historical detection limits are unavailable
* TE = [2,3,7,8-TCDD Toxicity Equivalency Factor (TEF)] x Analyte Concentration

AR308540

TABLE 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	CHRISTINA RIVER				CHRISTINA RIVER			
LOCATION	RS-15				RS-15			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.00 INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Semi-Volatile Compounds								
1,1,2,2-Tetrachloroethane	**200**		J	UG/KG				
1,2,4-Trichlorobenzene	470	470	U	UG/KG	1800	1800	U	UG/KG
1,2-Dichlorobenzene	470	470	U	UG/KG	1800	1800	U	UG/KG
1,3-Dichlorobenzene	470	470	U	UG/KG	1800	1800	U	UG/KG
1,4-Dichlorobenzene	470	470	U	UG/KG	1800	1800	U	UG/KG
2,2'-oxybis(1-Chloropropane)	470	470	U	UG/KG	1800	1800	U	UG/KG
2,4,5-Trichlorophenol	1200	1200	U	UG/KG	4400	4400	U	UG/KG
2,4,6-Trichlorophenol	470	470	U	UG/KG	1800	1800	U	UG/KG
2,4-Dichlorophenol	470	470	U	UG/KG	1800	1800	U	UG/KG
2,4-Dimethylphenol	470	470	U	UG/KG	1800	1800	U	UG/KG
2,4-Dinitrophenol	1200	1200	U	UG/KG	4400	4400	U	UG/KG
2,4-Dinitrotoluene	470	470	U	UG/KG	1800	1800	U	UG/KG
2,6-Dinitrotoluene	470	470	U	UG/KG	1800	1800	U	UG/KG
2-Chloronaphthalene	470	470	U	UG/KG	1800	1800	U	UG/KG
2-Chlorophenol	470	470	U	UG/KG	1800	1800	U	UG/KG
2-Methylnaphthalene	470	470	U	UG/KG	1800	1800	U	UG/KG
2-Methylphenol	470	470	U	UG/KG	1800	1800	U	UG/KG
2-Nitroaniline	1200	1200	U	UG/KG	4400	4400	U	UG/KG
2-Nitrophenol	470	470	U	UG/KG	1800	1800	U	UG/KG
3,3'-Dichlorobenzidine	470	470	U	UG/KG	1800	1800	U	UG/KG
3-Nitroaniline	1200	1200	U	UG/KG	4400	4400	U	UG/KG
4,6-Dinitro-2-methylphenol	1200	1200	U	UG/KG	4400	4400	U	UG/KG
4-Bromophenyl-phenylether	470	470	U	UG/KG	1800	1800	U	UG/KG
4-Chloro-3-methylphenol	470	470	U	UG/KG	1800	1800	U	UG/KG
4-Chloroaniline	470	470	U	UG/KG	1800	1800	U	UG/KG
4-Chlorophenyl-phenylether	470	470	U	UG/KG	1800	1800	U	UG/KG
4-Methylphenol	470	470	U	UG/KG	1800	1800	U	UG/KG
4-Nitroaniline	1200	1200	U	UG/KG	4400	4400	U	UG/KG
4-Nitrophenol	1200	1200	U	UG/KG	4400	4400	U	UG/KG
Acenaphthene	470	470	U	UG/KG	1800	1800	U	UG/KG
Acenaphthylene	470	470	U	UG/KG	1800	1800	U	UG/KG
Anthracene	470	470	U	UG/KG	1800	1800	U	UG/KG
Benzo(a)anthracene	**73**		J	UG/KG	1800	1800	U	UG/KG
Benzo(a)pyrene	**33**		J	UG/KG	1800	1800	U	UG/KG

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TABLE 2-6

Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	CHRISTINA RIVER				CHRISTINA RIVER			
LOCATION	RS-15				RS-15			
DEPTH	*0.00 TO 6.00 INCHES*				*6.00 TO 12.00 INCHES*			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Benzo(b)fluoranthene	**76**		J	UG/KG	**260**		J	UG/KG
Benzo(g,h,i)perylene	470	470	U	UG/KG	1800	1800	U	UG/KG
Benzo(k)fluoranthene	470	470	U	UG/KG	1800	1800	U	UG/KG
bis(2-Chloroethoxy)methane	470	470	U	UG/KG	1800	1800	U	UG/KG
bis(2-Chloroethyl)ether	470	470	U	UG/KG	1800	1800	U	UG/KG
bis(2-Ethylhexyl)phthalate	**59**		J	UG/KG	1800	1800	U	UG/KG
Butylbenzylphthalate	470	470	U	UG/KG	1800	1800	U	UG/KG
Carbazole	470	470	U	UG/KG	1800	1800	U	UG/KG
Chrysene	**66**		J	UG/KG	**170**		J	UG/KG
Di-n-butylphthalate	**38**		J	UG/KG	1800	1800	U	UG/KG
Di-n-octylphthalate	470	470	U	UG/KG	1800	1800	U	UG/KG
Dibenz(a,h)anthracene	470	470	U	UG/KG	1800	1800	U	UG/KG
Dibenzofuran	470	470	U	UG/KG	1800	1800	U	UG/KG
Diethylphthalate	470	470	U	UG/KG	1800	1800	U	UG/KG
Dimethylphthalate	470	470	U	UG/KG	1800	1800	U	UG/KG
Fluoranthene	**130**		J	UG/KG	**150**		J	UG/KG
Fluorene	470	470	U	UG/KG	1800	1800	U	UG/KG
Hexachlorobenzene	470	470	U	UG/KG	1800	1800	U	UG/KG
Hexachlorobutadiene	470	470	U	UG/KG	1800	1800	U	UG/KG
Hexachlorocyclopentadiene	470	470	U	UG/KG	1800	1800	U	UG/KG
Hexachloroethane	470	470	U	UG/KG	1800	1800	U	UG/KG
Indeno(1,2,3-c,d)pyrene	470	470	U	UG/KG	1800	1800	U	UG/KG
Isophorone	470	470	U	UG/KG	1800	1800	U	UG/KG
N-Nitroso-di-n-propylamine	470	470	U	UG/KG	1800	1800	U	UG/KG
N-Nitrosodiphenylamine	470	470	U	UG/KG	1800	1800	U	UG/KG
Naphthalene	470	470	U	UG/KG	1800	1800	U	UG/KG
Nitrobenzene	470	470	U	UG/KG	1800	1800	U	UG/KG
Pentachlorophenol	1200	1200	U	UG/KG	4400	4400	U	UG/KG
Phenanthrene	**79**		J	UG/KG	1800	1800	U	UG/KG
Phenol	470	470	U	UG/KG	1800	1800	U	UG/KG
Pyrene	**110**		J	UG/KG	**140**		J	UG/KG

AR308542

TABLE 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	CHRISTINA RIVER				CHRISTINA RIVER			
LOCATION	RS-15				RS-15			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.00 INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Inorganic Compounds								
Aluminum	**1190**	200		MG/KG	**3690**	200		MG/KG
Antimony	0.56	60	U	MG/KG	0.53	60	U	MG/KG
Arsenic	**1.4**	10	B	MG/KG	**4.3**	10		MG/KG
Barium	**12.9**	200		MG/KG	**47.2**	200		MG/KG
Beryllium	0.28	5	U	MG/KG	**0.62**	5		MG/KG
Cadmium	0.28	5	U	MG/KG	**0.76**	5		MG/KG
Calcium	**405**	5000		MG/KG	**688**	5000		MG/KG
Chromium	**6.9**	10		MG/KG	**14.6**	10		MG/KG
Cobalt	**3.4**	50		MG/KG	**7.3**	50		MG/KG
Copper	**4.8**	25	B	MG/KG	**13.5**	25		MG/KG
Cyanide		20	NA	MG/KG		20	NA	MG/KG
Iron	**4460**	100	J	MG/KG	**9110**	100	J	MG/KG
Lead	**12**	3	J	MG/KG	**42**	3	J	MG/KG
Magnesium	**288**	5000		MG/KG	**699**	5000		MG/KG
Manganese	**75.7**	15	J	MG/KG	**174**	15	J	MG/KG
Mercury	**0.09**	0.2		MG/KG	0.07	0.2	U	MG/KG
Nickel	**3**	40		MG/KG	**8.5**	40		MG/KG
Potassium	**121**	5000		MG/KG	**292**	5000		MG/KG
Selenium	1.1	5	U	MG/KG	1.1	5	U	MG/KG
Silver	0.84	10	U	MG/KG	0.8	10	U	MG/KG
Sodium	**43.5**	5000	B	MG/KG	**68.9**	5000	B	MG/KG
Thallium	2	10	U	MG/KG	1.9	10	U	MG/KG
Vanadium	**7.3**	50		MG/KG	**19.3**	50		MG/KG
Zinc	40.2	20	J	MG/KG	**166**	20	J	MG/KG

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TABLE 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	CHRISTINA RIVER				CHRISTINA RIVER			
LOCATION	RS-15				RS-15			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.00 INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
PCDDs/PCDFs								
1,2,3,4,6,7,8-HpCDD		0.039	U	NG/G		0.052	U	NG/G
1,2,3,4,6,7,8-HpCDF		0.056	U	NG/G		0.11	U	NG/G
1,2,3,4,7,8,9-HpCDF		0.077	U	NG/G		0.15	U	NG/G
1,2,3,4,7,8-HxCDD		0.077	U	NG/G		0.093	U	NG/G
1,2,3,4,7,8-HxCDF		0.057	U	NG/G		0.064	U	NG/G
1,2,3,6,7,8-HxCDD		0.064	U	NG/G		0.077	U	NG/G
1,2,3,6,7,8-HxCDF		0.047	U	NG/G		0.053	U	NG/G
1,2,3,7,8,9-HxCDD		0.07	U	NG/G		0.085	U	NG/G
1,2,3,7,8,9-HxCDF		0.069	U	NG/G		0.078	U	NG/G
1,2,3,7,8-PeCDD		0.085	U	NG/G		0.12	U	NG/G
1,2,3,7,8-PeCDF		0.054	U	NG/G		0.077	U	NG/G
2,3,4,6,7,8-HxCDF		0.058	U	NG/G		0.065	U	NG/G
2,3,4,7,8-PeCDF		0.058	U	NG/G		0.084	U	NG/G
2,3,7,8-TCDD		0.051	U	NG/G		0.053	U	NG/G
2,3,7,8-TCDF		0.12	U	NG/G		0.16	U	NG/G
HpCDDs (total)		0.039	U	NG/G		0.052	U	NG/G
HpCDFs (total)		0.056	U	NG/G		0.11	U	NG/G
HxCDDs (total)		0.064	U	NG/G		0.077	U	NG/G
HxCDFs (total)		0.047	U	NG/G		0.053	U	NG/G
OCDD	**0.23**		J	NG/G	**0.71**		J	NG/G
OCDD TE* (TEF = 0.001)	**(0.00023)***			NG/G	**(0.00071)***			NG/G
OCDF		0.085	U	NG/G		0.15	U	NG/G
PeCDDs (total)		0.085	U	NG/G		0.12	U	NG/G
PeCDFs (total)		0.054	U	NG/G		0.077	U	NG/G
TCDDs (total)		0.051	U	NG/G		0.053	U	NG/G
TCDFs (total)		0.12	U	NG/G		0.16	U	NG/G

TAbLE 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	CHRISTINA RIVER				CHRISTINA RIVER			
LOCATION	RS-15				RS-15			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.00 INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Pesticides/PCBs								
4,4'-DDD	**0.3**	4.6	B	UG/KG	0.5	4.4	B	UG/KG
4,4'-DDE	**0.27**	4.6	J	UG/KG	**0.52**	4.4	J	UG/KG
4,4'-DDT	4.6	4.6	U	UG/KG	4.4	4.4	U	UG/KG
Aldrin	2.4	2.4	U	UG/KG	2.3	2.3	U	UG/KG
alpha-BHC	2.4	2.4	U	UG/KG	2.3	2.3	U	UG/KG
alpha-Chlordane	**0.43**	2.4	J	UG/KG	**0.93**	2.3	J	UG/KG
beta-BHC	2.4	2.4	U	UG/KG	2.3	2.3	U	UG/KG
delta-BHC	2.4	2.4	U	UG/KG	2.3	2.3	U	UG/KG
Dieldrin	4.6	4.6	U	UG/KG	4.4	4.4	P	UG/KG
Endosulfan I	2.4	2.4	U	UG/KG	2.3	2.3	U	UG/KG
Endosulfan II	4.6	4.6	U	UG/KG	4.4	4.4	U	UG/KG
Endosulfan Sulfate	4.6	4.6	U	UG/KG	4.4	4.4	U	UG/KG
Endrin	4.6	4.6	U	UG/KG	4.4	4.4	U	UG/KG
Endrin ketone	4.6	4.6	U	UG/KG	4.4	4.4	U	UG/KG
gamma-BHC (Lindane)	2.4	2.4	U	UG/KG	2.3	2.3	U	UG/KG
gamma-Chlordane	**0.76**	2.4	J	UG/KG	**1.4**	2.3	J	UG/KG
Heptachlor	2.4	2.4	U	UG/KG	2.3	2.3	U	UG/KG
Heptachlor epoxide	2.4	2.4	U	UG/KG	2.3	2.3	U	UG/KG
Methoxychlor	24	24	U	UG/KG	23	23	U	UG/KG
PCB-1016	46	46	U	UG/KG	44	44	U	UG/KG
PCB-1221	94	94	U	UG/KG	89	89	U	UG/KG
PCB-1232	46	46	U	UG/KG	44	44	U	UG/KG
PCB-1242	46	46	U	UG/KG	44	44	U	UG/KG
PCB-1248	46	46	U	UG/KG	44	44	U	UG/KG
PCB-1254	46	46	U	UG/KG	44	44	U	UG/KG
PCB-1260	**3.6**	46	J	UG/KG	**7.4**	44	J	UG/KG
Toxaphene	240	240	U	UG/KG	230	230	U	UG/KG

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TA. . 2-6

Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	CHRISTINA RIVER				CHRISTINA RIVER			
LOCATION	RS-15				RS-15			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.00 INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Volatile Compounds								
1,1,1-Trichloroethane	14	14	U	UG/KG	100	100	U	UG/KG
1,1,2,2-Tetrachloroethane	14	14	U	UG/KG	100	100	U	UG/KG
1,1,2-Trichloroethane	14	14	U	UG/KG	100	100	U	UG/KG
1,1-Dichloroethane	14	14	U	UG/KG	100	100	U	UG/KG
1,1-Dichloroethene	14	14	U	UG/KG	100	100	U	UG/KG
1,2-Dichloroethane	14	14	U	UG/KG	100	100	U	UG/KG
1,2-Dichloroethene (total)	14	14	U	UG/KG	100	100	U	UG/KG
1,2-Dichloropropane	14	14	U	UG/KG	100	100	U	UG/KG
2-Butanone	14	14	U	UG/KG	**230**		J	UG/KG
2-Hexanone	14	14	U	UG/KG	100	100	UJ	UG/KG
4-Methyl-2-Pentanone	14	14	U	UG/KG	100	100	U	UG/KG
Acetone	14	14	U	UG/KG	**1800**		J	UG/KG
Benzene	14	14	U	UG/KG	100	100	U	UG/KG
Bromodichloromethane	14	14	U	UG/KG	100	100	U	UG/KG
Bromoform	14	14	U	UG/KG	100	100	U	UG/KG
Bromomethane	14	14	U	UG/KG	100	100	U	UG/KG
Carbon Disulfide	14	14	U	UG/KG	100	100	U	UG/KG
Carbon Tetrachloride	14	14	U	UG/KG	100	100	U	UG/KG
Chlorobenzene	14	14	U	UG/KG	100	100	U	UG/KG
Chloroethane	14	14	U	UG/KG	100	100	UJ	UG/KG
Chloroform	14	14	U	UG/KG	100	100	U	UG/KG
Chloromethane	14	14	U	UG/KG	100	100	U	UG/KG
cis-1,3-Dichloropropene	14	14	U	UG/KG	100	100	U	UG/KG
Dibromochloromethane	14	14	U	UG/KG	100	100	U	UG/KG
Ethylbenzene	14	14	U	UG/KG	**1100**			UG/KG
Methylene Chloride	14	14	U	UG/KG	100	100	U	UG/KG
Styrene	14	14	U	UG/KG	100	100	U	UG/KG
Tetrachloroethene	14	14	U	UG/KG	100	100	U	UG/KG
Toluene	14	14	U	UG/KG	**220**			UG/KG
trans-1,3-Dichloropropene	14	14	U	UG/KG	100	100	U	UG/KG
Trichloroethene	14	14	U	UG/KG	100	100	U	UG/KG
Vinyl Chloride	14	14	U	UG/KG	100	100	U	UG/KG
Xylenes (total)	14	14	U	UG/KG	**2900**			UG/KG

AR308546

Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	HERSHEY RUN				HERSHEY RUN			
LOCATION	HR-0				HR-0			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.00INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Semi-Volatile Compounds								
1,2,4-Trichlorobenzene	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
1,2-Dichlorobenzene	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
1,3-Dichlorobenzene	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
1,4-Dichlorobenzene	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
2,2'-oxybis(1-Chloropropane)	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
2,4,5-Trichlorophenol	2000	2000	UJ	UG/KG	3900	3900	UJ	UG/KG
2,4,6-Trichlorophenol	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
2,4-Dichlorophenol	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
2,4-Dimethylphenol	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
2,4-Dinitrophenol	2000	2000	UJ	UG/KG	3900	3900	UJ	UG/KG
2,4-Dinitrotoluene	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
2,6-Dinitrotoluene	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
2-Chloronaphthalene	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
2-Chlorophenol	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
2-Methylnaphthalene	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
2-Methylphenol	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
2-Nitroaniline	2000	2000	UJ	UG/KG	3900	3900	UJ	UG/KG
2-Nitrophenol	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
3,3'-Dichlorobenzidine	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
3-Nitroaniline	2000	2000	UJ	UG/KG	3900	3900	UJ	UG/KG
4,6-Dinitro-2-methylphenol	2000	2000	UJ	UG/KG	3900	3900	UJ	UG/KG
4-Bromophenyl-phenylether	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
4-Chloro-3-methylphenol	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
4-Chloroaniline	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
4-Chlorophenyl-phenylether	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
4-Methylphenol	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
4-Nitroaniline	2000	2000	UJ	UG/KG	3900	3900	UJ	UG/KG
4-Nitrophenol	2000	2000	UJ	UG/KG	3900	3900	UJ	UG/KG
Acenaphthene	800	800	U	UG/KG	1600	1600	U	UG/KG
Acenaphthylene	800	800	U	UG/KG	1600	1600	U	UG/KG
Anthracene	**230**		J	UG/KG	1600	1600	U	UG/KG
Benzo(a)anthracene	**840**		J	UG/KG	1600	1600	U	UG/KG
Benzo(a)pyrene	**330**		J	UG/KG	1600	1600	U	UG/KG
Benzo(b)fluoranthene	**650**		J	UG/KG	**430**		J	UG/KG

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Table 2-6

Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	HERSHEY RUN				HERSHEY RUN			
LOCATION	HR-0				HR-0			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.00INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Benzo(g,h,i)perylene	800	800	U	UG/KG	1600	1600	U	UG/KG
Benzo(k)fluoranthene	**440**		J	UG/KG	1600	1600	U	UG/KG
bis(2-Chloroethoxy)methane	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
bis(2-Chloroethyl)ether	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
bis(2-Ethylhexyl)phthalate	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
Butylbenzylphthalate	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
Carbazole	800	800	U	UG/KG	1600	1600	U	UG/KG
Chrysene	**690**		J	UG/KG	1600	1600	U	UG/KG
Di-n-butylphthalate	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
Di-n-octylphthalate	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
Dibenz(a,h)anthracene	800	800	U	UG/KG	1600	1600	U	UG/KG
Dibenzofuran	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
Diethylphthalate	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
Dimethylphthalate	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
Fluoranthene	**1600**			UG/KG	**700**		J	UG/KG
Fluorene	800	800	U	UG/KG	1600	1600	U	UG/KG
Hexachlorobenzene	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
Hexachlorobutadiene	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
Hexachlorocyclopentadiene	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
Hexachloroethane	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
Indeno(1,2,3-c,d)pyrene	800	800	U	UG/KG	1600	1600	U	UG/KG
Isophorone	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
N-Nitroso-di-n-propylamine	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
N-Nitrosodiphenylamine	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
Naphthalene	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
Nitrobenzene	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
Pentachlorophenol	2000	2000	UJ	UG/KG	3900	3900	UJ	UG/KG
Phenanthrene	**1200**			UG/KG	**350**		J	UG/KG
Phenol	800	800	UJ	UG/KG	1600	1600	UJ	UG/KG
Pyrene	**1300**			UG/KG	**530**		J	UG/KG

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Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	HERSHEY RUN				HERSHEY RUN			
LOCATION	HR-0				HR-0			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.OOINCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Inorganic Compounds								
Aluminum	**2030**	200		MG/KG	**1390**	200		MG/KG
Antimony	0.6	60	B	MG/KG	0.47	60	UL	MG/KG
Arsenic	1.3	10	B	MG/KG	1	10	B	MG/KG
Barium	**19.5**	200		MG/KG	**11.2**	200		MG/KG
Beryllium	0.24	5	UL	MG/KG	0.24	5	UL	MG/KG
Cadmium	**0.28**	5	L	MG/KG	0.24	5	UL	MG/KG
Calcium	**689**	5000		MG/KG	**510**	5000		MG/KG
Chromium	**7.5**	10		MG/KG	**10.6**	10		MG/KG
Cobalt	2.6	50	U	MG/KG	2.6	50	U	MG/KG
Copper	**4.9**	25	K	MG/KG	**2.8**	25		MG/KG
Cyanide		20	NA	MG/KG		20	NA	MG/KG
Iron	**5570**	100		MG/KG	**3990**	100		MG/KG
Lead	**11.8**	3		MG/KG	**9.8**	3		MG/KG
Magnesium	**747**	5000		MG/KG	**387**	5000		MG/KG
Manganese	116	15	J	MG/KG	**43.1**	15	L	MG/KG
Mercury	0.06	0.2	U	MG/KG	0.06	0.2	U	MG/KG
Nickel	5.4	40	B	MG/KG	1.7	40	U	MG/KG
Potassium	**170**	5000		MG/KG	**153**	5000		MG/KG
Selenium	0.96	5	UL	MG/KG	0.95	5	U	MG/KG
Silver	0.72	10	U	MG/KG	0.71	10	U	MG/KG
Sodium	**55**	5000		MG/KG	**29.8**	5000		MG/KG
Thallium	**2.5**	10		MG/KG	1.7	10	UL	MG/KG
Vanadium	**9.4**	50		MG/KG	**9.9**	50		MG/KG
Zinc	**116**	20	L	MG/KG	**43.3**	20	L	MG/KG

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Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	HERSHEY RUN				HERSHEY RUN			
LOCATION	HR-0				HR-0			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.OOINCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
PCDDs/PCDFs								
1,2,3,4,6,7,8-HpCDD		0.1	U	NG/G	NS			
1,2,3,4,6,7,8-HpCDF		0.1	U	NG/G	NS			
1,2,3,4,7,8,9-HpCDF		0.12	U	NG/G	NS			
1,2,3,4,7,8-HxCDD		0.086	U	NG/G	NS			
1,2,3,4,7,8-HxCDF		0.13	U	NG/G	NS			
1,2,3,6,7,8-HxCDD		0.082	U	NG/G	NS			
1,2,3,6,7,8-HxCDF		0.11	U	NG/G	NS			
1,2,3,7,8,9-HxCDD		0.08	U	NG/G	NS			
1,2,3,7,8,9-HxCDF		0.14	U	NG/G	NS			
1,2,3,7,8-PeCDD		0.18	U	NG/G	NS			
1,2,3,7,8-PeCDF		0.1	U	NG/G	NS			
2,3,4,6,7,8-HxCDF		0.12	U	NG/G	NS			
2,3,4,7,8-PeCDF		0.11	U	NG/G	NS			
2,3,7,8-TCDD		0.077	U	NG/G	NS			
2,3,7,8-TCDF		0.2	U	NG/G	NS			
HpCDDs (total)		0.1	U	NG/G	NS			
HpCDFs (total)		0.1	U	NG/G	NS			
HxCDDs (total)		0.08	U	NG/G	NS			
HxCDFs (total)		0.11	U	NG/G	NS			
OCDD		0.38	U	NG/G	NS			
OCDF		0.13	U	NG/G	NS			
PeCDDs (total)		0.18	U	NG/G	NS			
PeCDFs (total)		0.1	U	NG/G	NS			
TCDDs (total)		0.077	U	NG/G	NS			
TCDFs (total)		0.2	U	NG/G	NS			

Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	HERSHEY RUN				HERSHEY RUN			
LOCATION	HR-0				HR-0			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.00INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Pesticides/PCBs								
4,4'-DDD	4	4	U	UG/KG	NS			
4,4'-DDE	**0.34**	4	J	UG/KG	NS			
4,4'-DDT	**1.4**	4	J	UG/KG	NS			
Aldrin	2	2	U	UG/KG	NS			
alpha-BHC	2	2	U	UG/KG	NS			
alpha-Chlordane	**0.99**	2	J	UG/KG	NS			
beta-BHC	2	2	U	UG/KG	NS			
delta-BHC	2	2	U	UG/KG	NS			
Dieldrin	**0.45**	4	J	UG/KG	NS			
Endosulfan I	2	2	U	UG/KG	NS			
Endosulfan II	4	4	U	UG/KG	NS			
Endosulfan Sulfate	4	4	U	UG/KG	NS			
Endrin	4	4	U	UG/KG	NS			
Endrin aldehyde	4	4	U	UG/KG	NS			
Endrin ketone	4	4	U	UG/KG	NS			
gamma-BHC (Lindane)	2	2	U	UG/KG	NS			
gamma-Chlordane	**0.43**	2	J	UG/KG	NS			
Heptachlor	2	2	U	UG/KG	NS			
Heptachlor epoxide	**0.35**	2	J	UG/KG	NS			
Methoxychlor	20	20	U	UG/KG	NS			
PCB-1016	40	40	U	UG/KG	NS			
PCB-1221	80	80	U	UG/KG	NS			
PCB-1232	40	40	U	UG/KG	NS			
PCB-1242	40	40	U	UG/KG	NS			
PCB-1248	40	40	U	UG/KG	NS			
PCB-1254	40	40	U	UG/KG	NS			
PCB-1260	40	40	U	UG/KG	NS			
Toxaphene	200	200	U	UG/KG	NS			

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Table 2-6

Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	HERSHEY RUN				HERSHEY RUN			
LOCATION	HR-0				HR-0			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.OOINCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Volatile Compounds								
1,1,1-Trichloroethane	14	14	U	UG/KG	13	13	U	UG/KG
1,1,2,2-Tetrachloroethane	14	14	U	UG/KG	13	13	U	UG/KG
1,1,2-Trichloroethane	14	14	U	UG/KG	13	13	U	UG/KG
1,1-Dichloroethane	14	14	U	UG/KG	13	13	U	UG/KG
1,1-Dichloroethene	14	14	U	UG/KG	13	13	U	UG/KG
1,2-Dichloroethane	14	14	U	UG/KG	13	13	U	UG/KG
1,2-Dichloroethene (total)	14	14	U	UG/KG	13	13	U	UG/KG
1,2-Dichloropropane	14	14	U	UG/KG	13	13	U	UG/KG
2-Butanone	14	14	U	UG/KG	13	13	U	UG/KG
2-Hexanone	14	14	U	UG/KG	13	13	U	UG/KG
4-Methyl-2-Pentanone	14	14	U	UG/KG	13	13	U	UG/KG
Acetone	14	14	U	UG/KG	13	13	U	UG/KG
Benzene	14	14	U	UG/KG	13	13	U	UG/KG
Bromodichloromethane	14	14	U	UG/KG	13	13	U	UG/KG
Bromoform	14	14	U	UG/KG	13	13	U	UG/KG
Bromomethane	14	14	U	UG/KG	13	13	U	UG/KG
Carbon Disulfide	14	14	U	UG/KG	13	13	U	UG/KG
Carbon Tetrachloride	14	14	U	UG/KG	13	13	U	UG/KG
Chlorobenzene	14	14	U	UG/KG	13	13	U	UG/KG
Chloroethane	14	14	U	UG/KG	13	13	U	UG/KG
Chloroform	14	14	U	UG/KG	13	13	U	UG/KG
Chloromethane	14	14	U	UG/KG	13	13	U	UG/KG
cis-1,3-Dichloropropene	14	14	U	UG/KG	13	13	U	UG/KG
Dibromochloromethane	14	14	U	UG/KG	13	13	U	UG/KG
Ethylbenzene	14	14	U	UG/KG	13	13	U	UG/KG
Methylene Chloride	14	14	U	UG/KG	13	13	U	UG/KG
Styrene	14	14	U	UG/KG	13	13	U	UG/KG
Tetrachloroethene	14	14	U	UG/KG	13	13	U	UG/KG
Toluene	14	14	U	UG/KG	13	13	U	UG/KG
trans-1,3-Dichloropropene	14	14	U	UG/KG	13	13	U	UG/KG
Trichloroethene	14	14	U	UG/KG	13	13	U	UG/KG
Vinyl Chloride	14	14	U	UG/KG	13	13	U	UG/KG
Xylenes (total)	14	14	U	UG/KG	13	13	U	UG/KG

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Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	WHITE CLAY CREEK				WHITE CLAY CREEK			
LOCATION	WH-1				WH-1			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.00 INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Semi-Volatile Compounds								
1,2,4-Trichlorobenzene	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
1,2-Dichlorobenzene	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
1,3-Dichlorobenzene	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
1,4-Dichlorobenzene	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
2,2'-oxybis(1-Chloropropane)	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
2,4,5-Trichlorophenol	2900	2900	UJ	UG/KG	5000	5000	UJ	UG/KG
2,4,6-Trichlorophenol	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
2,4-Dichlorophenol	1200	1200	U	UG/KG	2000	2000	UJ	UG/KG
2,4-Dimethylphenol	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
2,4-Dinitrophenol	2900	2900	UJ	UG/KG	5000	5000	UJ	UG/KG
2,4-Dinitrotoluene	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
2,6-Dinitrotoluene	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
2-Chloronaphthalene	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
2-Chlorophenol	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
2-Methylnaphthalene	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
2-Methylphenol	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
2-Nitroaniline	2900	2900	UJ	UG/KG	5000	5000	UJ	UG/KG
2-Nitrophenol	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
3,3'-Dichlorobenzidine	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
3-Nitroaniline	2900	2900	UJ	UG/KG	5000	5000	UJ	UG/KG
4,6-Dinitro-2-methylphenol	2900	2900	UJ	UG/KG	5000	5000	UJ	UG/KG
4-Bromophenyl-phenylether	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
4-Chloro-3-methylphenol	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
4-Chloroaniline	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
4-Chlorophenyl-phenylether	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
4-Methylphenol	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
4-Nitroaniline	2900	2900	UJ	UG/KG	5000	5000	UJ	UG/KG
4-Nitrophenol	2900	2900	UJ	UG/KG	5000	5000	UJ	UG/KG
Acenaphthene	1200	1200	U	UG/KG	2000	2000	U	UG/KG
Acenaphthylene	1200	1200	U	UG/KG	2000	2000	U	UG/KG
Anthracene	1200	1200	U	UG/KG	2000	2000	U	UG/KG
Benzo(a)anthracene	**360**		J	UG/KG	2000	2000	U	UG/KG
Benzo(a)pyrene	1200	1200	U	UG/KG	2000	2000	U	UG/KG
Benzo(b)fluoranthene	**430**		J	UG/KG	2000	2000	U	UG/KG

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Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	WHITE CLAY CREEK				WHITE CLAY CREEK			
LOCATION	WH-1				WH-1			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.00 INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Benzo(g,h,i)perylene	**260**		J	UG/KG	2000	2000	U	UG/KG
Benzo(k)fluoranthene	1200	1200	U	UG/KG	2000	2000	U	UG/KG
bis(2-Chloroethoxy)methane	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
bis(2-Chloroethyl)ether	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
bis(2-Ethylhexyl)phthalate	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
Butylbenzylphthalate	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
Carbazole	1200	1200	U	UG/KG	2000	2000	U	UG/KG
Chrysene	**430**		J	UG/KG	2000	2000	U	UG/KG
Di-n-butylphthalate	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
Di-n-octylphthalate	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
Dibenz(a,h)anthracene	1200	1200	U	UG/KG	2000	2000	U	UG/KG
Dibenzofuran	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
Diethylphthalate	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
Dimethylphthalate	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
Fluoranthene	**1100**		J	UG/KG	2000	2000	U	UG/KG
Fluorene	1200	1200	U	UG/KG	2000	2000	U	UG/KG
Hexachlorobenzene	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
Hexachlorobutadiene	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
Hexachlorocyclopentadiene	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
Hexachloroethane	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
Indeno(1,2,3-c,d)pyrene	**240**		J	UG/KG	2000	2000	U	UG/KG
Isophorone	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
N-Nitroso-di-n-propylamine	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
N-Nitrosodiphenylamine	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
Naphthalene	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
Nitrobenzene	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
Pentachlorophenol	2900	2900	UJ	UG/KG	5000	5000	UJ	UG/KG
Phenanthrene	**640**		J	UG/KG	2000	2000	U	UG/KG
Phenol	1200	1200	UJ	UG/KG	2000	2000	UJ	UG/KG
Pyrene	**800**		J	UG/KG	2000	2000	U	UG/KG

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Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	WHITE CLAY CREEK				WHITE CLAY CREEK			
LOCATION	WH-1				WH-1			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.00 INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Inorganic Compounds								
Aluminum	**13200**	200		MG/KG	**13900**	200		MG/KG
Antimony	0.7	60	UL	MG/KG	0.97	60	B	MG/KG
Arsenic	2.7	10	B	MG/KG	**1.5**	10	L	MG/KG
Barium	136	200		MG/KG	**126**	200		MG/KG
Beryllium	**0.79**	5	L	MG/KG	**0.76**	5	L	MG/KG
Cadmium	0.35	5	UL	MG/KG	**0.81**	5	L	MG/KG
Calcium	**2250**	5000		MG/KG	**1870**	5000		MG/KG
Chromium	**28.9**	10		MG/KG	**27.1**	10		MG/KG
Cobalt	**15.2**	50		MG/KG	**14.1**	50		MG/KG
Copper	**17.6**	25		MG/KG	**19**	25		MG/KG
Cyanide		20	NA	MG/KG		20	NA	MG/KG
Iron	**22100**	100		MG/KG	**20300**	100		MG/KG
Lead	**19.1**	3		MG/KG	**28.7**	3		MG/KG
Magnesium	**5580**	5000		MG/KG	**4740**	5000		MG/KG
Manganese	**502**	15	L	MG/KG	**258**	15	L	MG/KG
Mercury	**0.09**	0.2	U	MG/KG	**0.08**	0.2		MG/KG
Nickel	**15**	40		MG/KG	**17.3**	40		MG/KG
Potassium	**4800**	5000		MG/KG	**4270**	5000		MG/KG
Selenium	1.4	5	U	MG/KG	1.2	5	U	MG/KG
Silver	1.1	10	U	MG/KG	0.91	10	U	MG/KG
Sodium	**97.1**	5000		MG/KG	**79.7**	5000		MG/KG
Thallium	2.5	10	UL	MG/KG	2.1	10	UL	MG/KG
Vanadium	**43.1**	50		MG/KG	**43.1**	50		MG/KG
Zinc	**264**	20	L	MG/KG	**896**	20	L	MG/KG

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Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	WHITE CLAY CREEK				WHITE CLAY CREEK			
LOCATION	WH-1				WH-1			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.00 INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
PCDDs/PCDFs								
1,2,3,4,6,7,8-HpCDD		0.12	U	NG/G	NS			
1,2,3,4,6,7,8-HpCDF		0.077	U	NG/G	NS			
1,2,3,4,7,8,9-HpCDF		0.087	U	NG/G	NS			
1,2,3,4,7,8-HxCDD		0.093	U	NG/G	NS			
1,2,3,4,7,8-HxCDF		0.11	U	NG/G	NS			
1,2,3,6,7,8-HxCDD		0.089	U	NG/G	NS			
1,2,3,6,7,8-HxCDF		0.093	U	NG/G	NS			
1,2,3,7,8,9-HxCDD		0.087	U	NG/G	NS			
1,2,3,7,8,9-HxCDF		0.12	U	NG/G	NS			
1,2,3,7,8-PeCDD		0.19	U	NG/G	NS			
1,2,3,7,8-PeCDF		0.091	U	NG/G	NS			
2,3,4,6,7,8-HxCDF		0.11	U	NG/G	NS			
2,3,4,7,8-PeCDF		0.097	U	NG/G	NS			
2,3,7,8-TCDD		0.14	U	NG/G	NS			
2,3,7,8-TCDF		0.25	U	NG/G	NS			
HpCDDs (total)		0.12	U	NG/G	NS			
HpCDFs (total)		0.077	U	NG/G	NS			
HxCDDs (total)		0.087	U	NG/G	NS			
HxCDFs (total)		0.093	U	NG/G	NS			
OCDD	2		J	NG/G	NS			
OCDD TE* (TEF = 0.001)	(0.002)*			NG/G	NS			
OCDF		0.17	U	NG/G	NS			
PeCDDs (total)		0.19	U	NG/G	NS			
PeCDFs (total)		0.091	U	NG/G	NS			
TCDDs (total)		0.14	U	NG/G	NS			
TCDFs (total)		0.25	U	NG/G	NS			

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Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	WHITE CLAY CREEK				WHITE CLAY CREEK			
LOCATION	WH-1				WH-1			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.00 INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Pesticides/PCBs								
4,4'-DDD	**1.7**	5.8	J	UG/KG	NS			
4,4'-DDE	**0.54**	5.8	J	UG/KG	NS			
4,4'-DDT	5.8	5.8	U	UG/KG	NS			
Aldrin	3	3	U	UG/KG	NS			
alpha-BHC	3	3	U	UG/KG	NS			
alpha-Chlordane	**0.48**	3	J	UG/KG	NS			
beta-BHC	3	3	U	UG/KG	NS			
delta-BHC	3	3	U	UG/KG	NS			
Dieldrin	5.8	5.8	U	UG/KG	NS			
Endosulfan I	3	3	U	UG/KG	NS			
Endosulfan II	5.8	5.8	U	UG/KG	NS			
Endosulfan Sulfate	5.8	5.8	U	UG/KG	NS			
Endrin	5.8	5.8	U	UG/KG	NS			
Endrin aldehyde	5.8	5.8	U	UG/KG	NS			
Endrin ketone	5.8	5.8	U	UG/KG	NS			
gamma-BHC (Lindane)	3	3	U	UG/KG	NS			
gamma-Chlordane	**0.2**	3	J	UG/KG	NS			
Heptachlor	3	3	U	UG/KG	NS			
Heptachlor epoxide	3	3	U	UG/KG	NS			
Methoxychlor	30	30	U	UG/KG	NS			
PCB-1016	58	58	U	UG/KG	NS			
PCB-1221	120	120	U	UG/KG	NS			
PCB-1232	58	58	U	UG/KG	NS			
PCB-1242	58	58	U	UG/KG	NS			
PCB-1248	58	58	U	UG/KG	NS			
PCB-1254	58	58	U	UG/KG	NS			
PCB-1260	58	58	U	UG/KG	NS			
Toxaphene	300	300	U	UG/KG	NS			

AR308557

Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	WHITE CLAY CREEK				WHITE CLAY CREEK			
LOCATION	WH-1				WH-1			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.00 INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Volatile Compounds								
1,1,1-Trichloroethane	16	16	U	UG/KG	18	18	U	UG/KG
1,1,2,2-Tetrachloroethane	16	16	U	UG/KG	18	18	U	UG/KG
1,1,2-Trichloroethane	16	16	U	UG/KG	18	18	U	UG/KG
1,1-Dichloroethane	16	16	U	UG/KG	18	18	U	UG/KG
1,1-Dichloroethene	16	16	U	UG/KG	18	18	U	UG/KG
1,2-Dichloroethane	16	16	U	UG/KG	18	18	U	UG/KG
1,2-Dichloroethene (total)	16	16	U	UG/KG	18	18	U	UG/KG
1,2-Dichloropropane	16	16	U	UG/KG	18	18	U	UG/KG
2-Butanone	16	16	U	UG/KG	18	18	U	UG/KG
2-Hexanone	16	16	U	UG/KG	18	18	U	UG/KG
4-Methyl-2-Pentanone	16	16	U	UG/KG	18	18	U	UG/KG
Acetone	5		B	UG/KG	18	18	U	UG/KG
Benzene	16	16	U	UG/KG	18	18	U	UG/KG
Bromodichloromethane	16	16	U	UG/KG	18	18	U	UG/KG
Bromoform	16	16	U	UG/KG	18	18	U	UG/KG
Bromomethane	16	16	U	UG/KG	18	18	U	UG/KG
Carbon Disulfide	16	16	U	UG/KG	18	18	U	UG/KG
Carbon Tetrachloride	16	16	U	UG/KG	18	18	U	UG/KG
Chlorobenzene	16	16	U	UG/KG	18	18	U	UG/KG
Chloroethane	16	16	U	UG/KG	18	18	U	UG/KG
Chloroform	16	16	U	UG/KG	18	18	U	UG/KG
Chloromethane	16	16	U	UG/KG	18	18	U	UG/KG
cis-1,3-Dichloropropene	16	16	U	UG/KG	18	18	U	UG/KG
Dibromochloromethane	16	16	U	UG/KG	18	18	U	UG/KG
Ethylbenzene	16	16	U	UG/KG	18	18	U	UG/KG
Methylene Chloride	16	16	U	UG/KG	18	18	U	UG/KG
Styrene	16	16	U	UG/KG	18	18	U	UG/KG
Tetrachloroethene	16	16	U	UG/KG	18	18	U	UG/KG
Toluene	16	16	U	UG/KG	18	18	U	UG/KG
trans-1,3-Dichloropropene	16	16	U	UG/KG	18	18	U	UG/KG
Trichloroethene	16	16	U	UG/KG	18	18	U	UG/KG
Vinyl Chloride	16	16	U	UG/KG	18	18	U	UG/KG
Xylenes (total)	16	16	U	UG/KG	18	18	U	UG/KG

AR308558

Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	WHITE CLAY CREEK				WHITE CLAY CREEK			
LOCATION	EPA-1				EPA-1			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.00 INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Semi-Volatile Compounds								
1,2,4-Trichlorobenzene	930	930	U	UG/KG	830	830	U	UG/KG
1,2-Dichlorobenzene	930	930	U	UG/KG	830	830	U	UG/KG
1,3-Dichlorobenzene	930	930	U	UG/KG	830	830	U	UG/KG
1,4-Dichlorobenzene	930	930	U	UG/KG	830	830	U	UG/KG
2,2'-oxybis(1-Chloropropane)	930	930	U	UG/KG	830	830	U	UG/KG
2,4,5-Trichlorophenol	2300	2300	U	UG/KG	2100	2100	U	UG/KG
2,4,6-Trichlorophenol	930	930	U	UG/KG	830	830	U	UG/KG
2,4-Dichlorophenol	930	930	U	UG/KG	830	830	U	UG/KG
2,4-Dimethylphenol	930	930	U	UG/KG	830	830	U	UG/KG
2,4-Dinitrophenol	2300	2300	U	UG/KG	2100	2100	U	UG/KG
2,4-Dinitrotoluene	930	930	U	UG/KG	830	830	U	UG/KG
2,6-Dinitrotoluene	930	930	U	UG/KG	830	830	U	UG/KG
2-Chloronaphthalene	930	930	U	UG/KG	830	830	U	UG/KG
2-Chlorophenol	930	930	U	UG/KG	830	830	U	UG/KG
2-Methylnaphthalene	930	930	U	UG/KG	830	830	U	UG/KG
2-Methylphenol	930	930	U	UG/KG	830	830	U	UG/KG
2-Nitroaniline	2300	2300	U	UG/KG	2100	2100	U	UG/KG
2-Nitrophenol	930	930	U	UG/KG	830	830	U	UG/KG
3,3'-Dichlorobenzidine	930	930	U	UG/KG	830	830	U	UG/KG
3-Nitroaniline	2300	2300	U	UG/KG	2100	2100	U	UG/KG
4,6-Dinitro-2-methylphenol	2300	2300	U	UG/KG	2100	2100	U	UG/KG
4-Bromophenyl-phenylether	930	930	U	UG/KG	830	830	U	UG/KG
4-Chloro-3-methylphenol	930	930	U	UG/KG	830	830	U	UG/KG
4-Chloroaniline	930	930	U	UG/KG	830	830	U	UG/KG
4-Chlorophenyl-phenylether	930	930	U	UG/KG	830	830	U	UG/KG
4-Methylphenol	930	930	U	UG/KG	830	830	U	UG/KG
4-Nitroaniline	2300	2300	U	UG/KG	2100	2100	U	UG/KG
4-Nitrophenol	2300	2300	U	UG/KG	2100	2100	U	UG/KG
Acenaphthene	930	930	U	UG/KG	830	830	U	UG/KG
Acenaphthylene	930	930	U	UG/KG	830	830	U	UG/KG
Anthracene	930	930	U	UG/KG	830	830	U	UG/KG
Benzo(a)anthracene	**240**		J	UG/KG	830	830	U	UG/KG
Benzo(a)pyrene	930	930	U	UG/KG	830	830	U	UG/KG
Benzo(b)fluoranthene	**300**		J	UG/KG	830	830	U	UG/KG

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Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	WHITE CLAY CREEK				WHITE CLAY CREEK			
LOCATION	EPA-1				EPA-1			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.00 INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Benzo(g,h,i)perylene	930	930	U	UG/KG	830	830	U	UG/KG
Benzo(k)fluoranthene	930	930	U	UG/KG	830	830	U	UG/KG
bis(2-Chloroethoxy)methane	930	930	U	UG/KG	830	830	U	UG/KG
bis(2-Chloroethyl)ether	930	930	U	UG/KG	830	830	U	UG/KG
bis(2-Ethylhexyl)phthalate	**300**		J	UG/KG	830	830	U	UG/KG
Butylbenzylphthalate	930	930	UJ	UG/KG	830	830	UJ	UG/KG
Carbazole	930	930	U	UG/KG	830	830	U	UG/KG
Chrysene	**200**		J	UG/KG	830	830	U	UG/KG
Di-n-butylphthalate	**240**		J	UG/KG	830	830	U	UG/KG
Di-n-octylphthalate	930	930	U	UG/KG	830	830	U	UG/KG
Dibenz(a,h)anthracene	930	930	U	UG/KG	830	830	U	UG/KG
Dibenzofuran	930	930	U	UG/KG	830	830	U	UG/KG
Diethylphthalate	930	930	U	UG/KG	830	830	U	UG/KG
Dimethylphthalate	930	930	U	UG/KG	830	830	U	UG/KG
Fluoranthene	**490**		J	UG/KG	830	830	U	UG/KG
Fluorene	930	930	U	UG/KG	830	830	U	UG/KG
Hexachlorobenzene	930	930	U	UG/KG	830	830	U	UG/KG
Hexachlorobutadiene	930	930	U	UG/KG	830	830	U	UG/KG
Hexachlorocyclopentadiene	930	930	U	UG/KG	830	830	U	UG/KG
Hexachloroethane	930	930	U	UG/KG	830	830	U	UG/KG
Indeno(1,2,3-c,d)pyrene	930	930	U	UG/KG	830	830	U	UG/KG
Isophorone	930	930	U	UG/KG	830	830	U	UG/KG
N-Nitroso-di-n-propylamine	930	930	U	UG/KG	830	830	U	UG/KG
N-Nitrosodiphenylamine	930	930	U	UG/KG	830	830	U	UG/KG
Naphthalene	930	930	U	UG/KG	830	830	U	UG/KG
Nitrobenzene	930	930	U	UG/KG	830	830	U	UG/KG
Pentachlorophenol	2300	2300	U	UG/KG	2100	2100	U	UG/KG
Phenanthrene	**200**		J	UG/KG	830	830	U	UG/KG
Phenol	930	930	U	UG/KG	830	830	U	UG/KG
Pyrene	**340**		J	UG/KG	830	830	U	UG/KG

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Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	WHITE CLAY CREEK				WHITE CLAY CREEK			
LOCATION	EPA-1				EPA-1			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.00 INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Inorganic Compounds								
Aluminum	**8270**	200		MG/KG	**5120**	200		MG/KG
Antimony	0.84	60	U	MG/KG	0.75	60	U	MG/KG
Arsenic	1.7	10	U	MG/KG	1.5	10	U	MG/KG
Barium	**91.2**	200		MG/KG	**57.5**	200		MG/KG
Beryllium	**0.58**	5		MG/KG	**0.4**	5		MG/KG
Cadmium	0.28	5	U	MG/KG	0.25	5	U	MG/KG
Calcium	**1050**	5000		MG/KG	**472**	5000		MG/KG
Chromium	**18.4**	10		MG/KG	**13.8**	10		MG/KG
Cobalt	**7.5**	50		MG/KG	**5.9**	50		MG/KG
Copper	**13.6**	25		MG/KG	**6.9**	25		MG/KG
Cyanide		20	NA	MG/KG		20	NA	MG/KG
Iron	**14800**	100		MG/KG	**10200**	100		MG/KG
Lead	**23.2**	3		MG/KG	**10.5**	3		MG/KG
Magnesium	**3040**	5000		MG/KG	**2120**	5000		MG/KG
Manganese	**396**	15		MG/KG	**191**	15		MG/KG
Mercury	0.07	0.2	U	MG/KG	0.06	0.2	U	MG/KG
Nickel	**11.7**	40		MG/KG	**6.5**	40		MG/KG
Potassium	**2710**	5000		MG/KG	**2220**	5000		MG/KG
Selenium	1.1	5	U	MG/KG	1	5	U	MG/KG
Silver	0.84	10	U	MG/KG	0.75	10	U	MG/KG
Sodium	**104**	5000		MG/KG	**70.6**	5000		MG/KG
Thallium	2.5	10	U	MG/KG	2.2	10	U	MG/KG
Vanadium	**26.5**	50		MG/KG	**18.6**	50		MG/KG
Zinc	**229**	20		MG/KG	**166**	20		MG/KG

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Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	WHITE CLAY CREEK				WHITE CLAY CREEK			
LOCATION	EPA-1				EPA-1			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12.00 INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Volatile Compounds								
1,1,1-Trichloroethane	14	14	U	UG/KG	12	12	U	UG/KG
1,1,2,2-Tetrachloroethane	14	14	U	UG/KG	12	12	U	UG/KG
1,1,2-Trichloroethane	14	14	U	UG/KG	12	12	U	UG/KG
1,1-Dichloroethane	14	14	U	UG/KG	12	12	U	UG/KG
1,1-Dichloroethene	14	14	U	UG/KG	12	12	U	UG/KG
1,2-Dichloroethane	14	14	U	UG/KG	12	12	U	UG/KG
1,2-Dichloroethene (total)	14	14	U	UG/KG	12	12	U	UG/KG
1,2-Dichloropropane	14	14	U	UG/KG	12	12	U	UG/KG
2-Butanone	14	14	U	UG/KG	12	12	U	UG/KG
2-Hexanone	14	14	U	UG/KG	12	12	U	UG/KG
4-Methyl-2-Pentanone	14	14	U	UG/KG	12	12	U	UG/KG
Acetone	14	14	U	UG/KG	12	12	U	UG/KG
Benzene	14	14	U	UG/KG	12	12	U	UG/KG
Bromodichloromethane	14	14	U	UG/KG	12	12	U	UG/KG
Bromoform	14	14	U	UG/KG	12	12	U	UG/KG
Bromomethane	14	14	U	UG/KG	12	12	U	UG/KG
Carbon Disulfide	14	14	U	UG/KG	12	12	U	UG/KG
Carbon Tetrachloride	14	14	U	UG/KG	12	12	U	UG/KG
Chlorobenzene	14	14	U	UG/KG	12	12	U	UG/KG
Chloroethane	14	14	U	UG/KG	12	12	U	UG/KG
Chloroform	14	14	U	UG/KG	12	12	U	UG/KG
Chloromethane	14	14	U	UG/KG	12	12	U	UG/KG
cis-1,3-Dichloropropene	14	14	U	UG/KG	12	12	U	UG/KG
Dibromochloromethane	14	14	U	UG/KG	12	12	U	UG/KG
Ethylbenzene	14	14	U	UG/KG	12	12	U	UG/KG
Methylene Chloride	14	14	U	UG/KG	12	12	U	UG/KG
Styrene	14	14	U	UG/KG	12	12	U	UG/KG
Tetrachloroethene	14	14	U	UG/KG	12	12	U	UG/KG
Toluene	14	14	U	UG/KG	12	12	U	UG/KG
trans-1,3-Dichloropropene	14	14	U	UG/KG	12	12	U	UG/KG
Trichloroethene	14	14	U	UG/KG	12	12	U	UG/KG
Vinyl Chloride	14	14	U	UG/KG	12	12	U	UG/KG
Xylenes (total)	14	14	U	UG/KG	12	12	U	UG/KG

AR308562

Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	CHURCHMAN'S MARSH				CHURCHMAN'S MARSH			
LOCATION	CMD-1				CMD-1			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Semi-Volatile Compounds								
1,2,4-Trichlorobenzene	610	610	UJ	UG/KG	490	490	U	UG/KG
1,2-Dichlorobenzene	610	610	UJ	UG/KG	490	490	U	UG/KG
1,3-Dichlorobenzene	610	610	UJ	UG/KG	490	490	U	UG/KG
1,4-Dichlorobenzene	610	610	UJ	UG/KG	490	490	U	UG/KG
2,2'-oxybis(1-Chloropropane)	610	610	UJ	UG/KG	490	490	U	UG/KG
2,4,5-Trichlorophenol	1500	1500	UJ	UG/KG	1200	1200	U	UG/KG
2,4,6-Trichlorophenol	610	610	UJ	UG/KG	490	490	U	UG/KG
2,4-Dichlorophenol	610	610	UJ	UG/KG	490	490	U	UG/KG
2,4-Dimethylphenol	610	610	UJ	UG/KG	490	490	U	UG/KG
2,4-Dinitrophenol	1500	1500	UJ	UG/KG	1200	1200	U	UG/KG
2,4-Dinitrotoluene	610	610	UJ	UG/KG	490	490	U	UG/KG
2,6-Dinitrotoluene	610	610	UJ	UG/KG	490	490	U	UG/KG
2-Chloronaphthalene	610	610	UJ	UG/KG	490	490	U	UG/KG
2-Chlorophenol	610	610	UJ	UG/KG	490	490	U	UG/KG
2-Methylnaphthalene	610	610	UJ	UG/KG	490	490	U	UG/KG
2-Methylphenol	610	610	UJ	UG/KG	490	490	U	UG/KG
2-Nitroaniline	1500	1500	UJ	UG/KG	1200	1200	U	UG/KG
2-Nitrophenol	610	610	UJ	UG/KG	490	490	U	UG/KG
3,3'-Dichlorobenzidine	610	610	UJ	UG/KG	490	490	U	UG/KG
3-Nitroaniline	1500	1500	UJ	UG/KG	1200	1200	U	UG/KG
4,6-Dinitro-2-methylphenol	1500	1500	UJ	UG/KG	1200	1200	U	UG/KG
4-Bromophenyl-phenylether	610	610	UJ	UG/KG	490	490	U	UG/KG
4-Chloro-3-methylphenol	610	610	UJ	UG/KG	490	490	U	UG/KG
4-Chloroaniline	610	610	UJ	UG/KG	490	490	U	UG/KG
4-Chlorophenyl-phenylether	610	610	UJ	UG/KG	490	490	U	UG/KG
4-Methylphenol	610	610	UJ	UG/KG	490	490	U	UG/KG
4-Nitroaniline	1500	1500	UJ	UG/KG	1200	1200	U	UG/KG
4-Nitrophenol	1500	1500	UJ	UG/KG	1200	1200	U	UG/KG
Acenaphthene	610	610	U	UG/KG	490	490	U	UG/KG
Acenaphthylene	610	610	U	UG/KG	490	490	U	UG/KG
Anthracene	610	610	U	UG/KG	490	490	U	UG/KG
Benzo(a)anthracene	610	610	U	UG/KG	490	490	U	UG/KG
Benzo(a)pyrene	610	610	U	UG/KG	490	490	UJ	UG/KG
Benzo(b)fluoranthene	610	610	U	UG/KG	490	490	U	UG/KG
Benzo(g,h,i)perylene	610	610	U	UG/KG	490	490	UJ	UG/KG
Benzo(k)fluoranthene	610	610	U	UG/KG	490	490	UJ	UG/KG
bis(2-Chloroethoxy)methane	610	610	UJ	UG/KG	490	490	U	UG/KG
bis(2-Chloroethyl)ether	610	610	UJ	UG/KG	490	490	U	UG/KG
bis(2-Ethylhexyl)phthalate	160		J	UG/KG	490	490	U	UG/KG
Butylbenzylphthalate	610	610	UJ	UG/KG	490	490	U	UG/KG

Ta. . 2-6

Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	CHURCHMAN'S MARSH				CHURCHMAN'S MARSH			
LOCATION	CMD-1				CMD-1			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Carbazole	610	610	U	UG/KG	490	490	U	UG/KG
Chrysene	610	610	U	UG/KG	490	490	U	UG/KG
Di-n-butylphthalate	**210**		J	UG/KG	**320**		J	UG/KG
Di-n-octylphthalate	610	610	UJ	UG/KG	490	490	U	UG/KG
Dibenz(a,h)anthracene	610	610	U	UG/KG	490	490	UJ	UG/KG
Dibenzofuran	610	610	UJ	UG/KG	490	490	U	UG/KG
Diethylphthalate	610	610	UJ	UG/KG	490	490	U	UG/KG
Dimethylphthalate	610	610	UJ	UG/KG	490	490	U	UG/KG
Fluoranthene	610	610	U	UG/KG	490	490	U	UG/KG
Fluorene	610	610	U	UG/KG	490	490	U	UG/KG
Hexachlorobenzene	610	610	UJ	UG/KG	490	490	U	UG/KG
Hexachlorobutadiene	610	610	UJ	UG/KG	490	490	U	UG/KG
Hexachlorocyclopentadiene	610	610	UJ	UG/KG	490	490	U	UG/KG
Hexachloroethane	610	610	UJ	UG/KG	490	490	U	UG/KG
Indeno(1,2,3-c,d)pyrene	610	610	U	UG/KG	490	490	U	UG/KG
Isophorone	610	610	UJ	UG/KG	490	490	U	UG/KG
N-Nitroso-di-n-propylamine	610	610	UJ	UG/KG	490	490	U	UG/KG
N-Nitrosodiphenylamine	610	610	UJ	UG/KG	490	490	U	UG/KG
Naphthalene	610	610	UJ	UG/KG	490	490	U	UG/KG
Nitrobenzene	610	610	UJ	UG/KG	490	490	U	UG/KG
Pentachlorophenol	1500	1500	UJ	UG/KG	1200	1200	U	UG/KG
Phenanthrene	610	610	U	UG/KG	490	490	U	UG/KG
Phenol	610	610	UJ	UG/KG	490	490	U	UG/KG
Pyrene	610	610	U	UG/KG	490	490	U	UG/KG

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Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	CHURCHMAN'S MARSH				CHURCHMAN'S MARSH			
LOCATION	CMD-1				CMD-1			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Inorganic Compounds								
Aluminum	**15600**	200		MG/KG	**16900**	200		MG/KG
Antimony	1.1	60	R	MG/KG	0.88	60	R	MG/KG
Arsenic	**6.1**	10		MG/KG	**2.9**	10		MG/KG
Barium	**253**	200		MG/KG	**183**	200		MG/KG
Beryllium	**1.3**	5		MG/KG	**1.3**	5		MG/KG
Cadmium	**2.2**	5	J	MG/KG	0.29	5	U	MG/KG
Calcium	**2200**	5000		MG/KG	**1970**	5000		MG/KG
Chromium	**44.1**	10		MG/KG	**40.5**	10		MG/KG
Cobalt	**14.7**	50	K	MG/KG	**13.8**	50		MG/KG
Copper	**36.3**	25	J	MG/KG	**10.5**	25		MG/KG
Cyanide		20	NA	MG/KG		20	NA	MG/KG
Iron	**26400**	100		MG/KG	**23800**	100		MG/KG
Lead	**45.6**	3	J	MG/KG	**12.7**	3		MG/KG
Magnesium	**4560**	5000		MG/KG	**5670**	5000		MG/KG
Manganese	**474**	15		MG/KG	**296**	15		MG/KG
Mercury	0.09	0.2	U	MG/KG	0.07	0.2	U	MG/KG
Nickel	**23.7**	40		MG/KG	**22.5**	40	J	MG/KG
Potassium	**1980**	5000		MG/KG	**1520**	5000		MG/KG
Selenium	1.5	5	UL	MG/KG	1.2	5	U	MG/KG
Silver	1.1	10	U	MG/KG	0.88	10	U	MG/KG
Sodium	**158**	5000		MG/KG	**224**	5000		MG/KG
Thallium	3.3	10	U	MG/KG	2.6	10	U	MG/KG
Vanadium	**50.5**	50		MG/KG	**44.9**	50		MG/KG
Zinc	**627**	20	J	MG/KG	**87.3**	20	J	MG/KG

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Table 2-6

Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	CHURCHMAN'S MARSH				CHURCHMAN'S MARSH			
LOCATION	CMD-1				CMD-1			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
PCDDs/PCDFs								
1,2,3,4,6,7,8-HpCDD		0.24	U	NG/G	NS			
1,2,3,4,6,7,8-HpCDF		0.1	U	NG/G	NS			
1,2,3,4,7,8,9-HpCDF		0.12	U	NG/G	NS			
1,2,3,4,7,8-HxCDD		0.19	U	NG/G	NS			
1,2,3,4,7,8-HxCDF		0.069	U	NG/G	NS			
1,2,3,6,7,8-HxCDD		0.16	U	NG/G	NS			
1,2,3,6,7,8-HxCDF		0.058	U	NG/G	NS			
1,2,3,7,8,9-HxCDD		0.17	U	NG/G	NS			
1,2,3,7,8,9-HxCDF		0.078	U	NG/G	NS			
1,2,3,7,8-PeCDD		0.16	U	NG/G	NS			
1,2,3,7,8-PeCDF		0.12	U	NG/G	NS			
2,3,4,6,7,8-HxCDF		0.067	U	NG/G	NS			
2,3,4,7,8-PeCDF		0.13	U	NG/G	NS			
2,3,7,8-TCDD		0.073	U	NG/G	NS			
2,3,7,8-TCDF		0.18	U	NG/G	NS			
HpCDDs (total)		0.24	U	NG/G	NS			
HpCDFs (total)		0.1	U	NG/G	NS			
HxCDDs (total)		0.16	U	NG/G	NS			
HxCDFs (total)		0.058	U	NG/G	NS			
OCDD	**1.6**		J	NG/G	NS			
OCDD TE* (TEF = 0.001)	**(0.0016)***			NG/G	NS			
OCDF		0.21	U	NG/G	NS			
PeCDDs (total)		0.16	U	NG/G	NS			
PeCDFs (total)		0.12	U	NG/G	NS			
TCDDs (total)		0.073	U	NG/G	NS			
TCDFs (total)		0.18	U	NG/G	NS			

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Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	CHURCHMAN'S MARSH				CHURCHMAN'S MARSH			
LOCATION	CMD-1				CMD-1			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Pesticides/PCBs								
4,4'-DDD	6.1	6.1	U	UG/KG	NS			
4,4'-DDE	**1.4**	6.1	J	UG/KG	NS			
4,4'-DDT	6.1	6.1	U	UG/KG	NS			
Aldrin	3.1	3.1	U	UG/KG	NS			
alpha-BHC	3.1	3.1	U	UG/KG	NS			
alpha-Chlordane	3.1	3.1	U	UG/KG	NS			
beta-BHC	3.1	3.1	U	UG/KG	NS			
delta-BHC	3.1	3.1	U	UG/KG	NS			
Dieldrin	6.1	6.1	U	UG/KG	NS			
Endosulfan I	3.1	3.1	U	UG/KG	NS			
Endosulfan II	6.1	6.1	U	UG/KG	NS			
Endosulfan Sulfate	6.1	6.1	U	UG/KG	NS			
Endrin	6.1	6.1	U	UG/KG	NS			
Endrin ketone	6.1	6.1	U	UG/KG	NS			
gamma-BHC (Lindane)	3.1	3.1	U	UG/KG	NS			
gamma-Chlordane	**0.53**	3.1	J	UG/KG	NS			
Heptachlor	3.1	3.1	U	UG/KG	NS			
Heptachlor epoxide	**0.4**	3.1	J	UG/KG	NS			
Methoxychlor	31	31	U	UG/KG	NS			
PCB-1016	61	61	U	UG/KG	NS			
PCB-1221	120	120	U	UG/KG	NS			
PCB-1232	61	61	U	UG/KG	NS			
PCB-1242	61	61	U	UG/KG	NS			
PCB-1248	61	61	U	UG/KG	NS			
PCB-1254	61	61	U	UG/KG	NS			
PCB-1260	**8.8**	61	J	UG/KG	NS			
Toxaphene	310	310	U	UG/KG	NS			

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Table 2-6

Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

SITE	CHURCHMAN'S MARSH				CHURCHMAN'S MARSH			
LOCATION	CMD-1				CMD-1			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Volatile Compounds								
1,1,1-Trichloroethane	19	19	U	UG/KG	15	15	U	UG/KG
1,1,2,2-Tetrachloroethane	19	19	U	UG/KG	15	15	U	UG/KG
1,1,2-Trichloroethane	19	19	U	UG/KG	15	15	U	UG/KG
1,1-Dichloroethane	19	19	U	UG/KG	15	15	U	UG/KG
1,1-Dichloroethene	19	19	U	UG/KG	15	15	U	UG/KG
1,2-Dichloroethane	19	19	U	UG/KG	15	15	U	UG/KG
1,2-Dichloroethene (total)	19	19	U	UG/KG	15	15	U	UG/KG
1,2-Dichloropropane	19	19	U	UG/KG	15	15	U	UG/KG
2-Butanone	19	19	U	UG/KG	15	15	U	UG/KG
2-Hexanone	19	19	U	UG/KG	15	15	U	UG/KG
4-Methyl-2-Pentanone	19	19	U	UG/KG	15	15	U	UG/KG
Acetone	41		J	UG/KG	35		J	UG/KG
Benzene	19	19	U	UG/KG	15	15	U	UG/KG
Bromodichloromethane	19	19	U	UG/KG	15	15	U	UG/KG
Bromoform	19	19	U	UG/KG	15	15	U	UG/KG
Bromomethane	19	19	U	UG/KG	15	15	U	UG/KG
Carbon Disulfide	19	19	U	UG/KG	15	15	U	UG/KG
Carbon Tetrachloride	19	19	U	UG/KG	15	15	U	UG/KG
Chlorobenzene	19	19	U	UG/KG	15	15	U	UG/KG
Chloroethane	19	19	UJ	UG/KG	15	15	UJ	UG/KG
Chloroform	19	19	U	UG/KG	15	15	U	UG/KG
Chloromethane	19	19	U	UG/KG	15	15	U	UG/KG
cis-1,3-Dichloropropene	19	19	U	UG/KG	15	15	U	UG/KG
Dibromochloromethane	19	19	U	UG/KG	15	15	U	UG/KG
Ethylbenzene	19	19	U	UG/KG	15	15	U	UG/KG
Methylene Chloride	19	19	U	UG/KG	15	15	U	UG/KG
Styrene	19	19	U	UG/KG	15	15	U	UG/KG
Tetrachloroethene	19	19	U	UG/KG	15	15	U	UG/KG
Toluene	19	19	U	UG/KG	15	15	U	UG/KG
trans-1,3-Dichloropropene	19	19	U	UG/KG	15	15	U	UG/KG
Trichloroethene	19	19	U	UG/KG	15	15	U	UG/KG
Vinyl Chloride	19	19	U	UG/KG	15	15	U	UG/KG
Xylenes (total)	19	19	U	UG/KG	15	15	U	UG/KG

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Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

LOCATION	CMM-1				CMM-1			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12 INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Semi-Volatile Compounds								
1,2,4-Trichlorobenzene	720	720	UJ	UG/KG	650	650	UJ	UG/KG
1,2-Dichlorobenzene	720	720	UJ	UG/KG	650	650	UJ	UG/KG
1,3-Dichlorobenzene	720	720	UJ	UG/KG	650	650	UJ	UG/KG
1,4-Dichlorobenzene	720	720	UJ	UG/KG	650	650	UJ	UG/KG
2,2'-oxybis(1-Chloropropane)	720	720	UJ	UG/KG	650	650	UJ	UG/KG
2,4,5-Trichlorophenol	1800	1800	UJ	UG/KG	1600	1600	UJ	UG/KG
2,4,6-Trichlorophenol	720	720	UJ	UG/KG	650	650	UJ	UG/KG
2,4-Dichlorophenol	720	720	UJ	UG/KG	650	650	UJ	UG/KG
2,4-Dimethylphenol	720	720	UJ	UG/KG	650	650	UJ	UG/KG
2,4-Dinitrophenol	1800	1800	UJ	UG/KG	1600	1600	UJ	UG/KG
2,4-Dinitrotoluene	720	720	UJ	UG/KG	650	650	UJ	UG/KG
2,6-Dinitrotoluene	720	720	UJ	UG/KG	650	650	UJ	UG/KG
2-Chloronaphthalene	720	720	UJ	UG/KG	650	650	UJ	UG/KG
2-Chlorophenol	720	720	UJ	UG/KG	650	650	UJ	UG/KG
2-Methylnaphthalene	720	720	UJ	UG/KG	650	650	UJ	UG/KG
2-Methylphenol	720	720	UJ	UG/KG	650	650	UJ	UG/KG
2-Nitroaniline	1800	1800	UJ	UG/KG	1600	1600	UJ	UG/KG
2-Nitrophenol	720	720	UJ	UG/KG	650	650	UJ	UG/KG
3,3'-Dichlorobenzidine	720	720	UJ	UG/KG	650	650	UJ	UG/KG
3-Nitroaniline	1800	1800	UJ	UG/KG	1600	1600	UJ	UG/KG
4,6-Dinitro-2-methylphenol	1800	1800	UJ	UG/KG	1600	1600	UJ	UG/KG
4-Bromophenyl-phenylether	720	720	UJ	UG/KG	650	650	UJ	UG/KG
4-Chloro-3-methylphenol	720	720	UJ	UG/KG	650	650	UJ	UG/KG
4-Chloroaniline	720	720	UJ	UG/KG	650	650	UJ	UG/KG
4-Chlorophenyl-phenylether	720	720	UJ	UG/KG	650	650	UJ	UG/KG
4-Methylphenol	720	720	UJ	UG/KG	650	650	UJ	UG/KG
4-Nitroaniline	1800	1800	UJ	UG/KG	1600	1600	UJ	UG/KG
4-Nitrophenol	1800	1800	UJ	UG/KG	1600	1600	UJ	UG/KG
Acenaphthene	720	720	U	UG/KG	650	650	U	UG/KG
Acenaphthylene	720	720	U	UG/KG	650	650	U	UG/KG
Anthracene	720	720	U	UG/KG	650	650	U	UG/KG
Benzo(a)anthracene	**210**		J	UG/KG	**280**		J	UG/KG
Benzo(a)pyrene	140		NJ	UG/KG	380		NJ	UG/KG
Benzo(b)fluoranthene	**220**		J	UG/KG	**250**		J	UG/KG

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Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

LOCATION	CMM-1				CMM-1			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12 INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Benzo(g,h,i)perylene	**110**		J	UG/KG	650	650	U	UG/KG
Benzo(k)fluoranthene	**89**		J	UG/KG	**190**		J	UG/KG
bis(2-Chloroethoxy)methane	720	720	UJ	UG/KG	650	650	UJ	UG/KG
bis(2-Chloroethyl)ether	720	720	UJ	UG/KG	650	650	UJ	UG/KG
bis(2-Ethylhexyl)phthalate	**280**		J	UG/KG	650	650	UJ	UG/KG
Butylbenzylphthalate	720	720	UJ	UG/KG	650	650	UJ	UG/KG
Carbazole	720	720	U	UG/KG	650	650	U	UG/KG
Chrysene	**160**		J	UG/KG	**290**		J	UG/KG
Di-n-butylphthalate	**550**		J	UG/KG	**510**		J	UG/KG
Di-n-octylphthalate	720	720	UJ	UG/KG	650	650	UJ	UG/KG
Dibenz(a,h)anthracene	720	720	U	UG/KG	650	650	U	UG/KG
Dibenzofuran	720	720	UJ	UG/KG	650	650	UJ	UG/KG
Diethylphthalate	720	720	UJ	UG/KG	650	650	UJ	UG/KG
Dimethylphthalate	720	720	UJ	UG/KG	650	650	UJ	UG/KG
Fluoranthene	**250**		J	UG/KG	**260**		J	UG/KG
Fluorene	720	720	U	UG/KG	650	650	U	UG/KG
Hexachlorobenzene	720	720	UJ	UG/KG	650	650	UJ	UG/KG
Hexachlorobutadiene	720	720	UJ	UG/KG	650	650	UJ	UG/KG
Hexachlorocyclopentadiene	720	720	UJ	UG/KG	650	650	UJ	UG/KG
Hexachloroethane	720	720	UJ	UG/KG	650	650	UJ	UG/KG
Indeno(1,2,3-c,d)pyrene	**110**		J	UG/KG	650	650	U	UG/KG
Isophorone	720	720	UJ	UG/KG	650	650	UJ	UG/KG
N-Nitroso-di-n-propylamine	720	720	UJ	UG/KG	650	650	UJ	UG/KG
N-Nitrosodiphenylamine	720	720	UJ	UG/KG	650	650	UJ	UG/KG
Naphthalene	720	720	UJ	UG/KG	650	650	UJ	UG/KG
Nitrobenzene	720	720	UJ	UG/KG	650	650	UJ	UG/KG
Pentachlorophenol	1800	1800	UJ	UG/KG	1600	1600	UJ	UG/KG
Phenanthrene	**88**		J	UG/KG	650	650	U	UG/KG
Phenol	720	720	UJ	UG/KG	650	650	UJ	UG/KG
Pyrene	**270**		J	UG/KG	**230**		J	UG/KG

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Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

LOCATION	CMM-1				CMM-1			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12 INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Inorganic Compounds								
Aluminum	**24000**	200		MG/KG	**25900**	200		MG/KG
Antimony	**0.93**	60	L	MG/KG	**2.5**	60	L	MG/KG
Arsenic	**3.9**	10	L	MG/KG	**13.9**	10		MG/KG
Barium	**323**	200		MG/KG	**641**	200		MG/KG
Beryllium	**1.4**	5		MG/KG	**1.6**	5		MG/KG
Cadmium	**5.5**	5		MG/KG	**20.1**	5		MG/KG
Calcium	**2290**	5000		MG/KG	**1970**	5000		MG/KG
Chromium	**59.6**	10	J	MG/KG	**78.5**	10	J	MG/KG
Cobalt	**15.2**	50	K	MG/KG	19.9	50	K	MG/KG
Copper	**59.7**	25		MG/KG	**153**	25		MG/KG
Cyanide		20	NA	MG/KG		20	NA	MG/KG
Iron	**30900**	100		MG/KG	**29300**	100		MG/KG
Lead	**77**	3	J	MG/KG	**166**	3	J	MG/KG
Magnesium	**5030**	5000		MG/KG	**4950**	5000		MG/KG
Manganese	**691**	15	L	MG/KG	**296**	15	L	MG/KG
Mercury	**0.29**	0.2		MG/KG	**0.41**	0.2		MG/KG
Nickel	**27.4**	40		MG/KG	**37.2**	40		MG/KG
Potassium	**2580**	5000		MG/KG	**2480**	5000		MG/KG
Selenium	1.7	5	UL	MG/KG	1.6	5	UL	MG/KG
Silver	1.3	10	U	MG/KG	1.2	10	U	MG/KG
Sodium	**235**	5000		MG/KG	**179**	5000		MG/KG
Thallium	**4.4**	10	K	MG/KG	2.7	10	U	MG/KG
Vanadium	**59.9**	50		MG/KG	**64.4**	50		MG/KG
Zinc	**1240**	20	J	MG/KG	**5860**	20	J	MG/KG

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Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

LOCATION	CMM-1				CMM-1			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12 INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
PCDDs/PCDFs								
1,2,3,4,6,7,8-HpCDD		0.22	U	NG/G		0.23	U	NG/G
1,2,3,4,6,7,8-HpCDF		0.2	U	NG/G		0.29	U	NG/G
1,2,3,4,7,8,9-HpCDF		0.22	U	NG/G		0.33	U	NG/G
1,2,3,4,7,8-HxCDD		0.13	U	NG/G		0.16	U	NG/G
1,2,3,4,7,8-HxCDF		0.074	U	NG/G		0.079	U	NG/G
1,2,3,6,7,8-HxCDD		0.11	U	NG/G		0.13	U	NG/G
1,2,3,6,7,8-HxCDF		0.061	U	NG/G		0.066	U	NG/G
1,2,3,7,8,9-HxCDD		0.12	U	NG/G		0.14	U	NG/G
1,2,3,7,8,9-HxCDF		0.081	U	NG/G		0.086	U	NG/G
1,2,3,7,8-PeCDD		0.18	U	NG/G		0.21	U	NG/G
1,2,3,7,8-PeCDF		0.12	U	NG/G		0.11	U	NG/G
2,3,4,6,7,8-HxCDF		0.071	U	NG/G		0.076	U	NG/G
2,3,4,7,8-PeCDF		0.13	U	NG/G		0.11	U	NG/G
2,3,7,8-TCDD		0.074	U	NG/G		0.089	U	NG/G
2,3,7,8-TCDF		0.15	U	NG/G		0.17	U	NG/G
HpCDDs (total)	**0.18**		J	NG/G	**0.19**		J	NG/G
HpCDD TE* (TEF = 0.01)	**(0.0018)***			NG/G	**(0.0019)***			NG/G
HpCDFs (total)		0.2	U	NG/G		0.29	U	NG/G
HxCDDs (total)		0.11	U	NG/G		0.13	U	NG/G
HxCDFs (total)		0.061	U	NG/G		0.066	U	NG/G
OCDD	**6.5**			NG/G	**7.1**			NG/G
OCDD TE* (TEF = 0.001)	**(.0065)***			NG/G	**(.0071)***			NG/G
OCDF	**0.2**		J	NG/G	**0.23**		J	NG/G
OCDF TE* (TEF = 0.001)	**(0.0002)***				**(0.00023)***			
PeCDDs (total)		0.18	U	NG/G		0.21	U	NG/G
PeCDFs (total)		0.12	U	NG/G		0.11	U	NG/G
TCDDs (total)		0.074	U	NG/G		0.089	U	NG/G
TCDFs (total)		0.15	U	NG/G		0.17	U	NG/G

Table 2-6
Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

LOCATION	CMM-1				CMM-1			
DEPTH	0.00 TO 6.00 INCHES				6.00 TO 12 INCHES			
COMPOUND	RESULT	DL	QUAL	UNITS	RESULT	DL	QUAL	UNITS
Volatile Compounds								
1,1,1-Trichloroethane	22	22	U	UG/KG	20	20	U	UG/KG
1,1,2,2-Tetrachloroethane	22	22	U	UG/KG	20	20	U	UG/KG
1,1,2-Trichloroethane	22	22	U	UG/KG	20	20	U	UG/KG
1,1-Dichloroethane	22	22	U	UG/KG	20	20	U	UG/KG
1,1-Dichloroethene	22	22	U	UG/KG	20	20	U	UG/KG
1,2-Dichloroethane	22	22	U	UG/KG	20	20	U	UG/KG
1,2-Dichloroethene (total)	22	22	U	UG/KG	20	20	U	UG/KG
1,2-Dichloropropane	22	22	U	UG/KG	20	20	U	UG/KG
2-Butanone	22	22	U	UG/KG	20	20	U	UG/KG
2-Hexanone	22	22	U	UG/KG	20	20	U	UG/KG
4-Methyl-2-Pentanone	22	22	U	UG/KG	20	20	U	UG/KG
Acetone	22	22	U	UG/KG	20	20	U	UG/KG
Benzene	22	22	U	UG/KG	20	20	U	UG/KG
Bromodichloromethane	22	22	U	UG/KG	20	20	U	UG/KG
Bromoform	22	22	U	UG/KG	20	20	U	UG/KG
Bromomethane	22	22	U	UG/KG	20	20	U	UG/KG
Carbon Disulfide	22	22	U	UG/KG	20	20	U	UG/KG
Carbon Tetrachloride	22	22	U	UG/KG	20	20	U	UG/KG
Chlorobenzene	22	22	U	UG/KG	20	20	U	UG/KG
Chloroethane	22	22	UJ	UG/KG	20	20	U	UG/KG
Chloroform	22	22	U	UG/KG	20	20	U	UG/KG
Chloromethane	22	22	U	UG/KG	20	20	U	UG/KG
cis-1,3-Dichloropropene	22	22	U	UG/KG	20	20	U	UG/KG
Dibromochloromethane	22	22	U	UG/KG	20	20	U	UG/KG
Ethylbenzene	22	22	U	UG/KG	20	20	U	UG/KG
Methylene Chloride	22	22	U	UG/KG	20	20	U	UG/KG
Styrene	22	22	U	UG/KG	20	20	U	UG/KG
Tetrachloroethene	9		J	UG/KG	5		J	UG/KG
Toluene	22	22	U	UG/KG	20	20	U	UG/KG
trans-1,3-Dichloropropene	22	22	U	UG/KG	20	20	U	UG/KG
Trichloroethene	22	22	U	UG/KG	20	20	U	UG/KG
Vinyl Chloride	22	22	U	UG/KG	20	20	U	UG/KG
Xylenes (total)	22	22	U	UG/KG	20	20	U	UG/KG

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TABLE 2-6

Summary of Analyte Concentrations in Sediment and Peat at Reference Locations
Former Koppers Company, Inc., Newport Site, Newport, Delaware

Notes:

* TE = [2,3,7,8-TCDD Toxicity Equivalency Factor (TEF) x Analyte Concentration

NS: No sample data available

J:Analyte present; value may not be accurate.

B: Not detected, substantially above the level reported in laboratory or field blanks.

K: Analyte present; reported value may be biased high, actual value is expected to be lower.

U: Not detected.

UJ: Not detected, Quantitiation limit may be inaccurate or imprecise.

UL: Not detected, Quantitiation limit may be biased low and is expected to be higher.

DL: Detection Limit

QUAL: Laboratory Qualifier

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TABLE 2-7

SEDIMENT/PEAT GRAIN-SIZE PERCENT LESS THAN 63 um (SILT AND CLAY)
FORMER KOPPERS COMPANY-NEWPORT SITE

DRAINAGEWAY SEDIMENT		
LOCATION	DEPTH	
	0-0.5'	0.5-1.0'
Upstream Reference Locations		
RS 15	4	7
WH 1	28	43
EPA 1	13	1
HR 0	1	2
CMD 1	98	99
CMM 1	96	97
Christina River and White Clay Creek		
CR 1	92	77
CR 2	89	67
CR 3	34	47
CR 4	72.5	55
WH2	peat	2
WH3	69	86
WH4	46	57
WH5	87	88
Hershey Run		
HR 1	89	74
HR 2	97	94
HR 3	73	67
HR 4	56	42
HR 5	88	87
HR 6	30	14
HR7	80	74
HR 8	not meas.	not meas.
East Drainage		
E 1	peat	93
E 2	peat	peat
Central Drainage		
C 1	peat	90
C 2	peat	92
C 3	peat	79
East Central Drainage		
EC 1	92	97
EC 2	95	94
EC 3	97	96
EC 4	peat	99
EC 5	49	92
EC 6	peat	peat
EC 7	peat	96
EC 8	peat	peat
West Central Drainage		
WC 1	77	93
WC 2	not meas.	not meas.
WC 3	not meas.	77
WC 4	not meas.	92
WC 5	not meas.	not meas.
WC 6	not meas.	not meas.

MARSH PEAT		
LOCATION	DEPTH	
	0-0.5'	0.5-1.0'
East Central Marsh		
ECM 1	92	94
ECM 2	peat	peat
ECM 8	94	97
ECM 9	88	95
ECM 10	peat	74
ECM 11	peat	95
ECM 12	peat	peat
Central Marsh		
CM 1	peat	peat
CM 2	92	peat
CM 3	peat	89
West Central Marsh		
WCM 1	peat	peat
WCM 5	peat	peat
WCM 6	peat	peat
Hershey Run Marsh		
HRM 1	peat	95
HRM 2	peat	peat
HRM 3	95	97
HRM 4	92	94
HRM 5	peat	peat
HRM 6	88	89
HRM 7	93	93
HRM 8	peat	79

ON SITE SEDIMENT		
LOCATION	DEPTH	
	0-0.5'	0.5-1.0'
South Pond		
SP 1	not meas.	not meas.
SP 2	not meas.	not meas.
SP 3	12	63
SP 4	not meas.	not meas.
Fire Pond		
FP 1	not meas.	not meas.
FP 2	not meas.	not meas.
FP 3	55	52
K Pond		
KP 1	not meas.	40
J Area		
J 1	84	92
J 2	not meas.	not meas.

NOTES:
not meas. = NAPL in sample prevented grain size analysis
peat = samples contained insufficient inorganic sediment to perform grain size analysis

TABLE 2-8

REFERENCE STATION
NORMALIZED SEDIMENT METAL CONCENTRATIONS (mg/kg)
FORMER KOPPERS COMPANY - NEWPORT SITE

Location:	Christina River		Hershey Run		White Clay Creek				
	RS15		HR0		WH1		EPA1		
Metal	0-0.5'	0.5-1.0'	0-0.5'	0.5-1.0'	0-0.5'	0.5-1.0'	0-0.5'	0.5-1.0'	Average (mg/kg)
Al[1]	1190	3690	1390	2030	13200	13900	8270	5120	6099
Sb	9.46	2.89	6.8	5.95	1.07	1.4	2.04	2.94	4.07
As	23.77	23.4	14.47	12.88	4.11	2.17	4.13	5.88	11.4
Ba	218	257.3	162	193	207	182	222	225	208
Be	4.73	3.38	3.47	2.38	1.20	1.1	1.41	1.57	2.4
Cd	4.73	4.14	3.47	2.77	0.53	1.17	0.68	0.98	2.3
Ca	6845	3750	7380	6827	3428.6	2706	2553	1850	4417
Cr	116.7	79.6	153.4	74.3	44	39.2	44.75	54.1	75.8
Co	57.47	39.79	37.6	25.76	23.2	20.4	18.2	23.1	30.7
Cu	81.13	73.6	40.5	48.5	26.8	28.2	33	27.0	44.8
Fe	75388	49660	57740	55192	33677	29376	35998	39995	47112
Pb	202.8	229	141.8	116.9	29.1	41.5	56.4	41.17	107.3
Mg	4868	3810	5600	7402	8503	6859	7394	8313	6594
Mn	1279	948.5	623.7	1149	765	373	963	749	856
Hg	1.52	0.38	0.868	0.59	0.137	0.115	0.17	0.23	0.50
Ni	50.7	46.3	24.6	53.5	22.8	25.0	28.4	25.5	34.6
K	2045	1592	2214	1684.5	7314	6179	6591	8704	4540
Se	18.59	5.99	13.7	9.51	2.13	1.74	2.67	3.92	7.28
Ag	14.19	4.36	10.27	7.13	1.7	1.32	2.04	2.94	5.49
Na	735.2	375.6	431	545	148	115	253	277	360
Tl	33.8	10.36	24.6	24.77	3.81	3.04	6.08	8.6	12.8
V	123.4	105.2	143.3	93.1	65.7	62.3	64.4	72.9	91.3
Zn	679.5	904.9	626.6	1149.4	402.3	1297	557	650.9	783

NOTE: (1) Al = Non-normalized

TABLE 3-1

SUMMARY OF ONSITE SOILS SCREENING OF METALS
FORMER KOPPERS COMPANY- NEWPORT SITE

Metal	Geologic Reference [1] (mg/kg)	Onsite Maximum Value in Total Soil Column (mg/kg)	Frequency of Occurrence > Geo. Ref. (percent) (delete < 5%)	Essential Nutrients and Non-Toxic Metals (delete)	Dietary Toxicological Benchmark for Wildlife (mg/kg)	Frequency of Exceedances of Benchmark (percent) (delete < 5)	Retain for Further Consideration
Aluminum	30,000	35,900	1.4 delete				
Antimony	< 1 *	81.2	8.6		5.0 [2]	0.4 delete	
Arsenic	2.6	36.5	71.4		145 [2]	0 delete	
Barium	500	1530	4.3 delete				
Beryllium	< 1 *	13.5	27.6		10 [3]	2.8 delete	
Cadmium	< 1 *	12.4	0.9 delete				
Calcium	2300	176,000	22.9	delete			
Chromium	50	110	1.9 delete				
Cobalt	5	137	78.6	delete			
Copper	10	528	61.9		275 [3]	0.5 delete	
Iron	10,000	75,400	94.3	delete			
Lead	20	566	24.8		140 [3]	1.4 delete	
Magnesium	1500	49,000	84.8	delete			
Manganese	150	15,100	69		1850 [2]	6.2	retain Mn
Mercury	0.051	8.8	23.4		3.75 [2]	0.9 delete	
Nickel	10	150	64.3		250 [3]	0 delete	
Potassium	16000	5800	0 delete				
Selenium	0.5	3.1	18.1		1.5 [3]	3.8 delete	
Silver	< 1 *	10.6	0.5 delete				
Sodium	5000	2740	0 delete				
Thallium	< 1 *	44	16.7		3.75 [2]	6.6	retain Tl
Vanadium	50	295	25.7	delete			
Zinc	28	2500	80.5		1500 [3]	0.5 delete	

[1] Specific metal distribution map for northern Delaware, Shacklette and Boerngen, 1984

Note: None of the above data were normalized for any parameter

[2] Derived from Lewis, 1992

[3] Toxicological Benchmarks for Wildlife (Opresko et al. 1994)

* Metals with background levels < 1 are screened against 1 mg/kg

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TABLE 3-2

PAHs, Detection Frequency, and Immunoassay Sensitivity - Sediment and Soil

FORMER KOPPERS COMPANY- NEWPORT SITE

Compound	Sediment Frequency of Detection (%) (n=144)	Soil Frequency of Detection (%) (n=210)	Immunoassay Sensitivity [1] (mg/kg)
Naphthalene	15*	0	200
2-Methylnaphthalene	10	9*	
Acenaphthylene	4	1	7.5
Acenaphthene	17*	0	8.1
Fluorene	28	0	1.5
Phenanthrene	20*	31*	1
Anthracene	36*	0	0.81
Fluoranthene	15*	0	1.4
Pyrene	41*	0	3.5
Benz(a)anthracene	53	29*	1.6
Chrysene	44	6*	1.2
Benzo(a)pyrene	24	37*	8.3
Benzo(k)fluoranthene	21	11*	9.4
Benzo(b)fluoranthene	19	27*	4.6
Benzo(g,h,i)perylene	15	25*	>200
Indeno(1,2,3-c,d)pyrene	26	22	11
Dibenz(a,h)anthracene	19	20*	>200

* compounds contributing major proportion of Total PAH

[1] Ensys, PAH RIS

TABLE 3-3

SUMMARY OF SEDIMENT/PEAT SCREENING OF METALS
FORMER KOPPERS COMPANY- NEWPORT SITE

Metal	Geologic Reference [1] (mg/kg)	Onsite Sediment/Peat Maximum (mg/kg)	Frequency of Occurrence > Geo. Ref. (percent) (delete < 5%)	Essential Nutrients and Non-Toxic Metals (delete)	Risk Based Aquatic Toxicity Sed. Benchmark [2] ER-L	ER-M	Frequency of Exceedances of Benchmark (percent) ER-L	ER-M	Retain for Further Consideration
Aluminum	30,000	28500	0 delete						
Antimony	< 1 *	7.2	24.1		2	25	13	0	delete
Arsenic	2.6	31.3	83.5		8.2	70	47	0	retain As
Barium	500	3060	13.5	delete					
Beryllium	< 1 *	8.8	14.3						see text
Cadmium	< 1 *	25.9	61.7		1.2	9.6	58	6.2	retain Cd
Calcium	2300	7900	15.8	delete					
Chromium	50	150	34.6		81	370	7.5	0	delete
Cobalt	5	32.4	24.1	delete					
Copper	10	188	99.2		34	270	70	0	retain Cu
Iron	10000	54800	77.4	delete					
Lead	20	3150	93.2		46.7	218	71.5	4.1	retain Pb
Magnesium	1500	6680	70	delete					
Manganese	150	4300	23.3	delete					
Mercury	0.051	8.8	72.9		0.15	0.71	59	6.9	retain Hg
Nickel	10	111	97.0		20.9	51.6	67	0.1	retain Ni
Potassium	16000	4810	0	delete					
Selenium	0.5	6.6	14.3						retain Se
Silver	< 1 *	3.8	3.8 delete						
Sodium	5000	345	0	delete					
Thallium	< 1 *	32.6	10.5						see text
Vanadium	50	154	12	delete					
Zinc	28	8770	100		150	410	85	69	retain Zn

[1] Specific metal distribution map for northern Delaware, Shacklette and Boerngen, 1984

[2] Benthic Biota Effects Range Low (ER-L) and Medium (ER-M); Long et al. 1994; and Long and Morgan, 1990

Note: None of the above data were normalized for any parameter

* Metals with background levels < 1 are screened against 1 mg/kg

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TABLE 3-4
PRELIMINARY SEDIMENT METALS EVALUATION
FORMER KOPPERS COMPANY - NEWPORT SITE

Metal	On Site Samples 95% UCL (mg/kg)	Reference Samples 95% UCL (mg/kg)	Shacklette and Boerngen, 1984 Eastern USA	
			Arithmetic Mean (mg/kg)	Geometric Mean (mg/kg)
Aluminum	21186	14710	57000	33000
Antimony	1.9	2.1	0.76	0.52
Arsenic	10.3	6.1	7.4	4.8
Barium	514	264	420	290
Beryllium	1.5	2.1	0.85	0.55
Cadmium	3.9	6.8	<1*	
Calcium	2398	2119	63000	34000
Chromium	55.6	41	52	33
Cobalt	16.9	21	9.2	5.9
Copper	68.4	52.6	22	13
Iron	30811	21382	25000	14000
Lead	160.2	61.9	17	14
Magnesium	4594	4369	4600	2100
Manganese	848	378	640	240
Mercury	0.24	0.2	0.12	0.081
Nickel	28.6	23.8	18	11
Potassium	2304	2842	12000	12000
Selenium	2.2	ND	0.45	0.3
Silver	4.9	ND	<1	
Sodium	198	1041	7800	2500
Thallium	4.9	5.2	<1	
Vanadium	68.9	45	66	43
Zinc	1240	1736	52	40

Notes: * Dragun, 1988
None of the above data were normalized for any parameter

TABLE 3-5

SUMMARY OF SEDIMENT/PEAT SCREENING OF VOCs
FORMER KOPPERS COMPANY - NEWPORT SITE

Compound	Maximum Concentration (µg/kg)	Present in Blanks Lab	Frequency of Occurrence > Detection Limit (Delete < 5%)	Risk Based Aquatic Toxicity Benchmark (µg/kg)	Maximum < Benchmark
Acetone	1300	Yes(1)			
2-Butanone	1100	Yes(1)			
Methylene Chloride	37	Yes(1)			
Chloroform	10	Yes(1)			
Benzene	29	--	0.7 - Delete		
Chloromethane	5700	--	0.7 - Delete		
Styrene	3100	--	2.0 - Delete		
Ethylbenzene	8500	--	10 - Retain	11,300	Delete
. etrachloroethene	33	--	8 - Retain	1,672	De
Toluene	2700	--	6 - Retain	23,025	Delete
Xylene	4400	--	12 - Retain	5,612	Delete

(1) These compounds were identified in sampling and laboratory blanks at low concentrations, but will be evaluated during the risk assessment.

Table 3-6
Sediment and Peat - Screening of PAHs
Former Koppers Co., Inc., Newport Site
Newport, Delaware

PAH	Sediment/Peat Maximum (ug/kg)	Benthic Biota Toxicity Benchmark ER-L ; ER-M SQC			Frequency of Occurrence > Benchmark percent		Potential Constituents of Concern select > 5%
		sed	peat		sed	peat	
Low Molecular Weight:							
Naphthalene	7.70E+06	160	2100	1	10.4	10.4	select *
2-methylnaphthalene	3.20E+06	70	670	1	10	17	select
Acenaphthylene	2.80E+05	44	640	1	4	0	
Acenaphthene	8.60E+06	4816	8162	2	17	17	select *
Fluorene	9.50E+06	19	540	1	28	25	select
Phenanthrene	2.90E+07	4128	7000	2	20	20	select *
Anthracene	1.20E+07	85.3	1100	1	36	28	select *
High Molecular Weight:							
Fluoranthene	1.70E+07	35000	59470	2	15	15	select *
Pyrene	1.20E+07	665	2600	1	41	28	select *
Benz(a)anthracene	3.40E+06	261	1600	1	53	28	select
Chrysene	2.10E+06	384	2800	1	44	24	select
Benzo(a)pyrene	7.50E+05	430	1600	1	24	22	select
Benzo(k)fluoranthene	8.20E+05	1700	9600	1	21	0	select
Benzo(g,h,i)perylene	1.90E+05	1700	9600	1	15	0	select
Benzo(b)fluoranthene	1.70E+06	1700	9600	1	19	0	select
Indeno(1,2,3-c,d)pyrene	2.40E+05	1700	9600	1	26	0	select
Dibenzo(a,h) anthracene	4.20E+04	63.4	260	1	19	14	select

* Compounds contributing Major Proportion of Total PAH

1 Benthic Biota Effects Range Low (ER-L); Long et. al, 1994

2 USEPA TOC adjusted Proposed Sediment Quality Criteria

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TABLE 3-7

PCDDs/PCDFs DETECTION SUMMARY (WITH TOXICITY EQUIVALENT CONCENTRATIONS) FOR SEDIMENTS
FORMER KOPPERS COMPANY - NEWPORT SITE

Detected PCDD Congener (µg/kg)	SAMPLING LOCATION AND DEPTH (IN)											
	HR2		HR3		HRM1		HRM4		HRM6		HRM7	
	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12
1,2,3,6,7,8-HxCDD	ND	NS	ND	NS	ND	NS	ND	NS	ND	ND	ND	ND
TE (TEF = 0.1)												
1,2,3,7,8,9-HxCDD	ND	NS	ND	NS	ND	NS	ND	NS	ND	ND	ND	ND
TE (TEF = 0.1)												
Other HxCDDs	ND	NS	ND	NS	ND	NS	ND	NS	ND	ND	ND	ND
TE = 0 (TEF = 0)												
1,2,3,4,6,7,8-HpCDD	0.28	NS	0.25	NS	ND	NS	0.34	NS	ND	ND	0.37	0.43
TE (TEF = 0.01)	0.0028		0.0025				0.0034				0.0037	0.0043
Other HpCDDs	0.37	NS	0.3	NS	0.14	NS	0.34	NS	0.23	0.19	0.34	0.43
TE = 0 (TEF = 0)	0		0		0		0		0	0	0	0
OCDD	9.5	NS	8.4	NS	4.6	NS	10	NS	9	7.7	10	12
TE (TEF = 0.001)	0.0095		0.0084		0.0046		0.010		0.009	0.0077	0.010	0.012
Detected PCDF Congener (µg/kg)												
1,2,3,4,7,8-HxCDF	ND	NS	ND	NS	ND	NS	ND	NS	ND	ND	ND	ND
TE (TEF = 0.1)												
1,2,3,7,8,9-HxCDF	ND	NS	ND	NS	ND	NS	ND	NS	ND	ND	ND	ND
TE (TEF = 0.1)												
Other HxCDFs	ND	NS	ND	NS	ND	NS	ND	NS	ND	ND	ND	ND
TE = 0 (TEF = 0)												
1,2,3,4,6,7,8-HpCDF	ND	NS	ND	NS	ND	NS	ND	NS	ND	ND	ND	ND
TE (TEF = 0.01)												
1,2,3,4,7,8,9-HpCDF	ND	NS	ND	NS	ND	NS	ND	NS	ND	ND	ND	ND
TE (TEF = 0.01)												
Other HpCDFs	ND	NS	ND	NS	ND	NS	ND	NS	ND	ND	ND	ND
TE = 0 (TEF = 0)												
OCDF	0.24	NS	ND	NS	ND	NS	0.26	NS	0.21	ND	0.24	0.27
TE (TEF = 0.001)	0.00024						0.00026		0.00021		0.00024	0.00027
Total TE for sample	0.01254	NS	0.0109	NS	0.0046	NS	0.01366	NS	0.00921	0.0077	0.01394	0.01657

ND = Not Detected
NS = Not Sampled
TEF = [illegible]ity Equivalency Factor
TE = [illegible]quivalent (to 2,3,7,8-TCDD)

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TABLE 3-7 (continued)

PCDDs/PCDFs DETECTION SUMMARY (WITH TOXICITY EQUIVALENT CONCENTRATIONS) FOR SEDIMENTS
FORMER KOPPERS COMPANY - NEWPORT SITE

Detected PCDD Congener (µg/kg)	SAMPLING LOCATION AND DEPTH (IN)											
	HRM8		FP2		KP1		SP2		WC3		WCM1	
	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12
1,2,3,6,7,8-HxCDD	ND	NS	ND	NS	ND	NS	ND	NS	ND	NS	ND	ND
TE (TEF = 0.1)												
1,2,3,7,8,9-HxCDD	ND	NS	ND	NS	ND	NS	ND	NS	ND	NS	ND	ND
TE (TEF = 0.1)												
Other HxCDDs	ND	NS	ND	NS	ND	NS	ND	NS	ND	NS	1.1	ND
TE = 0 (TEF = 0)											0	
1,2,3,4,6,7,8-HpCDD	ND	NS	43	NS	7.1	NS	26	NS	5.7	NS	5.8	18
TE (TEF = 0.01)			0.43		0.071		0.26		0.057		0.058	0.18
Other HpCDDs	ND	NS	38	NS	35	NS	56	NS	10.3	NS	10.2	31
TE = 0 (TEF = 0)			0		0		0		0		0	0
OCDD	3.9	NS	370	NS	62	NS	250	NS	71	NS	73	170
TE (TEF = 0.001)	0.0039		0.370		0.062		0.250		0.071		0.073	0.170
Detected PCDF Congener (µg/kg)												
1,2,3,4,7,8-HxCDF	ND	NS	3.1	NS	ND	NS	ND	NS	ND	NS	ND	ND
TE (TEF = 0.1)			0.31									
1,2,3,7,8,9-HxCDF	ND	NS	ND	NS	ND	NS	ND	NS	ND	NS	ND	ND
TE (TEF = 0.1)												
Other HxCDFs	ND	NS	20	NS	ND	NS	ND	NS	ND	NS	2.7	ND
TE = 0 (TEF = 0)			0								0	
1,2,3,4,6,7,8-HpCDF	ND	NS	12	NS	ND	NS	2.8	NS	1.5	NS	ND	4.5
TE (TEF = 0.01)			0.12				0.028		0.015			0.045
1,2,3,4,7,8,9-HpCDF	ND	NS	1.5	NS	ND	NS	0.26	NS	ND	NS	ND	0.49
TE (TEF = 0.01)			0.015				0.0026					0.0049
Other HpCDFs	ND	NS	40.5	NS	16	NS	11.94	NS	7.0	NS	11	22
TE = 0 (TEF = 0)			0		0		0		0		0	0
OCDF	ND	NS	35	NS	ND	NS	18	NS	9	NS	10	28
TE (TEF = 0.001)			0.035				0.018		0.009		0.010	0.028
Total TE for sample	**0.0039**	**NS**	**1.280**	**NS**	**0.133**	**NS**	**0.5586**	**NS**	**0.152**	**NS**	**0.141**	**0.4279**

ND = Not Detected
NS = Not Sampled
TEF = Toxicity Equivalency Factor
TE = Toxic Equivalent (to 2,3,7,8-TCDD)

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TABLE 3-7 (continued)

PCDDs/PCDFs DETECTION SUMMARY (WITH TOXICITY EQUIVALENT CONCENTRATIONS) FOR SEDIMENTS
FORMER KOPPERS COMPANY - NEWPORT SITE

	SAMPLING LOCATION AND DEPTH (IN)									
Detected PCDD	WCM5		WCM6		CM1		E1		EC7	
Congener (µg/kg)	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12
1,2,3,6,7,8-HxCDD	ND	ND	ND	ND	ND	NS	ND	NS	ND	NS
TE (TEF = 0.1)										
1,2,3,7,8,9-HxCDD	ND	ND	ND	ND	ND	NS	ND	NS	ND	NS
TE (TEF = 0.1)										
Other HxCDDs	ND	ND	ND	ND	ND	NS	ND	NS	ND	NS
TE = 0 (TEF = 0)										
1,2,3,4,6,7,8-HpCDD	ND	ND	ND	ND	ND	NS	1	NS	0.2	NS
TE (TEF = 0.01)							0.01		0.002	
Other HpCDDs	ND	ND	ND	ND	ND	NS	1.3	NS	0.25	NS
TE = 0 (TEF = 0)							0		0	
OCDD	6.6	7.7	4.6	5.2	2.6	NS	15	NS	5.5	NS
TE (TEF = 0.001)	0.0066	0.0077	0.0046	0.0052	0.0026		0.015		0.0055	
Detected PCDF Congener (µg/kg)										
1,2,3,4,7,8-HxCDF	ND	ND	ND	ND	ND	NS	ND	NS	ND	NS
TE (TEF = 0.1)										
1,2,3,7,8,9-HxCDF	ND	ND	ND	ND	ND	NS	ND	NS	ND	NS
TE (TEF = 0.1)										
Other HxCDFs	ND	ND	ND	ND	ND	NS	ND	NS	ND	NS
TE = 0 (TEF = 0)										
1,2,3,4,6,7,8-HpCDF	ND	ND	ND	ND	ND	NS	0.2	NS	ND	NS
TE (TEF = 0.01)							0.002			
1,2,3,4,7,8,9-HpCDF	ND	ND	ND	ND	ND	NS	ND	NS	ND	NS
TE (TEF = 0.01)										
Other HpCDFs	ND	ND	ND	ND	ND	NS	0.73	NS	ND	NS
TE = 0 (TEF = 0)							0			
OCDF	0.32	0.54	ND	0.18	ND	NS	1.1	NS	0.25	NS
TE (TEF = 0.001)	0.00032	0.00054		0.00018			0.0011		0.00025	
Total TE for sample	0.00692	0.00824	0.0046	0.00538	0.0026	NS	0.0281	NS	0.00775	NS

ND = Not Detected
NS = Not Sampled
TEF · icity Equivalency Factor
TE Equivalent (to 2,3,7,8-TCDD)

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TABLE 3-*i* (continued)

PCDDs/PCDFs DETECTION SUMMARY (WITH TOXICITY EQUIVALENT CONCENTRATIONS) FOR SEDIMENTS
FORMER KOPPERS COMPANY - NEWPORT SITE

	SAMPLING LOCATION AND DEPTH (IN)											
Detected PCDD Congener (µg/kg)	EC8		ECM1		ECM2		ECM10		ECM11		ECM12	
	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12
1,2,3,6,7,8-HxCDD	ND	NS	ND	NS	ND	NS	ND	ND	ND	ND	ND	ND
TE (TEF = 0.1)												
1,2,3,7,8,9-HxCDD	ND	NS	ND	NS	ND	NS	ND	ND	ND	ND	ND	ND
TE (TEF = 0.1)												
Other HxCDDs	ND	NS	ND	NS	ND	NS	ND	ND	ND	ND	ND	ND
TE = 0 (TEF = 0)												
1,2,3,4,6,7,8-HpCDD	ND	NS	ND	NS	ND	NS	ND	ND	ND	ND	ND	ND
TE (TEF = 0.01)												
Other HpCDDs	0.16	NS	ND	NS	ND	NS	ND	ND	0.19	0.34	ND	ND
TE = 0 (TEF = 0)	0								0	0		
OCDD	2.6	NS	5.6	NS	6.3	NS	3.2	4	5.8	7.8	1.8	5.1
TE (TEF = 0.001)	0.0026		0.0056		0.0063		0.0032	0.004	0.0058	0.0078	0.0018	0.0051
Detected PCDF Congener (µg/kg)												
1,2,3,4,7,8-HxCDF	ND	NS	ND	NS	ND	NS	ND	ND	ND	ND	ND	ND
TE (TEF = 0.1)												
1,2,3,7,8,9-HxCDF	ND	NS	ND	NS	ND	NS	ND	ND	ND	ND	ND	ND
TE (TEF = 0.1)												
Other HxCDFs	ND	NS	ND	NS	ND	NS	ND	ND	ND	ND	ND	ND
TE = 0 (TEF = 0)												
1,2,3,4,6,7,8-HpCDF	ND	NS	ND	NS	ND	NS	ND	ND	ND	ND	ND	ND
TE (TEF = 0.01)												
1,2,3,4,7,8,9-HpCDF	ND	NS	ND	NS	ND	NS	ND	ND	ND	ND	ND	ND
TE (TEF = 0.01)												
Other HpCDFs	ND	NS	ND	NS	ND	NS	ND	ND	ND	ND	ND	ND
TE = 0 (TEF = 0)												
OCDF	0.18	NS	ND	NS	ND	NS	ND	ND	0.19	0.34	ND	ND
TE (TEF = 0.001)	0.00018								0.00019	0.00034		
Total TE for sample	0.00278	NS	0.0056	NS	0.0063	NS	0.0032	0.004	0.00599	0.00814	0.0018	0.0051

ND = Not Detected
NS = Not Sampled
TEF = Toxicity Equivalency Factor
TE = Toxic Equivalent (to 2,3,7,8-TCDD)

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TABLE 4-1

SUMMARY OF SURFICIAL SOIL SAMPLES SCHEDULED FOR COLLECTION FROM WEATHERED NAPL AREAS GREATER THAN 50 FEET WIDE FORMER KOPPERS COMPANY - NEWPORT SITE

	Total Immunoassay Screening Samples[1]		Total Analytical Samples		
Locations	Horizontal Extent	Vertical Extent	Horizontal Extent	Vertical Extent	Analyses
Process Area	6	6	5	5	(3), (4)
Drip Tracks	6	6	4	4	(2)
Identified Hot Spots	4	4	3	3	(2)
Fire Pond	3	3	2	2	(2)
South Ponds	12	12	10	10	(3), (4)
Area K	2	2	2	2	(3), (4)
TOTALS	**33**	**33**	**22**	**22**	

NOTES:
(1) Immunoassay Screening Methodology: EPA Draft Method 4035
(2) Total PAH Compounds: CLP Protocol
(3) Target Compound List Volatile Organics: CLP Protocol
(4) Target Compound List Semi-Volatile Organics: CLP Protocol

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TABLE 4-2

SUMMARY OF PHASE II SCOPE OF WORK
FORMER KOPPERS COMPANY - NEWPORT SITE

Media	Area	Task	Objective	Scope	Rationale
1. SOIL					
• SURFACE	Former Process Area, Drip Tracks Fire Pond, South Ponds, K-Area	Identify weathered NAPL areas >50 feet long	• Horizontal/vertical extent • Composition • Ecological and Human Health Exposure Evaluation	• Estimate 5 areas • GPS sample locations • 1 geoprobe boring per area to top of Potomac Formation • 66 PAH Immunoassay samples (33 horz./33 vert.) • 44 Laboratory SVOC analysis (22 horz./22 vert.) with some VOC analysis • 2 samples 0 to 1 foot of weathered NAPL for physico-chemical characteristics[1]	• Determining Extent for Risk Assessment (ERA/HHE) • Volume for Feasibility Study (FS) • Composition for FS
• SURFACE	Former Process Area, Drip Tracks, Fire Pond, South Ponds, SB-616, Wood Storage Area	Identify weatered NAPL areas <50 feet long	• Horizontal/vertical extent • Composition	• GPS location • Hand auger to determine thickness • Estimate 5 areas	• Determining Extent for Risk Assessment (ERA/HHE) • Volume for Feasibility Study (FS) • Composition for FS
• DNAPL	Former Process Area, Drip Tracks, Fire Pond, South Ponds, Wood Storage Area, SB-616	DNAPL Investigation	• Horizontal/vertical extent • Delineation of subsurface boundary • Drain pipe investigation	• 115 Geoprobe borings to top of Potomac/field screen • 6 Geoprobe borings in Wood Storage Yard area to top of Potomac • Excavate with backhoe at T pipe area to verify pipe presence/extent • Visually assess NAPL occurrence in excavation	• Determine extent for ERA/HHE/FS • Determine volume of DNAPL • Determine DNAPL zone • Identify potential NAPL migration path in pipeline • Confirm basin geometry in Potomac Formation
2. SURFACE WATER					
	Fire Pond	Pond Water Sampling	Representative samples for characteristics	• 1 sample of surface water for physicochemical characterization[2]	• General characteristics for FS planning
	South Ponds	Pond Water Sampling	Representative samples for characteristics	• 2 samples for physicochemical characterization[2]	
	K-Area	Pond Water Sampling	Representative samples for characteristics	• 1 sample for physicochemical characterization[2]	

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TABLE 4-2
(continued)

Media	Area	Task	Objective	Scope	Rationale
3. **SEDIMENT/PEAT**					
· MARSHES/ DRAINAGEWAYS	Hershey Run				
- Step I	West Central Drainage Area	NAPL Delineation	· Horizontal/vertical extent of NAPL	· Hand coring to base of peat on grid, visual mapping of NAPL	· Determine NAPL zone and mass volumes for ERA/HHE/FS
- Step II	East Central Drainage Area	Sediment/Peat Sampling and Analysis	· Horizontal/vertical extent of PAHs · Gradient of PAHs	· 20 Immunoassay samples for PAH >100 mg/kg, 10 - 100 mg/kg, <10 mg/kg, and reference station in marsh and drainageways · 20 samples for SVOC analysis (using CLP) (0 to 0.5 feet) · Lead - 120/Cesium - 137 dating of 21 samples · 2 samples of NAPL sediment for physicochemical character[1] (1 from Hershey Run; 1 from West Central Drainage Area)	· Ecological Risk Assessment · Evaluate NAPL sediment cover stability for ERA/HHE/FS
· ADDITIONAL SEDIMENT	West Central Marsh WC7, WC8, WC9	PAH Analyses	· Extent of PAH	· Sediment cores 0.0 to 0.5, 0.5 to 1.0 feet and composite from 1.0 to top of Columbia Formation	· Evaluate presence of PAH
	Hershey Run Marsh West Central Marsh Churchman's Marsh	Pb^{210} and C_s^{137} dating	· Evaluate sediment deposition	· Six depth intervals from high concentration areas in each of three areas (18 samples)	· RA and FS input
· POND SEDIMENTS	Fire Ponds South Ponds, K-Area	Depth of NAPL	Vertical extent of NAPL	· One sediment core at center of each of 4 ponds · Pond dimensions to be GPS-mapped	· FS
· FISH	Hershey Run West Central Drainage East Central Drainage Reference	Fish Tissue Analysis	Food chain bioaccumulation modeling	· Forage Fish Analysis · Qualitative inventory on-Site and reference	· Ecological Risk Assessment
	White Clay Creek Reference	Fish Tissue Analysis	HHE	· Edible Fish Analysis (Fillets)	· HHE
· WILDLIFE	All cover types Reference Areas	Semi-Quantitative Wildlife Survey	Ecological Exposure Evaluation	· Field Surveys	· ERA

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TABLE 4-2
(continued)

	Media	Area	Task	Objective	Scope	Rationale
4.	**GROUNDWATER**	Columbia Formation Aquifer and Potomac Formation Aquifer	Install new site monitoring wells	Horizontal/vertical extent of dissolved PAHs and phenolic semi-volatile (SVOCs) Assess true background upgradient from Site	Install MW-12A and MW-13A in Columbia Aquifer Install MW-14A and MW-14B in Columbia/Potomac Aquifers on Sears Corporation property north of Site Install MW-15 and MW-15B in Columbia/Potomac Aquifers downgradient of the former Process Area. Monitor tidal effects on Columbia and Potomac for 3 days in downgradient wells near Hershey Run, West Central, East Central, and Eastern Drainage Areas 2 episodes of sampling (dry/wet seasons) in all wells. Analyze for PAHs, phenolic SVOCs, and VOCs in Site wells using CLP and also PCP by Method 515.1 and cations/anions. Analyze for TCL/TAL and PCP and cations/anions in upgradient wells.	Evaluate potential for downgradient migration MW-12A to identify possible dissolved constituents for downgradient from South Pond. MW-13A to assess possible dissolved constituents downgradient from Process Area migrating to Hershey Run. MW-14A and MW-14B will provide more representative upgradient background characterization for comparison to groundwater quality in the process area. MW-15A and MW-15B will provide data immediately downgradient of the former Process Area. General water chemistry for FS.
5.	**UNDERGROUND STORAGE TANKS**	1d	UST Evaluation	Verify presence or absence of USTs from Phase I geophysics	Probe to detect tank surface if UST found, excavate with backhoe to expose top of tank. Access tank and identify contents by chemical analysis. Backfill excavation with same soil where appropriate.	Identify whether USTs are potential source of constituents in soil and groundwater. Provide FS data.

NOTES: (1) Polycyclic Aromatic Hydrocarbons (PAHs) and phenolic Semi-Volatiles (SVOCs) using CLP, Ignitability, Corrosivity, Reactivity, Percent Organic, Heating Value, Organic Phosphorous, Total Organic Carbon (TOC), Flash Point, Cations/Anions, Oil and Grease, and Redox.

(2) Biological and chemical oxygen demand (BOD/COD), dissolved oxygen (DO), pH, specific conductance, hardness, anions, and cations.

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TABLE 4-3

SUMMARY OF SOIL, SEDIMENT, AND SURFACE WATER ANALYTICAL METHODS FORMER KOPPERS COMPANY - NEWPORT SITE

Analysis	Analysis Methods
SOILS/SEDIMENTS	
Immunoassay (PAHs)	USEPA Draft Method 4035
Ensys PAH RIS	
PAHs/Phenolics	USEPA CLP OLM 01.8, Aug 91*
PCP	USEPA CLP 515.1
TCLP	
VOC	USEPA SW 1311/8260
BNA	USEPA SW 1311/8270
Pesticides	USEPA SW 1311/8080
Herbicides	USEPA SW 1311/8150
Metals	USEPA SW 1311/6010A
Ignitability (flash point)	USEPA SW 1010
Corrosivity	USEPA 9040
Reactivity	
CN^-	USEPA SW 7.3.3.2
S^{2-}	USEPA SW 7.3.4.2
Percent Organic Matter	ASTM D2974
Heating Value (BTU)	ASTM D2015-85
Organic phosphorus	
Total Organic Carbon (TOC)	USEPA 9060A
Oil and Grease	USEPA SW 9070
Redox potential (Eh)	BMI 1599-001
Cations (Na, K, Ca, Mg)	USEPA SW 6010A

TABLE 4-3
(continued)

Analysis	Analysis Methods
SOILS/SEDIMENTS (concluded)	
Anions:	
Cl	USEPA 9252
SO_4	USEPA SW 9038
SiO_3	USEPA SW 6010A
NO_3	USEPA 353.2
F	USEPA 340.2
Sediment/Dating	
CS-137	Teledyne Procedure No: PRO-042-5
Pb-210	Teledyne Procedure No: PRO-062-123
SURFACE WATER	
Hardness	USEPA 130.2
BOD	USEPA 405.1
COD	USEPA 410.4
Cations (Na, K, Ca, Mg)	USEPA SW 6010A
Anions:	
Cl	USEPA 325.2
SO_4	USEPA SW 9038
SiO_3	USEPA SW 6010A
NO_3	USEPA 353.2
F	USEPA 340.2
FISH TISSUE	
TCL Organics	USEPA CLP Protocol

TABLE 4-3
(continued)

Analysis	Analysis Methods
TAL Inorganics	USEPA SW 846 6010/7000
PCDD/PCDFs	USEPA SW 846 8290

NOTE: * Method references are presented in the Phase I RI WP, dated January 31, 1994.

Table 4-4
Summary of Surface Soil Field Screening
Former Koppers Co. Inc., Newport Site
Newport, Delaware

Location	Depth (ft.)	Headspace HNu (ppm)	Headspace OVA (ppm)	Ultraviolet Light Screening Scale Screening Scale (1)	Visual Observations of NAPL (2)	Odors (3)	Total Potentially Carcinogenic PAHs (ppm)	Total Non Carcinogenic PAHs (ppm)	Total PAHs (ppm)
SB-101	0-0.5	2.1	0.4	none	trace	none	27.8	22.3	50.1
SB-104	0-0.5	0.0	0.0	none	none	none	ND	ND	ND
SB-105	0-0.5	0.5	0.4	none	none	none	2.7	1.6	4.3
SB-106	0-0.5	0.0	0.0	none	none	none	11.5	6.8	18.3
SB-107	0-2.0	0.0	0.0	trace	trace	none	1.5	0.8	2.3
SB-108	0-0.5	0.1	0.0	none	none	none	6.9	7.1	14.1
SB-108	0-2.0	1.0	0.0	none	none	none	2.0	1.5	3.6
SB-111	0-0.5	0.3	0.0	none	trace	none	82.1	59.8	141.9
SB-111	0-2.0	0.1	0.0	trace	none	none	23.5	17.8	41.3
SB-112	0-2.0	8.8	0.6	weak to moderate	moderate	none	876.0	8060.0	8936.0
SB-113	0-0.5	0.0	0.0	none	trace	none	471.0	230.0	701.0
SB-114	0-0.5	7.1	1.4	strong	strong	strong	261.0	152.0	413.0
SB-115	0-0.5	0.0	0.0	none	none	none	15.3	11.6	26.9
SB-116	0-0.5	3.1	0.1	weak to moderate	strong	strong	484.0	245.0	729.0
SB-118	0-0.5	0.3	0.0	none	none	none	ND	0.1	0.1
SB-121	0-0.5	0.4	0.2	none	trace	none	290.0	372.0	662.0
SB-123	0-0.5	2.1	0.6	none	trace	none	173.0	95.2	268.2
SB-125	0-0.5	0.0	0.0	none	none	none	91.1	68.9	160.0
SB-126	0-0.5	0.0	0.0	none	none	none	491.0	439.0	930.0
SB-127	0-0.5	32.0	5.0	weak	strong	trace	1280.0	681.0	1961.0
SB-202	0-0.5	0.4	0.0	none	strong	none	38.4	30.4	68.8
SB-203	0-0.5	0.0	0.4	none	none	none	528.0	238.0	766.0
SB-204	0-0.5	0.0	0.0	none	trace	none	31.5	20.3	51.8
SB-205	0-2.0	0.6	0.0	none	none	none	7.4	4.6	12.0
SB-206	0-0.5	0.0	0.0	none	none	none	702.0	1020.0	1722.0
SB-206	0-2.0	0.0	0.0	none	none	none	0.7	0.5	1.2
SB-207	0-0.5	0.0	0.2	none	trace	none	663.0	399.0	1062.0
SB-208	0-0.5	0.0	0.0	none	none	none	380.0	218.0	598.0
SB-209	0-0.5	0.0	0.0	none	none	none	374.0	301.0	675.0
SB-210	0-0.5	0.0	0.0	none	none	none	15.3	11.4	26.7
SB-211	0-2.0	1.1	1.0	none	none	none	ND	0.2	0.2
SB-212	0-0.5	0.4	0.2	none	none	none	59.2	40.8	100.0
SB-214	0-0.5	0.0	0.0	none	none	none	50.0	38.2	88.2
SB-215	0-0.5	0.0	0.0	none	none	none	22.7	10.3	33.0
SB-215	0-2.0	0.0	0.0	none	none	none	0.3	ND	0.3
SB-216	0-2.0	0.0	0.0	none	none	none	2.2	1.3	3.5
SB-301	0-0.5	3.1	7.0	trace	trace	none	253.0	290.0	543.0
SB-301	0-2.0	21.0	12.0	moderate	trace	none	19.8	11.8	31.6
SB-302	0-0.5	0.3	2.4	none	none	none	4.8	3.5	8.3
SB-302	0-2.0	0.7	1.4	none	none	none	13.4	6.0	19.4
SB-401	0-0.5	0.0	0.0	trace	none	none	1.1	1.5	2.6

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Table 4-4
Summary of Surface Soil Field Screening
Former Koppers Co. Inc., Newport Site
Newport, Delaware

Location	Depth (ft.)	Headspace HNu (ppm)	Headspace OVA (ppm)	Ultraviolet Light Screening Scale Screening Scale (1)	Visual Observations of NAPL (2)	Odors (3)	Total Potentially Carcinogenic PAHs (ppm)	Total Non Carcinogenic PAHs (ppm)	Total PAHs (ppm)
SB-402	0-0.5	0.1	0.0	none	trace	none	978.0	713.0	1691.0
SB-403	0-0.5	0.0	0.0	none	trace	none	ND	ND	ND
SB-403	0-2.0	0.2	0.0	none	strong	none	123.0	108.0	231.0
SB-607	0-0.5	0.0	0.0	none	none	none	114.0	88.7	202.7
SB-611	0-0.5	0.6	0.0	none	trace	none	201.0	100.0	301.0
SB-612	0-0.5	0.9	0.0	none	none	none	78.9	37.0	115.9
SB-613	0-0.5	0.2	0.0	none	none	none	ND	ND	ND
SB-614	0-0.5	-	0.4	trace	none	none	1490.0	1170.0	2660.0
SB-615	0-0.5	0.5	0.0	trace	none	none	53.6	28.7	82.3
SB-616	0-0.5	1.7	1.5	none	none	strong	49.9	26.6	76.5
SB-617	0-0.5	0.0	0.0	none	none	none	1260.0	940.0	2200.0
SB-618	0-0.5	83.0	92.0	strong	strong	none	3240.0	33100.0	36340.0
SB-619	0-0.5	0.0	0.1	none	none	none	72.5	63.3	135.8
SB-620	0-0.5	0.2	0.5	none	none	none	1.0	0.5	1.5
SB-621	0-0.5	-	2.2	weak to moderate	none	none	1.3	27.4	28.7
SB-622	0-0.5	0.8	0.0	none	none	none	1.0	0.9	1.9

Notes:
(1) UV Light Reaction Scale: None, Trace, Weak, Moderate, and Strong
(2) Visual Observations of NAPL: None, Trace, Moderate and Strong
(3) Odor Scale: None, Trace, Moderate and Strong
(4) ND: Not Detected

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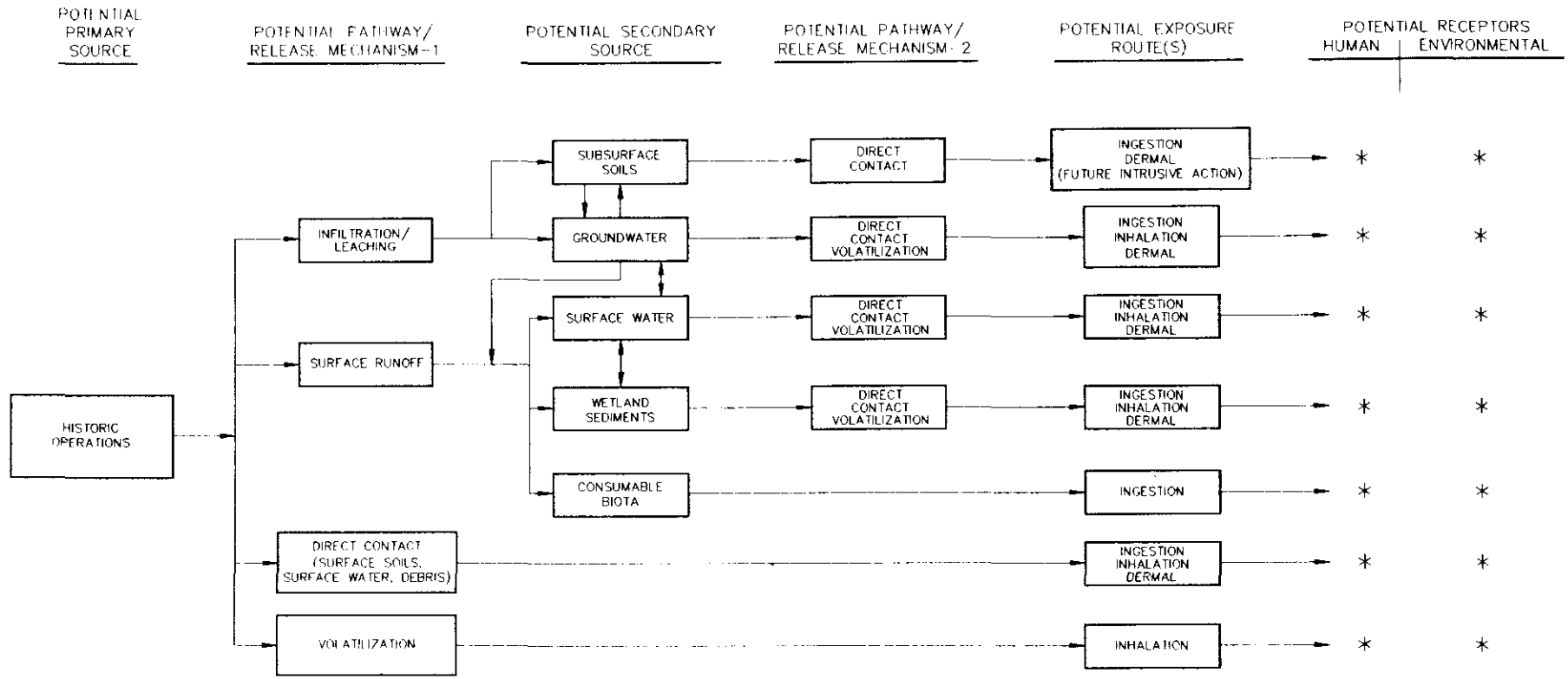
AAC

Figures



LEGEND:

* DENOTES POSSIBLE PRESENCE OF POTENTIAL RECEPTOR

NOTE: THIS CONCEPTUAL SITE MODEL IS PRELIMINARY AND SUBJECT TO REVISION AS THE REMEDIAL INVESTIGATION IS CONDUCTED.

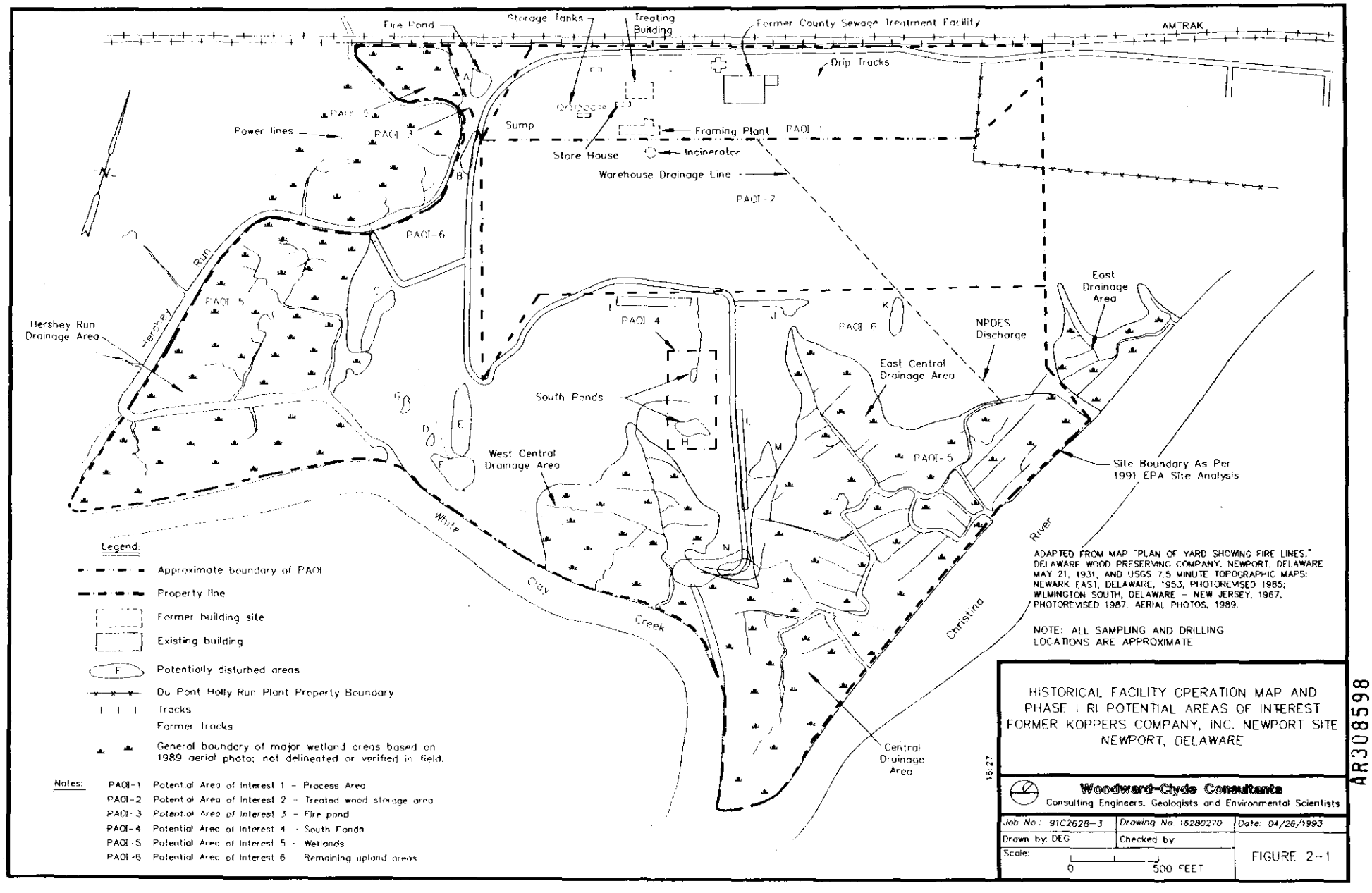
Rev. No.	Date	Type of Revision	Checked by

PHASE I RI
CONCEPTUAL SITE MODEL
FORMER KOPPERS COMPANY, INC.
NEWPORT SITE
NEWPORT, DELAWARE

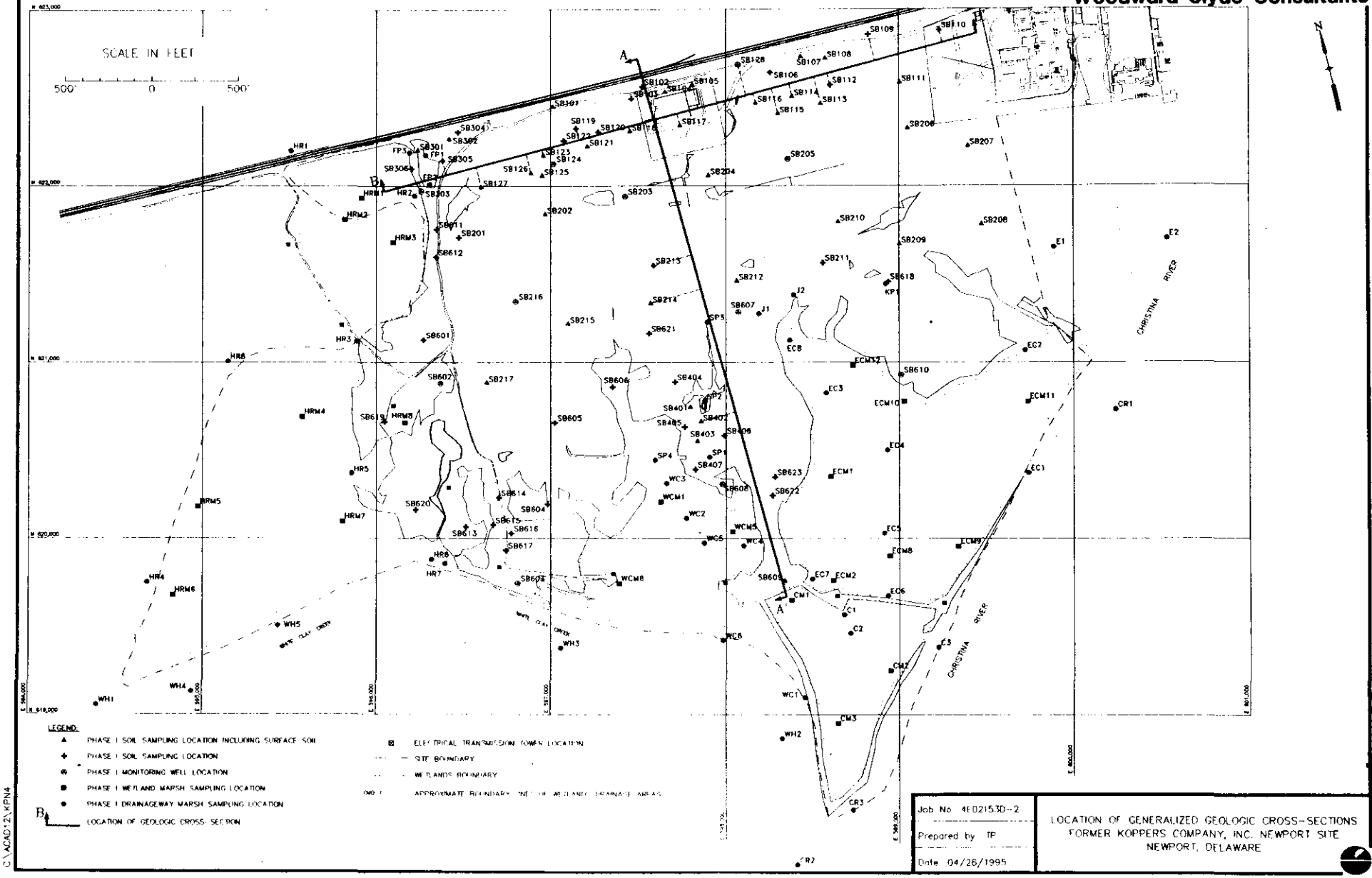
Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No.: 91C2628-3	Drawing No. 1628014A	Date: 08/04/1995
Drawn by: DEG	Checked by:	FIGURE 1-1
Scale:		

AR308597


Fire Pond
Storage Tanks
Treating Building
Former County Sewage Treatment Facility
AMTRAK
Drip Tracks
Power lines
PAOI 3
Sump
Framing Plant
PAOI 1
Store House
Incinerator
Warehouse Drainage Line
PAOI-2
PAOI-6
Hershey Run
Hershey Run Drainage Area
PAOI 5
PAOI 4
PAOI 6
NPDES Discharge
East Drainage Area
East Central Drainage Area
South Ponds
West Central Drainage Area
PAOI-5
Site Boundary As Per 1991 EPA Site Analysis
White Clay Creek
Christina River
Central Drainage Area
Legend:
Approximate boundary of PAOI
Property line
Former building site
Existing building
Potentially disturbed areas
Du Pont Holly Run Plant Property Boundary
Tracks
Former tracks
General boundary of major wetland areas based on 1989 aerial photo; not delineated or verified in field.
Notes:
PAOI-1 Potential Area of Interest 1 - Process Area
PAOI-2 Potential Area of Interest 2 - Treated wood storage area
PAOI-3 Potential Area of Interest 3 - Fire pond
PAOI-4 Potential Area of Interest 4 - South Ponds
PAOI-5 Potential Area of Interest 5 - Wetlands
PAOI-6 Potential Area of Interest 6 - Remaining upland areas
ADAPTED FROM MAP "PLAN OF YARD SHOWING FIRE LINES," DELAWARE WOOD PRESERVING COMPANY, NEWPORT, DELAWARE, MAY 21, 1931, AND USGS 7.5 MINUTE TOPOGRAPHIC MAPS: NEWARK EAST, DELAWARE, 1953, PHOTOREVISED 1985; WILMINGTON SOUTH, DELAWARE - NEW JERSEY, 1967, PHOTOREVISED 1987. AERIAL PHOTOS, 1989.
NOTE: ALL SAMPLING AND DRILLING LOCATIONS ARE APPROXIMATE
HISTORICAL FACILITY OPERATION MAP AND PHASE I RI POTENTIAL AREAS OF INTEREST
FORMER KOPPERS COMPANY, INC. NEWPORT SITE
NEWPORT, DELAWARE
Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
Job No.: 91C2628-3
Drawing No. 16280270
Date: 04/26/1993
Drawn by: DEG
Checked by:
Scale:
0
500 FEET
FIGURE 2-1
16.27

AR308598

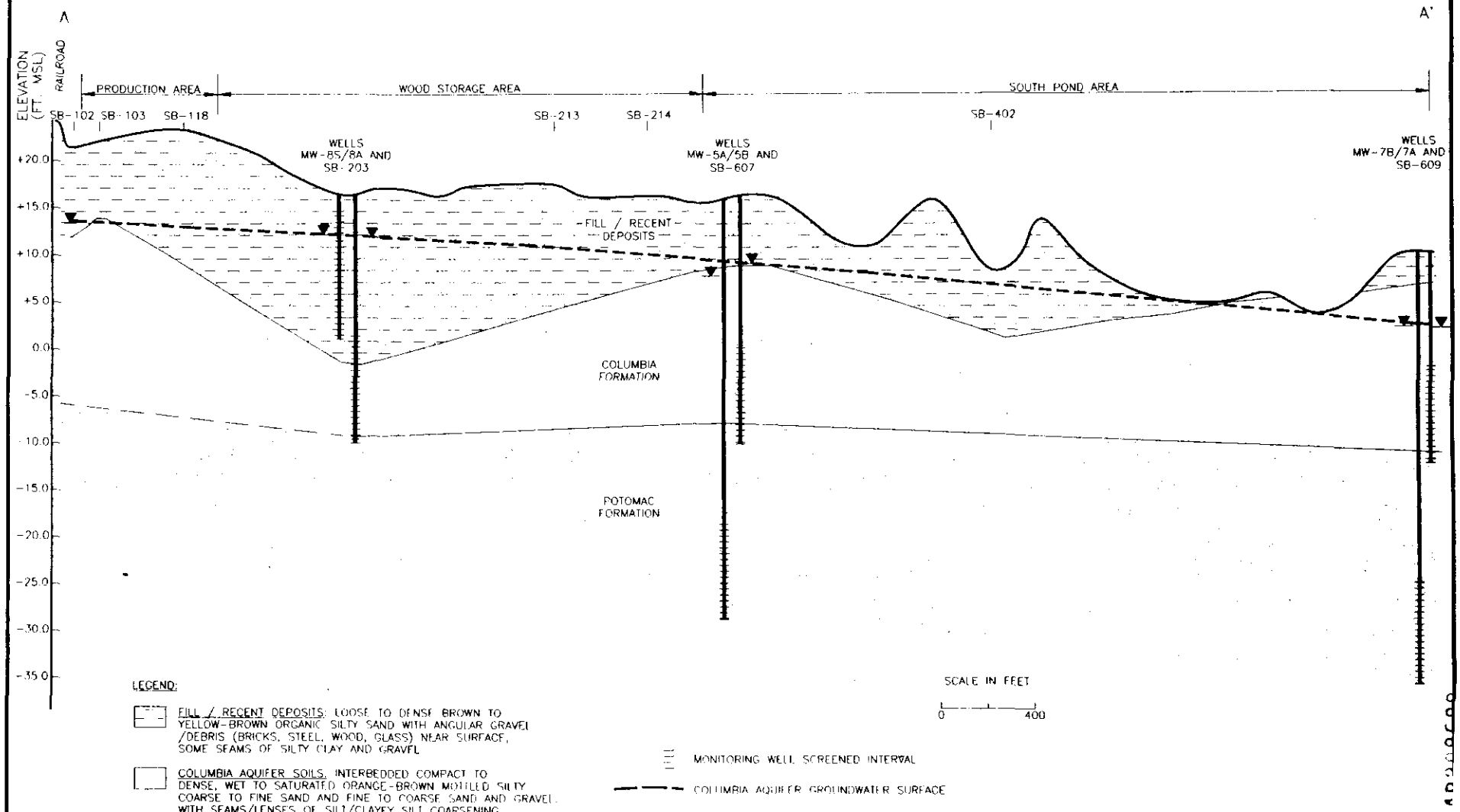


Job No 4E02153D-2 Prepared by TP Date 04/26/1995	LOCATION OF GENERALIZED GEOLOGIC CROSS-SECTIONS FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE

C:\ACAD12\KPN4

AR308599

Figure 2-2



LEGEND:

FILL / RECENT DEPOSITS: LOOSE TO DENSE BROWN TO YELLOW-BROWN ORGANIC SILTY SAND WITH ANGULAR GRAVEL /DEBRIS (BRICKS, STEEL, WOOD, GLASS) NEAR SURFACE, SOME SEAMS OF SILTY CLAY AND GRAVEL

COLUMBIA AQUIFER SOILS: INTERBEDDED COMPACT TO DENSE, WET TO SATURATED ORANGE-BROWN MOTTLED SILTY COARSE TO FINE SAND AND FINE TO COARSE SAND AND GRAVEL WITH SEAMS/LENSES OF SILT/CLAYEY SILT COARSENING WITH DEPTH; COARSE GRAVEL RED TYPICAL AT BASE OF FORMATION

POTOMAC FORMATION: VARIEGATED RED, GRAY, PURPLE, YELLOW SANDY SILTS AND CLAYS INTERBEDDED WITH CLAYEY SANDS AND OCCASIONAL GRAVELS

MONITORING WELL SCREENED INTERVAL

COLUMBIA AQUIFER GROUNDWATER SURFACE

APPROXIMATE GEOLOGIC UNIT CONTACT

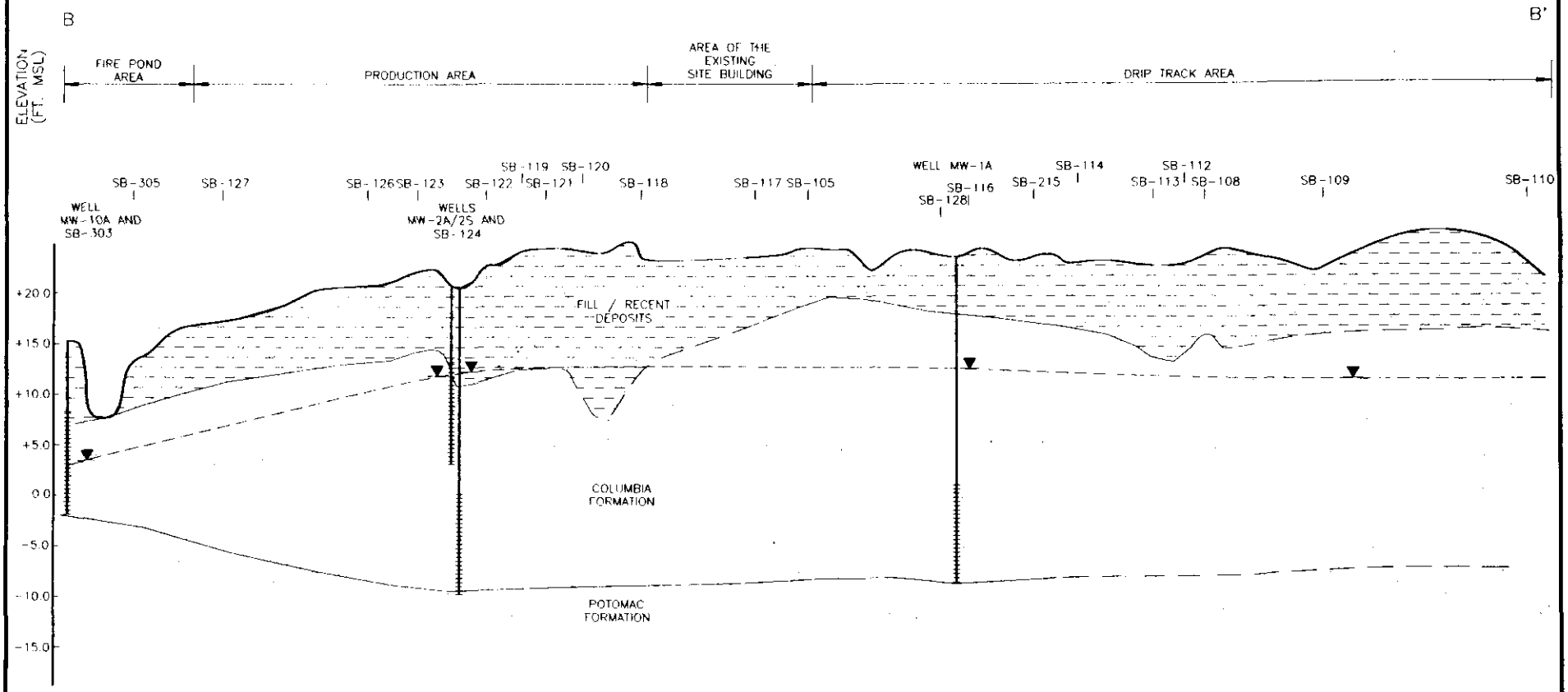
SB-214 BORING LOCATION

GROUNDWATER ELEVATION

Job No. 4E02153-F3	GENERALIZED CROSS-SECTION A-A' FORMER KOPPERS SITE NEWPORT, DELAWARE
Prepared by: TP	
Date: 04/26/1995	

C:\ACAD12\KPN15

Figure 2-3A



SCALE IN FEET

0 — 400

LEGEND:

FILL / RECENT DEPOSITS. LOOSE TO DENSE BROWN TO YELLOW-BROWN ORGANIC SILTY SAND WITH ANGULAR GRAVEL /DEBRIS (BRICKS, STEEL, WOOD, GLASS) NEAR SURFACE. SOME SEAMS OF SILTY CLAY AND GRAVEL

COLUMBIA AQUIFER SOILS. INTERBEDDED COMPACT TO DENSE, WET TO SATURATED ORANGE-BROWN MOTTLED SILTY COARSE TO FINE SAND AND FINE TO COARSE SAND AND GRAVEL. WITH SEAMS/LENSES OF SILT/CLAYEY SILT COARSENING WITH DEPTH; COARSE GRAVEL BED TYPICAL AT BASE OF FORMATION

POTOMAC FORMATION. VARIEGATED RED, GRAY, PURPLE, YELLOW SANDY SILTS AND CLAYS INTERBEDDED WITH CLAYEY SANDS AND OCCASIONAL GRAVELS.

MONITORING WELL SCREENED INTERVAL

COLUMBIA AQUIFER GROUNDWATER SURFACE

APPROXIMATE GEOLOGIC UNIT CONTACT

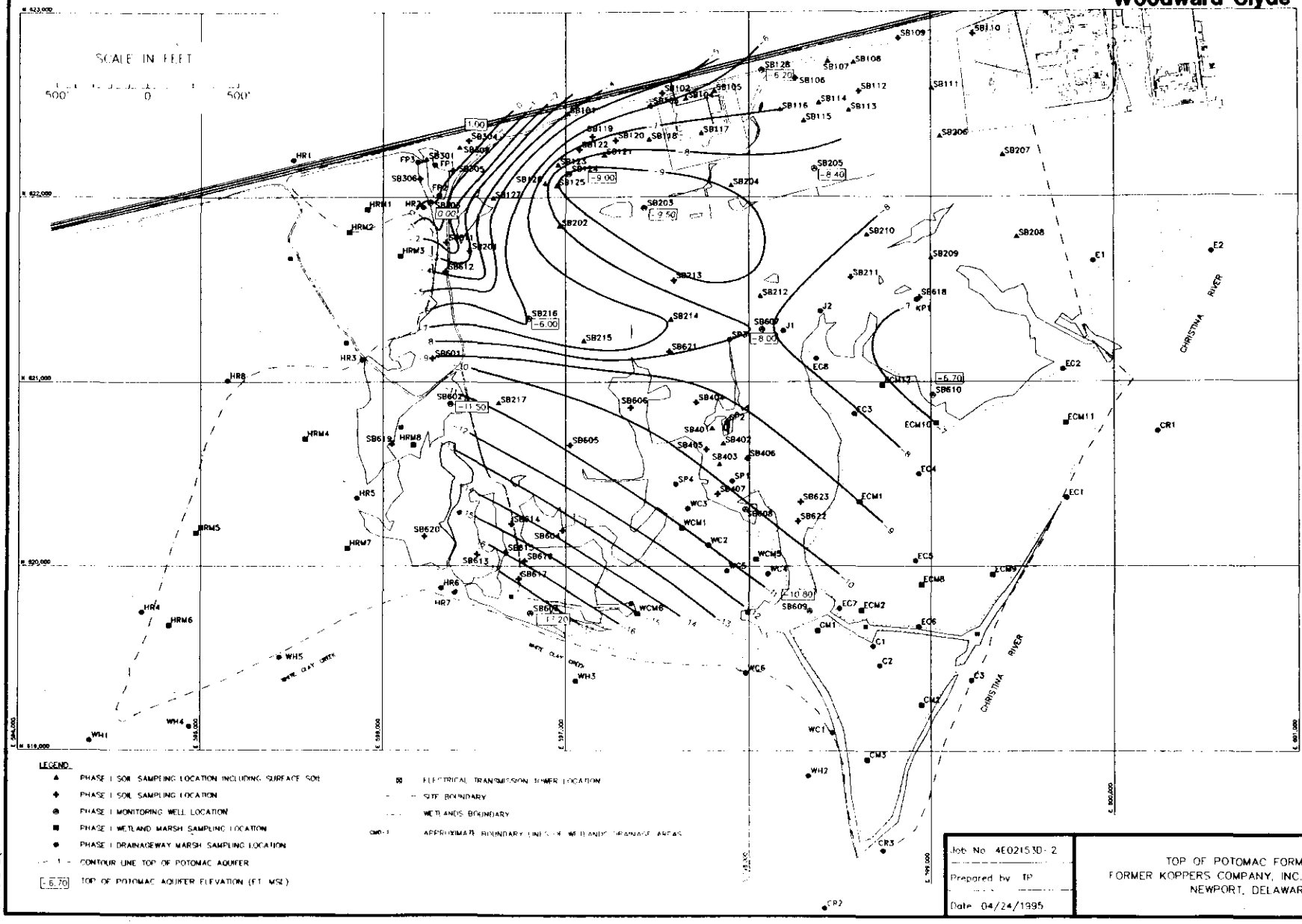
SB-214 BORING LOCATION

GROUNDWATER ELEVATION

Job No. 4E02153-F3 Prepared by: TP Date 04/26/1995	GENERALIZED CROSS-SECTION B-B' FORMER KOPPERS SITE NEWPORT, DELAWARE

C:\ACAD12\KPN16A

Figure 2-3B



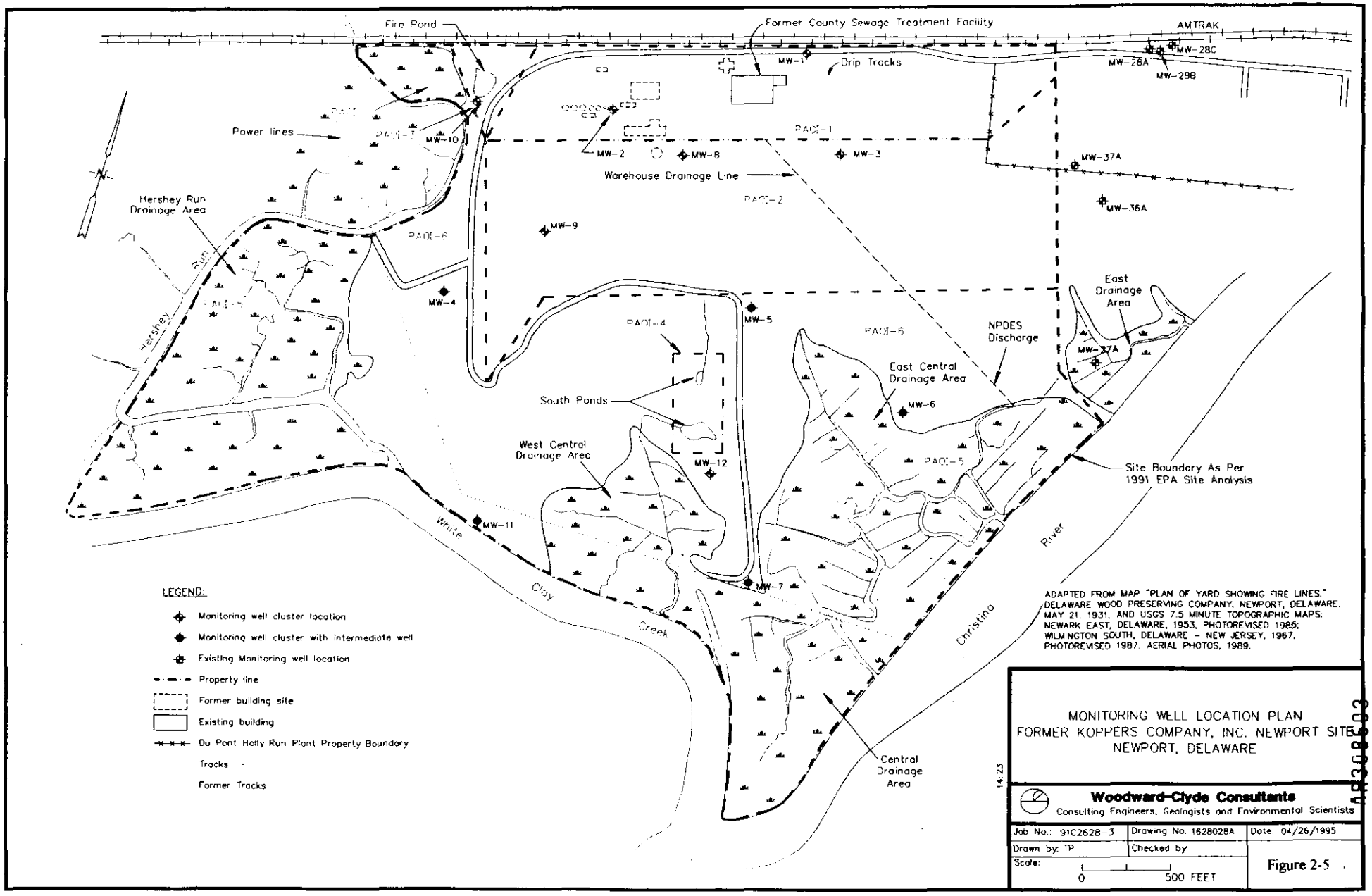
Job No. 4E021530-2
Prepared by TP
Date 04/24/1995

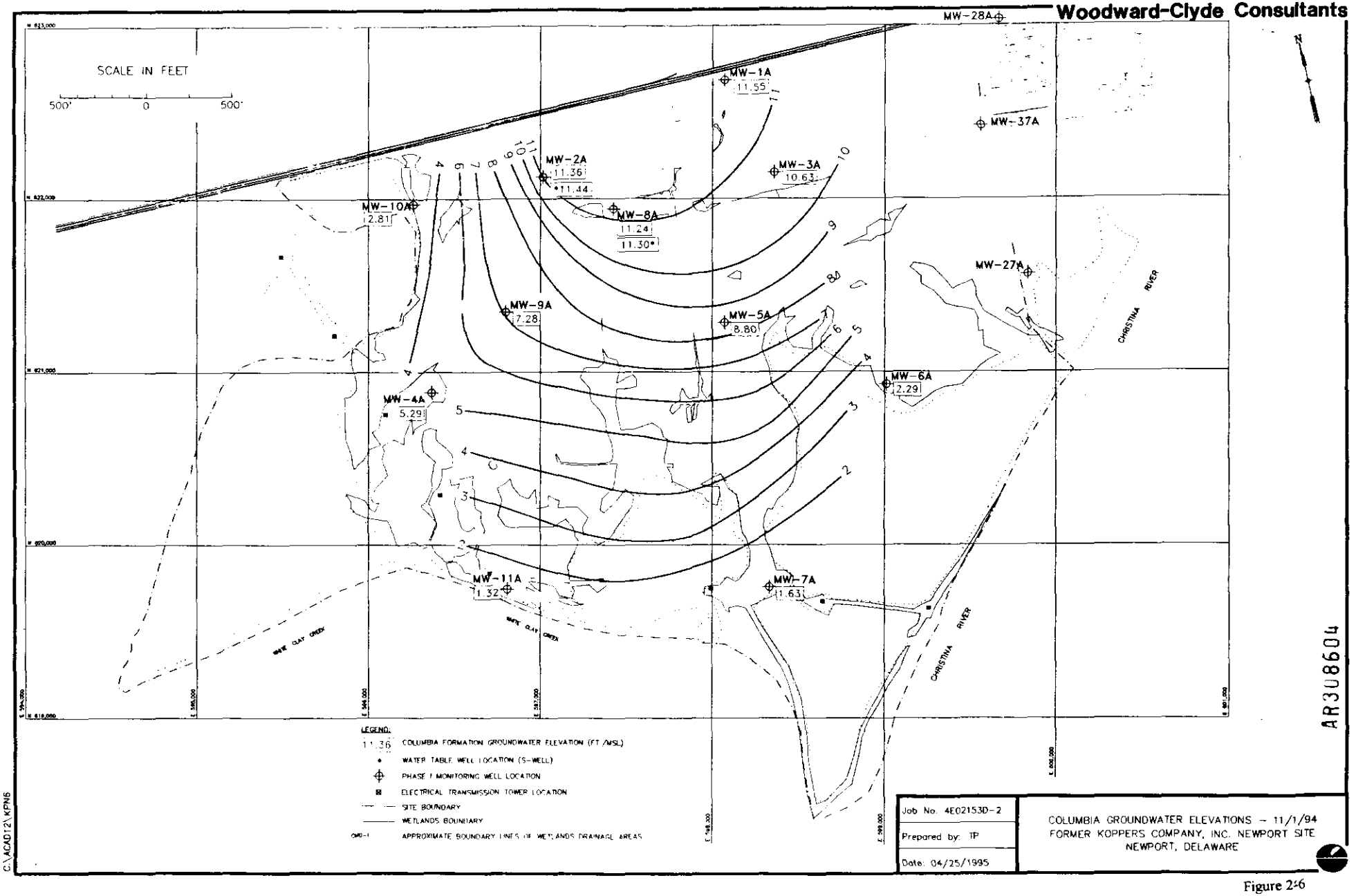
TOP OF POTOMAC FORMATION
FORMER KOPPERS COMPANY, INC. NEWPORT SITE
NEWPORT, DELAWARE

C:\ACAD12\KPN1

AR308602

Figure 2-4


Fire Pond
Former County Sewage Treatment Facility
AMTRAK
MW-1
Drip Tracks
MW-28A
MW-28B
MW-28C
Power lines
MW-10
MW-2
MW-8
MW-3
PAOI-1
PAOI-2
Warehouse Drainage Line
MW-37A
MW-36A
Hershey Run Drainage Area
Hershey Run
PAOI-6
MW-9
MW-4
MW-5
PAOI-4
PAOI-6
NPDES Discharge
East Drainage Area
MW-27A
East Central Drainage Area
MW-6
South Ponds
West Central Drainage Area
MW-12
PAOI-5
Site Boundary As Per 1991 EPA Site Analysis
MW-11
White Clay Creek
MW-7
Christina River
Central Drainage Area
LEGEND:
Monitoring well cluster location
Monitoring well cluster with intermediate well
Existing Monitoring well location
Property line
Former building site
Existing building
Du Pont Holly Run Plant Property Boundary
Tracks
Former Tracks
ADAPTED FROM MAP "PLAN OF YARD SHOWING FIRE LINES." DELAWARE WOOD PRESERVING COMPANY. NEWPORT, DELAWARE. MAY 21, 1931, AND USGS 7.5 MINUTE TOPOGRAPHIC MAPS: NEWARK EAST, DELAWARE, 1953, PHOTOREVISED 1985; WILMINGTON SOUTH, DELAWARE - NEW JERSEY, 1967, PHOTOREVISED 1987. AERIAL PHOTOS, 1989.
MONITORING WELL LOCATION PLAN
FORMER KOPPERS COMPANY, INC. NEWPORT SITE
NEWPORT, DELAWARE
Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
Job No.: 91C2628-3
Drawing No. 1628028A
Date: 04/26/1995
Drawn by: TP
Checked by:
Scale:
0
500 FEET
Figure 2-5



AR308604

Figure 2-6

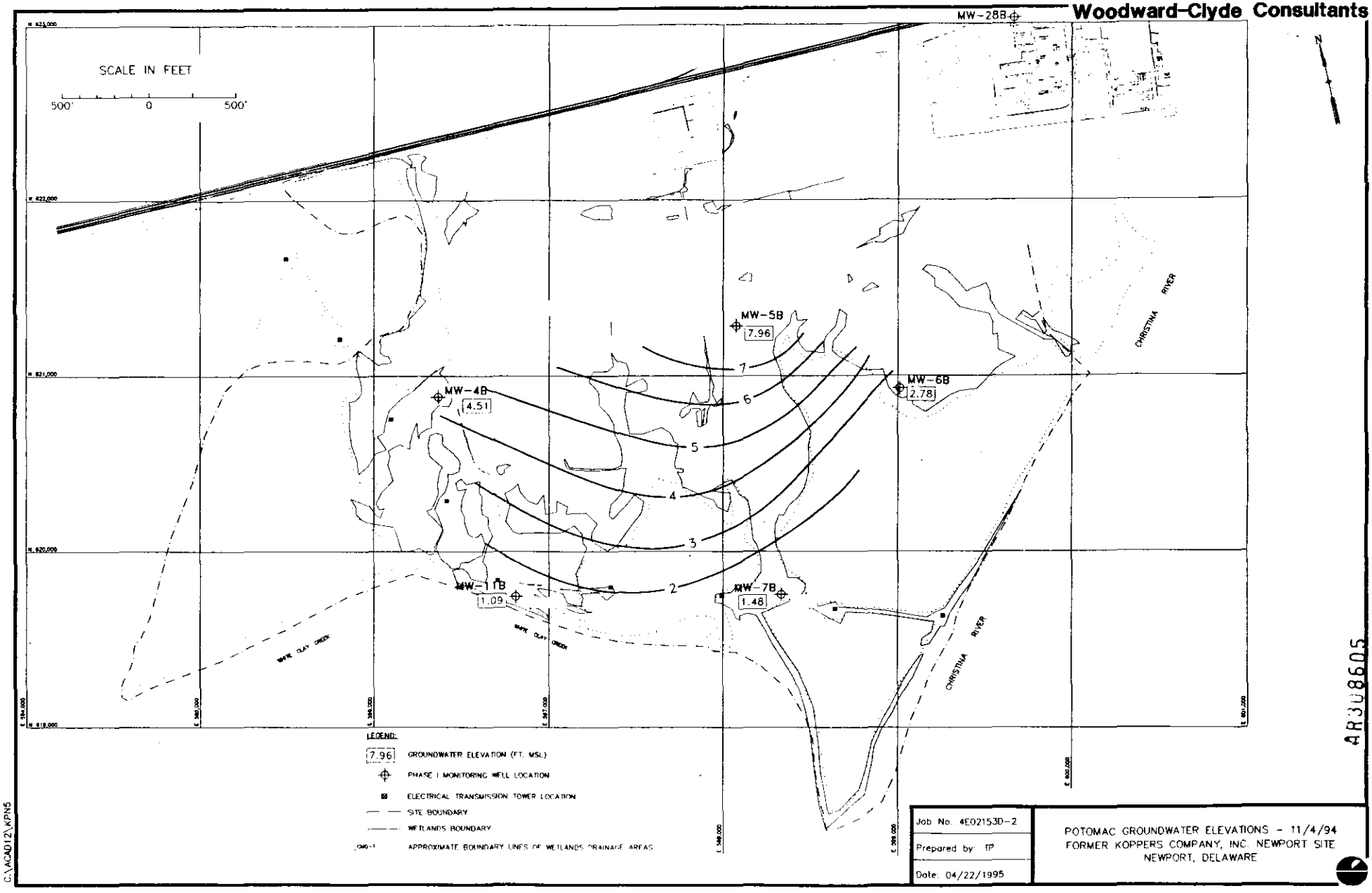
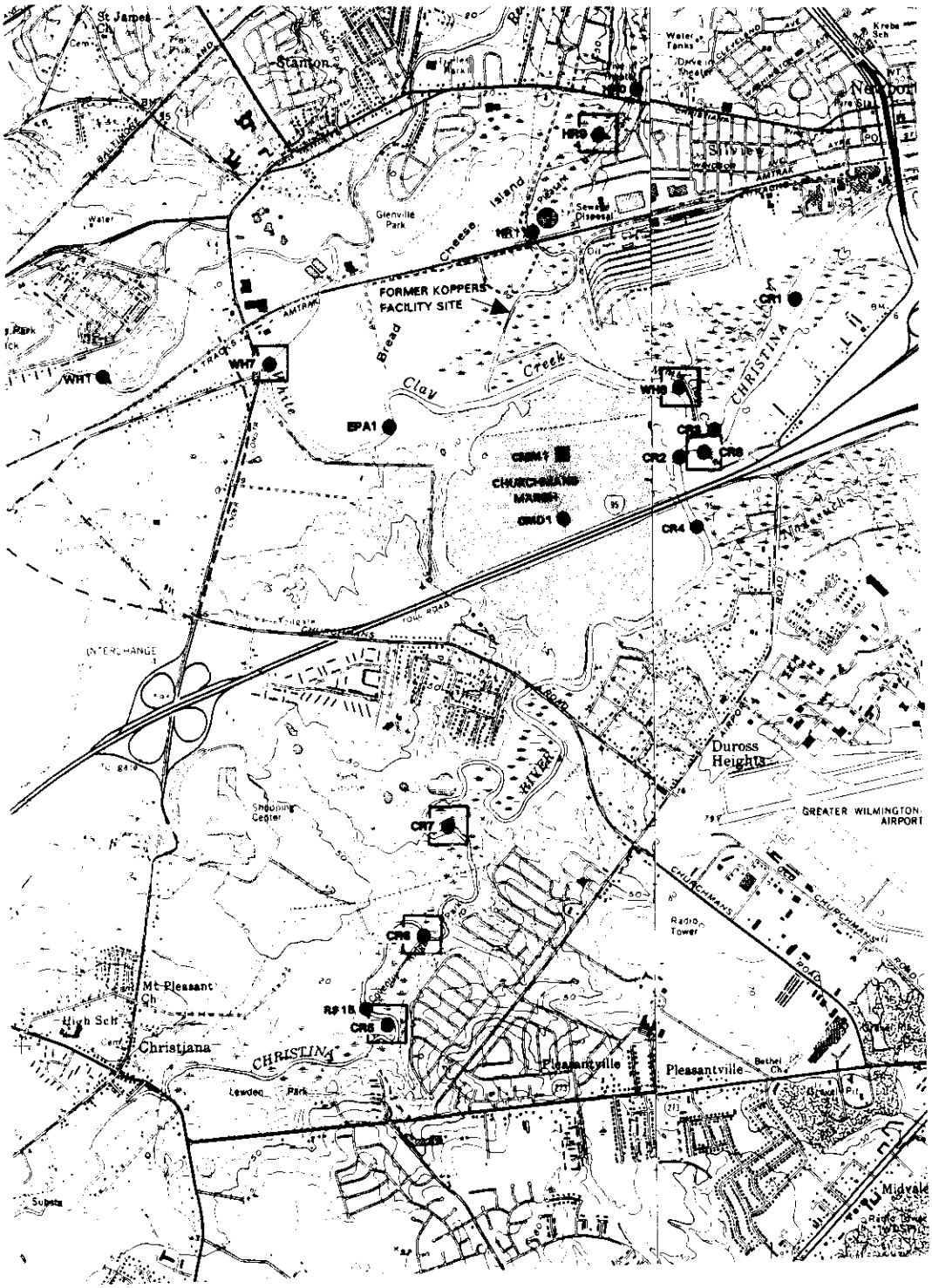

Woodward-Clyde Consultants
SCALE IN FEET
500'
0
500'
MW-28B
MW-5B
7.96
MW-4B
4.51
MW-6B
2.78
MW-11B
1.09
MW-7B
1.48
7
6
5
4
3
2
CHRISTINA RIVER
WHITE CLAY CREEK
LEGEND:
7.96 GROUNDWATER ELEVATION (FT. MSL)
PHASE I MONITORING WELL LOCATION
ELECTRICAL TRANSMISSION TOWER LOCATION
SITE BOUNDARY
WETLANDS BOUNDARY
APPROXIMATE BOUNDARY LINES OF WETLANDS DRAINAGE AREAS
Job No. 4E02153D-2
Prepared by: fP
Date: 04/22/1995
POTOMAC GROUNDWATER ELEVATIONS - 11/4/94
FORMER KOPPERS COMPANY, INC. NEWPORT SITE
NEWPORT, DELAWARE
C:\ACAD12\KPN5
AR308605

Figure 2-7



SOURCE: USGS 7.5 MINUTE TOPOGRAPHICAL MAPS;
NEWARK EAST, DE. 1953, PHOTOREVISED 1985
WILMINGTON SOUTH, DE. - NJ. 1967
PHOTOREVISED 1987.

NOTE: THE SHOWN LOCATIONS ARE APPROXIMATE; THE ACTUAL LOCATIONS WILL BE BASED ON FIELD RECONNAISSANCE

LEGEND

- PHASE I DRAINAGEWAY SURFACE WATER AND SEDIMENT SAMPLING LOCATION
- PROPOSED PHASE II DRAINAGEWAY SURFACE WATER AND SEDIMENT SAMPLING LOCATION
- PHASE I WETLAND MARSH SAMPLING LOCATION

APPROXIMATE OFF-SITE AQUATIC SAMPLING LOCATIONS
FORMER KOPPERS COMPANY, INC. NEWPORT SITE
NEWPORT, DELAWARE

Rev. No.	Date	Type of Revision	Checked By

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No. 91C2628-3X2	Drawing No.	Date: 8/8/95	
Drawn by:	Checked by:		
Scale: 0 2000 FT.			Figure 2-8

162800AS

AR308606

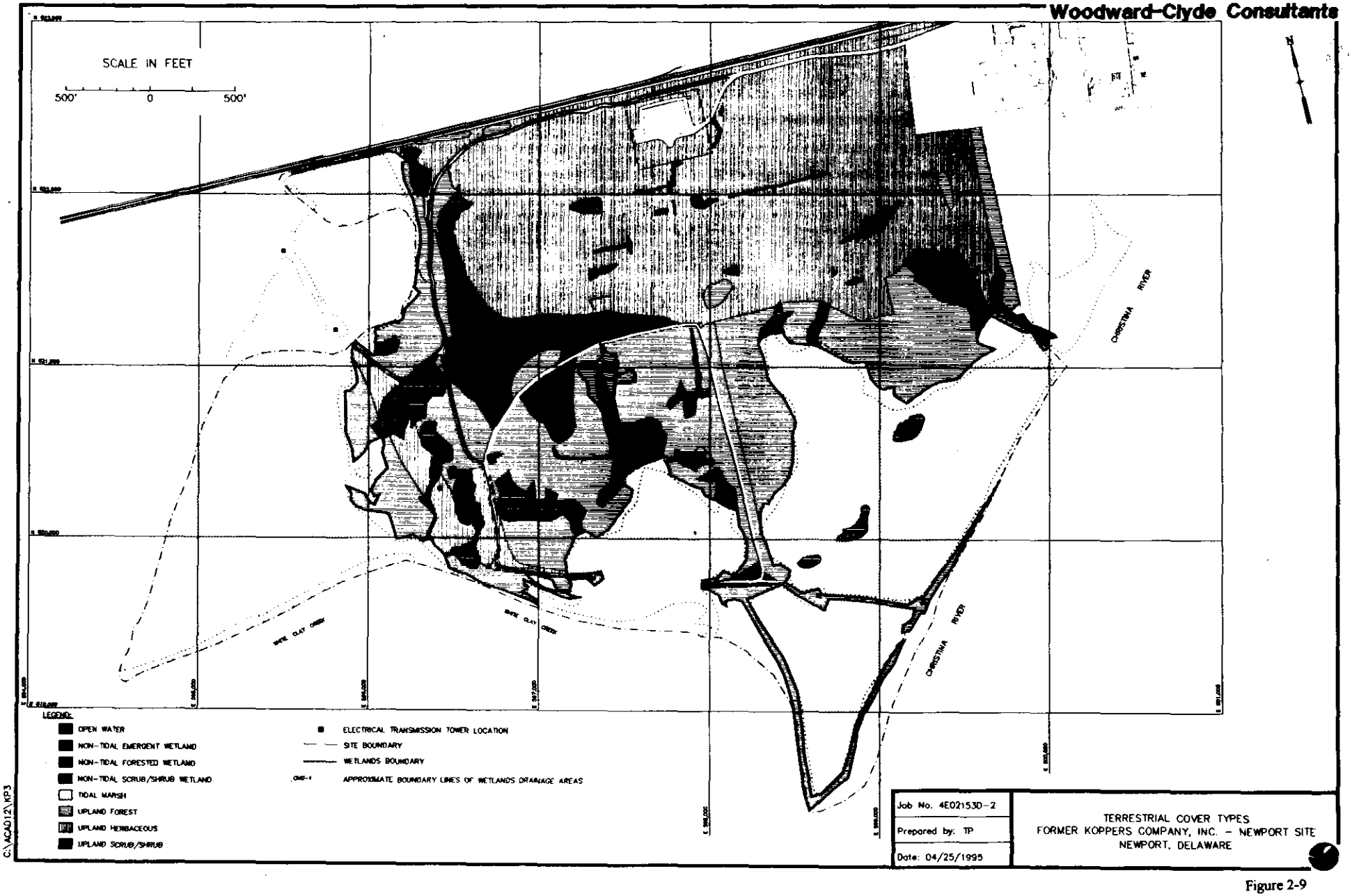


Figure 2-9

AR308607

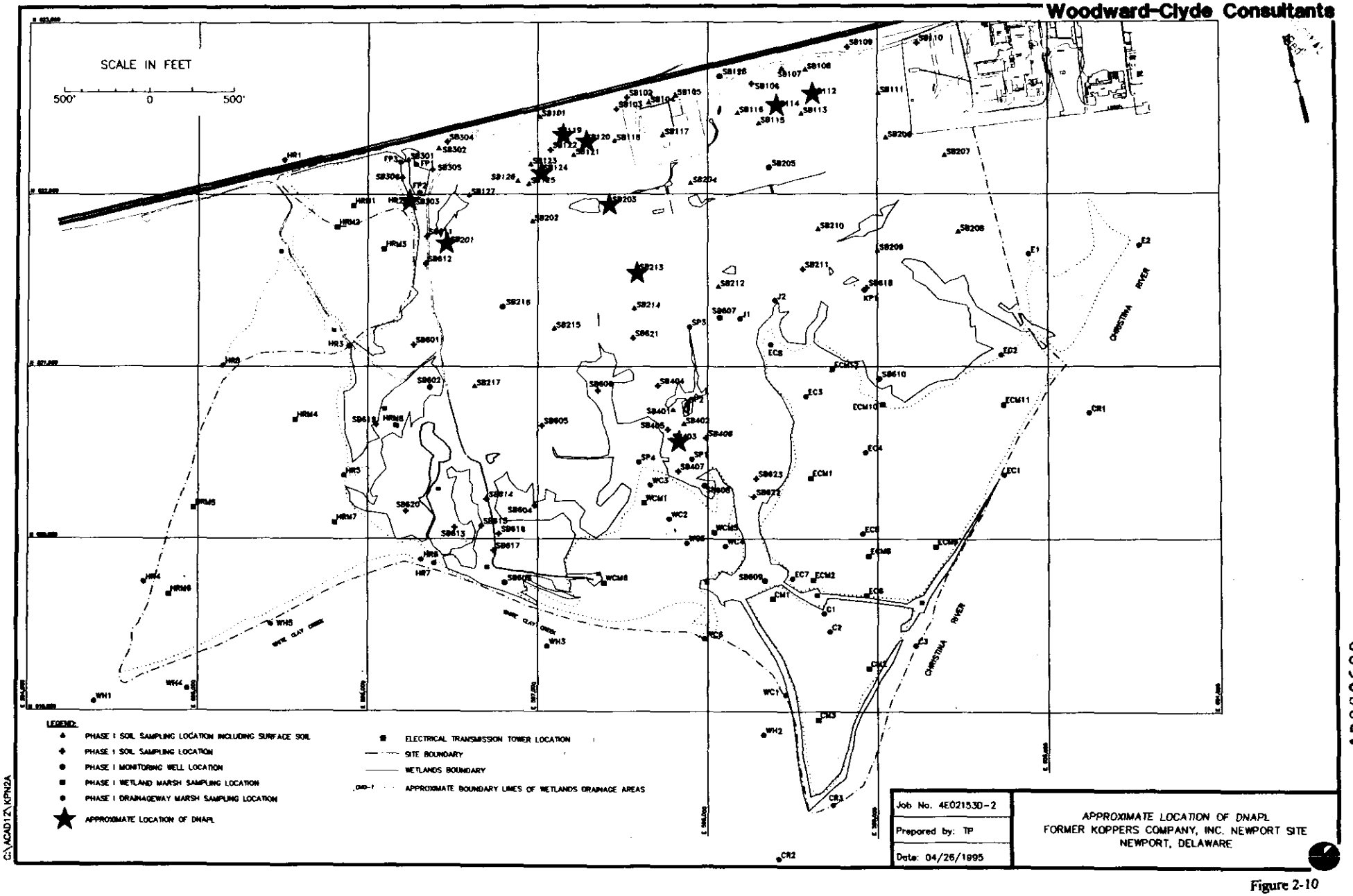
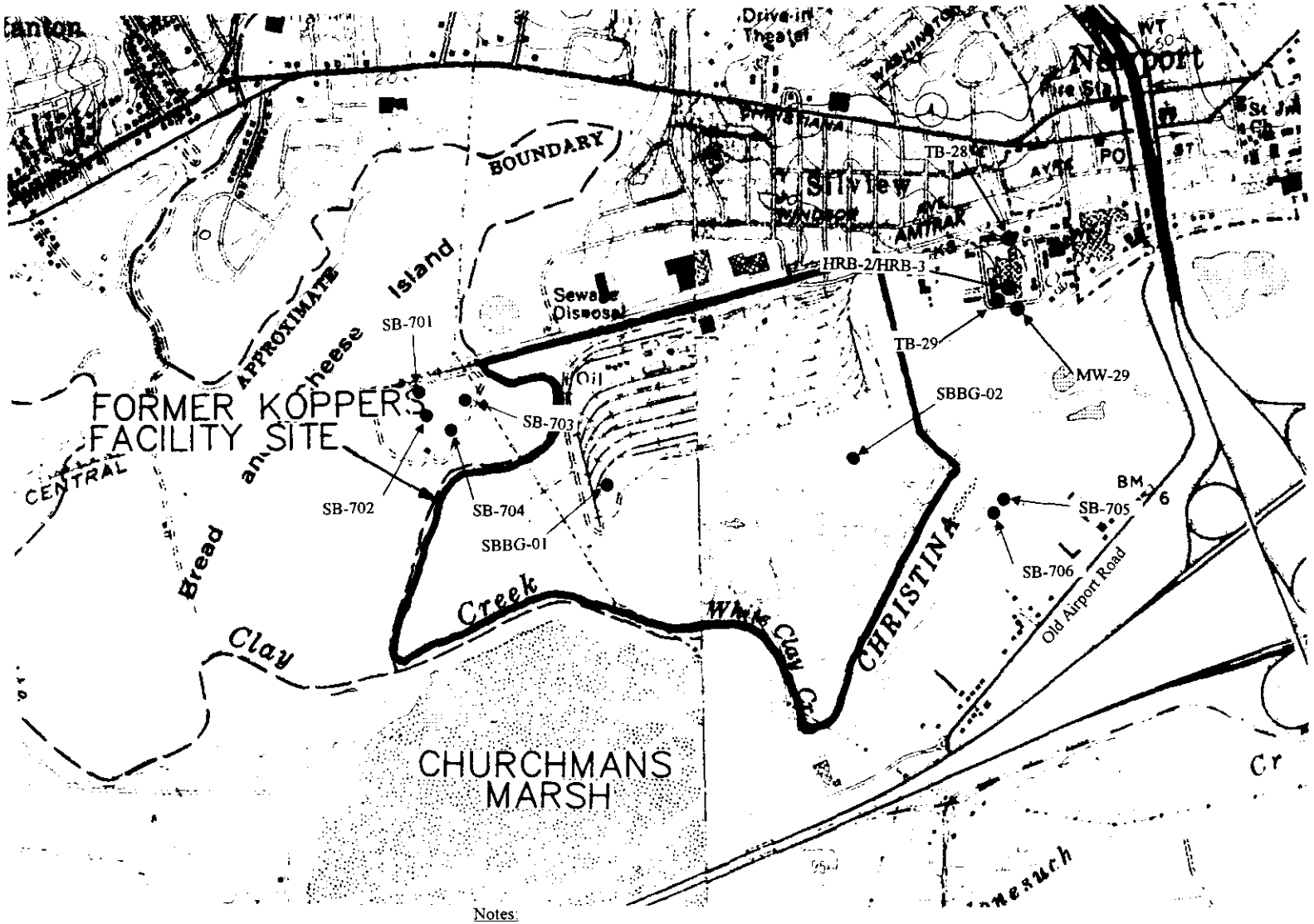


Figure 2-10

AR308608



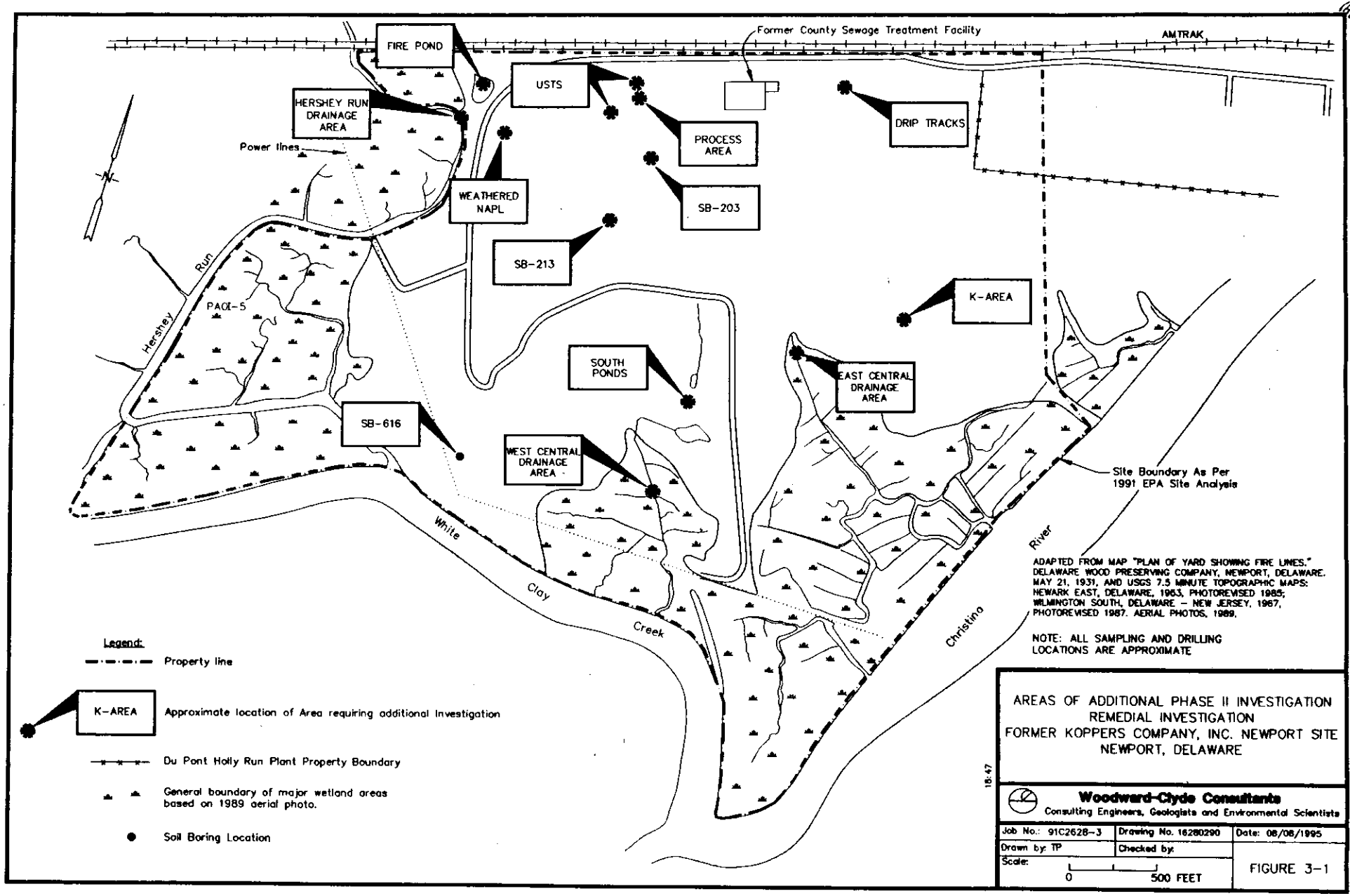
Notes:

● Background Soil Reference Locations

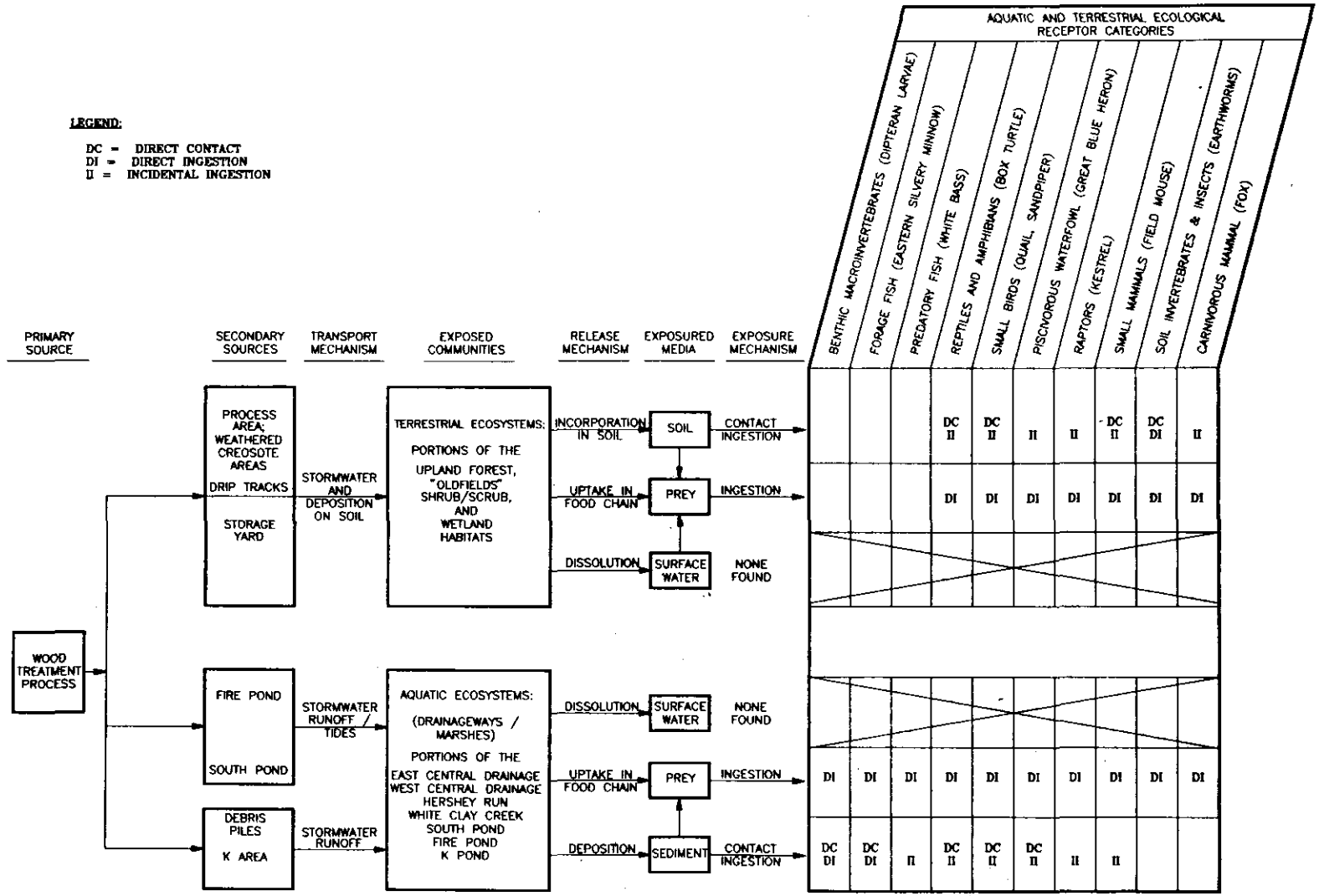
Not To Scale

Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Reference Soil Sampling Locations Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure 2-11

AR300609


FIRE POND
Former County Sewage Treatment Facility
AMTRAK
USTS
HERSHEY RUN DRAINAGE AREA
PROCESS AREA
DRIP TRACKS
Power lines
WEATHERED NAPL
SB-203
SB-213
K-AREA
Hershey Run
PAOI-5
SOUTH PONDS
EAST CENTRAL DRAINAGE AREA
SB-616
WEST CENTRAL DRAINAGE AREA
Site Boundary As Per 1991 EPA Site Analysis
White Clay Creek
Christina River
ADAPTED FROM MAP "PLAN OF YARD SHOWING FIRE LINES." DELAWARE WOOD PRESERVING COMPANY, NEWPORT, DELAWARE. MAY 21, 1931, AND USGS 7.5 MINUTE TOPOGRAPHIC MAPS: NEWARK EAST, DELAWARE, 1953, PHOTOREVISED 1985; WILMINGTON SOUTH, DELAWARE - NEW JERSEY, 1967, PHOTOREVISED 1987. AERIAL PHOTOS, 1989.
NOTE: ALL SAMPLING AND DRILLING LOCATIONS ARE APPROXIMATE
Legend:
Property line
K-AREA
Approximate location of Area requiring additional Investigation
Du Pont Holly Run Plant Property Boundary
General boundary of major wetland areas based on 1989 aerial photo.
Soil Boring Location
AREAS OF ADDITIONAL PHASE II INVESTIGATION
REMEDIAL INVESTIGATION
FORMER KOPPERS COMPANY, INC. NEWPORT SITE
NEWPORT, DELAWARE
Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
Job No.: 91C2628-3
Drawing No. 16280290
Date: 08/08/1995
Drawn by: TP
Checked by:
Scale:
0
500 FEET
FIGURE 3-1
18:47

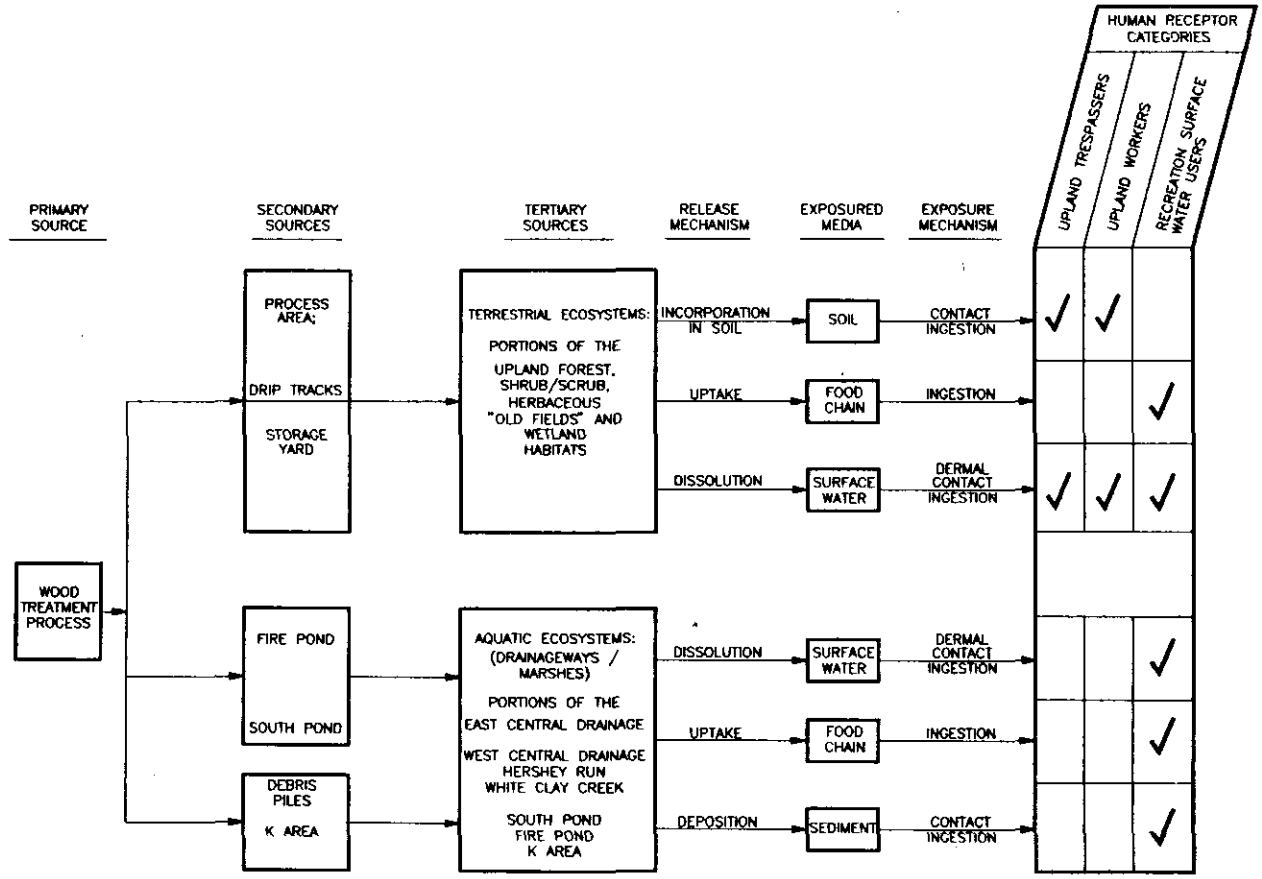
AR308610



Job No. 4E02153	ECOLOGICAL CONCEPTUAL SITE MODEL POTENTIALLY SIGNIFICANT EXPOSURE PATHWAYS FORMER KOPPERS COMPANY – NEWPORT SITE
Prepared by: TP	
Date: 08/08/1995	FIGURE 3-2

C:\ACAD12\JP3A

AR308611

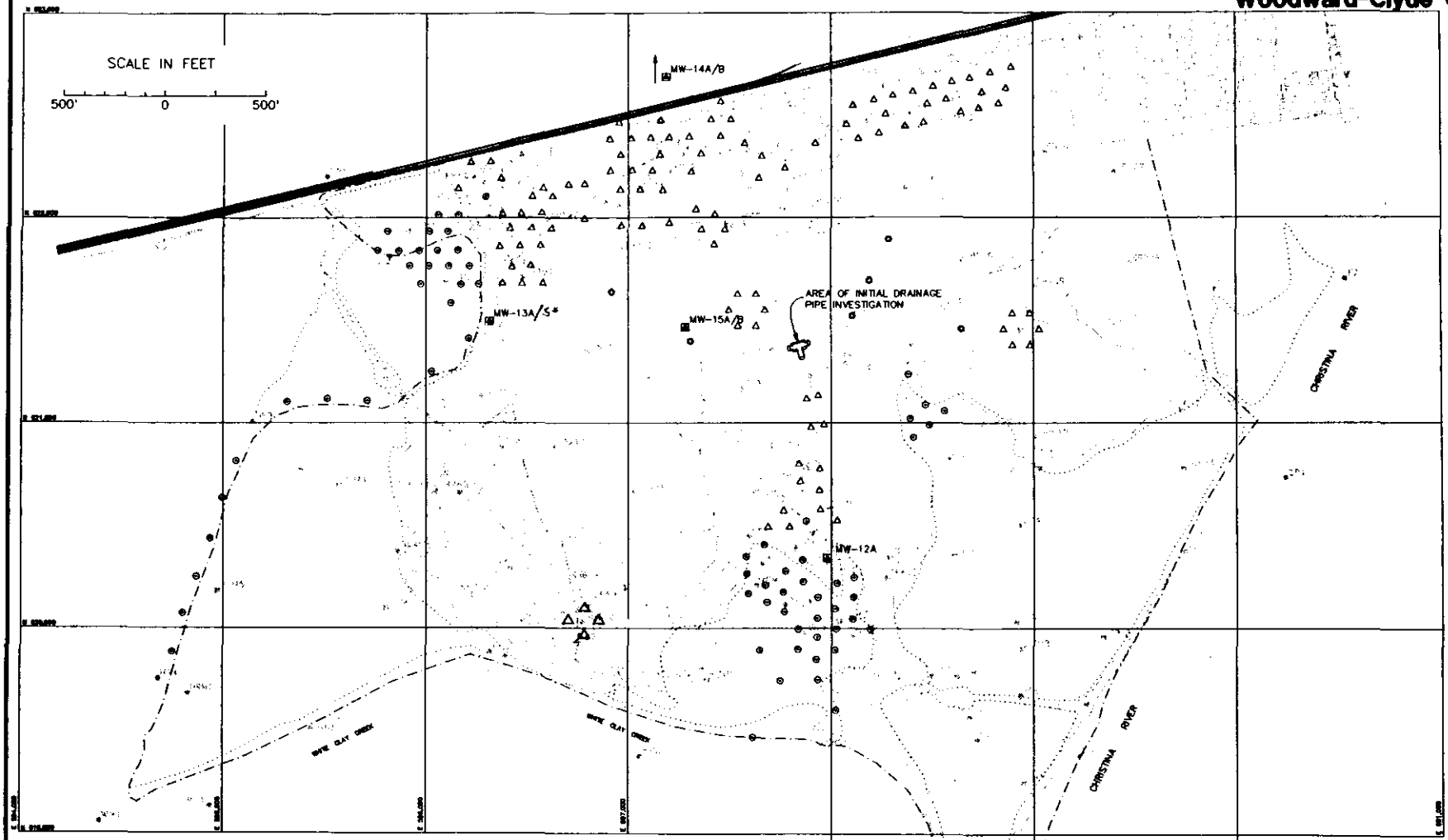


Job No. 4E02153	HUMAN HEALTH CONCEPTUAL EXPOSURE MODEL FORMER KOPPERS COMPANY - NEWPORT SITE
Prepared by: TP	FIGURE 3-3
Date: 08/16/1995	

C:\ACAD12\JP4E

AR308612

Woodward-Clyde Consultants



LEGEND:

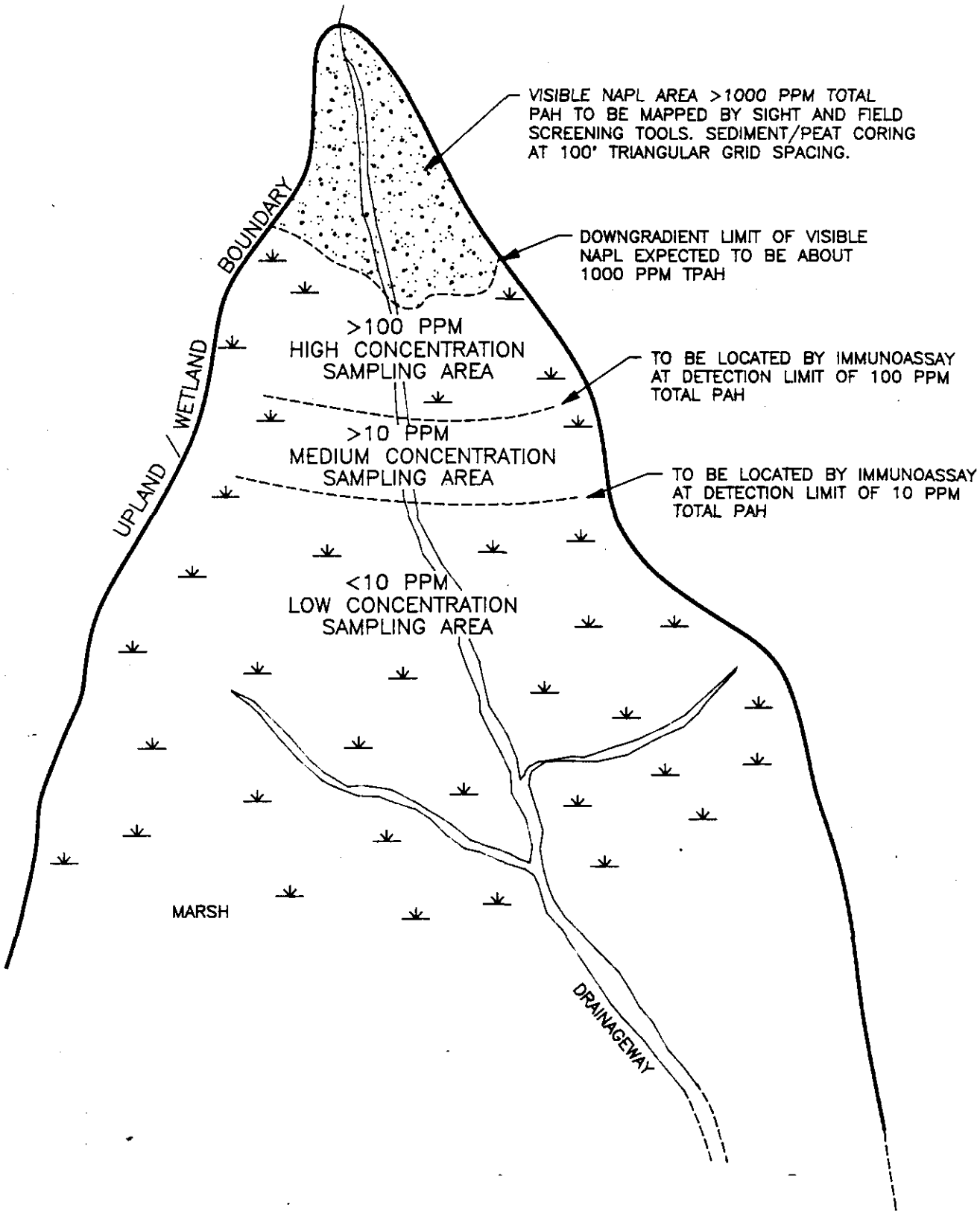
- PHASE I SOIL SAMPLING LOCATION INCLUDING SURFACE SOIL
- PHASE I SOIL SAMPLING LOCATION
- PHASE I MONITORING WELL LOCATION
- PHASE I WETLAND MARSH SAMPLING LOCATION
- PHASE I DRAINAGEWAY MARSH SAMPLING LOCATION
- AREA OF KNOWN DRAINAGE PIPE
- PHASE II MONITORING WELL LOCATION
- AREA OF UNDERGROUND STORAGE TANK INVESTIGATION
- PHASE II SOIL BORINGS FOR TOP OF POTOMAC DELINEATION
- PHASE II SEDIMENT SAMPLE LOCATIONS FOR NAPL DELINEATION
- PHASE II SOIL BORINGS FOR NAPL DELINEATION
- ELECTRICAL TRANSMISSION TOWER LOCATION
- SITE BOUNDARY
- WETLANDS BOUNDARY
- APPROXIMATE BOUNDARY LINES OF WETLANDS DRAINAGE AREAS
- TENATIVE SHALLOW MONITORING WELL LOCATION

Job No. 4E021530-2	LOCATION OF PROPOSED PHASE II SITE INVESTIGATION AREAS FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE
Prepared by: TP	
Date: 08/04/1995	

C:\ACAD12\KPN20A

AR308613

Figure 4-1

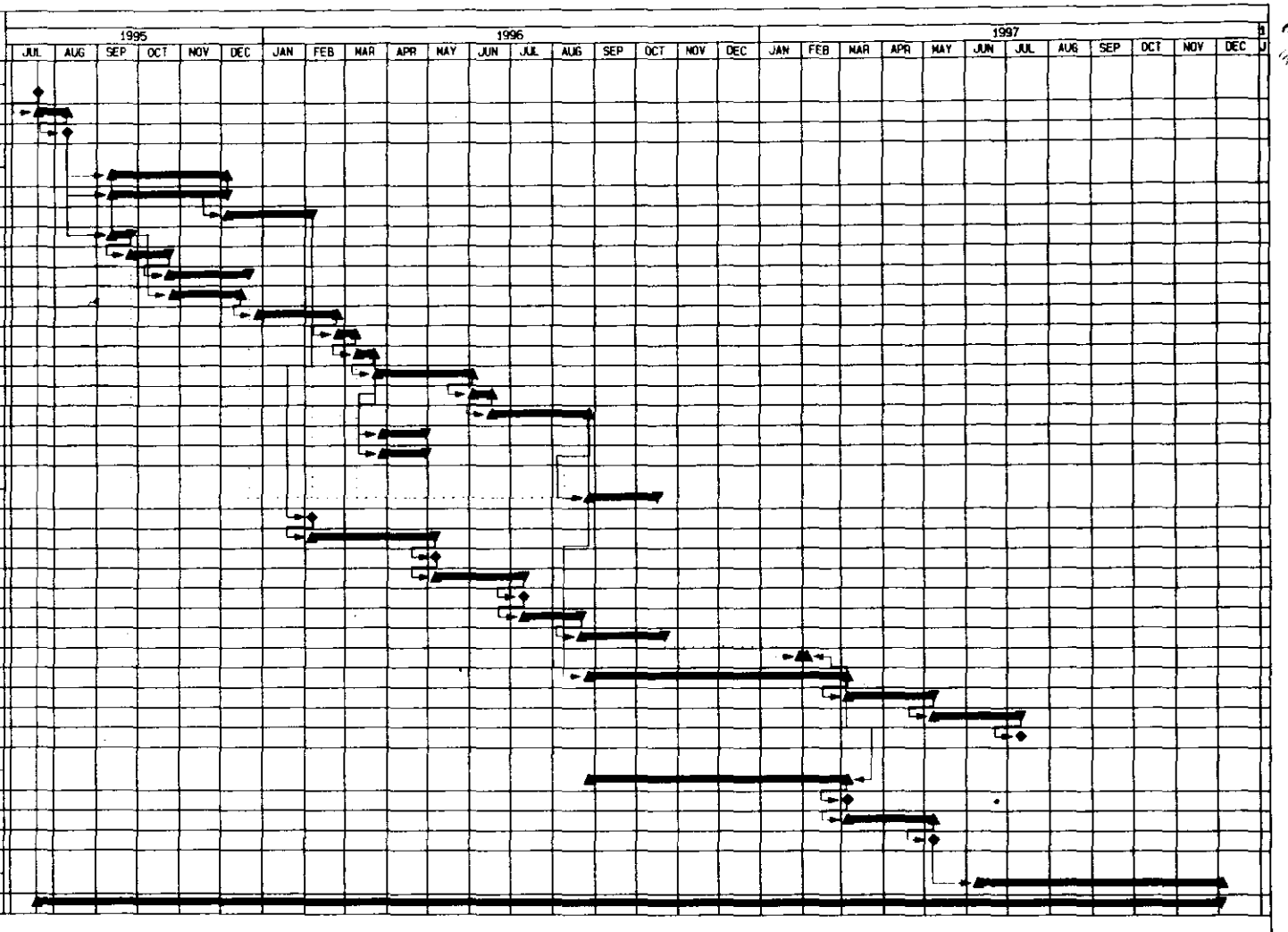


Job No. 4E02153	SCHEMATIC OF STEP 1 FIELD SCREENING PROCEDURES TO IDENTIFY SEDIMENT / PEAT SAMPLING AREAS IN MARSHES. FORMER KOPPERS SITE NEWPORT, DELAWARE
Prepared by: TP	
Date: 04/24/1995	

FIGURE 4-2

C:\ARTX\ 22

Description	Dur
Phase II - Remedial Investigation SO	
Submitt Revised Phase II RI SOW	0
EPA Review of Revised Phase II RI SOW	15
EPA Approval of Revised Phase II SOW	0
Phase II - Remedial Investigation	
Weathered NAPL Delineation- Collect Field Data	60
Marsh/Drnwy-NAPL Borings/Wildlife Surveys-Field	60
NAPL Delin-Lab Analysis/Validation	42
Sediment Coring/surface water sampling of Ponds	10
Sediment sample collection River and Creeks	20
Sediment/surface water Lab Analysis/Validation	42
DNAPL Delineation-Collect Field Data	35
Well Installation/Development-Collect Field Data	40
Tidal Monitoring & Evaluation	10
Well Sampling-Collect Field Data (1st Round)	10
Well Sampling - Analysis/Validation (1st Round)	50
Well Sampling-Collect Field Data (2nd Round)	10
Well Sampling - Analysis/Validation (2nd Round)	50
Drain Pipe Assessment-Collect Field Data	22
UST Assessment-Collect Field Data	22
Phase III - Remedial Investigation	
Compile Field Data for Draft RI Report	35
BEGIN PHASE III PLANNING	0
Prepare Phase III RI SOW	65
Submitt Phase III RI SOW to EPA	0
EPA Review of Phase III RI SOW	45
EPA Approval of Phase III RI SOW	0
Tox-Bio Sample Collection	30
Tox-Bio Sample Analysis	42
Present Draft RI Report to EPA (Meeting)	3
Prepare Draft RI Report	132
EPA Review of Draft Remedial Investigation Rept	45
Incorp EPA Comments & Submit Final Draft Report	44
EPA Approval of Remedial Investigation Report	0
Risk Assessment	
Preparation of Risk Assessment	132
Submittal of Risk Assessment to EPA	0
EPA Review of Risk Assessment	45
EPA Approval of Risk Assessment	0
Feasibility Report	
Conduct Treatability and Feasibility Study	124
Monthly Progress Reports to EPA	610



Early bar
Early start poi
Early finish po
Critical bar
Critical point
Start milestone
Finish mileston

Start Date: 29JUL95
Finish Date: 03DEC97

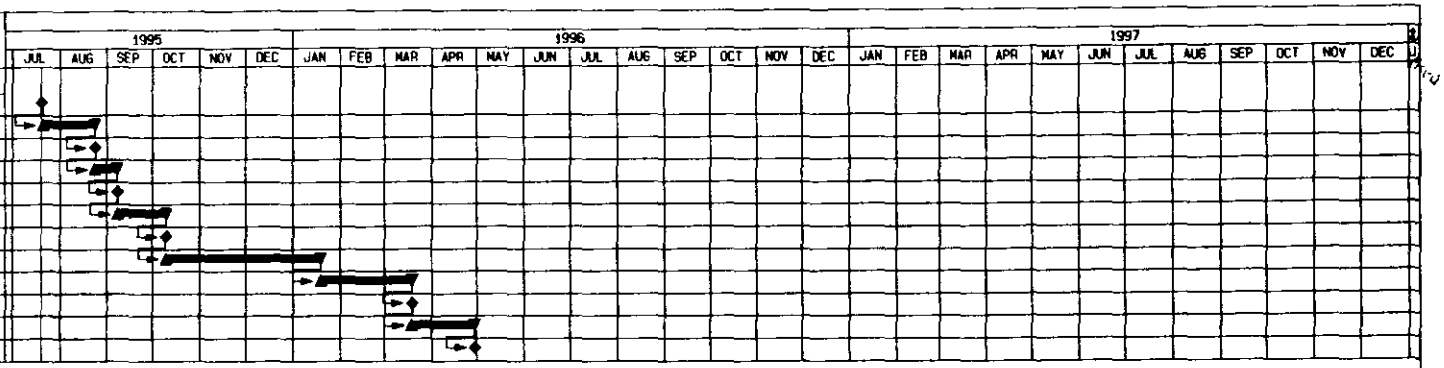
Revised RI/FS Schedule
FORMER KOPPERS Co. SITE
Newport, Delaware

Page 2A
BZE2
Data Date: 29JUL95
Run Date: 18AUG95

FIGURE 5-1 A

AR308615

Description	Dur
Phase IB-Cultural Resources Survey	
Submittal of Phase IB Interim Document	0
EPA Review of Interim Document	25
EPA Approval of Interim Document	0
Preparation of Revised Phase IB Survey Plan	10
Submittal of Revised Phase IB Survey Plan	0
EPA Review of Revised Phase IB Survey Plan	22
EPA Approval of Phase IB Survey Plan	0
Conduct Ph IB Hist/Prehist Survey (Marsh Core)	70
Preparation of Phase IB Report	42
Submittal of Phase IB Report to EPA	0
EPA Review of Phase IB Report	30
EPA Approval of Phase IB Report	0



Early bar
Early start poi
Early finish po
Critical bar
Critical point
Start milestone
Finish mileston

Start Date: 20JUL95
Finish Date: 03DEC97

Revised RI/FS Schedule
FORMER KOPPERS Co. SITE
Newport, Delaware

Page 2A
SZE2
Data Date: 20JUL95
Run Date: 16AUG95

FIGURE 5-1B

AR308616

Appendix A

APPENDIX A

PHASE I DATA MAPS AND TABLES

APPENDIX A
TABLE OF CONTENTS

LIST OF TABLES

SUMMARY OF PHASE I BENTHIC MACROINVERTEBRATE DATA

TABLE 1 DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE EAST DRAINAGEWAY USING A PETITE PONAR BOTTOM GRAB, SEPTEMBER, 1994

TABLE 2 DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE EAST CENTRAL DRAINAGEWAY USING A PETITE PONAR BOTTOM GRAB, AUGUST, 1994

TABLE 3 DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE CENTRAL DRAINAGEWAY USING A PETITE PONAR BOTTOM GRAB, SEPTEMBER, 1994

TABLE 4 DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE CHURCHMAN'S MARSH DRAINAGEWAY USING A PETITE PONAR BOTTOM GRAB, SEPTEMBER, 1994

TABLE 5 DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE WEST CENTRAL DRAINAGEWAY USING A PETITE PONAR BOTTOM GRAB, AUGUST, 1994

TABLE 6 DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE CHRISTINA RIVER USING A PETITE PONAR BOTTOM GRAB, SEPTEMBER, 1994

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TABLE 8 DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE HERSHEY RUN USING A PETITE PONAR BOTTOM GRAB, SEPTEMBER, 1994

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TABLE 1
DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE EAST DRAINAGEWAY
USING A PETITE PONAR BOTTOM GRAB
SEPTEMBER 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

TAXON	STATION NUMBERS (1) E01	E02
Mollusca		
Bivalvia		
Veneroida		
Sphaeriidae		
Pisidium casertanum	1623	
Gastropoda		
Basommatophora		
Planorbidae		
Gyraulus deflectus	15	
Lymnaeidae		
Pseudosuccinea columella	73	
Arthropoda		
Crustacea		
Isopoda		
Asellidae		
Caecidotea sp.	174	
Amphipoda		
Gammaridae		
Gammarus fasciatus		130
Insecta		
Diptera		
Chironomidae		
Chironomus decorus gr.		58
Cryptochironomus fulvus gr.		15
Eukiefferiella sp.	130	
Pseudorthocladius	15	
Tipulidae		
Ormosia sp.	29	
Pilaria sp.	15	
Limnophila sp.	15	
Tipula sp.	15	
Annelida		
Oligochaeta		
Tubificida		
Tubificidae		
Branchiura sowerbyi		15
Aulodrilus pluriseta	15	
Ilyodrilus templetoni		15
Limnodrilus cervix		275
Limnodrilus hoffmeisteri		478
Quistadrilus multisetosus		29
Tubifex sp.	44	
Limnodrilus sp.		1145

Notes:
(1) Stations arranged in order from upstream to downstream.
(2) Densities represent averages of three replicate samples per station.

TABLE 1
DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE EAST DRAINAGEWAY
USING A PETITE PONAR BOTTOM GRAB
SEPTEMBER 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

TAXON	STATION NUMBERS (1) E01	E02
Lumbricida		
Lumbricidae		
Lumbricidae	145	159
Lubriculida		
Lumbriculidae		
Lumbriculus variegatus	87	
Annelida		
Hirudinea		
Pharyngobdellida		
Erpobdellidae		
Erpobdella punctata punctata	29	
Rhynchobdellida		
Glossiphoniidae		
Helobdella elongata	58	
Nemertea		
Enopla		
Hoplonemertea		
Tetrastemmatidae		
Prostoma graecense	15	
Density (#/sq. m) (2)	2494	2319
Species richness	19	10

Notes:
(1) Stations arranged in order from upstream to downstream.
(2) Densities represent averages of three replicate samples per station.

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TABLE 2
DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE EAST CENTRAL DRAINAGEWAY
USING A PETITE PONAR BOTTOM GRAB
AUGUST 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

	STATION NUMBERS (1)								
TAXON	J 2	EC08	EC03	EC04	EC02	EC07	EC06	EC05	EC01
Mollusca									
Bivalvia									
Veneroida									
Sphaeriidae									
Pisidium casertanum		2855	44			44			
Pisidium sp.		841			174	188		29	
Sphaerium sp.	507								
Gastropoda									
Basommatophora									
Planorbidae									
Planorbella trivolis		29							
Lymnaeidae									
Fossaria		15							
Arthropoda									
Crustacea									
Cumacea									
Nannastacidae									
Almyracuma proximoculi								58	
Isopoda									
Asellidae									
Caecidotea sp.	420	261	29			304			
Anthuridae									
Cyathura polita								449	15
Amphipoda									
Gammaridae									
Gammarus fasciatus		275	362			44	159		
Stygobromus	145								
Insecta									
Coleoptera									
Curculionidae									
Curculionidae							29		
Chrysomelidae									
Donacia sp.						15			
Dytiscidae									
Hydroporus sp.	15								
Hydrophilidae									
Hydrobius sp.		15							
Trichoptera									
Polycentropodidae									
Phylocentropus sp.		1015							
Limnephilidae									
Frenesia missa/difficilis	73	15							

Notes:
(1) Stations arranged in order from upstream to downstream.
(2) Densities represent averages of three replicate samples per station.

AR308628

TABLE 2
DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE EAST CENTRAL DRAINAGEWAY
USING A PETITE PONAR BOTTOM GRAB
AUGUST 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

	STATION NUMBERS (1)								
TAXON	J 2	EC08	EC03	EC04	EC02	EC07	EC06	EC05	EC01
Leptoceridae									
Triaenodes sp.		29							
Odonata									
Libellulidae									
Libellula sp.							29		
Diptera									
Tipulidae									
Limnophila sp.		101							
Ormosia sp.					29	15			
Pilaria sp.	15								
Megaloptera									
Corydalidae									
Chauliodes sp.		15							
Diptera									
Ceratopogonidae									
Bezzia/palpomyia gr.					15				
Ceratopogonidae									
Culicoides sp.						29			
Chironomidae									
Chironomini						15			
Chironomus sp.	203								
Chironomus decorus gr.						15		203	232
Cladopelma sp.						44			
Cryptochironomus fulvus gr.									15
Orthocladiinae						15			
Paratendipes albimanus						116			
Polypedilum halterale gr.									15
Polypedilum illinoense							29		
Procladius sp.	29				44			145	
Prodiamesa sp.	29			15					
Tanypus sp.					15				
Tanytarsus sp.	768	5522							
Zavrelimyia sp.	15								
Ptychopteridae									
Ptychoptera sp.		3000							
Tabanidae									
Tabanus sp.		29							
Annelida									
Oligochaeta									
Tubificida									
Tubificidae									
Aulodrilus pluriseta	2015	58							275
Branchiura sowerbyi			44			87	58	15	44

Notes:
(1) Stations arranged in order from upstream to downstream.
(2) Densities represent averages of three replicate samples per station.

AR308629

TABLE 2
DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE EAST CENTRAL DRAINAGEWAY
USING A PETITE PONAR BOTTOM GRAB
AUGUST 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

	STATION NUMBERS (1)								
TAXON	J 2	EC08	EC03	EC04	EC02	EC07	EC06	EC05	EC01
Ilyodrilus templetoni		29	145		377	217	44	44	
Imm. Tub. with hair cheatae	246	44							73
Limnodrilus cervix							174		
Limnodrilus hoffmeisteri	145		2362	101	2073	87	3638	1536	5029
Limnodrilus sp.			1203	870	6797	29	3145	1145	
Quistadrilus multisetosus			73			203			29
Lumbricida									
Lumbricidae									
Lumbricidae	29	130		130	15		15		
Lumbriculida									
Lumbriculidae									
Lumbriculus variegatus							2348		
Hirudinea									
Pharyngobdellida									
Erpobdellidae									
Erpobdella punctata punctata						101			
Mooreobdella fervida						15			
Rhynchobdellida									
Glossiphoniidae									
Helobdella elongata			73			73	73		
Helobdella stagnalis						15	15		
Piscicolidae									
Myzobdella lugubris						15			
Platyhelminthes									
Turbellaria									
Tricladia									
Planariidae									
Phagocata sp.	391								
Density (#/sq m) (2)	5045	14275	4333	1116	9536	1681	9754	3623	5725
Species richness	16	18	9	5	9	23	13	9	9
Incidental species									
Nematoda				15					
Unidentified						15			

Notes:
(1) Stations arranged in order from upstream to downstream.
(2) Densities represent averages of three replicate samples per station.

AR308630

TABLE 3
DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE CENTRAL DRAINAGEWAY
USING A PETITE PONAR BOTTOM GRAB
SEPTEMBER 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

TAXON	STATION NUMBERS (1) CO1	CO2	CO3
Mollusca			
Bivalvia			
Veneroida			
Sphaeriidae			
Pisidium casertanum		58	
Arthropoda			
Crustacea			
Amphipoda			
Gammaridae			
Gammarus fasciatus		15	
Insecta			
Diptera			
Chironomidae			
Chironomus decorus gr.		507	44
Cryptochironomus fulvus gr.			29
Microtendipes rydalensis gr.		15	
Polypedilum halterale gr.			29
Procladius sp.		58	44
Tanytarsus sp.			15
Ceratopogonidae			
Culicoides sp.	15		
Annelida		159	15
Oligochaeta			
Tubificida			
Tubificidae			
Branchiura sowerbyi			
Ilyodrilus templetoni		145	101
Imm. Tub. with hair chaetae		188	
Limnodrilus cervix			362
Limnodrilus hoffmeisteri	232	725	1304
Limnodrilus sp.	826	5551	1580
Quistadrilus multisetosus	15	15	15
Varichaetadrilus fulleri	203		
Lumbricida			
Lumbricidae			
Lumbricidae	44	15	
Density (#/ sq m) (2)	1333	7449	3536
Species richness	6	12	11

Notes:
(1) Stations arranged in order from upstream to downstream.
(2) Densities represent averages of three replicate samples per station.

AR308631

TABLE 4
DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE CHURCHMAN'S MARSH DRAINAGEWAY
USING A PETITE PONAR BOTTOM GRAB
SEPTEMBER 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

TAXON	STATION NUMBER CMD 01
Arthropoda	
Insecta	
Diptera	
Chironomidae	
Chironomini	73
Chironomus deconus gr.	652
Coelotanypus sp.	15
Cryptochironomus fulvus gr.	15
Procladius sp.	1116
Tanytarsus sp.	29
Annelida	
Oligochaeta	
Tubificida	
Tubificidae	
Branchiura sowerbyi	29
Limnodrilus cervix	174
Limnodrilus hoffmeisteri	4406
Limnodrilus sp.	2319
Quistadrilus multisetosus	15
Density (#/sq m) (1)	8841
Species richness	11

Notes:
(1) Densities represent averages of three replicate samples per station.

AR308632

TABLE 5
DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE WEST CENTRAL DRAINAGEWAY
USING A PETITE PONAR BOTTOM GRAB
AUGUST 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

	STATION NUMBER (1)									
TAXON	SP 3	SP 2	SP 1	SP 4	WC03	WC02	WC05	WC04	WC06	WC01
Annelida										
Hirudinea										
Pharyngobdellida										
Erpobdellidae										
Erpobdella punctata punctata								73		
Mooreobdella fervida						29				29
Rhynchobdellida										
Glossiphoniidae										
Helobdella elongata				15						
Glossiphonia complanata				29						
Oligochaeta										
Lumbricida										
Lumbricidae										
Lumbricidae					101	797				
Lumbriculida										
Lumbriculus sp.					101					
Lumbriculus variegatus								29		
Tubificida										
Naididae										
Dero digitata		73								
Dero furcata			232							
Dero sp.								15		
Tubificidae										
Aulodrilus pluriseta		1304		44		130				
Branchiura sowerbyi										44
Ilyodrilus templetoni	15			58	15	44		420	87	
Limnodrilus cervix									2304	1391
Limnodrilus hoffmeisteri						551	1783	29	4493	2406
Limnodrilus sp.		4015	29	29	15	1000	6913	377	2203	5275
Limnodrilus udekemianus									159	
Tubifex sp.				87						
Quistadrilus multisetosus							58	1420	44	
Arthropoda										
Crustacea										
Amphipoda										
Gammaridae										
Gammarus fasciatus				29		58	2015	15		
Cumacea										
Nannastacidae										
Almyracuma proximoculi									15	
Isopoda										
Anthuridae										

Note:
(1) Stations arranged in order from upstream to downstream.
(2) Densities represent averages of three replicate samples per station.

AR308633

TABLE 5
DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE WEST CENTRAL DRAINAGEWAY
USING A PETITE PONAR BOTTOM GRAB
AUGUST 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

	STATION NUMBER (1)									
TAXON	SP 3	SP 2	SP 1	SP 4	WC03	WC02	WC05	WC04	WC06	WC01
Cyathura polita									15	
Asellidae										
Caecidotea sp.				290	29	15		536		
Dytiscidae					15					
Insecta										
Coleoptera										
Phyrganeidae										
Ptilostomis sp.				15						
Scirtidae										
Cyphon sp.		681								
Dytiscidae		15								
Hydroporus sp.		15								
Helochares sp.		15								
Diptera										
Ephydridae										44
Ceratopogonidae			522					377		
Ceratopogon sp.								493		
Ceratopogonidae									15	
Chironomidae										
Chironomini		15					15			
Chironomus decorus gr.			638					15	377	246
Cryptochironomus fulvus gr.								15	101	29
Paratendipes albimanus				15						
Polypedilum halterale gr.									203	44
Polypedilum illinoense						174				
Polypedilum scalaenum									15	
Polypedilum trigonus								304		
Polypedilum tritum			15							
Procladius sp.			29	15					188	174
Prodiamesa sp.				15						
Rheotanytarsus sp.							15			
Tanypodinae				15						
Tanytarsus sp.							145	246	232	174
Simulidae										
Simulium sp.				15						
Tabanidae										
Tabanus sp.						15				
Tipulidae										
Ormosia sp.					15	116				
Pilaria sp.	15	116								
Limnophila sp.								29		
Megaloptera										

Note:
(1) Stations arranged in order from upstream to downstream.
(2) Densities represent averages of three replicate samples per station.

AR308634

TABLE 5
DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE WEST CENTRAL DRAINAGEWAY
USING A PETITE PONAR BOTTOM GRAB
AUGUST 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

TAXON	STATION NUMBER (1)									
	SP 3	SP 2	SP 1	SP 4	WC03	WC02	WC05	WC04	WC06	WC01
Corydalidae										
Chauliodes sp.		44								
Odonata										
Libellulidae										
Libellula sp.			15	87	15					
Mollusca										
Bivalvia										
Veneroida										
Corbiculidae										
Corbicula fluminea									15	
Sphaeriidae										
Pisidium casertanum		913		957	203	348	87			15
Pisidium sp.		87					15			
Musculium sp.							130			
Gastropoda										
Basommatophora										
Lymnaeidae										
Pseudosuccinea columella		15		15	44					
Physidae										
Physa sp.								44		
Planorbidae										
Planorbella trivolvis gr.								44		
Gyraulis deflectus				29						
Nemertea										
Enopla										
Hoplonemertea										
Tetrastemmatidae										
Prostoma graecense								29		
Density (#/sq. m) (2	30	7308	1480	1759	551	3275	11174	4507	10464	9870
Species richness	2	14	8	20	10	12	10	20	15	12

Note:
(1) Stations arranged in order from upstream to downstream.
(2) Densities represent averages of three replicate samples per station.

AR308635

TABLE 6
DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE CHRISTINA RIVER
USING A PETITE PONAR BOTTOM GRAB
AUGUST 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

TAXON	STATION NUMBERS (1) RS15	CR04	CR02	CR03	CR01
Mollusca					
Bivalvia					
Veneroida					
Sphaeriidae					
Pisidium casertanum	15	29			
Sphaerium simile	44				
Arthropoda					
Crustacea					
Cumacea					
Nannastacidae					
Almyrcuma proximoculi	609		29	15	29
Arthropoda					
Crustacea					
Isopoda					
Idoteidae					
Chiridotea almyra					15
Anthuridae					
Cyathura polita	261		203		348
Arthropoda					
Crustacea					
Amphipoda					
Gammaridae					
Gammarus fasciatus	44	15			
Arthropoda					
Insecta					
Diptera					
Ceratopogonidae	15				15
Culicoides sp.				15	
Chironomidae					
Chironomus decorus gr.	15	29		15	29
Chironomini	58				
Cryptochironomus fulvus gr.	159	87	15	73	130
Dicrotendipes neomodestus				15	15
Glyptotendipes sp.				15	
Harnischia nr. curtilamellata		29			
Hyporhygma quadripunctatum				15	
Polypedilum halterale gr.			232	58	15
Polypedilum sp.	1609	130			
Procladius sp.		145	58		
Tanytarsus sp.	44				
Simuliidae					

Note:
(1) Stations arranged in order from upstream to downstream.
(2) Densities represent averages of three replicate samples per station.

AR308636

TABLE 6
DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE CHRISTINA RIVER
USING A PETITE PONAR BOTTOM GRAB
AUGUST 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

Simulium sp.	15				
Odonata					
Gomphidae					
Gomphus sp.			15		
Annelida					
Oligochaeta					
Tubificida					
Tubificidae					
Branchiura sowerbyi			44	29	
Ilyodrilus templetoni		15			
Imm. Tub. w/o hair chaetae		29			
Limnodrilus cervix		1812	261		
Limnodrilus hoffmeisteri	116	12377	2203	3130	
Limnodrilus sp.	899	4406	942		362
Limnodrilus udekemianus		348			
Quistadrilus multisetosus	29	44			
Annelida					
Oligochaeta					
Tubificida					
Naididae					
Specaria josinae		15			
Nais nr. variabilis		44			
Density (# / sq m) (2)	3928	19551	4000	3377	957
Species richness	15	16	10	11	10
Incidental species					
Nematoda				15	
Unidentified					15

Note:

(1) Stations arranged in order from upstream to downstream.

(2) Densities represent averages of three replicate samples per station.

AR308637

TABLE 7
DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE WHITE CLAY CREEK
USING A PETITE PONAR BOTTOM GRAB
AUGUST 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

TAXON	STATION NUMBERS (1)					
	EPA01	WH01	WH04	WH05	WH03	WH02
Arthropoda						
Insecta						
Diptera						
Ceratopogonidae		15		73		
Chironomidae						
Chironomini		261	15	15		
Chironomus decorus gr.		15		58		58
Cryptochironomus fulvus gr.		652	15	15	29	145
Dicrotendipes neomodestus		159				
Lenziella sp.		159				
Phaenopsectra sp.		58				
Polypedilum halterale gr.		261	391		826	87
Polypedilum illinoense		0	44			
Polypedilum scalaenum		913				
Polypedilum sp.			15			
Procladius sp.		15	44	87	15	188
Rheotanytarsus sp.		333				
Stictochironomus sp.		87				
Tanytarsus sp.	15	188	29			29
Larsia sp.		15				
Thienemannimyia gr.		29				
Tipulidae						
Pilaria sp.		15				
Ormosia sp.	73					
Coleoptera						
Elmidae						
Macronychus glabratus		15				
Odonata						
Gomphidae						
Gomphus sp.		15				
Aeschnidae						
Boyeria sp.		15				
Annelida						
Hirudinea						
Rhynchobdellida						
Glossiphoniidae						
Helobdella elongata		15		87		
Oligochaeta						
Tubificida						
Tubificidae						
Ilyodrilus templetoni			58	44		44
Branchiura sowerbyi			522	29		15

Notes:
(1) Stations arranged in order from upstream to down stream.
(2) Densities represent averages of three replicate samples per station.

AR308638

TABLE 7
DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE WHITE CLAY CREEK
USING A PETITE PONAR BOTTOM GRAB
AUGUST 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

	STATION NUMBERS (1)					
TAXON	EPA01	WH01	WH04	WH05	WH03	WH02
Limnodrilus cervix			725	58	652	
Limnodrilus hoffmeisteri	478	5377	10565	2797	8957	3899
Limnodrilus sp.	1899	8333	4754	2841	4174	1551
Lumbricida						
Lumbricidae						
Lumbricidae	435					
Lumbriculida						
Lumbriculidae						
Lumbriculus					145	
Lumbriculus variegatus						73
Mollusca						
Bivalvia						
Veneroida						
Sphaeriidae						
Pisidium casertanum		101	188		73	
Corbiculidae						
Corbicula fluminea			15			
Nemertea						
Enopla						
Hoplonemertea						
Tetrastemmatidae						
Prostoma graecense		29				
Density (#/ sq. m) (2)	2899	17073	17377	6102	14870	6087
Species richness	5	24	14	11	8	10

Notes:
(1) Stations arranged in order from upstream to down stream.
(2) Densities represent averages of three replicate samples per station.

AR308639

TABLE 8
DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE HERSHEY RUN
USING A PETITE PONAR BOTTOM GRAB
SEPTEMBER 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

TAXON	STATION NUMBERS (1) HR0	HR01	HR02	HR03	HR08	HR04
Annelida						
Hirudinea						
Rynchobdellida						
Glossiphiniidae						
Helobdella elongata						
Oligochaeta						
Lumbricida						
Lumbricidae						
Lumbricidae						
Lumbriculida						
Lumbriculidae						
Lumbriculidae						
Tubificida						
Tubificidae						
Aulodrilus pluriseta		15				
Branchiura sowerbyi						15
Ilyodrilus templetoni		15		44	44	15
Imm. Tub. with hair chaetae						
Limnodrilus cervix					29	
Limnodrilus hoffmeisteri			130	565		1855
Limnodrilus sp.	87	841	391	5420	304	1971
Quistadrilus multisetosus			15	73		
Naididae						
Dero digitata						
Dero sp.						
Naididae						
Arthropoda						
Crustacea						
Amphipoda						
Gammaridae						
Gammarus fasciatus			15		15	
Cumacea						
Nannastacidae						
Almyracuma proximoculi				58		
Isopoda						
Anthuridae						
Cyathura polita			377	681		
Asellidae						
Caecidotea sp.		15				
Arthropoda						
Insecta						

Notes:
(1) Stations arranged in order from upstream to downstream.
(2) Densitities represent averages of three replicate samples per station

TABLE 8
DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE HERSHEY RUN
USING A PETITE PONAR BOTTOM GRAB
SEPTEMBER 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

TAXON	STATION NUMBERS (1) HR0	HR01	HR02	HR03	HR08	HR04
Coleoptera						
Limnephilidae						
Copelatus sp.						
Noteridae						
Hydrocanthus sp.						
Diptera						
Ceratopogonidae						
Bezzia sp.						
Ceratopogonidae						44
Culicidae						
Aedes sp.						
Culex sp.						
Chironomidae						
Ablabesmyia sp.					14.5	
Chironomini			58	87		
Chironomus decorus					145	
Chironomus decorus gr.		15	188	188	44	1609
Chironomus sp.						
Cladopelma sp.				15		
Cryptochironomus fulvus gr.						15
Dicrotendipes neomodestus			188			
Glyptotendipes sp.		1580	44			
Monopelopia sp.						
Orthocladiinae						
Polypedilum halterale gr.			101	638		87
Polypedilum illinoense			58			
Polypedilum scalaenum				73		
Polypedilum sp.				87		
Polypedilum trigonus						
Procladius sp.		15		29	15	188
Tanypodinae				15		
Tanytarsus sp.			58			15
Thienemannimyia gr.	44					
Zavrelimyia sp.	15					
Tabanidae						
Chrysops sp.						
Tipulidae						
Ormosia sp.						
Pilaria sp.						
Limnophila sp.						
Megaloptera						
Corydaliddae						

Notes:
(1) Stations arranged in order from upstream to downstream.
(2) Densitities represent averages of three replicate samples per station.

AR308641

TABLE 8
DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE HERSHEY RUN
USING A PETITE PONAR BOTTOM GRAB
SEPTEMBER 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

	STATION NUMBERS (1)					
TAXON	HR0	HR01	HR02	HR03	HR08	HR04
Chauliodes sp.						
Arthropoda						
Insecta						
Odonata						
Coenagrionidae						
Argia sp.	15					
Enallagma sp.						
Trichoptera						
Hydropsychidae						
Hydropsyche sp.		15				
Mollusca						
Bivalvia						
Veneroida						
Corbiculidae						
Corbicula fluminea				15		
Sphaeriidae						
Pisidium casertanum				73		
Gastropoda						
Cephalaspidea						
Retusidae						
Retusa canaliculata				15		
Basommatophora						
Physidae						
Physa sp.						
Platyhelminthes						
Turbellaria						
Tricladida						
Planariidae						
Planariidae			58			
Density (#/ sq. m)	160	2638	1551	8073	608	5812
Species Richness	4	9	12	17	3	10

Notes:
(1) Stations arranged in order from upstream to downstream.
(2) Densitities represent averages of three replicate samples per station.

AR308642

TABLE 8
DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE HERSHEY RUN
USING A PETITE PONAR BOTTOM GRAB
SEPTEMBER 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

TAXON	STATION NUMBERS (1) HR05	HR06	HR07	FP 1	FP 2	FP 3
Annelida						
Hirudinea						
Rynchobdellida						
Glossiphiniidae						
Helobdella elongata			15			
Oligochaeta						
Lumbricida						
Lumbricidae						
Lumbricidae				1623	4652	
Lumbriculida						
Lumbriculidae						
Lumbriculidae				754		
Tubificida						
Tubificidae						
Aulodrilus pluriseta						73
Branchiura sowerbyi	145		58			
Ilyodrilus templetoni	29				29	
Imm. Tub. with hair chaetae					73	
Limnodrilus cervix	73		1971			
Limnodrilus hoffmeisteri	609	2986	8565			696
Limnodrilus sp.	2203	2261	12130		29	3754
Quistadrilus multisetosus	58		15			
Naididae						
Dero digitata					174	
Dero sp.						15
Naididae				58		
Arthropoda						
Crustacea						
Amphipoda						
Gammaridae						
Gammarus fasciatus		15				
Cumacea						
Nannastacidae						
Almyracuma proximoculi						
Isopoda						
Anthuridae						
Cyathura polita	29	73				
Asellidae						
Caecidotea sp.				15	44	
Arthropoda						
Insecta						

Notes:
(1) Stations arranged in order from upstream to downstream.
(2) Densitities represent averages of three replicate samples per station.

AR308643

TABLE 8
DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE HERSHEY RUN
USING A PETITE PONAR BOTTOM GRAB
SEPTEMBER 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

	STATION NUMBERS (1)					
TAXON	HR05	HR06	HR07	FP 1	FP 2	FP 3
Coleoptera						
Limnephilidae						
Copelatus sp.						15
Noteridae						
Hydrocanthus sp.					29	
Diptera						
Ceratopogonidae						
Bezzia sp.		15				
Ceratopogonidae			217	536	159	
Culicidae						
Aedes sp.				15		203
Culex sp.						391
Chironomidae						
Ablabesmyia sp.						
Chironomini	29	15				
Chironomus decorus						
Chironomus decorus gr.	87	29	116			
Chironomus sp.		29				
Cladopelma sp.						
Cryptochironomus fulvus gr.	73	73				
Dicrotendipes neomodestus						
Glyptotendipes sp.						
Monopelopia sp.				15	15	
Orthocladiinae	15					
Polypedilum halterale gr.		29	58			
Polypedilum illinoense						15
Polypedilum scalaenum						
Polypedilum sp.			73			
Polypedilum trigonus				116	29	
Procladius sp.	130	15	15			
Tanypodinae						
Tanytarsus sp.		44		15		
Thienemannimyia gr.						
Zavrelimyia sp.						
Tabanidae					15	
Chrysops sp.				15		
Tipulidae						
Ormosia sp.					15	29
Pilaria sp.				15	29	116
Limnophila sp.					44	44
Megaloptera						
Corydaliddae						

Notes:
(1) Stations arranged in order from upstream to downstream.
(2) Densitities represent averages of three replicate samples per station.

AR308644

TABLE 8
DENSITIES OF MACROINVERTEBRATES COLLECTED IN THE HERSHEY RUN
USING A PETITE PONAR BOTTOM GRAB
SEPTEMBER 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

	STATION NUMBERS (1)					
TAXON	HR05	HR06	HR07	FP 1	FP 2	FP 3
Chauliodes sp.				58		
Arthropoda						
Insecta						
Odonata						
Coenagrionidae						
Argia sp.						
Enallagma sp.				87	159	
Trichoptera						
Hydropsychidae						
Hydropsyche sp.						
Mollusca						
Bivalvia						
Veneroida						
Corbiculidae						
Corbicula fluminea						
Sphaeriidae						
Pisidium casertanum			101			464
Gastropoda						
Cephalaspidea						
Retusidae						
Retusa canaliculata						
Basommatophora						
Physidae						
Physa sp.						44
Platyhelminthes						
Turbellaria						
Tricladida						
Planariidae						
Planariidae						
Density (#/ sq. m)	3478	5580	23333	3322	5495	5859
Species Richness	12	12	12	16	17	14

Notes:
(1) Stations arranged in order from upstream to downstream.
(2) Densitities represent averages of three replicate samples per station.

AR308645

TABLE 9
DENSITIES OF MACROINVERTEBRATES COLLECTED IN K AREA
USING A PETITE PONAR BOTTOM GRAB
AUGUST 1994
FORMER KOPPERS COMPANY INC - NEWPORT SITE

TAXON	STATION NUMBER KP01
Arthropoda	
Insecta	
Diptera	
Chironomidae	
Chironomini	15
Chironomus decorus gr.	1058
Polypedilum trigonus	15
Annelida	
Oligochaeta	
Tubificida	
Tubificidae	
Ilyodrilus templetoni	15
Limnodrilus sp.	681
Density (#/ sq. m) (1)	1783
Species Richness	5

(1) Densities represent averages of three replicate samples per station

AR308646

TABLE A1-1
SUMMARY OF DETECTED METALS (MG/KG) IN SOIL
AREA: PAOI-1
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
Aluminum	57	57	1980.0	24000.0	13289.1
Antimony	57	17	0.5	1.2	0.8.
Arsenic	57	51	0.9	12.7	4.2
Barium	57	57	15.1	491.0	115.1
Beryllium	57	55	0.3	2.1	0.9
Cadmium	57	5	0.3	12.3	2.8
Calcium	57	57	133.0	84800.0	7056.3
Chromium	57	57	5.8	47.0	23.9
Cobalt	57	55	3.0	19.9	8.4
Copper	57	57	1.4	68.5	11.8
Iron	57	57	4710.0	32200.0	17967.7
Lead	57	57	1.8	566.0	22.5
Magnesium	57	57	292.0	27700.0	3722.0
Manganese	57	57	43.6	15100.0	618.7
Mercury	56	19	0.0	4.2	0.5
Nickel	57	56	3.4	28.6	12.3
Potassium	57	57	164.0	1660.0	953.0
Selenium	57	10	0.3	1.7	1.0
Sodium	57	57	44.0	1460.0	172.2
Thallium	57	10	0.6	13.2	4.1
Vanadium	57	57	8.9	153.0	43.3
Zinc	57	57	5.2	2500.0	81.9
SURFACE SOIL					
Aluminum	17	17	6020.0	35900.0	15051.2
Antimony	17	11	0.5	1.4	0.9
Arsenic	17	16	1.7	9.9	4.7
Barium	17	17	21.1	1040.0	347.9
Beryllium	17	17	0.4	3.9	1.4
Cadmium	17	6	0.2	0.5	0.4
Calcium	17	17	592.0	161000.0	36687.9
Chromium	17	17	6.5	80.5	24.6
Cobalt	17	17	4.1	12.0	6.8
Copper	17	17	1.4	134.0	28.4
Iron	17	17	4430.0	22700.0	15101.8
Lead	17	17	3.8	400.0	49.6
Magnesium	17	17	307.0	49000.0	10873.4
Manganese	17	17	207.0	7160.0	1754.7
Mercury	17	6	0.1	3.0	1.3
Nickel	17	17	4.0	51.8	12.5
Potassium	17	17	172.0	2100.0	966.6
Selenium	17	2	1.1	2.3	1.7
Sodium	17	17	27.8	2740.0	554.7
Thallium	17	12	1.6	44.4	8.8
Vanadium	17	16	9.0	295.0	74.2
Zinc	17	17	6.4	168.0	64.8

Note: Data not normalized

AR308647

TABLE A-2
SUMMARY OF DETECTED METALS (MG/KG) IN SOIL
AREA PA01-2
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
Aluminum	34	34	7410.0	27300.0	13372.9
Antimony	34	4	0.5	1.2	1.8
Arsenic	34	31	1.0	5.1	3.6
Barium	34	34	40.8	283.0	65.5
Beryllium	34	34	0.5	2.6	0.9
Calcium	34	34	339.0	114000.0	5426.9
Chromium	34	34	12.6	63.5	28.7
Cobalt	34	33	3.5	12.4	7.4
Copper	34	34	6.0	30.3	11.8
Iron	34	34	7970.0	48600.0	20320.8
Lead	34	34	4.0	21.8	9.3
Magnesium	34	34	1410.0	38700.0	4107.6
Manganese	34	34	42.3	1100.0	233.6
Mercury	34	5	0.0	0.3	0.1
Nickel	34	34	7.1	28.3	12.9
Potassium	34	34	468.0	5300.0	1263.3
Selenium	34	3	0.6	1.6	1.1
Sodium	34	34	50.9	311.0	122.2
Thallium	34	3	0.3	1.9	0.9
Vanadium	34	34	22.4	102.0	45.4
Zinc	34	34	19.2	87.1	34.5
SURFACE SOIL					
Aluminum	12	12	2070.0	31900.0	17233.0
Antimony	12	4	0.8	1.4	1.0
Arsenic	12	11	1.5	14.0	5.8
Barium	12	12	39.6	1530.0	568.2
Beryllium	12	12	0.3	3.9	1.8
Cadmium	12	4	0.3	0.5	0.4
Calcium	12	11	670.0	178000.0	76848.2
Chromium	12	12	3.7	35.8	15.4
Cobalt	12	9	3.1	7.1	5.5
Copper	12	12	7.3	528.0	61.3
Iron	12	12	4990.0	20900.0	13139.3
Lead	12	12	9.1	137.0	43.3
Magnesium	12	12	518.0	42600.0	15585.5
Manganese	12	12	43.6	5440.0	1829.1
Mercury	12	6	0.1	0.2	0.1
Nickel	12	12	4.2	10.5	7.4
Potassium	12	12	306.0	3060.0	1575.1
Selenium	12	3	1.0	1.6	1.3
Silver	12	1	1.1	1.1	1.1
Sodium	12	12	52.5	2350.0	922.8
Thallium	12	6	2.0	11.7	6.4
Vanadium	12	12	7.6	233.0	55.9

AR306649

TABLE A1-2
SUMMARY OF DETECTED METALS (MG/KG) IN SOIL
AREA: PAOI-2
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Zinc	12	12	21.6	311.0	83.3
Note: Data Not Normalized					

AR308649

TABLE A1-3
SUMMARY OF DETECTED METALS (MG/KG) IN SOIL
AREA: PAOI-3
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
Aluminum	12	12	7900.0	21700.0	14959.2
Antimony	12	5	0.7	1.0	0.8
Arsenic	12	11	1.3	4.2	3.0
Barium	12	12	35.1	132.0	88.7
Beryllium	12	12	0.3	1.3	0.8
Calcium	12	12	257.0	1230.0	623.4
Chromium	12	12	15.2	70.8	32.6
Cobalt	12	12	3.1	21.8	8.9
Copper	12	12	6.4	23.5	15.5
Iron	12	12	13000.0	44100.0	22683.3
Lead	12	12	4.8	12.9	8.9
Magnesium	12	12	962.0	6940.0	3590.2
Manganese	12	12	35.9	474.0	205.4
Mercury	12	2	0.0	0.0	0.0
Nickel	12	12	5.5	24.6	15.6
Potassium	12	12	513.0	4680.0	2169.9
Selenium	12	3	0.5	1.3	0.9
Sodium	12	12	40.1	130.0	75.5
Thallium	12	4	0.6	2.2	1.6
Vanadium	12	12	26.7	75.8	51.6
Zinc	12	12	17.8	65.6	42.7
SURFACE SOIL					
Aluminum	2	2	8930.0	18400.0	13665.0
Antimony	2	2	0.8	1.0	0.9
Arsenic	2	2	3.9	3.9	3.9
Barium	2	2	73.9	108.0	91.0
Beryllium	2	2	0.5	0.7	0.6
Calcium	2	2	791.0	1310.0	1050.5
Chromium	2	2	27.1	37.8	32.5
Cobalt	2	2	6.1	11.0	8.6
Copper	2	2	15.0	19.9	17.5
Iron	2	2	22700.0	24400.0	23550.0
Lead	2	2	35.1	104.0	69.6
Magnesium	2	2	1670.0	4250.0	2960.0
Manganese	2	2	180.0	187.0	183.5
Nickel	2	2	10.3	20.2	15.3
Potassium	2	2	1130.0	2130.0	1630.0
Sodium	2	2	57.1	96.6	76.9
Vanadium	2	2	48.4	66.0	57.2
Zinc	2	2	40.4	56.0	48.2

Note: Data Not Normalized

AR308650

TABLE A1-4
SUMMARY OF DETECTED METALS (MG/KG) IN SOIL
AREA: PAOI-4
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
Aluminum	14	14	8000.0	14700.0	9968.6
Antimony	14	4	0.9	1.1	1.0
Arsenic	14	14	2.0	6.0	3.8
Barium	14	14	30.5	357.0	121.1
Beryllium	14	14	0.5	1.4	1.0
Calcium	14	14	226.0	2470.0	719.6
Chromium	14	14	14.6	35.4	20.1
Cobalt	14	14	2.9	17.9	7.2
Copper	14	14	4.5	17.2	9.5
Iron	14	14	11400.0	29200.0	16214.3
Lead	14	14	5.5	49.1	15.0
Magnesium	14	14	1150.0	3040.0	1847.1
Manganese	14	14	47.7	432.0	167.2
Mercury	14	4	0.1	0.1	0.1
Nickel	14	14	6.7	18.0	10.6
Potassium	14	14	344.0	1600.0	732.9
Sodium	14	14	40.3	113.0	67.0
Vanadium	14	14	23.9	67.5	35.2
Zinc	14	14	17.0	89.3	37.8
SURFACE SOIL					
Aluminum	3	3	9110.0	9690.0	9433.3
Antimony	3	3	0.8	1.1	0.9
Arsenic	3	3	9.6	11.1	10.2
Barium	3	3	64.8	497.0	323.9
Beryllium	3	3	1.2	1.7	1.5
Calcium	3	3	349.0	3710.0	1603.7
Chromium	3	3	17.3	24.5	20.3
Cobalt	3	3	5.3	46.4	25.3
Copper	3	3	7.2	23.6	14.5
Iron	3	3	13000.0	31200.0	24500.0
Lead	3	3	9.8	68.2	45.5
Magnesium	3	3	718.0	2900.0	1849.3
Manganese	3	3	549.0	4430.0	1863.0
Mercury	3	1	0.1	0.1	0.1
Nickel	3	3	7.0	13.1	10.4
Potassium	3	3	295.0	1000.0	620.7
Selenium	3	2	1.1	1.3	1.2
Sodium	3	3	45.7	78.4	61.0
Thallium	3	1	5.3	5.3	5.3
Vanadium	3	3	52.6	100.0	72.2
Zinc	3	3	40.1	165.0	81.9

Note: Data Not Normalized

AR308651

TABLE A1-5
SUMMARY OF DETECTED METALS (MG/KG) IN SOIL
AREA: PAOI-6
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
Aluminum	45	45	1130.0	20000.0	11886.2
Antimony	45	17	0.7	1.9	1.0
Arsenic	45	41	1.1	36.5	4.6
Barium	45	45	5.9	297.0	84.8
Beryllium	45	45	0.4	1.4	0.8
Cadmium	45	11	0.1	2.2	0.3
Calcium	45	45	101.0	7080.0	868.7
Chromium	45	45	13.8	110.0	28.8
Cobalt	45	44	2.9	20.9	9.1
Copper	45	45	2.6	194.0	16.9
Iron	45	45	7600.0	75400.0	23382.2
Lead	45	45	1.9	106.0	12.0
Magnesium	45	45	120.0	5270.0	2843.5
Manganese	45	45	15.1	704.0	257.8
Mercury	45	13	0.0	8.8	0.8
Nickel	45	45	5.1	42.8	13.3
Potassium	45	45	47.8	5310.0	1718.1
Selenium	45	12	0.8	3.1	1.2
Sodium	45	45	33.2	795.0	326.9
Thallium	45	4	0.5	13.9	4.8
Vanadium	45	45	20.8	205.0	49.5
Zinc	45	45	7.9	133.0	43.3
SURFACE SOIL					
Aluminum	14	14	4870.0	13700.0	9096.4
Antimony	14	10	0.8	1.4	1.0
Arsenic	14	14	3.5	11.7	5.7
Barium	14	14	73.3	350.0	179.9
Beryllium	14	14	0.4	1.2	0.7
Cadmium	14	9	0.1	0.5	0.3
Calcium	14	14	275.0	9780.0	2165.4
Chromium	14	14	9.7	26.1	19.6
Cobalt	14	14	3.0	10.0	6.6
Copper	14	14	8.7	35.0	18.2
Iron	14	14	11200.0	23200.0	17764.3
Lead	14	14	15.7	129.0	48.7
Magnesium	14	14	1120.0	2780.0	1922.9
Manganese	14	14	94.6	658.0	324.3
Mercury	14	8	0.1	1.6	0.6
Nickel	14	14	6.1	14.4	11.0
Potassium	14	14	525.0	1400.0	918.5
Selenium	14	4	0.6	1.8	1.1
Sodium	14	14	66.4	795.0	444.3
Thallium	14	1	0.4	0.4	0.4
Vanadium	14	14	16.9	61.6	36.9

AR308652

TABLE A1-5
SUMMARY OF DETECTED METALS (MG/KG) IN SOIL
AREA: PAOI-6
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Zinc	14	14	28.2	221.0	86.2
Note: Data Not Normalized					

AR308653

TABLE A1-6
SUMMARY OF DETECTED METALS (MG/KG) IN SOIL
AREA: PAOI-7
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Aluminum	8	8	4990.0	17800.0	12038.8
Antimony	8	1	3.7	3.7	3.7
Arsenic	8	8	1.2	6.0	3.6
Barium	8	8	24.4	141.0	88.6
Beryllium	8	7	0.4	0.8	0.6
Cadmium	8	1	0.1	0.1	0.1
Calcium	8	8	149.0	14500.0	2444.8
Chromium	8	8	9.7	50.1	30.7
Cobalt	8	8	3.4	16.0	9.8
Copper	8	8	1.8	31.1	16.4
Iron	8	8	6890.0	29200.0	21123.8
Lead	8	8	4.3	72.3	20.7
Magnesium	8	8	708.0	7780.0	3703.5
Manganese	8	8	106.0	331.0	219.4
Mercury	8	1	0.1	0.1	0.1
Nickel	8	8	4.8	21.4	14.6
Potassium	8	8	581.0	4560.0	2070.1
Selenium	8	2	0.9	1.0	1.0
Sodium	8	8	62.4	653.0	234.2
Vanadium	8	8	18.5	60.1	43.4
Zinc	8	8	13.4	89.7	52.1
Aluminum	8	8	3300.0	19300.0	10538.8
Antimony	8	2	0.9	4.3	2.6
Arsenic	8	8	2.2	7.4	5.3
Barium	8	8	42.6	345.0	206.4
Beryllium	8	8	0.2	1.1	0.7
Cadmium	8	2	0.2	0.5	0.3
Calcium	8	8	720.0	74400.0	10633.6
Chromium	8	8	7.4	39.6	20.7
Cobalt	8	8	3.0	15.3	8.7
Copper	8	8	10.6	34.3	20.5
Iron	8	8	8230.0	27100.0	16316.3
Lead	8	8	18.3	176.0	83.7
Magnesium	8	8	1060.0	40200.0	6967.5
Manganese	8	8	147.0	1060.0	497.8
Mercury	8	3	0.1	0.3	0.2
Nickel	8	8	5.1	26.4	12.5
Potassium	8	8	647.0	1860.0	1007.8
Selenium	8	2	1.6	2.1	1.9
Sodium	8	8	51.3	716.0	235.1
Vanadium	8	8	17.3	62.8	36.0
Zinc	8	8	38.7	420.0	133.4

Note: Data Not Normalized

AR308654

TABLE A2-1
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN SOIL
AREA: PAOI-1
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
2-Butanone	57	5	5.0	25.0	13.2
2-Hexanone	57	1	6.0	6.0	6.0
Acetone	57	25	3.0	1300.0	129.8
Benzene	57	5	14.0	530.0	247.0
Carbon Disulfide	57	2	4.0	5.0	4.5
Ethylbenzene	57	15	2.0	4300.0	870.1
Methylene Chloride	57	26	2.0	610.0	45.5
Styrene	57	7	5.0	3100.0	1217.7
Tetrachloroethene	57	21	3.0	23.0	9.9
Toluene	57	13	2.0	5700.0	958.8
Xylenes (total)	57	17	2.5	24300.0	3507.2
SURFACE SOIL					
Benzene	18	1	5.0	5.0	5.0
Chloroform	18	1	5.0	5.0	5.0
Ethylbenzene	17	4	4.0	74.0	22.8
Methylene Chloride	17	7	5.0	17.0	10.4
Tetrachloroethene	17	15	4.0	37.0	13.2
Toluene	17	7	4.0	65.0	18.4
Xylenes (total)	17	5	3.3	233.0	55.4

AR308655

TABLE A2-2
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN SOIL
AREA: PAOI-2
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
2-Butanone	33	3	8.0	30.0	18.3
Acetone	33	15	7.0	260.0	50.5
Benzene	33	1	30.0	30.0	30.0
Carbon Disulfide	33	3	5.0	7.0	6.3
Chloroform	33	4	3.0	3.0	3.0
Ethylbenzene	33	1	72.0	72.0	72.0
Methylene Chloride	33	17	1.0	17.0	7.4
Styrene	33	1	44.0	44.0	44.0
Tetrachloroethene	33	2	3.0	3.0	3.0
Toluene	33	5	3.0	110.0	27.6
Xylenes (total)	33	4	2.0	390.0	99.4
SURFACE SOIL					
Chloroform	12	2	3.0	3.0	3.0
Methylene Chloride	12	10	3.0	18.0	8.8
Tetrachloroethene	12	8	4.0	74.0	16.6
Toluene	12	5	4.0	25.0	10.8

AR308656

TABLE A2-3
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN SOIL
AREA: PAOI-3
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
Acetone	12	5	11.0	73.0	28.4
Chloroform	12	1	4.0	4.0	4.0
Ethylbenzene	12	1	11.0	11.0	11.0
Methylene Chloride	12	7	2.0	9.0	5.6
Tetrachloroethene	12	3	10.0	39.0	21.7
Toluene	12	3	2.0	7.0	4.0
Xylenes (total)	12	1	54.0	54.0	54.0
SURFACE SOIL					
Acetone	2	1	50.0	50.0	50.0
Ethylbenzene	2	1	5.0	5.0	5.0
Tetrachloroethene	2	2	4.0	37.0	20.5
Toluene	2	1	10.0	10.0	10.0
Xylenes (total)	2	1	4.0	4.0	4.0

AR308657

TABLE A2-4
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN SOIL
AREA: PAOI-4
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
Acetone	14	3	54.0	82.0	64.7
Ethylbenzene	14	1	30.0	30.0	30.0
Methylene Chloride	14	11	4.0	12.0	6.3
Styrene	14	1	22.0	22.0	22.0
Tetrachloroethene	14	2	3.0	7.0	5.0
Toluene	14	4	2.0	18.0	6.8
Xylenes (total)	14	2	10.3	350.0	180.2
SURFACE SOIL					
Methylene Chloride	3	2	4.0	6.0	5.0
Tetrachloroethene	3	1	5.0	5.0	5.0

AR308658

TABLE A2-5
SUMMARY OF DETECTED METALS (MG/KG) IN SOIL
AREA: PAOI-6
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
SUBSURFACE SOIL					
Acetone	45	20	3.0	1800.0	311.4
Benzene	45	3	3.0	21000.0	9034.3
Carbon Disulfide	45	4	3.0	20.0	9.3
Ethylbenzene	45	3	3.0	67000.0	29667.7
Methylene Chloride	45	15	1.0	500.0	39.6
Styrene	45	2	14000.0	43000.0	28500.0
Toluene	45	10	3.0	63000.0	8106.2
Xylenes (total)	45	2	52000.0	171000.0	111500.0
SURFACE SOIL					
1,1,1-Trichloroethane	24	3	3.0	3.0	3.0
Acetone	25	5	7.0	17.0	10.8
Carbon Disulfide	25	13	3.0	23.0	12.2
Ethylbenzene	24	2	4.0	4.0	4.0
Methylene Chloride	25	11	4.0	10.0	6.8
Toluene	24	16	3.0	43.0	11.7
Xylenes (total)	24	2	5.7	5.7	5.7

AR308659

TABLE A2-6
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN SOIL
AREA: PAOI-7
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Acetone	8	5	570.0	3400.0	1714.0
Acetone	9	4	7.0	580.0	158.8
Tetrachloroethene	8	1	5.0	5.0	5.0
Toluene	8	3	7.0	15.0	10.0

AR308660

TABLE A3-1
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN SOIL
AREA: PAOI-1
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
1,1,2,2-Tetrachloroethane	11	11	100.0	400.0	227.3
2-Methylnaphthalene	57	14	140.0	610000.0	163982.1
Acenaphthene	57	17	180.0	790000.0	189421.8
Acenaphthylene	57	4	59.0	44000.0	11056.5
Anthracene	57	20	110.0	860000.0	103322.0
Benzo(a)anthracene	57	30	130.0	310000.0	33602.7
Benzo(a)pyrene	57	23	100.0	90000.0	10083.9
Benzo(b)fluoranthene	57	28	150.0	180000.0	19235.0
Benzo(g,h,i)perylene	57	18	110.0	170000.0	13678.9
Benzo(k)fluoranthene	57	16	120.0	65000.0	12008.8
Carbazole	57	15	72.0	300000.0	49313.9
Chrysene	57	31	91.0	200000.0	29444.5
Di-n-butylphthalate	57	21	29.0	500.0	174.4
Dibenz(a,h)anthracene	57	9	74.0	130000.0	15277.2
Dibenzofuran	57	17	270.0	580000.0	133449.4
Diethylphthalate	57	2	55.0	100.0	77.5
Fluoranthene	57	33	130.0	1200000.0	133308.2
Fluorene	57	21	66.0	770000.0	143409.2
Indeno(1,2,3-c,d)pyrene	57	19	56.0	95000.0	9100.8
Naphthalene	57	17	35.0	3000000.0	447377.9
Pentachlorophenol	57	2	130.0	5500.0	2815.0
Phenanthrene	57	31	44.0	2100000.0	259313.9
Pyrene	57	35	41.0	850000.0	96842.9
bis(2-Ethylhexyl)phthalate	57	8	47.0	790.0	203.5
1,1,2,2-Tetrachloroethane	2	2	100.0	300.0	200.0
2-Methylnaphthalene	17	2	820.0	880.0	850.0
Acenaphthene	17	2	500.0	2900.0	1700.0
Anthracene	17	9	140.0	260000.0	34896.7
Benzo(a)anthracene	17	14	380.0	170000.0	43462.9
Benzo(a)pyrene	17	14	340.0	240000.0	40646.4
Benzo(b)fluoranthene	17	14	930.0	370000.0	76209.3
Benzo(g,h,i)perylene	17	14	340.0	94000.0	24690.7
Benzo(k)fluoranthene	17	13	170.0	110000.0	26560.8
Carbazole	17	4	98.0	65000.0	17634.5
Chrysene	17	14	560.0	260000.0	48890.0
Di-n-butylphthalate	17	2	190.0	210.0	200.0
Dibenz(a,h)anthracene	17	8	440.0	22000.0	8078.8
Dibenzofuran	17	3	1000.0	12000.0	4900.0
Fluoranthene	17	15	94.0	370000.0	58289.6
Fluorene	17	2	950.0	27000.0	13975.0
Indeno(1,2,3-c,d)pyrene	17	14	300.0	110000.0	25022.1
Naphthalene	17	2	2100.0	3100.0	2600.0
Pentachlorophenol	17	1	650.0	650.0	650.0
Phenanthrene	17	12	130.0	35000.0	7827.1
Pyrene	17	14	510.0	190000.0	51879.3

AR308661

TABLE A3-2
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN SOIL
AREA: PAOI-2
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
2-Methylnaphthalene	34	3	200.0	970.0	500.0
Acenaphthene	34	3	630.0	1500.0	956.7
Acenaphthylene	34	1	84.0	84.0	84.0
Anthracene	34	7	83.0	5000.0	1311.4
Benzo(a)anthracene	34	16	110.0	1100.0	430.0
Benzo(a)pyrene	34	12	84.0	1400.0	390.3
Benzo(b)fluoranthene	34	17	85.0	2800.0	690.9
Benzo(g,h,i)perylene	34	10	84.0	1800.0	385.9
Benzo(k)fluoranthene	34	11	91.0	730.0	294.6
Carbazole	34	4	47.0	2800.0	1061.8
Chrysene	34	18	72.0	1800.0	510.2
Di-n-butylphthalate	34	27	83.0	530.0	200.9
Dibenz(a,h)anthracene	34	4	100.0	370.0	217.5
Dibenzofuran	34	3	550.0	1100.0	780.0
Diethylphthalate	34	1	26.0	26.0	26.0
Fluoranthene	34	20	82.0	3000.0	943.5
Fluorene	34	3	770.0	1600.0	1156.7
Indeno(1,2,3-c,d)pyrene	34	8	110.0	1300.0	453.8
Naphthalene	34	3	140.0	2400.0	1093.3
Pentachlorophenol	34	1	1000.0	1000.0	1000.0
Phenanthrene	34	11	41.0	4600.0	1141.9
Pyrene	34	19	83.0	2400.0	825.4
bis(2-Ethylhexyl)phthalate	34	3	42.0	83.0	57.3
SURFACE SOIL					
Acenaphthene	11	1	1800.0	1800.0	1800.0
Anthracene	11	5	470.0	11000.0	3344.0
Benzo(a)anthracene	11	11	1800.0	140000.0	41336.4
Benzo(a)pyrene	11	11	2300.0	96000.0	25100.0
Benzo(b)fluoranthene	11	11	4700.0	230000.0	58363.6
Benzo(g,h,i)perylene	11	10	1600.0	32000.0	16570.0
Benzo(k)fluoranthene	11	11	760.0	110000.0	24450.9
Carbazole	11	3	480.0	2800.0	1893.3
Chrysene	11	11	2100.0	130000.0	35672.7
Dibenz(a,h)anthracene	11	11	390.0	13000.0	4340.9
Fluoranthene	11	11	3600.0	150000.0	50490.9
Indeno(1,2,3-c,d)pyrene	11	11	370.0	70000.0	23242.7
Phenanthrene	11	10	460.0	16000.0	5296.0
Pyrene	11	11	2800.0	200000.0	56518.2

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TABLE A3-3
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN SOIL
AREA: PAOI-3
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
2-Methylnaphthalene	12	1	12000.0	12000.0	12000.0
Acenaphthene	12	2	44.0	39000.0	19522.0
Anthracene	12	5	44.0	150000.0	30390.8
Benzo(a)anthracene	12	5	72.0	33000.0	8094.4
Benzo(a)pyrene	12	4	42.0	11000.0	4360.5
Benzo(b)fluoranthene	12	5	120.0	24000.0	6884.0
Benzo(g,h,i)perylene	12	3	790.0	2300.0	1496.7
Benzo(k)fluoranthene	12	4	910.0	8000.0	3152.5
Carbazole	12	2	230.0	48000.0	24115.0
Chrysene	12	5	94.0	37000.0	8798.8
Di-n-butylphthalate	12	4	130.0	270.0	207.5
Dibenz(a,h)anthracene	12	3	280.0	600.0	440.0
Dibenzofuran	12	3	52.0	31000.0	10379.0
Diethylphthalate	12	1	44.0	44.0	44.0
Fluoranthene	12	6	190.0	160000.0	27881.7
Fluorene	12	4	47.0	57000.0	14306.8
Indeno(1,2,3-c,d)pyrene	12	3	870.0	1700.0	1190.0
Naphthalene	12	3	91.0	21000.0	7147.0
Phenanthrene	12	6	190.0	160000.0	26950.0
Pyrene	12	6	130.0	120000.0	21500.0
bis(2-Ethylhexyl)phthalate	12	2	110.0	140.0	125.0
SURFACE SOIL					
Anthracene	2	2	53.0	13000.0	6526.5
Benzo(a)anthracene	2	2	1300.0	53000.0	27150.0
Benzo(a)pyrene	2	2	460.0	11000.0	5730.0
Benzo(b)fluoranthene	2	2	1300.0	48000.0	24650.0
Benzo(g,h,i)perylene	2	2	290.0	7400.0	3845.0
Benzo(k)fluoranthene	2	2	450.0	56000.0	28225.0
Carbazole	2	1	40.0	40.0	40.0
Chrysene	2	2	940.0	77000.0	38970.0
Di-n-butylphthalate	2	1	220.0	220.0	220.0
Dibenz(a,h)anthracene	2	1	63.0	63.0	63.0
Fluoranthene	2	2	1400.0	140000.0	70700.0
Indeno(1,2,3-c,d)pyrene	2	2	320.0	8300.0	4310.0
Phenanthrene	2	1	140.0	140.0	140.0
Pyrene	2	2	1600.0	130000.0	65800.0
bis(2-Ethylhexyl)phthalate	2	1	67.0	67.0	67.0

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TABLE A3-4
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN SOIL
AREA: PAOI-4
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
2-Methylnaphthalene	14	2	350.0	120000.0	60175.0
Acenaphthene	14	2	800.0	260000.0	130400.0
Acenaphthylene	14	1	10000.0	10000.0	10000.0
Anthracene	14	4	280.0	130000.0	34220.0
Benzo(a)anthracene	14	7	360.0	87000.0	29537.1
Benzo(a)pyrene	14	6	210.0	32000.0	10723.3
Benzo(b)fluoranthene	14	7	320.0	97000.0	29524.3
Benzo(g,h,i)perylene	14	5	130.0	48000.0	14348.0
Benzo(k)fluoranthene	14	7	230.0	69000.0	15225.7
Butylbenzylphthalate	14	1	160.0	160.0	160.0
Carbazole	14	3	800.0	52000.0	18666.7
Chrysene	14	7	340.0	81000.0	26980.0
Di-n-butylphthalate	14	5	90.0	160.0	112.0
Dibenz(a,h)anthracene	14	3	820.0	14000.0	8273.3
Dibenzofuran	14	2	1100.0	150000.0	75550.0
Fluoranthene	14	8	150.0	390000.0	72611.3
Fluorene	14	3	550.0	230000.0	77250.0
Indeno(1,2,3-c,d)pyrene	14	4	230.0	58000.0	20657.5
Naphthalene	14	2	1900.0	390000.0	195950.0
Phenanthrene	14	8	77.0	670000.0	86598.8
Pyrene	14	8	110.0	320000.0	64615.0
bis(2-Ethylhexyl)phthalate	14	1	140.0	140.0	140.0
SURFACE SOIL					
Anthracene	3	1	11000.0	11000.0	11000.0
Benzo(a)anthracene	3	2	380.0	120000.0	60190.0
Benzo(a)pyrene	3	1	150000.0	150000.0	150000.0
Benzo(b)fluoranthene	3	2	290.0	300000.0	150145.0
Benzo(g,h,i)perylene	3	1	160000.0	160000.0	160000.0
Benzo(k)fluoranthene	3	2	150.0	110000.0	55075.0
Butylbenzylphthalate	3	1	170.0	170.0	170.0
Chrysene	3	2	260.0	130000.0	65130.0
Di-n-butylphthalate	3	1	90.0	90.0	90.0
Dibenz(a,h)anthracene	3	1	28000.0	28000.0	28000.0
Fluoranthene	3	2	550.0	270000.0	135275.0
Indeno(1,2,3-c,d)pyrene	3	1	140000.0	140000.0	140000.0
Phenanthrene	3	2	310.0	22000.0	11155.0
Pyrene	3	2	670.0	250000.0	125335.0

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TABLE A3-5
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN SOIL
AREA: PAOI-6
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
1,1,2,2-Tetrachloroethane	7	6	100.0	200.0	166.7
1,2-Dichlorobenzene	47	1	370.0	370.0	370.0
1,3-Dichlorobenzene	47	1	54.0	54.0	54.0
1,4-Dichlorobenzene	47	1	730.0	730.0	730.0
2,4-Dimethylphenol	47	2	90000.0	140000.0	115000.0
2-Methylnaphthalene	47	3	150.0	3600000.0	1900050.0
2-Methylphenol	47	2	73000.0	110000.0	91500.0
4-Methylphenol	47	2	230000.0	320000.0	275000.0
Acenaphthene	47	6	110.0	4200000.0	1033428.3
Acenaphthylene	47	2	51000.0	120000.0	85500.0
Anthracene	47	10	98.0	7500000.0	1421566.8
Benzo(a)anthracene	47	13	64.0	810000.0	89947.6
Benzo(a)pyrene	47	10	50.0	370000.0	59982.0
Benzo(b)fluoranthene	47	13	110.0	390000.0	52534.6
Benzo(g,h,i)perylene	47	8	120.0	120000.0	24237.5
Benzo(k)fluoranthene	47	8	200.0	240000.0	43051.3
Carbazole	47	7	140.0	9200000.0	2071775.7
Chrysene	47	11	80.0	810000.0	113565.8
Di-n-butylphthalate	47	20	88.0	480.0	208.1
Dibenz(a,h)anthracene	47	5	210.0	49000.0	11864.0
Dibenzofuran	47	6	100.0	3700000.0	950086.7
Fluoranthene	47	18	79.0	3900000.0	329235.9
Fluorene	47	8	89.0	5900000.0	1150111.1
Indeno(1,2,3-c,d)pyrene	47	8	120.0	130000.0	26532.5
Naphthalene	47	8	52.0	#########	2012725.3
Pentachlorophenol	47	2	35000.0	82000.0	58500.0
Phenanthrene	47	14	130.0	#########	1236685.0
Phenol	47	2	170000.0	220000.0	195000.0
Pyrene	47	20	52.0	2900000.0	199066.5
bis(2-Ethylhexyl)phthalate	47	7	45.0	200.0	102.7
SURFACE SOIL					
2,4-Dimethylphenol	14	1	36.0	36.0	36.0
2-Methylnaphthalene	14	3	450.0	1100000.0	368583.3
4-Methylphenol	14	1	72.0	72.0	72.0
Acenaphthene	14	4	220.0	3100000.0	778130.0
Acenaphthylene	14	3	1900.0	61000.0	22333.3
Anthracene	14	7	740.0	7700000.0	1112177.1
Benzo(a)anthracene	14	11	150.0	1200000.0	185093.6
Benzo(a)pyrene	14	11	100.0	550000.0	92203.6
Benzo(b)fluoranthene	14	12	260.0	750000.0	131780.8
Benzo(g,h,i)perylene	14	11	120.0	230000.0	40931.8
Benzo(k)fluoranthene	14	9	120.0	290000.0	66535.6
Butylbenzylphthalate	14	2	85.0	160.0	122.5
Carbazole	14	7	650.0	2600000.0	375215.7

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TABLE A3-5
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN SOIL
AREA: PAOI-6
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Chrysene	14	11	170.0	650000.0	113243.6
Di-n-butylphthalate	14	2	120.0	180.0	150.0
Dibenz(a,h)anthracene	14	8	1100.0	81000.0	14950.0
Dibenzofuran	14	4	210.0	1900000.0	477457.5
Fluoranthene	14	13	190.0	4700000.0	436719.2
Fluorene	14	5	170.0	3200000.0	642418.0
Indeno(1,2,3-c,d)pyrene	14	11	110.0	270000.0	47212.7
Naphthalene	14	5	260.0	1700000.0	343552.0
Pentachlorophenol	14	3	380.0	120000.0	42060.0
Phenanthrene	14	9	100.0	7900000.0	888466.7
Pyrene	14	13	230.0	3600000.0	367706.2
bis(2-Ethylhexyl)phthalate	14	1	170.0	170.0	170.0

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TABLE A3-6
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN SOIL
AREA: PAOI-7
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Benzo(a)anthracene	8	2	500.0	780.0	640.0
Benzo(a)pyrene	8	1	270.0	270.0	270.0
Benzo(b)fluoranthene	8	2	540.0	730.0	635.0
Benzo(g,h,i)perylene	8	2	120.0	380.0	250.0
Benzo(k)fluoranthene	8	1	170.0	170.0	170.0
Chrysene	8	1	370.0	370.0	370.0
Di-n-butylphthalate	8	6	98.0	230.0	161.3
Fluoranthene	8	2	1000.0	1300.0	1150.0
Indeno(1,2,3-c,d)pyrene	8	1	240.0	240.0	240.0
Phenanthrene	8	2	870.0	1100.0	985.0
Pyrene	8	2	910.0	1200.0	1055.0
bis(2-Ethylhexyl)phthalate	8	1	160.0	160.0	160.0
Anthracene	8	1	210.0	210.0	210.0
Benzo(a)anthracene	8	4	110.0	2100.0	655.0
Benzo(a)pyrene	8	1	1800.0	1800.0	1800.0
Benzo(b)fluoranthene	8	4	170.0	4100.0	1185.0
Benzo(g,h,i)perylene	8	2	110.0	1300.0	705.0
Benzo(k)fluoranthene	8	2	190.0	890.0	540.0
Butylbenzylphthalate	8	3	120.0	210.0	170.0
Chrysene	8	3	180.0	1800.0	766.7
Di-n-butylphthalate	8	7	150.0	400.0	245.7
Fluoranthene	8	6	170.0	2600.0	828.3
Indeno(1,2,3-c,d)pyrene	8	1	1400.0	1400.0	1400.0
Naphthalene	8	1	210.0	210.0	210.0
Phenanthrene	8	3	110.0	680.0	330.0
Pyrene	8	6	170.0	2500.0	771.7
bis(2-Ethylhexyl)phthalate	8	1	190.0	190.0	190.0

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TABLE A4-1
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN SOIL
AREA: PAOI-1 FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
Dieldrin	7	1	1.9	1.9	1.9
Endosulfan II	7	1	0.7	0.7	0.7
Methoxychlor	7	1	1.1	1.1	1.1
PCB-1254	7	1	460.0	460.0	460.0
SURFACE SOIL					
4,4'-DDD	3	1	3.8	3.8	3.8
Dieldrin	3	1	3.2	3.2	3.2
PCB-1260	3	1	340.0	340.0	340.0

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TABLE A4-2
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN SOIL
AREA: PAOI-2
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
4,4'-DDT	8	1	0.3	0.3	0.3
Dieldrin	8	1	0.2	0.2	0.2
Methoxychlor	8	1	30.0	30.0	30.0
SURFACE SOIL					
4,4'-DDT	2	1	6.9	6.9	6.9
Dieldrin	2	1	2.4	2.4	2.4
Endosulfan II	2	1	0.5	0.5	0.5
alpha-Chlordane	2	1	0.2	0.2	0.2

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TABLE A4-3
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN SOIL
AREA: PAOI-3
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
4,4'-DDD	2	1	1.8	1.8	1.8
Dieldrin	2	1	0.4	0.4	0.4
Heptachlor	2	1	0.2	0.2	0.2
alpha-Chlordane	2	1	1.7	1.7	1.7
SURFACE SOIL					
PCB-1260	1	1	14.0	14.0	14.0

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TABLE A4-4
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN SOIL
AREA: PAOI-4
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS		
			MINIMUM	MAXIMUM	AVERAGE
4,4'-DDE	1	1	15.0	15.0	15.0
4,4'-DDT	1	1	8.2	8.2	8.2
PCB-1260	1	1	8.3	8.3	8.3

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TABLE A4-5
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN SOIL
AREA: PAOI-6
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
4,4'-DDD	13	1	60.0	60.0	60.0
4,4'-DDE	13	1	0.5	0.5	0.5
4,4'-DDT	13	7	0.4	99.0	24.6
Aldrin	13	3	0.6	22.0	7.7
Dieldrin	13	3	0.9	6.7	3.2
Endosulfan II	13	1	1.4	1.4	1.4
Methoxychlor	13	6	0.4	8.1	3.6
PCB-1254	12	2	170.0	290.0	230.0
delta-BHC	13	1	0.2	0.2	0.2
gamma-Chlordane	13	1	0.3	0.3	0.3
SURFACE SOIL					
4,4'-DDD	5	3	9.5	97.0	45.2
4,4'-DDE	5	2	0.2	2.0	1.1
4,4'-DDT	5	2	40.0	58.0	49.0
Aldrin	5	1	2.5	2.5	2.5
Dieldrin	5	4	0.3	27.0	9.2
Endosulfan II	5	1	4.7	4.7	4.7
Methoxychlor	5	2	35.0	74.0	54.5
PCB-1254	5	1	40.2	40.2	40.2
PCB-1260	5	1	120.0	120.0	120.0
alpha-Chlordane	5	1	0.5	0.5	0.5
gamma-Chlordane	5	1	0.1	0.1	0.1

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TABLE A4-6
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN SOIL AREA: PAOI-7
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
4,4'-DDD	8	2	3.1	3.8	3.5
4,4'-DDT	8	2	0.4	6.4	3.4
Aldrin	8	2	0.4	0.6	0.5
Dieldrin	8	2	0.1	1.1	0.6
Heptachlor epoxide	8	2	0.5	0.6	0.5
Methoxychlor	8	2	1.3	3.9	2.6
PCB-1260	8	2	10.0	13.0	11.5
alpha-BHC	8	4	0.3	0.6	0.4
alpha-Chlordane	8	2	0.2	0.3	0.2
gamma-BHC (Lindane)	8	1	0.1	0.1	0.1
gamma-Chlordane	8	2	0.8	0.9	0.9
4,4'-DDD	8	1	0.5	0.5	0.5
4,4'-DDE	8	4	0.3	16.0	4.5
4,4'-DDT	8	2	4.3	41.0	22.7
Aldrin	8	2	0.5	1.0	0.7
Dieldrin	8	3	0.5	3.6	2.1
Heptachlor	8	1	4.0	4.0	4.0
Heptachlor epoxide	8	1	2.4	2.4	2.4
PCB-1254	8	1	120.0	120.0	120.0
PCB-1260	8	2	82.0	220.0	151.0
alpha-BHC	8	3	0.4	1.0	0.7
alpha-Chlordane	8	3	0.7	1.8	1.1
delta-BHC	8	1	0.5	0.5	0.5
gamma-BHC (Lindane)	8	2	0.3	0.6	0.4
gamma-Chlordane	8	2	0.8	6.7	3.7

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TABLE A5-1
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN SOIL
AREA: PAOI-1
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
1,2,3,4,6,7,8-HpCDD	10	2	0.2	3.3	1.7
HpCDDs (total)	10	3	0.5	14.0	5.1
OCDD	10	10	0.4	43.0	8.8
OCDF	10	1	0.7	0.7	0.7
SURFACE SOIL					
1,2,3,4,6,7,8-HpCDD	5	5	3.9	68.0	40.2
1,2,3,4,6,7,8-HpCDF	5	5	0.5	6.2	3.2
1,2,3,4,7,8,9-HpCDF	5	2	0.3	0.6	0.5
1,2,3,4,7,8-HxCDF	5	2	0.4	1.0	0.7
1,2,3,6,7,8-HxCDD	5	2	0.8	1.2	1.0
1,2,3,7,8,9-HxCDD	5	1	0.5	0.5	0.5
1,2,3,7,8,9-HxCDF	5	1	0.2	0.2	0.2
HpCDDs (total)	5	5	9.9	250.0	136.2
HpCDFs (total)	5	5	2.7	42.0	19.3
HxCDDs (total)	5	3	5.5	22.0	12.1
HxCDFs (total)	5	3	3.0	8.3	5.0
OCDD	5	5	48.0	930.0	541.6
OCDF	5	5	2.5	28.0	16.3

AR308674

TABLE A5-2
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN SOIL
AREA: PAOI-2
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS		
			MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
OCDD	2	2	4.1	4.2	4.2
SURFACE SOIL					
1,2,3,4,6,7,8-HpCDD	1	1	1.3	1.3	1.3
1,2,3,4,6,7,8-HpCDF	1	1	0.3	0.3	0.3
HpCDDs (total)	1	1	3.1	3.1	3.1
HpCDFs (total)	1	1	1.1	1.1	1.1
OCDD	1	1	26.0	26.0	26.0
OCDF	1	1	0.9	0.9	0.9

TABLE A5-3
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN SOIL
AREA: PAOI-3
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
1,2,3,4,6,7,8-HpCDD	2	2	1.1	2.9	2.0
1,2,3,4,6,7,8-HpCDF	2	2	0.3	0.6	0.4
HpCDDs (total)	2	2	2.9	6.7	4.8
HpCDFs (total)	2	2	1.3	2.8	2.1
HxCDFs (total)	2	1	1.3	1.3	1.3
OCDD	2	2	18.0	37.0	27.5
OCDF	2	2	1.0	1.6	1.3
SURFACE SOIL					
1,2,3,4,6,7,8-HpCDD	1	1	2.0	2.0	2.0
1,2,3,4,6,7,8-HpCDF	1	1	0.4	0.4	0.4
HpCDDs (total)	1	1	5.0	5.0	5.0
HpCDFs (total)	1	1	2.2	2.2	2.2
HxCDFs (total)	1	1	0.6	0.6	0.6
OCDD	1	1	29.0	29.0	29.0
OCDF	1	1	1.5	1.5	1.5

AR308676

TABLE A5-4
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN SOIL
AREA: PAOI-4
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
OCDD	2	1	0.6	0.6	0.6
SURFACE SOIL					
OCDD	1	1	13.0	13.0	13.0

AR308677

TABLE A5-5
SUMMARY OF DETECTED DIOXINS/FURANS (NG/KG) IN SOIL
AREA: PAOI-6
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
SUBSURFACE SOIL					
1,2,3,4,6,7,8-HpCDD	11	2	1.6	23.0	12.3
1,2,3,4,6,7,8-HpCDF	11	1	2.1	2.1	2.1
HpCDDs (total)	11	2	13.0	73.0	43.0
HpCDFs (total)	11	1	13.0	13.0	13.0
OCDD	11	7	0.3	450.0	71.3
OCDF	11	1	15.0	15.0	15.0
SURFACE SOIL					
1,2,3,4,6,7,8-HpCDD	5	1	26.0	26.0	26.0
HpCDDs (total)	5	1	200.0	200.0	200.0
OCDD	5	5	0.3	250.0	51.7

AR308678

TABLE A5-6
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN SOIL
AREA: PAOI-7
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS		
			MINIMUM	MAXIMUM	AVERAGE
OCDD	8	6	1.3	17.0	6.3
OCDD	9	8	2.5	5.0	3.2

AR308679

TABLE A6-1
SUMMARY OF DETECTED METALS (UG/L) IN GROUNDWATER
COLUMBIA FORMATION
AREA: PAOI-1
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
TOTAL					
Aluminum	3	3	87.0	60000.0	20835.7
Antimony	3	1	5.6	5.6	5.6
Arsenic	3	3	2.2	17.0	7.5
Barium	3	3	102.0	526.0	260.0
Beryllium	3	1	4.0	4.0	4.0
Calcium	3	3	16400.0	69700.0	50766.7
Chromium	3	3	2.8	97.2	37.2
Cobalt	3	2	15.0	59.4	37.2
Copper	3	3	5.4	40.6	17.6
Iron	3	3	11800.0	194000.0	78233.3
Lead	3	2	3.4	28.9	16.2
Magnesium	3	3	10200.0	52300.0	31833.3
Manganese	3	3	1090.0	7840.0	5550.0
Nickel	3	1	45.4	45.4	45.4
Potassium	3	3	2100.0	6990.0	4450.0
Silver	3	1	3.0	3.0	3.0
Sodium	3	3	6550.0	26900.0	14026.7
Thallium	3	2	9.8	10.2	10.0
Vanadium	3	3	5.1	173.0	66.1
Zinc	3	3	11.9	141.0	61.4
DISSOLVED					
Antimony	3	3	3.6	15.1	9.2
Barium	3	3	102.0	185.0	142.0
Calcium	3	3	19100.0	86900.0	57600.0
Cobalt	3	2	15.6	17.9	16.8
Iron	3	3	3200.0	36100.0	23200.0
Magnesium	3	3	11700.0	48500.0	33633.3
Manganese	3	3	1190.0	9740.0	5810.0
Potassium	3	3	2160.0	4890.0	3276.7
Selenium	3	2	14.7	33.0	23.9
Sodium	3	3	6450.0	30800.0	15510.0
Thallium	3	2	17.0	19.4	18.2
Zinc	3	2	7.5	8.8	8.2

AR308680

TABLE A6-2
SUMMARY OF DETECTED METALS (UG/L) IN GROUNDWATER
COLUMBIA FORMATION
AREA: PAOI-2
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
TOTAL					
Aluminum	4	4	23.8	74900.0	22953.5
Antimony	4	1	6.8	6.8	6.8
Arsenic	4	2	6.0	19.6	12.8
Barium	4	4	30.8	547.0	183.6
Beryllium	4	2	1.1	6.7	3.9
Cadmium	4	1	0.7	0.7	0.7
Calcium	4	4	16200.0	44600.0	28300.0
Chromium	4	3	15.1	287.0	115.8
Cobalt	4	3	23.1	56.1	35.2
Copper	4	3	8.7	118.0	47.0
Iron	4	4	82.7	141000.0	44510.7
Lead	4	2	11.8	53.6	32.7
Magnesium	4	4	9740.0	36900.0	23810.0
Manganese	4	4	244.0	1720.0	1086.5
Nickel	4	3	15.1	99.9	51.9
Potassium	4	4	3050.0	12800.0	6105.0
Selenium	4	1	6.0	6.0	6.0
Sodium	4	4	4080.0	80100.0	43670.0
Vanadium	4	3	16.0	435.0	168.6
Zinc	4	3	42.5	326.0	150.7
DISSOLVED					
Aluminum	4	3	36.5	294.0	149.8
Antimony	4	3	3.0	5.9	4.9
Arsenic	4	1	2.8	2.8	2.8
Barium	4	4	30.5	56.1	39.6
Calcium	4	4	16500.0	39300.0	28075.0
Cobalt	4	2	15.6	28.2	21.9
Iron	4	4	290.0	24400.0	8690.5
Magnesium	4	4	9240.0	29800.0	20060.0
Manganese	4	4	320.0	1560.0	911.5
Nickel	4	2	10.5	15.8	13.2
Potassium	4	4	1070.0	4370.0	3077.5
Selenium	4	4	5.6	15.6	11.0
Sodium	4	4	4410.0	80800.0	44327.5
Thallium	4	1	9.6	9.6	9.6
Vanadium	4	1	2.9	2.9	2.9
Zinc	4	4	2.0	25.4	12.0

AR308681

TABLE A6-3
SUMMARY OF DETECTED METALS (UG/L) IN GROUNDWATER
COLUMBIA FORMATION
AREA: PAOI-3
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
TOTAL					
Aluminum	1	1	8210.0	8210.0	8210.0
Arsenic	1	1	2.1	2.1	2.1
Barium	1	1	99.0	99.0	99.0
Calcium	1	1	21700.0	21700.0	21700.0
Chromium	1	1	44.8	44.8	44.8
Copper	1	1	13.8	13.8	13.8
Iron	1	1	38600.0	38600.0	38600.0
Lead	1	1	4.0	4.0	4.0
Magnesium	1	1	13100.0	13100.0	13100.0
Manganese	1	1	2380.0	2380.0	2380.0
Nickel	1	1	11.9	11.9	11.9
Potassium	1	1	2690.0	2690.0	2690.0
Sodium	1	1	9440.0	9440.0	9440.0
Vanadium	1	1	60.6	60.6	60.6
Zinc	1	1	36.6	36.6	36.6
DISSOLVED					
Aluminum	1	1	162.0	162.0	162.0
Barium	1	1	58.8	58.8	58.8
Calcium	1	1	24200.0	24200.0	24200.0
Iron	1	1	11600.0	11600.0	11600.0
Magnesium	1	1	12000.0	12000.0	12000.0
Manganese	1	1	2990.0	2990.0	2990.0
Potassium	1	1	1760.0	1760.0	1760.0
Selenium	1	1	8.7	8.7	8.7
Sodium	1	1	9690.0	9690.0	9690.0
Zinc	1	1	5.4	5.4	5.4

AR308682

TABLE A6-4
SUMMARY OF DETECTED METALS (UG/L) IN GROUNDWATER
COLUMBIA FORMATION
AREA: PAOI-6
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
TOTAL					
Aluminum	8	8	18.1	30800.0	7445.9
Antimony	8	1	3.2	3.2	3.2
Arsenic	8	5	1.8	6.1	3.1
Barium	8	8	28.2	409.0	132.3
Beryllium	8	1	5.4	5.4	5.4
Cadmium	8	2	0.2	0.4	0.3
Calcium	8	8	9040.0	52400.0	17385.0
Chromium	8	7	2.3	79.7	24.5
Cobalt	8	5	15.6	33.0	23.5
Copper	8	5	5.3	71.4	26.9
Iron	8	8	51.0	196000.0	39068.9
Lead	8	5	4.0	16.6	8.6
Magnesium	8	8	3920.0	21000.0	9892.5
Manganese	8	8	19.6	14300.0	3283.7
Nickel	8	5	8.4	39.3	18.4
Potassium	8	8	1360.0	6870.0	3300.0
Selenium	8	1	6.6	6.6	6.6
Sodium	8	8	3200.0	26100.0	12706.3
Vanadium	8	6	2.3	172.0	50.4
Zinc	8	8	8.3	109.0	47.5
DISSOLVED					
Aluminum	8	3	19.6	100.0	47.5
Antimony	8	6	3.6	7.4	5.5
Barium	8	8	24.2	140.0	78.9
Calcium	8	8	8640.0	54000.0	18067.5
Cobalt	8	3	12.5	18.8	14.6
Copper	8	1	5.6	5.6	5.6
Iron	8	8	6.1	32900.0	6755.8
Lead	8	1	3.0	3.0	3.0
Magnesium	8	8	4230.0	21500.0	9857.5
Manganese	8	8	18.8	14300.0	3273.0
Nickel	8	1	12.6	12.6	12.6
Potassium	8	8	1340.0	6650.0	2780.0
Selenium	8	4	6.4	11.5	8.2
Sodium	8	8	3080.0	27400.0	13165.0
Thallium	8	1	16.3	16.3	16.3
Vanadium	8	1	5.5	5.5	5.5
Zinc	8	7	2.1	44.6	10.5

AR308683

TABLE A6-5
SUMMARY OF DETECTED METALS (UG/L) IN GROUNDWATER
POTOMAC FORMATION
AREA: PAOI-6
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
TOTAL					
Aluminum	7	7	23.8	998.0	212.9
Arsenic	7	3	1.2	7.1	3.4
Barium	7	7	16.2	42.4	27.8
Cadmium	7	3	0.3	0.5	0.4
Calcium	7	7	3630.0	15000.0	7450.0
Chromium	7	6	2.4	27.8	8.3
Copper	7	3	7.4	63.0	26.5
Iron	7	7	127.0	32500.0	11827.6
Lead	7	4	2.1	77.7	21.1
Magnesium	7	7	1260.0	5770.0	2578.6
Manganese	7	7	5.3	320.0	113.0
Mercury	7	1	0.2	0.2	0.2
Nickel	7	2	11.2	12.6	11.9
Potassium	7	7	859.0	2100.0	1293.4
Sodium	7	7	3500.0	8720.0	5801.4
Vanadium	7	4	2.2	29.6	11.3
Zinc	7	7	11.5	276.0	61.4
DISSOLVED					
Aluminum	7	5	21.2	156.0	60.9
Antimony	7	4	5.7	9.0	6.8
Barium	7	7	14.5	43.0	26.9
Calcium	7	7	3830.0	15800.0	7792.9
Chromium	7	1	4.9	4.9	4.9
Copper	7	3	4.3	6.5	5.1
Iron	7	6	9.4	33700.0	13594.7
Magnesium	7	7	1280.0	6410.0	2790.0
Manganese	7	7	7.4	348.0	118.0
Nickel	7	2	10.5	12.6	11.6
Potassium	7	7	835.0	2160.0	1340.4
Sodium	7	7	3320.0	9350.0	5915.7
Vanadium	7	1	2.3	2.3	2.3
Zinc	7	6	2.0	14.5	8.5

TABLE A7-1
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/L) IN GROUNDWATER
COLUMBIA FORMATION
AREA: PAOI-1
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
1,2-Dichloropropane	3	2	29.0	240.0	134.5
Acetone	3	1	6.0	6.0	6.0
Benzene	3	2	30.0	650.0	340.0
Ethylbenzene	3	2	160.0	200.0	180.0
Styrene	3	2	33.0	210.0	121.5
Toluene	3	2	130.0	830.0	480.0
Xylenes (total)	3	2	520.0	710.0	615.0

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TABLE A7-2
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/L) IN GROUNDWATER
COLUMBIA FORMATION
AREA: PAOI-2
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
Acetone	4	1	8.0	8.0	8.0
Ethylbenzene	4	2	4.0	46.0	25.0
Styrene	4	1	41.0	41.0	41.0
Toluene	4	1	34.0	34.0	34.0
Xylenes (total)	4	2	3.0	223.0	113.0

AR308686

TABLE A7-3
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/L) IN GROUNDWATER
COLUMBIA FORMATION
AREA: PAOI-6
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
1,2-Dichloropropane	8	1	26.0	26.0	26.0
2-Butanone	8	1	19.0	19.0	19.0
Acetone	8	1	27.0	27.0	27.0
Benzene	8	1	2.0	2.0	2.0
Methylene Chloride	8	1	4.0	4.0	4.0
Tetrachloroethene	8	1	14.0	14.0	14.0
Trichloroethene	8	1	3.0	3.0	3.0

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TABLE A7-4
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/L) IN GROUNDWATER
POTOMAC FORMATION
AREA: PAOI-6
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
1,2-Dichloropropane	7	1	27.0	27.0	27.0
Acetone	7	1	7.0	7.0	7.0
Benzene	7	2	2.0	2.0	2.0

TABLE A8-1
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/L) IN GROUNDWATER
COLUMBIA FORMATION
AREA: PAOI-1
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
2,4-Dimethylphenol	3	2	430.0	15000.0	7715.0
2-Methylnaphthalene	3	2	1300.0	2000.0	1650.0
2-Methylphenol	3	1	22000.0	22000.0	22000.0
4-Methylphenol	3	2	1000.0	52000.0	26500.0
Acenaphthene	3	3	3.0	1000.0	587.7
Acenaphthylene	3	1	110.0	110.0	110.0
Anthracene	3	1	160.0	160.0	160.0
Benzo(a)anthracene	3	1	110.0	110.0	110.0
Benzo(a)pyrene	3	1	45.0	45.0	45.0
Benzo(b)fluoranthene	3	1	64.0	64.0	64.0
Carbazole	3	2	530.0	680.0	605.0
Chrysene	3	1	96.0	96.0	96.0
Dibenzofuran	3	3	3.0	620.0	377.7
Fluoranthene	3	2	4.0	580.0	292.0
Fluorene	3	2	4.0	530.0	267.0
Naphthalene	3	3	2.0	23000.0	11667.3
Phenanthrene	3	3	11.0	1300.0	637.0
Phenol	3	2	6500.0	58000.0	32250.0
Pyrene	3	1	320.0	320.0	320.0

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TABLE A8-2
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/L) IN GROUNDWATER
COLUMBIA FORMATION
AREA: PAOI-2
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
2-Methylnaphthalene	4	1	1100.0	1100.0	1100.0
4-Methylphenol	4	1	20.0	20.0	20.0
Acenaphthene	4	1	850.0	850.0	850.0
Acenaphthylene	4	1	45.0	45.0	45.0
Anthracene	4	1	120.0	120.0	120.0
Benzo(a)anthracene	4	1	39.0	39.0	39.0
Benzo(a)pyrene	4	1	13.0	13.0	13.0
Benzo(b)fluoranthene	4	1	24.0	24.0	24.0
Benzo(g,h,i)perylene	4	1	6.0	6.0	6.0
Benzo(k)fluoranthene	4	1	15.0	15.0	15.0
Carbazole	4	1	250.0	250.0	250.0
Chrysene	4	1	30.0	30.0	30.0
Dibenzofuran	4	1	520.0	520.0	520.0
Fluoranthene	4	1	290.0	290.0	290.0
Fluorene	4	1	490.0	490.0	490.0
Indeno(1,2,3-c,d)pyrene	4	1	5.0	5.0	5.0
Naphthalene	4	2	3.0	8700.0	4351.5
Pentachlorophenol	4	1	24.0	24.0	24.0
Phenanthrene	4	1	940.0	940.0	940.0
Phenol	4	1	43.0	43.0	43.0
Pyrene	4	1	250.0	250.0	250.0

AR308690

TABLE A8-3
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/L) IN GROUNDWATER
COLUMBIA FORMATION
AREA: PAOI-3
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Acenaphthene	1	1	25.0	25.0	25.0
Anthracene	1	1	2.0	2.0	2.0
Dibenzofuran	1	1	9.0	9.0	9.0
Fluoranthene	1	1	13.0	13.0	13.0
Fluorene	1	1	13.0	13.0	13.0
Naphthalene	1	1	7.0	7.0	7.0
Phenanthrene	1	1	3.0	3.0	3.0
Pyrene	1	1	4.0	4.0	4.0

AR308691

TABLE A8-4
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/L) IN GROUNDWATER
COLUMBIA FORMATION
AREA: PAOI-6
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
1,2-Dichlorobenzene	8	1	11.0	11.0	11.0

AR308692

TABLE A9-1
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/L) IN GROUNDWATER
COLUMBIA FORMATION
AREA: PAOI-1
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
4,4'-DDD	2	2	0.02	0.14	0.08
4,4'-DDE	2	1	0.01	0.01	0.01
4,4'-DDT	2	1	0.10	0.10	0.10
alpha-Chlordane	2	1	0.11	0.11	0.11

TABLE A9-2
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/L) IN GROUNDWATER
POTOMAC FORMATION
AREA: PAOI-6
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
4,4'-DDD	1	1	0.013	0.013	0.013
Aldrin	1	1	0.003	0.003	0.003

AR308694

TABLE A10-1
SUMMARY OF DETECTED DIOXINS/FURANS (NG/L) IN GROUNDWATER
COLUMBIA FORMATION
AREA: PAOI-1
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
HpCDDs (total)	2	1	3.9	3.9	3.9
OCDD	2	1	15.0	15.0	15.0

AR308695

TABLE A11-1
SUMMARY OF DETECTED METALS (UG/L) IN SURFACEWATER
AREA: CHRISTINA RIVER
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
TOTAL					
Aluminum	5	5	217.0	452.0	341.6
Barium	5	5	53.9	81.8	72.8
Calcium	5	5	9470.0	19900.0	16174.0
Chromium	5	3	1.9	4.1	2.9
Copper	5	5	4.5	8.2	6.2
Iron	5	5	608.0	1940.0	1178.4
Lead	5	4	3.3	11.8	6.2
Magnesium	5	5	4000.0	7640.0	6388.0
Manganese	5	5	94.7	291.0	205.7
Mercury	5	1	0.4	0.4	0.4
Potassium	5	5	2860.0	3810.0	3510.0
Sodium	5	5	11100.0	21000.0	16400.0
Vanadium	5	3	2.8	4.4	3.7
Zinc	5	5	35.5	73.2	51.2
DISSOLVED					
Aluminum	5	3	36.6	71.0	49.3
Antimony	5	5	6.1	10.7	7.9
Arsenic	5	1	2.0	2.0	2.0
Barium	5	5	39.5	67.2	59.2
Calcium	5	5	10100.0	20100.0	16760.0
Chromium	5	2	1.2	1.3	1.3
Copper	5	5	5.3	17.7	13.4
Iron	5	5	57.7	494.0	210.1
Magnesium	5	5	4280.0	8270.0	6846.0
Manganese	5	5	3.3	202.0	101.7
Nickel	5	1	8.5	8.5	8.5
Potassium	5	5	3160.0	4180.0	3764.0
Sodium	5	5	12100.0	23100.0	17860.0
Vanadium	5	2	2.4	2.7	2.6
Zinc	5	5	6.6	14.1	9.0

AR308696

TABLE A11-2
SUMMARY OF DETECTED METALS (UG/L) IN SURFACEWATER
AREA: WHITE CLAY CREEK
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
TOTAL					
Aluminum	6	6	67.1	899.0	305.4
Antimony	5	2	3.0	3.6	3.3
Arsenic	5	1	3.0	3.0	3.0
Barium	6	6	35.1	74.7	53.5
Calcium	6	6	16800.0	24600.0	22300.0
Chromium	5	2	1.6	1.8	1.7
Cobalt	5	3	13.2	13.2	13.2
Copper	6	6	3.6	9.2	5.4
Iron	6	6	200.0	2100.0	855.8
Lead	5	1	4.8	4.8	4.8
Magnesium	6	6	6210.0	8870.0	8212.0
Manganese	6	6	56.0	283.0	165.8
Nickel	5	1	7.7	7.7	7.7
Potassium	6	6	3900.0	5910.0	4905.0
Sodium	6	6	10400.0	15500.0	12950.0
Zinc	6	6	22.2	267.0	144.6
DISSOLVED					
Aluminum	5	3	18.4	34.4	24.5
Antimony	6	6	7.0	12.7	9.7
Arsenic	5	1	5.1	5.1	5.1
Barium	6	6	35.1	70.5	52.8
Calcium	6	6	16700.0	26000.0	23100.0
Chromium	6	3	1.1	4.1	2.6
Cobalt	5	3	13.2	16.6	14.3
Copper	6	5	7.5	16.4	12.0
Iron	5	5	80.8	247.0	152.1
Magnesium	6	6	6310.0	9490.0	8628.0
Manganese	6	6	43.3	162.0	102.7
Potassium	6	6	4270.0	5910.0	5200.0
Sodium	6	6	11200.0	14300.0	12480.0
Zinc	5	5	8.3	9.9	9.0

AR308697

TABLE A11-3
SUMMARY OF DETECTED METALS (UG/L) IN SURFACEWATER
AREA: HERSHEY RUN
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
TOTAL					
Aluminum	13	11	36.3	890.0	380.9
Antimony	13	5	3.0	13.1	7.6
Arsenic	13	6	1.4	4.4	2.6
Barium	13	13	33.6	84.8	61.1
Calcium	13	13	11000.0	23000.0	17546.2
Chromium	13	6	1.6	3.3	2.6
Cobalt	13	1	13.2	13.2	13.2
Copper	13	6	4.9	21.5	10.1
Iron	13	13	170.0	2780.0	996.2
Lead	13	4	2.3	4.2	3.5
Magnesium	13	13	3580.0	9130.0	7130.0
Manganese	13	13	9.8	456.0	176.9
Potassium	13	13	2490.0	4230.0	3517.7
Sodium	13	13	5390.0	15700.0	12042.3
Vanadium	13	4	2.0	4.9	3.5
Zinc	13	11	24.6	61.3	43.8
DISSOLVED					
Aluminum	10	5	19.8	50.4	34.5
Antimony	10	9	5.8	10.7	7.9
Barium	10	10	35.0	71.4	53.9
Calcium	10	10	11400.0	24800.0	18100.0
Chromium	10	1	5.1	5.1	5.1
Copper	10	6	11.3	16.4	13.6
Iron	10	7	98.1	454.0	217.9
Magnesium	10	10	4020.0	10200.0	7269.0
Manganese	10	10	27.6	223.0	124.4
Potassium	10	10	2790.0	4340.0	3597.0
Sodium	10	10	5850.0	17100.0	12207.0
Thallium	10	1	11.1	11.1	11.1
Zinc	10	6	9.8	42.9	22.3

AR308698

TABLE A11-4
SUMMARY OF DETECTED METALS (UG/L) IN SURFACEWATER
AREA: CHURCHMAN'S MARSH DRAINAGEWAY
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
TOTAL					
Aluminum	1	1	1040.0	1040.0	1040.0
Barium	1	1	154.0	154.0	154.0
Calcium	1	1	23600.0	23600.0	23600.0
Iron	1	1	6080.0	6080.0	6080.0
Lead	1	1	5.1	5.1	5.1
Magnesium	1	1	10400.0	10400.0	10400.0
Manganese	1	1	1410.0	1410.0	1410.0
Potassium	1	1	3490.0	3490.0	3490.0
Sodium	1	1	22000.0	22000.0	22000.0
Vanadium	1	1	5.3	5.3	5.3
Zinc	1	1	74.1	74.1	74.1
DISSOLVED					
Antimony	1	1	9.0	9.0	9.0
Barium	1	1	127.0	127.0	127.0
Calcium	1	1	25800.0	25800.0	25800.0
Copper	1	1	14.3	14.3	14.3
Iron	1	1	961.0	961.0	961.0
Magnesium	1	1	11300.0	11300.0	11300.0
Manganese	1	1	1420.0	1420.0	1420.0
Potassium	1	1	3730.0	3730.0	3730.0
Sodium	1	1	24100.0	24100.0	24100.0

TABLE A11-5
SUMMARY OF DETECTED METALS (UG/L) IN SURFACEWATER
AREA: EAST DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
TOTAL					
Aluminum	3	2	309.0	359.0	334.0
Antimony	3	2	3.1	5.4	4.3
Arsenic	3	1	2.0	2.0	2.0
Barium	3	3	91.4	147.0	126.1
Cadmium	3	1	1.4	1.4	1.4
Calcium	3	3	19200.0	20700.0	19833.3
Chromium	3	1	11.1	11.1	11.1
Copper	3	1	8.7	8.7	8.7
Iron	3	3	625.0	1150.0	899.3
Lead	3	2	5.0	29.2	17.1
Magnesium	3	3	7720.0	11400.0	10140.0
Manganese	3	3	143.0	801.0	374.7
Mercury	3	1	0.1	0.1	0.1
Potassium	3	3	2140.0	4270.0	3446.7
Sodium	3	3	15500.0	21900.0	17766.7
Vanadium	3	1	2.0	2.0	2.0
Zinc	3	3	23.1	470.0	184.1
DISSOLVED					
Aluminum	2	1	20.4	20.4	20.4
Antimony	2	2	6.6	8.9	7.8
Barium	2	2	78.5	132.0	105.3
Cadmium	2	1	1.1	1.1	1.1
Calcium	2	2	20100.0	20300.0	20200.0
Chromium	2	1	7.1	7.1	7.1
Copper	2	2	7.6	12.2	9.9
Iron	2	1	284.0	284.0	284.0
Lead	2	1	4.0	4.0	4.0
Magnesium	2	2	8630.0	11800.0	10215.0
Manganese	2	2	29.6	277.0	153.3
Potassium	2	2	4300.0	4470.0	4385.0
Sodium	2	2	17200.0	21500.0	19350.0
Zinc	2	1	436.0	436.0	436.0

TABLE A11-6
SUMMARY OF DETECTED METALS (UG/L) IN SURFACEWATER
AREA: EAST CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
TOTAL					
Aluminum	7	6	113.0	1410.0	509.0
Antimony	7	2	3.5	8.3	5.9
Arsenic	7	3	3.7	9.9	6.3
Barium	7	7	46.6	347.0	135.1
Calcium	7	7	17700.0	31200.0	22371.4
Chromium	7	4	1.3	9.1	3.9
Cobalt	7	3	13.1	16.6	14.3
Copper	7	4	6.0	11.3	8.8
Iron	7	7	694.0	34200.0	6777.4
Lead	7	3	2.7	10.8	7.9
Magnesium	7	7	7820.0	13700.0	9951.4
Manganese	7	7	144.0	6520.0	1879.6
Potassium	7	7	2070.0	4970.0	3140.0
Sodium	7	7	6260.0	42100.0	18324.3
Thallium	7	1	24.6	24.6	24.6
Vanadium	7	3	3.2	6.2	4.8
Zinc	7	7	5.4	126.0	49.2
DISSOLVED					
Aluminum	9	2	19.5	84.3	51.9
Antimony	9	9	5.8	9.9	8.3
Barium	9	9	39.6	219.0	100.1
Calcium	9	9	18600.0	32100.0	22300.0
Chromium	9	3	1.8	5.1	4.0
Cobalt	9	2	13.2	13.2	13.2
Copper	9	5	8.5	13.2	10.5
Iron	9	6	79.5	9020.0	1781.4
Magnesium	9	9	7820.0	14600.0	9895.6
Manganese	9	9	7.3	6650.0	1432.3
Nickel	9	1	9.8	9.8	9.8
Potassium	9	9	1640.0	5140.0	3454.4
Selenium	9	1	4.0	4.0	4.0
Sodium	9	9	6860.0	43100.0	18515.6
Thallium	9	2	20.0	22.6	21.3
Zinc	9	5	8.3	28.9	18.3

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TABLE A11-7
SUMMARY OF DETECTED METALS (UG/L) IN SURFACEWATER
AREA: CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
TOTAL					
Aluminum	3	3	318.0	1040.0	574.0
Arsenic	3	2	1.6	2.1	1.9
Barium	3	3	72.3	120.0	90.2
Calcium	3	3	16700.0	18800.0	18033.3
Chromium	3	2	2.6	4.4	3.5
Copper	3	2	4.2	4.8	4.5
Iron	3	3	748.0	2810.0	1566.0
Lead	3	2	2.0	3.8	2.9
Magnesium	3	3	7560.0	11400.0	9853.3
Manganese	3	3	82.9	421.0	206.0
Potassium	3	3	3770.0	6370.0	5170.0
Sodium	3	3	16200.0	44900.0	34133.3
Vanadium	3	1	2.6	2.6	2.6
Zinc	3	3	24.9	83.2	49.9
DISSOLVED					
Aluminum	5	1	27.0	27.0	27.0
Antimony	5	5	5.4	8.7	7.6
Barium	5	5	71.3	123.0	94.1
Calcium	5	5	18600.0	22300.0	20300.0
Copper	5	3	4.7	15.1	11.6
Iron	5	4	135.0	617.0	358.5
Magnesium	5	5	8410.0	11600.0	10174.0
Manganese	5	5	4.6	1350.0	517.1
Potassium	5	5	3280.0	6870.0	4714.0
Sodium	5	5	18000.0	45300.0	29640.0
Zinc	5	3	2.7	48.2	22.3

TABLE A11-8
SUMMARY OF DETECTED METALS (UG/L) IN SURFACEWATER
AREA: WEST CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
TOTAL					
Aluminum	8	7	87.6	3900.0	1292.8
Antimony	8	1	5.8	5.8	5.8
Arsenic	8	5	1.7	5.1	2.9
Barium	8	8	63.4	230.0	124.0
Calcium	8	8	15300.0	31400.0	21200.0
Chromium	8	4	1.2	10.4	6.4
Cobalt	8	4	13.2	16.6	14.1
Copper	8	5	5.5	15.7	9.3
Iron	8	7	878.0	18900.0	6118.3
Lead	8	4	3.8	18.8	11.3
Magnesium	8	8	6140.0	15000.0	9705.0
Manganese	8	8	10.8	1400.0	535.5
Nickel	8	1	8.0	8.0	8.0
Potassium	8	8	2010.0	4530.0	3401.3
Sodium	8	8	4900.0	32300.0	13641.3
Thallium	8	1	7.6	7.6	7.6
Vanadium	8	3	2.4	31.5	14.8
Zinc	8	7	30.5	238.0	91.8
DISSOLVED					
Aluminum	7	4	35.6	63.3	46.4
Antimony	7	5	5.6	10.7	7.8
Arsenic	7	1	1.1	1.1	1.1
Barium	7	7	62.3	140.0	94.5
Calcium	7	7	16800.0	30400.0	21657.1
Cobalt	7	4	13.2	13.2	13.2
Copper	7	5	4.5	14.3	9.0
Iron	7	7	42.6	9050.0	1739.2
Magnesium	7	7	6260.0	14900.0	9908.6
Manganese	7	7	2.2	1410.0	582.9
Potassium	7	7	1720.0	5040.0	3548.6
Selenium	7	1	4.4	4.4	4.4
Sodium	7	7	4860.0	35700.0	14392.9
Zinc	7	6	4.8	73.3	24.3

AR308703

TABLE A11-9
SUMMARY OF DETECTED METALS (UG/L) IN SURFACEWATER
AREA: FIRE POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
TOTAL					
Aluminum	3	2	127.0	1250.0	688.5
Antimony	3	2	3.4	9.7	6.6
Arsenic	3	2	2.4	2.6	2.5
Barium	3	3	39.3	77.3	56.7
Calcium	3	3	10600.0	34000.0	21000.0
Chromium	3	2	2.8	4.6	3.7
Copper	3	3	3.7	13.0	7.2
Iron	3	3	41.1	7720.0	3340.4
Lead	3	2	3.3	16.4	9.9
Magnesium	3	3	6350.0	16800.0	10183.3
Manganese	3	3	38.3	271.0	142.8
Nickel	3	1	7.3	7.3	7.3
Potassium	3	3	941.0	6270.0	2770.3
Sodium	3	3	2670.0	4020.0	3250.0
Thallium	3	1	11.1	11.1	11.1
Vanadium	3	2	8.2	11.4	9.8
Zinc	3	2	49.0	168.0	108.5
DISSOLVED					
Aluminum	2	2	39.5	130.0	84.8
Antimony	2	2	6.2	7.6	6.9
Barium	2	2	33.6	76.4	55.0
Calcium	2	2	11800.0	18300.0	15050.0
Copper	2	2	4.8	10.0	7.4
Iron	2	2	264.0	3520.0	1892.0
Magnesium	2	2	7080.0	8130.0	7605.0
Manganese	2	2	57.3	295.0	176.2
Nickel	2	1	16.4	16.4	16.4
Potassium	2	2	863.0	6920.0	3891.5
Selenium	2	1	4.6	4.6	4.6
Sodium	2	2	2620.0	3220.0	2920.0
Vanadium	2	1	3.5	3.5	3.5
Zinc	2	2	23.5	47.9	35.7

TABLE A11-10
SUMMARY OF DETECTED METALS (UG/L) IN SURFACEWATER
AREA: K-AREA POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
TOTAL					
Aluminum	1	1	64.6	64.6	64.6
Arsenic	1	1	2.1	2.1	2.1
Barium	1	1	56.0	56.0	56.0
Calcium	1	1	21500.0	21500.0	21500.0
Copper	1	1	4.2	4.2	4.2
Iron	1	1	6140.0	6140.0	6140.0
Magnesium	1	1	5680.0	5680.0	5680.0
Manganese	1	1	101.0	101.0	101.0
Potassium	1	1	3730.0	3730.0	3730.0
Sodium	1	1	1400.0	1400.0	1400.0
Vanadium	1	1	3.1	3.1	3.1
Zinc	1	1	21.5	21.5	21.5
DISSOLVED					
Aluminum	1	1	24.1	24.1	24.1
Antimony	1	1	9.0	9.0	9.0
Barium	1	1	53.8	53.8	53.8
Calcium	1	1	22700.0	22700.0	22700.0
Copper	1	1	8.8	8.8	8.8
Iron	1	1	2920.0	2920.0	2920.0
Magnesium	1	1	6060.0	6060.0	6060.0
Manganese	1	1	138.0	138.0	138.0
Potassium	1	1	4260.0	4260.0	4260.0
Sodium	1	1	1320.0	1320.0	1320.0
Vanadium	1	1	2.2	2.2	2.2
Zinc	1	1	12.0	12.0	12.0

AR308705

TABLE A11-11
SUMMARY OF DETECTED METALS (UG/L) IN SURFACEWATER
AREA: SOUTH POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
TOTAL					
Aluminum	5	5	33.8	148.0	68.4*
Antimony	5	1	2.2	2.2	2.2
Arsenic	5	4	2.2	10.1	5.1
Barium	5	5	34.8	88.1	63.6
Calcium	5	5	30000.0	89600.0	48760.0
Chromium	5	3	1.2	3.2	2.2
Copper	5	2	3.4	3.7	3.6
Iron	5	5	179.0	1870.0	756.6
Magnesium	5	5	13900.0	42100.0	25020.0
Manganese	5	5	8.9	482.0	190.3
Potassium	5	5	1510.0	4500.0	3076.0
Sodium	5	5	2430.0	4650.0	3480.0
Vanadium	5	4	3.2	19.4	8.0
Zinc	5	5	14.1	39.8	24.6
DISSOLVED					
Aluminum	5	2	17.8	30.5	24.2
Antimony	5	5	5.6	10.4	7.7
Arsenic	5	1	1.2	1.2	1.2
Barium	5	5	35.5	86.6	62.0
Calcium	5	5	30700.0	94000.0	51660.0
Cobalt	5	1	13.2	13.2	13.2
Copper	5	5	7.6	15.1	11.4
Iron	5	5	25.0	228.0	104.4
Magnesium	5	5	15400.0	43400.0	26260.0
Manganese	5	5	6.7	494.0	185.5
Potassium	5	5	1650.0	4940.0	3288.0
Selenium	5	4	4.9	14.2	7.9
Sodium	5	5	2440.0	4750.0	3494.0
Vanadium	5	3	3.5	16.0	8.7
Zinc	5	5	4.9	9.9	7.5

TABLE A11-12
SUMMARY OF DETECTED METALS (UG/L) IN SURFACEWATER
AREA: J-AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
TOTAL					
Aluminum	1	1	48.3	48.3	48.3
Antimony	1	1	2.8	2.8	2.8
Barium	1	1	33.2	33.2	33.2
Calcium	1	1	31300.0	31300.0	31300.0
Cobalt	1	1	13.2	13.2	13.2
Copper	1	1	5.4	5.4	5.4
Iron	1	1	742.0	742.0	742.0
Magnesium	1	1	13000.0	13000.0	13000.0
Manganese	1	1	181.0	181.0	181.0
Potassium	1	1	3060.0	3060.0	3060.0
Sodium	1	1	8430.0	8430.0	8430.0
Thallium	1	1	8.7	8.7	8.7
Zinc	1	1	38.2	38.2	38.2
DISSOLVED					
Aluminum	1	1	21.1	21.1	21.1
Antimony	1	1	7.3	7.3	7.3
Arsenic	1	1	9.5	9.5	9.5
Barium	1	1	34.0	34.0	34.0
Calcium	1	1	36100.0	36100.0	36100.0
Chromium	1	1	3.3	3.3	3.3
Cobalt	1	1	13.2	13.2	13.2
Copper	1	1	9.9	9.9	9.9
Iron	1	1	486.0	486.0	486.0
Magnesium	1	1	14900.0	14900.0	14900.0
Manganese	1	1	208.0	208.0	208.0
Potassium	1	1	3370.0	3370.0	3370.0
Selenium	1	1	4.4	4.4	4.4
Sodium	1	1	9120.0	9120.0	9120.0
Zinc	1	1	25.7	25.7	25.7

AR308707

TABLE A12-1
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/L) IN SURFACEWATER
AREA: CHRISTINA RIVER
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
Methylene Chloride	5.0	1.0	4.0	4.0	4.0
Tetrachloroethene	5.0	2.0	3.0	3.0	3.0

AR308708

TABLE A12-2
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/L) IN SURFACEWATER
AREA: WHITE CLAY CREEK
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
Acetone	5.0	1.0	11.0	11.0	11.0

TABLE A12-3
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/L) IN SURFACEWATER
AREA: HERSHEY RUN
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Acetone	12.0	5.0	3.0	6.0	4.0
Carbon Disulfide	12.0	1.0	21.0	21.0	21.0
Chloromethane	12.0	1.0	23.0	23.0	23.0
Methylene Chloride	12.0	2.0	3.0	14.0	8.5

AR308710

TABLE A12-4
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/L) IN SURFACEWATER
AREA: CHURCHMAN'S MARSH DRAINAGEWAY
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
Acetone	1.0	1.0	7.0	7.0	7.0

TABLE A12-5
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/L) IN SURFACEWATER
AREA: EAST DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
Methylene Chloride	3.0	1.0	12.0	12.0	12.0

TABLE A12-6
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/L) IN SURFACEWATER
AREA: EAST CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Acetone	10.0	3.0	5.0	5.0	5.0
Bromomethane	10.0	1.0	6.0	6.0	6.0
Chloromethane	10.0	1.0	17.0	17.0	17.0
Methylene Chloride	10.0	1.0	13.0	13.0	13.0

TABLE A12-7
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/L) IN SURFACEWATER
AREA: CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
Methylene Chloride	4.0	1.0	3.0	3.0	3.0

TABLE A12-8
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/L) IN SURFACEWATER
AREA: WEST CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
Acetone	7.0	1.0	5.0	5.0	5.0
Bromomethane	7.0	1.0	3.0	3.0	3.0
Methylene Chloride	7.0	1.0	3.0	3.0	3.0
Toluene	7.0	1.0	2.0	2.0	2.0

AR308715

TABLE A12-9
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/L) IN SURFACEWATER
AREA: FIRE POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Acetone	3.0	1.0	4.0	4.0	4.0
Methylene Chloride	3.0	1.0	3.0	3.0	3.0

TABLE A12-10
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/L) IN SURFACEWATER
AREA: SOUTH POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
Acetone	5.0	2.0	4.0	7.0	5.5

AR308717

TABLE A13-1
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/L) IN SURFACEWATER
AREA: CHRISTINA RIVER
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
bis(2-Ethylhexyl)phthalate	5.0	1.0	1.0	1.0	1.0

TABLE A13-2
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/L) IN SURFACEWATER
AREA: WHITE CLAY CREEK
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
bis(2-Ethylhexyl)phthalate	5.0	1.0	8.0	8.0	8.0

AR308719

TABLE A13-3
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/L) IN SURFACEWATER
AREA: HERSHEY RUN
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
bis(2-Ethylhexyl)phthalate	13.0	1.0	2.0	2.0	2.0

AR308720

TABLE A13-4
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/L) IN SURFACEWATER
AREA: CHURCHMAN'S MARSH DRAINAGEWAY
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
bis(2-Ethylhexyl)phthalate	1	1	4	4	4

TABLE A13-5
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/L) IN SURFACEWATER
AREA: EAST CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
Di-n-butylphthalate	10.0	1.0	3.0	3.0	3.0
bis(2-Ethylhexyl)phthalate	10.0	1.0	3.0	3.0	3.0

AR308722

TABLE A13-6
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/L) IN SURFACEWATER
AREA: CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
bis(2-Ethylhexyl)phthalate	5.0	2.0	6.0	6.0	6.0

AR308723

TABLE A13-7
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/L) IN SURFACEWATER
AREA: WEST CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
Benzo(b)fluoranthene	8.0	1.0	4.0	4.0	4.0
Chrysene	8.0	1.0	3.0	3.0	3.0
Fluoranthene	8.0	1.0	3.0	3.0	3.0
Pyrene	8.0	1.0	2.0	2.0	2.0

TABLE A13-8
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/L) IN SURFACEWATER
AREA: FIRE POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Acenaphthene	3.0	1.0	77.0	77.0	77.0
Anthracene	3.0	1.0	26.0	26.0	26.0
Benzo(a)anthracene	3.0	1.0	59.0	59.0	59.0
Benzo(a)pyrene	3.0	1.0	29.0	29.0	29.0
Benzo(b)fluoranthene	3.0	1.0	54.0	54.0	54.0
Benzo(g,h,i)perylene	3.0	1.0	26.0	26.0	26.0
Benzo(k)fluoranthene	3.0	1.0	47.0	47.0	47.0
Chrysene	3.0	1.0	90.0	90.0	90.0
Dibenzofuran	3.0	1.0	14.0	14.0	14.0
Fluoranthene	3.0	1.0	250.0	250.0	250.0
Fluorene	3.0	1.0	18.0	18.0	18.0
Indeno(1,2,3-c,d)pyrene	3.0	1.0	28.0	28.0	28.0
Naphthalene	3.0	1.0	17.0	17.0	17.0
Phenanthrene	3.0	1.0	42.0	42.0	42.0
Pyrene	3.0	1.0	210.0	210.0	210.0

TABLE A13-9
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/L) IN SURFACEWATER
AREA: SOUTH POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Acenaphthene	5.0	1.0	7.0	7.0	7.0
Benzo(b)fluoranthene	5.0	1.0	2.0	2.0	2.0
Chrysene	5.0	1.0	2.0	2.0	2.0
Fluoranthene	5.0	1.0	13.0	13.0	13.0
Fluorene	5.0	1.0	4.0	4.0	4.0
Pyrene	5.0	1.0	9.0	9.0	9.0

AR308726

TABLE a14-1
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/L) IN SURFACEWATER
AREA: HERSHEY RUN
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
Endrin ketone	3.000	1.000	0.007	0.007	0.007
alpha-Chlordane	3.000	2.000	0.005	0.005	0.005

TABLE A14-2
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/L) IN SURFACEWATER
AREA: WEST CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Endosulfan II	2.00	1.00	0.00	0.00	0.00
Methoxychlor	2.00	1.00	0.02	0.02	0.02

TABLE A14-3
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/L) IN SURFACEWATER
AREA: FIRE POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
PCB-1260	1.00	1.00	0.59	0.59	0.59

AR308729

TABLE A14-4
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/L) IN SURFACEWATER
AREA: K-AREA POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
alpha-Chlordane	1.00	1.00	0.01	0.01	0.01

AR308730

TABLE A14-5
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/L) IN SURFACEWATER
AREA: SOUTH POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
alpha-Chlordane	2.00	1.00	0.01	0.01	0.01
gamma-Chlordane	2.00	1.00	0.01	0.01	0.01

AR308731

TABLE A15-1
SUMMARY OF DETECTED DIOXINS/FURANS (NG/L) IN SURFACEWATER
AREA: FIRE POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
OCDD	1.0	1.0	19.0	19.0	19.0

AR308732

TABLE A16-1
SUMMARY OF DETECTED METALS (MG/KG) IN SEDIMENT
AREA: CHRISTINA RIVER
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Aluminum	10	10	1190	20100	13458
Antimony	10	8	1.2	2.6	1.6
Arsenic	10	10	1.4	13.7	5.84
Barium	10	10	12.9	1240	367.11
Beryllium	10	9	0.62	1.7	1.336
Cadmium	10	8	0.76	22.3	5.456
Calcium	10	10	405	2340	1435.3
Chromium	10	10	6.9	150	53.52
Cobalt	10	10	3.4	16.3	12.56
Copper	10	10	4.8	66.4	38.71
Iron	10	10	4460	28600	21517
Lead	10	10	12	220	79.81
Magnesium	10	9	288	4960	3559.667
Manganese	10	10	75.7	932	505.57
Mercury	10	8	0.09	0.63	0.28
Nickel	10	10	3	27.7	17.79
Potassium	10	10	121	3730	2074.3
Selenium	10	3	1.4	1.9	1.633
Sodium	10	10	43.5	276	179.14
Thallium	10	3	2.4	3.5	2.833
Vanadium	10	10	7.3	57.8	43.27
Zinc	10	10	40.2	3090	1001.12
Note: Not normalized					

TABLE A16-2
SUMMARY OF DETECTED METALS (MG/KG) IN SEDIMENT
AREA: WHITE CLAY CREEK
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Aluminum	12.0	12.0	3770.0	26700.0	17677.0
Antimony	10.0	9.0	0.7	1.8	1.3
Arsenic	10.0	10.0	1.4	8.3	4.1
Barium	12.0	12.0	43.3	667.0	239.0
Beryllium	12.0	12.0	0.3	1.5	1.1
Cadmium	10.0	6.0	0.4	3.7	1.8
Calcium	12.0	12.0	332.0	2790.0	1698.4
Chromium	12.0	12.0	13.8	50.1	32.0
Cobalt	12.0	12.0	4.5	22.6	15.8
Copper	12.0	12.0	4.5	50.0	27.4
Iron	12.0	12.0	8760.0	31100.0	24446.0
Lead	12.0	12.0	10.5	79.2	44.9
Magnesium	12.0	12.0	1410.0	6080.0	5170.0
Manganese	12.0	12.0	134.0	1010.0	515.1
Mercury	10.0	5.0	0.1	0.2	0.2
Nickel	12.0	12.0	5.4	27.7	20.5
Potassium	12.0	12.0	1510.0	5190.0	3846.0
Sodium	12.0	12.0	44.4	218.0	134.5
Thallium	10.0	2.0	4.0	4.2	4.1
Vanadium	12.0	12.0	14.6	67.1	51.7
Zinc	12.0	12.0	153.0	1210.0	575.3
Note: Not normalized					

TABLE A16-3
SUMMARY OF DETECTED METALS (MG/KG) IN SEDIMENT
AREA: HERSHEY RUN
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Aluminum	19	19	1390	32100	19311.053
Antimony	19	8	0.6	4	1.745
Arsenic	19	19	1	11.6	5.211
Barium	19	19	11.2	1850	400.563
Beryllium	19	17	0.75	2.2	1.534
Cadmium	19	15	0.28	14.5	3.594
Calcium	19	19	510	2530	1502.316
Chromium	19	19	7.5	108	48.353
Cobalt	19	17	8.6	20.3	15.8
Copper	19	19	2.8	179	51.379
Iron	19	19	3990	49100	28155.789
Lead	19	19	9.8	195	69.558
Magnesium	19	19	387	6680	4456.526
Manganese	19	19	43.1	1670	581.689
Mercury	19	15	0.08	0.86	0.236
Nickel	19	18	5.4	32.3	22.678
Potassium	19	19	153	4810	2484.368
Selenium	19	1	1.9	1.9	1.9
Sodium	19	19	29.8	215	143.437
Thallium	19	1	2.5	2.5	2.5
Vanadium	19	19	9.4	88.9	57.153
Zinc	19	19	43.3	8770	1543.305
Note Not normalized					

TABLE A16-4
SUMMARY OF DETECTED METALS (MG/KG) IN SEDIMENT
AREA: CHURCHMAN'S MARSH DRAINAGEWAY
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Aluminum	2	2	15600	16900	16250
Arsenic	2	2	2.9	6.1	4.5
Barium	2	2	183	253	218
Beryllium	2	2	1.3	1.3	1.3
Cadmium	2	1	2.2	2.2	2.2
Calcium	2	2	1970	2200	2085
Chromium	2	2	40.5	44.1	42.3
Cobalt	2	2	13.8	14.7	14.25
Copper	2	2	10.5	36.3	23.4
Iron	2	2	23800	26400	25100
Lead	2	2	12.7	45.6	29.15
Magnesium	2	2	4560	5670	5115
Manganese	2	2	296	474	385
Nickel	2	2	22.5	23.7	23.1
Potassium	2	2	1520	1980	1750
Sodium	2	2	158	224	191
Vanadium	2	2	44.9	50.5	47.7
Zinc	2	2	87.3	627	357.15
Note: Not normalized					

TABLE A16-5
SUMMARY OF DETECTED METALS (MG/KG) IN SEDIMENT
AREA: EAST DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Aluminum	4	4	18600	22800	20425
Antimony	4	4	2.2	7.2	3.6
Arsenic	4	4	9.8	26.2	14.5
Barium	4	4	415	1580	718.25
Beryllium	4	4	1.5	1.9	1.625
Cadmium	4	4	3.7	25.9	12.125
Calcium	4	4	2010	2630	2292.5
Chromium	4	4	50	69.2	62.075
Cobalt	4	4	17.2	20.6	19.025
Copper	4	4	77.4	188	152.85
Iron	4	4	25600	34400	30375
Lead	4	4	428	3150	1153.25
Magnesium	4	4	4080	4720	4485
Manganese	4	4	306	1220	679.75
Mercury	4	4	0.33	0.7	0.448
Nickel	4	4	23.5	40.7	34
Potassium	4	4	1320	2270	1787.5
Selenium	4	1	2.1	2.1	2.1
Sodium	4	4	187	211	200
Vanadium	4	4	51.9	79.2	65.85
Zinc	4	4	742	4610	2340.5

Note: Not normalized

TABLE A16-6
SUMMARY OF DETECTED METALS (MG/KG) IN SEDIMENT
AREA: EAST CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Aluminum	16	16	8820	28500	18976.25
Antimony	16	11	1.1	3.4	2
Arsenic	16	16	4.2	24.9	12.575
Barium	16	16	130	733	351.688
Beryllium	16	16	1.1	1.9	1.431
Cadmium	16	14	0.39	6.3	2.532
Calcium	16	16	1570	3240	2260.625
Chromium	16	16	23.9	90.8	58.094
Cobalt	16	16	8	26.2	17.85
Copper	16	16	11.5	157	55.944
Iron	16	16	20200	45800	33068.75
Lead	16	16	14.7	150	86.35
Magnesium	16	16	1460	5570	4433.125
Manganese	16	16	262	4300	1388.625
Mercury	16	14	0.1	0.35	0.186
Nickel	16	16	15.7	111	32.544
Potassium	16	16	442	2380	1781.563
Selenium	16	6	1.7	4.1	2.9
Silver	16	1	1.3	1.3	1.3
Sodium	16	16	120	325	212.125
Thallium	16	8	3.2	32.6	13.213
Vanadium	16	16	32.2	81.3	57.813
Zinc	16	16	68.5	1970	660.906

Note Not normalized

TABLE A16-7
SUMMARY OF DETECTED METALS (MG/KG) IN SEDIMENT
AREA: EAST CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Aluminum	4.0	4.0	13900.0	20700.0	16775.0
Antimony	4.0	3.0	1.4	2.8	1.9
Arsenic	4.0	4.0	9.5	22.9	15.9
Barium	4.0	4.0	342.0	723.0	514.3
Beryllium	4.0	4.0	1.3	1.7	1.5
Cadmium	4.0	3.0	0.9	3.3	2.0
Calcium	4.0	4.0	1730.0	5670.0	3157.5
Chromium	4.0	4.0	30.5	69.3	46.4
Cobalt	4.0	4.0	9.3	18.2	13.6
Copper	4.0	4.0	31.2	124.0	65.3
Iron	4.0	4.0	24400.0	54800.0	32375.0
Lead	4.0	4.0	84.9	161.0	114.2
Magnesium	4.0	4.0	2620.0	3690.0	3067.5
Manganese	4.0	4.0	426.0	1010.0	646.8
Mercury	4.0	2.0	0.1	0.2	0.2
Nickel	4.0	4.0	17.0	39.0	25.7
Potassium	4.0	4.0	702.0	1260.0	995.3
Selenium	4.0	2.0	1.9	6.6	4.3
Sodium	4.0	4.0	179.0	334.0	248.8
Vanadium	4.0	4.0	47.1	84.0	64.9
Zinc	4.0	4.0	325.0	1300.0	705.8
Note: Not Normalized					

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TABLE A16-8
SUMMARY OF DETECTED METALS (MG/KG) IN SEDIMENT
AREA: CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Aluminum	6	6	15400	23600	19283.333
Antimony	6	1	1.9	1.9	1.9
Arsenic	6	6	9.2	17.4	12.65
Barium	6	6	184	365	270.833
Beryllium	6	6	1.4	2	1.7
Cadmium	6	6	0.44	3.6	1.973
Calcium	6	6	1730	2380	2065
Chromium	6	6	39.1	71.3	54.45
Cobalt	6	6	11.6	20.2	16.4
Copper	6	6	14.8	108	59.183
Iron	6	6	25800	37100	31483.333
Lead	6	6	13.7	94.2	63.517
Magnesium	6	6	4140	5550	5080
Manganese	6	6	469	1030	602.667
Mercury	6	4	0.11	0.36	0.273
Nickel	6	6	21.1	31	26.717
Potassium	6	6	1380	3250	2218.333
Sodium	6	6	161	345	223.167
Vanadium	6	6	48.2	76	59.933
Zinc	6	6	172	1140	677
Note: Not normalized					

TABLE A16-9
SUMMARY OF DETECTED METALS (MG/KG) IN SEDIMENT
AREA: WEST CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Aluminum	12	12	15500	25800	21416.667
Antimony	12	8	1.2	2.5	1.8*
Arsenic	12	12	3.8	17.6	9.733
Barium	12	12	222	3020	814.833
Beryllium	12	12	0.93	1.9	1.411
Cadmium	12	12	0.9	21	5.192
Calcium	12	12	1330	3350	2021.667
Chromium	12	12	36.5	79.5	54.467
Cobalt	12	12	12.3	24.9	18.167
Copper	12	12	37.7	96	67.933
Iron	12	12	22100	41500	30141.667
Lead	12	12	38.1	159	96.842
Magnesium	12	12	2510	5810	4464.167
Manganese	12	12	382	1520	635.417
Mercury	12	11	0.14	0.66	0.282
Nickel	12	12	15.6	32.3	24.967
Potassium	12	12	1060	3930	2378.333
Selenium	12	5	1.6	4.4	2.5
Sodium	12	12	140	259	188
Thallium	12	4	2.7	5.5	3.975
Vanadium	12	12	52	87.2	69.025
Zinc	12	12	455	4330	1522.833

Note: Not normalized

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TABLE A16-10
SUMMARY OF DETECTED METALS (MG/KG) IN SEDIMENT
AREA: FIRE POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Aluminum	6	6	9700	14200	12333.333
Antimony	6	1	4.1	4.1	4.1
Arsenic	6	5	2.6	6.6	4.34
Barium	6	6	93.4	315	205.9
Beryllium	6	5	0.38	1.2	0.856
Cadmium	6	1	2.2	2.2	2.2
Calcium	6	6	1100	3070	1893.333
Chromium	6	6	26.6	41.3	32.783
Cobalt	6	6	8.7	14.9	11.417
Copper	6	6	18.4	109	40.1
Iron	6	6	17500	34700	25533.333
Lead	6	6	19.2	133	47.817
Magnesium	6	6	1990	3510	2751.667
Manganese	6	6	108	1630	584.5
Mercury	6	3	0.09	0.75	0.313
Nickel	6	6	16.4	44.9	21.8
Potassium	6	6	841	2290	1533.5
Sodium	6	6	54.8	168	98.7
Thallium	6	2	3.1	4.5	3.8
Vanadium	6	6	56.6	154	93.2
Zinc	6	6	80.8	1520	362.867

Note: Not normalized

TABLE A16-11
SUMMARY OF DETECTED METALS (MG/KG) IN SEDIMENT
AREA: K-AREA POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Aluminum	2	2	10500	16800	13650
Antimony	2	2	1.2	1.7	1.45
Arsenic	2	2	13.5	13.7	13.6
Barium	2	2	84.9	106	95.45
Beryllium	2	2	0.59	0.83	0.71
Cadmium	2	2	1.1	1.1	1.1
Calcium	2	2	938	1620	1279
Chromium	2	2	19.1	28	23.55
Cobalt	2	2	4.9	13.3	9.1
Copper	2	2	56.8	65.5	61.15
Iron	2	2	12600	21700	17150
Lead	2	2	72.8	84.1	78.45
Magnesium	2	2	1310	2160	1735
Manganese	2	2	89.7	229	159.35
Mercury	2	2	7.4	7.9	7.65
Nickel	2	2	8.5	14.5	11.5
Potassium	2	2	655	980	817.5
Selenium	2	2	2.4	2.5	2.45
Sodium	2	2	54.6	72.1	63.35
Thallium	2	2	3.1	6.3	4.7
Vanadium	2	2	27.5	46.2	36.85
Zinc	2	2	123	189	156

Note Not normalized

TABLE A16-12
SUMMARY OF DETECTED METALS (MG/KG) IN SEDIMENT
AREA: SOUTH POUND AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Aluminum	8	8	3690	17600	12100
Antimony	8	6	1	2.4	1.55
Arsenic	8	8	2.8	12.4	7
Barium	8	8	116	420	276.625
Beryllium	8	5	0.55	1	0.824
Cadmium	8	6	0.76	3.2	1.493
Calcium	8	8	2740	7900	4797.5
Chromium	8	8	8.4	64.9	34.2
Cobalt	8	8	4.2	18.7	10.938
Copper	8	8	17.3	153	59.95
Iron	8	8	5590	26000	16561.25
Lead	8	8	22.8	127	71.7
Magnesium	8	8	1930	4360	2793.75
Manganese	8	8	121	380	241.75
Mercury	8	6	0.33	8.8	2.04
Nickel	8	8	8	25.3	15.025
Potassium	8	8	300	2470	1021.625
Selenium	8	6	1.4	3.9	2.65
Silver	8	2	1.1	1.2	1.15
Sodium	8	8	85.9	212	159.975
Thallium	8	3	2.1	8.6	4.9
Vanadium	8	8	16.7	136	62.15
Zinc	8	8	104	475	291.625

Note Not normalized

TABLE A16-13
SUMMARY OF DETECTED METALS (MG/KG) IN SOIL
AREA: J-AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Aluminum	4.0	4.0	6040.0	14800.0	10660.0
Antimony	4.0	3.0	1.0	6.3	2.8
Arsenic	4.0	3.0	3.1	3.4	3.3
Barium	4.0	4.0	84.8	293.0	213.7
Beryllium	4.0	4.0	0.8	3.8	2.0
Calcium	4.0	4.0	524.0	3720.0	1828.0
Chromium	4.0	4.0	26.0	40.4	30.3
Cobalt	4.0	2.0	6.3	8.3	7.3
Copper	4.0	4.0	11.0	43.5	26.7
Iron	4.0	4.0	19400.0	33900.0	25550.0
Lead	4.0	4.0	11.5	119.0	62.1
Magnesium	4.0	4.0	1240.0	2870.0	2062.5
Manganese	4.0	4.0	95.9	155.0	123.0
Mercury	4.0	1.0	0.1	0.1	0.1
Nickel	4.0	4.0	10.7	18.9	13.1
Potassium	4.0	4.0	510.0	1070.0	800.3
Selenium	4.0	2.0	3.8	5.8	4.8
Sodium	4.0	4.0	70.0	192.0	127.5
Vanadium	4.0	4.0	33.4	51.3	42.9
Zinc	4.0	4.0	35.7	53.3	43.8
Note: Not Normalized					

TABLE A17-1
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: CHRISTINA RIVER
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
2-Butanone	10	6	16	230	66.667
Acetone	10	6	16	1800	551
Ethylbenzene	10	1	1100	1100	1100
Tetrachloroethene	10	1	9	9	9
Toluene	10	1	220	220	220
Xylenes (total)	10	1	2900	2900	2900

TABLE A17-2
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: WHITE CLAY CREEK
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
2-Butanone	6	2	10	23	16.5
Acetone	6	2	5	57	31
Carbon Disulfide	6	1	5	5	5
Tetrachloroethene	6	2	10	13	11.5
Toluene	6	1	10	10	10
Xylenes (total)	6	1	4.1	4.1	4.1

TABLE A17-3
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: HERSHEY RUN
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS		
			MINIMUM	MAXIMUM	AVERAGE
2-Butanone	18	10	13	65	27.8
Acetone	18	7	11	96	62
Carbon Disulfide	18	1	5	5	5
Chloromethane	18	1	5700	5700	5700
Ethylbenzene	18	4	9	8500	2263.5
Methylene Chloride	18	5	5	14	7.2
Tetrachloroethene	18	1	3	3	3
Toluene	18	1	13	13	13
Xylenes (total)	18	4	21.6	4400	1311.15

TABLE A17-4
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: CHURCHMAN'S MARSH DRAINAGEWAY
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
Acetone	2	2	35	41	38

TABLE A17-5
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: EAST DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
2-Butanone	4	3	24	63	37.667
Acetone	4	3	97	110	102.333
Methylene Chloride	4	1	7	7	7

TABLE A17-6
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: EAST CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
2-Butanone	16	9	24	78	42.889
Acetone	16	11	22	410	176.455
Carbon Disulfide	16	1	8	8	8
Methylene Chloride	16	7	7	17	10.571
Tetrachloroethene	16	3	5	11	7.333
Toluene	16	1	4	4	4

TABLE A17-7
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: EAST CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
2-Butanone	4.0	2.0	45.0	180.0	112.5
Acetone	4.0	1.0	190.0	190.0	190.0
Tetrachloroethene	4.0	3.0	5.0	33.0	15.3
Toluene	4.0	1.0	39.0	39.0	39.0

TABLE A17-8
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
2-Butanone	6.0	6.0	27.0	71.0	48.5
Acetone	6.0	4.0	110.0	280.0	197.5
Methylene Chloride	6.0	4.0	7.0	65.0	22.3
Tetrachloroethene	6.0	1.0	5.0	5.0	5.0

TABLE A17-9
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: WEST CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
2-Butanone	8.0	6.0	22.0	1100.0	219.5
Acetone	8.0	5.0	12.0	1300.0	384.4
Benzene	8.0	1.0	7.0	7.0	7.0
Carbon Disulfide	8.0	1.0	4.0	4.0	4.0
Ethylbenzene	8.0	5.0	60.0	2100.0	672.0
Methylene Chloride	8.0	1.0	8.0	8.0	8.0
Styrene	8.0	3.0	5.0	16.0	9.0
Tetrachloroethene	8.0	1.0	7.0	7.0	7.0
Toluene	8.0	4.0	15.0	92.0	49.0
Xylenes (total)	8.0	5.0	152.0	5700.0	1614.4

TABLE A17-10
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: FIRE POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
2-Butanone	4.0	1.0	32.0	32.0	32.0
Acetone	4.0	2.0	6.0	76.0	41.0
Benzene	4.0	2.0	2.0	29.0	15.5
Ethylbenzene	4.0	2.0	52.0	190.0	121.0
Methylene Chloride	4.0	2.0	5.0	6.0	5.5
Tetrachloroethene	4.0	1.0	5.0	5.0	5.0
Toluene	4.0	2.0	7.0	100.0	53.5
Xylenes (total)	4.0	2.0	106.0	1030.0	568.0

TABLE A17-11
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: K-AREA POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
Acetone	2.0	2.0	76.0	190.0	133.0
Ethylbenzene	2.0	1.0	17.0	17.0	17.0*
Xylenes (total)	2.0	1.0	66.0	66.0	66.0

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TABLE A17-12
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: SOUTH POND AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
2-Butanone	8.0	2.0	26.0	30.0	28.0
Acetone	8.0	4.0	21.0	480.0	167.3
Ethylbenzene	8.0	3.0	2000.0	3700.0	2900.0
Methylene Chloride	8.0	1.0	37.0	37.0	37.0
Styrene	8.0	2.0	1400.0	3100.0	2250.0
Tetrachloroethene	8.0	1.0	12.0	12.0	12.0
Toluene	8.0	4.0	13.0	2700.0	1578.3
Xylenes (total)	8.0	5.0	6.0	20000.0	7685.8

AR308757

TABLE A17-13
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN SOIL
AREA: J-AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
Chloroform	4.0	2.0	4.0	4.0	4.0
Tetrachloroethene	4.0	4.0	6.0	26.0	12.0

TABLE A18-1
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: CHRISTINA RIVER
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
1,1,2,2-Tetrachloroethane	4.0	4.0	200.0	400.0	300.0
2-Methylnaphthalene	10.0	1.0	50.0	50.0	50.0
Acenaphthene	10.0	3.0	60.0	880.0	406.7
Anthracene	10.0	2.0	100.0	130.0	115.0
Benzo(a)anthracene	10.0	7.0	73.0	1600.0	533.3
Benzo(a)pyrene	10.0	6.0	33.0	330.0	180.7
Benzo(b)fluoranthene	10.0	7.0	76.0	950.0	460.9
Benzo(g,h,i)perylene	10.0	1.0	140.0	140.0	140.0
Benzo(k)fluoranthene	10.0	1.0	310.0	310.0	310.0
Butylbenzylphthalate	10.0	2.0	86.0	120.0	103.0
Chrysene	10.0	7.0	66.0	1300.0	446.6
Di-n-butylphthalate	10.0	4.0	38.0	140.0	102.0
Dibenzofuran	10.0	1.0	65.0	65.0	65.0
Fluoranthene	10.0	8.0	130.0	5700.0	1148.8
Fluorene	10.0	4.0	58.0	1300.0	426.0
Indeno(1,2,3-c,d)pyrene	10.0	2.0	140.0	360.0	250.0
Naphthalene	10.0	2.0	62.0	89.0	75.5
Phenanthrene	10.0	6.0	79.0	6000.0	1353.2
Pyrene	10.0	8.0	110.0	4800.0	971.3
bis(2-Ethylhexyl)phthalate	10.0	4.0	59.0	780.0	462.3

TABLE A18-2
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: WHITE CLAY CREEK
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Benzo(a)anthracene	12.0	5.0	230.0	430.0	325.0
Benzo(b)fluoranthene	12.0	6.0	230.0	430.0	320.0
Benzo(g,h,i)perylene	10.0	1.0	260.0	260.0	260.0
Benzo(k)fluoranthene	10.0	1.0	110.0	110.0	110.0
Chrysene	12.0	4.0	150.0	430.0	283.3
Di-n-butylphthalate	12.0	2.0	240.0	370.0	305.0
Fluoranthene	12.0	6.0	290.0	1100.0	682.0
Indeno(1,2,3-c,d)pyrene	10.0	1.0	240.0	240.0	240.0
Phenanthrene	12.0	6.0	180.0	640.0	352.0
Pyrene	12.0	5.0	300.0	800.0	552.5
bis(2-Ethylhexyl)phthalate	12.0	3.0	220.0	390.0	305.0

TABLE A18-3
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: HERSHEY RUN
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
2-Methylnaphthalene	19.0	6.0	290.0	990000.0	193698.3
Acenaphthene	19.0	8.0	500.0	1100000.0	227112.5
Acenaphthylene	19.0	1.0	5400.0	5400.0	5400.0
Anthracene	19.0	14.0	230.0	2100000.0	224633.6
Benzo(a)anthracene	19.0	17.0	400.0	340000.0	41861.8
Benzo(a)pyrene	19.0	12.0	240.0	94000.0	18728.3
Benzo(b)fluoranthene	19.0	18.0	400.0	130000.0	17083.9
Benzo(g,h,i)perylene	19.0	6.0	420.0	36000.0	10686.7
Benzo(k)fluoranthene	19.0	13.0	230.0	99000.0	15478.5
Carbazole	19.0	9.0	330.0	93000.0	40103.3
Chrysene	19.0	18.0	250.0	200000.0	31757.8
Di-n-butylphthalate	19.0	3.0	200.0	340.0	290.0
Dibenz(a,h)anthracene	19.0	5.0	360.0	12000.0	4170.0
Dibenzofuran	19.0	8.0	670.0	960000.0	190696.3
Fluoranthene	19.0	19.0	370.0	1100000.0	153024.7
Fluorene	19.0	10.0	320.0	1300000.0	209507.0
Indeno(1,2,3-c,d)pyrene	19.0	6.0	500.0	45000.0	11883.3
Naphthalene	19.0	4.0	3100.0	2100000.0	604175.0
Phenanthrene	19.0	18.0	260.0	2700000.0	287336.7
Pyrene	19.0	19.0	420.0	900000.0	111081.6
bis(2-Ethylhexyl)phthalate	19.0	4.0	260.0	600.0	372.5

AR308761

TABLE A18-4
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: CHURCHMAN'S MARSH DRAINAGEWAY
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Di-n-butylphthalate	2.0	2.0	210.0	320.0	265.0
bis(2-Ethylhexyl)phthalate	2.0	1.0	160.0	160.0	160.0

TABLE A18-5
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: EAST DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Anthracene	4	1	260	260	260
Benzo(a)anthracene	4	3	270	620	493.333
Benzo(a)pyrene	4	2	300	410	355
Benzo(b)fluoranthene	4	2	420	660	540
Benzo(g,h,i)perylene	4	1	340	340	340
Benzo(k)fluoranthene	4	2	260	480	370
Butylbenzylphthalate	4	2	320	1200	760
Chrysene	4	2	350	450	400
Di-n-butylphthalate	4	1	270	270	270
Fluoranthene	4	4	360	1300	885
Fluorene	4	2	130	250	190
Indeno(1,2,3-c,d)pyrene	4	2	260	290	275
Phenanthrene	4	2	440	990	715
Pyrene	4	4	370	1200	742.5
bis(2-Ethylhexyl)phthalate	4	2	220	610	415

TABLE A18-6
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: EAST CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Anthracene	15	3	400	1700	846.667
Benzo(a)anthracene	15	9	280	960	483.333
Benzo(a)pyrene	15	4	240	410	340
Benzo(b)fluoranthene	15	8	360	1500	696.25
Benzo(k)fluoranthene	15	7	150	750	357.143
Butylbenzylphthalate	15	1	190	190	190
Carbazole	15	1	700	700	700
Chrysene	15	8	270	1100	532.5
Di-n-butylphthalate	15	9	310	750	484.444
Fluoranthene	15	9	340	1400	678.889
Fluorene	15	1	310	310	310
Indeno(1,2,3-c,d)pyrene	15	1	190	190	190
Phenanthrene	15	6	200	1400	566.667
Pyrene	15	9	320	1800	744.444
bis(2-Ethylhexyl)phthalate	15	5	160	210	186

TABLE A18-7
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: EAST CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
1,1,2,2-Tetrachloroethane	3	3	300	1000	566.667

TABLE A18-8
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Benzo(a)anthracene	6	4	290	640	440
Benzo(a)pyrene	6	2	240	240	240
Benzo(b)fluoranthene	6	4	340	450	375
Benzo(k)fluoranthene	6	1	260	260	260
Chrysene	6	3	290	780	503.333
Di-n-butylphthalate	6	6	210	450	291.667
Fluoranthene	6	4	390	1800	825
Phenanthrene	6	3	240	360	313.333
Pyrene	6	4	390	1400	700
bis(2-Ethylhexyl)phthalate	6	1	350	350	350

TABLE A18-9
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: WEST CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
2-Methylnaphthalene	12	7	1000	970000	394428.571
Acenaphthene	12	8	410	1600000	624488.75
Anthracene	12	9	730	890000	286658.889
Benzo(a)anthracene	12	12	560	460000	145788.333
Benzo(a)pyrene	12	10	290	89000	28869
Benzo(b)fluoranthene	12	12	500	200000	70775
Benzo(g,h,i)perylene	12	7	260	59000	17732.857
Benzo(k)fluoranthene	12	10	340	220000	38235
Carbazole	12	6	13000	450000	150500
Chrysene	12	12	330	470000	115331.667
Di-n-butylphthalate	12	2	410	420	415
Dibenz(a,h)anthracene	12	3	15000	25000	20000
Dibenzofuran	12	8	350	1100000	425281.25
Fluoranthene	12	12	810	2200000	573342.5
Fluorene	12	8	670	1600000	624683.75
Indeno(1,2,3-c,d)pyrene	12	8	440	72000	20441.25
Naphthalene	12	6	20000	2500000	830000
Phenanthrene	12	10	180	4300000	1278479
Pyrene	12	12	680	1500000	303189.167

TABLE A18–10
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: FIRE POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
2-Methylnaphthalene	6	4	180000	1300000	785000
Acenaphthene	6	4	930000	3800000	1882500
Acenaphthylene	6	1	72000	72000	72000
Anthracene	6	6	740	2800000	1188740
Benzo(a)anthracene	6	6	4700	3400000	837316.667
Benzo(a)pyrene	6	6	6100	750000	235850
Benzo(b)fluoranthene	6	6	7800	1700000	464466.667
Benzo(g,h,i)perylene	6	6	3500	190000	65250
Benzo(k)fluoranthene	6	6	4200	320000	126383.333
Carbazole	6	4	140000	1700000	820000
Chrysene	6	6	5300	1400000	473716.667
Dibenz(a,h)anthracene	6	5	860	42000	20372
Dibenzofuran	6	4	630000	3600000	1655000
Fluoranthene	6	6	8600	8400000	2953433.333
Fluorene	6	4	1100000	4200000	2200000
Indeno(1,2,3-c,d)pyrene	6	6	3200	240000	77533.333
Naphthalene	6	4	180000	1600000	825000
Phenanthrene	6	6	960	15000000	4834010
Pyrene	6	6	7400	5200000	1953066.667

TABLE A18-11
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: K-AREA POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
2-Methylnaphthalene	2	2	170000	210000	190000
3,3'-Dichlorobenzidine	2	1	7400	7400	7400
Acenaphthene	2	2	13000	88000	50500
Acenaphthylene	2	1	2300	2300	2300
Anthracene	2	2	1500000	3100000	2300000
Benzo(a)anthracene	2	2	580000	940000	760000
Benzo(a)pyrene	2	2	31000	190000	110500
Benzo(b)fluoranthene	2	2	140000	310000	225000
Benzo(g,h,i)perylene	2	2	41000	86000	63500
Benzo(k)fluoranthene	2	2	52000	110000	81000
Carbazole	2	2	710000	1600000	1155000
Chrysene	2	2	310000	480000	395000
Dibenz(a,h)anthracene	2	2	18000	29000	23500
Dibenzofuran	2	2	200000	250000	225000
Fluoranthene	2	2	540000	770000	655000
Fluorene	2	2	430000	500000	465000
Indeno(1,2,3-c,d)pyrene	2	2	50000	110000	80000
Naphthalene	2	2	99000	140000	119500
Pentachlorophenol	2	2	8900	22000	15450
Phenanthrene	2	2	550000	800000	675000
Pyrene	2	2	790000	810000	800000

TABLE A18-12
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: SOUTH POND AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
2-Methylnaphthalene	8	5	110000	3200000	1684000
Acenaphthene	8	6	6000	8600000	3401500
Acenaphthylene	8	2	2100	5100	3600
Anthracene	8	8	11000	12000000	3460125
Benzo(a)anthracene	8	8	62000	3100000	966500
Benzo(a)pyrene	8	5	61000	180000	100000
Benzo(b)fluoranthene	8	8	83000	1400000	490375
Benzo(g,h,i)perylene	8	4	21000	80000	48750
Benzo(k)fluoranthene	8	7	34000	820000	260428.571
Carbazole	8	7	220000	4200000	1411428.571
Chrysene	8	8	75000	2100000	811875
Dibenz(a,h)anthracene	8	4	10000	27000	18750
Dibenzofuran	8	7	40000	5800000	1960000
Fluoranthene	8	8	67000	17000000	5079625
Fluorene	8	7	130000	9500000	3172857.143
Indeno(1,2,3-c,d)pyrene	8	5	26000	98000	60400
Naphthalene	8	5	43000	7700000	4018800
Phenanthrene	8	8	11000	29000000	8526375
Pyrene	8	8	79000	12000000	3347375

TABLE A18-13
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN SEDIMENT
AREA: J-AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
2-Methylnaphthalene	4	1	49	49	49
Anthracene	4	3	160	2000	1086.667
Benzo(a)anthracene	4	3	720	21000	9206.667
Benzo(a)pyrene	4	3	480	9200	3960
Benzo(b)fluoranthene	4	3	2200	16000	8000
Benzo(g,h,i)perylene	4	3	260	5500	2486.667
Benzo(k)fluoranthene	4	3	820	9800	4240
Butylbenzylphthalate	4	2	120	820	470
Carbazole	4	3	46	1200	612
Chrysene	4	3	470	14000	6856.667
Di-n-butylphthalate	4	1	160	160	160
Dibenz(a,h)anthracene	4	3	110	1800	780
Dibenzofuran	4	1	58	58	58
Fluoranthene	4	4	48	25000	8562
Indeno(1,2,3-c,d)pyrene	4	3	380	5700	2726.667
Naphthalene	4	2	130	220	175
Phenanthrene	4	3	95	2800	1331.667
Pyrene	4	4	54	23000	7963.5

TABLE A19-1
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN SEDIMENT
AREA: CHRISTINA RIVER
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS		
			MINIMUM	MAXIMUM	AVERAGE
4,4'-DDD	2.0	2.0	0.3	0.5	0.4
4,4'-DDE	2.0	2.0	0.3	0.5	0.4
Dieldrin	2.0	1.0	4.4	4.4	4.4
PCB-1260	2.0	2.0	3.6	7.4	5.5
alpha-Chlordane	2.0	2.0	0.4	0.9	0.7
gamma-Chlordane	2.0	2.0	0.8	1.4	1.1

AR308772

TABLE A19-2
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN SEDIMENT
AREA: WHITE CLAY CREEK
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
4,4'-DDD	1.0	1.0	1.7	1.7	1.7
4,4'-DDE	1.0	1.0	0.5	0.5	0.5
alpha-Chlordane	1.0	1.0	0.5	0.5	0.5
gamma-Chlordane	1.0	1.0	0.2	0.2	0.2

AR308773

TABLE A19-3
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN SEDIMENT
AREA: HERSHEY RUN
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
4,4'-DDD	5.0	2.0	0.7	2.7	1.7
4,4'-DDE	5.0	3.0	0.3	6.4	2.6
4,4'-DDT	5.0	1.0	1.4	1.4	1.4
Aldrin	5.0	2.0	3.7	4.5	4.1
Dieldrin	5.0	1.0	0.5	0.5	0.5
Endosulfan I	5.0	1.0	1.1	1.1	1.1
Heptachlor epoxide	5.0	1.0	0.4	0.4	0.4
PCB-1254	5.0	1.0	48.0	48.0	48.0
alpha-BHC	5.0	2.0	0.3	1.5	0.9
alpha-Chlordane	5.0	1.0	1.0	1.0	1.0
gamma-Chlordane	5.0	2.0	0.3	0.4	0.4

AR308774

TABLE A19-4
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN SEDIMENT
AREA: CHURCHMAN'S MARSH DRAINAGEWAY
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
4,4'-DDE	1.0	1.0	1.4	1.4	1.4
Heptachlor epoxide	1.0	1.0	0.4	0.4	0.4
PCB-1260	1.0	1.0	8.8	8.8	8.8
gamma-Chlordane	1.0	1.0	0.5	0.5	0.5

TABLE A19-5
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN SEDIMENT
AREA: EAST DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
4,4'-DDE	1.0	1.0	3.5	3.5	3.5
PCB-1254	1.0	1.0	210.0	210.0	210.0
gamma-Chlordane	1.0	1.0	4.1	4.1	4.1

AR308776

TABLE A19-6
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN SEDIMENT
AREA: EAST CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
4,4'-DDD	3.0	2.0	1.8	2.3	2.1
4,4'-DDE	3.0	2.0	3.0	4.6	3.8
PCB-1254	3.0	2.0	18.0	85.0	51.5
alpha-Chlordane	3.0	2.0	0.6	1.0	0.8
gamma-Chlordane	3.0	2.0	0.4	3.6	2.0

AR308777

TABLE A19-7
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN SEDIMENT
AREA: EAST CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
4,4'-DDD	4.0	3.0	1.2	3.0	1.9
4,4'-DDE	4.0	4.0	4.3	7.3	5.5
Methoxychlor	4.0	1.0	7.6	7.6	7.6
PCB-1254	4.0	2.0	140.0	170.0	155.0
PCB-1260	4.0	1.0	12.0	12.0	12.0
gamma-Chlordane	4.0	2.0	1.1	2.1	1.6

AR308778

TABLE A19-8
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN SEDIMENT
AREA: WEST CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
4,4'-DDD	1.0	1.0	14.0	14.0	14.0
4,4'-DDT	1.0	1.0	14.0	14.0	14.0

AR308779

TABLE A19-9
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN SEDIMENT
AREA: FIRE POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
4,4'-DDD	1.0	1.0	360.0	360.0	360.0

AR308780

TABLE A19-10
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN SEDIMENT
AREA: K-AREA POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
4,4'-DDD	1.0	1.0	400.0	400.0	400.0
4,4'-DDT	1.0	1.0	130.0	130.0	130.0

TABLE A19-11
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN SEDIMENT
AREA: SOUTH POND AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
4,4'-DDD	2.0	1.0	34.0	34.0	34.0
4,4'-DDT	2.0	2.0	30.0	1200.0	615.0
Dieldrin	2.0	1.0	13.0	13.0	13.0

AR308782

TABLE A20-1
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN SEDIMENT
AREA: CHRISTINA RIVER
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS		
			MINIMUM	MAXIMUM	AVERAGE
OCDD	2.0	2.0	0.2	0.7	0.5

AR308783

TABLE A20-2
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN SEDIMENT
AREA: WHITE CLAY CREEK
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
OCDD	1.0	1.0	2.0	2.0	2.0

TABLE A20-3
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN SEDIMENT
AREA: HERSHEY RUN
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

ORIGINAL (Red)

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
1,2,3,4,6,7,8-HpCDD	5.00	4.00	0.24	0.50	0.32
HpCDDs (total)	5.00	4.00	0.55	0.96	0.74
OCDD	5.00	4.00	8.00	11.00	9.23
OCDF	5.00	2.00	0.24	0.27	0.26

AR308785

TABLE A20-4
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN SEDIMENT
AREA: CHURCHMAN'S MARSH DRAINAGEWAY
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
OCDD	1.0	1.0	1.6	1.6	1.6

AR308786

TABLE A20-5
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN SEDIMENT
AREA: EAST DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

Original (Red)

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
1,2,3,4,6,7,8-HpCDD	2.00	2.00	0.31	1.00	0.66
1,2,3,4,6,7,8-HpCDF	2.00	1.00	0.20	0.20	0.20
HpCDDs (total)	2.00	2.00	0.61	2.30	1.46
HpCDFs (total)	2.00	1.00	0.93	0.93	0.93
OCDD	2.00	2.00	6.90	15.00	10.95
OCDF	2.00	2.00	0.32	1.10	0.71

AR308787

TABLE A20-6
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN SEDIMENT
AREA: EAST CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
1,2,3,4,6,7,8-HpCDD	2.00	1.00	0.20	0.20	0.20
HpCDDs (total)	2.00	2.00	0.16	0.45	0.31
OCDD	2.00	2.00	2.60	5.50	4.05
OCDF	2.00	2.00	0.18	0.25	0.22

TABLE A20-7
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN SEDIMENT
AREA: EAST CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
OCDD	4.00	4.00	1.80	5.10	3.53

AR308789

TABLE A20-8
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN SEDIMENT
AREA: WEST CENTRAL DRAINAGE AREA
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
1,2,3,4,6,7,8-HpCDD	1.0	1.0	5.7	5.7	5.7
1,2,3,4,6,7,8-HpCDF	1.0	1.0	1.5	1.5	1.5
HpCDDs (total)	1.0	1.0	16.0	16.0	16.0
HpCDFs (total)	1.0	1.0	8.5	8.5	8.5
HxCDFs (total)	1.0	1.0	1.0	1.0	1.0
OCDD	1.0	1.0	71.0	71.0	71.0
OCDF	1.0	1.0	9.0	9.0	9.0

AR308790

TABLE A20-9
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN SEDIMENT
AREA: FIRE POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
1,2,3,4,6,7,8-HpCDD	1.0	1.0	43.0	43.0	43.0
1,2,3,4,6,7,8-HpCDF	1.0	1.0	12.0	12.0	12.0
1,2,3,4,7,8,9-HpCDF	1.0	1.0	1.5	1.5	1.5
1,2,3,4,7,8-HxCDF	1.0	1.0	3.1	3.1	3.1
HpCDDs (total)	1.0	1.0	81.0	81.0	81.0
HpCDFs (total)	1.0	1.0	54.0	54.0	54.0
HxCDFs (total)	1.0	1.0	23.0	23.0	23.0
OCDD	1.0	1.0	370.0	370.0	370.0
OCDF	1.0	1.0	35.0	35.0	35.0

AR308791

TABLE A20-10
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN SEDIMENT
AREA: K-AREA POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
1,2,3,4,6,7,8-HpCDD	1.0	1.0	7.1	7.1	7.1
HpCDDs (total)	1.0	1.0	42.0	42.0	42.0
HpCDFs (total)	1.0	1.0	16.0	16.0	16.0
OCDD	1.0	1.0	62.0	62.0	62.0

AR308792

TABLE A20-11
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN SEDIMENT
AREA: SOUTH POND
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
1,2,3,4,6,7,8-HpCDD	1.0	1.0	26.0	26.0	26.0
1,2,3,4,6,7,8-HpCDF	1.0	1.0	2.8	2.8	2.8
1,2,3,4,7,8,9-HpCDF	1.0	1.0	0.3	0.3	0.3
HpCDDs (total)	1.0	1.0	82.0	82.0	82.0
HpCDFs (total)	1.0	1.0	15.0	15.0	15.0
HxCDFs (total)	1.0	1.0	2.0	2.0	2.0
OCDD	1.0	1.0	250.0	250.0	250.0
OCDF	1.0	1.0	18.0	18.0	18.0

TABLE A21-1
SUMMARY OF DETECTED METALS (MG/KG) IN PEAT
AREA: HERSHEY RUN MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Aluminum	16.0	16.0	15600.0	33900.0	28250.0
Antimony	16.0	6.0	0.9	2.3	1.5
Arsenic	16.0	14.0	2.7	12.1	6.5
Barium	16.0	16.0	245.0	519.0	316.3
Beryllium	16.0	15.0	0.9	2.0	1.7
Cadmium	16.0	13.0	0.6	3.0	1.7
Calcium	16.0	16.0	906.0	2930.0	2167.9
Chromium	16.0	16.0	23.6	90.3	60.1
Cobalt	16.0	16.0	5.5	23.1	17.7
Copper	16.0	16.0	13.9	117.0	64.2
Iron	16.0	16.0	13000.0	44400.0	33293.8
Lead	16.0	16.0	33.9	263.0	94.8
Magnesium	16.0	16.0	2160.0	5880.0	5135.0
Manganese	16.0	16.0	91.4	4200.0	923.4
Mercury	16.0	11.0	0.2	0.5	0.3
Nickel	16.0	16.0	13.0	40.7	32.4
Potassium	16.0	16.0	597.0	3200.0	2550.3
Selenium	16.0	2.0	2.1	4.6	3.4
Silver	16.0	2.0	1.8	3.8	2.8
Sodium	16.0	16.0	99.6	272.0	199.4
Thallium	16.0	4.0	2.9	5.8	4.7
Vanadium	16.0	16.0	38.5	95.8	75.3
Zinc	16.0	16.0	83.2	2100.0	1042.0
Note: Not Normalized					

AR308794

TABLE A21-2
SUMMARY OF DETECTED METALS (MG/KG) IN PEAT
AREA: CHURCHMAN'S MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Aluminum	2.0	2.0	24000.0	25900.0	24950.0
Antimony	2.0	2.0	0.9	2.5	1.7
Arsenic	2.0	2.0	3.9	13.9	8.9
Barium	2.0	2.0	323.0	641.0	482.0
Beryllium	2.0	2.0	1.4	1.6	1.5
Cadmium	2.0	2.0	5.5	20.1	12.8
Calcium	2.0	2.0	1970.0	2290.0	2130.0
Chromium	2.0	2.0	59.6	78.5	69.1
Cobalt	2.0	2.0	15.2	19.9	17.6
Copper	2.0	2.0	59.7	153.0	106.4
Iron	2.0	2.0	29300.0	30900.0	30100.0
Lead	2.0	2.0	77.0	166.0	121.5
Magnesium	2.0	2.0	4950.0	5030.0	4990.0
Manganese	2.0	2.0	296.0	691.0	493.5
Mercury	2.0	2.0	0.3	0.4	0.4
Nickel	2.0	2.0	27.4	37.2	32.3
Potassium	2.0	2.0	2480.0	2580.0	2530.0
Sodium	2.0	2.0	179.0	235.0	207.0
Thallium	2.0	1.0	4.4	4.4	4.4
Vanadium	2.0	2.0	59.9	64.4	62.2
Zinc	2.0	2.0	1240.0	5860.0	3550.0
Note: Not Normalized					

AR308795

TABLE A21-3
SUMMARY OF DETECTED METALS (MG/KG) IN PEAT
AREA: EAST CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Aluminum	10.0	10.0	20000.0	28400.0	23810.0
Antimony	10.0	10.0	1.3	3.7	2.6
Arsenic	10.0	10.0	12.1	31.3	18.8
Barium	10.0	10.0	351.0	577.0	429.2
Beryllium	10.0	10.0	1.3	1.9	1.6
Cadmium	10.0	10.0	2.0	6.5	3.4
Calcium	10.0	10.0	1570.0	2980.0	2134.0
Chromium	10.0	10.0	60.6	99.1	76.8
Cobalt	10.0	10.0	12.1	32.4	18.9
Copper	10.0	10.0	67.9	162.0	109.4
Iron	10.0	10.0	26000.0	46500.0	35040.0
Lead	10.0	10.0	89.1	220.0	131.6
Magnesium	10.0	10.0	3970.0	5330.0	4638.0
Manganese	10.0	10.0	323.0	1870.0	876.2
Mercury	10.0	7.0	0.2	0.9	0.5
Nickel	10.0	10.0	30.3	44.2	36.2
Potassium	10.0	10.0	1620.0	2250.0	1969.0
Selenium	10.0	1.0	1.9	1.9	1.9
Sodium	10.0	10.0	183.0	276.0	219.4
Thallium	10.0	3.0	3.3	5.2	4.3
Vanadium	10.0	10.0	66.1	81.2	73.5
Zinc	10.0	10.0	889.0	1620.0	1218.5
Note: Not Normalized					

AR308796

TABLE A21-4
SUMMARY OF DETECTED METALS (MG/KG) IN PEAT
AREA: CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Aluminum	6.0	6.0	18800.0	26400.0	21933.3
Antimony	6.0	6.0	1.1	4.1	2.2
Arsenic	6.0	6.0	12.2	26.2	17.3
Barium	6.0	6.0	361.0	530.0	440.7
Beryllium	6.0	6.0	1.4	1.8	1.6
Cadmium	6.0	6.0	0.8	3.5	1.7
Calcium	6.0	6.0	917.0	2120.0	1526.2
Chromium	6.0	6.0	44.2	67.9	59.5
Cobalt	6.0	6.0	13.5	24.8	19.3
Copper	6.0	6.0	40.7	109.0	68.4
Iron	6.0	6.0	25000.0	30800.0	27866.7
Lead	6.0	6.0	64.6	116.0	93.5
Magnesium	6.0	6.0	4510.0	5270.0	4886.7
Manganese	6.0	6.0	504.0	674.0	560.0
Mercury	6.0	6.0	0.2	0.4	0.3
Nickel	6.0	6.0	23.9	40.9	31.8
Potassium	6.0	6.0	1840.0	2410.0	2156.7
Sodium	6.0	6.0	105.0	246.0	193.8
Thallium	6.0	2.0	3.1	6.1	4.6
Vanadium	6.0	6.0	54.0	80.7	67.1
Zinc	6.0	6.0	535.0	1160.0	793.3
Note: Not Normalized					

AR308797

TABLE A21-5
SUMMARY OF DETECTED METALS (MG/KG) IN PEAT
AREA: WEST CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Aluminum	6.0	6.0	20700.0	26400.0	22533.3
Antimony	6.0	3.0	1.5	2.7	2.2
Arsenic	6.0	6.0	6.0	22.0	11.7
Barium	6.0	6.0	342.0	3060.0	1074.7
Beryllium	6.0	6.0	1.4	2.1	1.7
Cadmium	6.0	6.0	1.0	14.0	4.2
Calcium	6.0	6.0	2550.0	6010.0	3568.3
Chromium	6.0	6.0	45.7	60.1	52.4
Cobalt	6.0	6.0	12.4	21.5	17.7
Copper	6.0	6.0	51.7	122.0	78.8
Iron	6.0	6.0	27100.0	33500.0	30133.3
Lead	6.0	6.0	71.2	148.0	109.7
Magnesium	6.0	6.0	4050.0	4900.0	4471.7
Manganese	6.0	6.0	354.0	2000.0	963.8
Mercury	6.0	6.0	0.2	0.4	0.3
Nickel	6.0	6.0	23.2	35.0	30.0
Potassium	6.0	6.0	1270.0	2220.0	1695.0
Selenium	6.0	3.0	2.4	5.5	3.5
Sodium	6.0	6.0	229.0	299.0	268.3
Thallium	6.0	1.0	4.1	4.1	4.1
Vanadium	6.0	6.0	74.9	110.0	87.5
Zinc	6.0	6.0	771.0	4140.0	1593.0
Note: Not Normalized					

AR308798

TABLE A22-1
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN PEAT
AREA: HERSHEY RUN MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
2-Butanone	16.0	7.0	19.0	68.0	35.1
Acetone	16.0	5.0	120.0	240.0	172.0
Chloroform	16.0	2.0	5.0	6.0	5.5
Methylene Chloride	16.0	3.0	5.0	17.0	11.3
Tetrachloroethene	16.0	7.0	4.0	23.0	11.1
Toluene	16.0	1.0	4.0	4.0	4.0
Xylenes (total)	16.0	1.0	5.0	5.0	5.0

AR308799

TABLE A22-2
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN PEAT
AREA: CHURCHMAN'S MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
Tetrachloroethene	2.0	2.0	5.0	9.0	7.0

AR308800

TABLE A22-3
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN PEAT
AREA: EAST CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
2-Butanone	10.0	6.0	19.0	160.0	53.7
Acetone	10.0	7.0	77.0	530.0	225.7
Carbon Disulfide	10.0	1.0	8.0	8.0	8.0
Chloroform	10.0	4.0	6.0	11.0	7.8
Methylene Chloride	10.0	5.0	6.0	27.0	19.4
Tetrachloroethene	10.0	7.0	5.0	17.0	9.4

TABLE A22-4
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN PEAT
AREA: CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
2-Butanone	6.0	5.0	29.0	87.0	49.4
Acetone	6.0	5.0	93.0	500.0	198.0
Carbon Disulfide	6.0	1.0	6.0	6.0	6.0
Chloroform	6.0	2.0	6.0	10.0	8.0
Methylene Chloride	6.0	4.0	5.0	13.0	8.5
Tetrachloroethene	6.0	5.0	6.0	32.0	14.0
Toluene	6.0	1.0	4.0	4.0	4.0

AR308802

TABLE A22-5
SUMMARY OF DETECTED VOLATILE COMPOUNDS (UG/KG) IN PEAT
AREA: WEST CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
2-Butanone	4.0	2.0	51.0	91.0	71.0
Acetone	4.0	2.0	78.0	760.0	419.0
Ethylbenzene	4.0	1.0	8.0	8.0	8.0
Tetrachloroethene	4.0	2.0	7.0	9.0	8.0
Xylenes (total)	4.0	1.0	26.0	26.0	26.0

AR308803

TABLE A23-1
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN PEAT
AREA: HERSHEY RUN MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
2-Methylnaphthalene	16.0	1.0	120.0	120.0	120.0
Acenaphthene	16.0	3.0	460.0	1300.0	830.0
Anthracene	16.0	5.0	190.0	3300.0	1670.0
Benzo(a)anthracene	16.0	9.0	120.0	3900.0	1007.8
Benzo(a)pyrene	16.0	8.0	110.0	1600.0	595.0
Benzo(b)fluoranthene	16.0	9.0	130.0	2700.0	743.3
Benzo(g,h,i)perylene	16.0	8.0	100.0	480.0	267.5
Benzo(k)fluoranthene	16.0	7.0	97.0	770.0	312.4
Butylbenzylphthalate	16.0	3.0	95.0	160.0	121.7
Carbazole	16.0	2.0	370.0	390.0	380.0
Chrysene	16.0	9.0	72.0	2800.0	872.4
Di-n-butylphthalate	16.0	9.0	100.0	580.0	362.2
Dibenz(a,h)anthracene	16.0	1.0	180.0	180.0	180.0
Dibenzofuran	16.0	3.0	280.0	760.0	530.0
Fluoranthene	16.0	10.0	130.0	7200.0	1871.0
Fluorene	16.0	3.0	790.0	1600.0	1263.3
Indeno(1,2,3-c,d)pyrene	16.0	8.0	95.0	820.0	278.1
Phenanthrene	16.0	5.0	300.0	5600.0	2574.0
Pyrene	16.0	9.0	130.0	5000.0	1486.7
bis(2-Ethylhexyl)phthalate	16.0	2.0	780.0	810.0	795.0

AR308804

TABLE A23-2
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN PEAT
AREA: CHURCHMAN'S MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
Benzo(a)anthracene	2.0	2.0	210.0	280.0	245.0
Benzo(a)pyrene	2.0	2.0	140.0	380.0	260.0
Benzo(b)fluoranthene	2.0	2.0	220.0	250.0	235.0
Benzo(g,h,i)perylene	2.0	1.0	110.0	110.0	110.0
Benzo(k)fluoranthene	2.0	2.0	89.0	190.0	139.5
Chrysene	2.0	2.0	160.0	290.0	225.0
Di-n-butylphthalate	2.0	2.0	510.0	550.0	530.0
Fluoranthene	2.0	2.0	250.0	260.0	255.0
Indeno(1,2,3-c,d)pyrene	2.0	1.0	110.0	110.0	110.0
Phenanthrene	2.0	1.0	88.0	88.0	88.0
Pyrene	2.0	2.0	230.0	270.0	250.0
bis(2-Ethylhexyl)phthalate	2.0	1.0	280.0	280.0	280.0

TABLE A23-3
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN PEAT
AREA: EAST CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
Acenaphthene	10.0	1.0	280.0	280.0	280.0
Anthracene	10.0	1.0	330.0	330.0	330.0
Benzo(b)fluoranthene	10.0	2.0	160.0	580.0	370.0
Butylbenzylphthalate	10.0	2.0	82.0	280.0	181.0
Chrysene	10.0	1.0	430.0	430.0	430.0
Di-n-butylphthalate	10.0	1.0	150.0	150.0	150.0
Dibenzofuran	10.0	1.0	270.0	270.0	270.0
Fluoranthene	10.0	4.0	140.0	440.0	232.5
Fluorene	10.0	1.0	430.0	430.0	430.0
Phenanthrene	10.0	1.0	650.0	650.0	650.0
Phenol	10.0	1.0	1500.0	1500.0	1500.0
Pyrene	10.0	3.0	160.0	500.0	273.3

TABLE A23-4
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN PEAT
AREA: CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
Benzo(a)anthracene	6.0	1.0	72.0	72.0	72.0
Benzo(b)fluoranthene	6.0	1.0	67.0	67.0	67.0
Butylbenzylphthalate	6.0	1.0	94.0	94.0	94.0
Chrysene	6.0	1.0	90.0	90.0	90.0
Di-n-butylphthalate	6.0	1.0	210.0	210.0	210.0
Fluoranthene	6.0	1.0	120.0	120.0	120.0
Pyrene	6.0	1.0	130.0	130.0	130.0

AR308807

TABLE A23-5
SUMMARY OF DETECTED SEMI-VOLATILE COMPOUNDS (UG/KG) IN PEAT
AREA: WEST CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
2-Methylnaphthalene	4.0	2.0	3800.0	580000.0	291900.0
Acenaphthene	4.0	2.0	340000.0	1000000.0	670000.0
Acenaphthylene	4.0	2.0	3100.0	280000.0	141550.0
Anthracene	4.0	2.0	170000.0	660000.0	415000.0
Benzo(a)anthracene	4.0	2.0	270000.0	370000.0	320000.0
Benzo(a)pyrene	4.0	2.0	49000.0	120000.0	84500.0
Benzo(b)fluoranthene	4.0	2.0	140000.0	210000.0	175000.0
Benzo(g,h,i)perylene	4.0	2.0	40000.0	53000.0	46500.0
Benzo(k)fluoranthene	4.0	2.0	41000.0	50000.0	45500.0
Carbazole	4.0	2.0	48000.0	290000.0	169000.0
Chrysene	4.0	2.0	250000.0	280000.0	265000.0
Dibenz(a,h)anthracene	4.0	2.0	14000.0	14000.0	14000.0
Dibenzofuran	4.0	2.0	470000.0	840000.0	655000.0
Fluoranthene	4.0	2.0	1100000.0	1100000.0	1100000.0
Fluorene	4.0	2.0	400000.0	1100000.0	750000.0
Indeno(1,2,3-c,d)pyrene	4.0	2.0	43000.0	57000.0	50000.0
Naphthalene	4.0	2.0	26000.0	860000.0	443000.0
Phenanthrene	4.0	2.0	1400000.0	2800000.0	2100000.0
Pyrene	4.0	2.0	770000.0	880000.0	825000.0

TABLE A24-1
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN PEAT
AREA: HERSHEY RUN MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
4,4'-DDD	4.0	4.0	2.1	4.4	3.3
4,4'-DDE	4.0	4.0	2.2	3.6	2.6
4,4'-DDT	4.0	1.0	66.0	66.0	66.0
Endosulfan Sulfate	4.0	1.0	0.2	0.2	0.2
Methoxychlor	4.0	1.0	3.6	3.6	3.6
PCB-1254	4.0	3.0	20.0	88.0	47.3
alpha-Chlordane	4.0	1.0	0.7	0.7	0.7
gamma-Chlordane	4.0	2.0	0.7	1.4	1.0

AR308809

TABLE A24-2
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN PEAT
AREA: EAST CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
4,4'-DDE	4.0	3.0	1.5	18.0	7.0
PCB-1254	4.0	1.0	520.0	520.0	520.0
PCB-1260	4.0	1.0	26.0	26.0	26.0
gamma-Chlordane	4.0	2.0	0.8	3.6	2.2

TABLE A24-2
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN PEAT
AREA: EAST CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
4,4'-DDE	4.0	3.0	1.5	18.0	7.0
PCB-1254	4.0	1.0	520.0	520.0	520.0
PCB-1260	4.0	1.0	26.0	26.0	26.0
gamma-Chlordane	4.0	2.0	0.8	3.6	2.2

AR308811

TABLE A24-3
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN PEAT
AREA: CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
4,4'-DDE	1.0	1.0	2.1	2.1	2.1
PCB-1260	1.0	1.0	39.0	39.0	39.0
gamma-Chlordane	1.0	1.0	0.6	0.6	0.6

AR308812

TABLE A24-4
SUMMARY OF DETECTED PESTICIDES/PCBS (UG/KG) IN PEAT
AREA: WEST CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
4,4'-DDD	6.0	5.0	0.4	200.0	66.9
4,4'-DDE	6.0	2.0	16.0	21.0	18.5
4,4'-DDT	6.0	2.0	130.0	140.0	135.0
Aldrin	6.0	1.0	6.5	6.5	6.5
Endosulfan II	6.0	1.0	3.9	3.9	3.9
Endosulfan Sulfate	6.0	1.0	0.4	0.4	0.4
Heptachlor	6.0	1.0	3.2	3.2	3.2
Heptachlor epoxide	6.0	1.0	0.8	0.8	0.8
PCB-1260	6.0	3.0	15.0	252.0	94.7
gamma-Chlordane	6.0	1.0	0.6	0.6	0.6

AR308813

TABLE A25-1
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN PEAT
AREA: HERSHEY RUN MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
1,2,3,4,6,7,8-HpCDD	7.00	3.00	0.34	0.43	0.38
HpCDDs (total)	7.00	6.00	0.14	0.86	0.47
OCDD	7.00	7.00	3.90	12.00	8.17
OCDF	7.00	4.00	0.21	0.27	0.25

TABLE A25-2
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN PEAT
AREA: CHURCHMAN'S MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
HpCDDs (total)	2.00	2.00	0.18	0.19	0.19
OCDD	2.00	2.00	6.50	7.10	6.80
OCDF	2.00	2.00	0.20	0.23	0.22

AR308815

TABLE A25-3
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN PEAT
AREA: EAST CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

COMPOUND	TOTAL NUMBER OF SAMPLES	NUMBER OF DETECTIONS	CONCENTRATIONS MINIMUM	MAXIMUM	AVERAGE
HpCDDs (total)	4.00	2.00	0.19	0.34	0.27
OCDD	4.00	4.00	5.60	7.80	6.38
OCDF	4.00	2.00	0.19	0.34	0.27

AR308816

TABLE A25-4
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN PEAT
AREA: CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

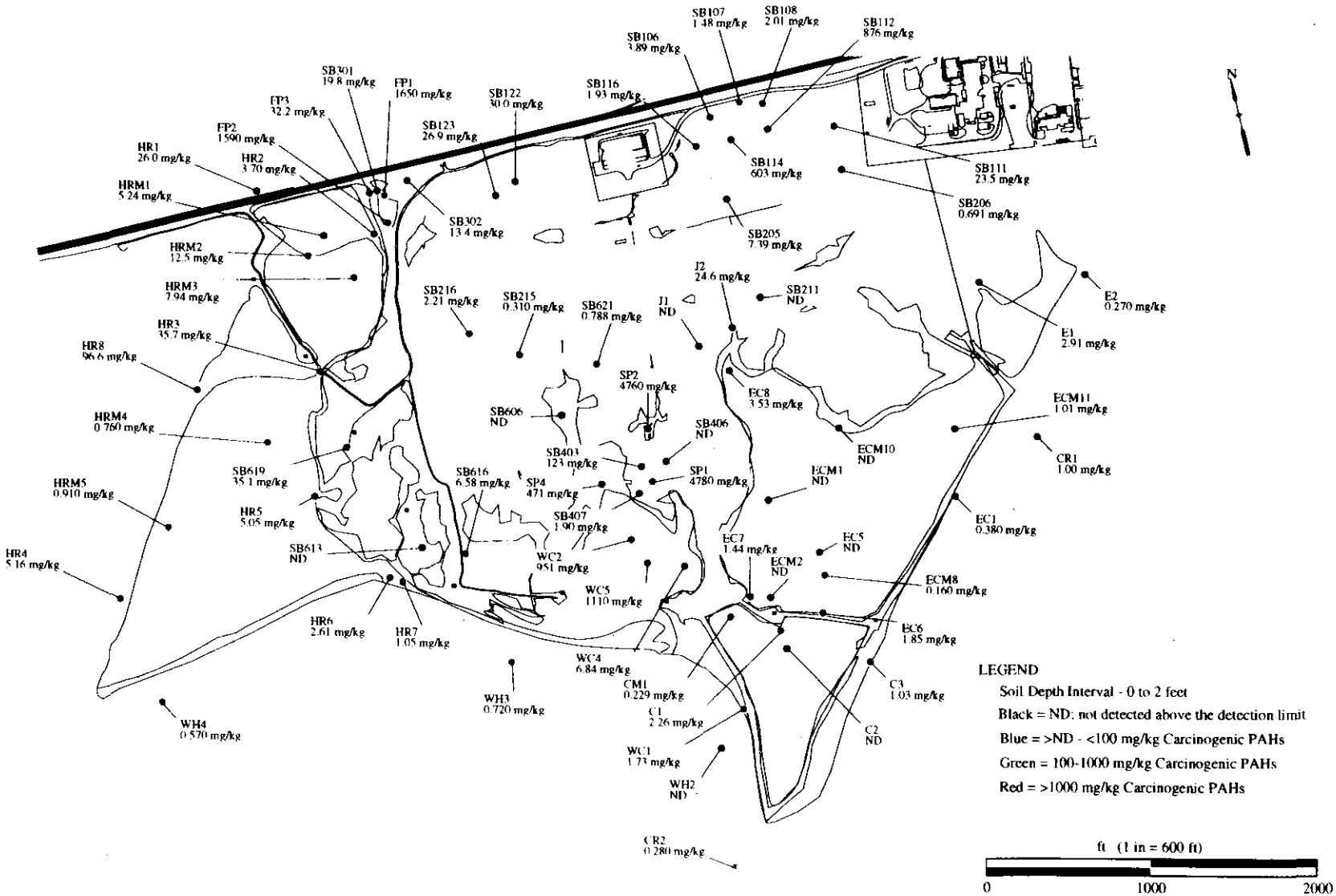
COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
OCDD	1.00	1.00	2.60	2.60	2.60

AR308817

TABLE A25-5
SUMMARY OF DETECTED DIOXINS/FURANS (NG/G) IN PEAT
AREA: WEST CENTRAL DRAINAGE AREA MARSH
FORMER KOPPERS CO. SITE
NEWPORT, DELAWARE

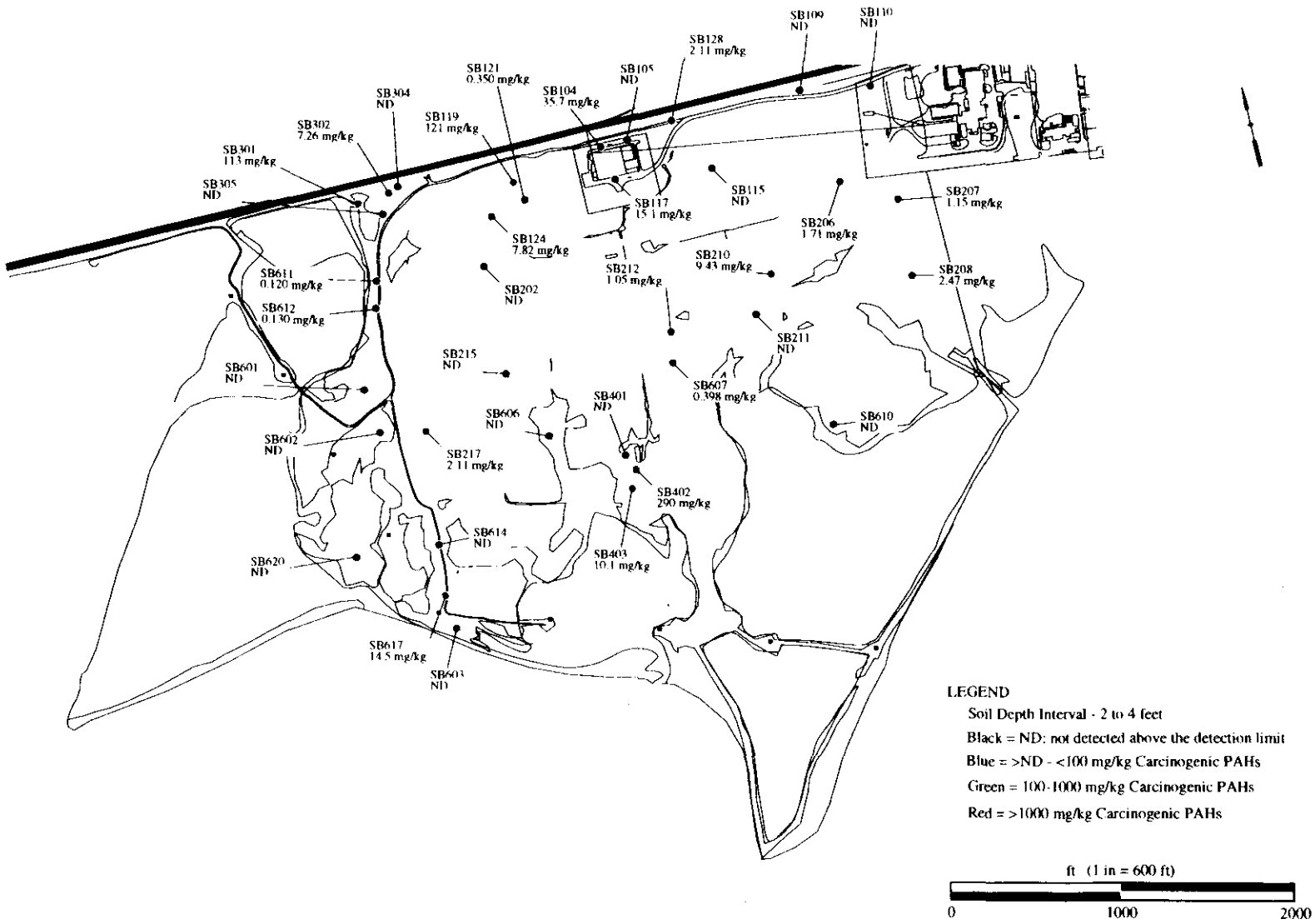
COMPOUND	TOTAL	NUMBER	CONCENTRATIONS		
	NUMBER OF	OF DETECTIONS	MINIMUM	MAXIMUM	AVERAGE
	SAMPLES				
1,2,3,4,6,7,8-HpCDD	6.0	2.0	5.8	18.0	11.9
1,2,3,4,6,7,8-HpCDF	6.0	2.0	1.7	4.5	3.1
1,2,3,4,7,8,9-HpCDF	6.0	2.0	0.2	0.5	0.4
1,2,3,4,7,8-HxCDF	6.0	2.0	0.4	0.6	0.5
HpCDDs (total)	6.0	2.0	16.0	49.0	32.5
HpCDFs (total)	6.0	2.0	11.0	27.0	19.0
HxCDDs (total)	6.0	1.0	1.1	1.1	1.1
HxCDFs (total)	6.0	2.0	2.7	3.3	3.0
OCDD	6.0	6.0	4.6	170.0	44.5
OCDF	6.0	5.0	0.2	28.0	7.8

155982



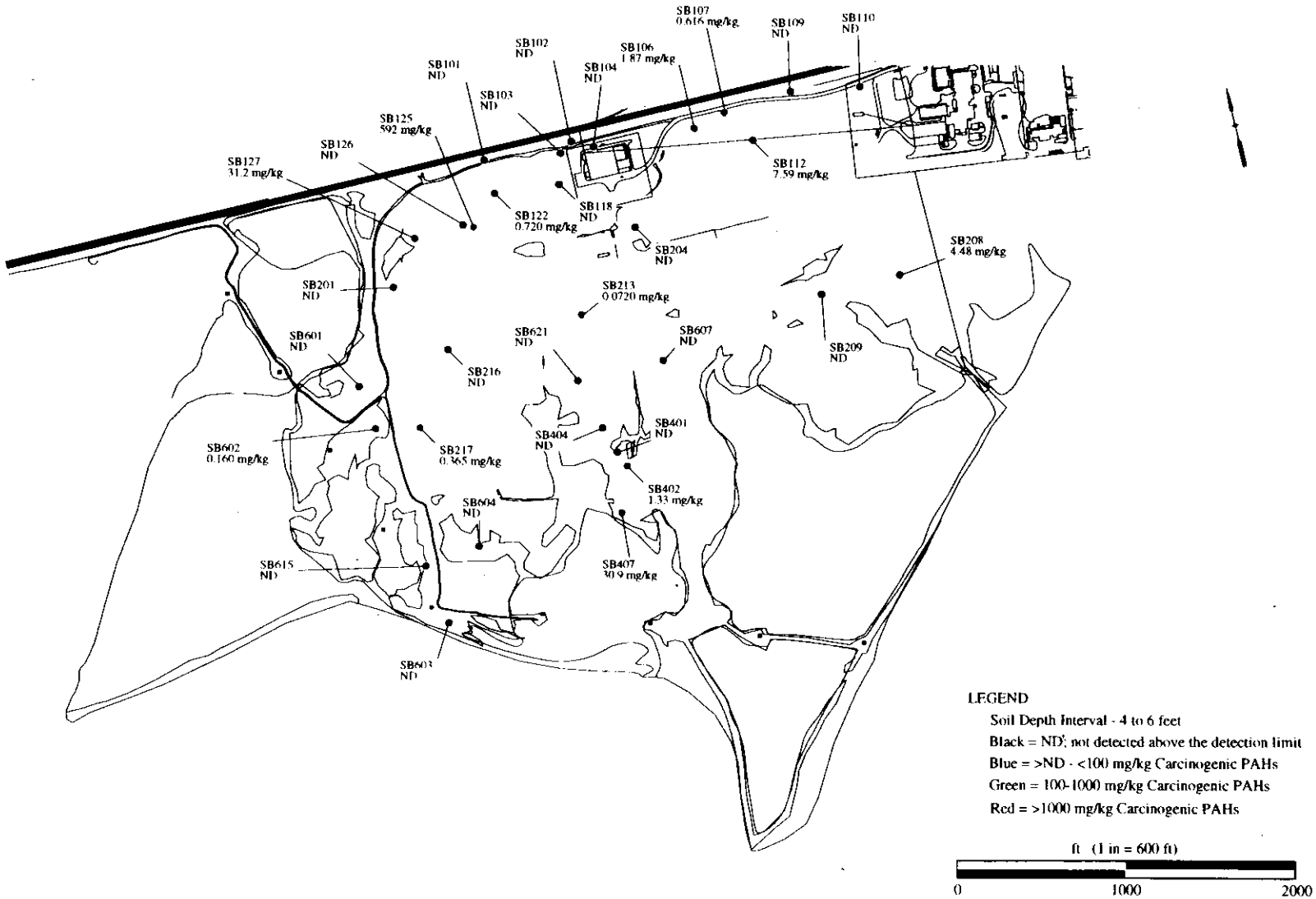
Project No. 4E02153F-3	Beazer East, Inc. and E.I. DuPont	TOTAL POTENTIALLY CARCINOGENIC PAHs IN SOIL (0-2 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	March 7, 1995
Woodward-Clyde Consultants			Figure A-1

AR300019



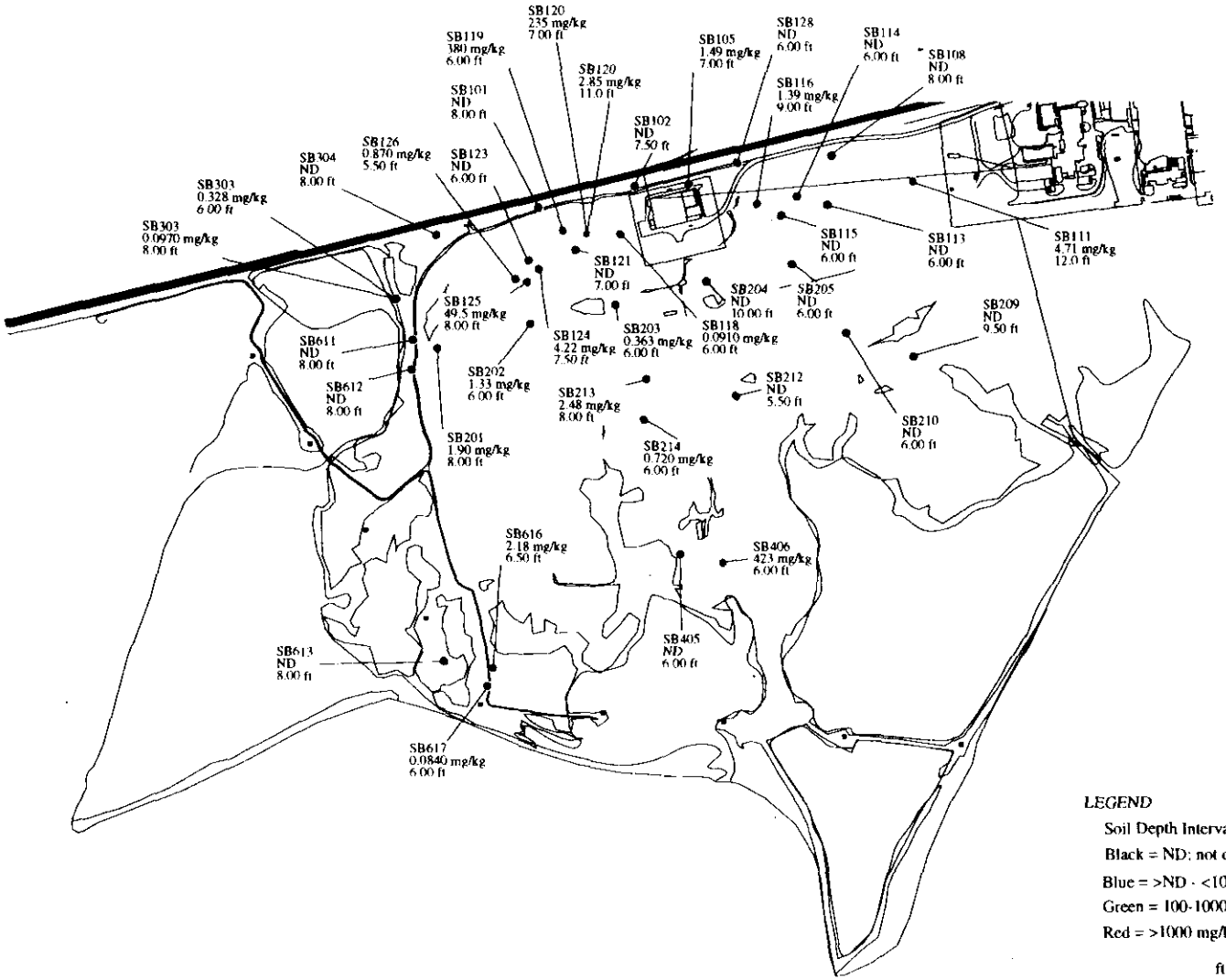
Project No. 4E02153F-3	Beazer East, Inc. and E.I. DuPont	TOTAL POTENTIALLY CARCINOGENIC PAHs IN SOIL (2-4 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	March 7, 1995
Woodward-Clyde Consultants			Figure A-2

AR308820



Project No. 4E02153F-3	Beazer East, Inc. and E.I. DuPont	Total Potentially Carcinogenic PAHs (4-6 ft.) Former Koppers Company, Inc. Newport Site Newport, Delaware	March 7, 1995
Woodward-Clyde Consultants			Figure A-3

AR308821



LEGEND

Soil Depth Interval - >6 feet

Black = ND; not detected above the detection limit

Blue = >ND - <100 mg/kg Carcinogenic PAHs

Green = 100-1000 mg/kg Carcinogenic PAHs

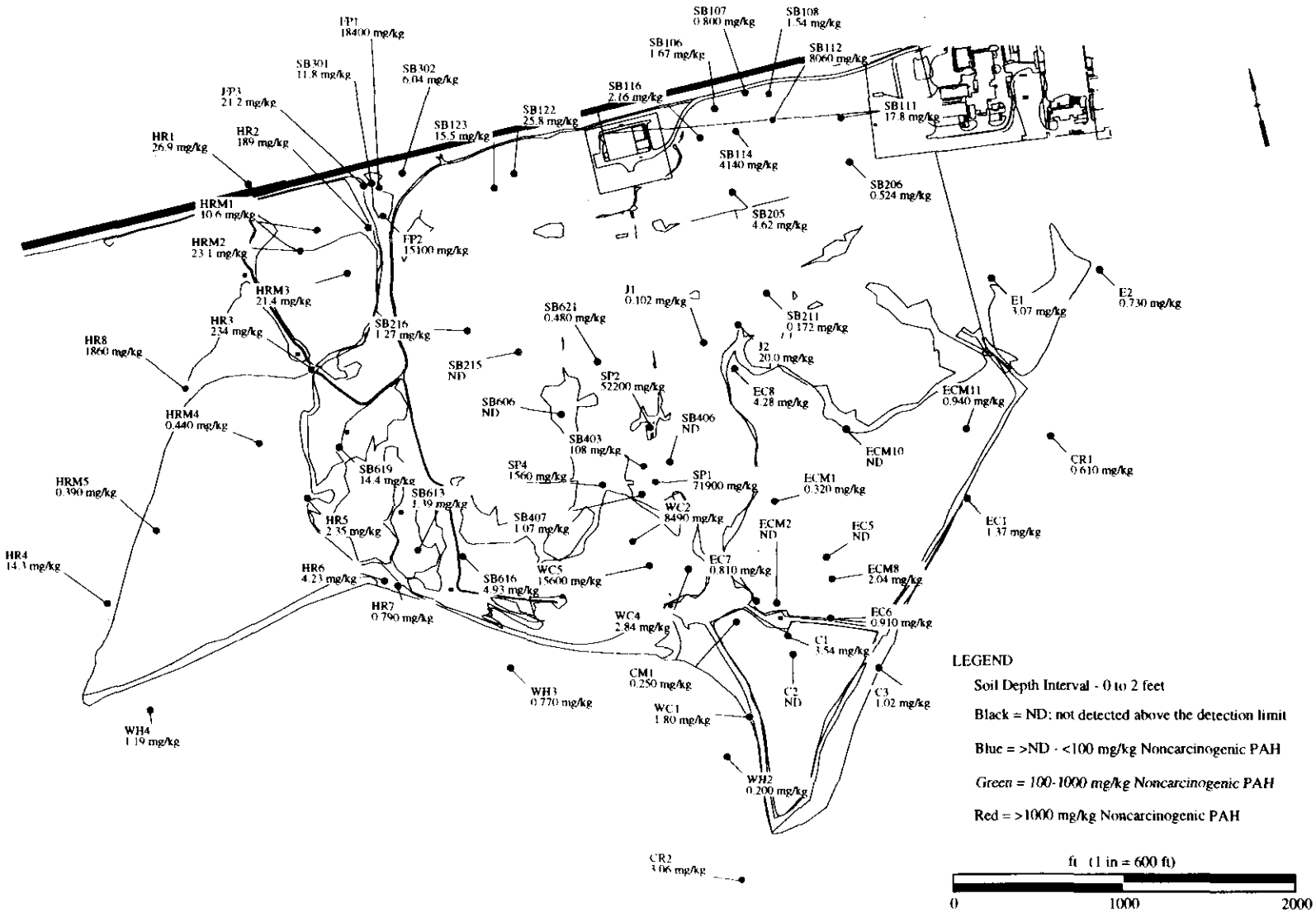
Red = >1000 mg/kg Carcinogenic PAHs

ft (1 in = 600 ft)

0 1000 2000

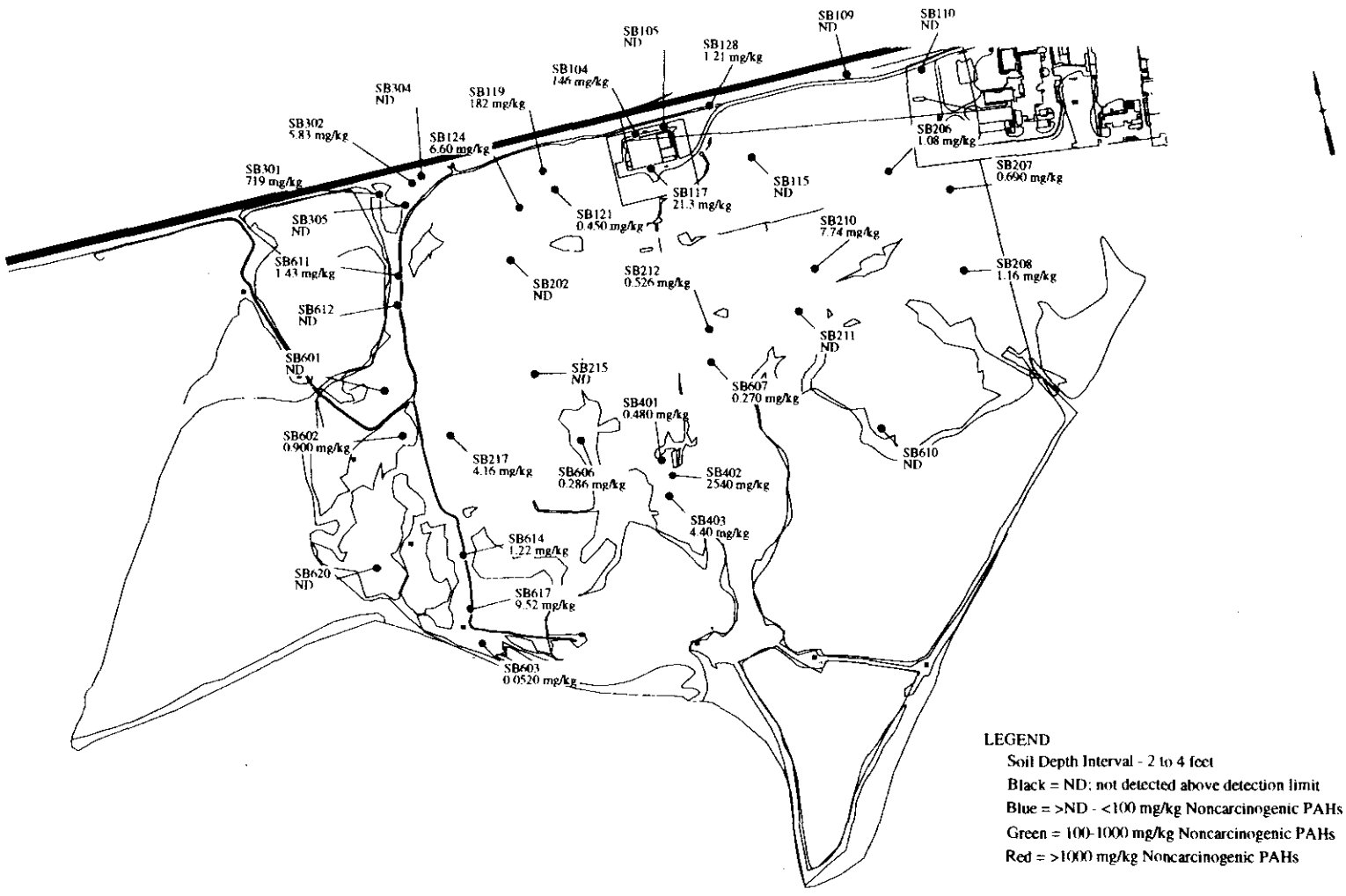
Project No 4E02153F-3	Beazer East, Inc. and E.I. DuPont	Total Potentially Carcinogenic PAHs (>6 ft.) Former Koppers Company, Inc. Newport Site Newport, Delaware	March 7, 1995
Woodward-Clyde Consultants			Figure A-4

AR308822



Project No. 4E02153F-3	Beazer East, Inc. and E.I. DuPont	TOTAL NONCARCINOGENIC PAHs IN SOIL (0–2 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	March 7, 1995
Woodward-Clyde Consultants			Figure A–5

AR308823



LEGEND

Soil Depth Interval - 2 to 4 feet

Black = ND; not detected above detection limit

Blue = >ND - <100 mg/kg Noncarcinogenic PAHs

Green = 100-1000 mg/kg Noncarcinogenic PAHs

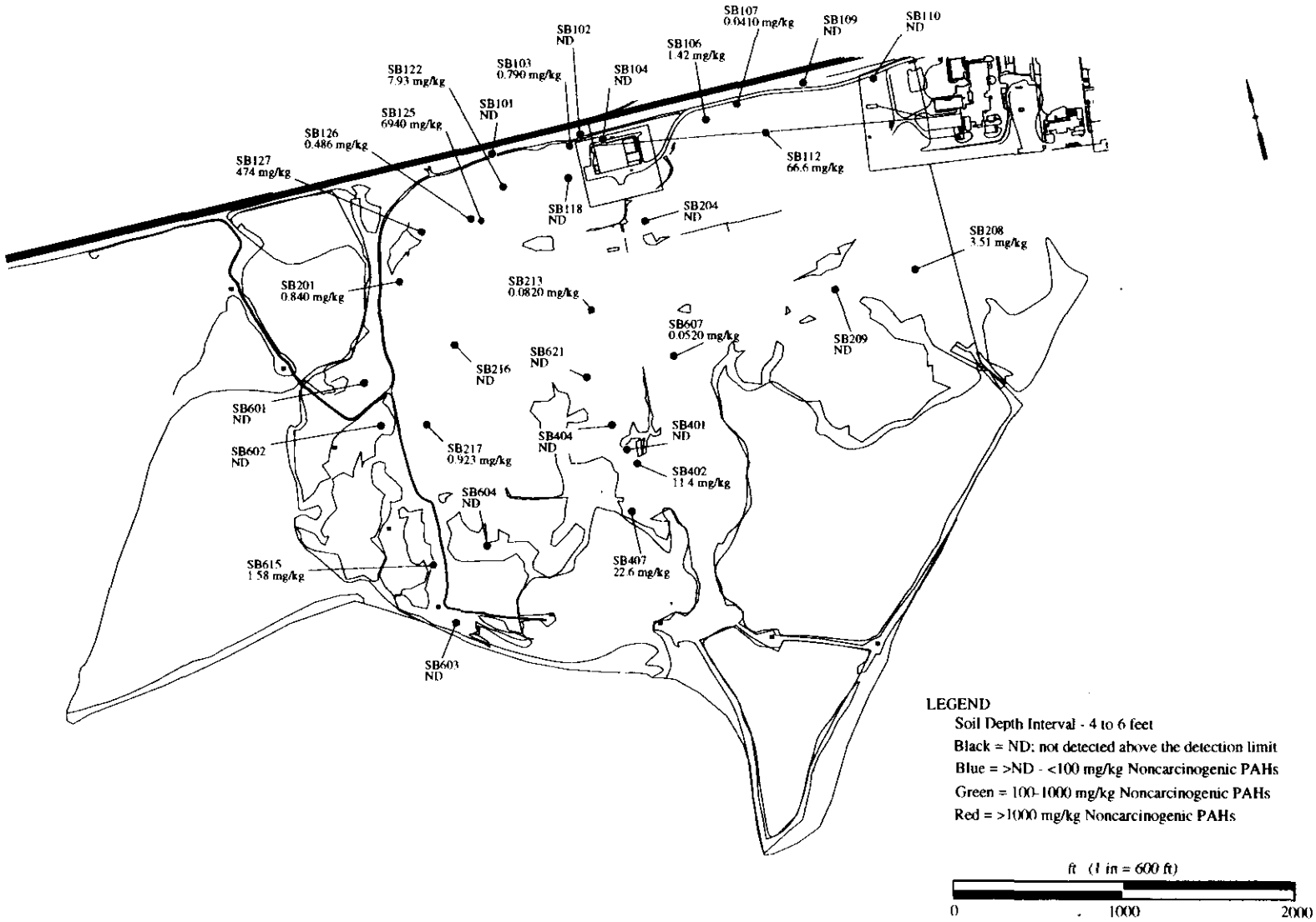
Red = >1000 mg/kg Noncarcinogenic PAHs

ft (1 in = 600 ft)

0 1000 2000

Project No. 4E02153F-3	Beazer East, Inc. and E.I. DuPont	TOTAL NONCARCINOGENIC PAHs (2–4 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	March 7, 1995
Woodward-Clyde Consultants			Figure A–6

AR308824



LEGEND

Soil Depth Interval - 4 to 6 feet

Black = ND: not detected above the detection limit

Blue = >ND - <100 mg/kg Noncarcinogenic PAHs

Green = 100-1000 mg/kg Noncarcinogenic PAHs

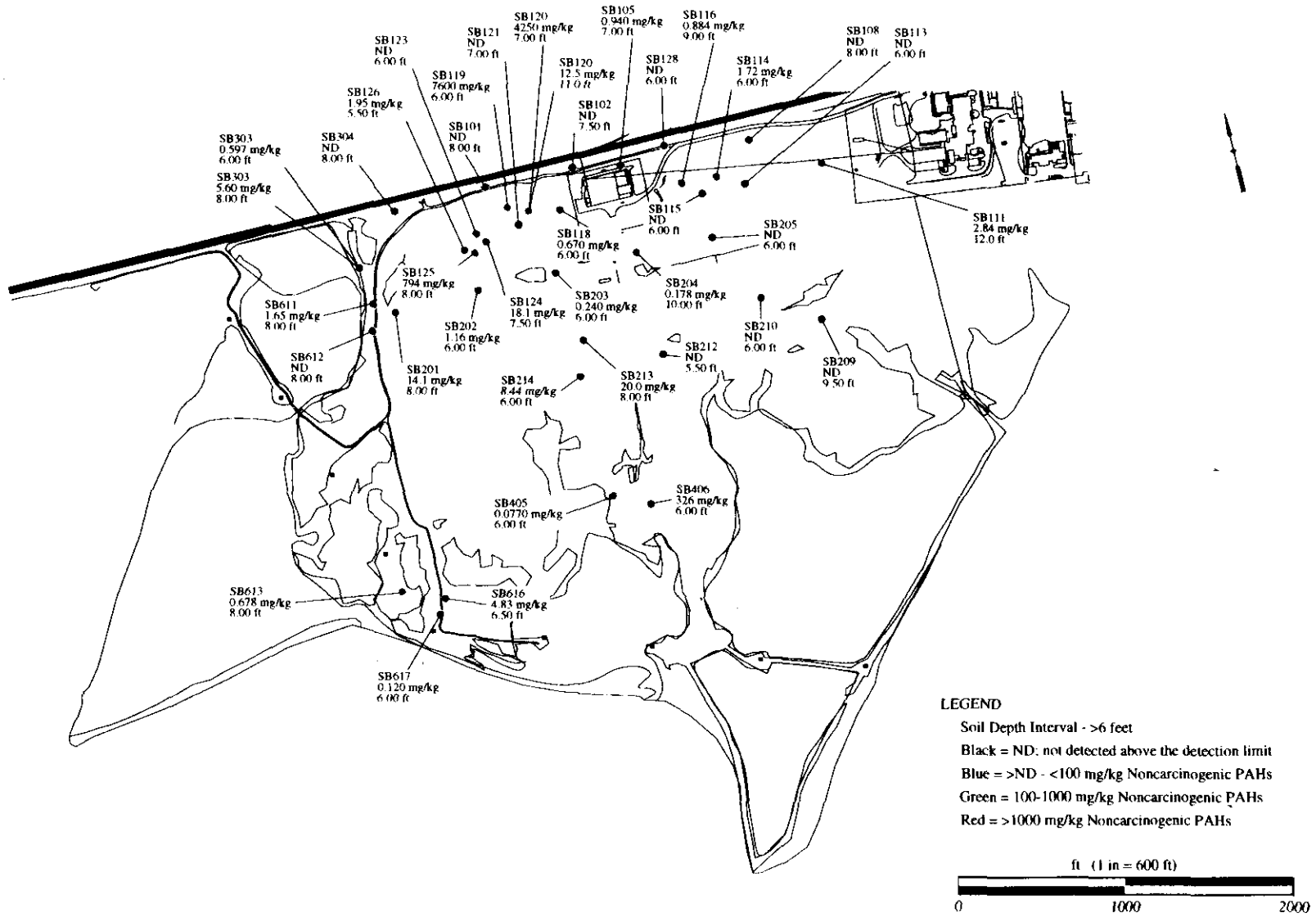
Red = >1000 mg/kg Noncarcinogenic PAHs

ft (1 in = 600 ft)

0 1000 2000

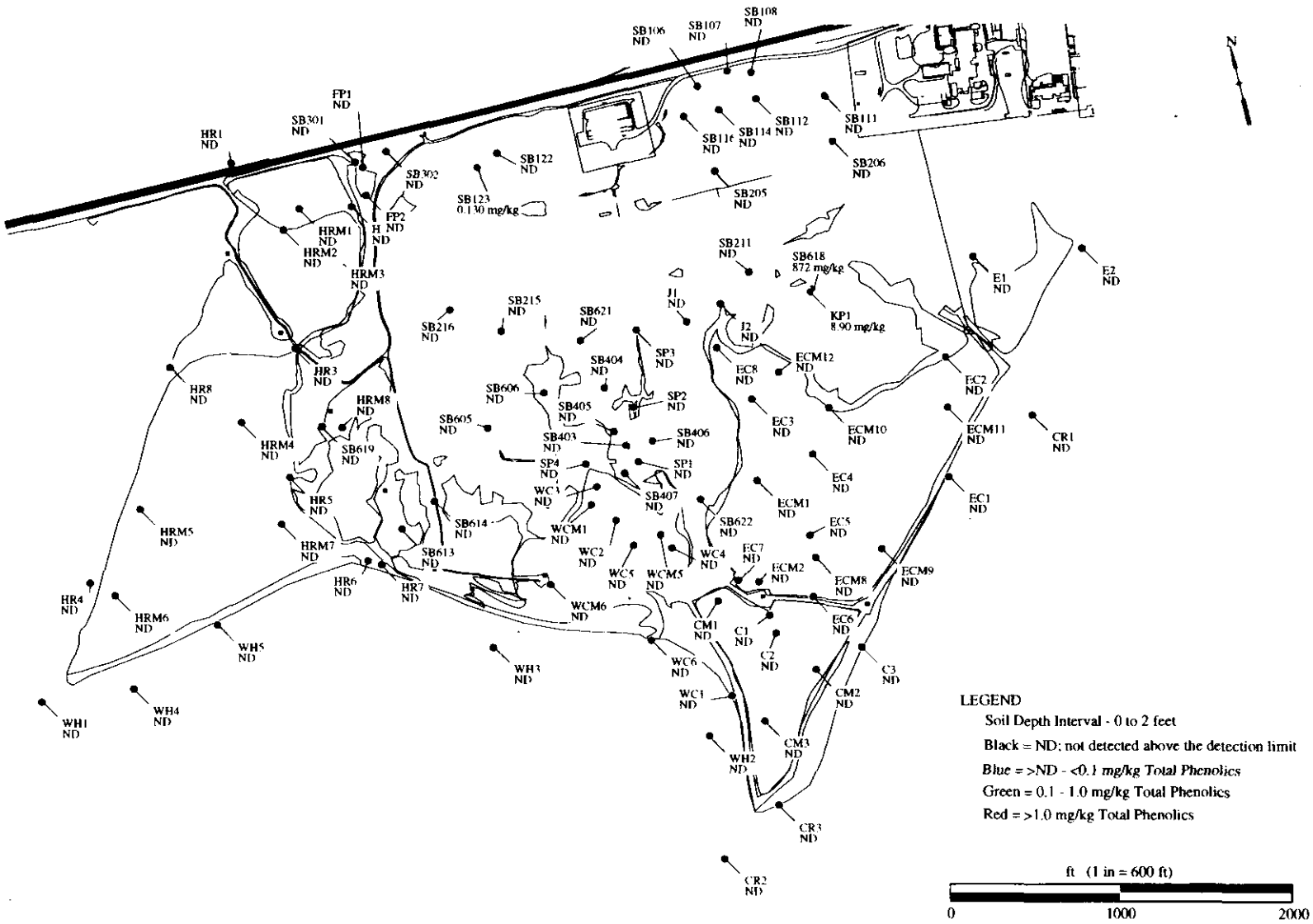
Project No. 4E02153F-3	Beazer East, Inc. and E.I. DuPont	TOTAL NONCARCINOGENIC PAHs (4-6 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	March 7, 1995
Woodward-Clyde Consultants			Figure A-7

AR308825



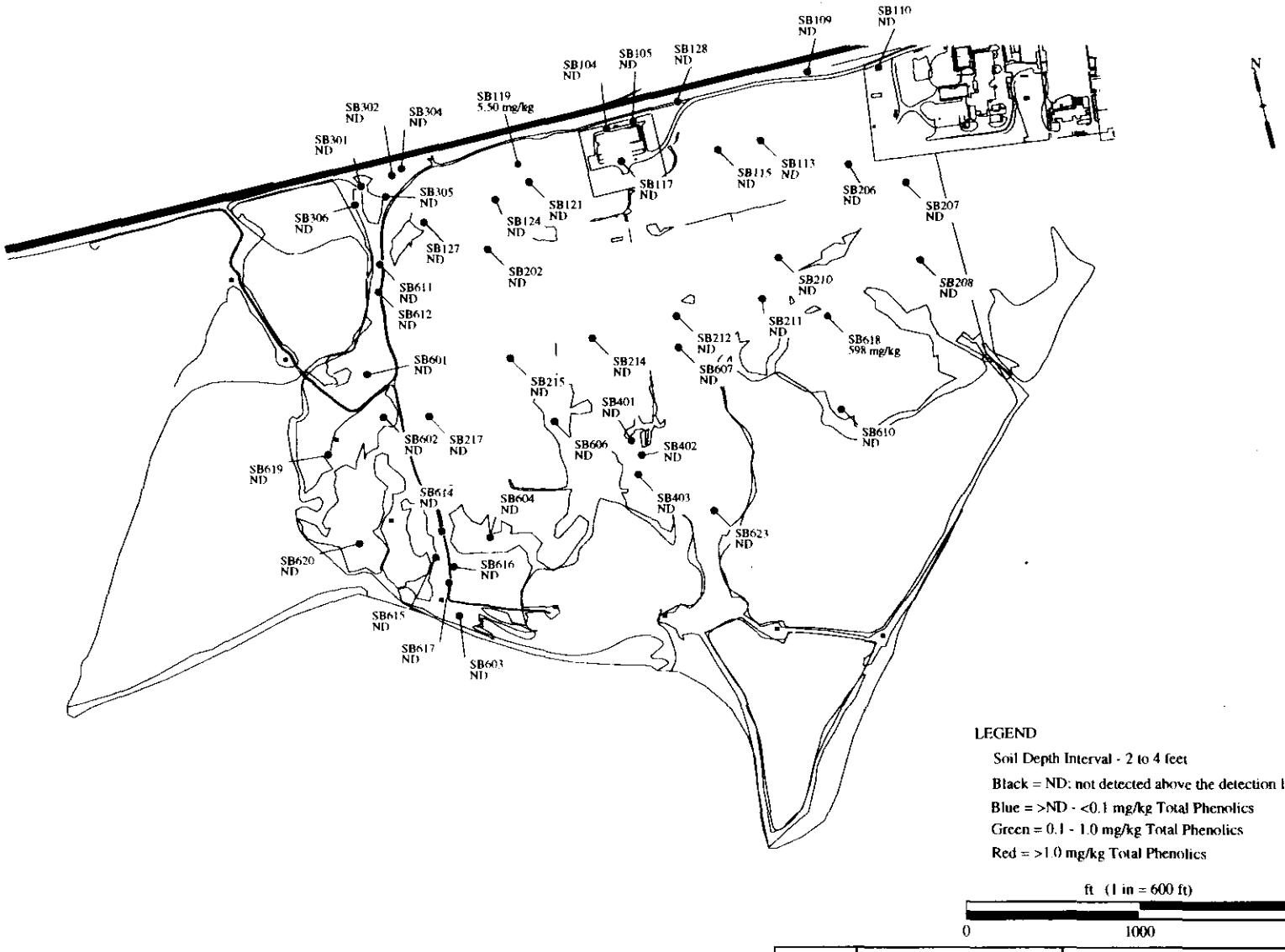
Project No. 4E02153F-3	Beazer East, Inc. and E.I. DuPont	TOTAL NONCARCINOGENIC PAHs IN SOIL (>6 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	March 7, 1995
Woodward-Clyde Consultants			Figure A-8

AR308826



Project No 4E02153F-5	Beazer East, Inc. and E.I. DuPont	TOTAL PHENOLICS IN SOIL (0-2 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	April, 1995
Woodward-Clyde Consultants			Figure A-9

AR308027



LEGEND

Soil Depth Interval - 2 to 4 feet

Black = ND: not detected above the detection limit

Blue = >ND - <0.1 mg/kg Total Phenolics

Green = 0.1 - 1.0 mg/kg Total Phenolics

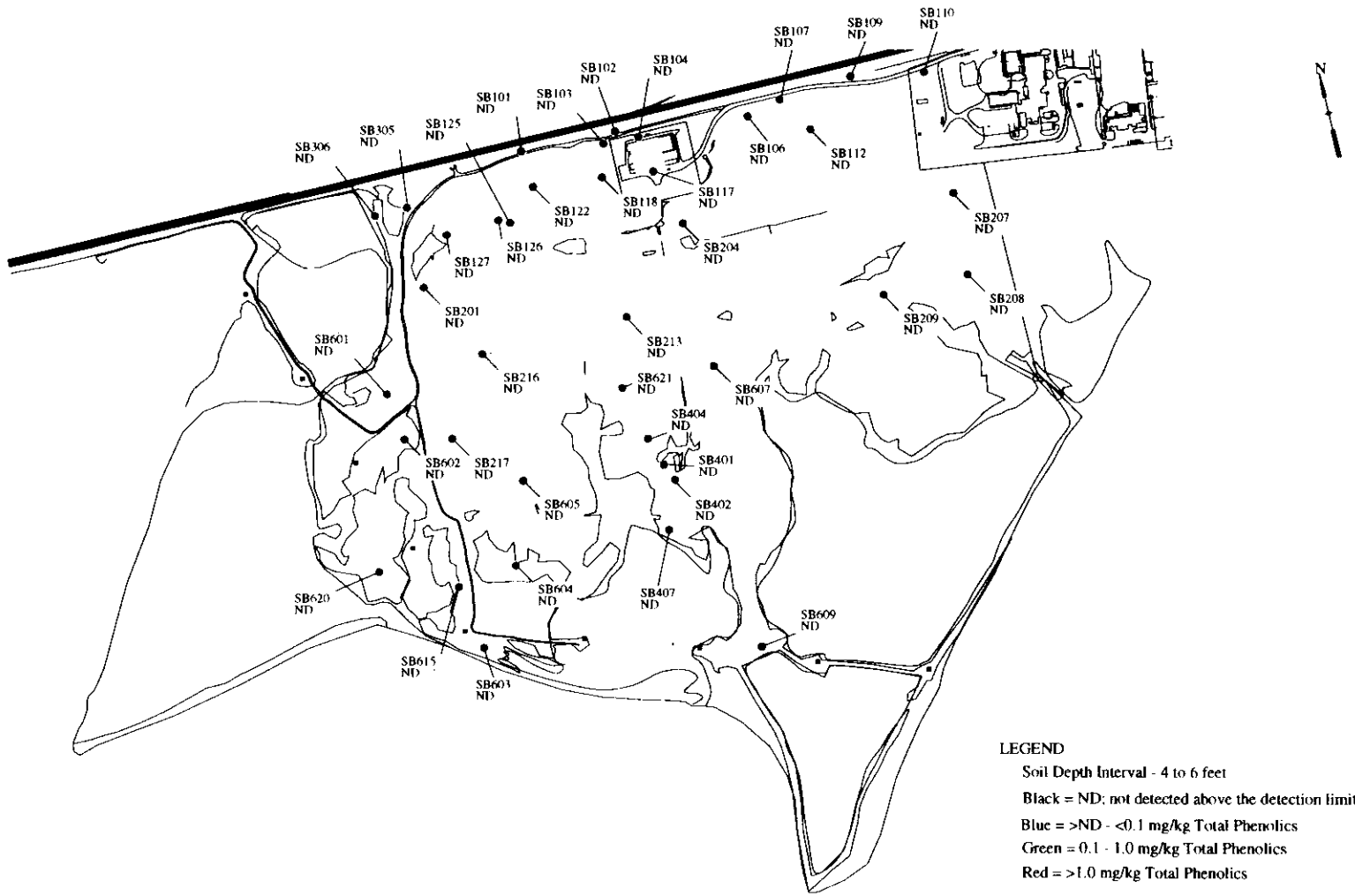
Red = >1.0 mg/kg Total Phenolics

ft (1 in = 600 ft)

0 1000 2000

Project No. 4E02153F-5	Beazer East, Inc. and E.I. DuPont	TOTAL PHENOLICS IN SOIL (2-4 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	April, 1995
Woodward-Clyde Consultants			Figure A-10

AR308828



LEGEND

Soil Depth Interval - 4 to 6 feet

Black = ND; not detected above the detection limit

Blue = >ND - <0.1 mg/kg Total Phenolics

Green = 0.1 - 1.0 mg/kg Total Phenolics

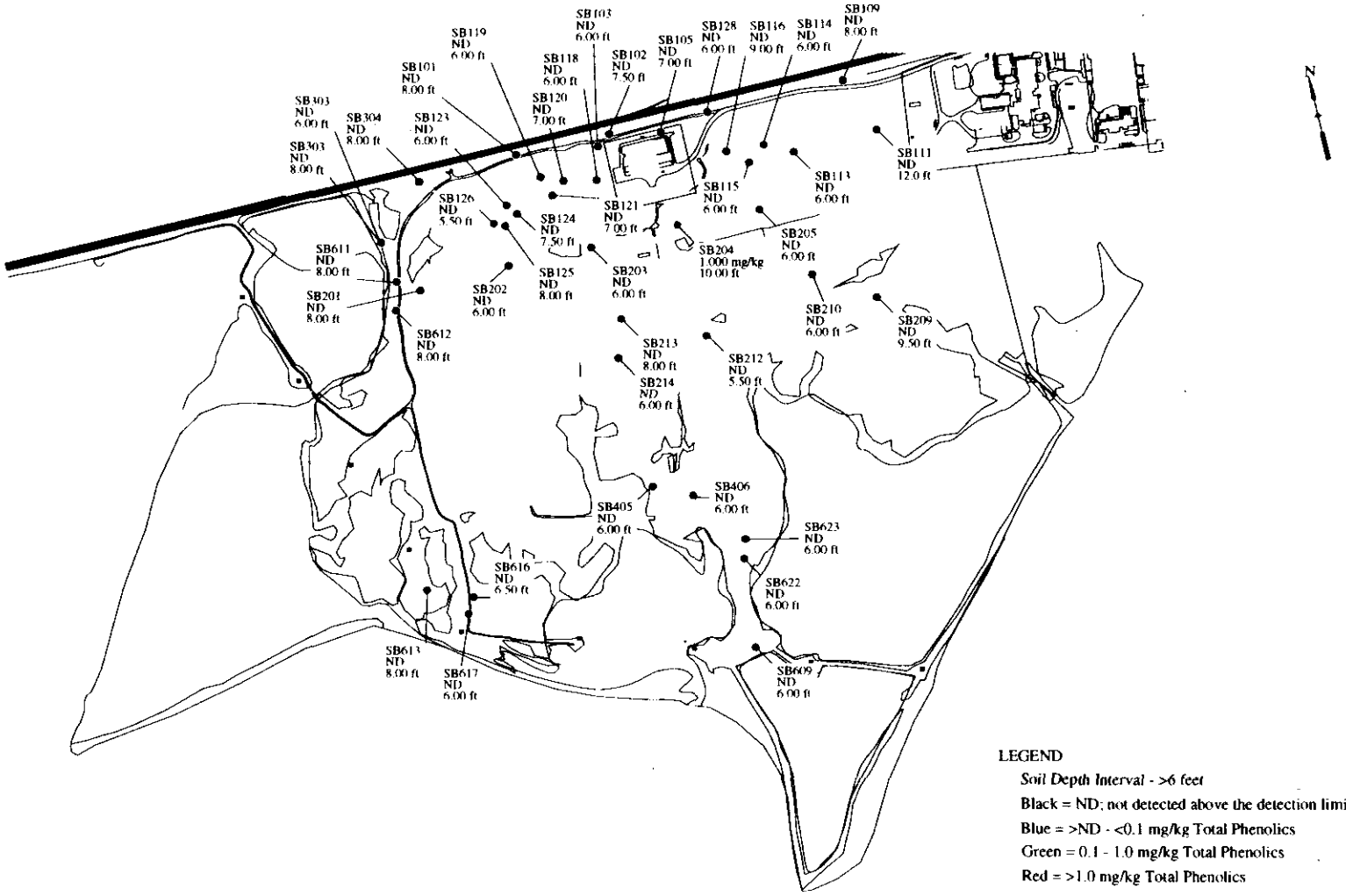
Red = >1.0 mg/kg Total Phenolics

ft (1 in = 600 ft)

0 1000 2000

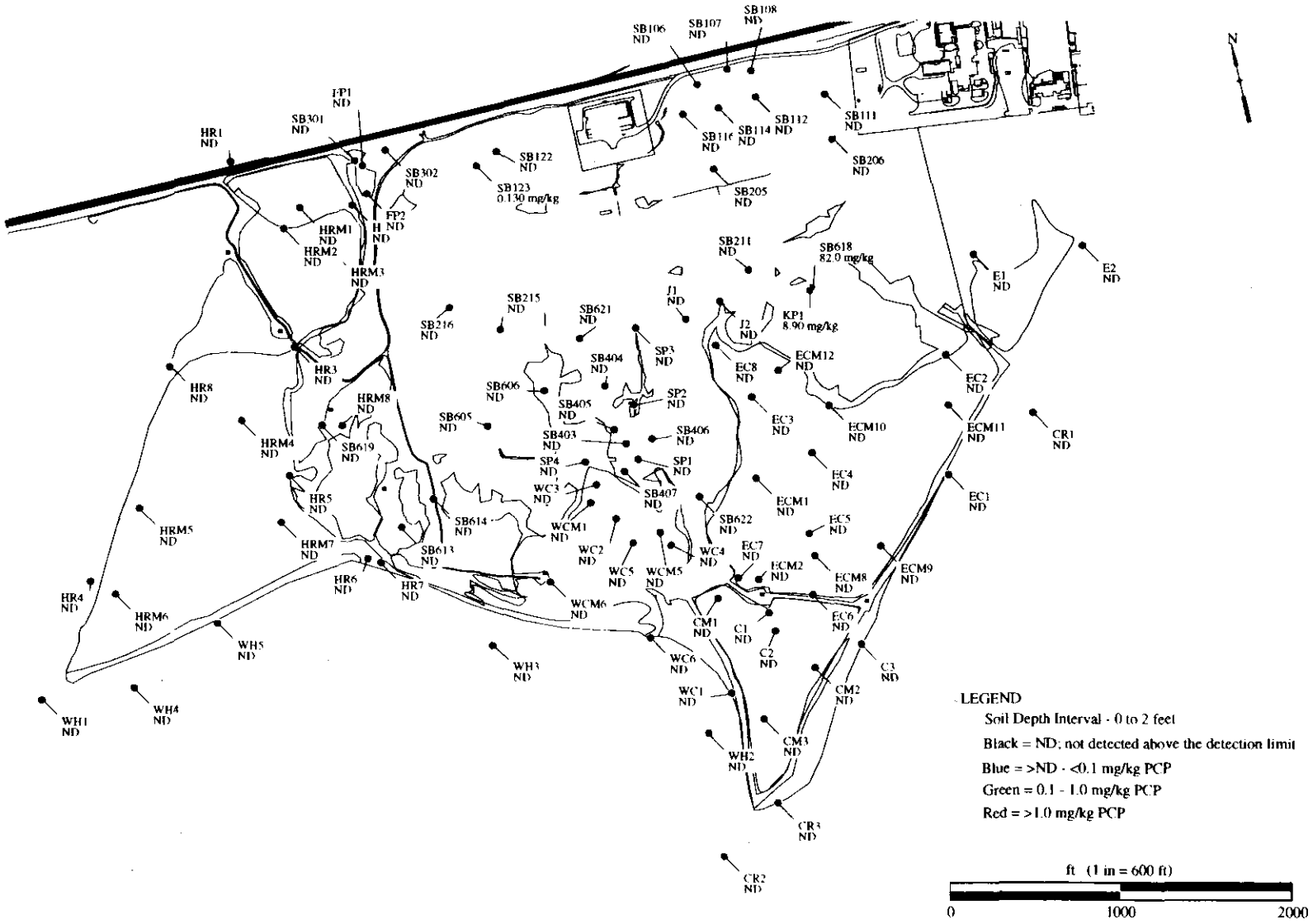
Project No. 4E02153F-5	Beazer East, Inc. and E.I. DuPont	TOTAL PHENOLICS IN SOIL (4-6 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	April, 1995
Woodward-Clyde Consultants			Figure A-11

AR308829



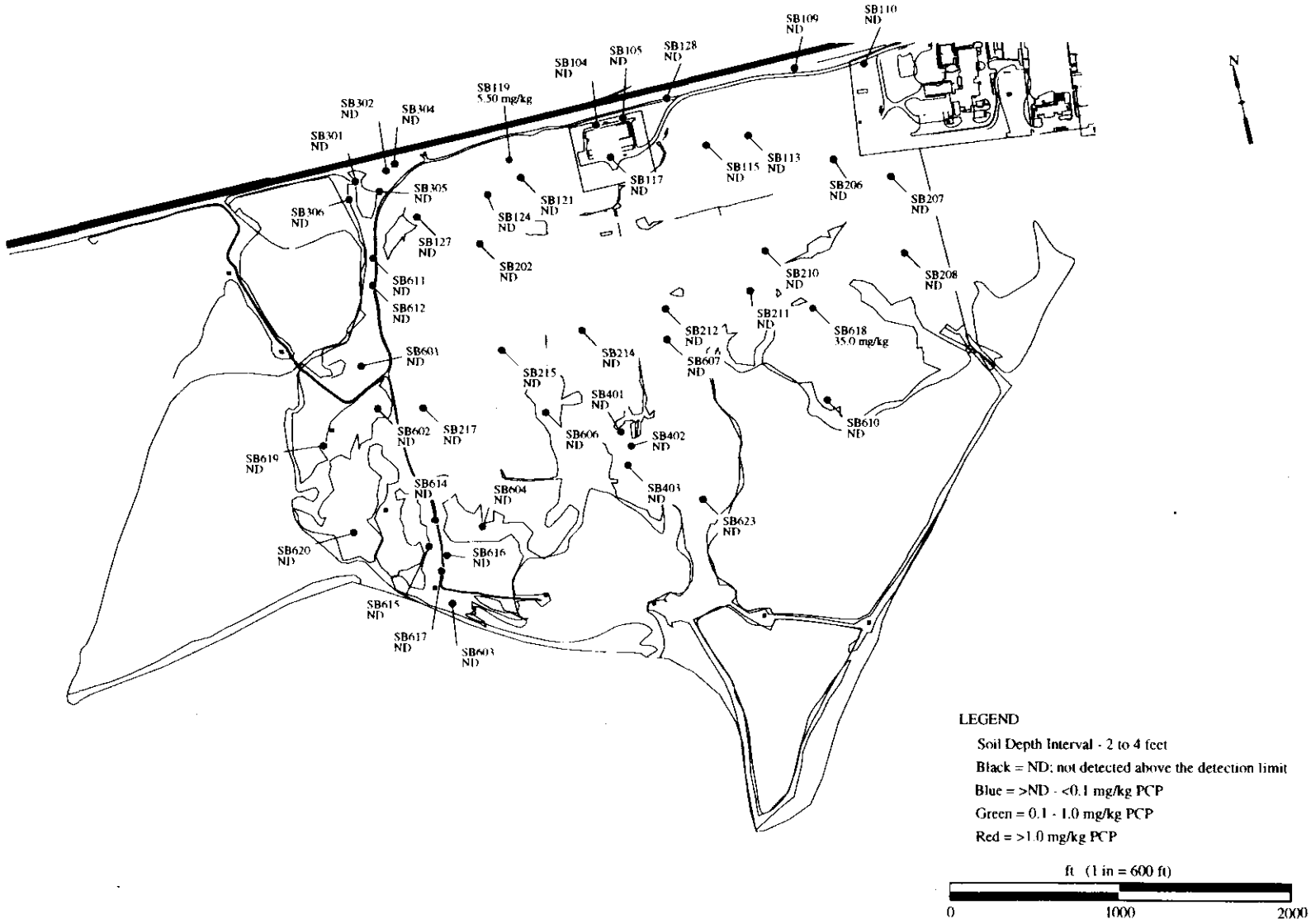
Project No. 4E02153F-5	Beazer East, Inc. and E.I. DuPont	TOTAL PHENOLICS IN SOIL (>6 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	April, 1995
Woodward-Clyde Consultants			Figure A-12

AR308830



Project No. 4E02153F-3		Total PCP (0-2.0 ft.) Former Koppers Company, Inc. Newport Site Newport, Delaware	March 7, 1995
Woodward-Clyde			Figure A-13

AR308831



LEGEND

Soil Depth Interval - 2 to 4 feet

Black = ND; not detected above the detection limit

Blue = >ND - <0.1 mg/kg PCP

Green = 0.1 - 1.0 mg/kg PCP

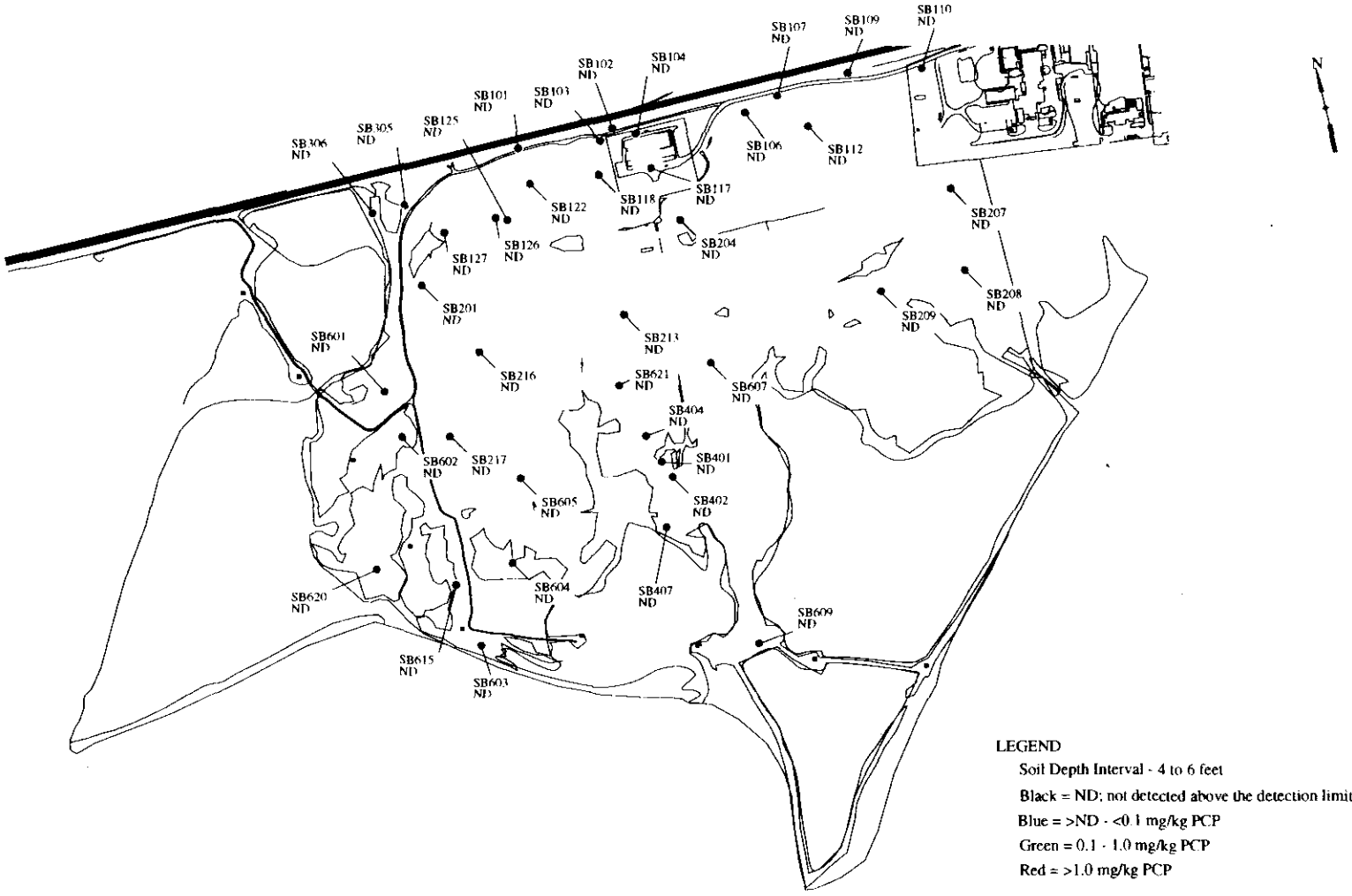
Red = >1.0 mg/kg PCP

ft (1 in = 600 ft)

0 1000 2000

Project No. 4E02153F-3	Beazer East, Inc. and E.I. DuPont	Total PCP (2-4 ft) Former Koppers Company, Inc. Newport Site Newport, Delaware	March 7, 1995
Woodward-Clyde Consultants			Figure A-14

AR308832



LEGEND

Soil Depth Interval - 4 to 6 feet

Black = ND; not detected above the detection limit

Blue = >ND - <0.1 mg/kg PCP

Green = 0.1 - 1.0 mg/kg PCP

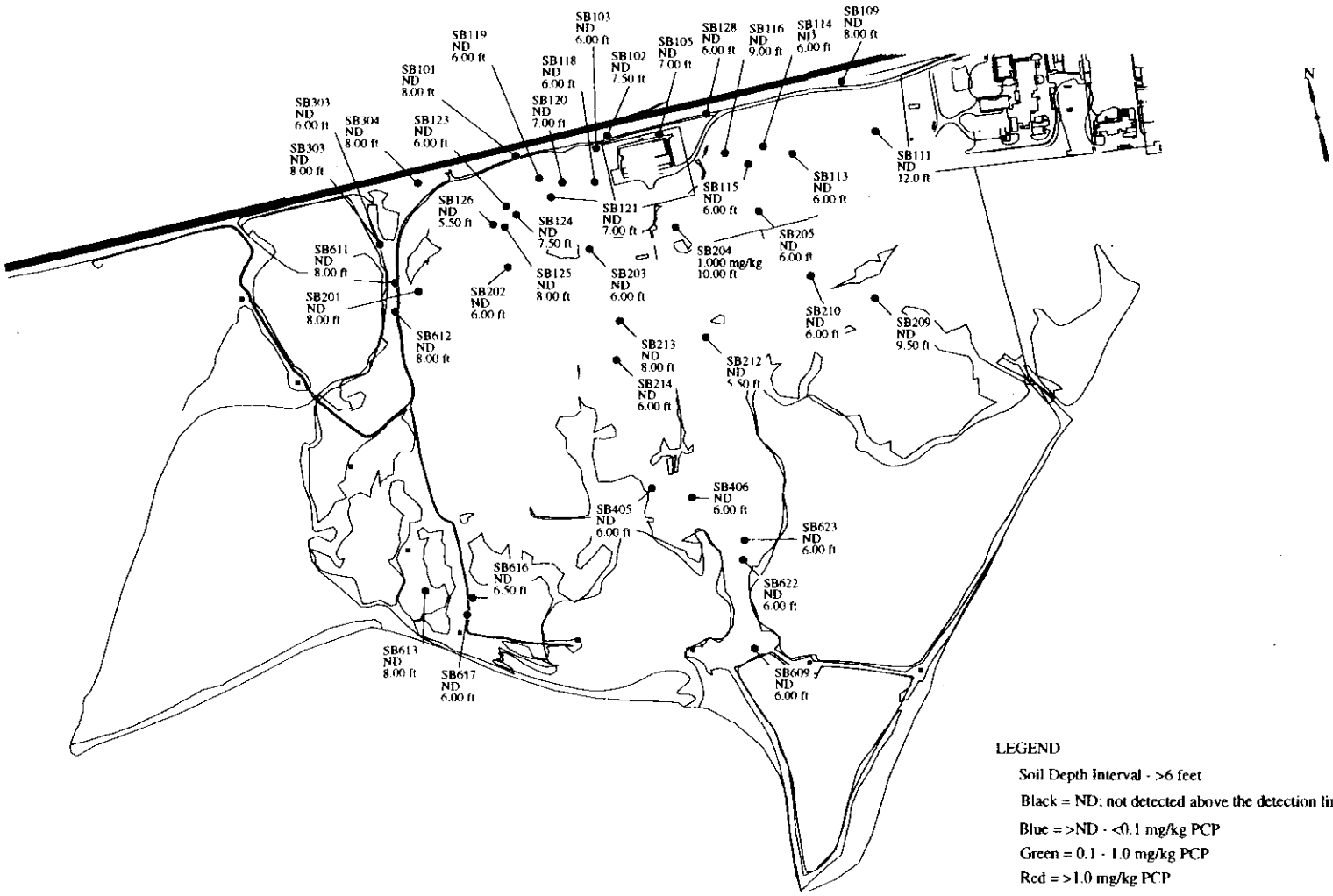
Red = >1.0 mg/kg PCP

ft (1 in = 600 ft)

0 1000 2000

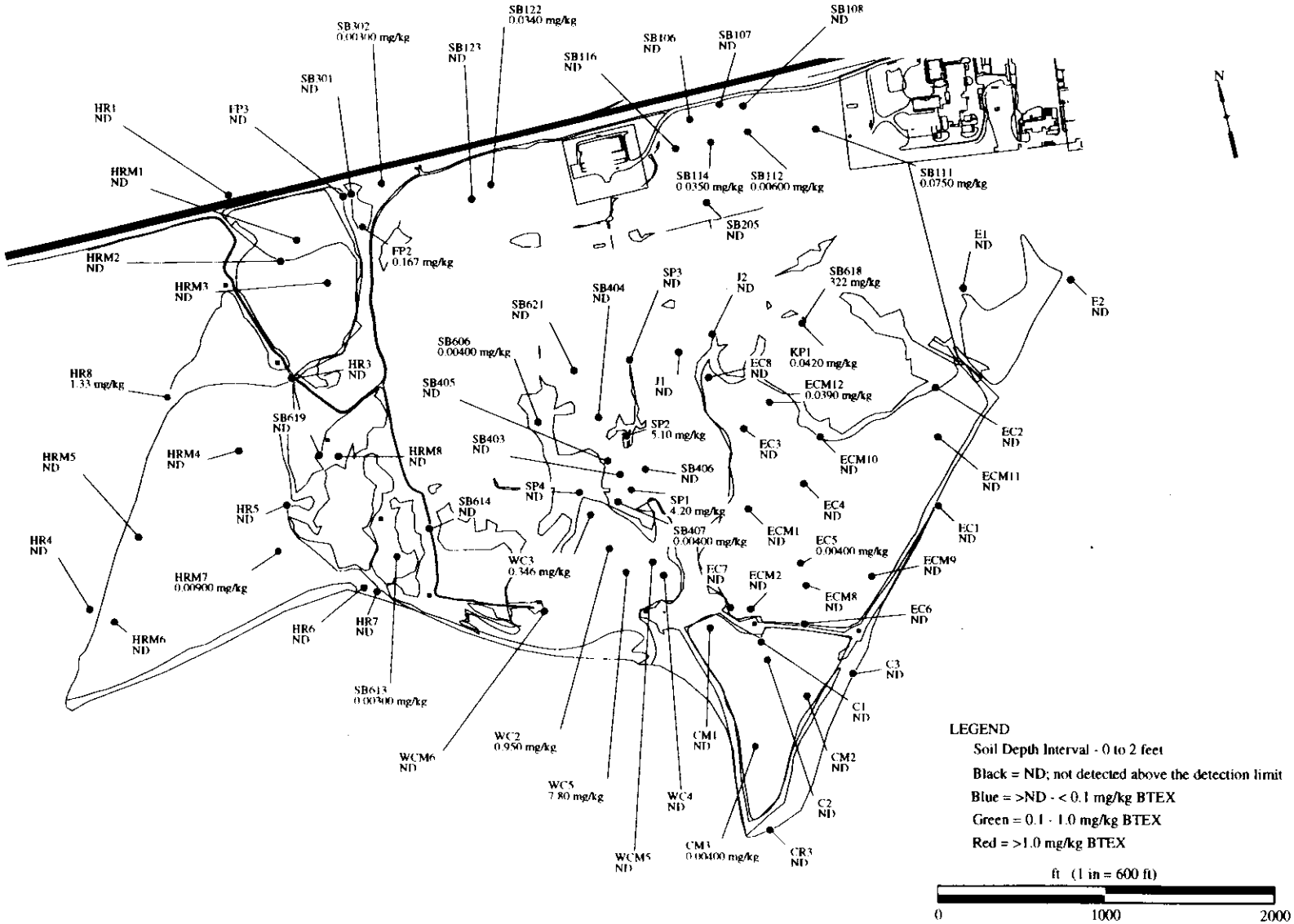
Project No 4E02153F-5	Beazer East, Inc. and E.I. DuPont	TOTAL PCP IN SOIL (4-6 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	April, 1995
Woodward-Clyde Consultants			Figure A-15

AR308833



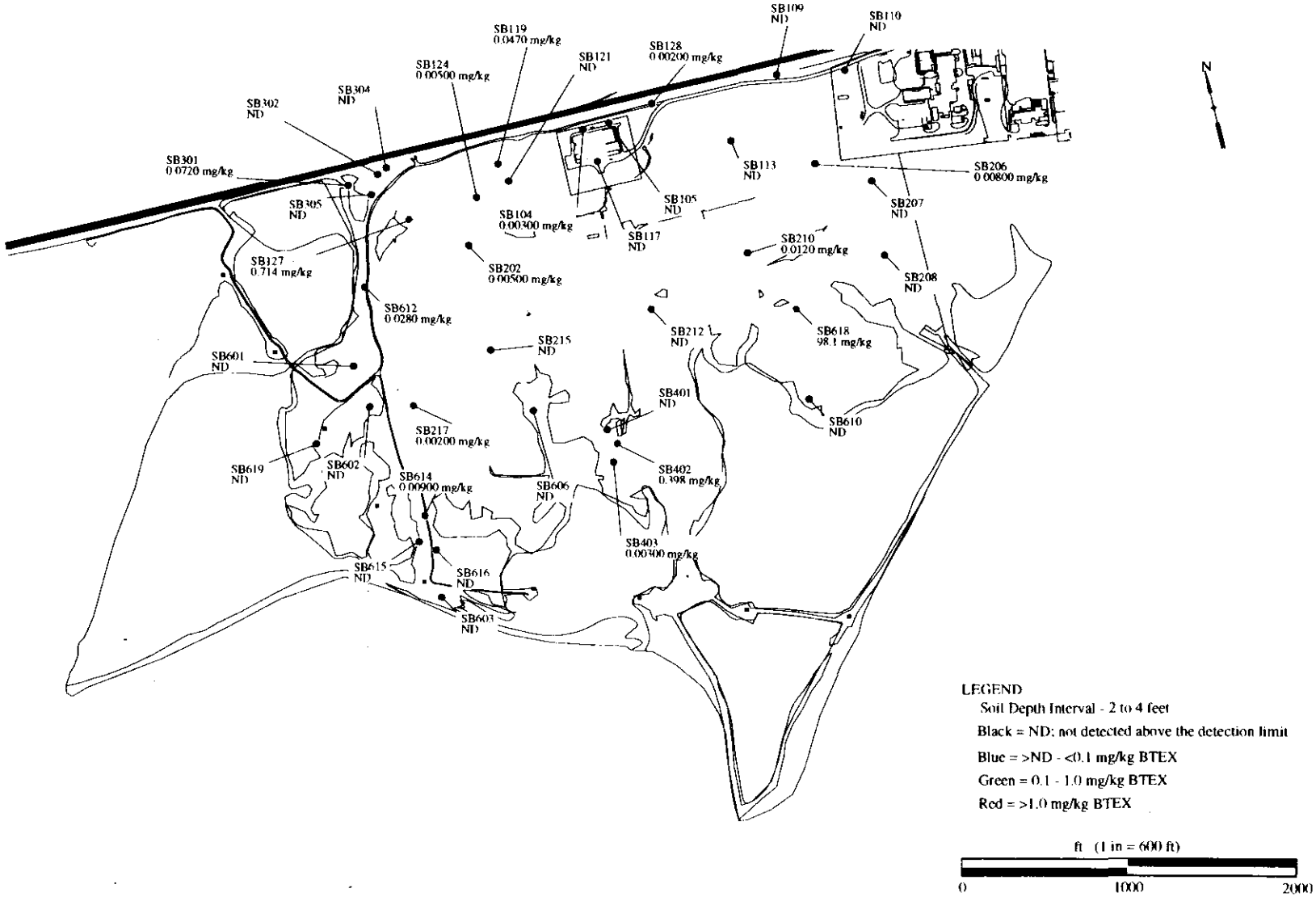
Project No. 4E02153F-3	Beazer East, Inc. and E.I. DuPont	Total PCP (>6 ft) Former Koppers Company, Inc. Newport Site Newport, Delaware	March 7, 1995
Woodward-Clyde Consultants			Figure A-16

AR308834



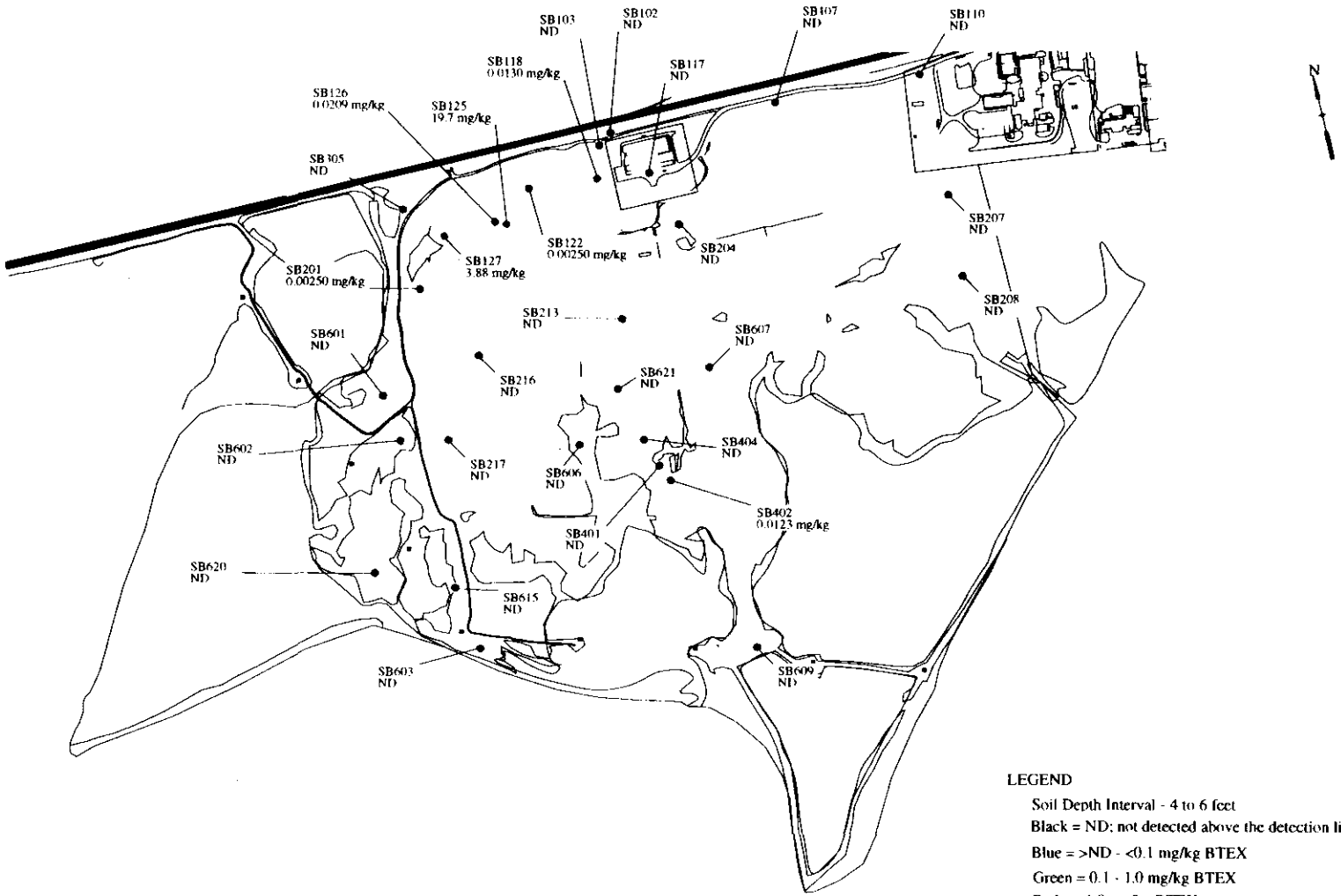
Project No. 4E02153F-3	Beazer East, Inc. and E.I. DuPont	Total BTEX (0-2.0 ft.) Former Koppers Company, Inc. Newport Site Newport, Delaware	March 7, 1995
Woodward-Clyde Consultants			Figure A-17

AR300835



Project No 4E02153F-3	Total BTEX (2-4 ft) Former Koppers Company, Inc Newport Site Newport, Delaware	March 7, 1995
Woodward-Clyde Consultants		Figure A-18

AR300836



LEGEND

Soil Depth Interval - 4 to 6 feet

Black = ND; not detected above the detection limit

Blue = >ND - <0.1 mg/kg BTEX

Green = 0.1 - 1.0 mg/kg BTEX

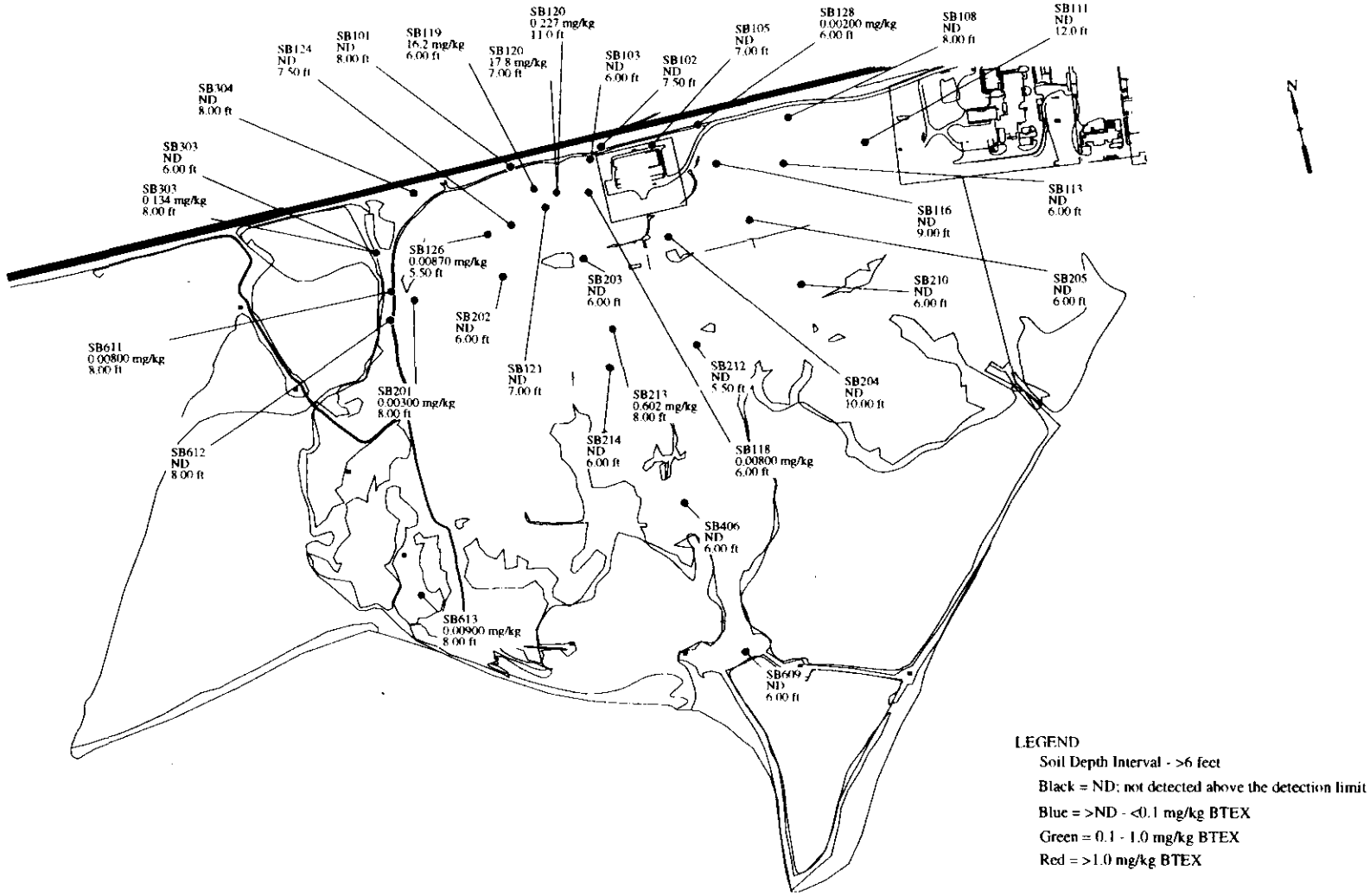
Red = >1.0 mg/kg BTEX

ft (1 in = 600 ft)

0 1000 2000

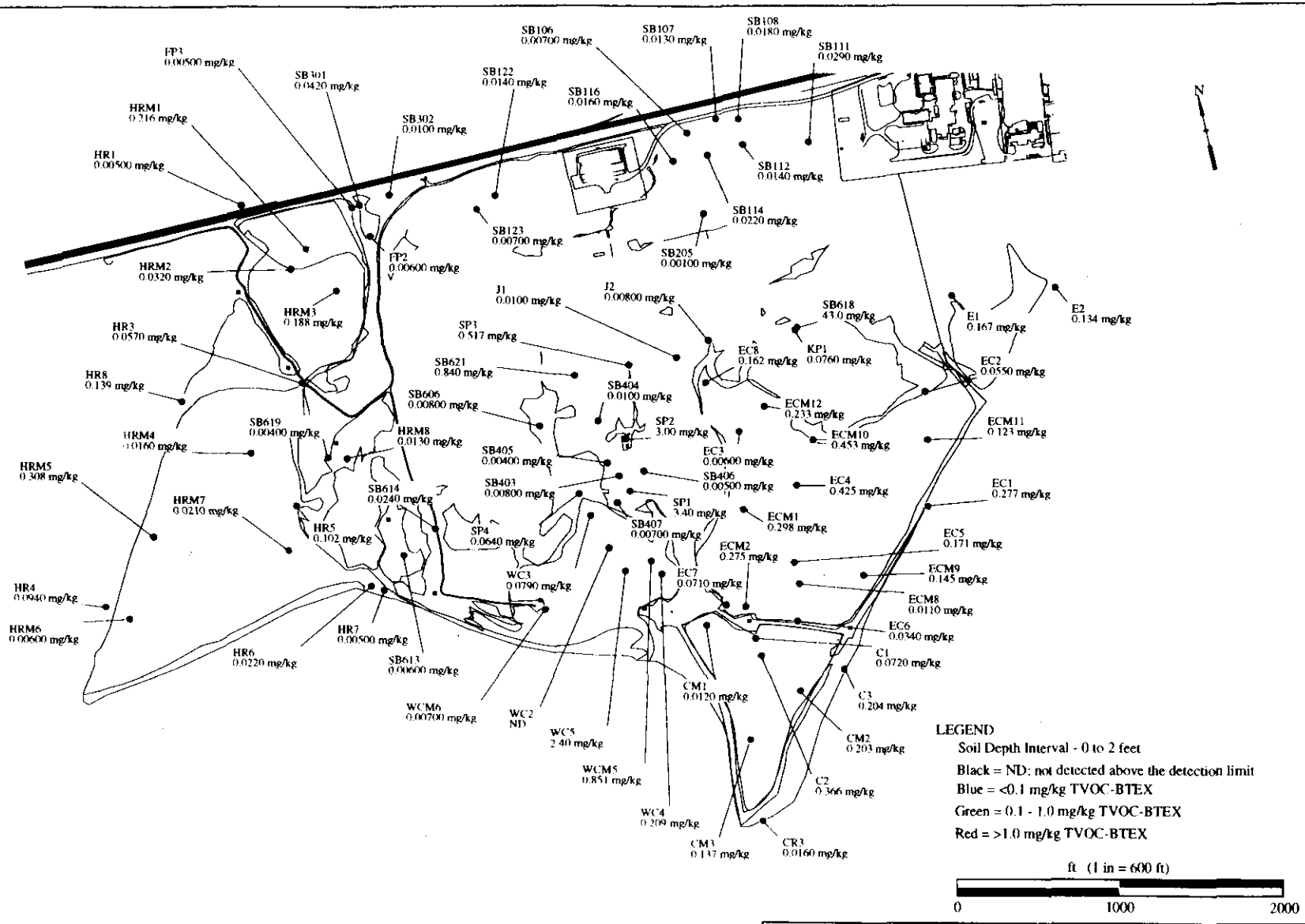
Project No. 4E02153F-3		Total BTEX (4-6 ft) Former Koppers Company, Inc Newport Site Newport, Delaware	March 7, 1995
Woodward-Clyde Consultants			Figure A-19

AR308837



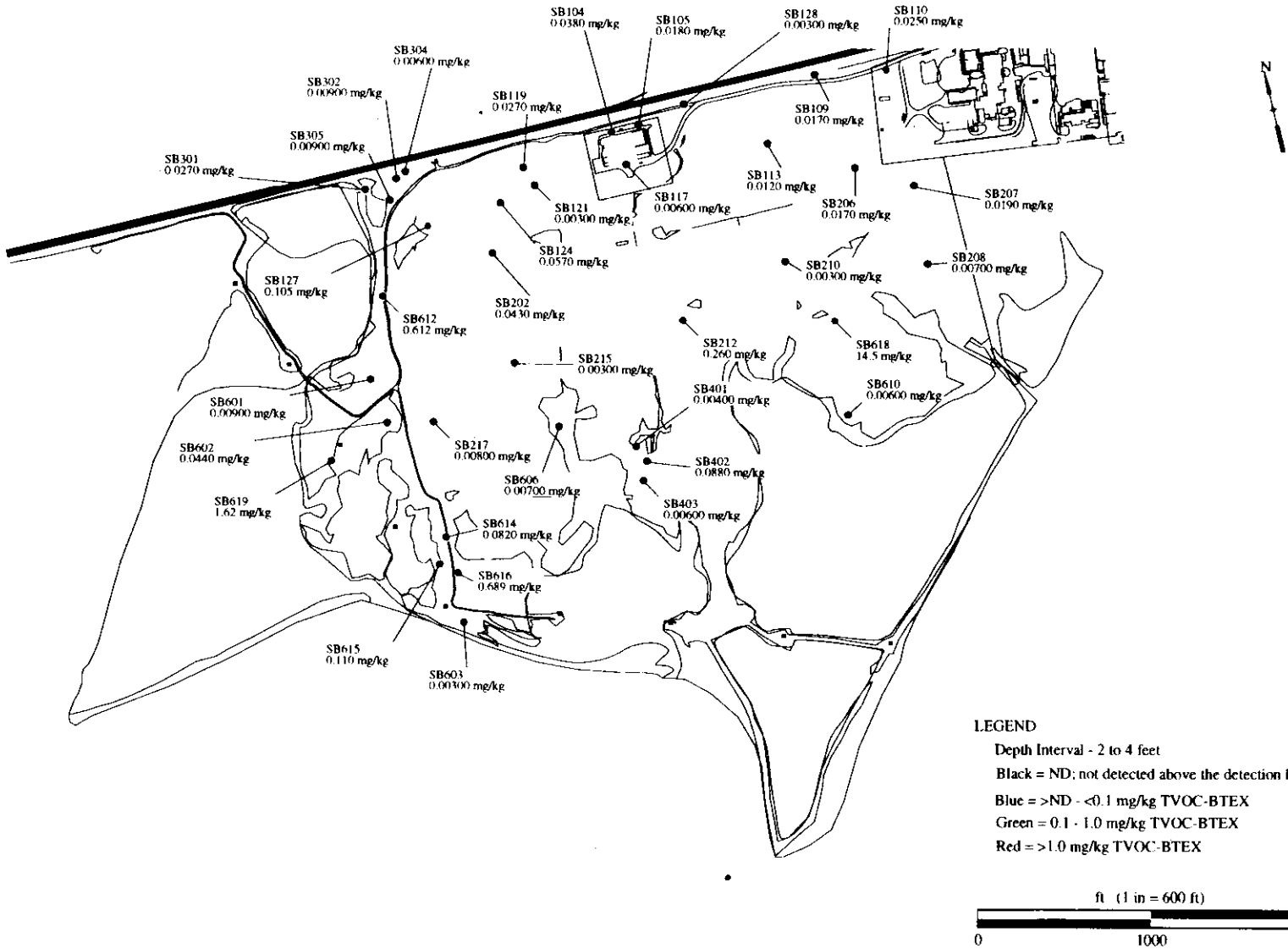
Project No 4E02153F-3	Beazer East, Inc. and E.I. DuPont	Total BTEX (>6 ft.) Former Koppers Company, Inc Newport Site Newport, Delaware	March 7, 1995
Woodward-Clyde			Figure A-20

AR308838



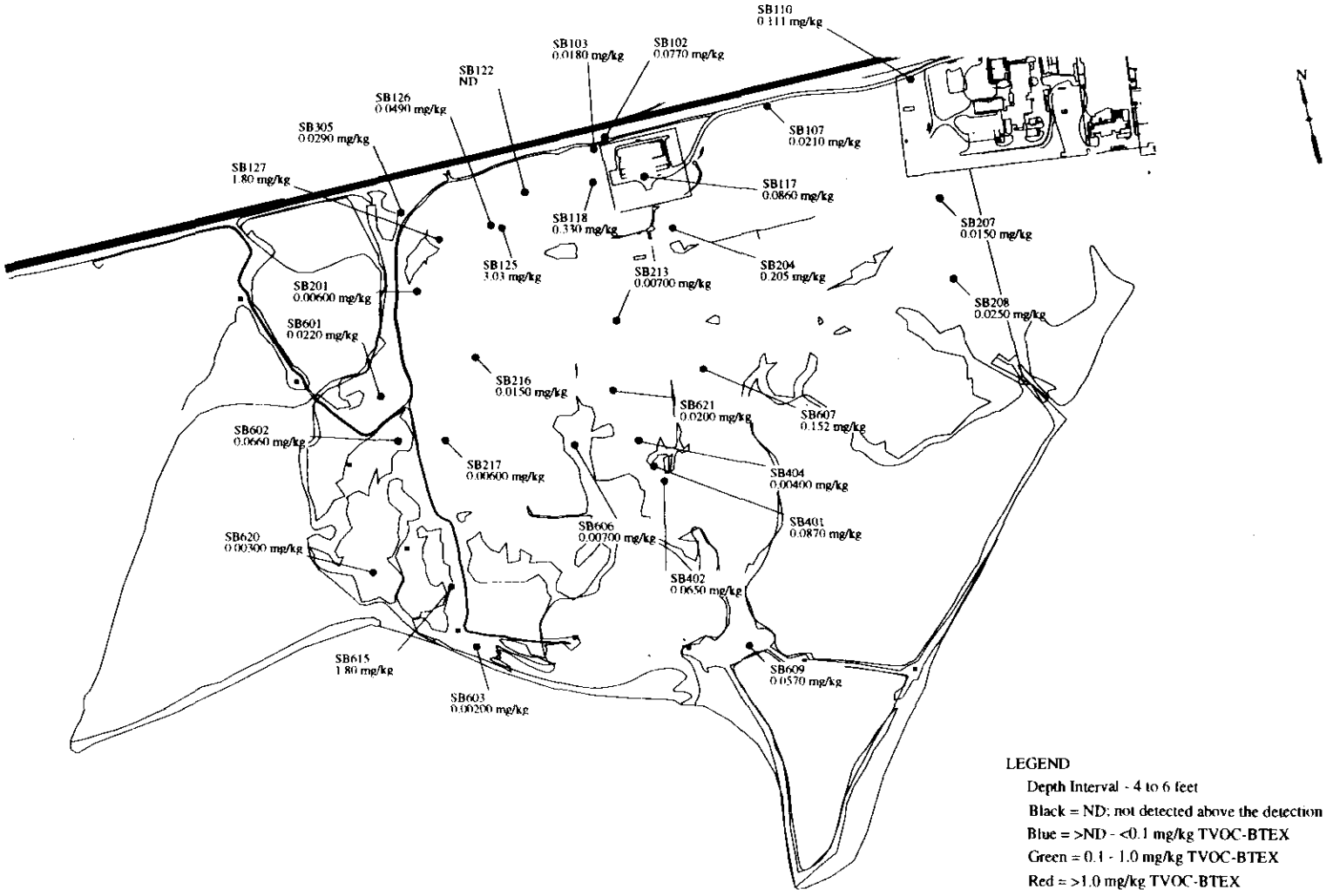
Project No. 4E02153F-3	Beazer East, Inc. and E.I. DuPont	TOTAL VOCs WITHOUT BTEX IN SOIL (0–2 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	March 7, 1995
Woodward-Clyde Consultants			Figure A–21

AR308839



Project No. 4E02153F-3	Beazer East, Inc. and E.I. DuPont	TOTAL VOCs WITHOUT BTEX IN SOIL (2-4 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	March 7, 1995
Woodward-Clyde Consultants			Figure A-22

AR308840



LEGEND

Depth Interval - 4 to 6 feet

Black = ND; not detected above the detection limit

Blue = >ND - <0.1 mg/kg TVOC-BTEX

Green = 0.1 - 1.0 mg/kg TVOC-BTEX

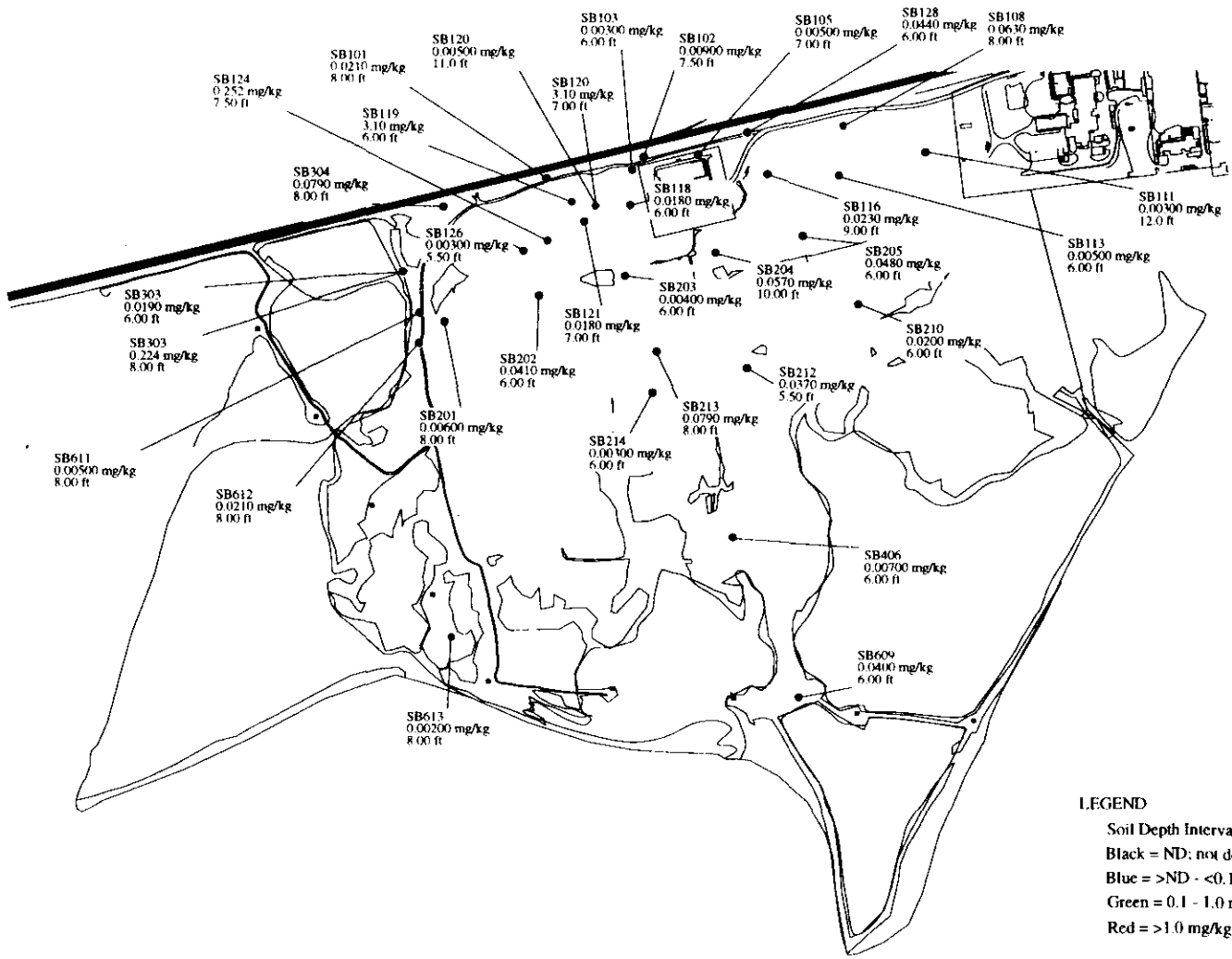
Red = >1.0 mg/kg TVOC-BTEX

ft (1 in = 600 ft)

0 1000 2000

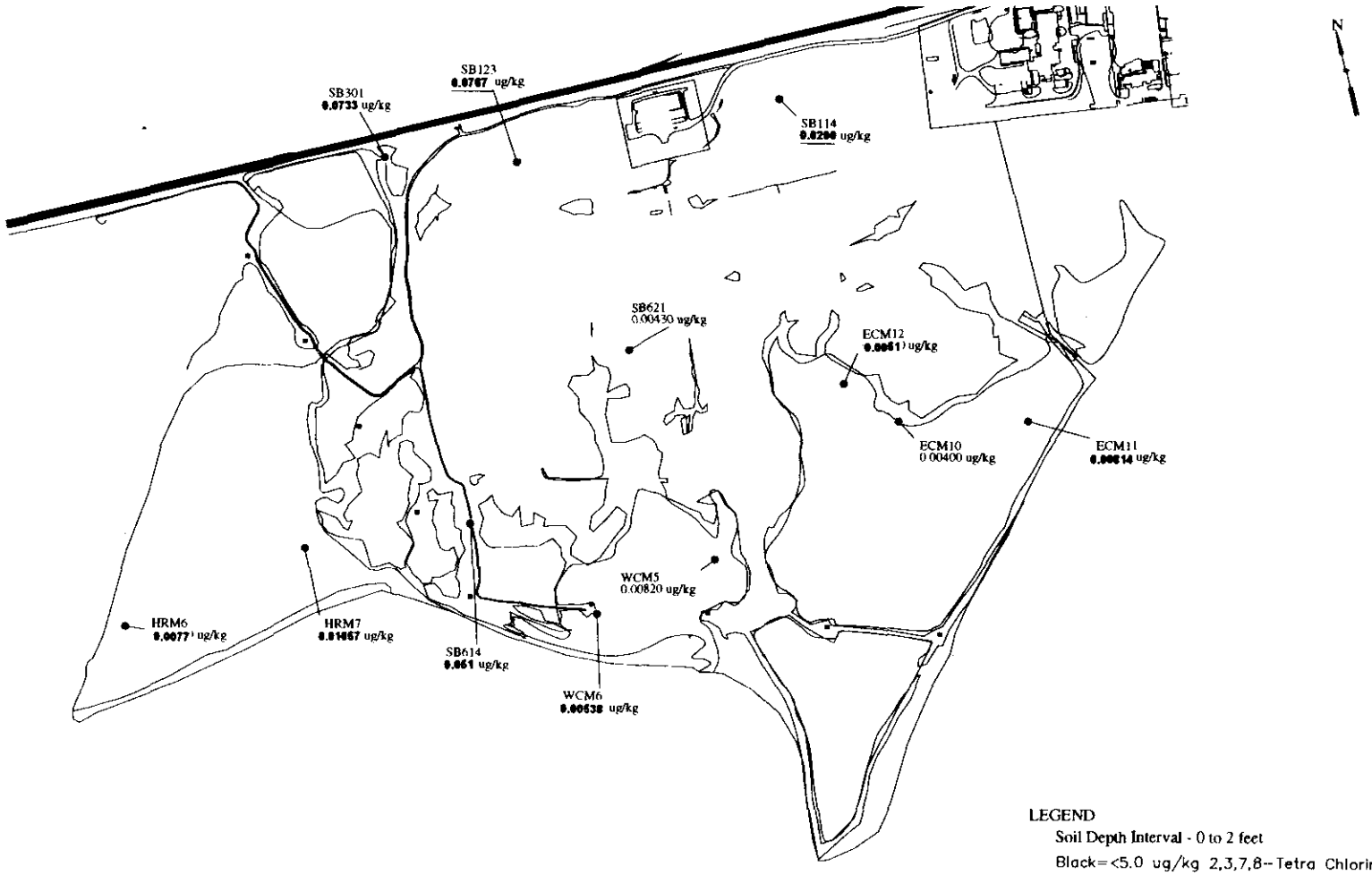
Project No. 4E02153F-3	Beazer East, Inc. and E.I. DuPont	TOTAL VOCs WITHOUT BTEX IN SOIL (4–6 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	March 7, 1995
Woodward-Clyde Consultants			Figure A–23

AR308841



Project No. 4E02153F-3	Beazer East, Inc. and E.I. DuPont	TOTAL VOCs WITHOUT BTEX IN SOIL (>6 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	March 7, 1995
Woodward-Clyde Consultants			Figure A-24

AR308842



LEGEND

Soil Depth Interval - 0 to 2 feet

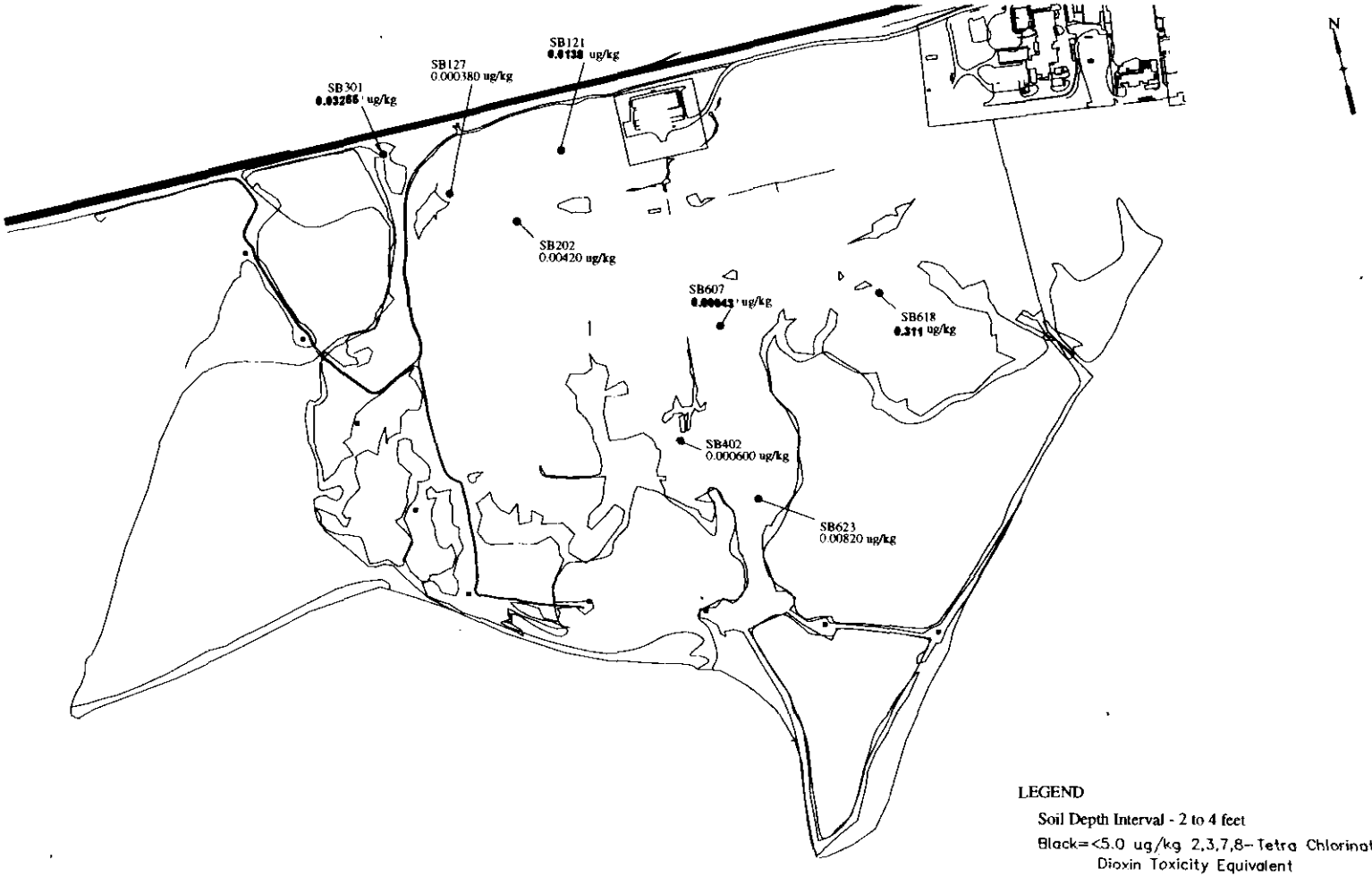
Black=<5.0 ug/kg 2,3,7,8--Tetra Chlorinated Dibenzo(p) Dioxin Toxicity Equivalent

ft (1 in = 600 ft)

0 1000 2000

Project No 4E02153F-5	Beazer East, Inc. and E.I. DuPont	2,3,7,8-TETRA CHLORINATED DIBENZO(p) DIOXIN TOXICITY EQUIVALENT IN SOIL (0-2 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	April, 1995
Woodward-Clyde Consultants			Figure A-25

AR300843



LEGEND

Soil Depth Interval - 2 to 4 feet

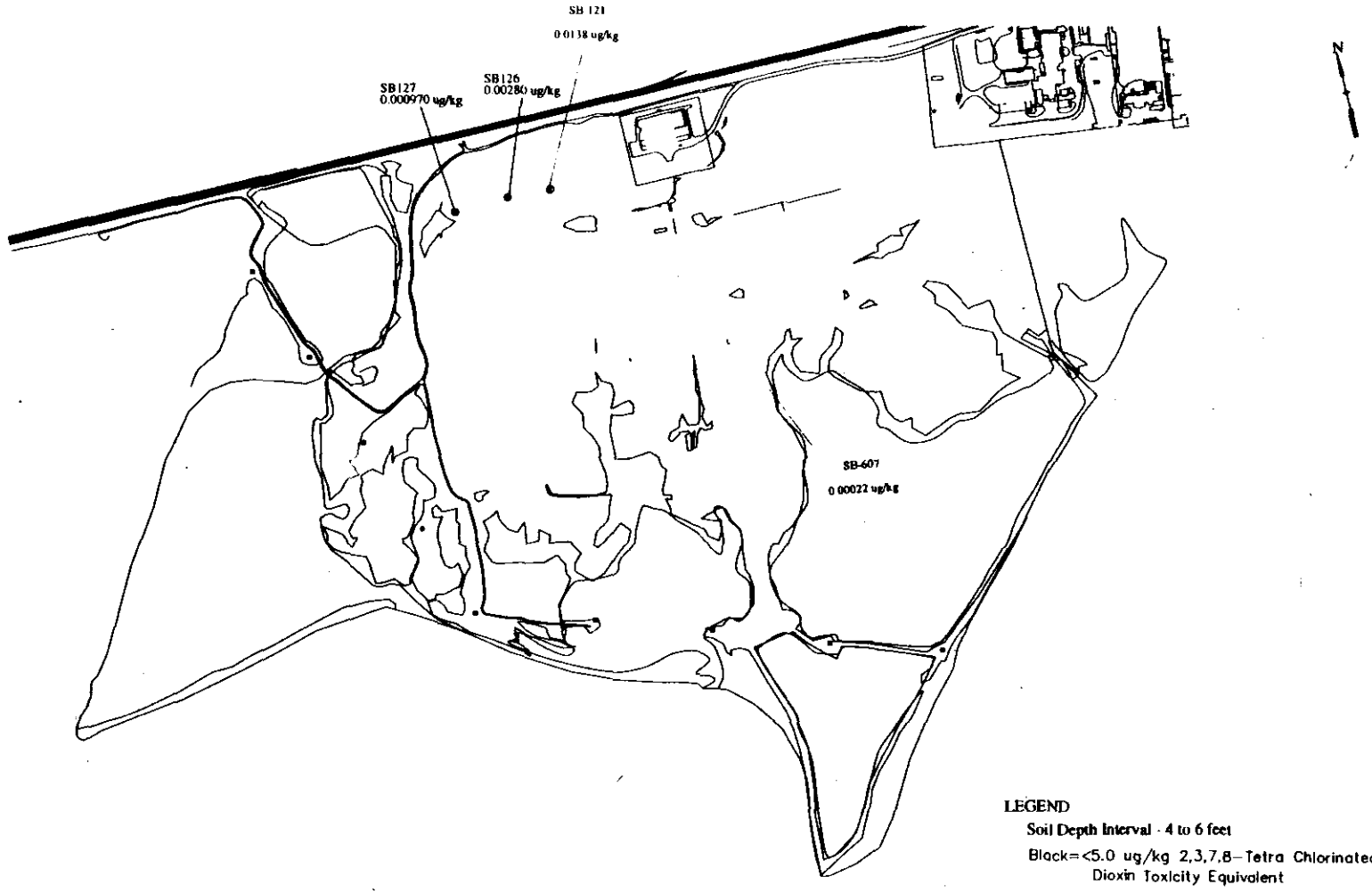
Black=<5.0 ug/kg 2,3,7,8-Tetra Chlorinated Dibenzo(p) Dioxin Toxicity Equivalent

ft (1 in = 600 ft)

0 1000 2000

Project No 4E0215.3F-5	Beazer East, Inc. and E.I. DuPont	DIOXIN TOXICITY EQUIVALENT CONCENTRATIONS IN SOIL (2-4 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	April, 1995
Woodward-Clyde Consultants			Figure A-26

AR308844



LEGEND

Soil Depth Interval - 4 to 6 feet

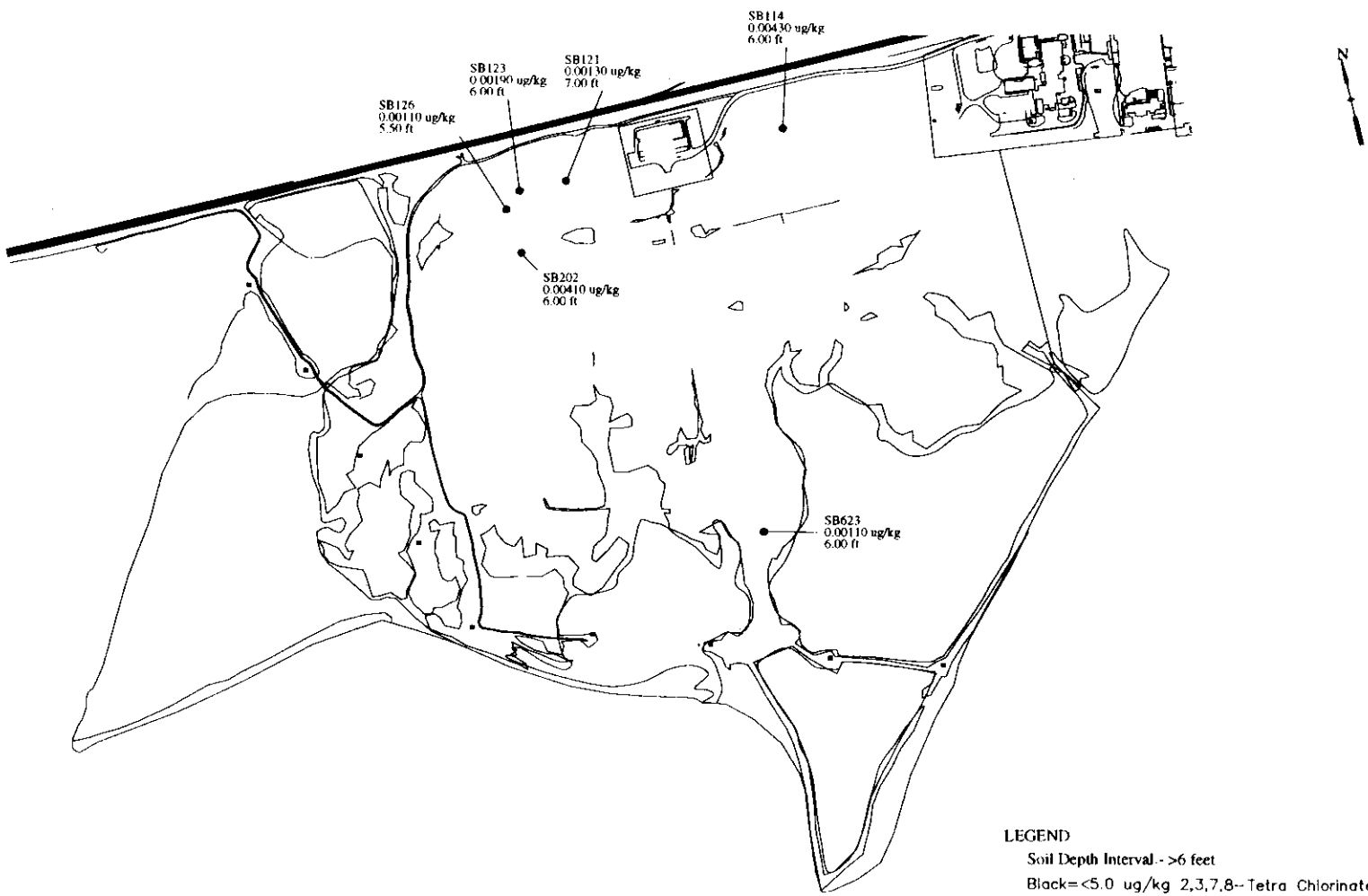
Black=<5.0 ug/kg 2,3,7,8-Tetra Chlorinated Dibenzo(p) Dioxin Toxicity Equivalent

ft (1 in = 600 ft)

0 1000 2000

Project No. 4E02153F-5	Bedzer East, Inc. and E.I. DuPont	DIOXIN TOXICITY EQUIVALENT CONCENTRATIONS IN SOIL (4-6 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	April, 1995
Woodward-Clyde Consultants			Figure A-27

AR308845



LEGEND

Soil Depth Interval - >6 feet

Black=<5.0 ug/kg 2,3,7,8--Tetra Chlorinated Dibenzo(p) Dioxin Toxicity Equivalent

ft (1 in = 600 ft)

0 1000 2000

Project No 4E02153F-5	Beazer East, Inc. and E.I. DuPont	DIOXIN TOXICITY EQUIVALENT CONCENTRATIONS IN SOIL (>6 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	April, 1995
Woodward-Clyde Consultants			Figure A-28

AR308846

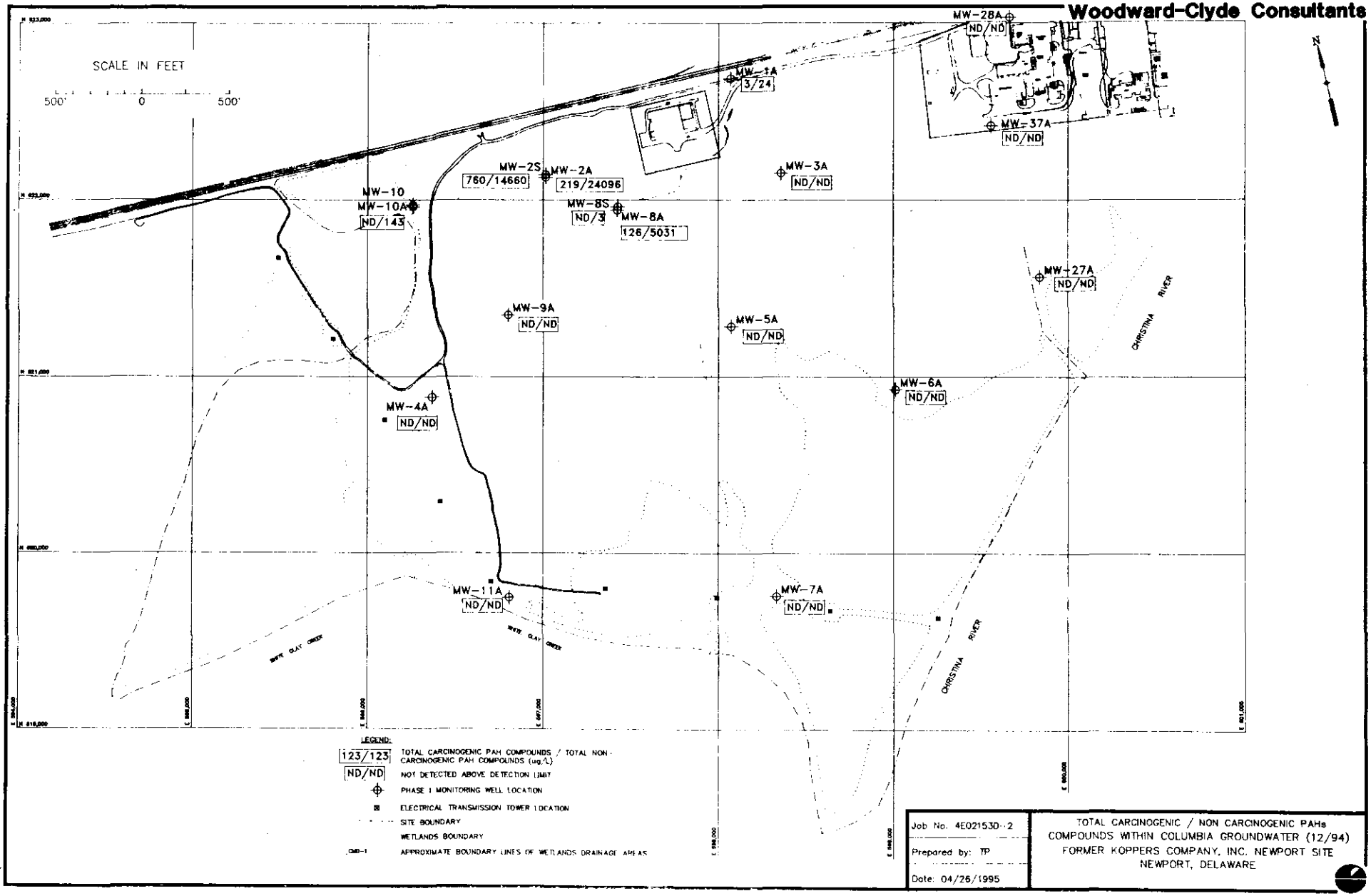
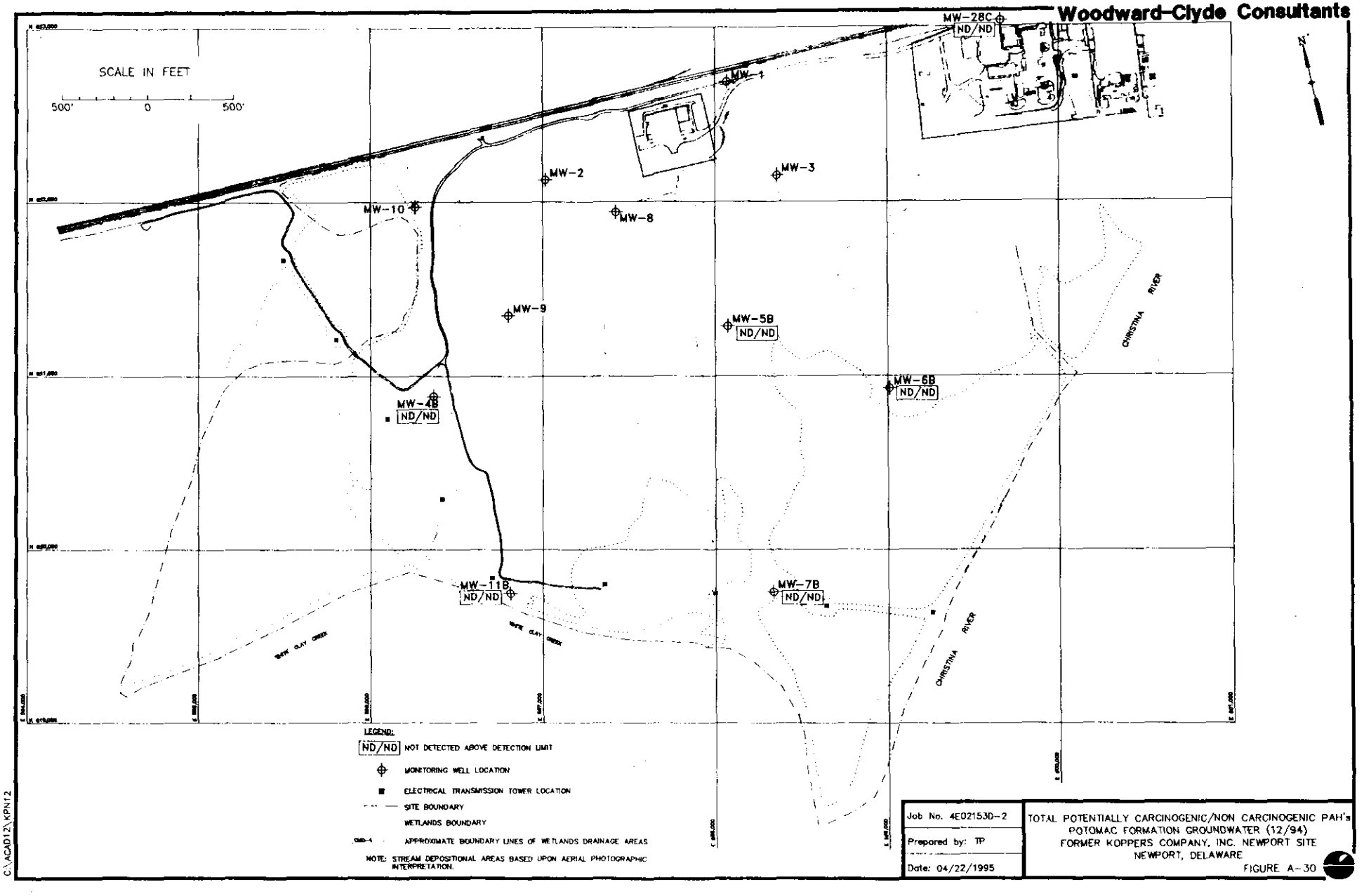


FIGURE A-29

AR308847

Woodward-Clyde Consultants



Job No. 4E02153D-2	TOTAL POTENTIALLY CARCINOGENIC/NON CARCINOGENIC PAH's POTOMAC FORMATION GROUNDWATER (12/94) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE
Prepared by: TP	
Date: 04/22/1995	FIGURE A-30

C:\ACAD12\KPN12

AR308848

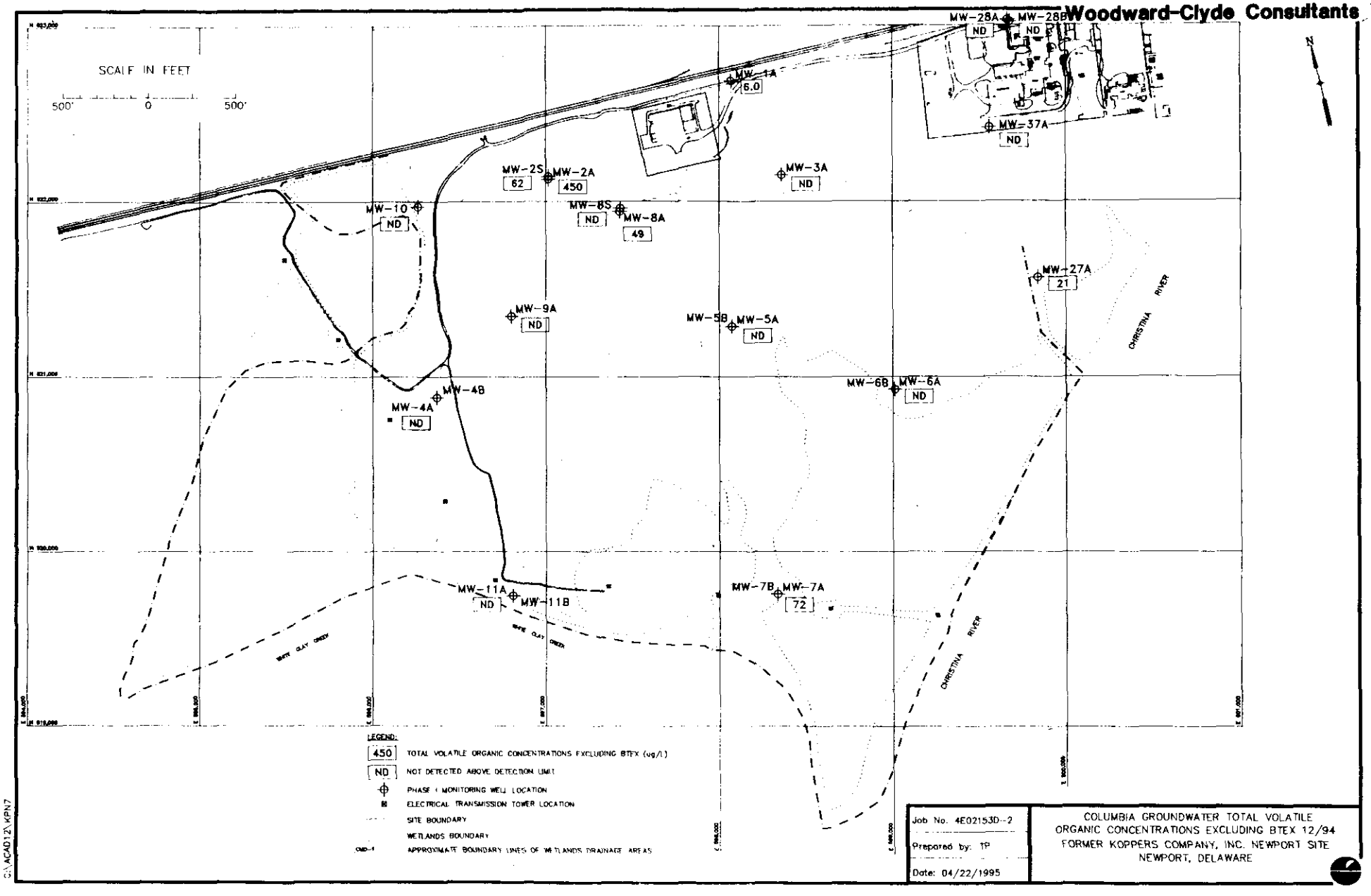
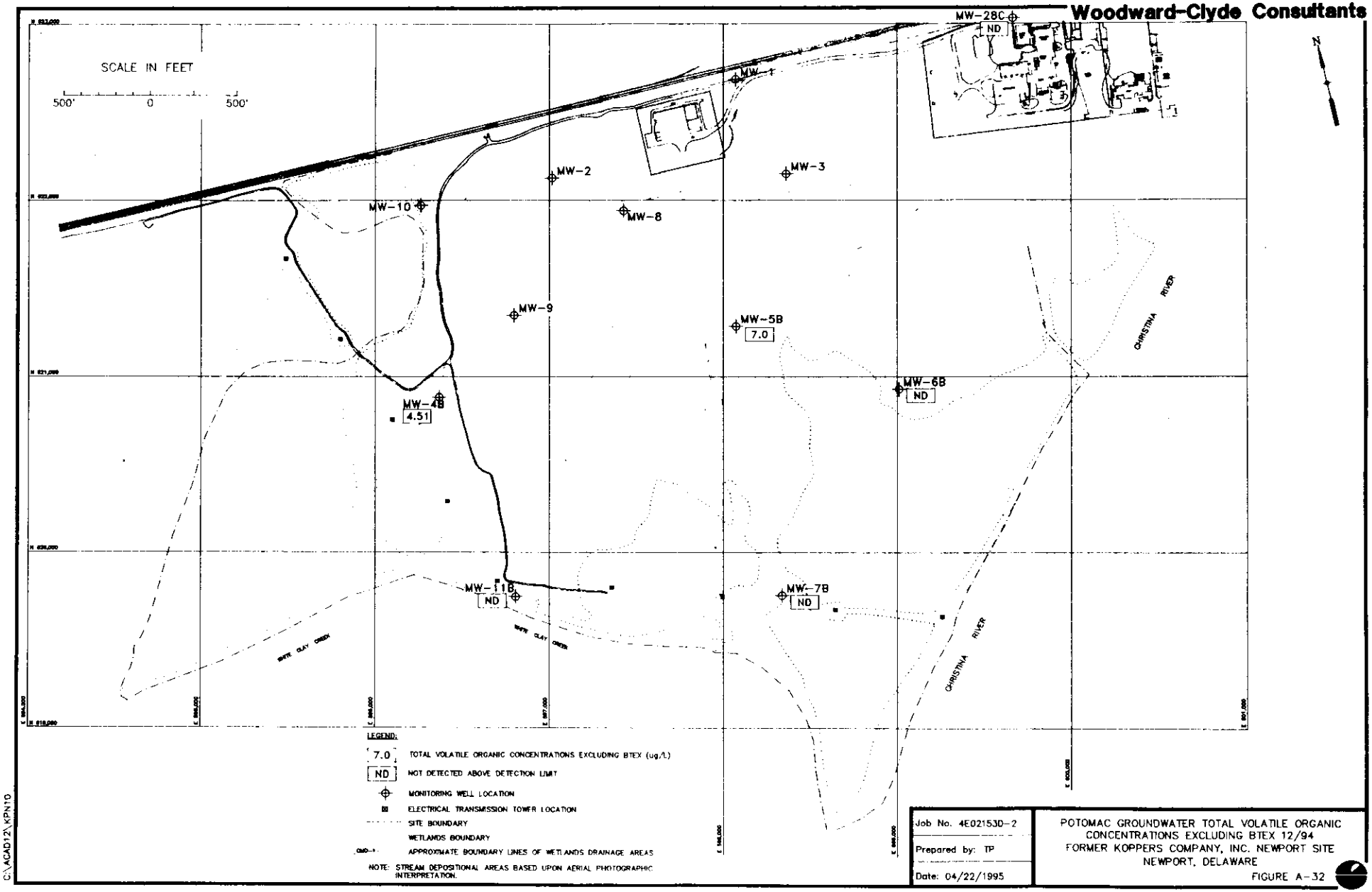


FIGURE A-31

AR308849

C:\ACAD12\KPN7

Woodward-Clyde Consultants



Job No. 4E02153D-2

Prepared by: TP

Date: 04/22/1995

POTOMAC GROUNDWATER TOTAL VOLATILE ORGANIC CONCENTRATIONS EXCLUDING BTEX 12/94
FORMER KOPPERS COMPANY, INC. NEWPORT SITE
NEWPORT, DELAWARE

FIGURE A-32

C:\ACAD12\KPN10

AR308850

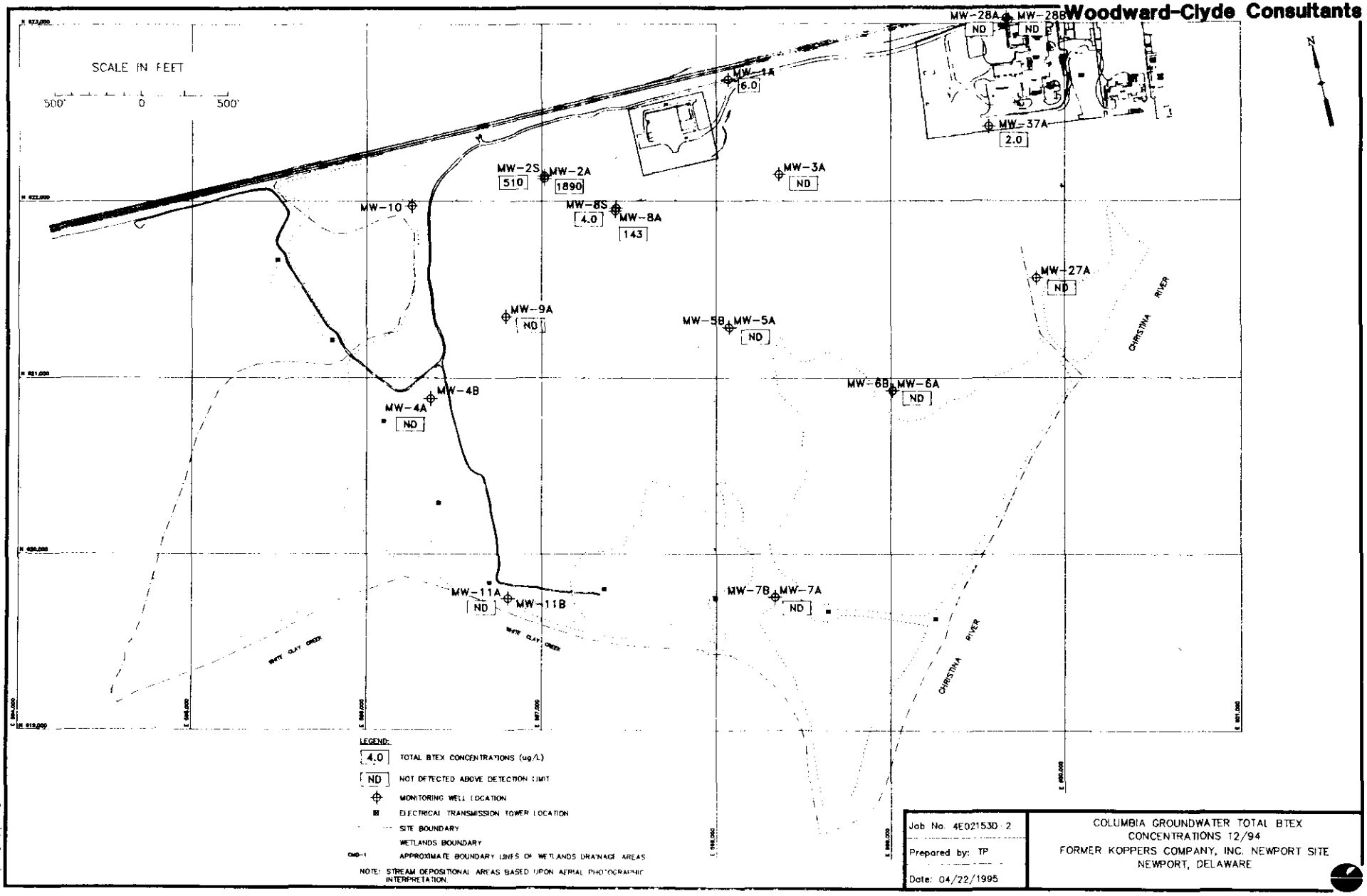
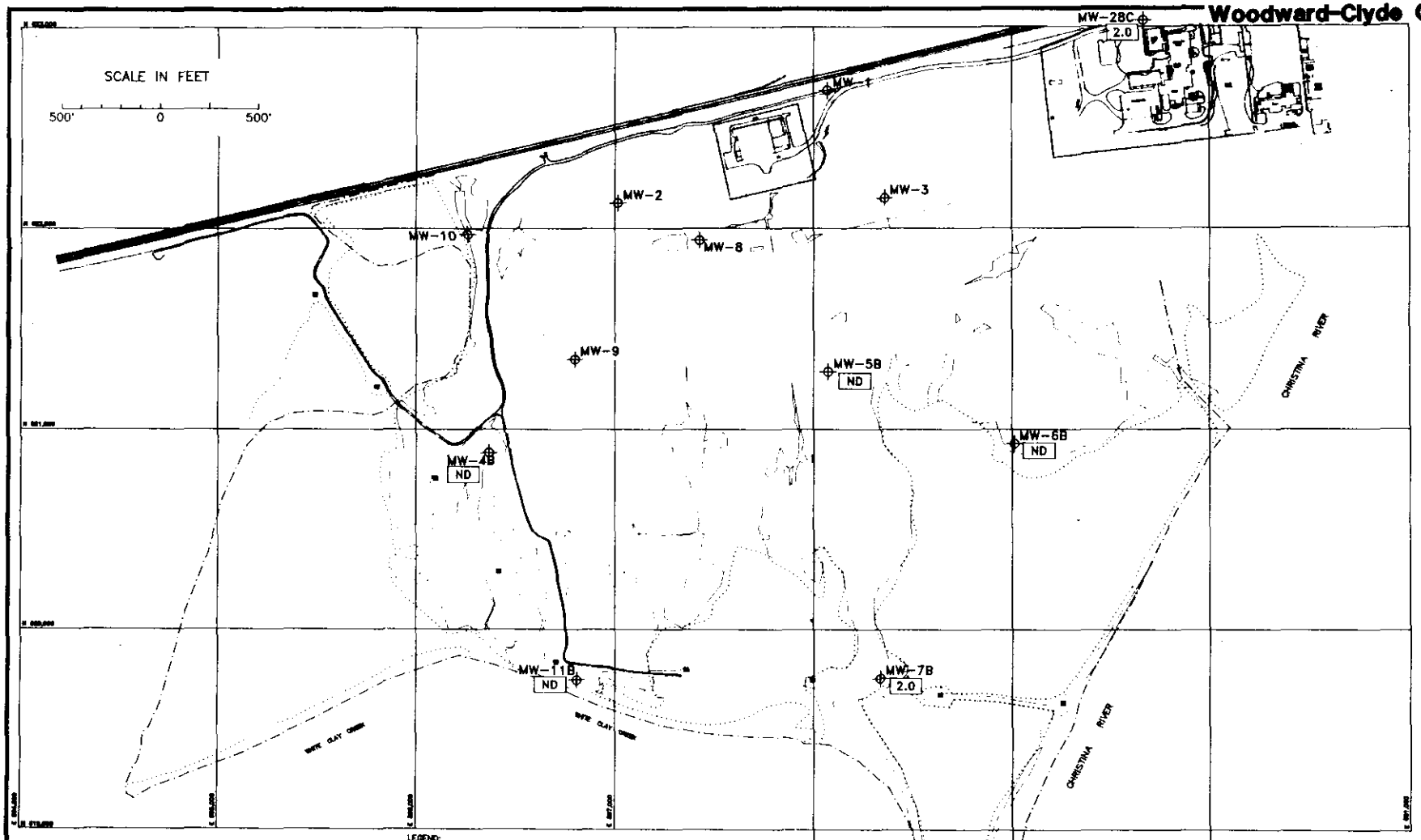


FIGURE A-33

AR308851

Woodward-Clyde Consultants



LEGEND:

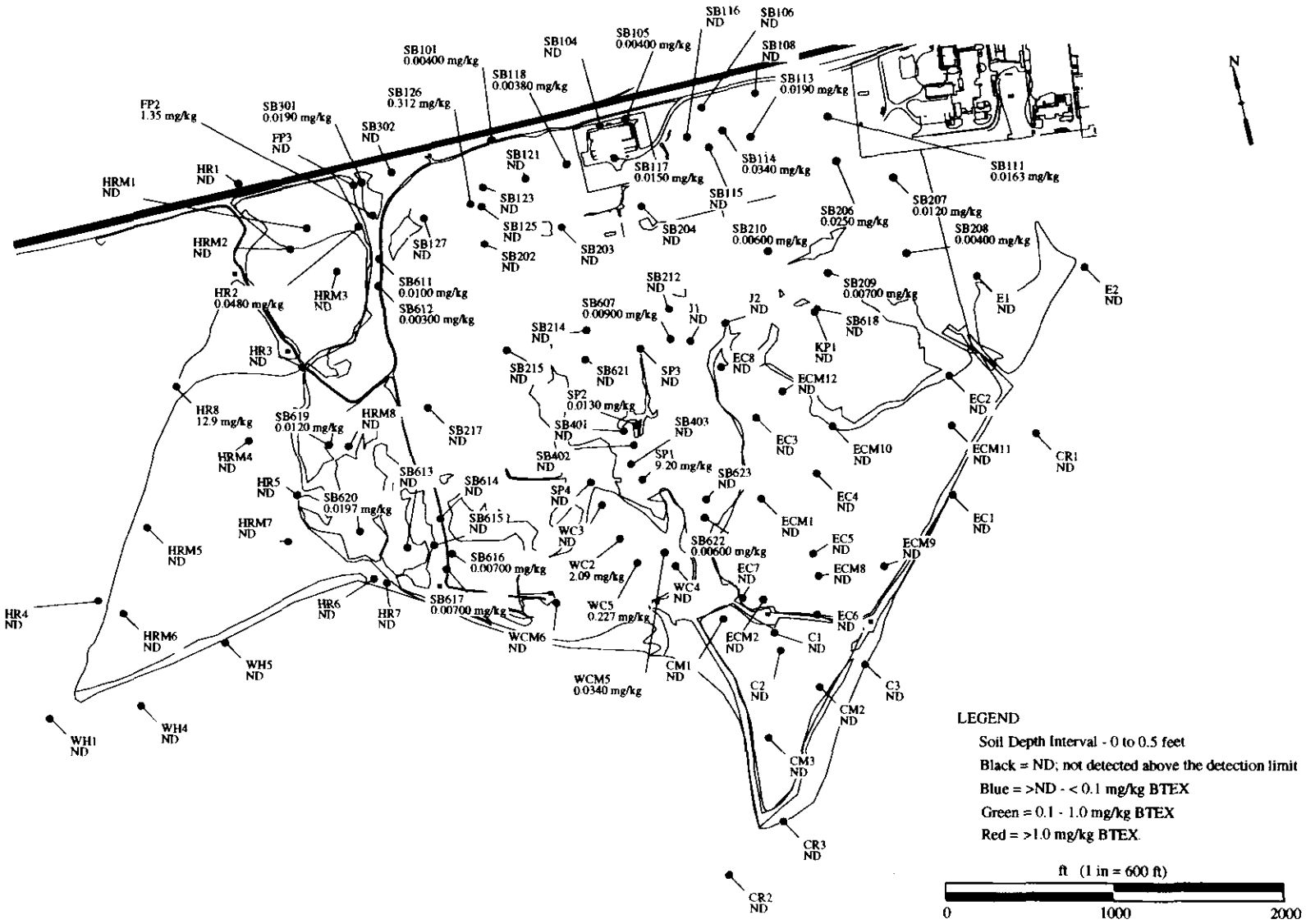
2.0	TOTAL BTEX CONCENTRATIONS (ug/L)
ND	NOT DETECTED ABOVE DETECTION LIMIT
⊕	MONITORING WELL LOCATION
■	ELECTRICAL TRANSMISSION TOWER LOCATION
— —	SITE BOUNDARY
	WETLANDS BOUNDARY
	APPROXIMATE BOUNDARY LINES OF WETLANDS DRAINAGE AREAS

NOTE: STREAM DEPOSITIONAL AREAS BASED UPON AERIAL PHOTOGRAPHIC INTERPRETATION.

Job No. 4E02153D-2	POTOMAC GROUNDWATER TOTAL BTEX CONCENTRATIONS 12/94 FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE
Prepared by: TP	
Date: 04/22/1995	FIGURE A-34

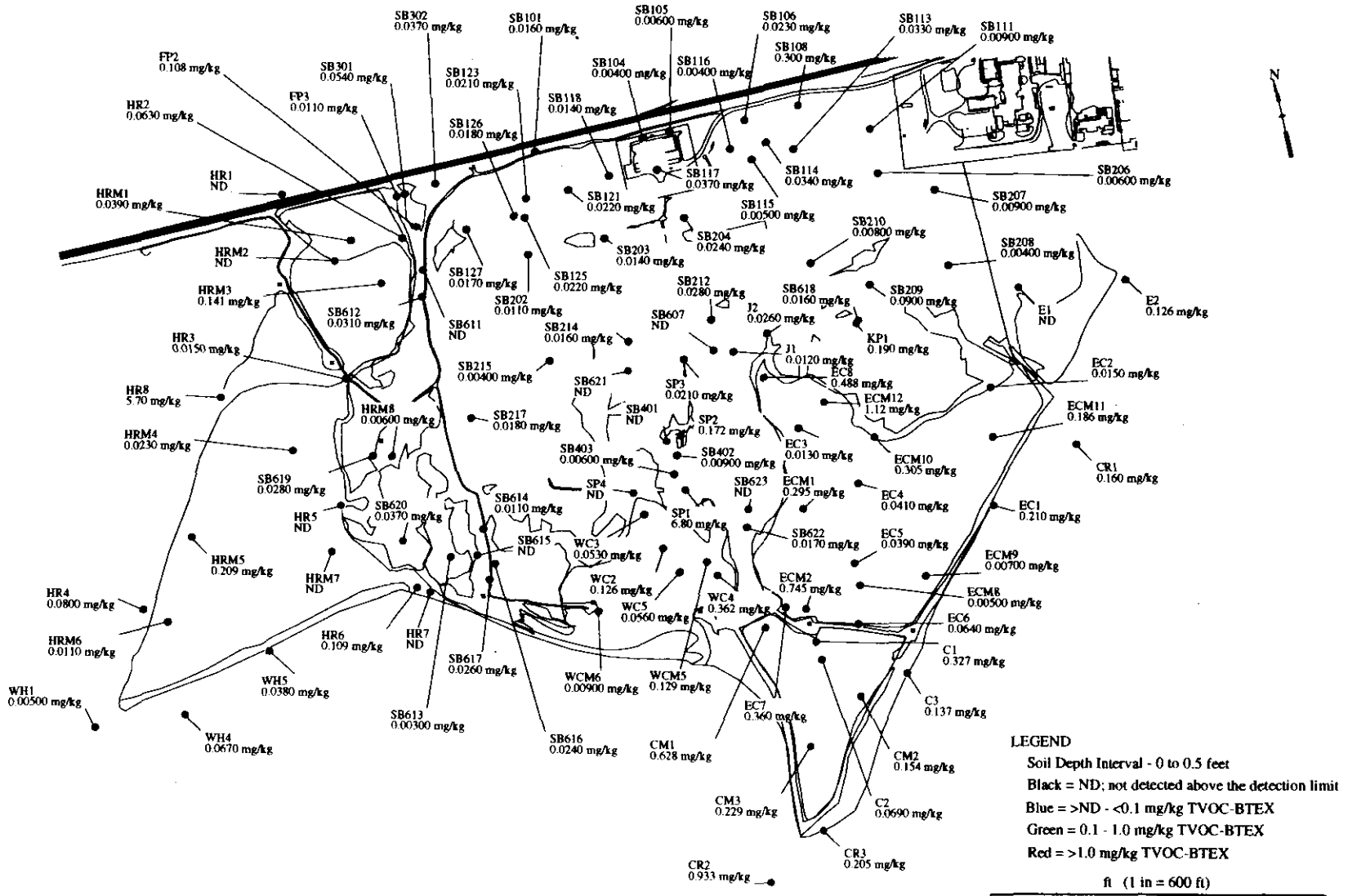
C:\ACAD12\KPN11

AR308852



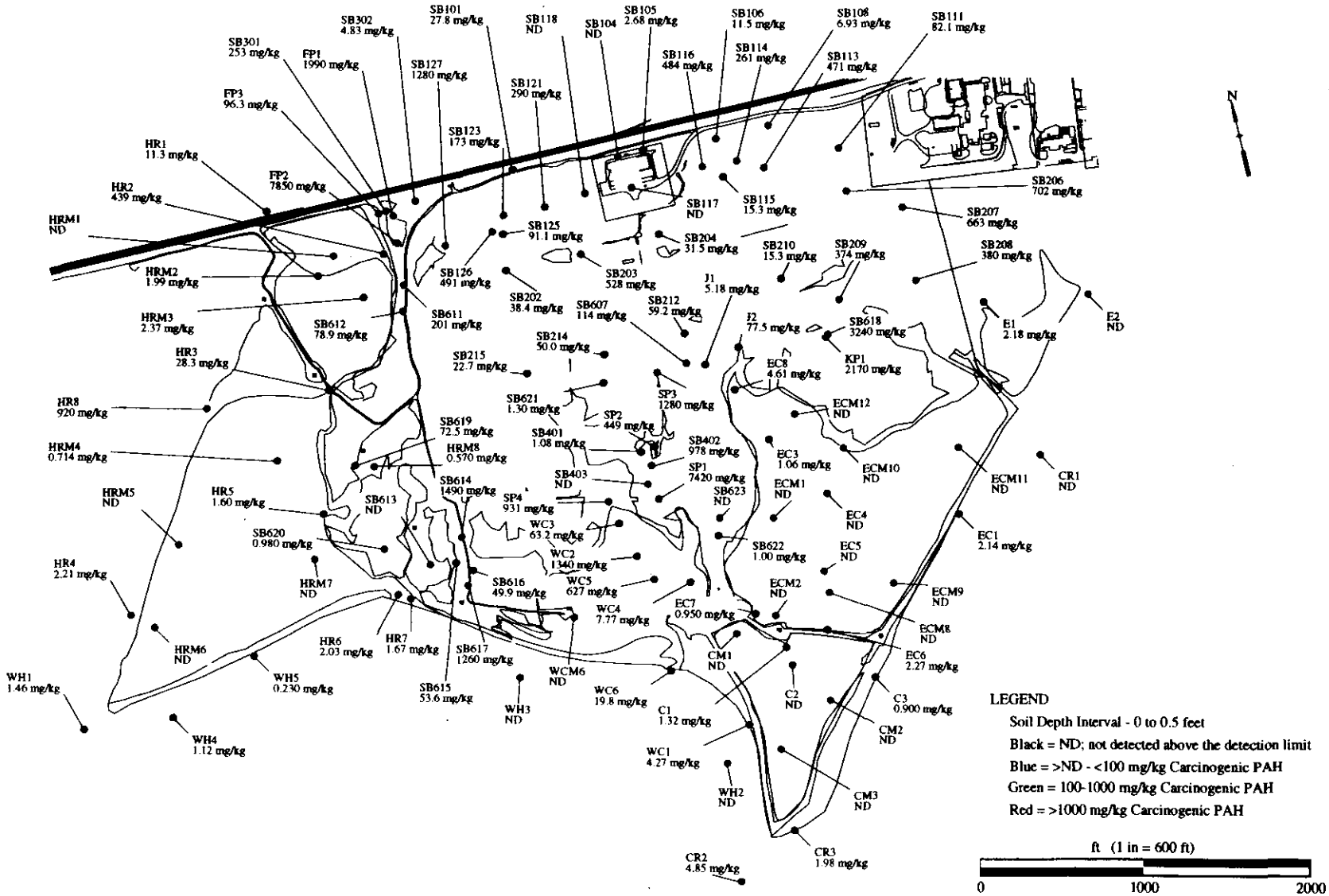
Project No. 4E02153F-3	Beazer East, Inc. and E.I. DuPont	Total BTEX (0-0.5 ft.) Former Koppers Company, Inc. Newport Site Newport, Delaware	March 7, 1995
Woodward-Clyde Consultants			Figure A-35

AR308853



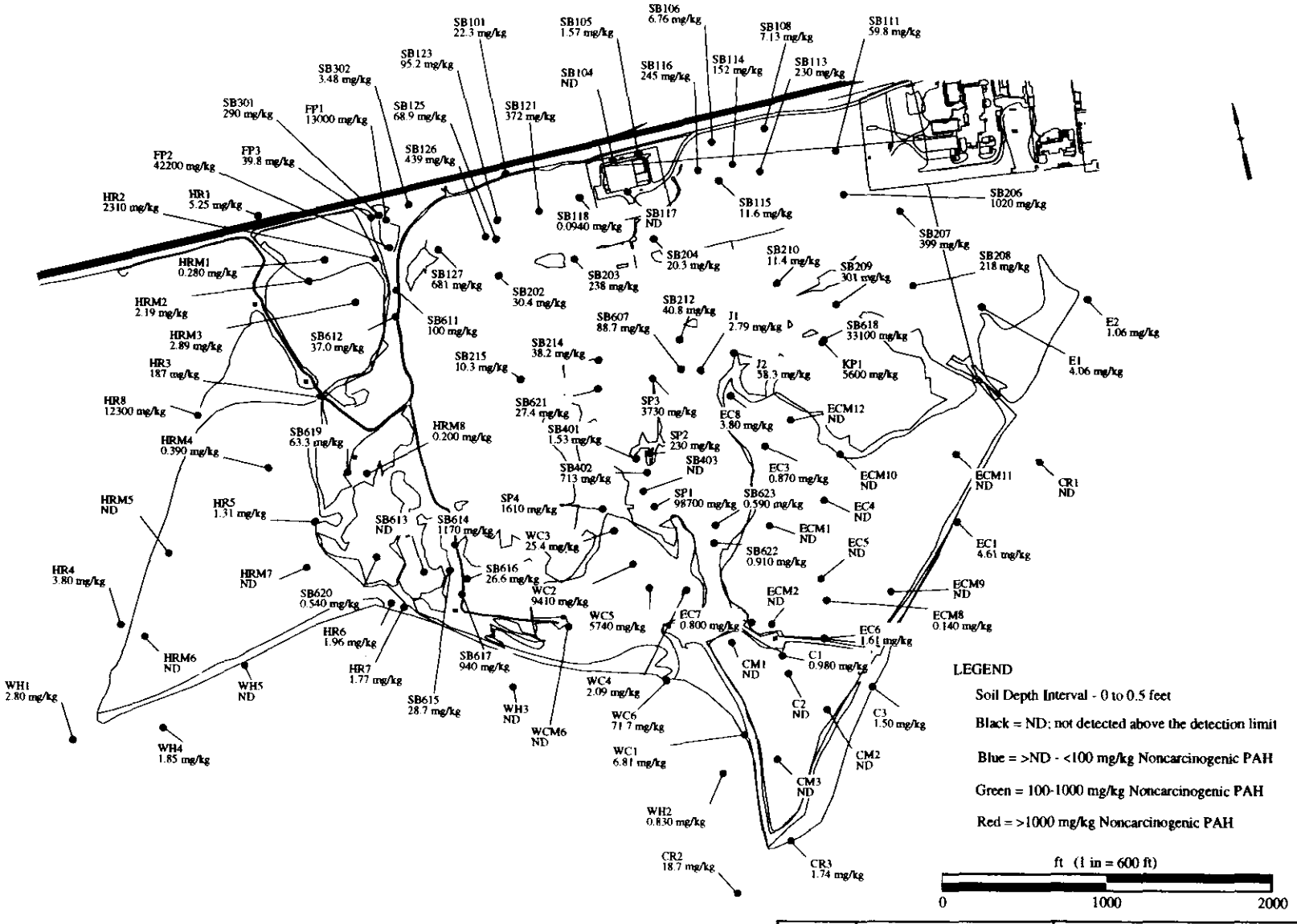
Project No. 4E02153F-3	Beazer East, Inc. and E.I. DuPont	TOTAL VOCs WITHOUT BTEX IN SEDIMENT / PEAT (0–0.5 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	March 7, 1995
Woodward-Clyde Consultants			Figure A–36

AR308854



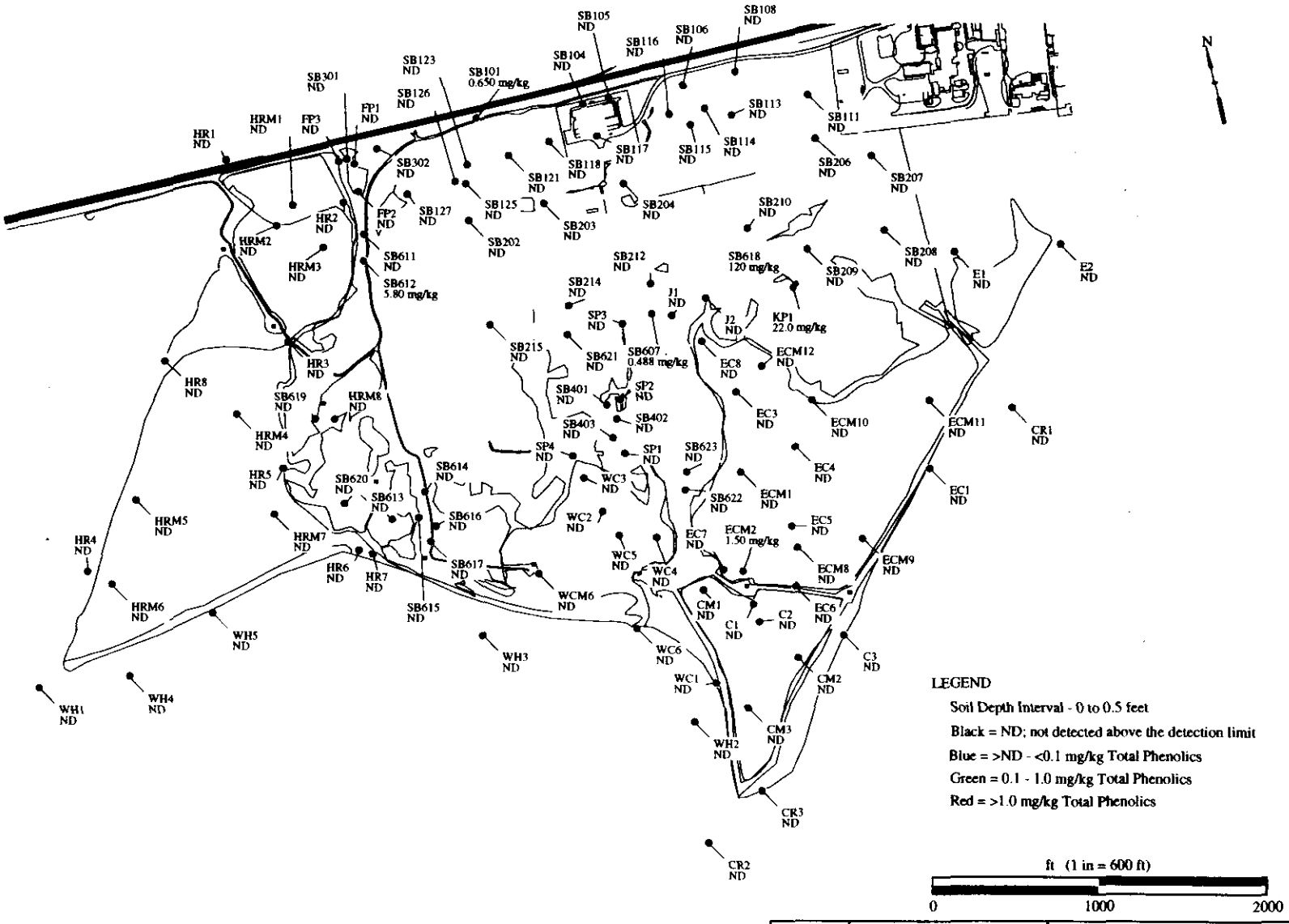
Project No. 4E02153F-3	Beazer East, Inc. and E.I. DuPont	TOTAL POTENTIALLY CARCINOGENIC PAHs IN SEDIMENT / PEAT (0–0.5 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	March 7, 1995
Woodward-Clyde Consultants			Figure A–37

AR308855



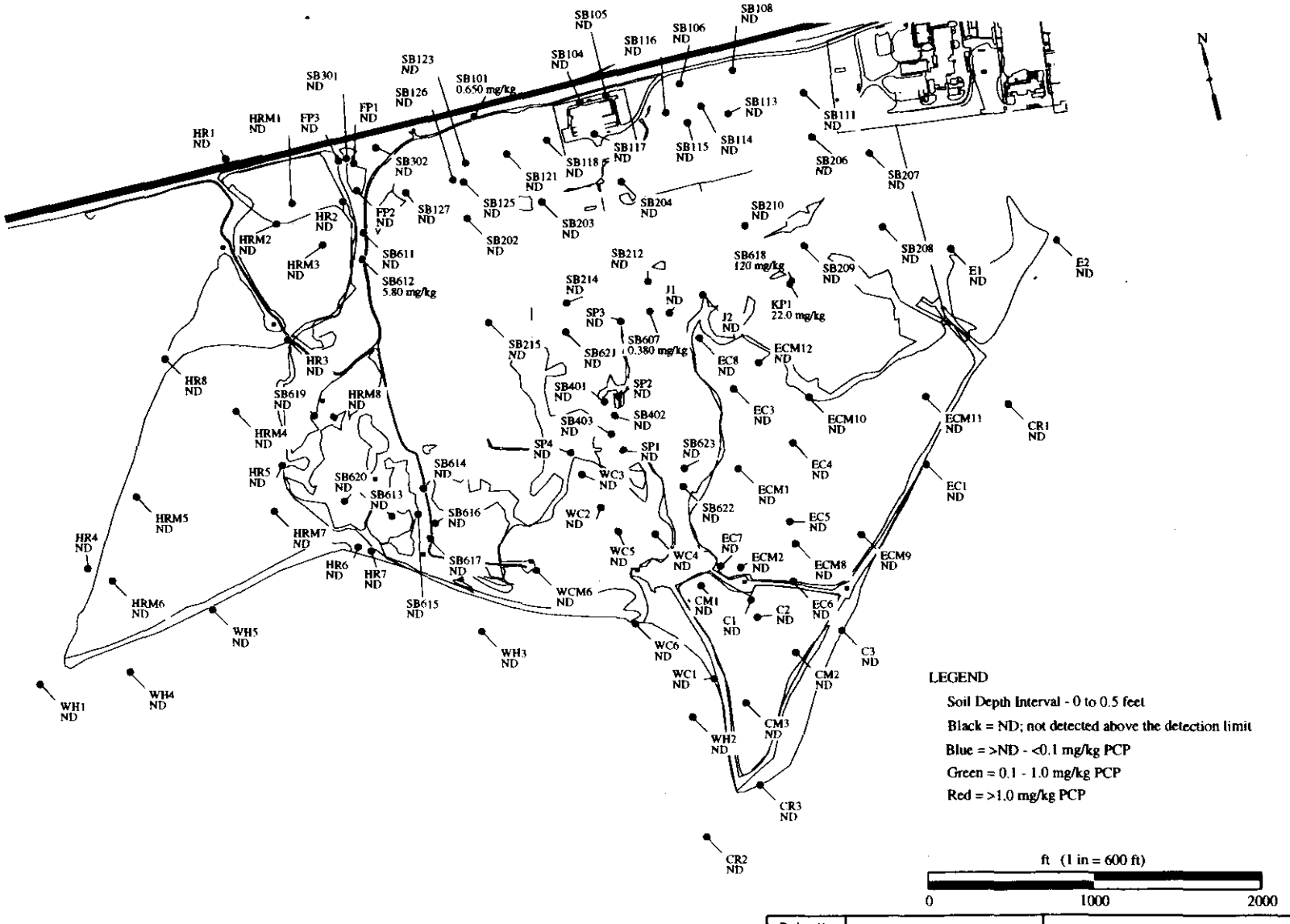
Project No. 4E02153F-3	Beazer East, Inc. and E.I. DuPont	TOTAL NONCARCINOGENIC PAHs in IN SEDIMENT / PEAT (0–0.5 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	March 7, 1995
Woodward-Clyde Consultants			Figure A–38

AR308856



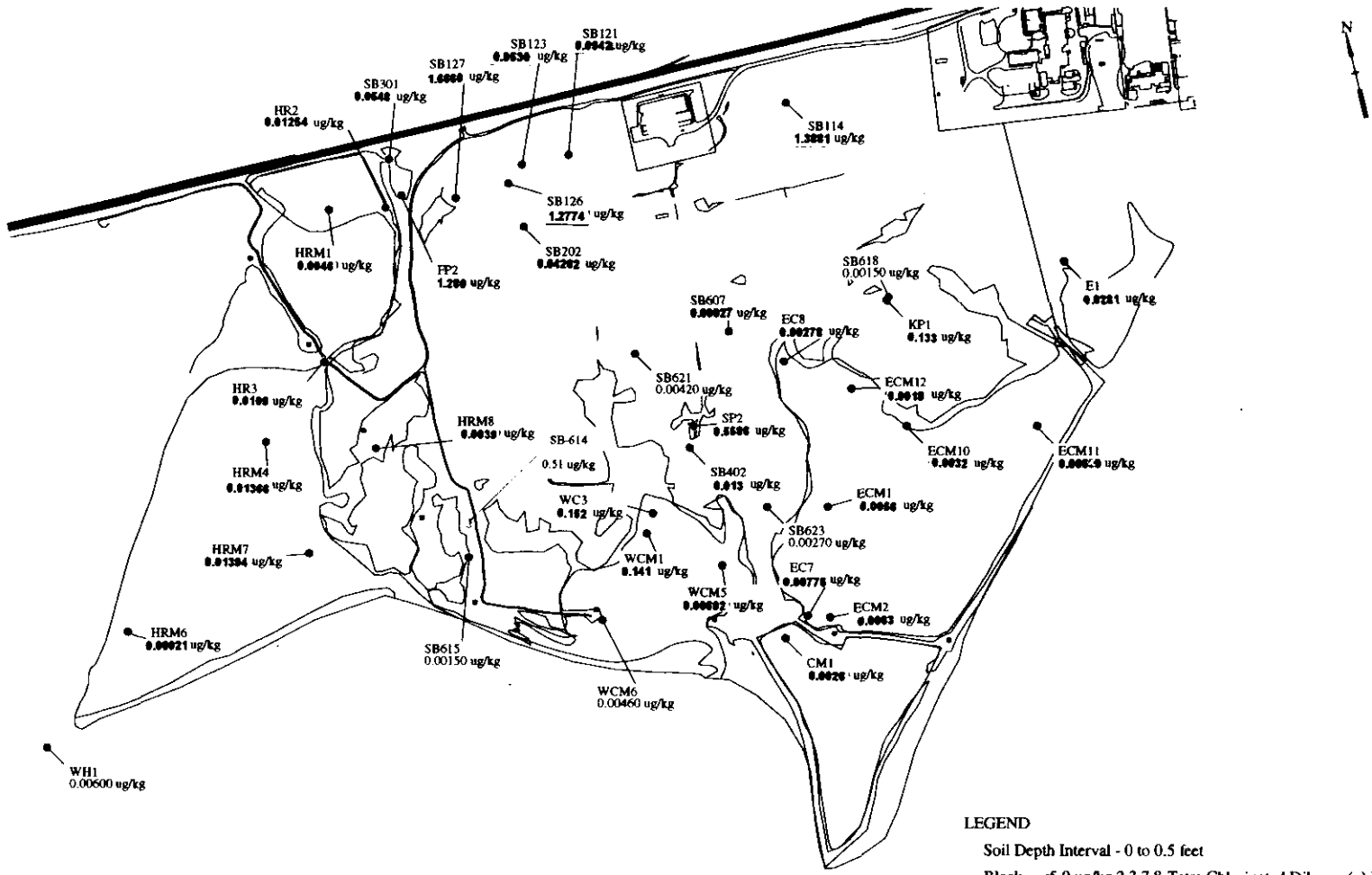
Project No. 4E02153F-5	Beazer East, Inc. and E.I. DuPont	TOTAL PHENOLICS IN SEDIMENT/PEAT (0-0.5 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	April, 1995
Woodward-Clyde Consultants			Figure A-39

AR308857



Project No. 4E02153F-3		Total PCP (0-0.5 ft.) Former Koppers Company, Inc. Newport Site Newport, Delaware	March 7, 1995
Woodward-Clyde			Figure A-40

AR308858



LEGEND

Soil Depth Interval - 0 to 0.5 feet

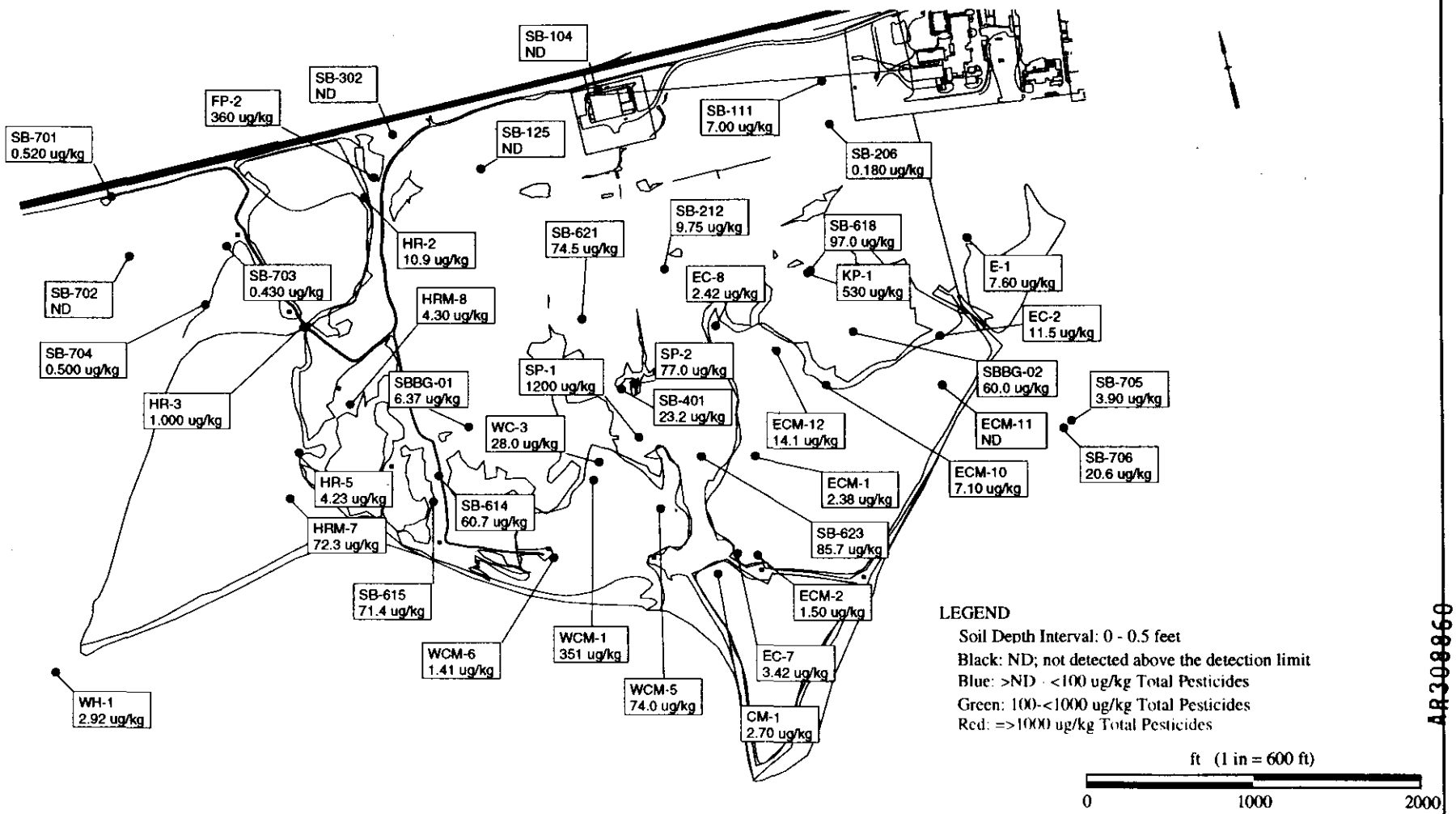
Black = <5.0 ug/kg 2,3,7,8-Tetra Chlorinated Dibenzo(p) Dioxin Toxicity Equivalent

ft (1 in = 600 ft)

0 1000 2000

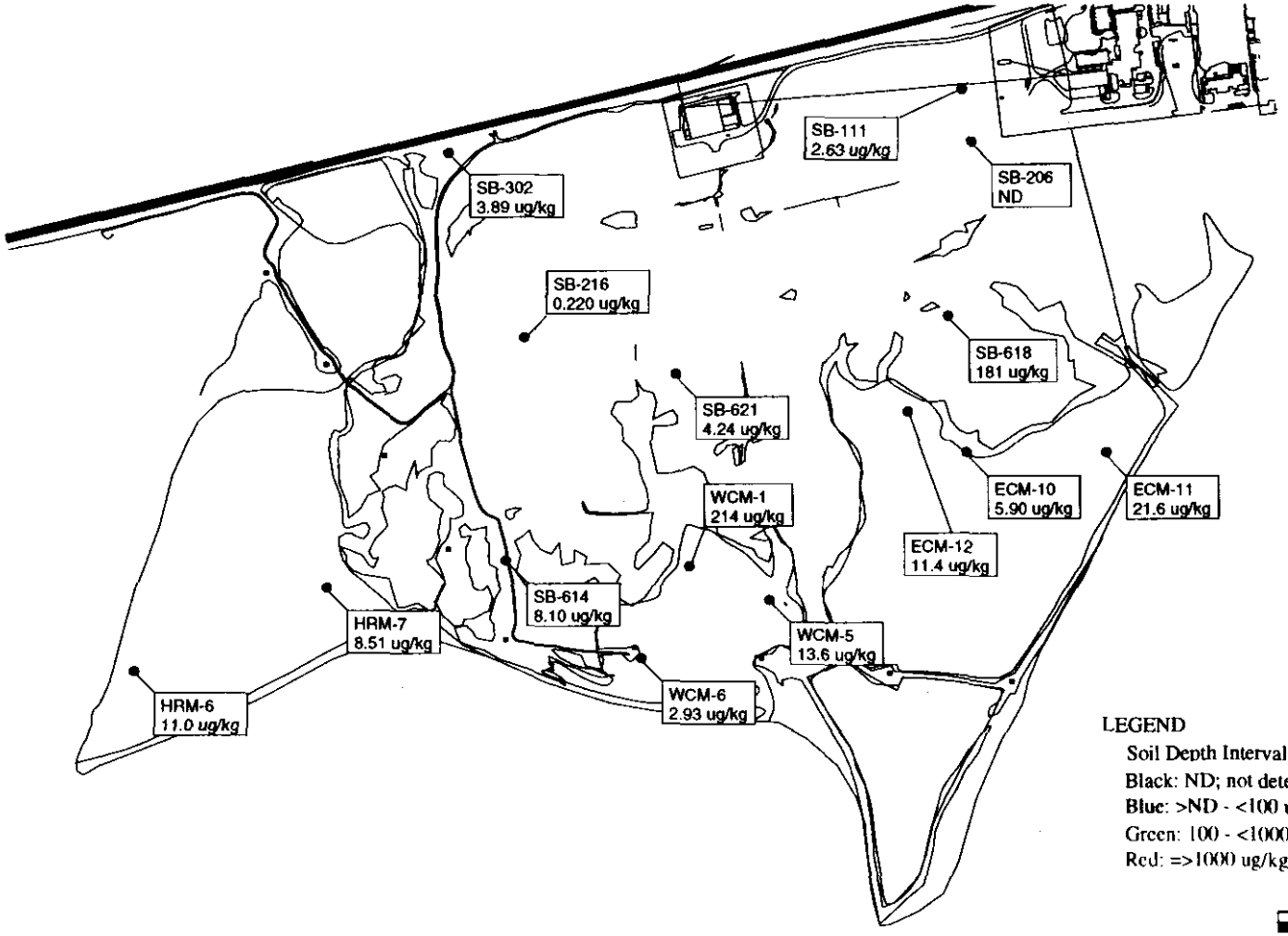
Project No. 4E02153F-5	Beazer East, Inc. and E.I. DuPont	DIOXIN TOXICITY EQUIVALENT CONCENTRATIONS IN SEDIMENT / PEAT (0-0.5 ft.) FORMER KOPPERS COMPANY, INC. NEWPORT SITE NEWPORT, DELAWARE	September 1993
Woodward-Clyde Consultants			Figure A-41

AR308859



Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Total Pesticide Concentrations in Soil (0-0.5 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-42

AR308860



LEGEND

Soil Depth Interval: 0 - 2 feet

Black: ND; not detected above the detection limit

Blue: >ND - <100 ug/kg Total Pesticides

Green: 100 - <1000 ug/kg Total Pesticides

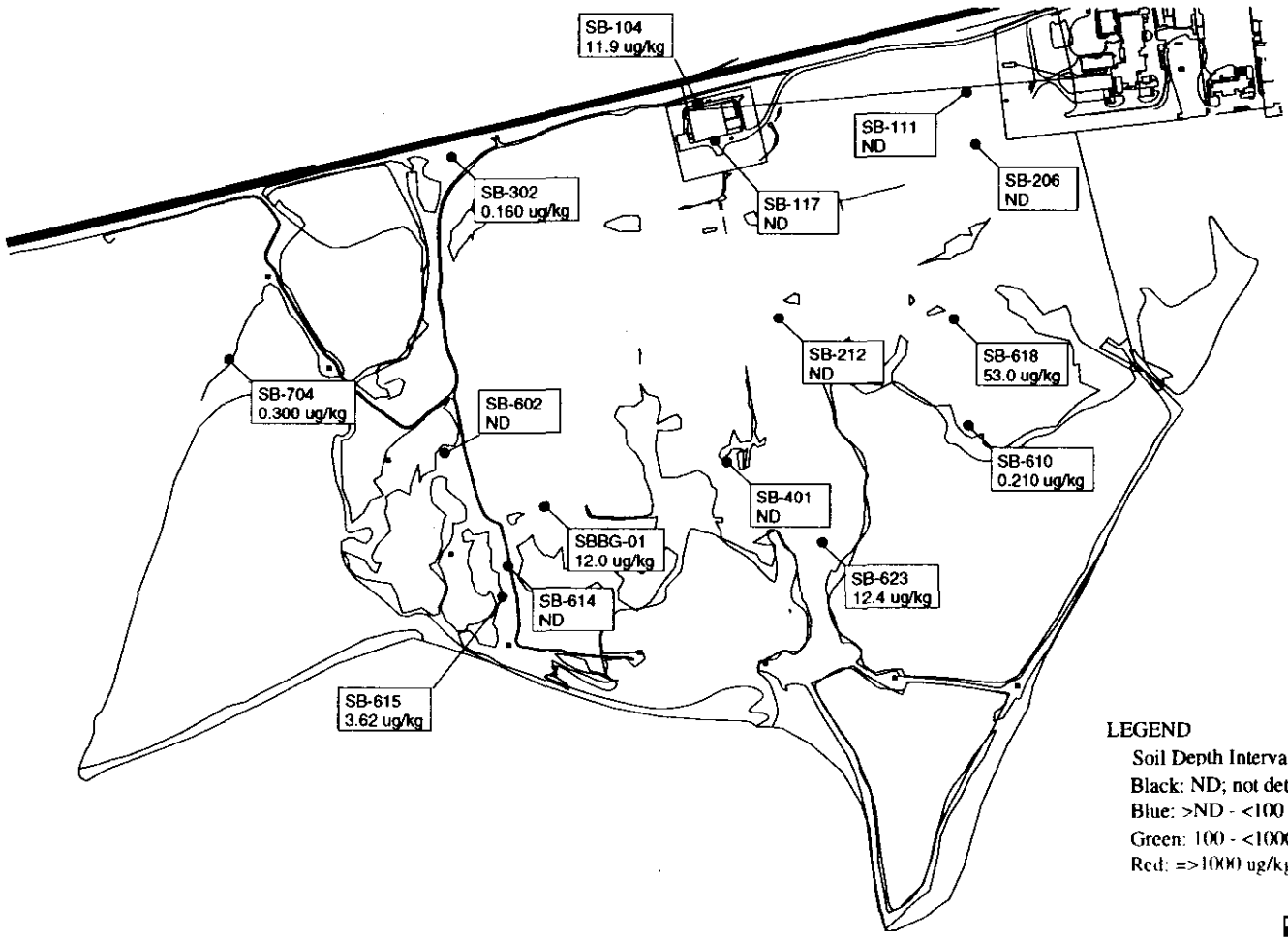
Red: =>1000 ug/kg Total Pesticides

ft (1 in = 600 ft)

0 1000 2000

Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Total Pesticide Concentrations in Soil (0-2 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-43

AR308861



LEGEND

Soil Depth Interval: 2 - 4 feet

Black: ND; not detected above the detection limit

Blue: >ND - <100 ug/kg Total Pesticides

Green: 100 - <1000 ug/kg Total Pesticides

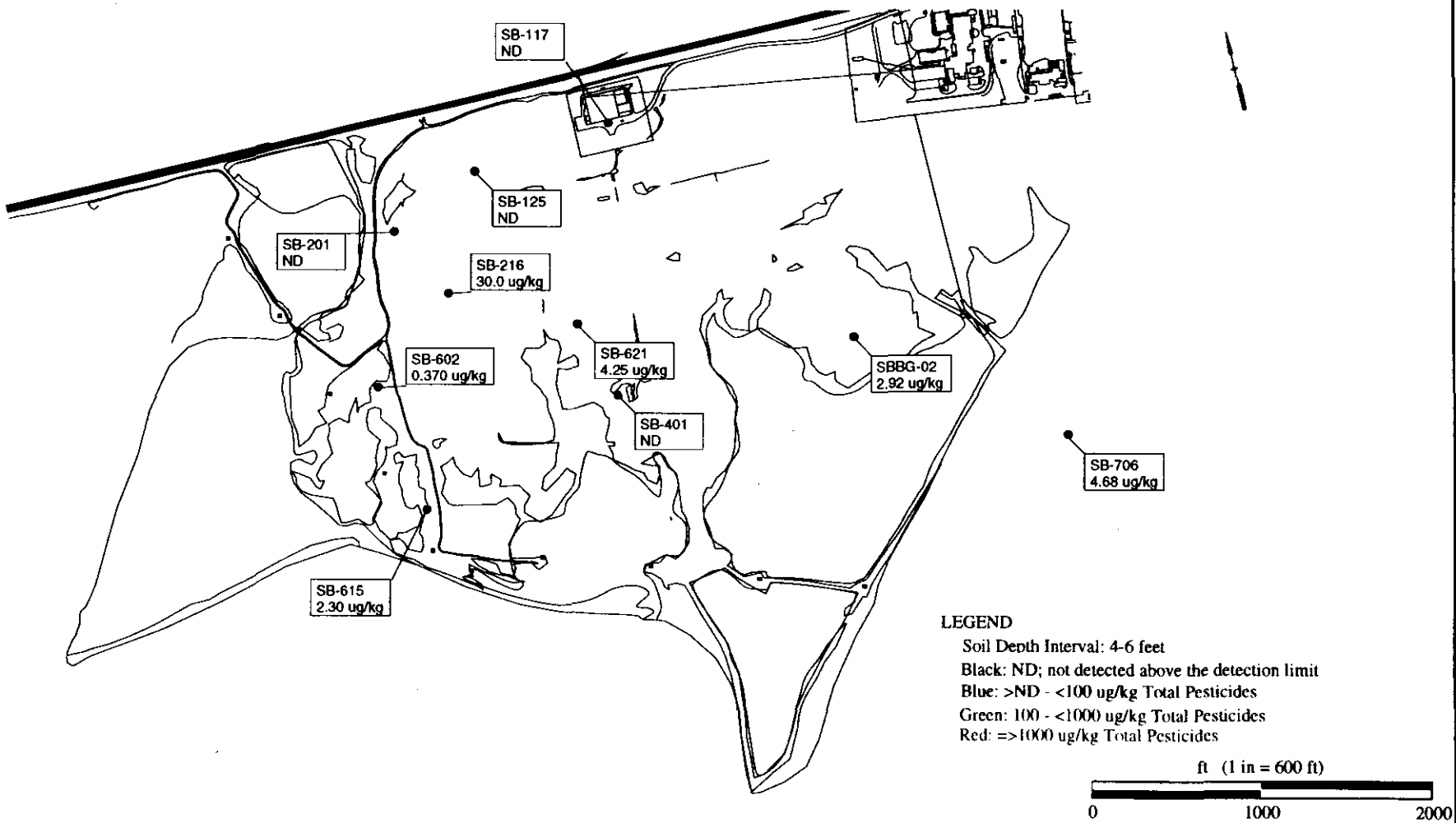
Red: =>1000 ug/kg Total Pesticides

ft (1 in = 600 ft)

0 1000 2000

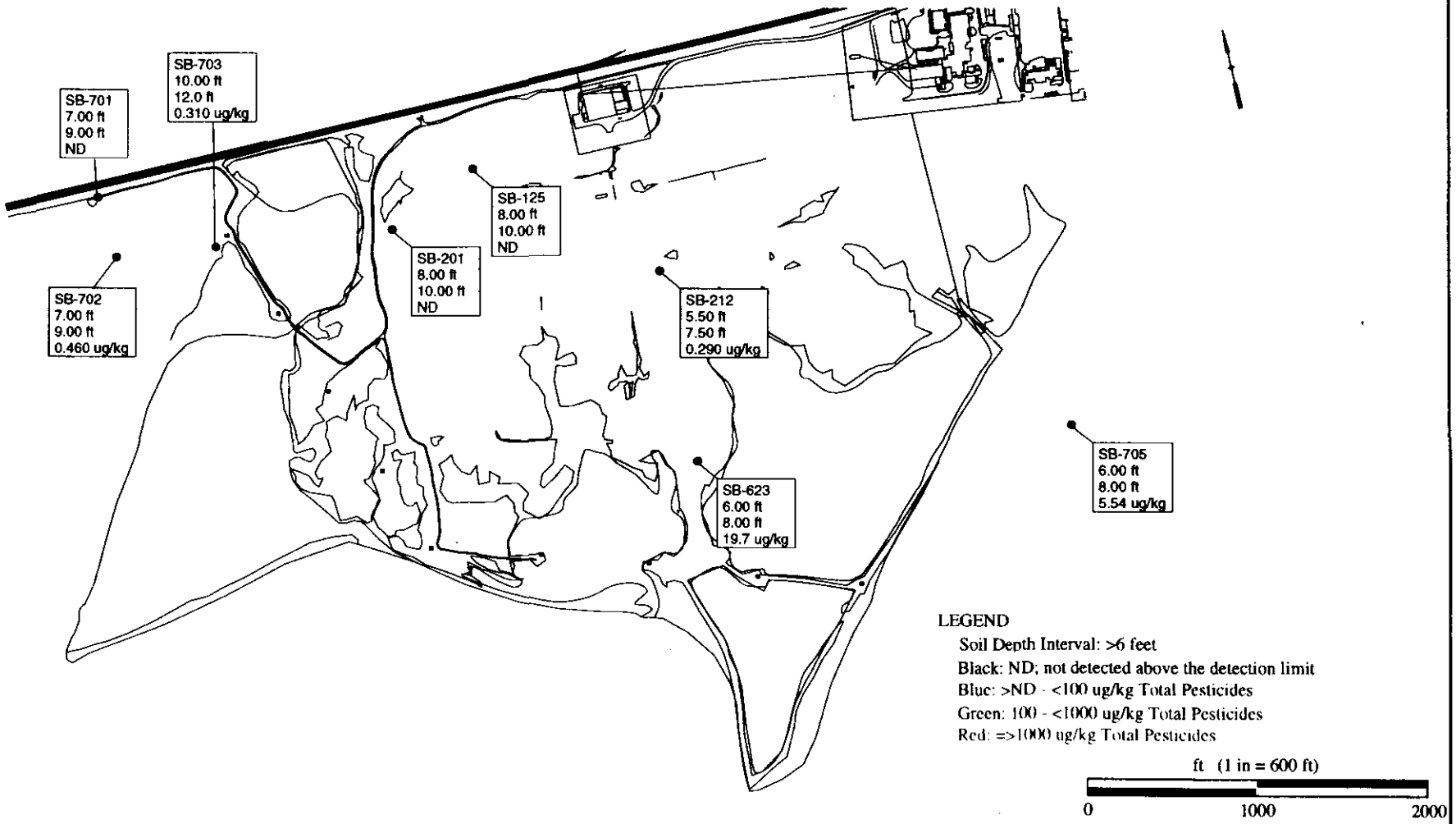
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Total Pesticide Concentrations in Soil (2-4 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-44

AR308862



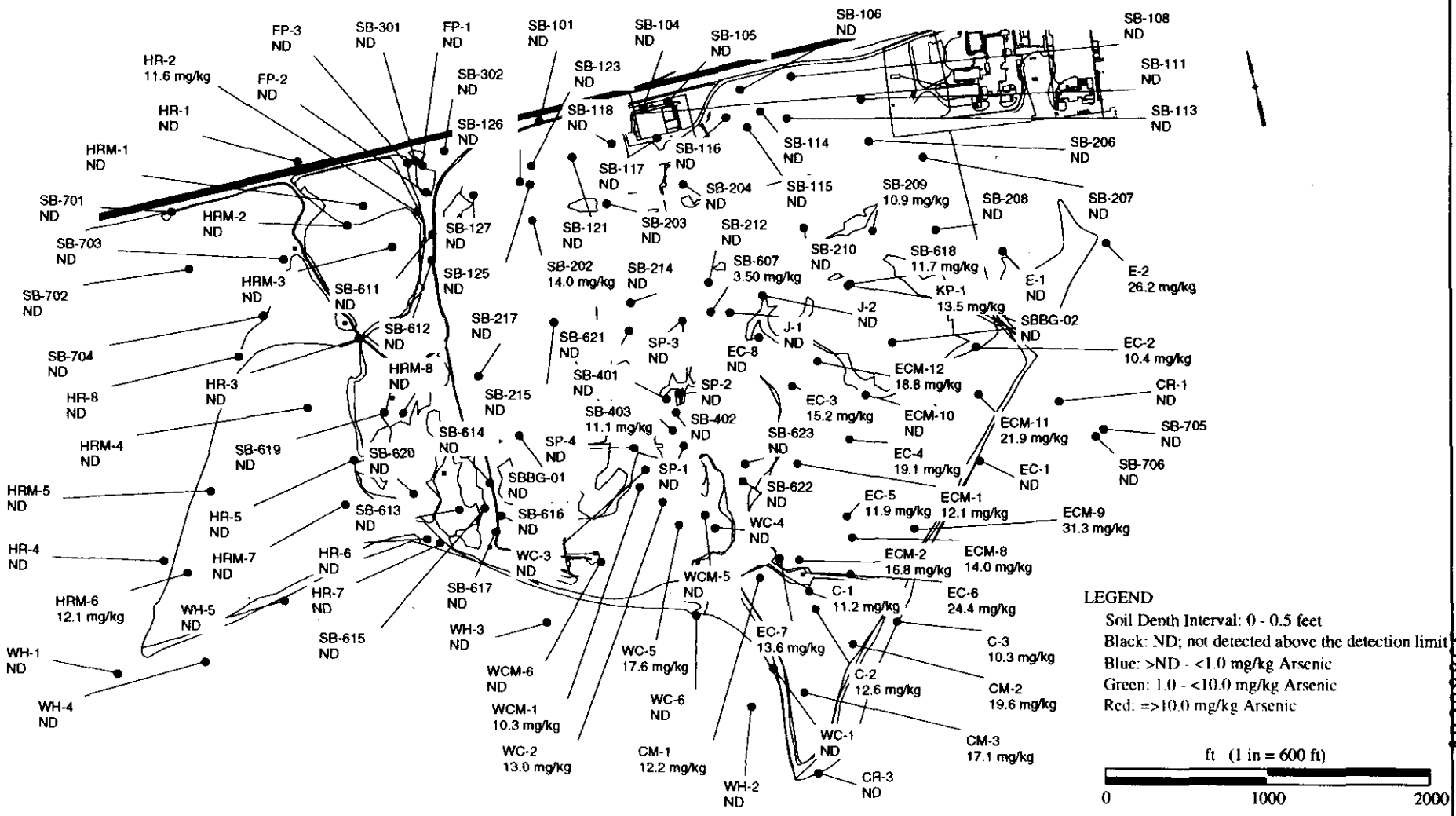
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Total Pesticide Concentrations in Soil (4-6 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-45

AR308863



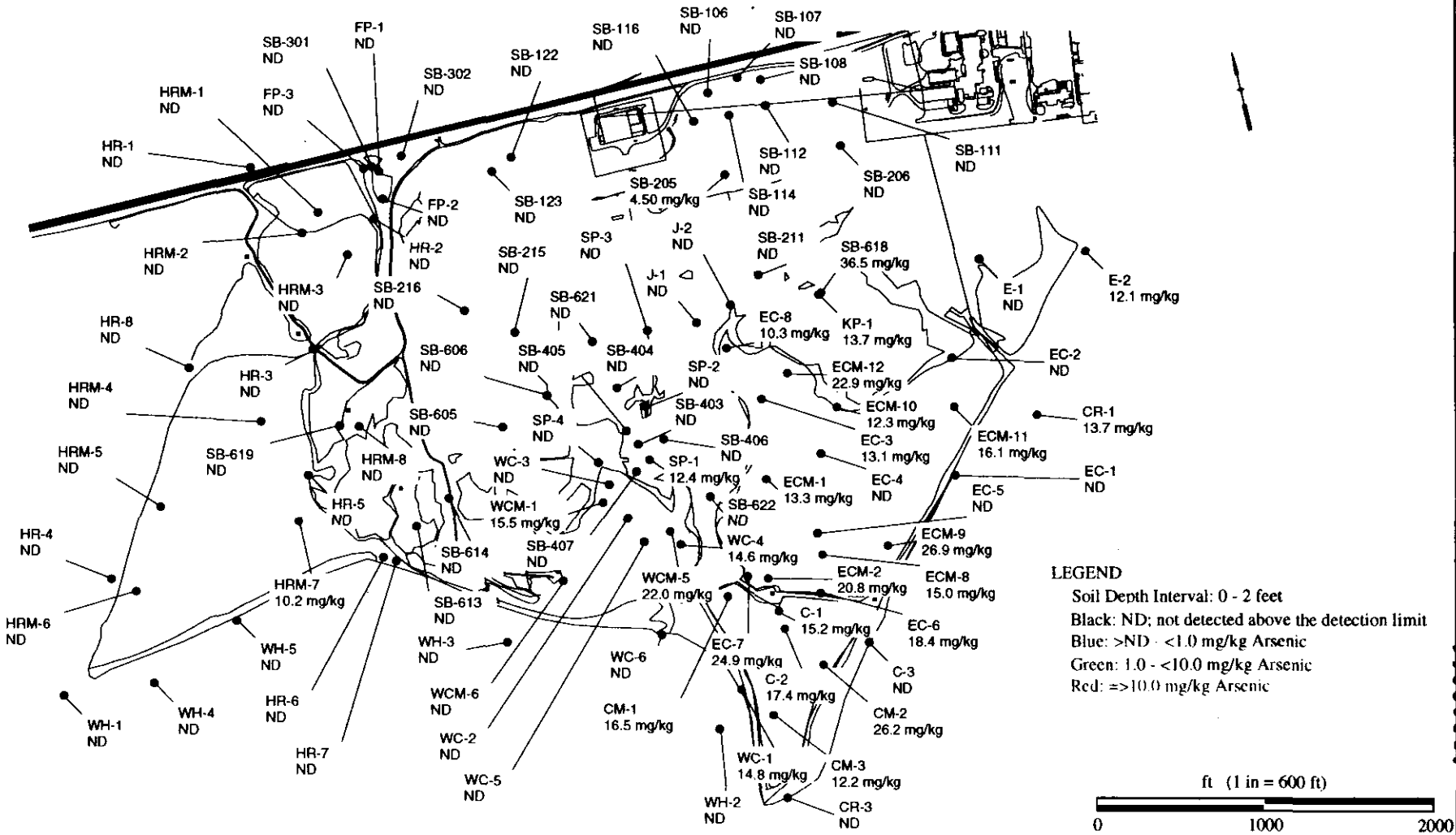
Project No 4E02153	Beazer East, Inc. & E.I. DuPont	Total Pesticide Concentrations in Soil (>6 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-46

AR308864



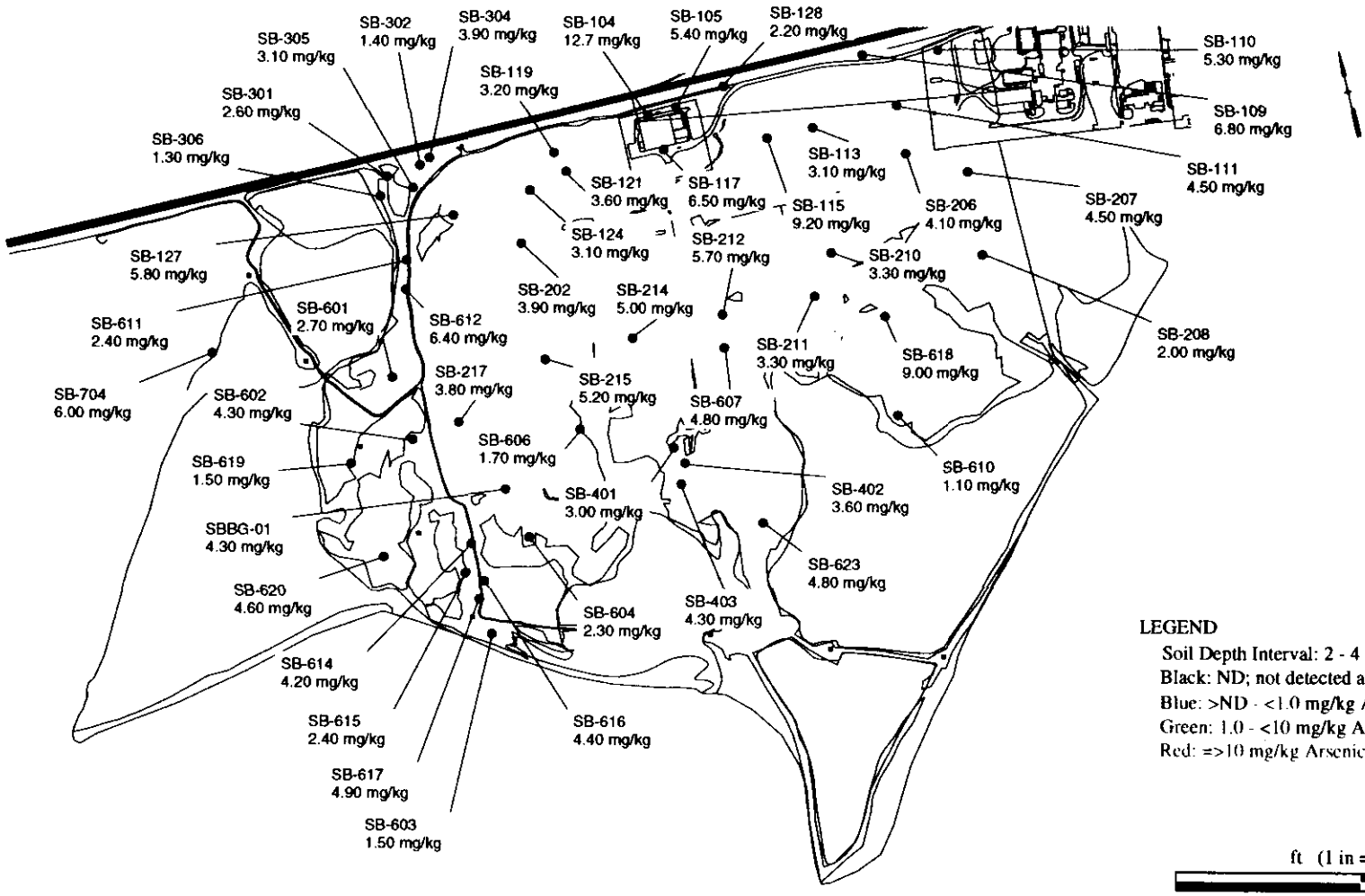
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Arsenic Concentrations in Soil (0-0.5 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-47

AR308865



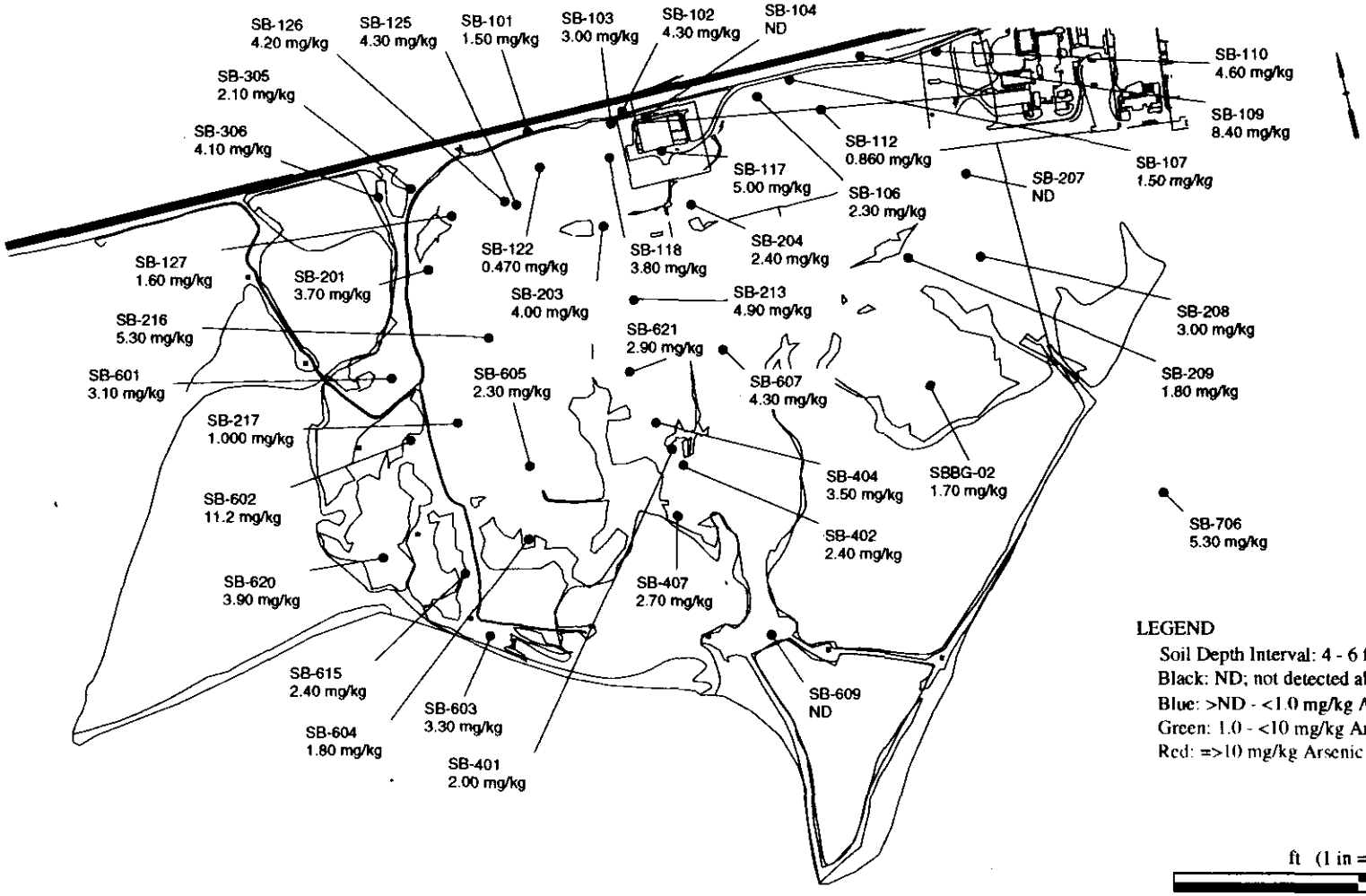
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Arsenic Concentrations in Soil (0-2 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-48

AR300866



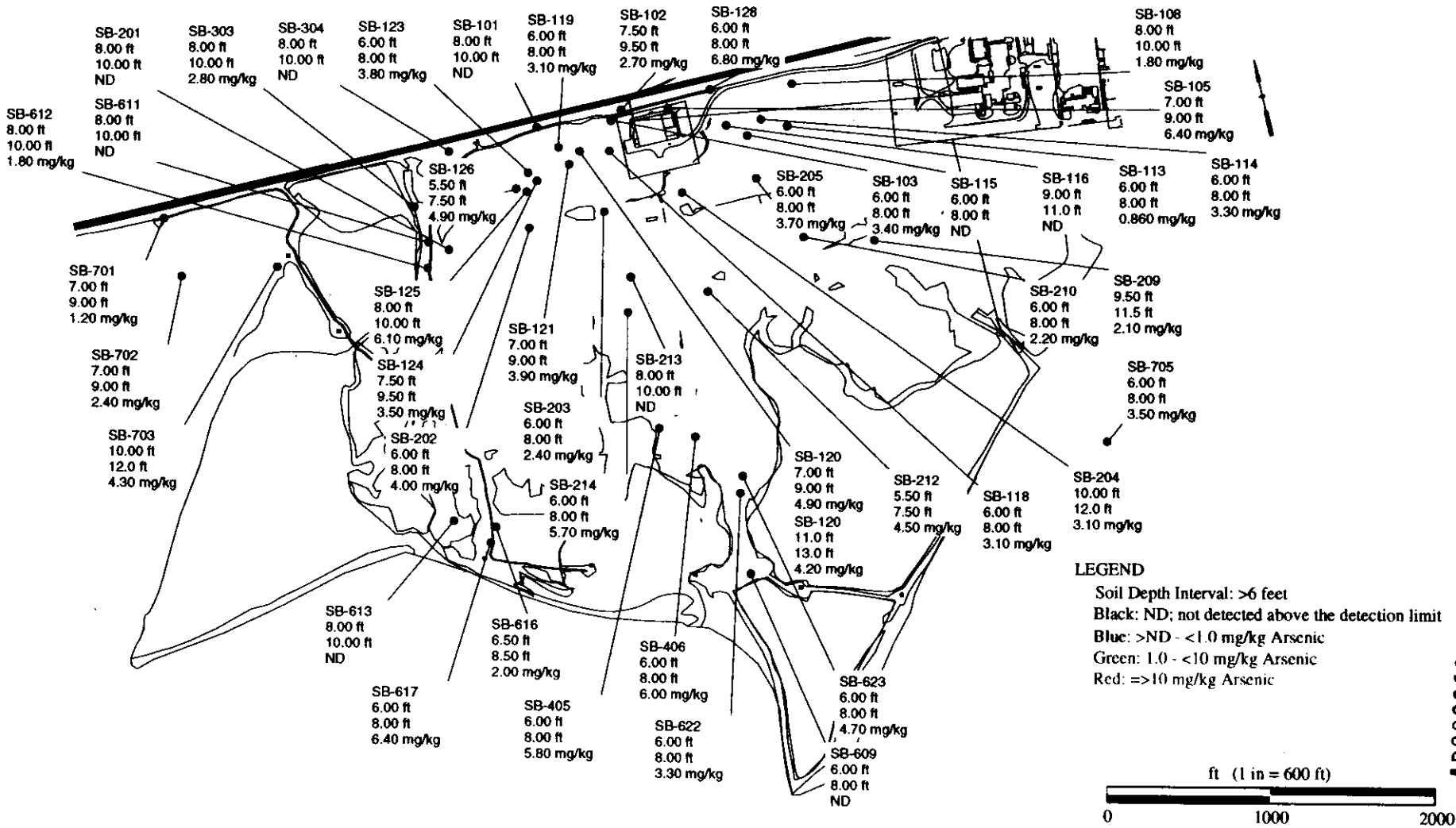
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Arsenic Concentrations in Soil (2-4 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-49

AR308867



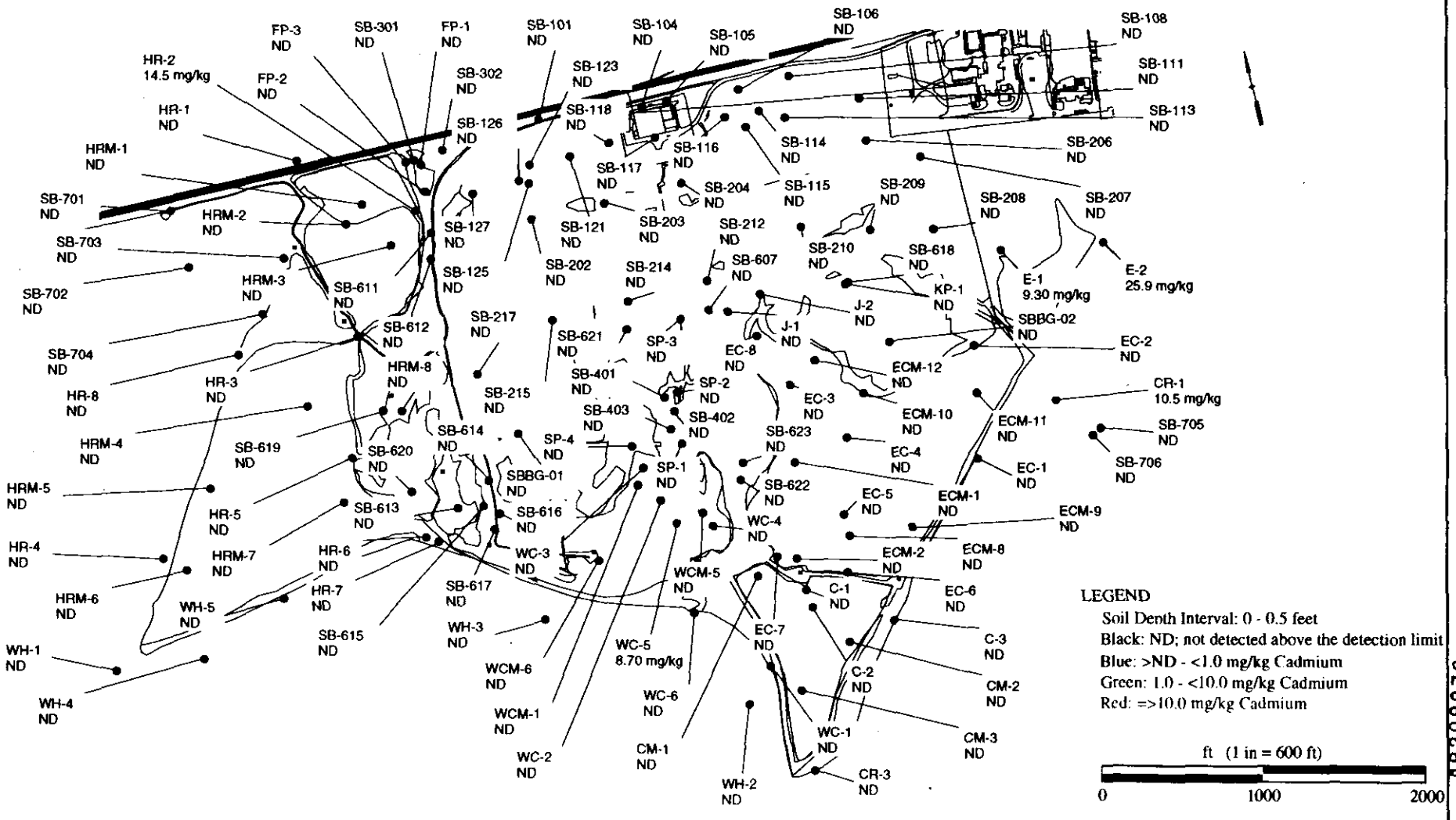
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Arsenic Concentrations in Soil (4-6 ft.) Former Koppers Co., Inc., Newport Site *Newport, Delaware*	July 17, 1995
Woodward-Clyde Consultants			Figure A-50

AR308868



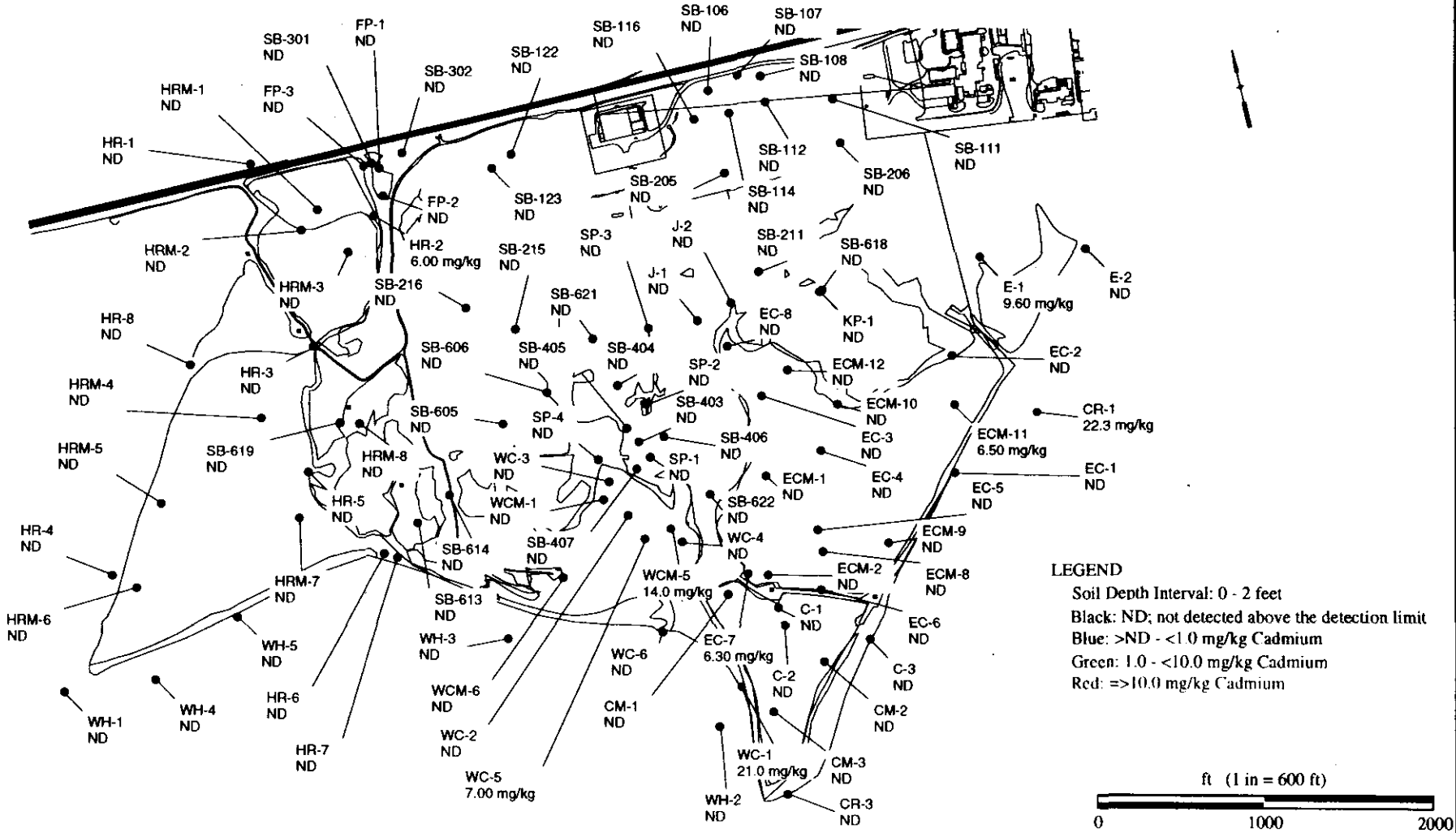
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Arsenic Concentrations in Soil (>6 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-51

AR300869



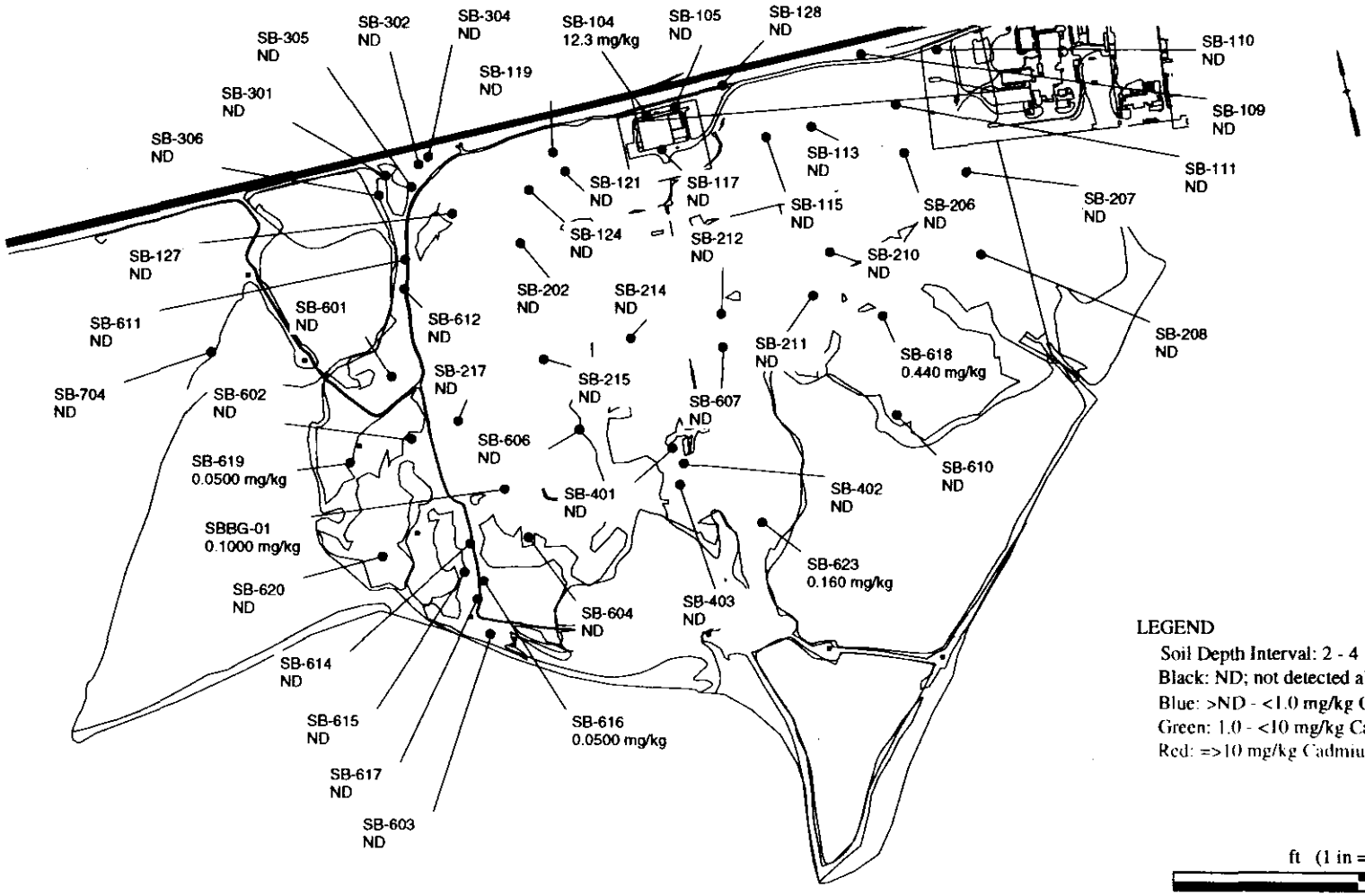
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Cadmium Concentrations in Soil (0-0.5 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1996
Woodward-Clyde Consultants			Figure A-52

AR308870



Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Cadmium Concentrations in Soil (0-2 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-53

AR300871



LEGEND

Soil Depth Interval: 2 - 4 feet

Black: ND; not detected above the detection limit

Blue: >ND - <1.0 mg/kg Cadmium

Green: 1.0 - <10 mg/kg Cadmium

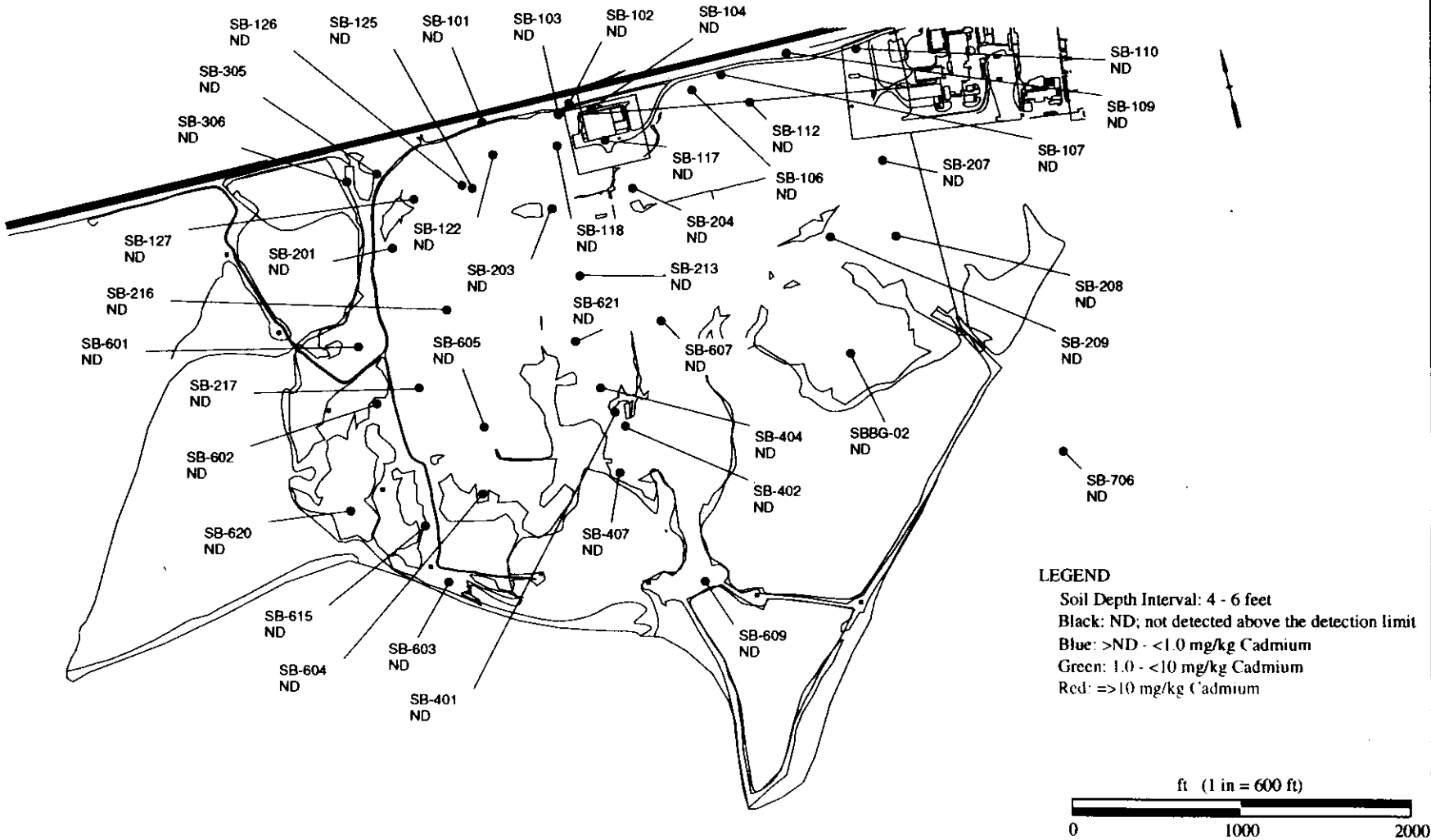
Red: =>10 mg/kg Cadmium

ft (1 in = 600 ft)

0 1000 2000

AR300872

Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Cadmium Concentrations in Soil (2-4 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-54



LEGEND

Soil Depth Interval: 4 - 6 feet

Black: ND; not detected above the detection limit

Blue: >ND - <1.0 mg/kg Cadmium

Green: 1.0 - <10 mg/kg Cadmium

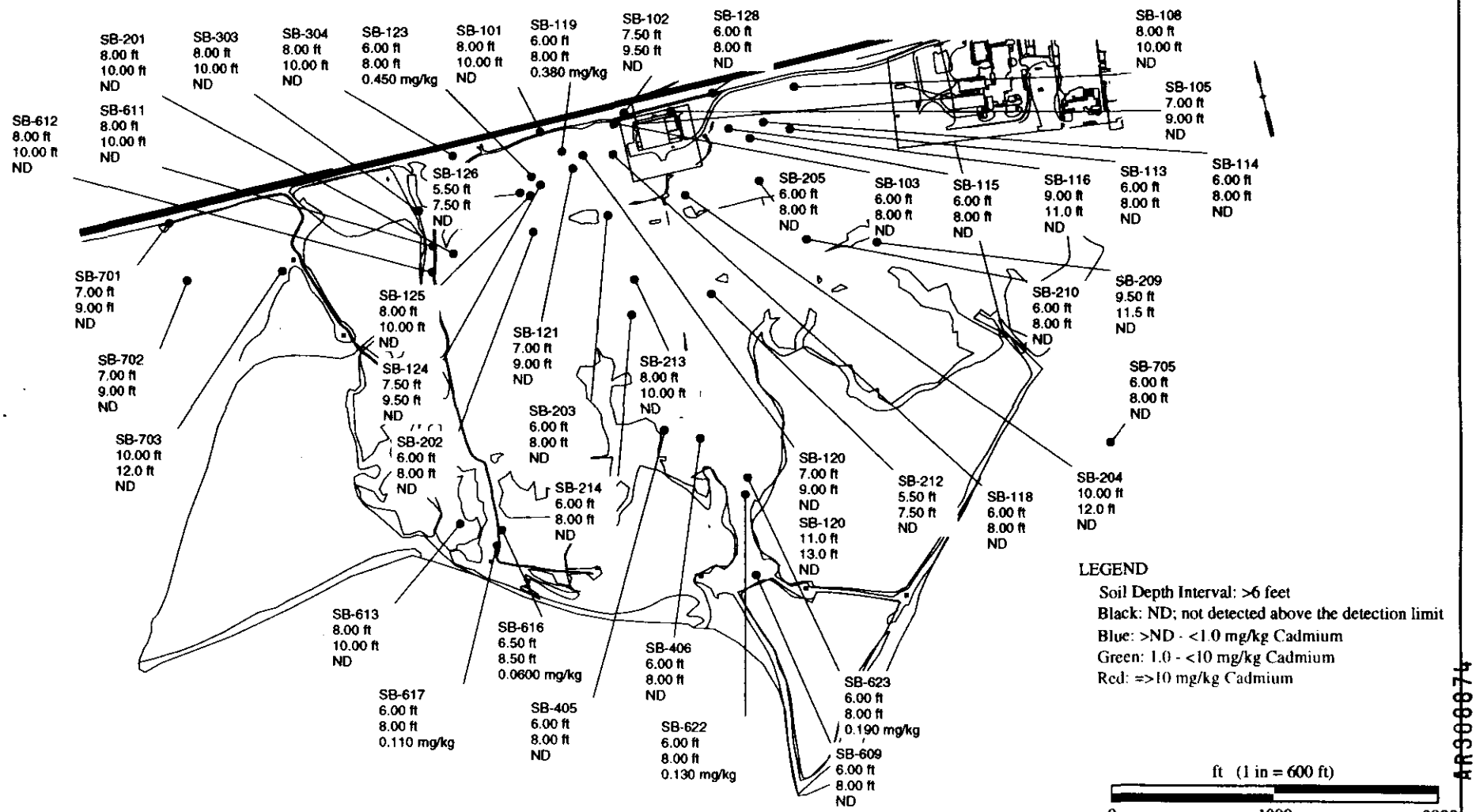
Red: =>10 mg/kg Cadmium

ft (1 in = 600 ft)

0 1000 2000

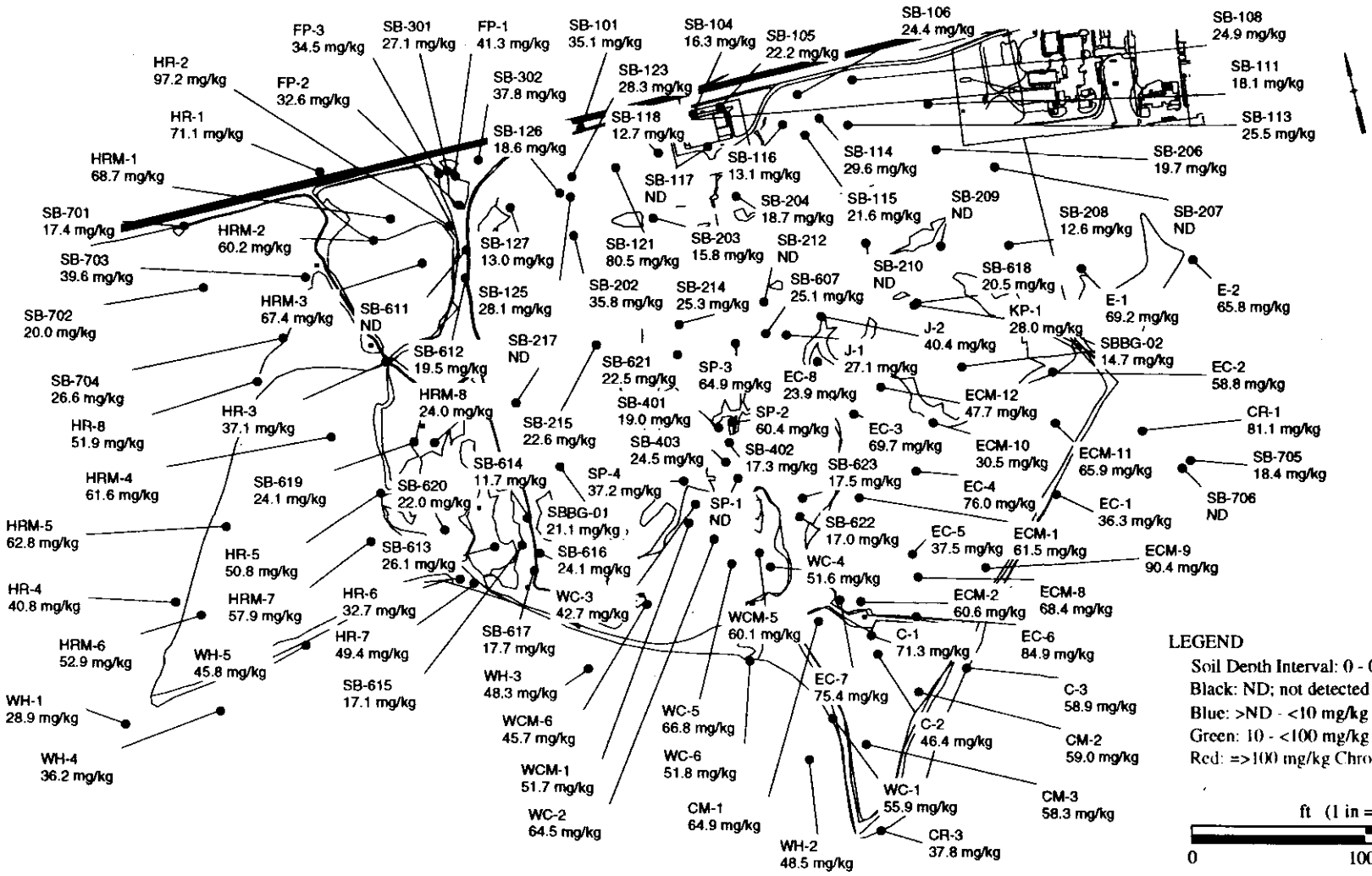
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Cadmium Concentrations in Soil (4-6 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-55

AR308873



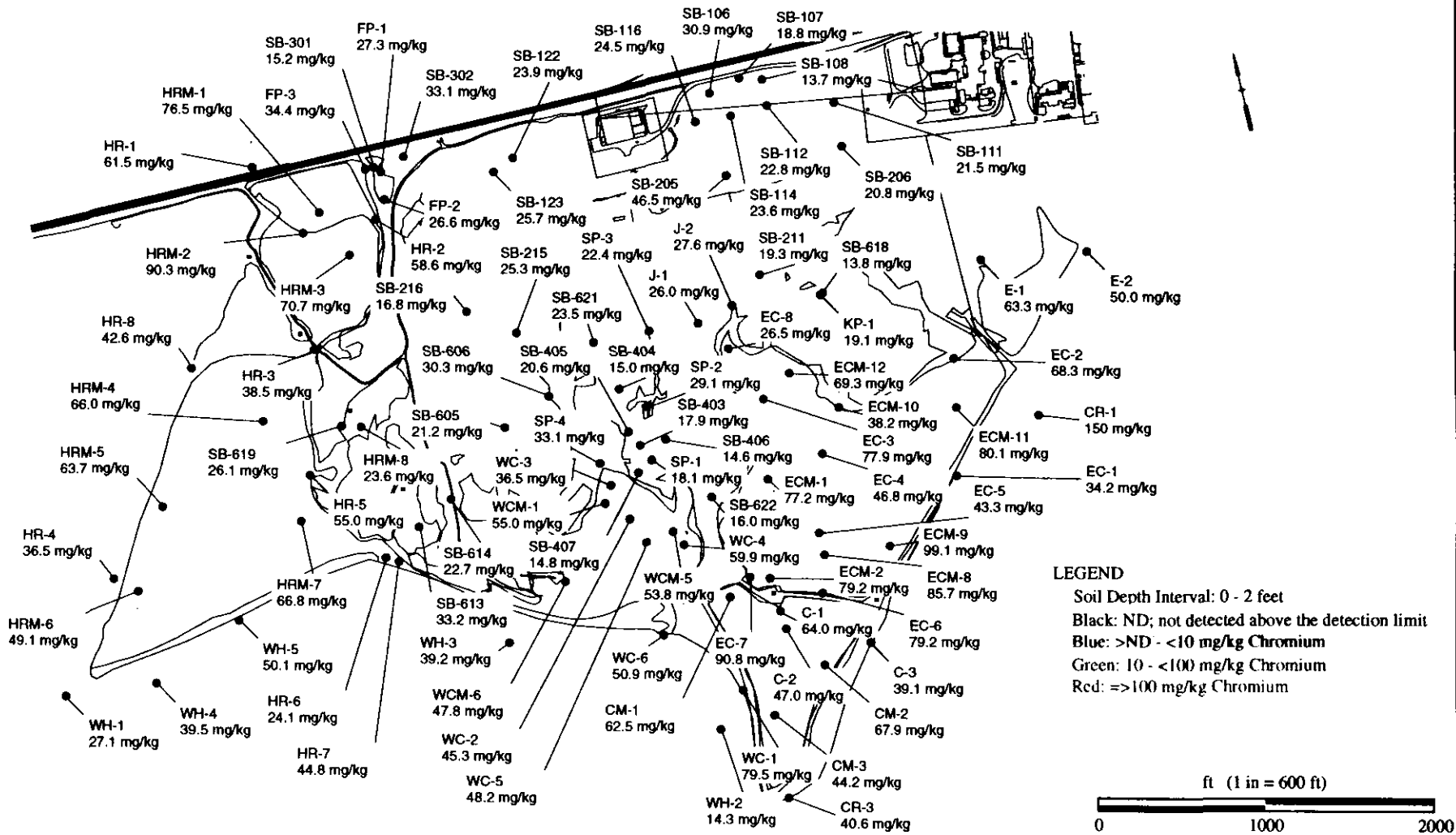
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Cadmium Concentrations in Soil (>6 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-56

AR300074



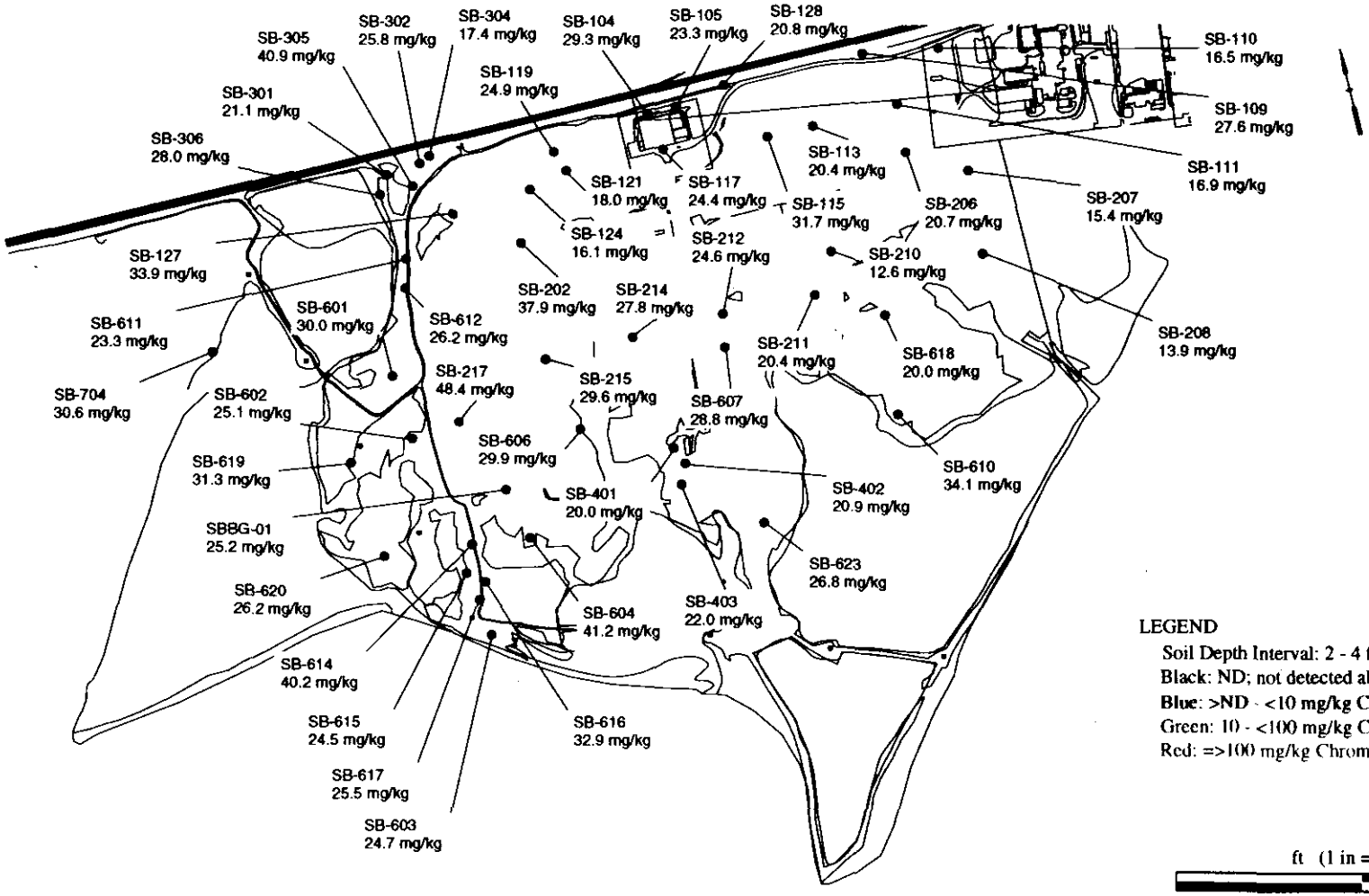
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Chromium Concentrations in Soil (0-0.5 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-57

AR308875



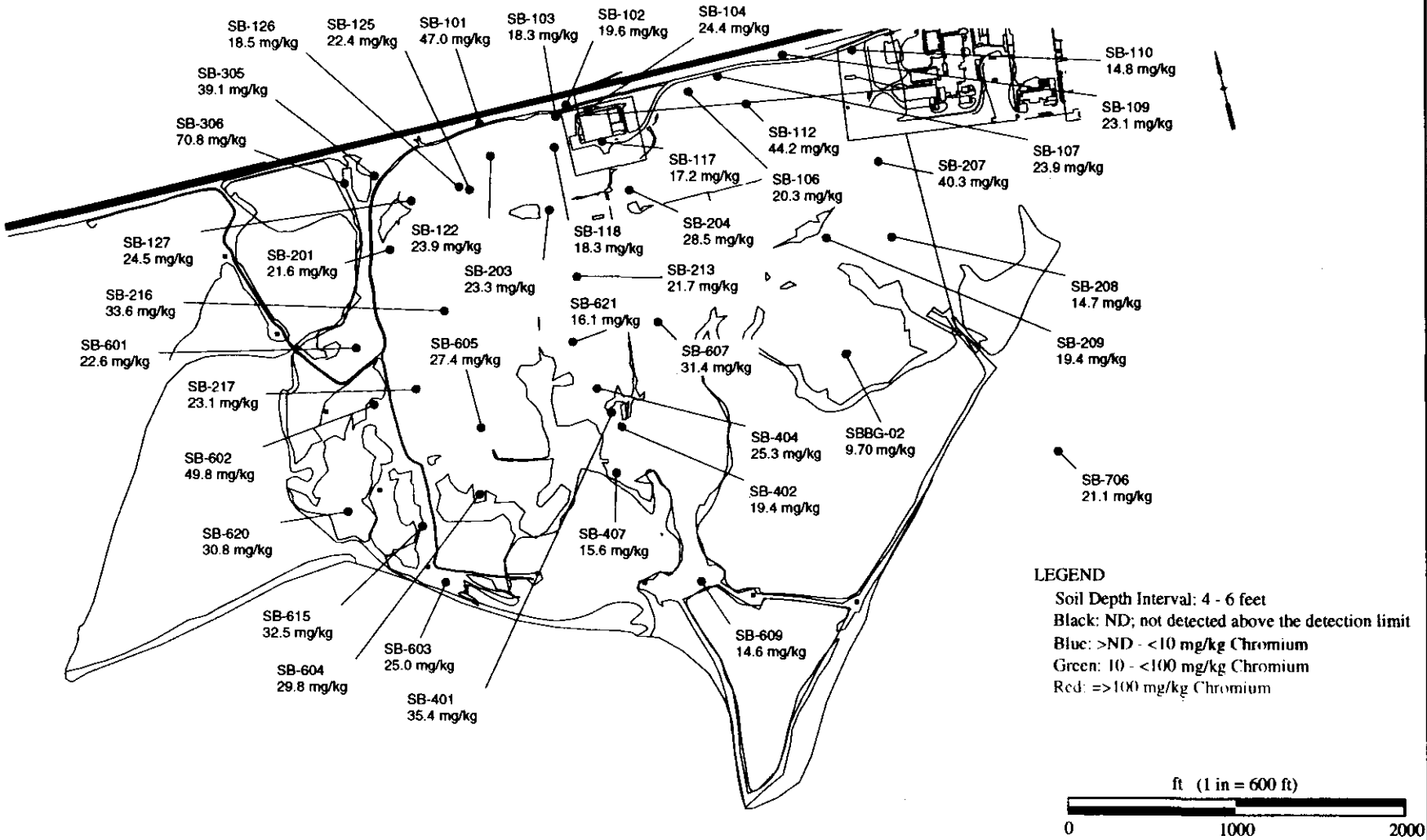
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Chromium Concentrations in Soil (0-2 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1996
Woodward-Clyde Consultants			Figure A-58

AR308876



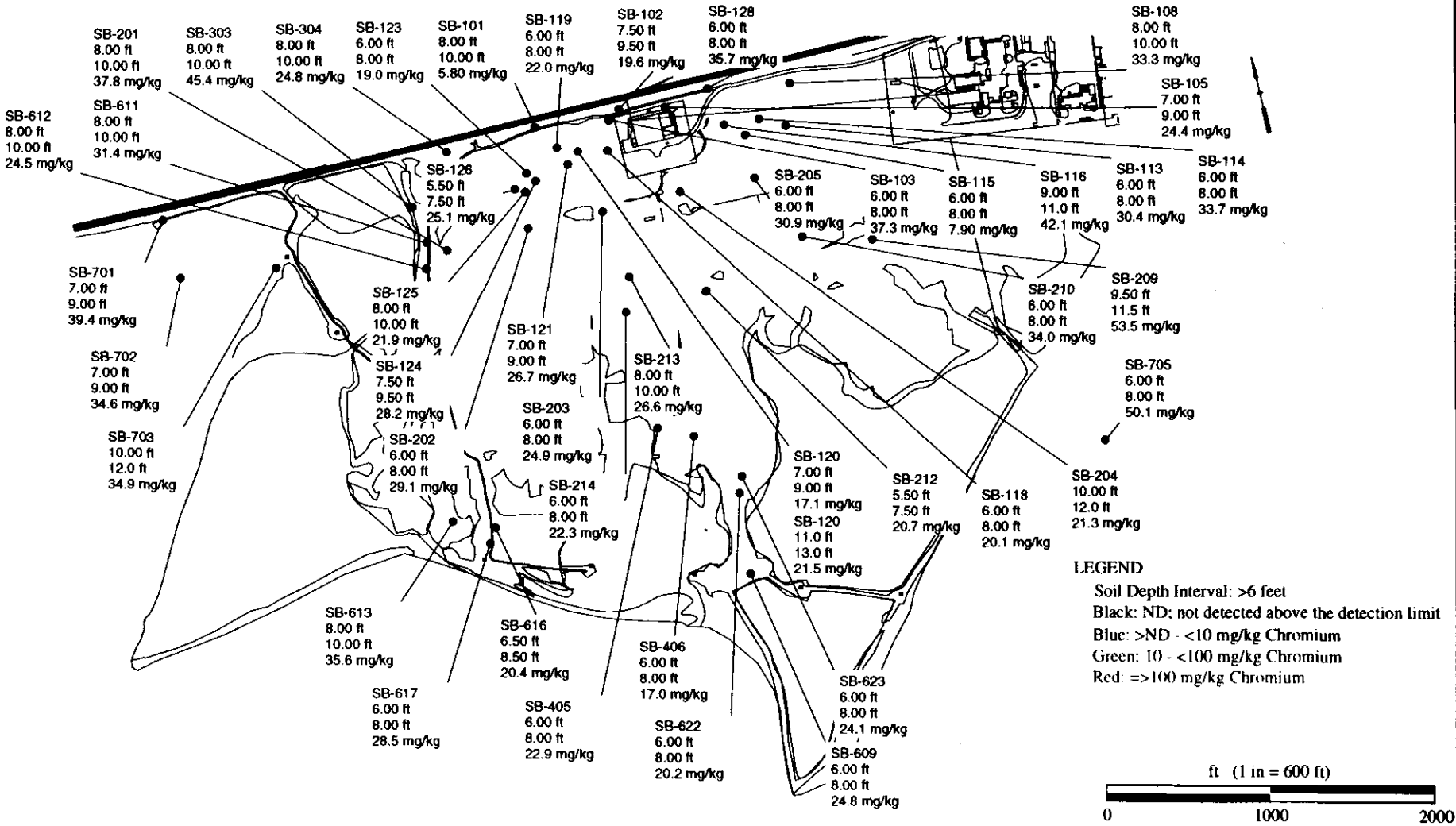
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Chromium Concentrations in Soil (2-4 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-59

AR308877



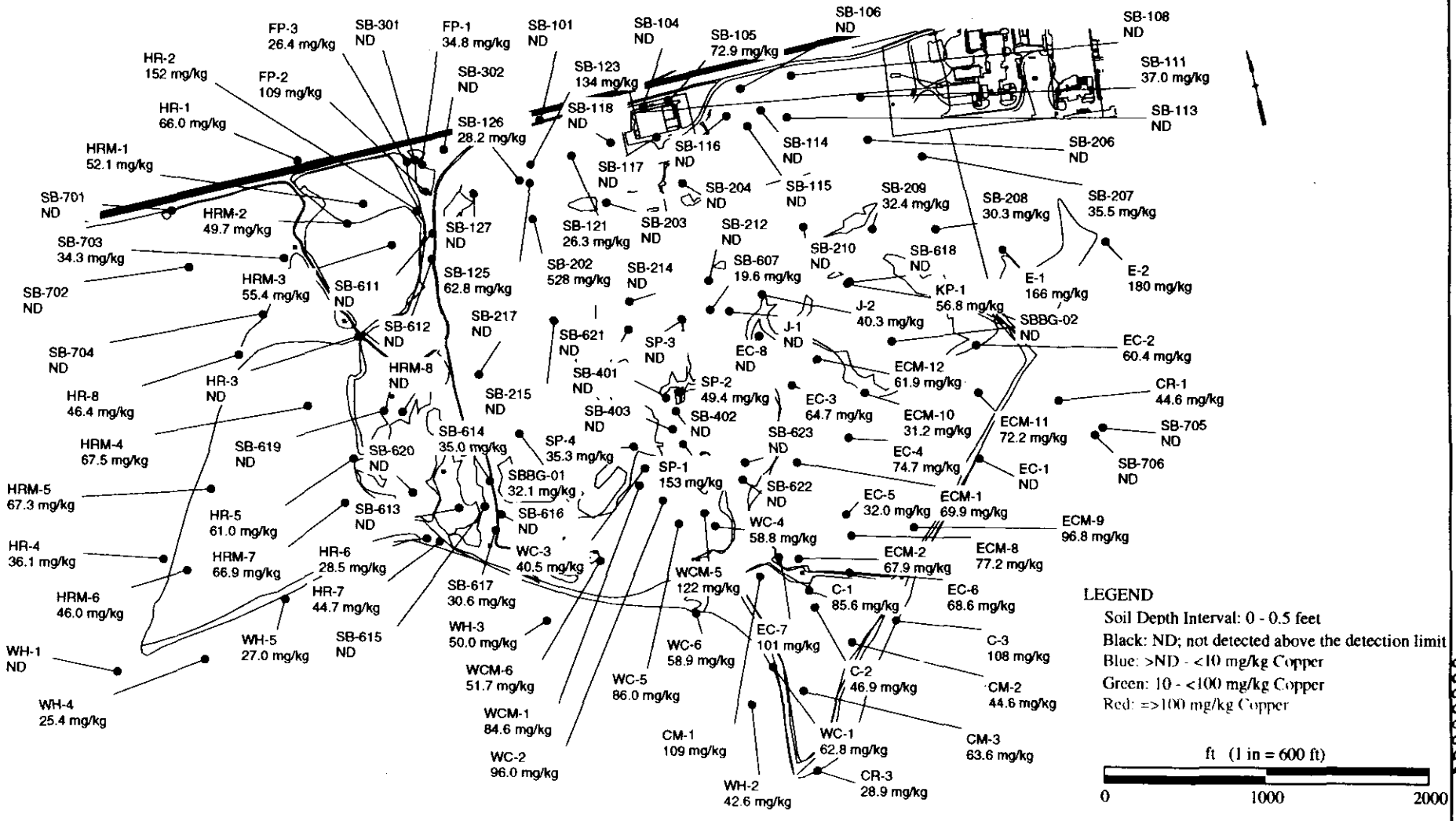
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Chromium Concentrations in Soil (4-6 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-60

AR308878



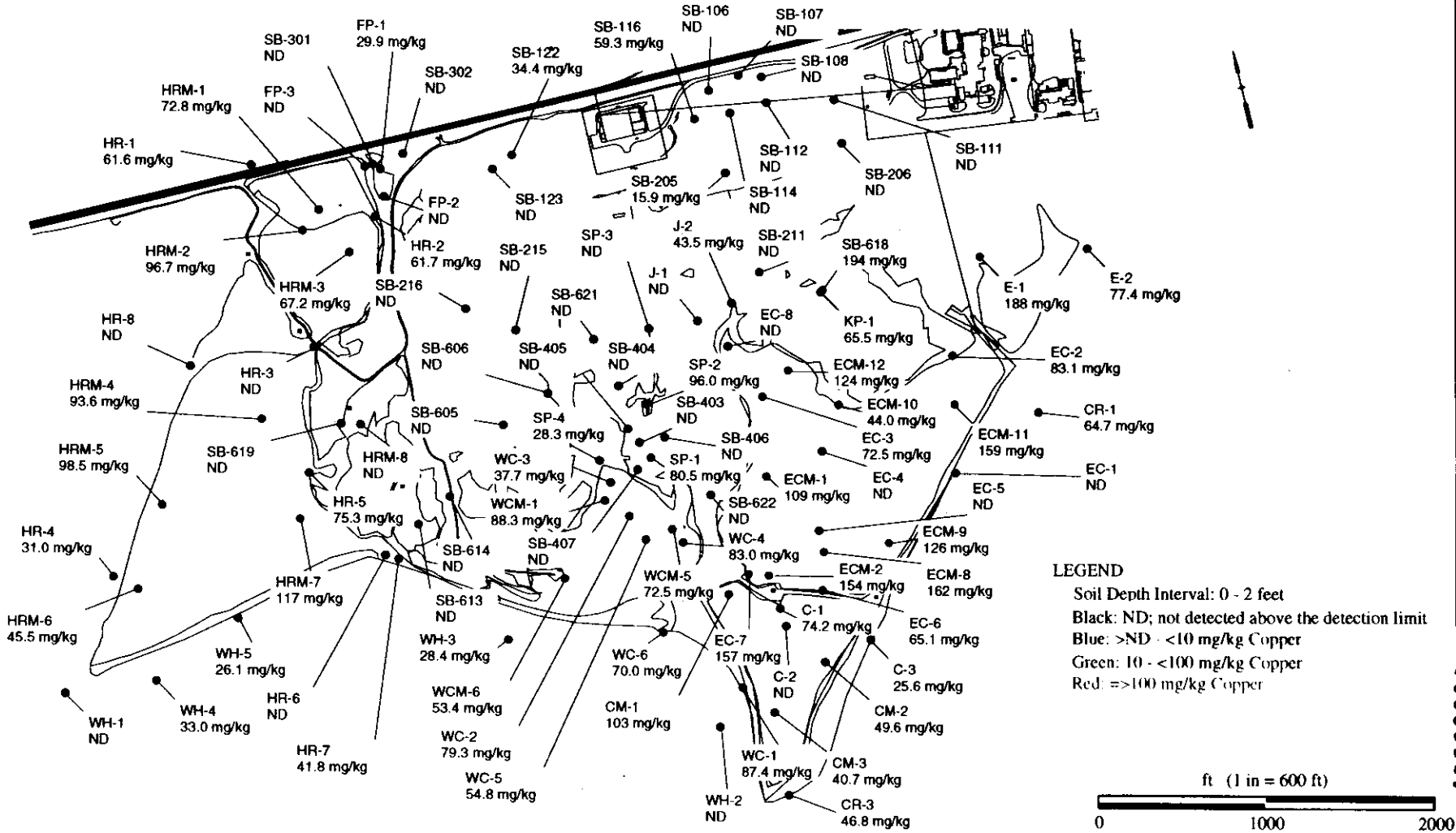
Project No 4E02153	Beazer East, Inc. & E.I. DuPont	Chromium Concentrations in Soil (>6 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-61

AR308879



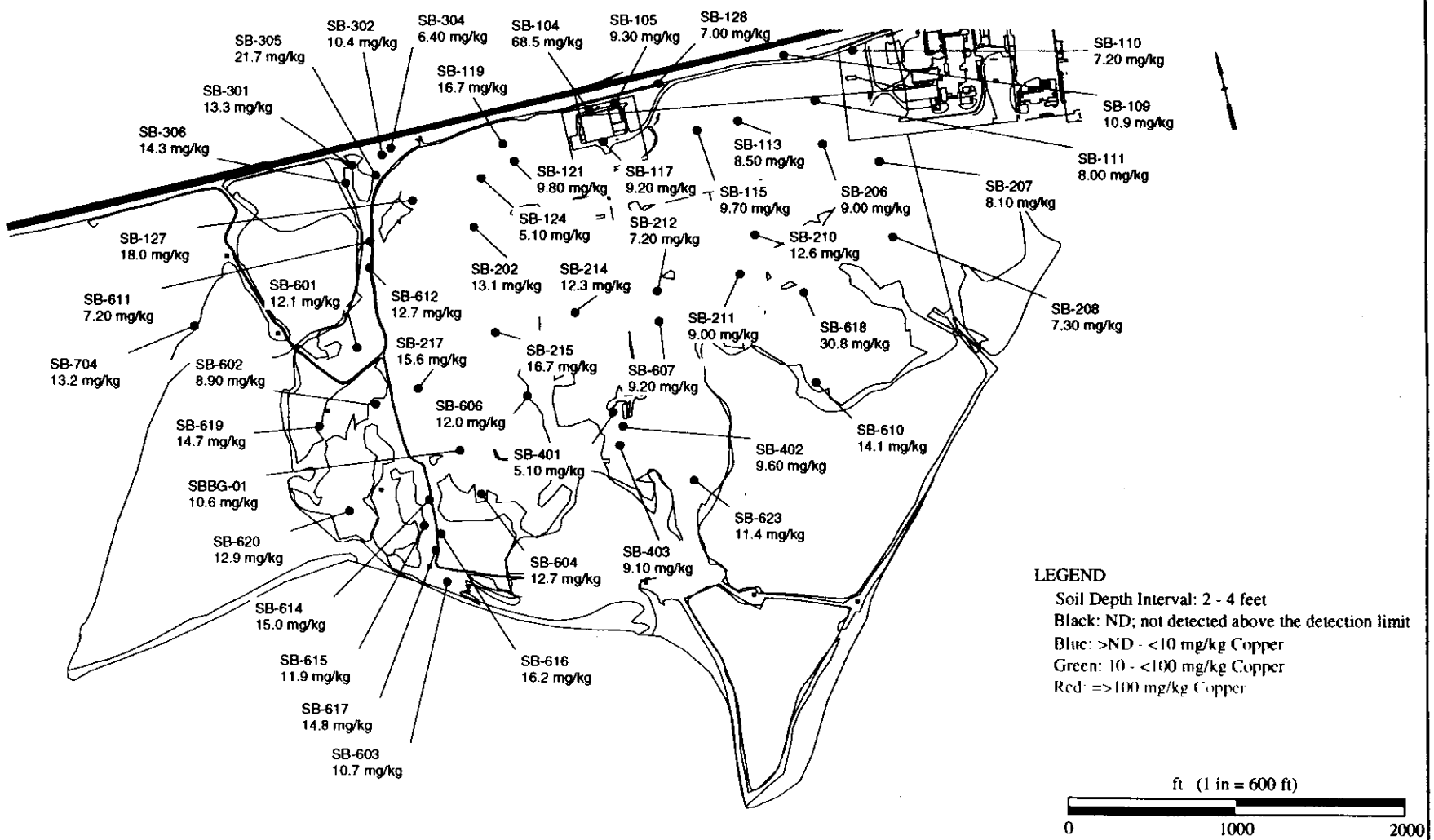
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Copper Concentrations in Soil (0-0.5 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-62

AR308880



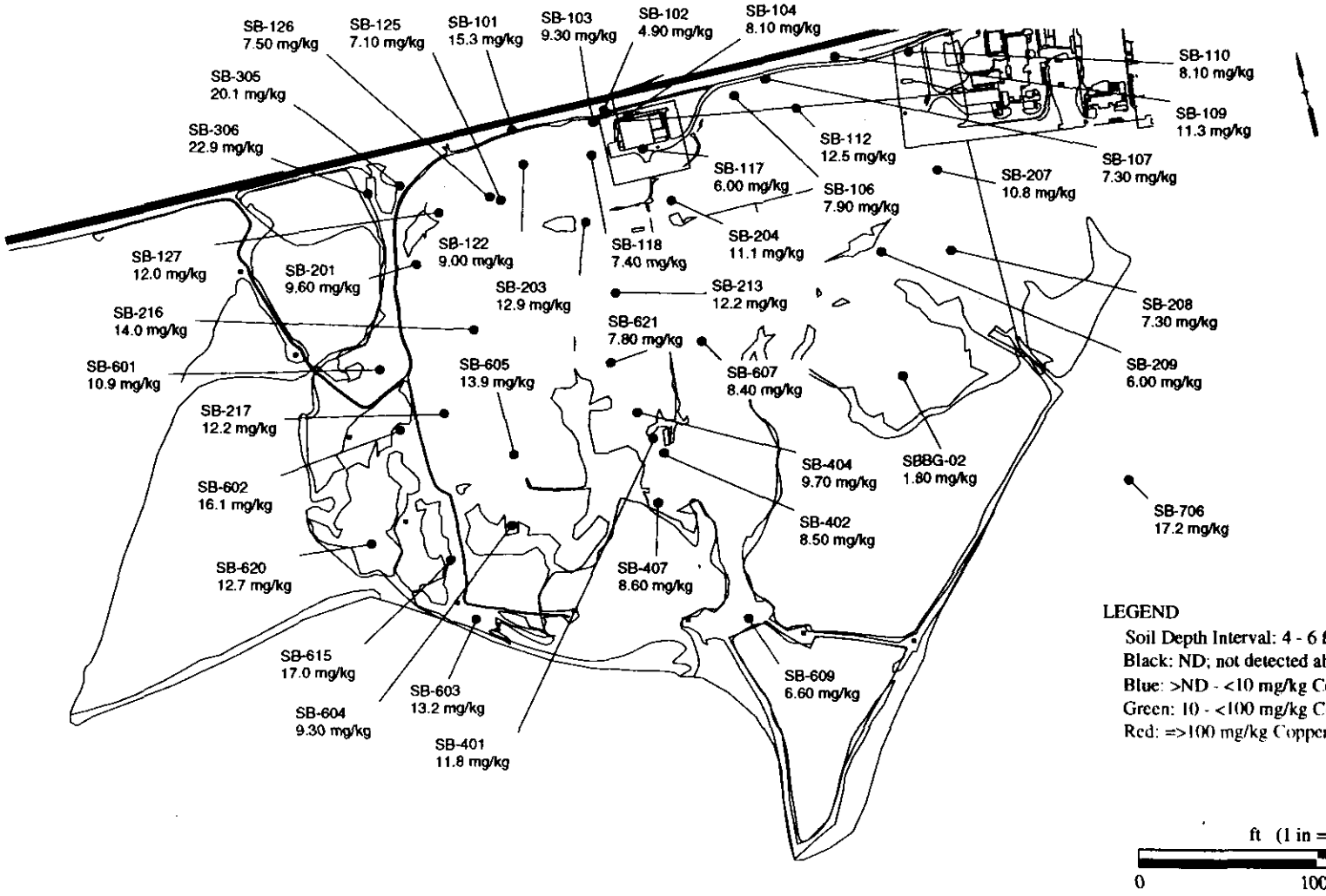
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Copper Concentrations in Soil (0-2 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-63

AR308881



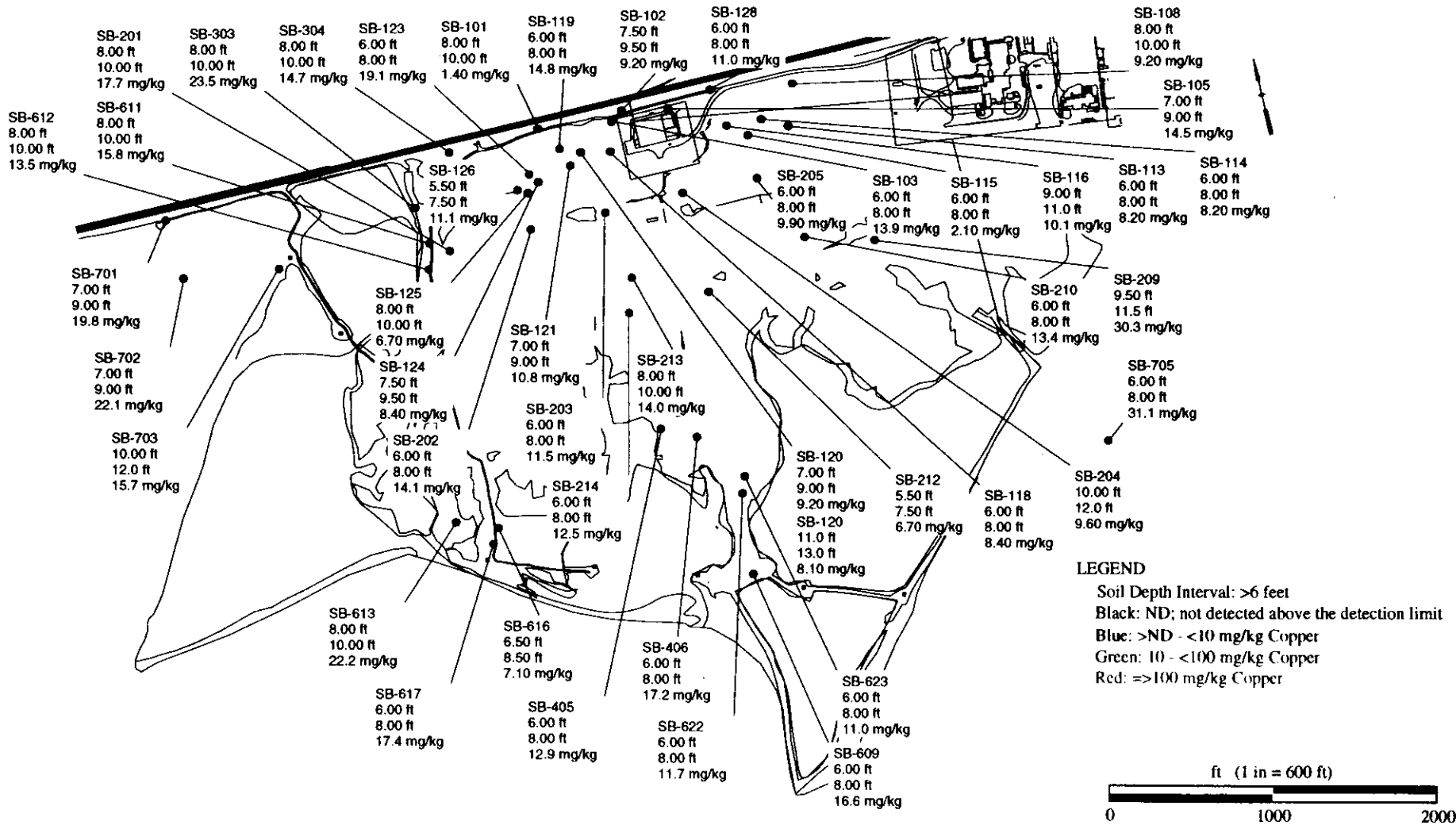
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Copper Concentrations in Soil (2-4 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-64

AR308882



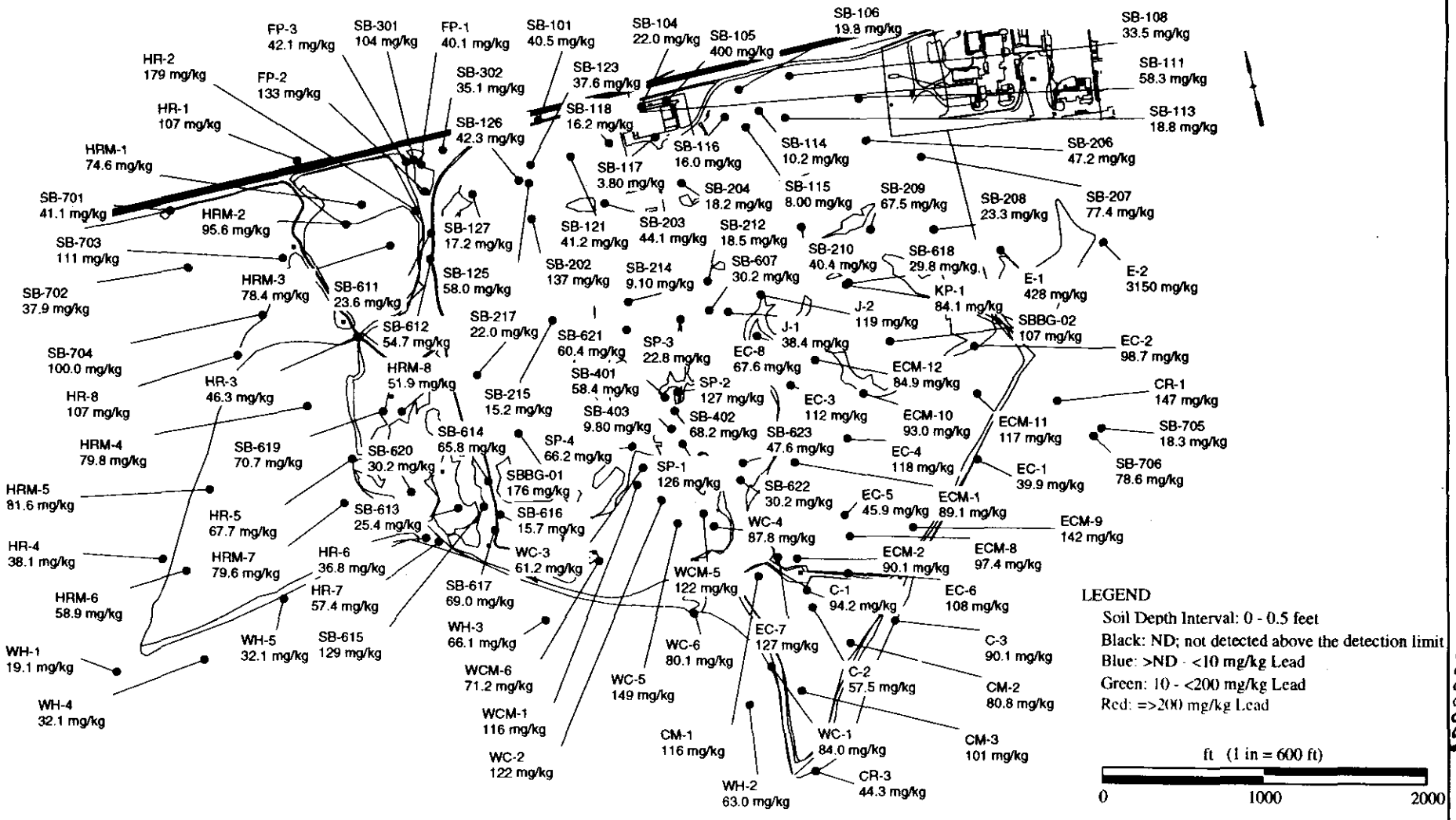
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Copper Concentrations in Soil (4-6 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-65

AR300883



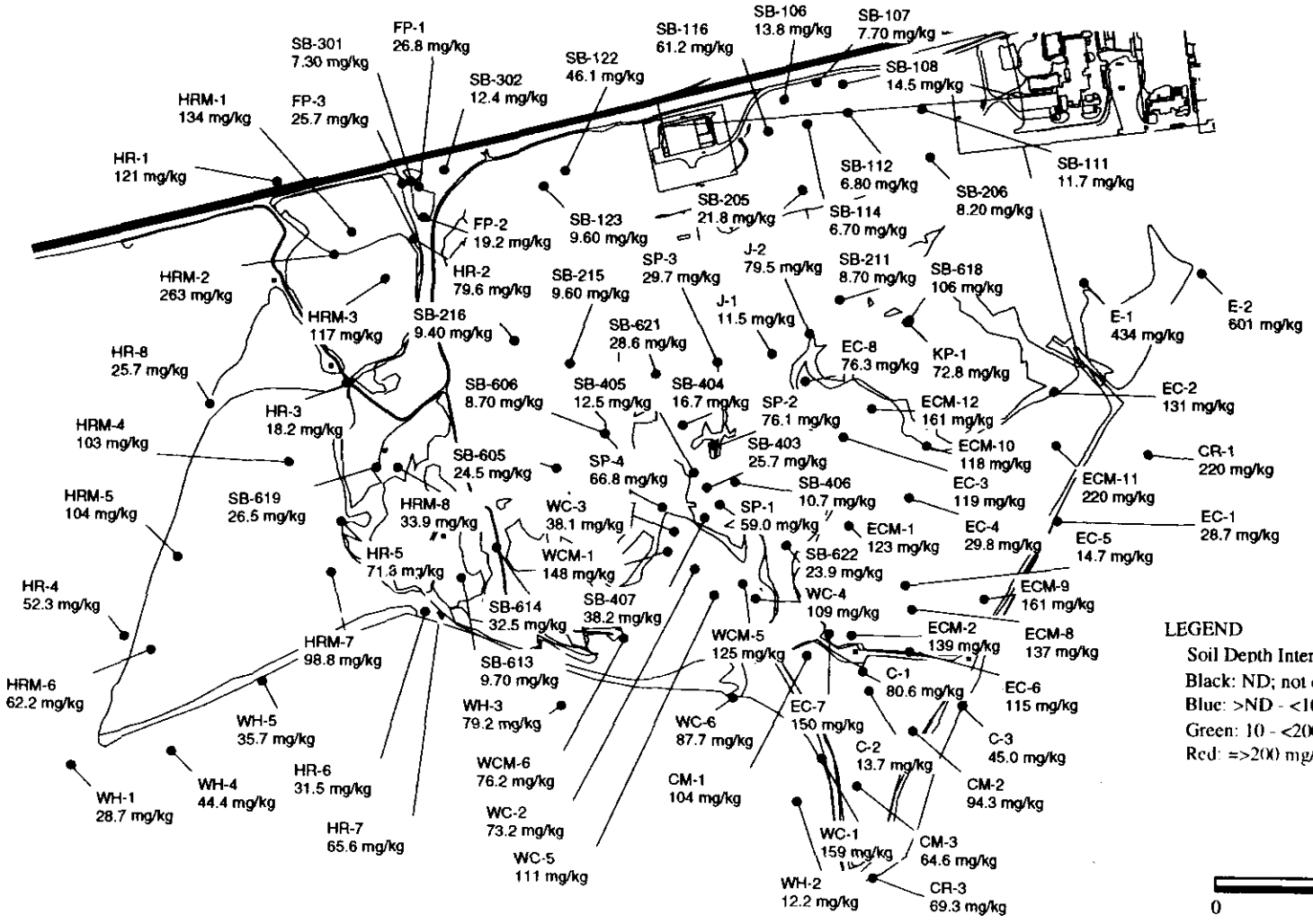
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Copper Concentrations in Soil (>6 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-66

AR308884



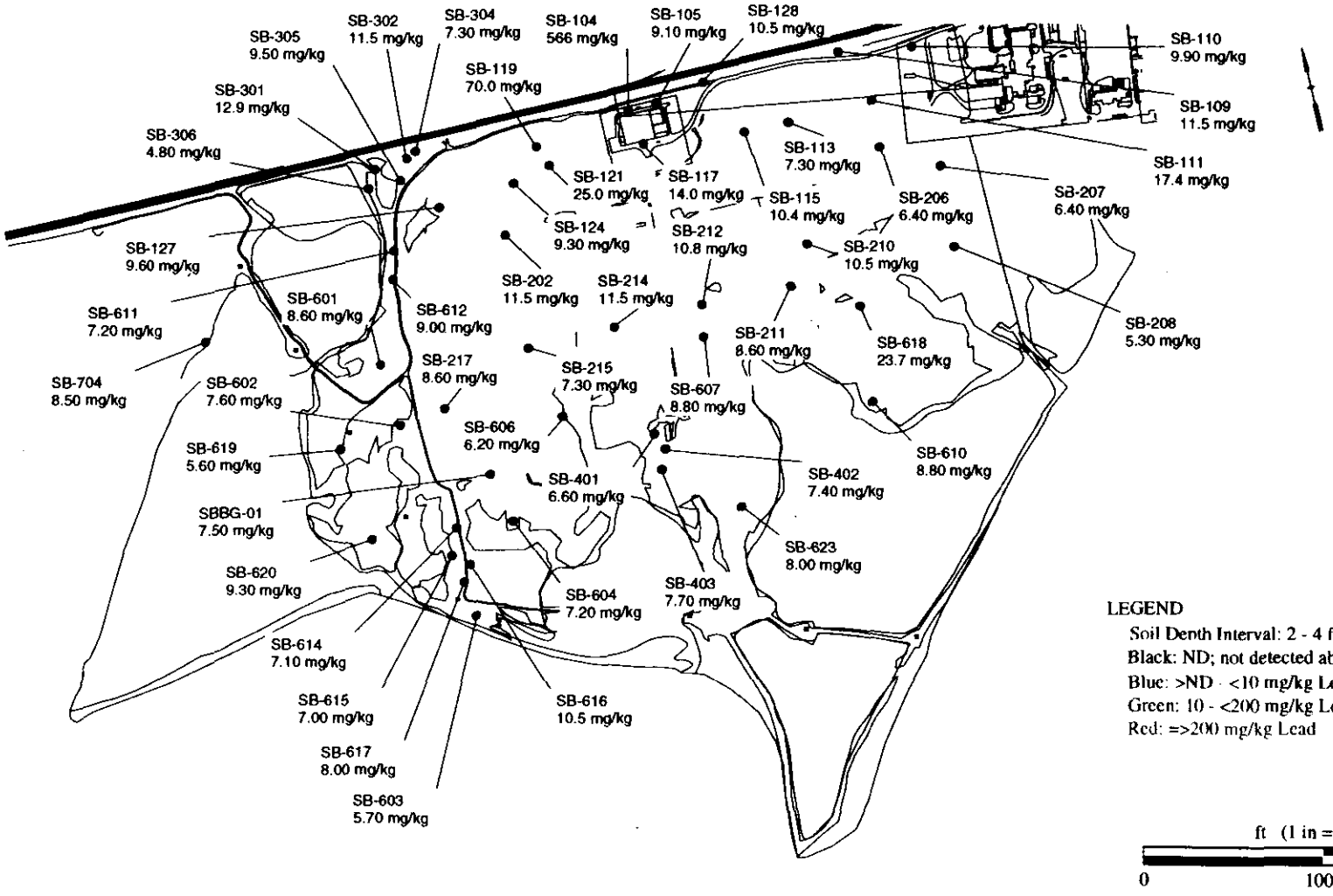
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Lead Concentrations in Soil (0-0.5 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-67

AR308885



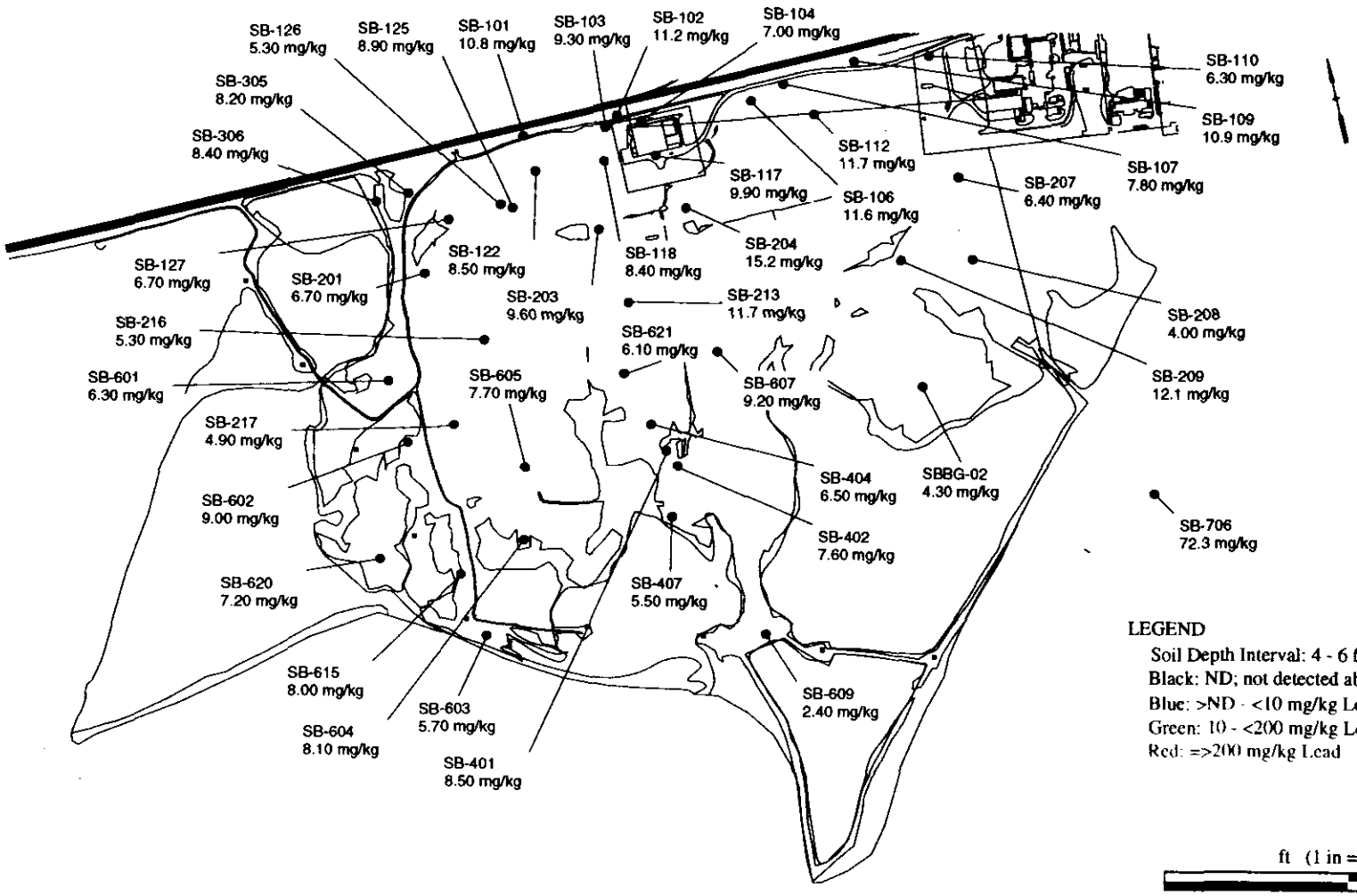
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Lead Concentrations in Soil (0-2 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-68

AR308886



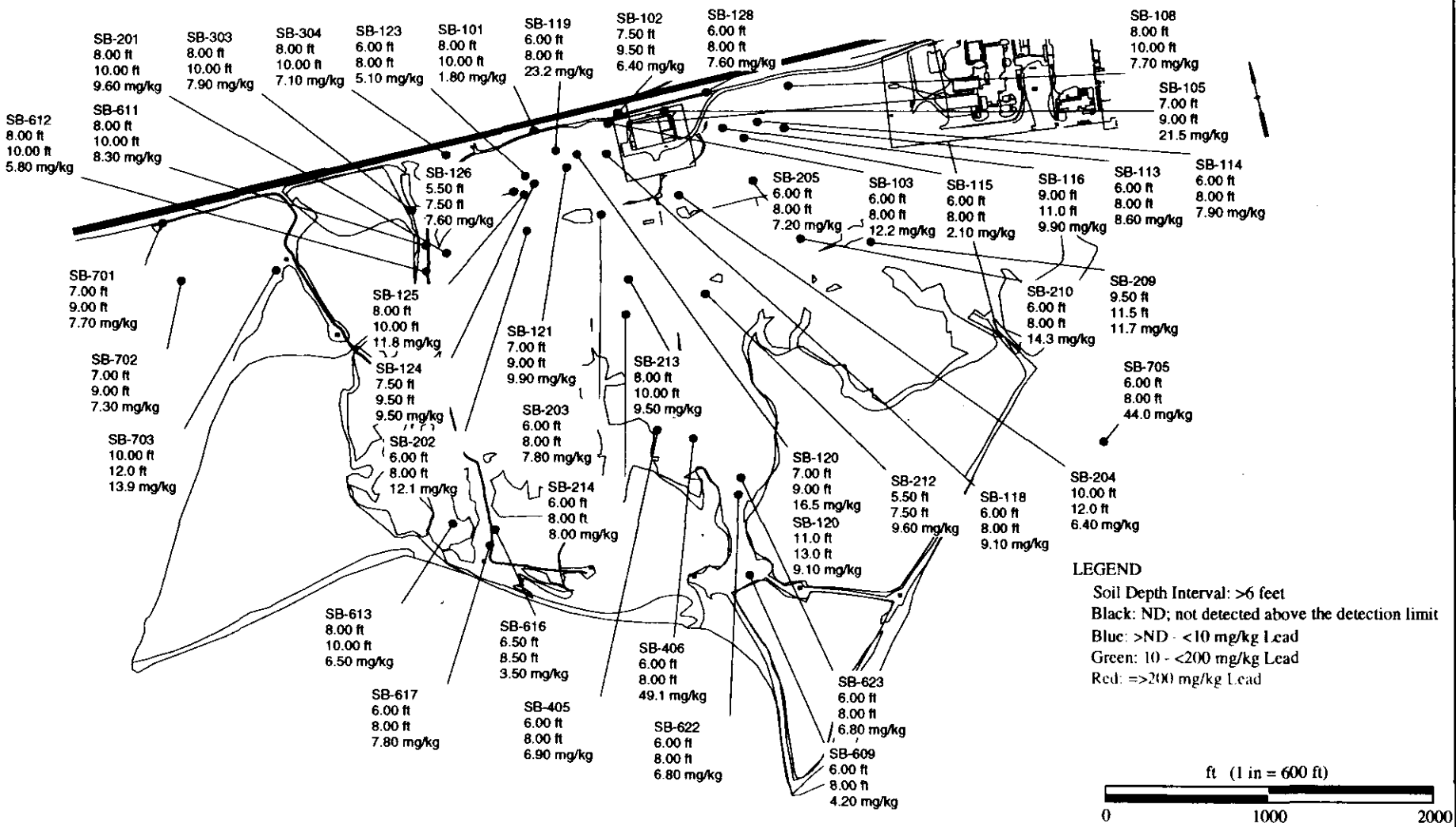
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Lead Concentrations in Soil (2-4 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-69

AR300087



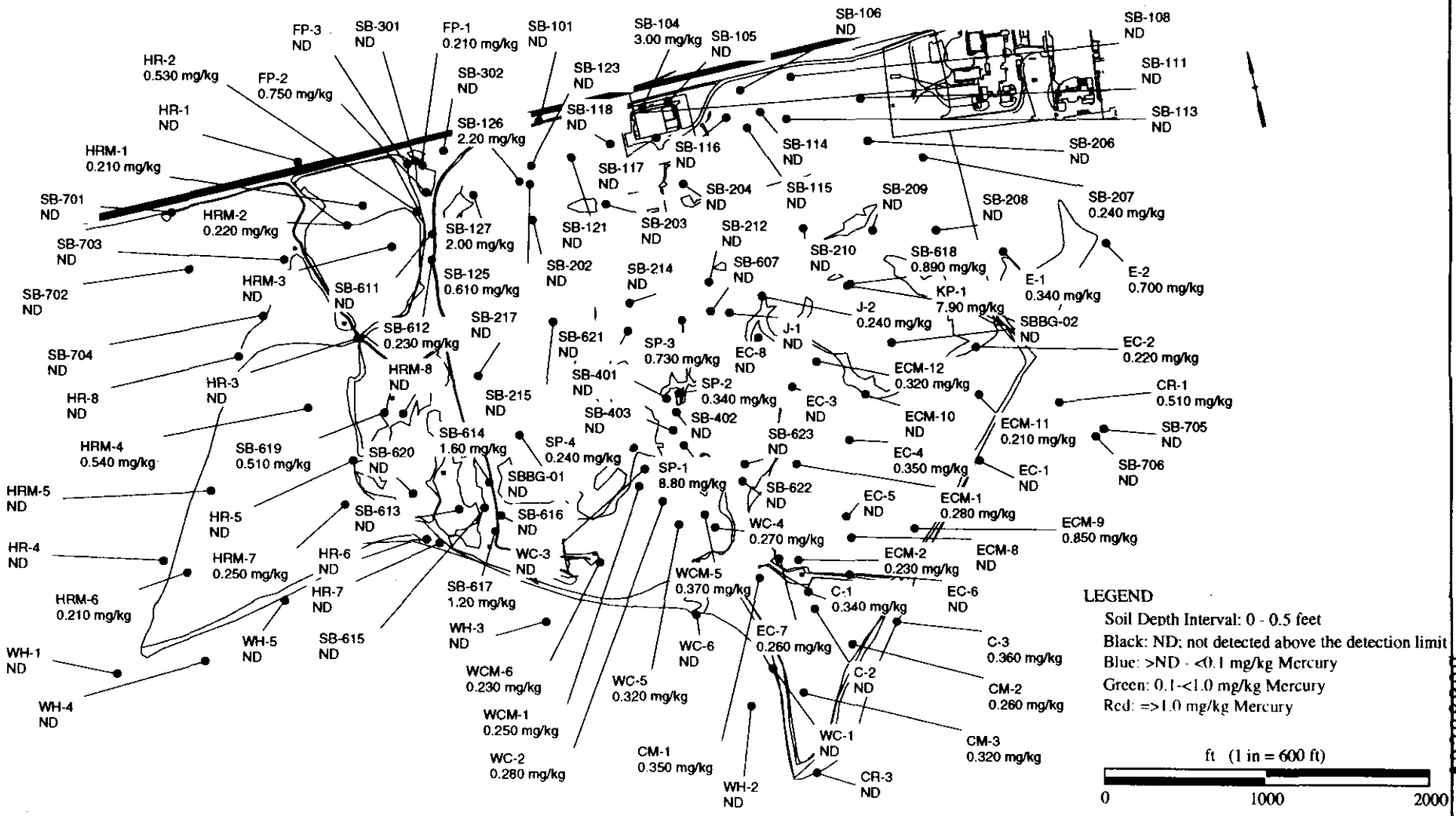
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Lead Concentrations in Soil (4-6 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-70

AR308808



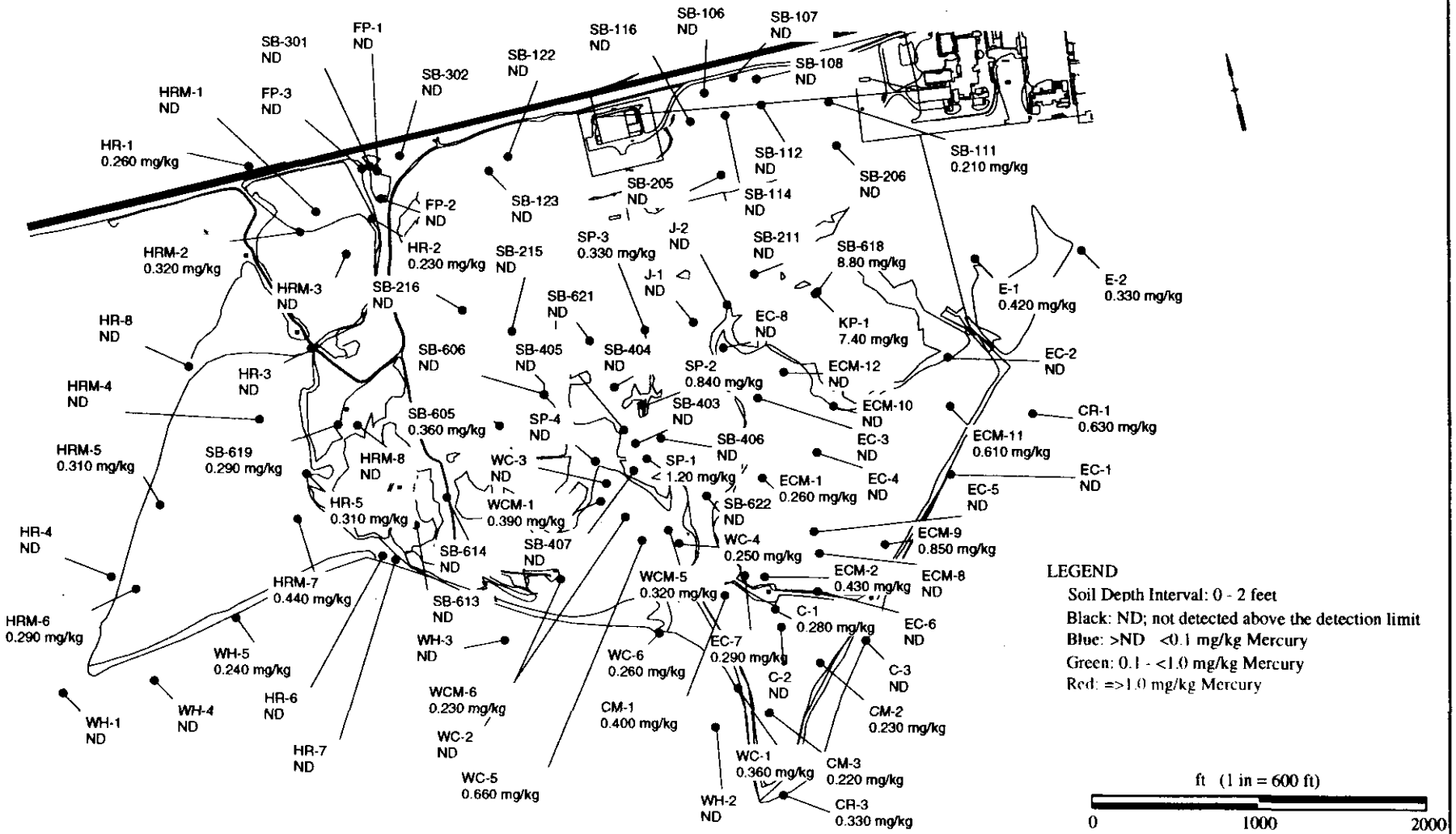
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Lead Concentrations in Soil (>6 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-71

AR308889



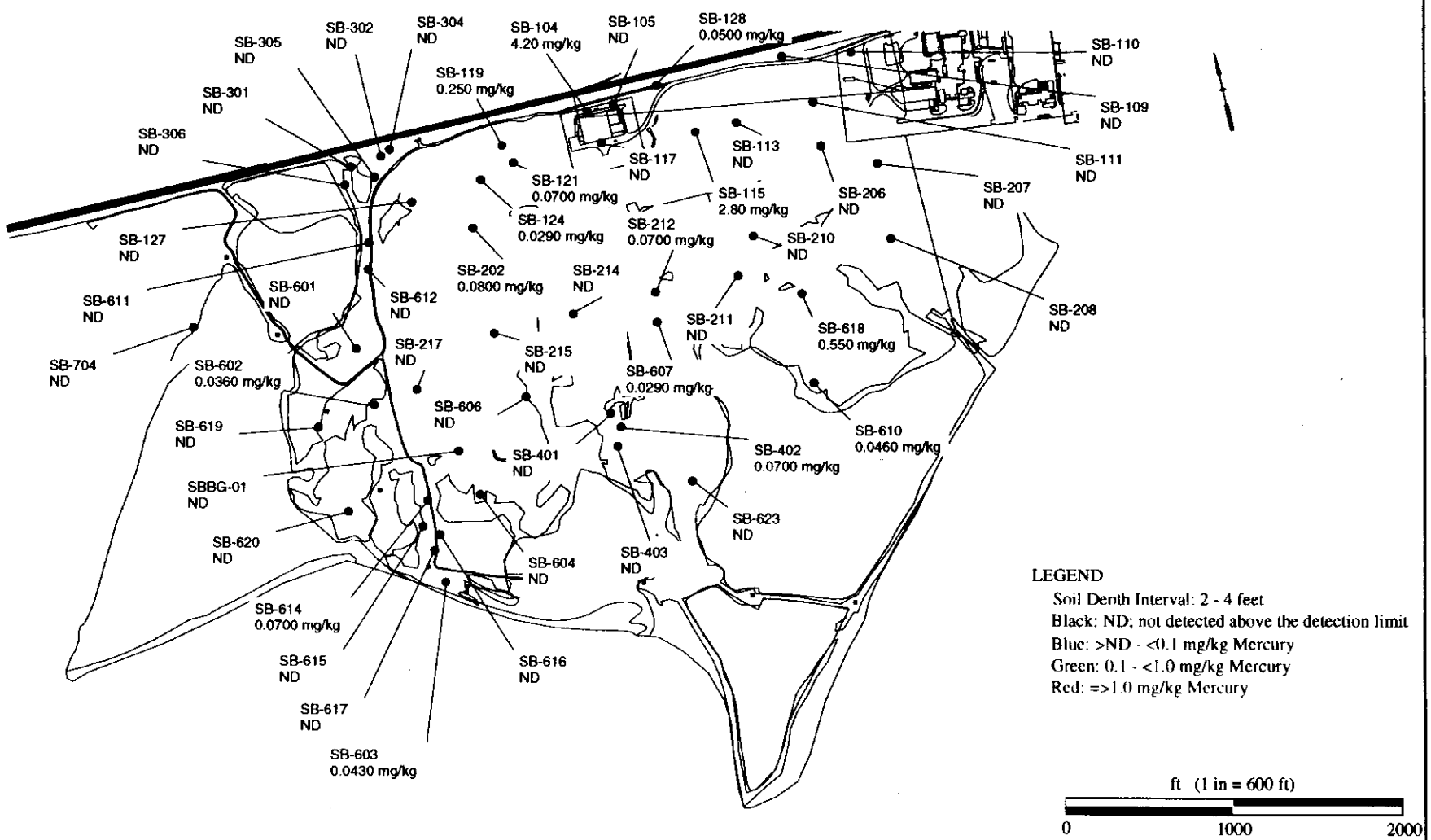
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Mercury Concentrations in Soil (0-0.5 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-72

AR308890



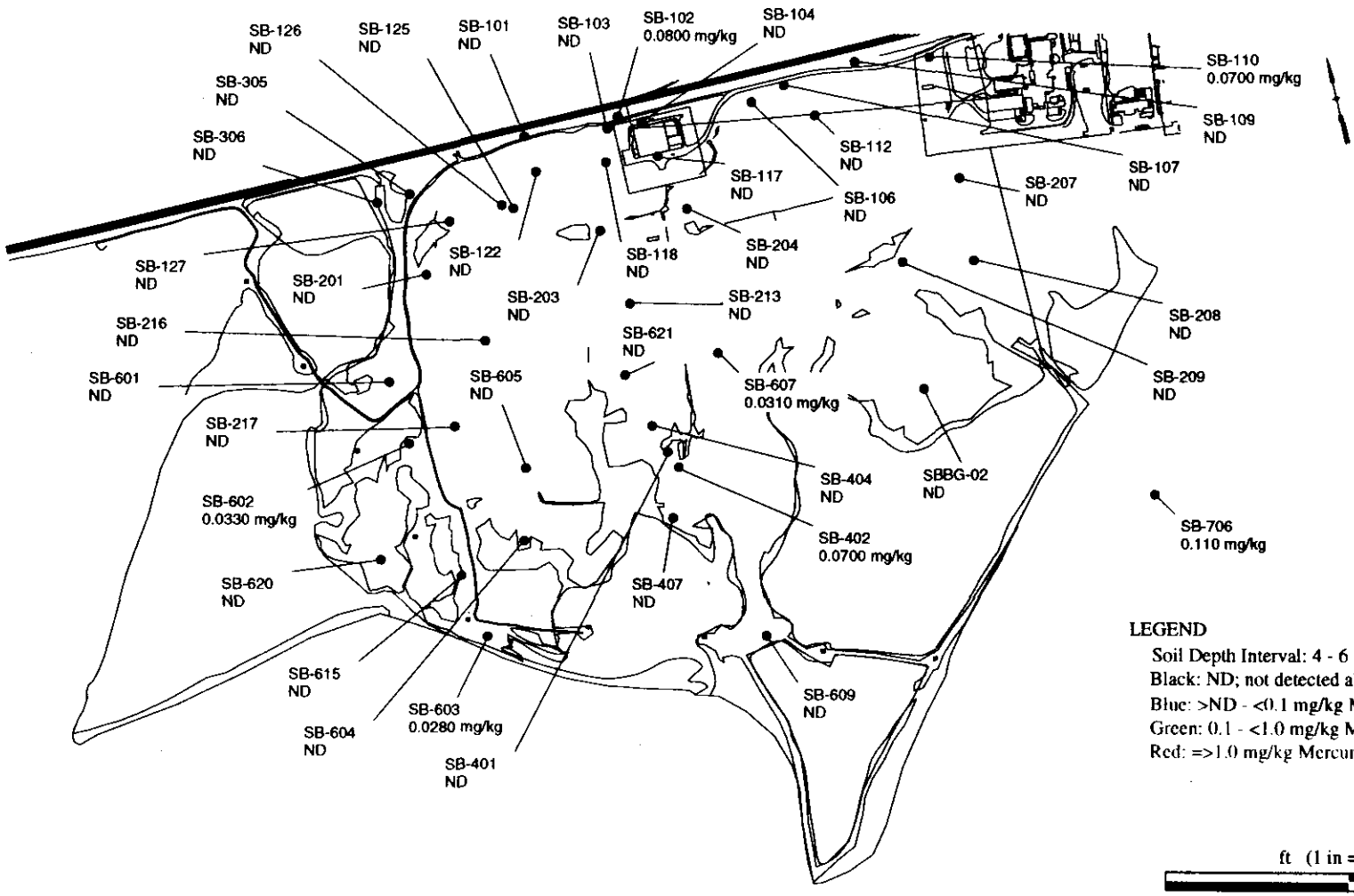
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Mercury Concentrations in Soil (0-2 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-73

AR308891



Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Mercury Concentrations in Soil (2-4 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-74

AR308892



LEGEND

Soil Depth Interval: 4 - 6 feet

Black: ND; not detected above the detection limit

Blue: >ND - <0.1 mg/kg Mercury

Green: 0.1 - <1.0 mg/kg Mercury

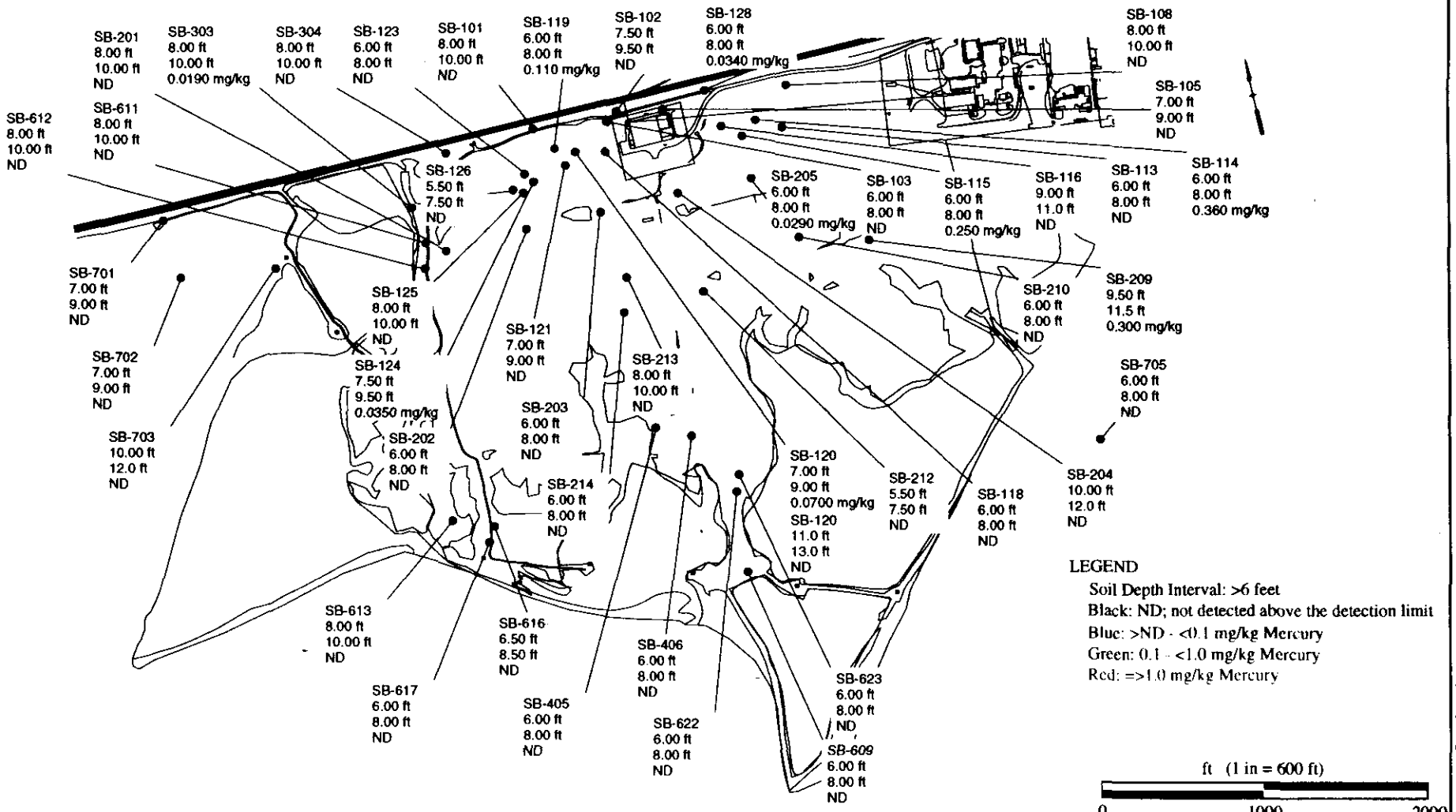
Red: =>1.0 mg/kg Mercury

ft (1 in = 600 ft)

0 1000 2000

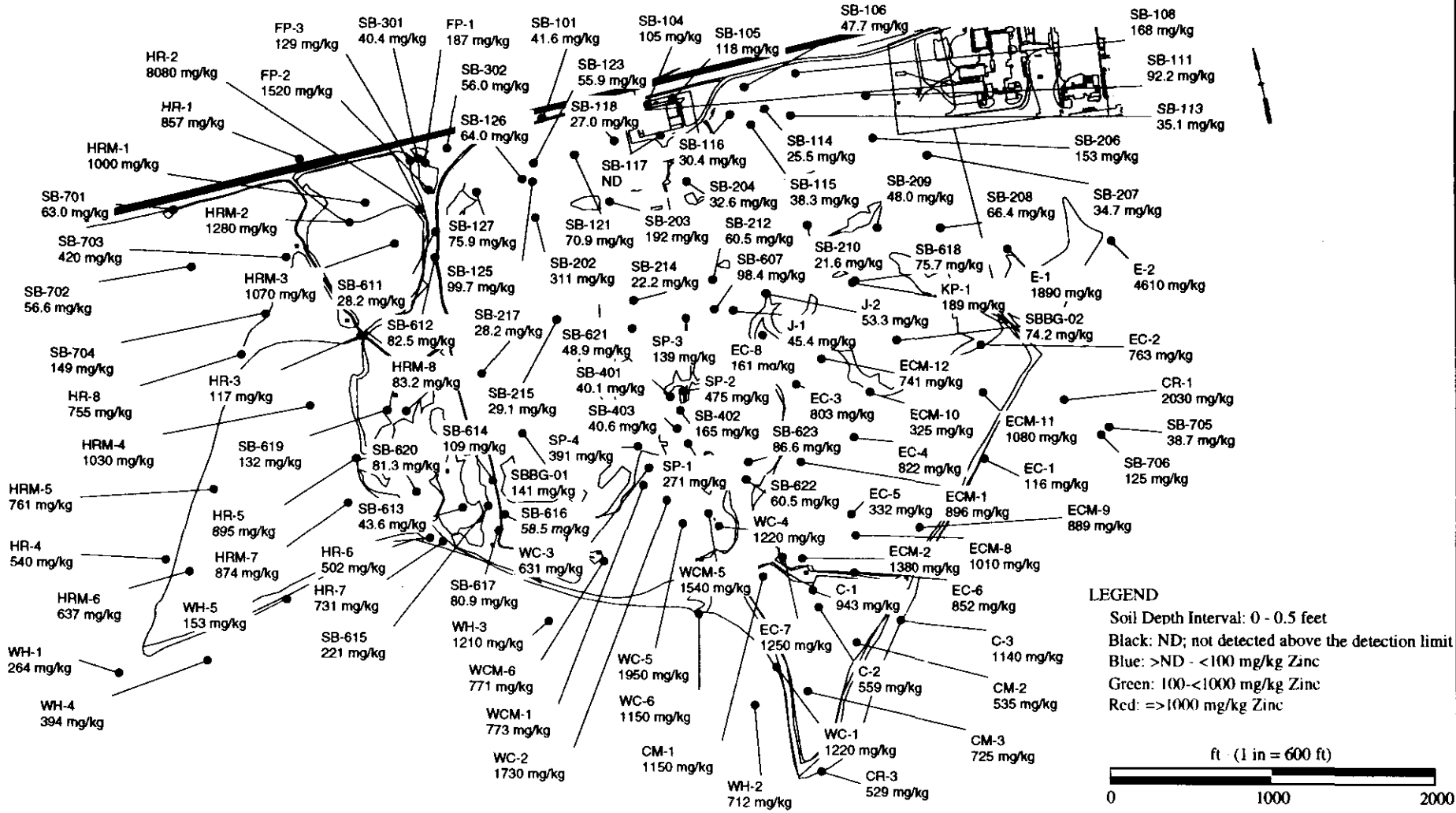
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Mercury Concentrations in Soil (4-6 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-75

AR300093



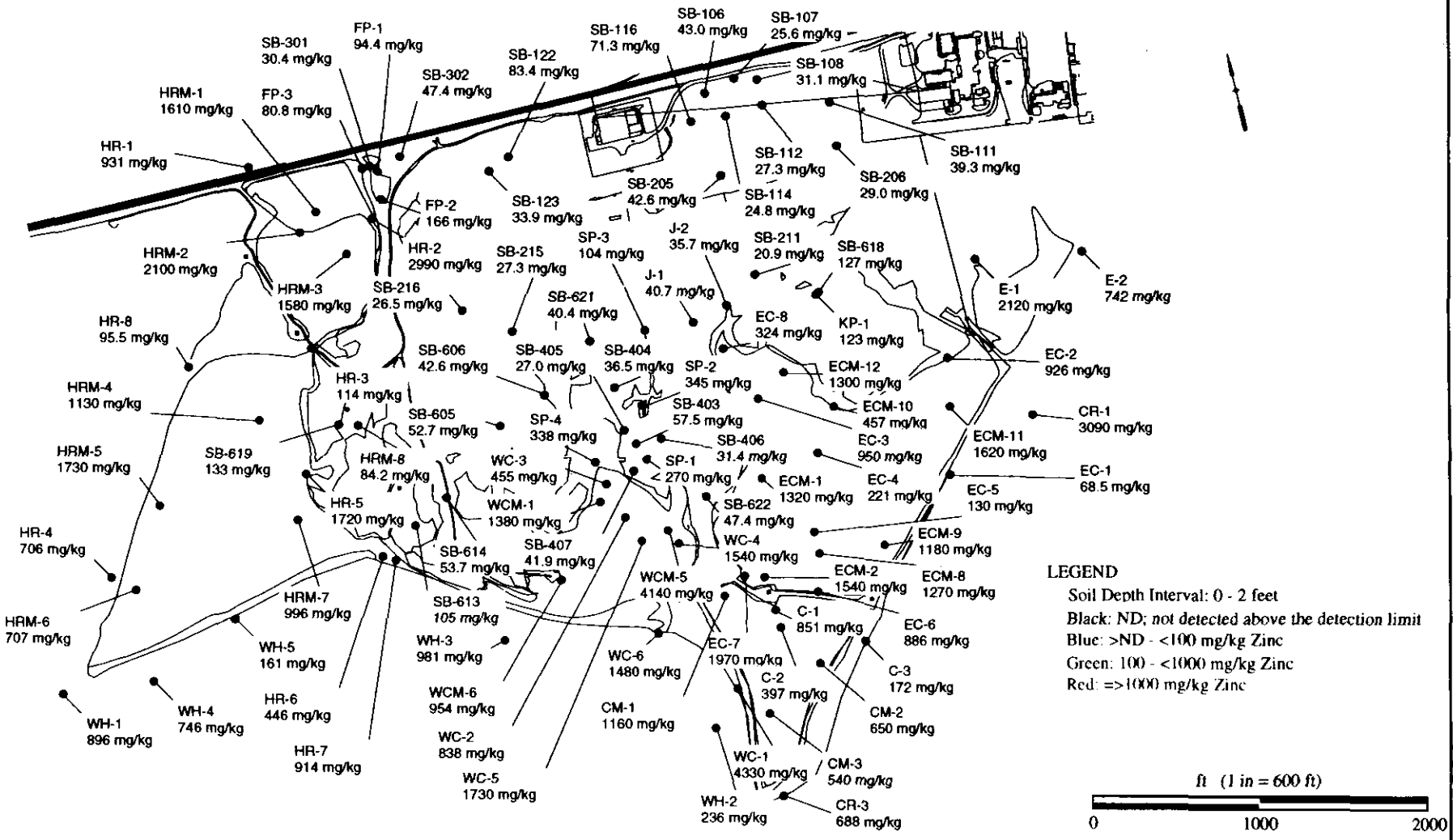
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Mercury Concentrations in Soil (>6 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-76

AR308894



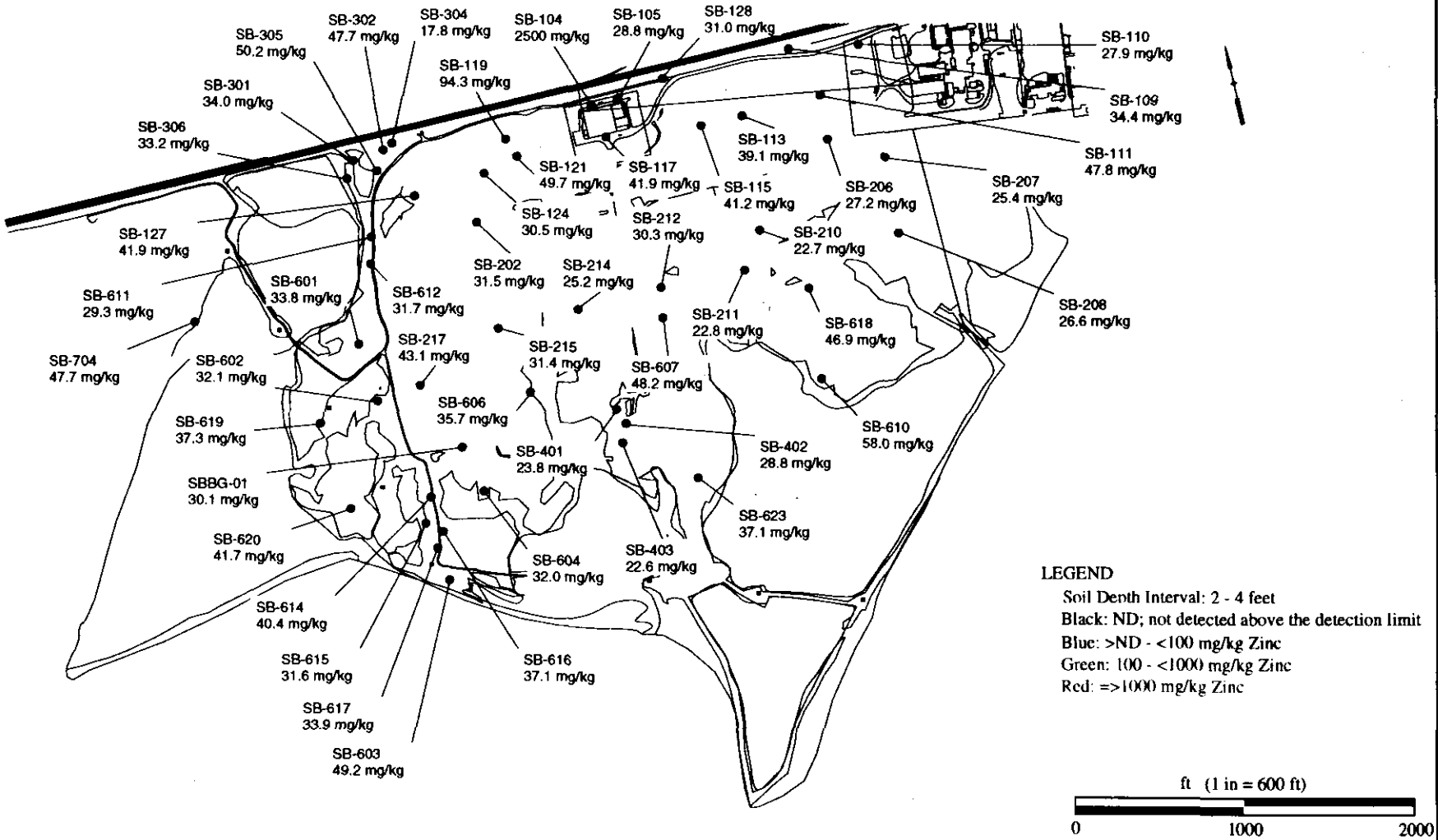
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Zinc Concentrations in Soil (0-0.5 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-77

AR308895



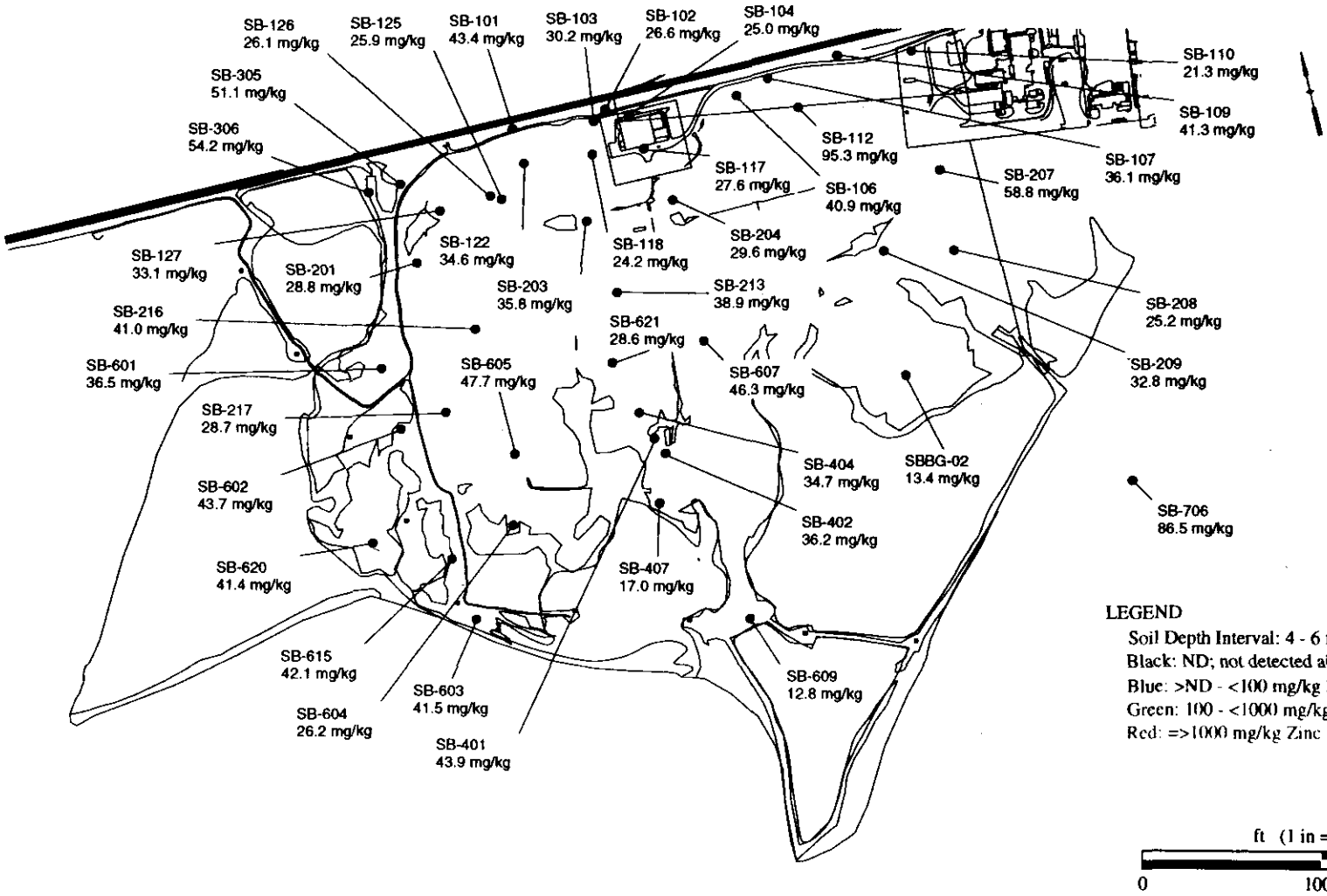
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Zinc Concentrations in Soil (0-2 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-78

AR308896



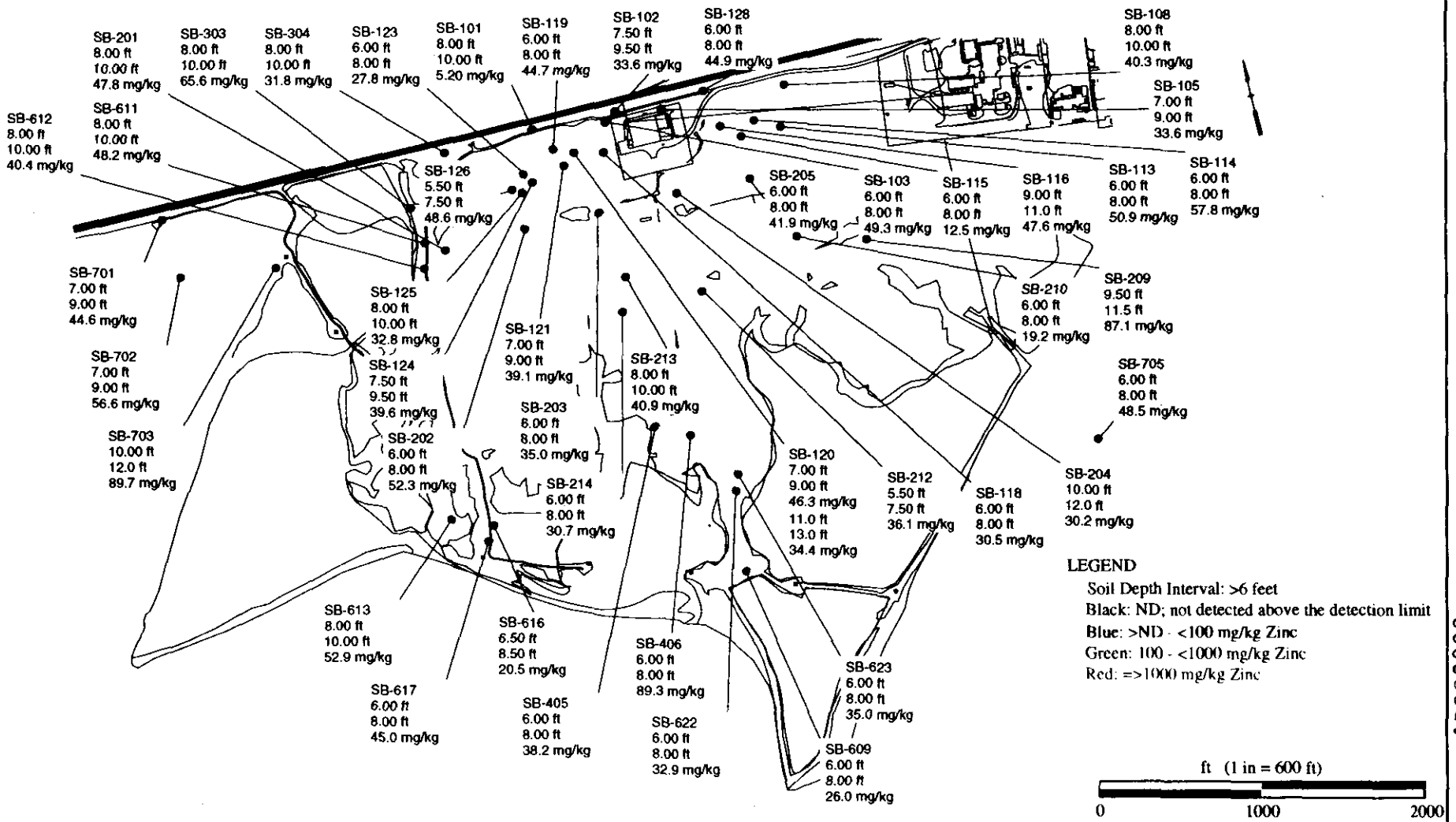
Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Zinc Concentrations in Soil (2-4 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-79

AR308897



Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Zinc Concentrations in Soil (4-6 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-80

AR308898



Project No. 4E02153	Beazer East, Inc. & E.I. DuPont	Zinc Concentrations in Soil (>6 ft.) Former Koppers Co., Inc., Newport Site Newport, Delaware	July 17, 1995
Woodward-Clyde Consultants			Figure A-81

AR308899

Appendix B

PROJECT TECHNICAL GUIDANCE NUMBER 15

FISH SAMPLING

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2.0	SAMPLING PROCEDURES	15-1
2.1	EQUIPMENT LIST	15-1
2.2	PROCEDURES	15-2

AR308901

1.0 PURPOSE AND SCOPE

This document defines the standard procedures to be used for collecting fish at the former Koppers Company, Inc., Newport Site. This project Technical Guidance (PTG) serves as a supplement to the Phase II SOW. Fish sampling locations are specified in the SOW.

This PTG is intended to be used together with the SOW. Health and Safety procedures and equipment that will be required during the investigation are detailed in the Health and Safety Plan (HSP).

2.0 SAMPLING PROCEDURES

2.1 EQUIPMENT LIST

- Electrofishing backpack equipment (equipped with "kill switch")
- Work boat (supplied with required safety equipment)
- Seine nets (6' x 50'), (6' x 25'), and (6' x 6')
- Reinforced kick nets with 5-foot handles
- 4' x 50' gill net
- Trap net
- Chest waders
- Personal protective equipment (tyvek suits, rubber gloves, etc.)
- Five gallon buckets or equivalent to be used as live wells
- Coolers with "blue ice" and dry ice
- Weighing scale
- Aluminum foil, plastic ziploc bags, labels
- Hexane is spray bottle, distilled water in spray bottle
- Fish measuring board
- Field identification guide
- Field notebook and waterproof pens
- Data forms, chain-of-custody forms
- Packing and shipping supplies (bubble wrap, clear tape, custody seals)

2.2 PROCEDURES

Fish sampling in the marsh drainageways will be performed to document community structure and to collect samples of the most common forage fish species for tissue analysis. Fish sampling in the adjacent stream (White Clay Creek) will be performed to document community structure and to collect samples of a common "panfish" for tissue analysis of edible fillets.

Marsh Drainageway Fish Sampling: Fish sampling in the marsh drainageways will be performed as follows:

1. Visit area to be sampled an verify that conditions allow safe for electrofishing and wading. Flag the reach of the drainageway to be sampled.

2. At the downstream end of the reach check with a long pole (12 feet) to confirm that water depth (< 4 feet) and substrate firmness will allow safe entry.

3. At high tide, arrange an appropriately sized sieve net across the drainageway channel to black escaping fish and anchor it firmly to the channel bottom and sides.

4. Enter the drainageway and proceed electrofishing in an upstream direction with a helper retrieving stunned fish with a dip net. Store fish in line wells until processed.

5. Proceed fishing upstream at about 50 feet intervals until sufficient fish are caught for documentation of community structure and tissue analysis samples.

6. Small forage fish species are not as susceptible to electrofishing as larger fish, and downstream sieving toward the block net will be performed as necessary to acquire sufficient fish.

Process Fish as Follows:

1. Identify and count each fish species captured, record length and weight data on field data sheets, select the dominant species for tissue analysis, return all other fish to the waterway and remove the blocking net. Record all field activities in the log book.

2. Randomly select dominant fish and prepare 3 replicate samples containing about 300 grams (wet weight) by enclosing fish in hexane rinsed and then distilled water rinsed aluminum foil packets and then seal these in plastic ziploc storage bags. Release all unused fish to the waterway.

3. Properly label each packet and place the bags in field coolers with "blue ice."

4. Return fish to the field station and freeze as soon as possible after capture.

5. After 24 hours of freezing, pack fish in coolers on dry ice, prepare chain-of-custody and ship samples to laboratory by priority overnight service.

Stream "Panfish" Sampling: Sampling in the stream will be performed using a combination of techniques as necessary to collect "panfish". Electrofishing will be the initial method of choice, but seining (6' x 50'), trap netting and/or gill netting may also be used.

Electrofishing will be performed according to the steps outlined above, except Step 3 is deleted since block netting not feasible due to broad channel width. The other methods will be performed next if electrofishing does not yield enough fish.

Seine Net Sampling: Is performed as follows:

1. Visit the area to be sampled at low tide and verify the conditions will allow safe wading and sieving. Select an area free of bottom obstructions.

AR308904

2.

3. At high tide, anchor the 6' x 50' sieve net brail in a vertical portion to the channel bottom and side and stretch the net downstream parallel to the shoreline.

4. Hold the downstream brail vertically and sweep the net in a semi-circular path going upstream, keeping the bottom of the net against the stream bottom.

5. Collect the fish and place in the wells. Repeat as necessary at about 100-foot intervals to obtain sufficient fish.

Trap Net Sampling: Is performed as follows:

1. Visit the area to be sampled at low tide and verify the conditions will allow safe wading and sieving. Select an area free of bottom obstructions.

2.

3. At low tide stake the trap net out in channel with the open mouth pointing upstream and the trap downstream. Select an area in the channel that fish are likely to follow on the outgoing tide.

4. Allow the net to remain until the next low tide.

5. Inspect the trap for fish and remove the live wells.

6. Allow net to remain in place for another tidal cycle if in sufficient fish are caught.

Gill Netting: Is probably the most effective sampling approach, but frequently fish are killed by this procedure and it will be used as the last resort as follows:

1. Visit the area to be sampled at low tide and verify the conditions will allow safe wading and sieving. Select an area free of bottom obstructions.

2.

3. At low tide stake the gill net out perpendicular from shore and arrange vertically like a curtain with multiple stake to withstand tidal currents.

4. Allow the net to remain until the next low tide.

5. Inspect the net and remove fish, repeat as necessary to acquire needed fish.

After sufficient "panfish" fish have been collected, the fish will be processed the same as above for the forage fish species.

PROJECT TECHNICAL GUIDANCE NUMBER 16

WILDLIFE SURVEY

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2.2	PROCEDURES	16-1

1.0 PURPOSE AND SCOPE

This document defines the standard procedures to be used for surveying wildlife at the former Koppers Company, Inc., Newport Site. This Project Technical Guidance (PTG) serves as a supplement to the Phase II SOW. Wildlife surveying endpoints and objectives are specified in the SOW.

This PTG is intended to be used together with the SOW. Health and Safety procedures and equipment that will be required during the survey are detailed in the Health and Safety Plan (HSP).

2.0 SAMPLING PROCEDURES

2.1 EQUIPMENT LIST

- Binoculars (8 x 50)
- 35mm Camera
- Microcassette tape recorder
- Camouflage clothing
- Chest waders
- Animal Identification Record forms, logbook, pens

2.2 PROCEDURES

The wildlife survey will be performed at fixed observation points and along belt transects established in each covertype on Site and at reference locations off Site in Churchmans Marsh and Bread and Cheese Island. Observations will be made during early morning or evening hours on three consecutive days for each covertype, weather permitting. The observer will be dressed in camouflage clothing. All birds, mammals, and herpetiles will be identified and counted to yield an index of species relative abundance. In each terrestrial covertype, surficial soil (0 to 1.0 feet) will be examined by hand digging to document the presence and relative abundance of visible soil invertebrates (e.g., annelids, insects).

Transect lengths and time spent in each covertype will be proportional to the area or length (streams) of each covertype, as indicated on the attached table.

In habitat where walking is possible, the transects will be slowly walked. The observer will stop at the proposed number of observation points for 10 minutes before moving on to the next point. In aquatic habitat where walking is not possible, the observer will use a small boat to transect the habitat and stop at the proposed number of 10 minute observation points.

Field observations will be recorded in the logbook, wildlife identification record (copy attached), and supplemented with tape recordings. The results will be summarized as species lists of birds, mammals, and herpetiles for each habitat type and will include frequency of observation and an estimate of relative abundance. The same procedures will be used at the reference locations and the amount of time spent will be equal to that spent on Site. The observation points in all habitats on Site and in the reference areas will be identified on a Site plan using differentially corrected GPS surveying.

WILDLIFE SURVEY TRANSECT LENGTHS AND/OR OBSERVATION POINT DURATION

	Area/Length	Transect Length (feet)	10 Minute Observation Points	Minimum Duration (minutes)
AQUATIC HABITAT COVERTYPES:				
Freshwater Tidal Marsh	115 acres	1000	5	50
Non-Tidal Emergent Wetlands	10.7 acres	200	2	20
Non-tidal Scrub/Shrub Wetlands	1.5 acres	point	1	10
Non-Tidal Forested Wetlands	8.6 acres	200	2	20
Open Water Ponds (Fire Pond)	<1 acre	point	1	10
Open Water Streams	2.5 miles	points	3	30
Churchmans Marsh*	~ 450 acres	via boat	14	140
TERRESTRIAL HABITAT COVERTYPES				
Herbaceous "Old Fields"	87.2 acres	800	4	40
Upland Forest	62 acres	600	3	30
Upland Scrub/Shrub	13.7 acres	200	2	20
Bread and Cheese Island*	~ 100 acres	1600	9	90

Note: * Reference Areas

AR309910

WOODWARD-CLYDE CONSULTANTS
ANIMAL IDENTIFICATION RECORD

Site Name: _____ Project Number: _____

Date: _____ Time of Day: start ___:___ AM/PM
finish ___:___ AM/PM

General Weather Conditions: (check all appropriate)

Rainy: ___ Sunny: ___ Overcast: ___
Hot: ___ Cold: ___ Temperature: ___

Location Animal Observed On-Site _____

Animals Identified: (P=primary evidence S=secondary evidence / number each animal species identified)

Mammals	Reptiles/ Amphibians	Birds (M/F)

Habitat: (use numbers that correspond to the animal identification)

Woods: _____ Bog: _____
Scrub/Shrub: _____ Open Water (SW or FW): _____
Open Field: _____ River/Stream (SW or FW): _____
Wetland: _____ Lake: _____
Marsh (T or NT): _____ Pond: _____
(T=Tidal -- NT=Non-Tidal -- SW=Salt Water -- FW=Fresh Water)

Description of Habitat: _____

Evidence of Human Activity: _____

Notes: _____

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WOODWARD-CLYDE CONSULTANTS
ANIMAL IDENTIFICATION RECORD

Site Name: _____ Project Number: _____

Date: _____ Time of Day: start ___:___ AM/PM
finish ___:___ AM/PM

General Weather Conditions: (check all appropriate)

Rainy: ___ Sunny: ___ Overcast: ___
Hot: ___ Cold: ___ Temperature: ___

Location Animal Observed On-Site _____

Animals Identified: (P=primary evidence S=secondary evidence / number each animal species identified)

Mammals	Reptiles/ Amphibians	Birds (M/F)

Habitat: (use numbers that correspond to the animal identification)

Woods: _____ Bog: _____
Scrub/Shrub: _____ Open Water (SW or FW): _____
Open Field: _____ River/Stream (SW or FW): _____
Wetland: _____ Lake: _____
Marsh (T or NT): _____ Pond: _____
(T=Tidal - - NT=Non-Tidal - - SW=Salt Water - - FW=Fresh Water)

Description of Habitat: _____

Evidence of Human Activity: _____

Notes: _____

AR308912

PROJECT TECHNICAL GUIDANCE NUMBER 17

SOIL/SEDIMENT PAH IMMUNOASSAY

TABLE OF CONTENTS

Section

Ensys, Inc. 1995. PAH Soil SamplePro, User's Guide

ENSYS INC.
ENVIRONMENTAL PRODUCTS

PAH SOIL SamplePro

RAPID DETECTION KIT

User's Guide

Important Notice

This method correctly identifies 95% of samples that are PAH-free and those containing PAHs at or above the selected test level. A sample that develops color, less than or equal to the standard is interpreted as positive. It contains PAHs. A sample that develops more color than the standard is interpreted as negative. It contains PAHs at less than the selected test level. The most sensitive SamplePro PAH test level is 1 ppm.

This test system should be used only under the supervision of a technically qualified individual who is capable of understanding any potential health and environmental risks of this product as identified in the product literature. The components must only be used for the analysis of soil samples for the presence of PAHs. After use, the kits must be disposed of in accordance with applicable federal and local regulations.

FOUR PHASES OF PAH SamplePro

The PAH SamplePro Rapid Detection Kit is divided into four phases.

PHASE I - Extraction and Preparation of the Samples

PAHs are extracted from a 10 gram soil sample with methanol. The soil extract containing PAH is then filtered.

PHASE II - Dilution of Sample and Standards

Different test levels require different dilution procedures. Each test level has a designated SamplePro program number. PAH Standards corresponding to the desired test level are provided in the kit and are diluted in the same way as the samples.

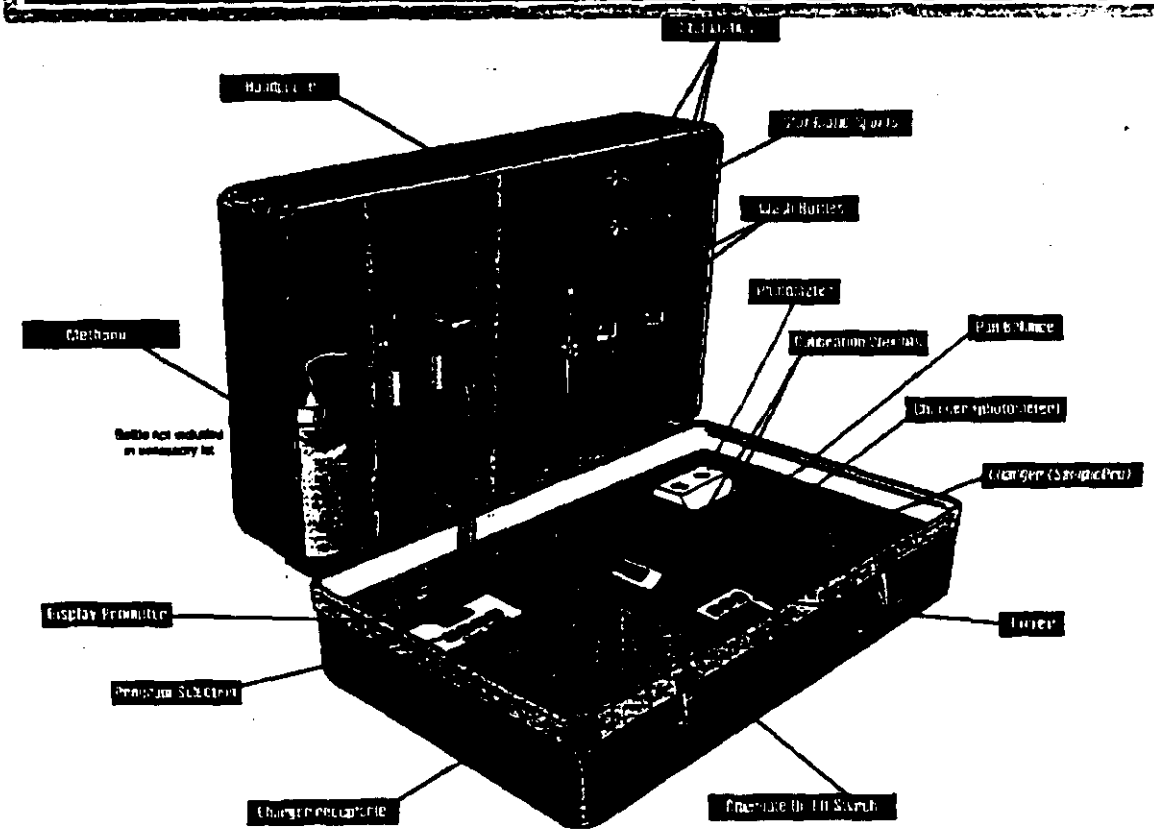
PHASE III - The Immunoassay

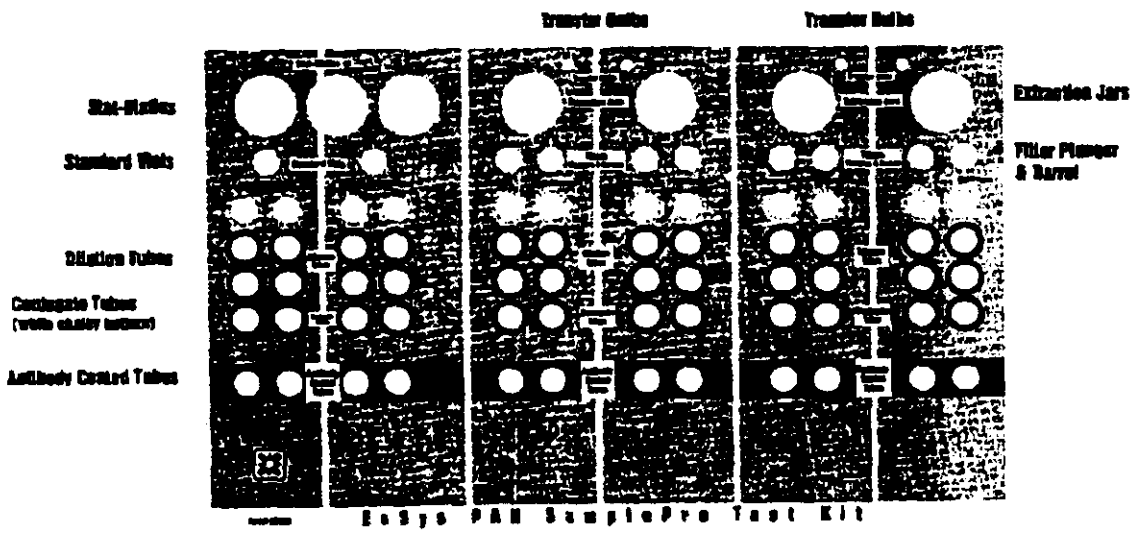
The PAH samples and standards are diluted into the enzyme conjugate and then added to the antibody coated tubes. The PAHs are allowed to bind to antibody binding sites for 10 minutes. During this incubation, the PAHs in the sample and the enzyme conjugate are "competing" for antibody binding sites. Next, washing the antibody coated tubes removes any unbound PAHs or enzyme conjugate. The addition of substrate solutions causes a colorimetric reaction.

PHASE IV - Interpretation of Results

The intensity of the color in the tube is inversely proportional to the concentration of the PAHs in the sample. The analysis of two standards provides a quality control check. Using the differential photometer the sample tubes are compared to the standard tube in order to make a greater than or less than interpretation for each test level.

SamplePro ACCESSORY KIT





SamplePro PAH Laminated Overlay for recognition and placement of your test components shown above.

MATERIALS

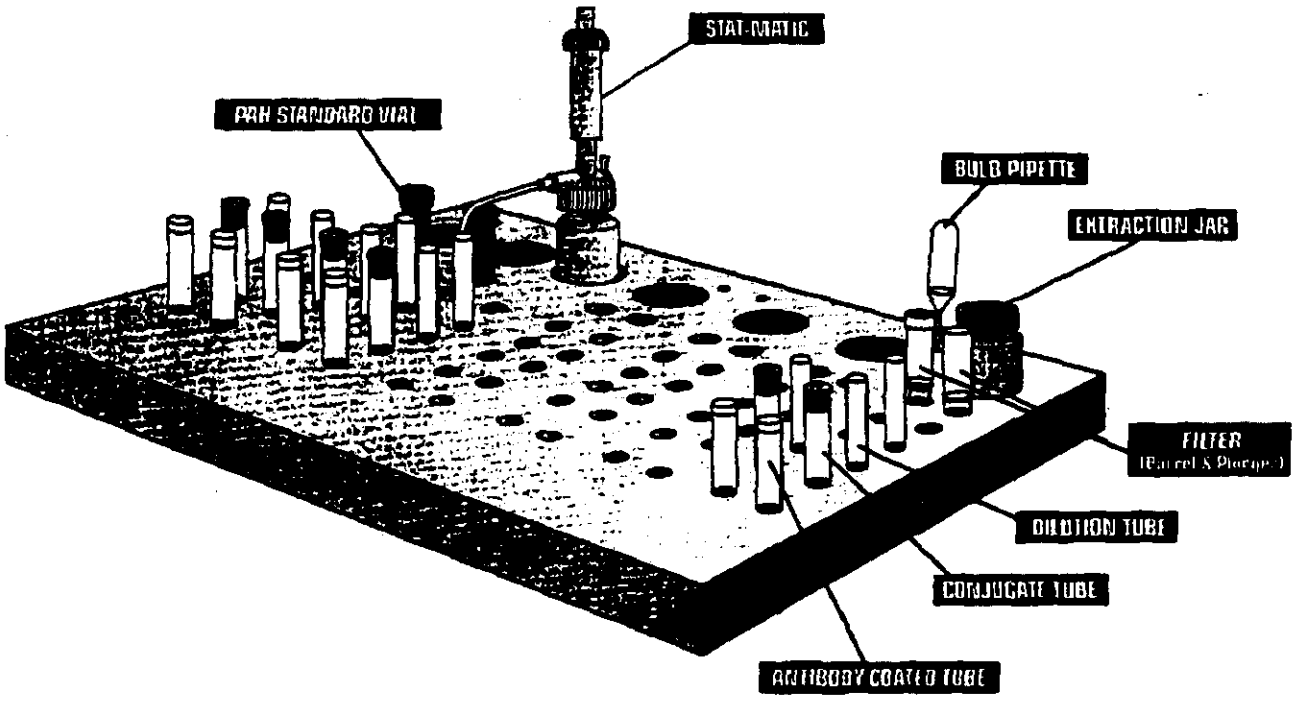
MATERIALS PROVIDED IN PAH SamplePro DETECTION KIT

Test Preparation
3 PAH Standards/Test level
6 Empty Vials
6 Transfer bulbs
1 10x Wash Concentrate
1 Ampule Cracker
2 Bottles of Methanol Diluent
1 Bottle of Conjugate Diluent
1 Bottle of Substrate A
1 Bottle of Substrate B
1 Bottle of Stop Solution

Phase I
24 Weigh Boats
24 Wooden Spatulas
24 Extraction Jars
24 Filtration Plungers and Barrels
24 Bulb Pipettes

Phase II
1 Box of Dilution tubes
1 Box of Handprobe tips

Phase III
6 Bags of Antibody Coated Tubes
72 Conjugate Tubes



ASSAY PERFORMANCE TIPS

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WASH STEP

Lack of vigorous washing may result in false positives or negatives depending on whether the wash error was committed on standard or sample tubes. Make sure to wash four times vigorously. Also make sure to wash the whole set of 12 tubes at once.

MIXING

Lack of thorough mixing, when instructed, can cause inconsistent results. Observe the times in the instructions and mix with sufficient force to ensure that the liquid is mixed.

TIMING

It is important to follow the timing steps in the instructions carefully. The incubation step in the antibody tubes can vary a bit without harm to the tests as long as all samples and standards within a run are incubated identically. The color development step timing is critical and should be no less than 2 minutes and no greater than 3 minutes.

WIPING TUBES

Antibody coated tubes should be wiped before they are read in the photometer because smudges and fingerprints on the tubes can give potentially false negative readings.

MIXING LOT #'S

Never mix lots! Each kit's components are matched for optimal performance and may give inaccurate results with the components from other kits with different lot #'s. Also, NEVER mix components from different types of kits (ex: Petro kit buffer can not be used with a PCB kit).

STORAGE OF ACCESSORY KIT

Never close unit and store without removing Methanol Bottle and flushing unit with DI water. Methanol Bottle may leak and flood electrical system.

STORAGE AND OPERATING TEMPERATURES FOR TEST KIT

Temperature requirements are very important and should be strictly adhered to. This information can be found in the kit User's Guide.

SHELF-LIFE

Each kit label contains the kit expiration date. To achieve accurate results, kits must be used prior to expiration.

SAMPLEPRO QUICK TIPS AND REMINDERS

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

TEST PREPARATION

1) Plug in **SamplePro** overnight before first use and after each day of use. Do not store the unit with a dead battery. Charge before storage.
2) Peel the label from the standard ampule and transfer it to the screw cap vial.
3) Label the antibody coated tubes with sample identification and test level.
4) Save the caps from substrate bottles. If you need to pack up the *Stat-Matic* substrate dispensers, first disassemble and purge the remaining fluid back into the appropriate bottle. Then recap bottles and flush the *Stat-Matic* dispensers with water.

RUNNING THE TEST

1) Before running each phase of the test procedure, make sure you have all the necessary components set up and ready. For example; Assemble and prime the *Stat-Matic* substrate dispensers; Pre-dilute the wash concentrate with distilled water, etc.
2) ***Do not rest the handprobe tip on the bottom of the container as the sample/standard is being picked up.***
3) **"Look"** to see that the sample has been picked up.
4) When a mistake in dilution has been made, discard the dilution tubes and start the dilution over. Reset the **SamplePro** by pressing **CHANGE PROGRAM.** followed by **ENTER.** - Now ready for sample pickup. Plenty of extra dilution tubes are supplied.
5) Change handprobe tips between samples and standards.
6) ***Keep handprobe tip fully inserted in the dilution tube until the beep sounds.***
7) Prime the *Stat-Matic* with 8-10 pumps when it is assembled. Also, before each set of tubes is developed, remove any air bubbles visible in the *Stat-Matic*.
8) Push *Stat-Matic* substrate dispenser button all the way down to deliver the appropriate amount of substrate.
9) You must run 4 samples at once to acheive 24 sample tests per kit.
10) Accomplished users may refer to page 18 of the User's Guide for the Abbreviated Procedure.

FLUSHING

Flush SamplePro unit after each day's use to avoid salt crystallization in moving parts. Also, flush unit several times with DI water before using unit on a different kit format.

TEST PREPARATION

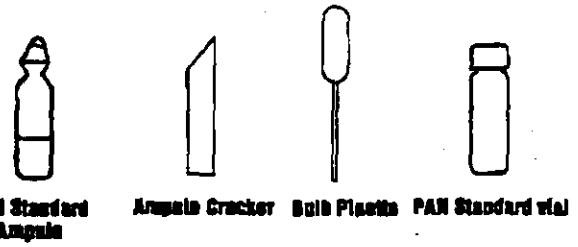
SamplePro Unit must be;
1. Charged overnight for 8 - 10 hours of normal use or operated from line voltage with charger attached.
2. To conserve battery, turn off SamplePro during long breaks.

MATERIALS NOT PROVIDED IN THIS KIT

Distilled Water
Paper towels
Liquid waste container
Permanent marking pen
Disposable gloves

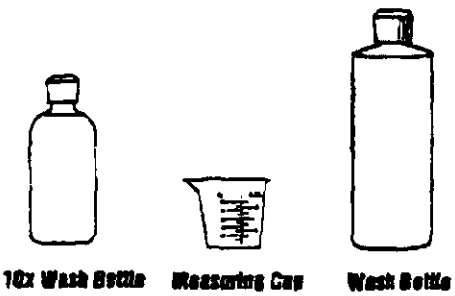
STANDARD PREPARATION

- Open PAH Standard ampules by slipping ampule cracker over top, and then breaking tip at scored neck. Transfer solution to empty vial with Bulb Pipettes.
- Label vial with current date. Standard is usable for 2 weeks. Always cap tightly when finished using Standard.
- A new PAH Standard should be opened for every 8 samples (Two test runs).



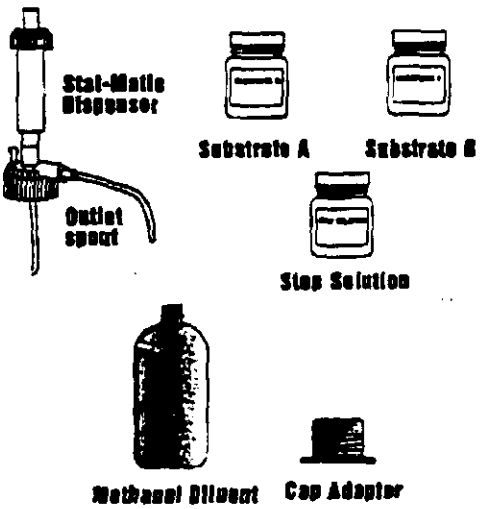
WASH PREPARATION

1. Measure 50ml of 10X Wash Concentrate into measuring cup.
2. Pour into an empty Wash Bottle and fill to top with distilled water.



SUBSTRATE PREPARATION

Attach outlet spout to each *Stat-Matic*. Label the caps of the Substrate jars with "A", "B" & "Stop" and save the caps for reclosure. Attach Stat-Matic dispenser tops to Substrate A, Substrate B, and Stop Solution. Prime dispensers by pumping 8-10 times into a waste container.



SamplePro SET-UP

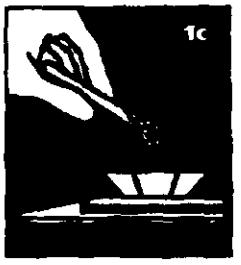
1. Attach Cap Adapter to the bottle of Methanol Diluent.
2. Attach the bottle of Methanol Diluent to the cap assembly on the SamplePro.
3. Switch unit ON. **SamplePro prompt: Flush**
4. Aiming handprobe into liquid waste container press white button to flush line. BEEP will sound to indicate flush is complete. Switch unit OFF.
5. Repeat steps 3 & 4 to ensure the SamplePro unit is flushed <u>twice</u> before each run.

IMPORTANT - The SamplePro must be flushed <u>TWICE</u> before each sample set run. (In order to flush the SamplePro Unit, it must be turned off and on again).

PHASE 1 EXTRACTION & PREPARATION OF THE SAMPLE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WEIGH SAMPLE

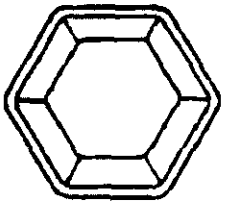


1a. Place unused weigh boat on pan balance.

1b. Press ON/MEMORY button on pan balance. Balance will beep and display 0.0.

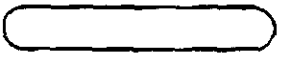
1c. Weigh out 10 ±0.1 grams of soil.

1d. If balance turns off prior to completing weighing, use empty weigh boat to retare, then continue.



Weigh Boat

Pan balance



Wooden spatula

EXTRACT PAHs

2a. Uncap extraction jar and place on flat surface. Without contacting liquid, puncture foil seal with ampule cracker or sharp object. Peel the remainder of the seal off extraction jar.

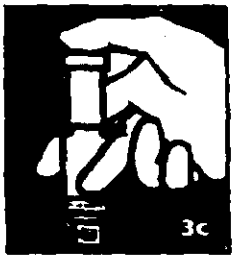
2b. Using wooden spatula, transfer 10 grams of soil from weigh boat into extraction jar.

2c. Recap extraction jar tightly and shake vigorously for one minute.

2d. Allow to settle for one minute. Repeat steps 1a - 2c for remaining three samples to be tested.

Extraction jar

FILTER SAMPLE



3a. Disassemble filtration plunger from filtration barrel.

3b. Insert bulb pipette into top (liquid) layer in extraction jar and draw up sample. Transfer **at least** ½ bulb capacity into filtration barrel. **Do not use more than one full bulb.**

3c. Press plunger firmly into barrel until adequate filtered sample is available (place on table and press if necessary).

Repeat steps 3a - 3c for each sample to be tested.

Filtration plunger

Filtration barrel

Bulb pipette

PHASE 2 DILUTION OF SAMPLES AND STANDARDS

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

The samples and standards are now in methanol. It is necessary to dilute the samples and standards in methanol and then into buffer. The SamplePro picks up the sample and dilutes it with a set amount of methanol. The SamplePro then delivers a portion of the sample to the conjugate which has been pre-diluted with buffer. The lowest PAH test levels requires one dilution. Higher test levels require up to three dilutions.

WORKSTATION SETUP

1) Find your lower test level on the chart and set up the necessary dilution tube in the purple columns.
2) Find your higher test level on the chart and set up the necessary dilution tubes in the green columns.
3) Uncap and load the conjugate tubes in to the red row.

Program	PAH SamplePro Test Levels (ppm)		
25	1	USE	1 set of empty dilution tubes in the BLUE Row
26	2		
27	5	USE	2 sets of empty dilution tubes in the BLUE and BLACK Rows
28	10		
29	20		
30	50		
31	100		
32	200	USE	3 sets of dilution tubes in the BLUE, BLACK, & YELLOW Rows
33	500		
34	1,000		

PHASE 2 DILUTION OF SAMPLES AND STANDARDS

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

CONJUGATE PREPARATION

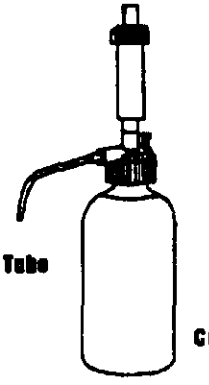
Before performing the SamplePro Dilutions, prefill the conjugate tubes with 1mL of buffer using the bottle-top dispenser.:

1) Attach the outlet tube to the body of the 1 mL bottle top dispenser.

2) Attach the dispenser to the bottle of the Conjugate Diluent.

3) Pump the dispenser 3 - 5 times into a waste container to clear air from the line.

4) Dispense one pump of Conjugate Diluent into each conjugate tube. (Red Row)

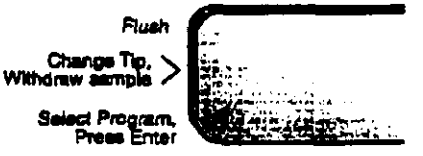


LOWER LEVEL TEST

1. Refer to chart to determine Program number for lower test level.

SamplePro prompt: Select Program, Press Enter

2. Use the + and - Arrow keys to set the SamplePro Program number. Press **ENTER.**
3. Working from left to right in workstation prepare conjugate and dilution tubes in all purple columns for all samples and lower level Standard using appropriate instructions on the following page.



HIGHER LEVEL TEST

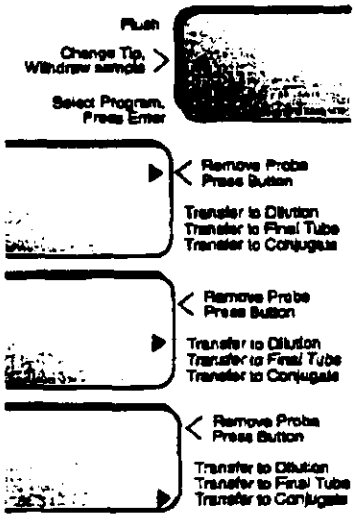
1. Refer to chart to determine Program number for higher test level.
2. **Press Change Program.** Use the + and - Arrow keys to set the SamplePro Program number. Press **ENTER.**
3. Working from left to right in workstation prepare conjugate and dilution tubes in all green columns for all samples and higher level Standard using appropriate instructions on the following page.

PHASE 2 DILUTION OF SAMPLES AND STANDARDS CONT'D

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

STEP D in each Dilution procedure must be completed **immediately** following STEP C within 1-2 seconds. **Remove tip from liquid** & press button a second time to avoid losing sample extract.

TO PREPARE BLUE DILUTION AND RED CONJUGATE TUBES



SamplePro prompt: Change tip, Withdraw sample

A. **Firmly** install tip on handprobe.
B. Place tip below liquid level of sample, but not touching bottom of container.
C. Press and release handprobe button once to withdraw sample. ***SHORT BEEP***

SamplePro prompt: Remove Probe, Press Button.

D. Remove handprobe from tube and press handprobe button again.

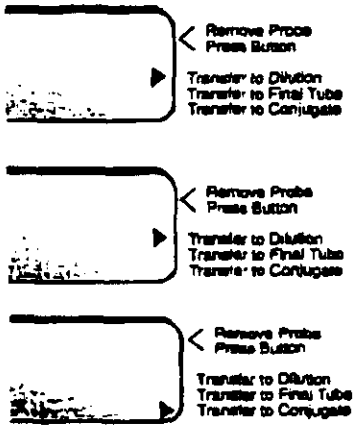
SamplePro prompt: Transfer to Dilution

E. Fully insert tip into dilution tube in BLUE row and press handprobe button. Do not remove tip before ***SHORT BEEP***.

SamplePro prompt: Transfer to Conjugate

F. Fully insert tip into conjugate tube in RED row and press handprobe button. ***SHORT BEEP, LONG BEEP***.
G. Eject tip into waste container.
H. Repeat steps A-G for each sample and Standard.

TO PREPARE BLACK & BLUE DILUTION TUBES & RED CONJUGATE TUBES



SamplePro prompt: Change Tip, Withdraw sample.

A. **Firmly** install tip on handprobe.
B. Place tip below liquid level of sample, but not touching bottom of container.
C. Press and release handprobe button once to withdraw sample.

SamplePro prompt: Remove probe, Press Button.

D. Remove handprobe from tube and press handprobe button again. ***SHORT BEEP***.

SamplePro prompt: Transfer to Dilution

E. Fully insert tip into dilution tube in BLACK row and press handprobe button. Do not remove tip before ***SHORT BEEP***.

SamplePro prompt: Transfer to Dilution

F. Fully insert tip into dilution tube in BLUE row and press handprobe button. Do not remove tip before ***SHORT BEEP***.

SamplePro prompt: Transfer to Conjugate

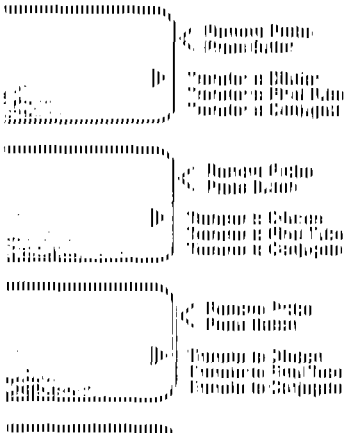
G. Fully insert tip into conjugate tube in RED row and press handprobe button. ***SHORT BEEP, LONG BEEP***.
H. Eject tip into waste container.
I. Repeat steps A - H for each sample and Standard.

PHASE 2 DILUTION OF SAMPLES AND STANDARDS

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

STEP D in each Dilution procedure must be completed immediately following STEP C within 1-2 seconds. Remove the frozen liquid & press button a second time to avoid losing sample extract.

TO PREPARE YELLOW, BLACK, BLUE DILUTION TUBES & RED CONJUGATE TUBES



SamplePro prompts: Change Tip, Withdraw sample.

A. Firmly install tip on handprobe.

B. Place tip below liquid level of sample, but not touching bottom of container.

C. Press and release handprobe button once to withdraw sample.

SamplePro prompts: Remove Probe, Press Button

D. Remove handprobe from tube and press handprobe button again. SECOND BEEP.

SamplePro prompts: Transfer to Dilution.

E. Fully insert tip into dilution tube in YELLOW row and press handprobe button. Do not remove tip before SECOND BEEP.

SamplePro prompts: Transfer to Dilution

F. Fully insert tip into dilution tube in BLACK row and press handprobe button. Do not remove tip before SECOND BEEP.

SamplePro prompts: Transfer to Dilution

G. Fully insert tip into dilution tube in BLUE row and press handprobe button. Do not remove tip before SECOND BEEP.

SamplePro prompts: Transfer to Conjugate

H. Fully insert tip into conjugate tube in RED row and press handprobe button. SECOND BEEP, LONG BEEP.

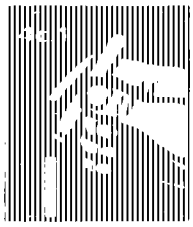
I. Eject tip into waste container.

J. Repeat steps A - H for each sample and Standard.

PHASE 3 THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

TRANSFER FROM CONJUGATE TUBE TO ANTIBODY COATED TUBE



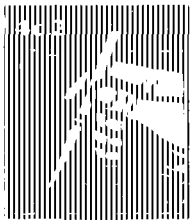
4a. Label the antibody coated tubes with sample identification and test level. [H(High), L(Low)]

4b. Set timer for 10 minutes.

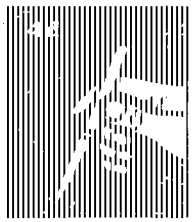
4c. Working left to right in the workstation:

1. Fit all antibody coated tubes firmly on top of all corresponding conjugate tubes.

2. Start timer and immediately invert all connected tube pairs so that the liquid is poured into the antibody coated tubes. Return the tube pairs to the appropriate workstation row making sure the larger (antibody coated) tube is on the bottom.



4d. Invert all tube pairs several more times making sure the pair is returned to the workstation with the larger (antibody coated) tube on the bottom.



4e. Disconnect and discard the smaller glass conjugate tubes. [It is not important to worry about drops of liquid adhering to lips of tubes].

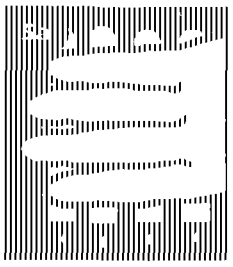
PHASE 3 THE IMMUNOASSAY

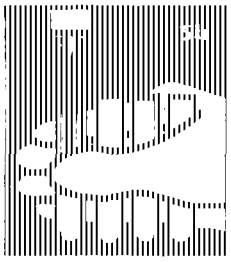
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING/ WASH PROCEDURE

- An accurate test requires a vigorous wash accomplished by directing a strong stream into the antibody coated tubes.
- The wash solution is a mild, dilute solution of detergent.
- *Wash all 12 tubes at once.*

WASH





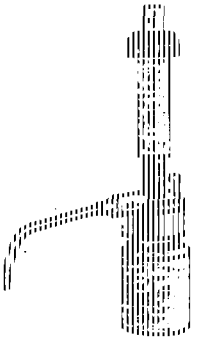
5a. After the 10 minute incubation, empty antibody coated tubes into liquid waste container.

5b. Wash antibody coated tubes by vigorously filling and emptying a total of 4 times.

5c. Tap antibody coated tubes upside down on paper towels to remove excess liquid. Residual foam in the tubes will not interfere with test results.

COLOR DEVELOPMENT

- Fully depress plunger button to dispense from *Stat-Matic* Dispenser.
- Add Solutions to tubes working from left to right in the workstation using the Stat-Matics.
  - 6a. Dispense Substrate A (yellow label) once in each tube.
  - 6b. *Set timer for 2½ minutes.*
  - 6c. Start timer and dispense Substrate B (green label) once in each tube. *Solution will turn begin to turn blue in some or all tubes.*
  - 6d. Gently shake tubes.
  - 6e. At 2½ minutes, dispense Stop (red label) once in each tube. *Solution will turn yellow in some or all tubes.*



Stat-Matic

Part # 30062 Rev. 4 Phil Bell SamplePro User's Guide AR306927 3/2/00

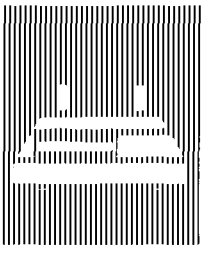
PHASE 4 INTERPRETATION OF RESULTS

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

PERFORM THESE FUNCTIONS FOR EACH TEST LEVEL

- Wipe outside of all antibody coated tubes before placing them in the photometer.

SELECT STANDARD

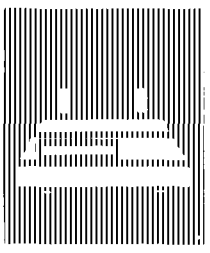


7a. Place the pair of Standard tubes for the lower test level in photometer.

7b. Switch tubes until the photometer reading is negative or zero. Record reading.
If reading is greater than - 0.5 in magnitude, results are outside QC limits. Retest the sample(s).

7c. Remove and discard tube in right well. The tube in the left well is the darker Standard.

MEASURE SAMPLE



8. Place first sample tube for the lower test level in right well of photometer and record reading.

If photometer reading is negative or zero, PAHs are present.

If photometer reading is positive, concentration of PAHs is less than the test level.

Continue and read the remaining sample tubes for the lower level.

Repeat the above process for the higher test level:
Select the darker of the two Standards and measure the sample tubes for the higher test level.

QUALITY CONTROL

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH TEST

Syrphon Description

Each PAH SamplePro System contains enough material to perform 24 complete tests, each at two test levels.

The PAH SamplePro System is divided into four phases. The instructions and risks should be reviewed before proceeding with each phase.

Information Manufacturer

If you need assistance or are missing necessary Test System materials, call toll free 1-800-343-RESC (7472).

Validation and Warranty Information

Product claims are based on validation studies carried out under controlled conditions. Data has been collected in accordance with valid statistical methods and the product has undergone quality control tests of each manufactured lot.

PAH-free soil that did not contain any PAHs at or above the test level were tested with the EnSys PAH SamplePro analytical method. The method correctly identified 95% of these samples. A sample that has developed less color than the standard is interpreted as positive. It contains PAH. A sample that has developed more color than the standard is interpreted as negative. It contains PAH at less than the selected test level.

The company does not guarantee that the results with the PAH SamplePro Soil Test System will always agree with instrument-based analytical laboratory methods. All analytical methods, both field and laboratory, need to be subject to the appropriate quality control procedures.

EnSys, Inc. warrants that this product conforms to the descriptions contained herein. No other warranties, whether expressed or implied, including warranties of merchantability and of fitness for a particular purpose shall apply to this product.

EnSys, Inc. neither assumes nor authorizes any representative or other person to assume for it any obligation or liability other than such as is expressly set forth herein.

Under no circumstances shall EnSys, Inc. be liable for incidental or consequential damages resulting from the use or handling of this product.

Storage Of Reagents

Standards, Samples, and color-change reagents are sealed in test tubes, coated with a chemical specific to PAHs. The concentration of PAHs in an unknown Sample is determined by comparing its color intensity with that of a Standard.

Note: PAH concentration is inversely proportional to color intensity; the lighter the color development of the sample, the higher the concentration of PAH.

Quality Control

Special precautions for maintaining quality control:

- Do not use reagents or test tubes from one Kit with reagents or test tubes from another Kit.
- Do not use the Test System after its expiration date.
- Do not manage the test using more than 12 antibody coated tubes (4 of which are Standards) at the same time.
- Do not exceed incubation periods prescribed by the specific steps.
- Always wash the number of times indicated in this guide.
- Use a method which is appropriate for your specific regulatory situation to confirm results.

Precaution and Handling Procedures

- Wear protective gloves and eyewear.
- Store kit at room temperature and out of direct sunlight (from 60°F).
- Keep abandoned pouch (containing unused antibody coated tubes) sealed when not in use.
- If Stop Solution, PAH Standard or Equal from the extraction jar comes into contact with eyes, wash thoroughly with cold water and seek immediate medical attention.
- Operate test at temperatures between 40°F/4°C and 90°F/32°C.

ON-SITE QUALITY CONTROL/QUALITY ASSURANCE RECOMMENDATIONS

ENVIROGARD™ TEST SYSTEM

Please read the following before proceeding with field testing.

SAMPLING

The result of your screening test is only as valid as the sample that was analyzed. Samples should be homogenized thoroughly to ensure that the 10 grams you remove for field testing is representative of the sample as a whole. All other applicable sample handling procedures should be followed as well.

PROOF OF REPEATED SAMPLES

Carefully follow the instructions in the User's Guide included with every test kit. This is the key element in obtaining accurate results. In addition, store your unused test kits at room temperature and do not use them past their expiration date (see label on each test kit).

INTERNAL TEST QC

Two standards are analyzed with each sample to provide internal test system quality control. With both standards inserted in the photometer, a valid test is indicated when the magnitude of the displayed number (irrespective of the sign, + or -) is less than the value given in the User's Guide. Test runs resulting in a greater number should be repeated to ensure valid conclusions.

QA/QC

The validity of field test results can be substantially enhanced by employing a modest, but effective QA/QC plan. EnSys recommends that you structure your QA/QC plan with the elements detailed below. These have been developed based on the data quality principles established by the U.S. Environmental Protection Agency.

A. Sample Documentation
   1. Location, depth
   2. Time and date of collection and field analysis

B. Field analysis documentation - provide raw data, calibration, any calculations, and final results of field analysis for all samples screened (including QC samples)

C. Method calibration - this is an integral part of EnSys ELISA™ measurement; a duplicate calibration is performed for each set of samples tested (see the instructions in the User's Guide)

D. Method blank - analyze one blank from the extraction jar.

E. Site-specific matrix background field analysis - collect and field analyze uncontaminated sample from nice creek to document matrix effect.

F. Duplicate sample field analysis - field analyze duplicate sample to document method repeatability; at least one of every 20 samples should be analyzed in duplicate

G. Confirmation of field analysis - provide confirmation of the quantication of the analyte via an EPA-approved method different from the field method on at least 10% of the samples; choose at least two representative samples testing above the action level; provide chain of custody and documentation such as gas chromatograms, mass spectra, etc.

H. Performance evaluation sample field analysis (optional, but strongly recommended) - field analyze performance evaluation sample daily to document method/operator performance

I. Matrix spike field analysis (optional) - field analyze matrix spike to document matrix effect on analyte measurement

FURTHER QUESTIONS?

EnSys technical support personnel are always prepared to discuss your quality needs to help you meet your data quality objectives.

PAH SamplePro
Abbreviated Procedure

1	Prepare PAH standards, wash, substrates and extraction jars. Attach methanol to SamplePro turn unit on, and flush twice before each sample set run.
2	Weigh out 10 grams of sample and transfer it to extraction jar. Shake extraction jar for 1 minute. Filter the extracted sample.
3	Set up the workstation and label tubes. Using a 1mL Statmatic, dilute all conjugate tubes. Select your LOW program. Dilute all samples and standards in the purple columns.
4	Select your HIGH program. Dilute all samples and standards in the green columns.
5	Set timer for 10 minutes. Fit antibody coated tubes (AbCT) on corresponding final tubes (red row). Working from left to right, invert all tube pairs and return to workstation. Invert each pair several more times.
6	After 10 minutes, IMMEDIATELY: Wash AbCT vigorously 4 times.
7	Working left to right, dispense Sub A (yellow) once in each AbCT. Set timer for 2½ minutes. Start timer and dispense B (green) once in each AbCT, shake. After 2½ minutes, dispense Stop (red) once in each AbCT.
8	Read tubes in photometer.

Data Sheet for PAH RISC® SamplePro Test

Operator: _____ Date: _____ Location: _____

	Low Test Level			High Test Level			
Sample ID	ΔOD Standards	OD sample ____ ppm	Interpretation	ΔOD Standards	OD sample ____ ppm	Interpretation	Comments

PROJECT TECHNICAL GUIDANCE NUMBER 18

SLUG TESTING OF MONITORING WELLS

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4.0	SLUG TEST DATA ANALYSIS	18-4

AR308933

1.0 PURPOSE AND SCOPE

The performance of slug test will permit the estimation of hydraulic variables such as permeability and transmissivity. The following is a summary of the procedures for performing slug tests.

2.0 SLUG TESTING PROCEDURES

2.1 EQUIPMENT LIST

Field equipment to be used for the slug testing activities includes:

- Electronic water level indicator
- Field books
- Slug of known volume for 2-inch-diameter wells
- Pressure transducer (10-50 psig)
- Data logger (Hermit) and Operation Manual (Hermit)
- Weighted measuring tap (100 feet)
- Nylon rope
- Keys to well locks
- Paper towels (organic and lint free)
- Stainless-steel knife
- Camera and film
- Waterproof and permanent marking pens
- Clock
- Appropriate health and safety equipment as specified in the SSHP

2.2 PRETEST DATA RECORDING

Pretest data will be collected in accordance with the following procedures:

- The well casing will be approached for upwind.

- The well cap will be unlocked and removed.

- Before beginning the test, the following information will be recorded:

  - Monitoring well identification number or letter

  - Location and elevation of the reference point from which water depth measurements are made (top of well casing)

  - Elevation of groundwater with respect to the reference point

  - Date and time of test

  - Well depth, screen length, riser pipe radius, well screen radius, and radius of gravel pack plus the well screen depth and radius (from well construction logs)

  - Aquifer or groundwater zone (lithology) being tested (from the well construction logs)

  - Volume of solid cylinder (slug)

  - Type of measuring device used

  - Names of personnel conducting test

2.3 TESTING PROCEDURES

Slug testing will be conducted in accordance with the following procedures.

1. The static water level in the well and total depth of the well will be determined to the nearest 0.01 foot. The appropriate pressure transducer will be inserted and the Hermit Data Logger activated. The water level recording interval will be programmed on the data logger to the logarithmic mode.

2. The slug of known volume will be instantaneously introduced to (or removed from) the well, taking care to fully submerge (or withdraw) the slug. It is important to remove or add the volume as quickly as possible because the analysis assumes an "instantaneous" change in volume in the well.

3. With the moment (time) of volume addition or removal assigned time zero, the depth of water will be measured and recorded. The pressure transducer will monitor weather level change. Care must be taken to ensure that the transducer is submerged throughout the test. Once the test has started, the transducer elevation must not be changed.

4. The test will continue until the water level has stabilized or 90 percent of the excess head has dissipated.

5. The slug testing equipment will be removed and wrapped for decontamination.

6. The well will be locked upon completion.

7. Gloves, aluminum foil/visquene will be disposed of as appropriate.

8. The slug will be decontaminated before the next slug test.

3.0 DECONTAMINATION

All slug testing equipment will be decontaminated prior to use. The slug will be decontaminated with:

- Soap (Alconox) and potable water wash and scrub brush
- Potable water rinse
- Nitric acid
- Distilled water rinse
- Isopropanol

AR308936

- Distilled water rinse
- Air drying of the equipment

All decontaminated equipment will be stored on clean aluminum foil sheeting or visquene, and the equipment will not be allowed to touch the ground adjacent to the well.

4.0 SLUG TEST DATA ANALYSIS

Slug test data will be evaluated using the method of Bouwer and Rice (1976) and Bouwer (1989). The Bouwer and Rice method is applicable to unconfined and confined aquifers and considers the effect of partial penetration, the radius of the filter pack, and the effective radius of influence of the test.

AR308937

PROJECT TECHNICAL GUIDANCE NUMBER 19

SOFT DIG LOCATING

TABLE OF CONTENTS

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1.0 SUMMARY

The following is a summary of the procedures to be used during the investigation for potential underground storage tanks (USTs). Based on the results of the Phase I geophysical survey, areas have been identified which may contain USTs. The following procedure will be used to provide additional information related to the investigation of the areas.

1. Prior to implementing Soft Dig Technology, additional geophysics will be performed to aid in locating the USTs by the subcontractor.

2. A 50 foot triangular grid will be established in the area of the anomalous geophysical readings and referenced with GPS.

3. Soft Dig technology will be used at the nodes within areas identified by the Phase I and Phase II geophysics.

    a. Soft Dig technology method will investigate the subsurface by using non-destructive vacuum excavation. Soil will be loosened by using a high pressure air lance and removed by vacuum within a maximum 10" x 10" excavation. All soils removed will be contained and handled according to the WCC Site Waste Management Plan. All work will be completed following the WCC Site Health and Safety Plan.

4. If a UST is encountered, additional Soft Dig excavations will be completed to define the orientation and size of the tank.

5. The contents of the UST will then be visually evaluated using the procedures in the PTG for Investigation of USTs.

6. Additional Soft Dig excavations will be completed at all node points within the area, to investigate the potential for multiple USTs.

7. Excavations will be backfilled with a clean granular material to grade.

AR308940

PROJECT TECHNICAL GUIDANCE NUMBER 20

PERFORMANCE OF BAIL DOWN TEST

Selected monitoring wells with DNAPL will be evaluated for the rate of DNAPL recharge by using the bail down test. The following is a summary of the procedures for performing the bail down test:

1. Measure the thickness of the DNAPL and the depth to water within the selected well(s) with an oil/water interface probe. Record the thickness and calculate the initial volume of DNAPL within the monitoring well casing.

2. Remove the DNAPL within the monitoring well casing utilizing a peristaltic pump with new silicone tubing, recording the time at which DNAPL extraction was initiated and completed, and the volume removed during each step of the process.

3. Measure and record the thickness of the DNAPL within the monitoring well for a maximum of 24 hours, or until 95 percent of the calculated initial volume of DNAPL has entered the monitoring well. The following measurement schedule is provided as general guidance for the frequency of data collection, but are subject to revision based on the actual rate of DNAPL recharge rate is low, the data collection frequency could be decreased; if the rate is high the frequency should be increased):

   - Every 10 minutes for the first hour
   - Every 30 minutes for the second and third hours
   - Every 60 minutes for the fifth and sixth hours
   - Every 6 hours, or until 95 percent DNAPL recovery, or 24 hours

4. Calculate and plot the rate of DNAPL recharge to the well following the performance of the bail down test.

All work will proceed following the Site specific Health and Safety and Waste Management Plans.

AR308941

Appendix C

Hazleton
Environmental
Services, Inc.

525 SCIENCE DRIVE • MADISON, WISCONSIN 53711

HES, Inc.

April 21, 1995

Scott Laird
Woodward-Clyde Consultants
5120 Butler Pike
Plymouth Meeting, PA 19462

Dear Mr. Laird:

Matt Marks asked that I forward the attached items to you. I hope they meet your needs.

Thank you for your interest in HES, Inc. If you need any more information or have any other questions, please contact Matt at (608) 232-3336 or me at (608) 232-3330.

Sincerely,

James A. Nettum
Vice President
Business Development and Administration

Enclosure

Hazleton
Environmental
Services, Inc.
525 SCIENCE DRIVE • MADISON, WISCONSIN 53711

HES, INC.

QUALITY ASSURANCE PLAN

UNCONTROLLED

JANUARY 1, 1995

Phone 608-232-3300

AR308944

Fax 608-233-0502

APPROVAL

The Quality Assurance Program described in this Quality Assurance Plan has the support of the management at HES, Inc.

Signature: Date:

Amy L. Austin 1/5/95

Amy L. Austin
Manager
Quality Assurance

David C. Hills 1-5-95

David C. Hills
Vice President
Laboratory Operations

Emilio Sturino 1-5-95

Emilio Sturino
President

The QA Plan will be distributed to all managers and supervisors. They are responsible for implementing the plan. All HES employees will be required to read this QA Plan on a yearly basis and to record this reading in the training files located in QAU.

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INTRODUCTION

Hazleton Environmental Services (HES,Inc), is an employee owned scientific contract testing and research laboratory with diverse testing capabilities in the Analytical Chemistry field designed to support government and industrial programs. With a staff of more than 60 scientists and support personnel, the staff of HES, located in Madison, Wisconsin, have more than 20 years of experience in method development, problem solving, and high volume analyses. As a result of this experience, sophisticated systems for sample handling, analysis, and reporting are already in place. The following document details the specific capabilities and extensive experience in supporting environmental monitoring programs.

HES maintains an extensive inventory of state-of-the-art instrumentation complemented by both computerized laboratory automation systems (LAS) to acquire and process analytical data and a computerized laboratory information management system (LIMS) to account for samples, assays, analytical data, results, and management functions.

The integrity of our data is ensured by our Quality Assurance Unit (QAU) that acts independently of the laboratory to monitor laboratory operations through periodic audits of analytical data or facilities for compliance with Standard Operating Procedures (SOPs) and project requirements.

HES conducts an average of about 3,300 separate assays per month. Sample matrices are very diverse, and many well established analytical procedures using sophisticated instrumentation are employed to detect and quantify analytes at residue, formulation, or naturally occurring levels. The organization is dedicated to providing rapid and accurate results.

QUALITY ASSURANCE POLICY AND OBJECTIVES

HES is committed to complying with the Good Laboratory Practice (GLP) Regulations for Nonclinical Laboratory Studies. Effective June 20, 1979, this regulation outlines the procedures which **must be followed** when conducting a non-clinical study which is intended to support the safety of an Food and Drug Agency (FDA) - regulated product. Copies of the regulation are available in the Quality Assurance Unit (QAU).

Many of the overall procedures required by the regulation have been incorporated into the overall Quality Assurance/Quality Control (QA/QC) program for HES, but because of some important differences the term "GLP" is not used for a particular study or project, unless all requirements as stated in the regulations have been met.

The specific objectives of the QA/QC Program are to:

- Ensure that all procedures are documented, including any changes in administrative and/or technical procedures.
- Ensure that all analytical procedures are conducted according to sound scientific principles and have been validated.
- Monitor the performance of HES by a systematic inspection program and provide for corrective action as necessary.
- Collaborate with other laboratories in establishing quality levels, as appropriate.
- Ensure that all data are properly recorded and archived.

This Program covers both the administrative system and the use of statistical techniques to ensure the quality of scientific data. It does not cover specific methodology since this information is detailed and available in our documentation of Method Procedures (MPs) and Standard Operating Procedures (SOPs).

QUALITY ASSURANCE MANAGEMENT

HES' comprehensive QA/QC program is coordinated by the Quality Assurance Unit (QAU) to ensure the integrity, validity and usability of the data generated by our laboratories. This unit is independent of all departments and reports directly to the president of HES.

The responsibilities of the QAU include but are not limited to the following:

- Monitoring compliance with established company procedures, government regulations (i.e., Good Laboratory Practices when applicable), client specifications, and general sound scientific principles.
- Approving and distributing the Quality Assurance Plan.
- Approving and distributing all SOPs and MPs. The unit also maintains a historical file for outdated procedures.
- Monitoring the QA/QC Program through in-progress inspections and data audits.
- Routine review and validation of project data requiring CLP or CLP-type data packages as well as maintaining case files for those projects .
- Notifying HES management of quality problems or concerns.
- Maintaining the master schedules of CERCLA and RCRA in-house projects.
- Maintaining the archives.

Inspections

Monitoring of the QA/QC Program by the QAU is done through the inspection program. There are two kinds of inspections: project specific inspection, and general departmental inspection.

- General inspections are of an area without regard to any specific project(s) being conducted. Inspections are conducted using established company procedures, government regulations, contractual agreements, and HES SOPs and MPs as the references.

- Project specific inspections, if required, are scheduled on a master calendar, approximately 1 month in advance. This procedure ensures that critical phases of a project as defined by the QAU or the QAPP, are inspected at least once every 3 months. For studies lasting less than 1 month, the phases are randomly selected for inspection.

The inspection process involves ensuring that the protocol or QAPP and all applicable SOPs and MPs are being followed. Personnel involved in the project are noted. Any deviations found are first reported to the project personnel for their immediate attention, are recorded and filed in the appropriate study file, and are reported to the Project Manager/Department Manager for his or her response.

Data Audits

The audit function of the QAU is an after-the-fact review of laboratory data. The audit may be of raw data previously generated by the laboratory, or a review of tabulated data in a final report. In the audit of raw data, the QA inspector checks to ensure that the recorded data are in conformance with established HES standards of data recording and record keeping. Checks include such items as labeling, supervisory approval(s), support data such as chromatograms, random calculation checks, and operating procedure and instrument references. In addition to the above, a final report is audited to ensure that the required data have been included in the report to determine if the narrative portion of the report is clear and that the data (including statistical treatment of data) support the statements contained in the narrative.

Any problems which are identified by the QAU during either the in-progress inspections or the data audits are brought to the attention of the Project Manager/Department Manager in writing. The QAU requires that management respond to the QAU observations in writing by the date specified in the inspection report. Management can either affirm the observation, delineate the corrective action taken, and/or describe the procedures implemented to ensure that the problem will not recur. If laboratory management does not agree with the observation, it must clarify the issue with the QAU to the satisfaction of the inspector.

A QAU report is submitted to management monthly. This includes a summary of all inspections, the response(s) to each inspection report, and an evaluation of QA/QC problems encountered during the last month.

Documentation of Procedures

The QA/QC Program is governed by a library of documents that cover the complete range of activities required of a contract laboratory. All procedures are documented as either Standard Operating Procedures (SOPs) or Method Procedures (MPs): These are written by the technical staff and submitted to the QAU which edits and controls the distribution and/or revision of all methods and procedures. The QAU maintains the central file which includes an outdated file for documents no longer in use.

Definition of Procedures

Standard Operating Procedures. There are three types of SOPs: Departmental, Technical, and Instrument. Departmental operating procedures are of a general and widely applicable nature such as data recording. Technical operating procedures cover specific technical matters that are also general in their applicability, such as reagent preparation. Instrument operating procedures detail the operation, calibration and maintenance of instruments and equipment. Each instrument must have an instrument operating procedure in the immediate vicinity. All instruments used to collect and/or generate data must be calibrated prior to use either on a scheduled or as used basis.

Method Procedures. Method procedures are more detailed than SOPs and are usually written for chemical assays. These procedures include the following sections:

- Scope - the type of sample the assay is applicable to.
- Principle
- Precision and Accuracy - HES data which includes the average percent recovery expected for a particular matrix and the percent relative standard deviation (%RSD).
- Method Detection Limits
- References
- Approved By and Reviewed By
- Safety Precautions
- Fundamental Equations, if any
- Interferences
- QA/QC - this section outlines the specific quality control measures to be performed and defines the frequency at which they must be performed.
- Apparatus
- Reagents
- Procedure - in a detailed step by step outline.
- Calculations

All routine work conducted by HES must have a written, approved method procedure. The use of references alone is not generally acceptable.

PROCEDURE IMPLEMENTATION

Laboratory management is responsible for the implementation of and adherence to SOPs and MPs. Personnel within each of the departments are required to document their familiarity and understanding of each of the relevant procedures before beginning work, and further are required to review these procedures on a yearly basis. This documentation is placed in the employee's training file in the QAU Office along with the employee's current curriculum vitae.

If it becomes necessary for laboratory personnel to change a particular procedure one of two options is available. For minor changes to a standard procedure required because of problems encountered with a specific sample or study, the laboratory analyst may request from his/her supervisor a deviation from procedure. This deviation must be documented in the raw data. These changes are usually one - time occurrences (modifications) specific to the samples or study. When it becomes necessary to implement a permanent change to a procedure because of problems or changes in approach (instrumentation change, extraction modifications, etc.), the laboratory supervisor will either issue an amendment to the study protocol or request an update of an existing operating procedure. Requests for updates are made in writing and submitted to the QAU. A draft of the revised procedure is returned by the QAU to laboratory management for the appropriate review and approval. Once the laboratory has approved the revision, the operating procedure will be returned to the QAU for approval and subsequent update and distribution.

When the new procedure is distributed, the QAU will ensure that the outdated procedures currently within the laboratory area are returned to the QAU for proper disposal. The original signed procedures (both current and outdated) are kept on file in the QAU office. All laboratory copies of procedures are marked as "Official Copies" for the HES QA/QC Program. The procedures are further labeled with the effective date and the date of the procedure being replaced.

PROJECT PERSONNEL

HES' project management system is specifically designed to accommodate the diverse needs of projects involving many different analytes and matrices. The system is based a project team approach, in which a project manager is assigned to a core group of scientists, each of whom, is a specialist in a particular discipline. The project manager functions as the key communication link between the client and the laboratory and fulfills the following functions:

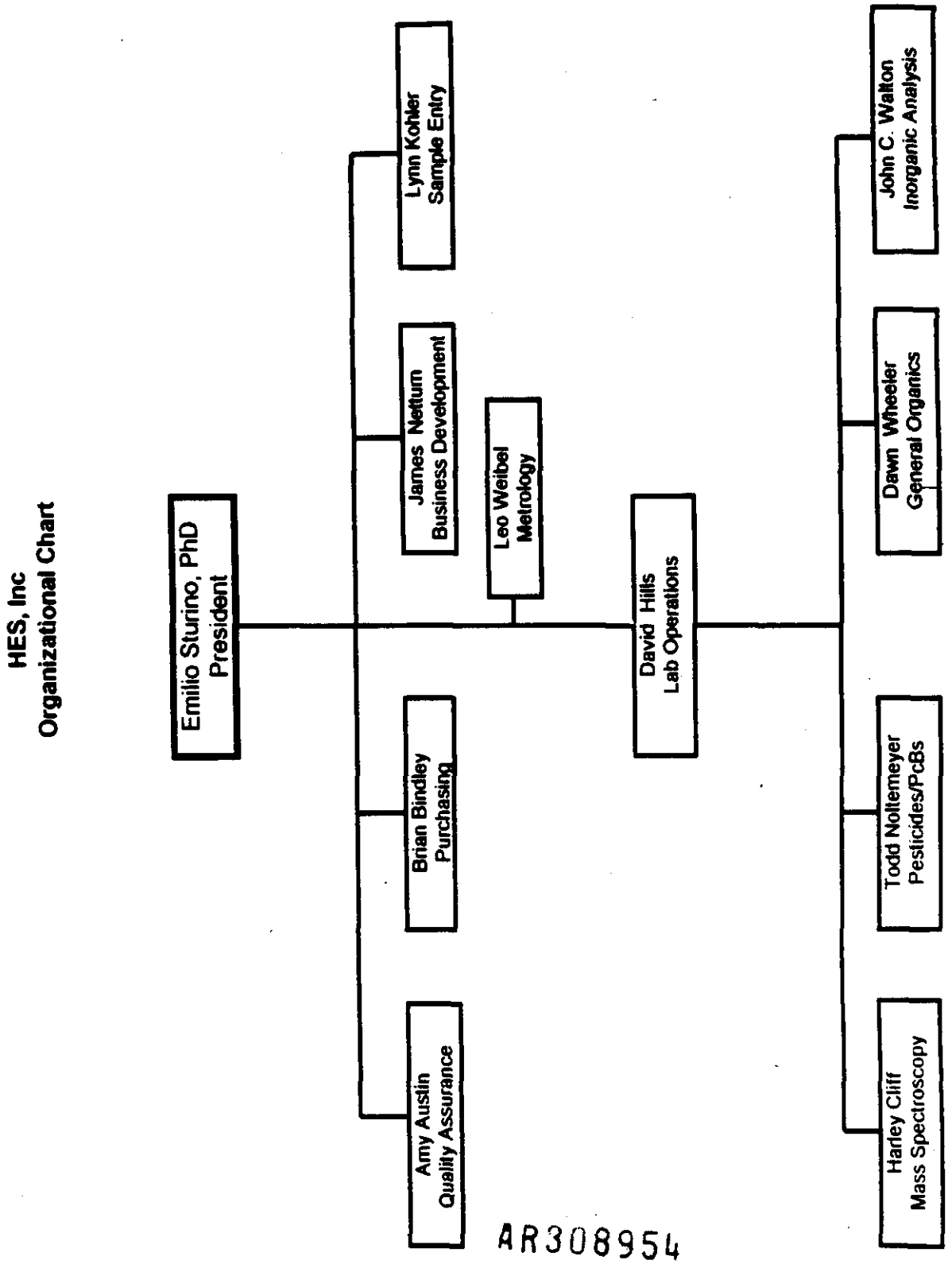
- Assigns work to appropriate scientists
- Sets up and monitors analytical tasks and quality control procedures
- Reviews data validation operations and is responsible for the final reports
- Provides technical consultation to the scientific staff
- Monitors workloads and ensures availability of resources through the support of upper management
- Maintains frequent communication with the client concerning project status, and problems and solutions

Each scientist who reports to the project manager has available other scientists and technicians who can be dedicated to project performance. Instrument and laboratory space also can be assigned so that other analyses will not interfere with the project. HES maintains an extensive inventory of equipment, and a staff that is cross-trained and flexible. Thus, project needs are always addressed as work loads vary.

Figure 1 shows HES's organization and is followed be a functional description of each team members's area of expertise and responsibilities.

Figure 1.

ORGANIZATION and REPORTING RELATIONSHIPS



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Key Personnel

President

Emilio Sturino, PhD. Dr. Sturino has been President of HES Inc since its incorporation in 1992. Prior to 1992, Dr. Sturino was Director of Environmental Chemistry at Hazleton Wisconsin, Inc. for eleven years, providing scientific direction and growth of the division. Previously, he served for eight years as Chief of the Organic Laboratory Section of the Central Regional Laboratory for Region V of the U.S. EPA.

Business Development & Administration Manager

James Nettum, BS-Chemistry, MBA. Mr. Nettum is currently Vice President of HES Business Development. Mr. Nettum is in charge of Business Development and also coordinates the company's employee benefits and business insurance. Mr. Nettum has more than 15 years of experience in analytical chemistry.

Laboratory Operations Manager

David C. Hills, BS. Mr. Hills is currently Vice President of HES Laboratory Operations. Scientific staff reporting to Mr. Hills are involved in the analysis of both organic and inorganic contaminants in a wide range of environmental matrices. Mr. Hills has 20 years of experience in the environmental chemistry field.

Quality Assurance Manager

Amy Austin BS. Ms. Austin is supervisor of HES' Quality Assurance Unit (QAU). Ms. Austin's responsibilities include performing periodic audits of the various Chemistry Sections of HES, overseeing and monitoring the in-house Performance Evaluation Program and supervising the Data Validation and Project Documentation Group. Ms. Austin reports directly to the President and General Manager of HES.

Ms. Austin's staff is responsible for routine data validation, report preparation, as well as the maintenance and purging of project files. Ms. Austin has over 5 years experience in performing data review and validation.

Mass Spectrometry Laboratory Supervisor

Harley Cliff, BS. Mr. Cliff is supervisor of HES's Mass Spectrometry Department and as such is responsible for the supervision, scheduling and data review of all samples to be analyzed by GCMS techniques, including all sample extractions and cleanups required for semivolatile organics.

Mr. Cliff has over 20 years of experience in the isolation and analysis of trace organic residues in a wide range of sample matrices utilizing GC, HPLC, and GCMS instrumentation. Mr. Cliff's background in GCMS spans over 15 years and includes direct experience with both electron impact and chemical ionization modes, selected ion monitoring and isotope dilution.

Pesticide Residue Laboratory Supervisor

Tod Noltemeyer, BS. Mr. Noltemeyer is supervisor of HES's Pesticide Residue Department and as such is responsible for the supervision, scheduling and data review of all samples analyzed for the organochlorine and organophosphate pesticides, phenoxy acid and triazine herbicides, and PCBs, including sample extractions and cleanups required for those samples.

Mr. Noltemeyer has over 8 years of experience with the isolation and analysis of a wide range of pesticides, herbicides, insecticides, PCBs and PBBs from a wide range of matrices, including direct experience with the use of EPA CLP methodologies. He is experienced with both GC and HPLC instrumentation and a wide range of detector systems.

General Organics Laboratory Supervisor

Dawn Wheeler, BS. Ms. Wheeler is supervisor of HES's General Organics Department and as such is responsible for the supervision, scheduling and data review of all samples analyzed for the Leaking Underground Storage (LUST) Program, Volatiles by GC, Polynuclear Aromatic Hydrocarbons (PAH) by HPLC, and Carbamate Pesticides, including sample extractions and cleanups required for those samples.

Ms. Wheeler has over 5 years of experience with the isolation and analysis of pesticides, PCBs, total petroleum hydrocarbons, Volatiles by GC, PAHs, and carbamates from a wide range of matrices, including direct experience with the use of EPA CLP methodologies. She is experienced with both GC and HPLC instrumentation and a variety of detector systems.

Inorganic Laboratory Supervisor

John Walton, MS. Mr. Walton is supervisor of HES's Inorganic Department and as such is responsible for the supervision, scheduling and data review of all samples analyzed for Inductively Coupled Plasma Emission and Atomic Spectroscopy, and wet chemistry techniques, including sample digestions required for those samples.

Mr. Walton has over 20 years of experience in the field of inorganic chemistry and inorganic methodologies. He is experienced with both Atomic Absorption and ICP instrumentation.

Metrology

Leo Weibel, BA. Mr. Weibel is a Research Associate with HES and acts as Metrology for the laboratory. Mr. Weibel has over 20 years of experience in repair and maintenance of laboratory instrumentation, and has provided education to the instrument operators on the theory, operation and maintenance of their instruments.

Lab Information Systems Manager

Curtiss Nelson. Mr. Nelson is a Research Assistant with HES and acts as the system manager for the laboratory's LAS system. Mr. Nelson has over 5 year experience in managing Laboratory data systems and provides formal training on those systems (Basic and advanced LAS, and use of Formaster Software).

Sample Entry/Custodian

Lynn Kohler. Ms. Kohler is responsible for the sample receipt, entry and custody of all samples received in our laboratory. Ms. Kohler is thoroughly familiar with those procedures as required for EPA's Contract Laboratory Program and has acted in a similar capacity for over 5 years.

LABORATORY FACILITIES AND SUPPORT GROUPS

Facilities

The HES analytical laboratories cover approximately 40,000 square feet of working space. They are designed to handle all types of chemical analyses and provide a safe and functional working environment. Separate rooms are provided for sample extraction and preparation. Areas for hazardous activities are isolated from the primary laboratory. Floor plans for the laboratories are presented in Figure 2.

Security

HES provides scientific services to many clients and must maintain security of facilities and data. Facilities security is maintained through limited-access buildings. Employees are required to wear identification badges at all times within the facilities, and visitors must sign in and are also required to wear a special badge and be escorted by a HES employee at all times. Security of data is maintained by the password/level of authority system that is part of the LIMS and an SOP defined data archiving system. Sample security is maintained through use of chain-of-custody procedures as defined by SOPs.

Sample and Data Handling Systems

The moment a sample arrives at HES it becomes part of a system that covers tracking, preparation, storage, analysis, and reporting. The key elements of this system have been in place for many years, allowing HES to be a highly responsive and efficient laboratory. These key elements are:

- A dedicated Sample Entry Group
- LIMS
- Flexible data reporting capabilities (hard copy or electronic)
- Formal chain-of-custody procedures
- A specialized Client Service Center

Health and Safety

HES' Health and Safety Officer makes regular inspections to ensure compliance with Occupational Safety and Health Administration regulations. Goggles, safety glasses, respirators, gloves, lab coats, and other protective clothing are provided to individuals working in all laboratory areas. All laboratory environments have extensive availability of first aid kits, eyewash stations, spill control kits, and fire extinguishers. Fume hoods are monitored on a regular basis to ensure they meet the appropriate guidelines

established by the American Conference of Governmental Industrial Hygienists for their intended use.

In addition, HES' Health and Safety Officer provides a comprehensive safety training program that includes safety seminars, equipment handling sessions, and a safety training manual. The program fosters a working knowledge and awareness of safety. The handling of carcinogenic and toxic materials is covered in training sessions and is emphasized in particular laboratory applications. HES complies with and follows the Department of Health, Education, and Welfare "Guidelines for the Laboratory Use of Chemical Substances Posing a Potential Occupational Carcinogenic Risk", (June 5, 1979).

Sample and Waste Disposal

HES' disposal procedures for chemical wastes are in accordance with federal, state and local regulations.

All hazardous wastes and byproducts of the analytical chemistry procedures are disposed of on a quarterly basis. The Health and Safety Officer monitors the hazardous waste program by ensuring the collecting, packaging, labeling, sampling, storage, and record keeping of all hazardous wastes. The Health and Safety Officer then ensures that it is transported and disposed of via an EPA-licensed hazardous waste hauler and incinerator facility, according to state and federal regulatory requirements.

Training

Training is provided for new employees and as continuing education for all employees at HES. On-the-job training of employees will be done by the supervisor or designee and will be conducted as the individual assists in performing specific duties. When a trainee is judged proficient in a given function, a training sheet describing on-the-job training is filled out and signed by the person responsible for the training and approved by the supervisor.

Ongoing training in technical and general skills for all employees will be conducted. Department staff, as well as outside companies will be utilized.

Acknowledgement of exposure to SOPs and Method Procedures is also used to document the continued training of personnel. Each HES employee is required to read on an annual basis the general SOPs (OP-GENs) and all SOPs and Method Procedures applicable to that employee.

Purchasing, Receiving and Acceptance of Supplies and Consumables

HES's policy, describing the requirements and guidelines for purchasing materials, equipment, repairs, or services, is outlined in the Policies and Procedures Manual under "Purchasing Procedures" (FS-007).

A purchase requisition is filled out and approved before placing an order with a vendor. The completed purchase requisition contains a detailed description of the material to be purchased including the vendor name and catalog number of each item to be purchased. If an item can be purchased at a cost savings from an equivalent vendor, Purchasing has the option of ordering that item from an alternate vendor. If for any reason, the laboratory requestor can not accept or use a particular item from an alternate supplier, the purchase requisition is specifically marked to "Accept no substitute".

The purchase requisition is signed by the department manager or authorized department personnel. Final approval is required on the original purchase order by the Purchasing manager or authorized buyer to validate the purchase order number.

When a package is delivered by any freight carrier, the outside carton is inspected by the receiving clerk for gross visual damage before the bill of lading is signed and dated. If damage is observed, its nature and extent (e.g.,"corner crushed","carton is wet on bottom") is indicated on the bill of lading. The delivery is also checked to ensure that the number of pieces ordered is received. The packing list is removed and the contents of the package are verified against the list by circling all received items in red. The packing slip is initialed and dated and forwarded to accounts payable.

If discrepancies or problems are documented by the receiving clerk or by the requestor, a discrepancy report is prepared and forwarded to Purchasing. The discrepancy report summarizes the nature of the problem and includes the purchase order number and the particular item involved.

Upon notification of a problem involving the receipt of goods on a purchase order, the problem is resolved with the vendor by Purchasing and the necessary paperwork to meet the needs of the laboratory is prepared.

Upon receipt, (as described in OP-GEN.8) all reagent, and standard reference material storage containers are to contain the following information:

Identity
Concentration/Purity
Storage Requirements
Expiration Date

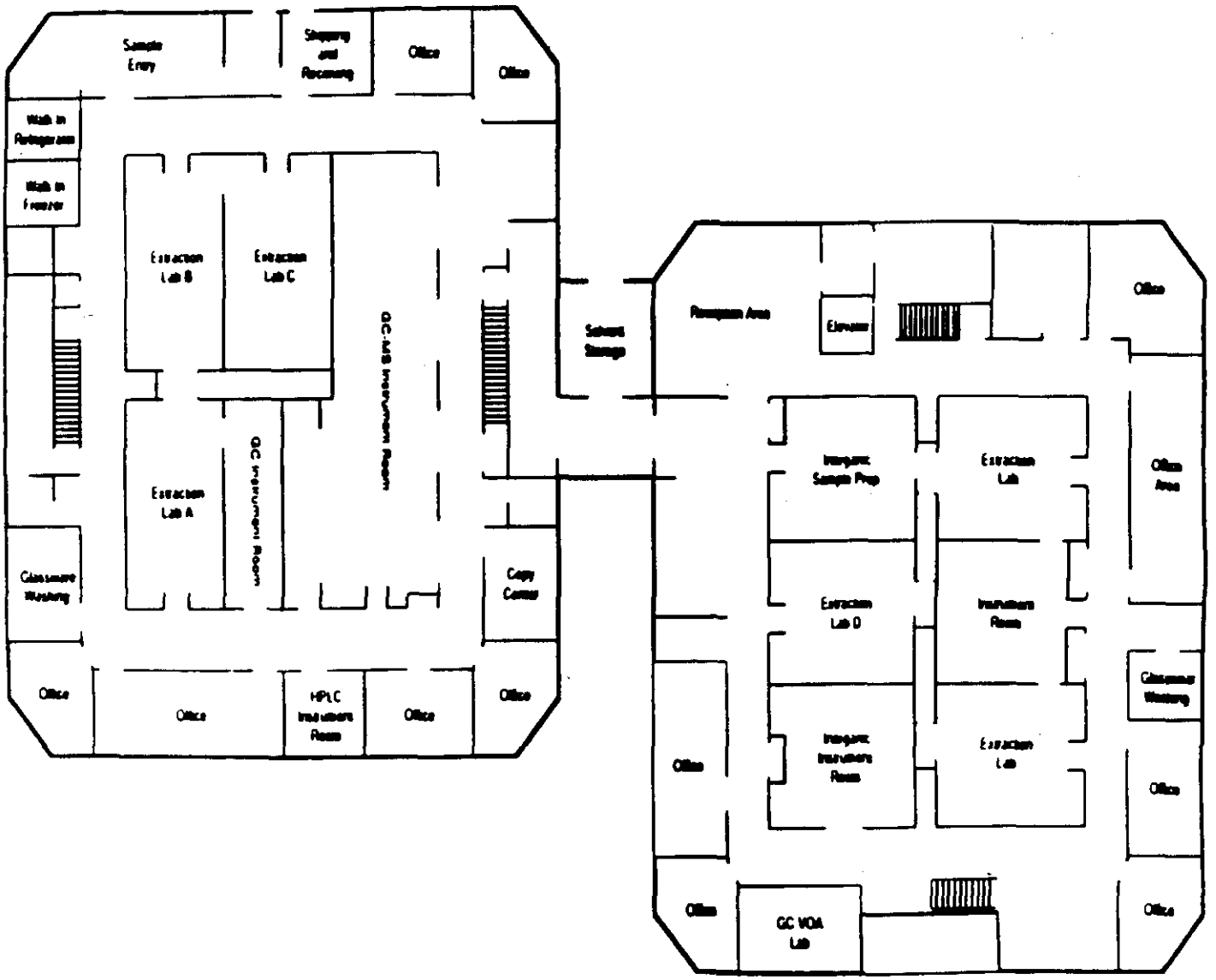
All Standard Reference Materials (SRMs) are purchased as either standard grade neat materials, certified stock solutions, or a certified reference material. All materials are logged into the standards logbook of the department in which they are used and all documentation (MSDS, standard certificates, backup data packages) are maintained in the department's standards files. All standards must be stored appropriately and contain an expiration date.

HES does not provide field sampling services; however sampling supplies (e.g. bottles, preservatives, trip blank and rinsate water, coolers, etc.) are made available upon request.

All bottles for sampling are purchased "Precleaned" and "Certified". The certificates of test results, verifying the bottle cleanliness, are retained and maintained in our files.

Figure 2.

Facility Floor Plans
HES Environmental Chemistry Laboratories
First Floor



Laboratory Instrumentation and Equipment

HES has an extensive inventory of major analytical equipment that includes Gas Chromatographs (GCs) and High-Performance Liquid Chromatography (HPLC) systems. This equipment is distributed throughout the laboratories and is accessible on an as-needed basis. Additional major equipment purchases continue to expand the list.

The following is a summary of the major analytical equipment currently dedicated to analysis of environmental samples.

ICAP Spectrometry

- Thermo-Jarrell Ash Model 61 simultaneous ICAP with autosampler

Atomic Absorption (AA) Spectrometry

- 2 Perkin Elmer Zeeman/5100 PC with AS-60 autosampler
- 1 Perkin Elmer 4100ZL with AS-60 autosampler
- 1 Perkin Elmer Model 3030 with AS-60 autosampler
  - Accessories: Perkin Elmer MHS20 Mercury/Hydride system
- 1 Leeman Labs PS200 Automated Mercury Analyzer

Microwave Digestion System

- CEM MDS-81D - fully programmable digestion system

Ion Chromatography

- Dionex Model 2020 I - dual channel ion chromatograph with Perkin Elmer ISS 100 autosampler

Spectrometry

- Varian DMS-80 Double-beam UV/VIS Spectrophotometer
- Beckman Acculab 4 IR Spectrometer

TOC Analyzer

Dohrman DC-190 TOC Analyzer
- Accessories: Dohrman Model 183 TOC Boat Sampler

Gas Chromatography Mass Spectrometry (GCMS)

Finnigan INCOS 50
- Accessories: HP5890A Gas Chromatograph
  Dynatech PTA-30 Autosampler
  Tekmar 4000 Headspace Concentrator

Finnigan 5100A
- Accessories: Finnigan 9611 Gas Chromatograph
  Tekmar ALS Automatic Liquid Sampler
  Tekmar LSC-2 Liquid Sample Concentrator

Finnigan 5100 EF
- Accessories: Finnigan 9611 Gas Chromatograph
  Tekmar ALS Automatic Liquid Sampler
  Tekmar LSC-2 Liquid Sample Concentrator

Finnigan INCOS 50
- Accessories: HP 5890A Gas Chromatograph
  HP 7673A Autosampler

Hewlett Packard 5985 (Upgraded to Model 5987)
- Accessories: HP 5840A Gas Chromatograph
  HP 7671A Autosampler

Hewlett Packard 5970 Mass Selected Detector
- Accessories: HP 5890A Gas Chromatograph
  HP 7673 Autosampler

Finnigan ITD 800
- Accessories: Varian 3400 Gas Chromatograph

Liquid Chromatography Mass Spectrometry

- Finnigan 4500
  - Accessories: Pulsed positive ion/negative ion chemical ionization accessories
    Vestec Model 701A HPLC Thermospray Interface

Gas Chromatography

- Gas Chromatographs
  - 8 Hewlett Packard 5890
  - 1 Hewlett Packard 5730
  - 4 Hewlett Packard 5710
  - 1 Varian 3700
  - 2 Varian 3400

- Detectors
  - 18 electron capture
  - 1 flame photometric
  - 1 nitrogen/phosphorus
  - 2 flame ionization
  - 2 Hall/photoionization combination
  - 1 flame ionization/photoionization combination

- Accessories
  - 6 HP 7673A Dual Tower Autosamplers
  - 2 HP 7673A Single Tower Autosampler
  - 3 HP 7672A Autosamplers
  - 2 HP 7671A Autosamplers
  - 2 Tekmar LSC 2000 Liquid Concentrators
  - 1 Tekmar LSC-2 Liquid Concentrator
  - 2 Tekmar ALS-2016 Liquid Autosamplers
  - 1 Tekmar Model 4200 Automatic Heated Sampler Module

High Performance Liquid Chromatography

- 1 Perkin Elmer Series LC 250 Liquid Chromatograph
  - Accessories: Perkin Elmer ISS 100 Autosampler
    Perkin Elmer LC-95 UV/Visible Detector
    Kratos 980 Fluorescence Detector
    Pickering PCX Post-column Reaction Module

1 Perkin Elmer Series 410 Liquid Chromatograph
- Accessories: Perkin Elmer ISS 200 Autosampler
  ABS 757 Absorbance Detector
  McPherson FL-750 Fluorescence Detector

Gel Permeation Chromatography

2 ABC Laboratories Model 1002B Autoprep GPC
- Accessories: (2) ABC UVD-1 UV detector
  (2) ABC SCR-1 Strip Chart Recorder

All GC/LC equipment is interfaced with either an HP 1000/A400 or HP 1000/A600 Laboratory Automation System for the acquisition and processing of analytical data.

Extraction Equipment

Extraction equipment and all associated glassware necessary for a wide range of extraction techniques is interspersed throughout the laboratory. The following list presents examples of that equipment with approximate quantities:

Item	Approximate Quantity
Wrist-action shakers (12 position)	4
Sonic probe, Heat Systems Model 375C	2
Sonic probe, Heat Systems Model	1
Soxhlet apparatus (full set)	50
Liquid-Liquid extraction apparatus	45
Rotoevaporators	3
Steam baths (eight position)	6
Kuderna Danish apparatus (full set)	75
Centrifuges, Damon/IEC, Model K	2
Rotary Extractors (6 Position)	3
ZHE extraction Vessels	6

A substantial amount of both general glassware and volumetric glassware is available throughout the laboratory.

SAMPLE ENTRY, STORAGE AND CHAIN OF CUSTODY PROCEDURES

The moment a sample arrives at HES it becomes part of a system that covers tracking, preparation, storage, analysis and reporting. The key elements of this system have been in place for many years, allowing HES to evolve into a highly responsive and efficient laboratory.

Sample Entry

Sample entry is a three-step process, governed by more than 30 SOPs. It includes a scheme for setting priorities for sample handling. Each step, described briefly below, provides a check on sample integrity.

Receipt. The quality of analytical data begins with sample receipt, because the analysis of a sample is only as good as the integrity of the sample itself. The shipping cartons are inspected to ensure that nothing occurred which may have jeopardized the enclosed samples. The samples themselves are examined closely for breakage, leaks, or other problems that may have occurred during shipment. If the samples were sent frozen or chilled, the conditions upon receipt are noted and documented.

Samples are inventoried and the descriptions on the labels are correlated with the corresponding paperwork. The compounds requested are reviewed to make certain they are compatible with the sample container and preservation technique used and to verify that an adequate sample volume was provided to perform the requested assay.

Entry. All client and sample information relating to the samples received are entered onto the computerized Laboratory Information Management System (LIMS), which assigns a unique Laboratory identification number to each sample. Based on accompanying paperwork and consultations with scientists and the Client Service Center, the following are recorded:

- Sample description
- Requested assays
- Reporting units
- Claimed values
- Sample preparation requirements
- Client I.D.
- Priority status (based on Client needs)

Post Processing. The LIMS generates printouts of the sample information and corresponding labels to be affixed directly to the sample containers. A postprocessor cross-checks the printouts and labels with the paperwork, labels the samples and forwards them to either Sample Preparation (depending on priorities and preparation requirements) or logs the samples in the appropriate secure storage location. Once this process is complete, the postprocessor releases the assigned samples number(s) from the computer, thus clearing the samples for analysis.

Sample Storage

Following sample entry and any preliminary sample preparation steps required (i.e., shinning, dissection, chopping, grinding, compositing and homogenization), the samples are forwarded to the laboratory where they are stored in either a refrigerator (water and soil matrices) maintained at 4°C or a freezer (biological tissues) maintained at -20°C. The temperatures of the walk-in refrigerators and freezers are monitored through the use of an alarm system that is set off if the temperature exceeds its acceptable operating range. All refrigerators and freezers, including walk-ins, are monitored using certified "high-low" thermometers on a daily basis and the data are recorded in a temperature log that is kept at each storage location.

Chain of Custody Procedures

When samples are received at the laboratory under strict chain of custody, in addition to the normal entry process, the accompanying Chain of Custody documents are reconciled with all other available sample documentation and any pertinent observations are recorded on the COC forms and finally signed as received.

All sample containers are transferred throughout the laboratories with internal chain of custody forms and while not in the direct possession of a laboratory analyst are stored in one of the refrigerators or freezers located throughout all HES facilities. Samples are signed out by analysts when taken into the laboratory for sample preparation/extraction or direct analysis and signed back in when returned to the storage location. This documentation is recorded on an Internal Custody Form and maintained as part of the project file.

CALIBRATION PROCEDURES AND FREQUENCY

Standard/Reagent Preparation

A critical element in the generation of quality data is the purity/quality and traceability of the standard solutions and reagents used in the analytical operations. They serve as the basis of all analytical results generated by the laboratory and the quality of the decisions made by the end data user.

All primary reference materials and standard solutions used by HES in the generation of quantitative and qualitative results are obtained form the National Bureau of Standards, the EPA Repository or other reliable commercial sources.

Standard Reference materials are defined to be:

- Pure organic and inorganic chemicals used to calibrate or standardize instruments which provide measurements for quantitative and qualitative analyses.
- Primary standard grade chemicals used to standardize other reagents for quantitative or qualitative determinations (e.g.,titrations, color comparisons, etc.).
- Purchased solutions and preparations of chemicals certified by the manufacturer or distributor to be of known concentration and suitability for use as standards.

Inventory

An Inventory of all Standard Reference Materials is maintained by the laboratory in either a bound laboratory notebook or a computerized data base containing entries for the following information:

- Compound Name
- CAS number
- Manufacturer/Distributor/Client*
- Manufacturer's Lot number
- Purity Information
- Storage Requirements
- Storage Location

* Note: If the standard reference material is a proprietary compound obtained from a client, then codes and other information supplied by the client may be substituted as necessary.

Labeling

Information on the standard reference material containers and all subsequent dilutions and preparations will conform to OP-GEN.8, "Labeling of Reagents and Solutions". Dilutions which are prepared or contained in small vials on which an all inclusive label cannot be attached may be identified by a coding system defined with the standards preparation information.

Preparation Information

When portions of standard reference material are weighed out, diluted or otherwise prepared for analysis, the preparation information will be recorded on an official and retrievable document. Examples of official documents are; LIMS worksheet, designated Standards Logbook, or an assigned Study notebook.

The preparation information must include:

- Compound name or code
- Manufacturer/distributor
- Lot number
- Purity information
- Preparation details
  - Balance used
  - All weighings
  - Dilutions
  - Solvent or carrier
  - Calculations used to convert weights to proper units of form (i.e.,use of a metal salt as a metal standard)
  - Signature of the preparer, date prepared

All standard preparation and dilutions subsequent to the initial preparation will contain a reference to the location of the initial preparation information. This could also be used as part of the code for standards in small containers.

Instrument Calibration and Tuning

Calibration of instrumentation is required to ensure that the analytical system is operating correctly and functioning at the proper sensitivity to meet established detection limits. Each instrument is calibrated with standards prepared from certified reference materials appropriate to the type of instrument and the linear range established for the analytical method. The frequency and acceptance criteria for the calibration of a particular instrument is determined by the manufacturer's guidelines, the analytical method or the requirements outlined in the Scope of Work (SOW) of a special contract.

Gas Chromatography/Mass Spectrometry (GC/MS)

Each instrument prior to the analysis of samples, is hardware tuned (to the specifications outlined in the applicable method) using either bromofluorobenzene (BFB) for volatile compounds or decafluorotriphenylphosphine (DFTPP) for semivolatile compounds. No samples are analyzed until all tuning specifications are first met.

The instrument is then calibrated for all target compounds. An initial calibration curve is produced and certain key compounds referred to as system performance calibration compounds (SPCC) and calibration check compounds (CCC) are evaluated to ensure that the system has been successfully calibrated within established specifications. Both the instrumental tuning and calibration is routinely verified at a defined frequency to assure that the instrument continues to meet all acceptance criteria for the continued analysis of samples.

Chromatography (GC, LC and IC)

The field of chromatography involves a variety of instrumentation and detection systems. While calibration standards and acceptance criteria may vary depending on the type of system, analytical method or the specific data quality objectives desired for a particular project, the general principles of calibration apply uniformly.

Each chromatographic system is calibrated prior to performance of analyses. Initial calibration consists of determining the linear range, establishing limits of detection, and establishing retention time windows.

The calibration is checked minimally on a daily basis, when a particular instrument is in use, to ensure that the system remains within the established criteria for the analysis of samples. If the calibration check is found to be outside the acceptance criteria, sample analysis is halted and the instrument is recalibrated prior to continuing with the analysis of any samples.

Metals (AA, ICAP)

Metals analysis basically involves two types of analytical instrumentation: Inductively coupled argon plasma emission spectroscopy (ICP), and atomic absorption spectroscopy (AA).

Each ICP is calibrated prior to the analyses being performed using criteria prescribed in the CLP protocol or method. The calibration is then verified using standards from an independent source. The linear range of the instrument is established once every quarter using a linear range verification check standard. No values are reported above this upper concentration value without dilution.

A calibration curve is established daily by analyzing a minimum of two standards, one of which is a calibration blank. The calibration is monitored throughout the day by analyzing a continuing calibration blank (CCB) and a continuing calibration verification standard (CCV). The standard must meet established criteria or the system is recalibrated and all samples analyzed since the last acceptable calibration check are reanalyzed.

An interelement check standard is analyzed at the beginning and end of each analytical run to verify that interelement and background correction factors have remained constant. Results outside of the established criteria trigger reanalysis of samples.

Each AA unit is calibrated prior to analyses being conducted. A calibration curve is prepared with a minimum of a calibration blank and three standards and then verified with a standard that has been prepared from an independent source at a concentration near the middle of the calibration range. The calibration is verified on an ongoing basis with a midpoint calibration standard. If the ongoing calibration standard does not meet established acceptance criteria, the system is recalibrated and all samples analyzed since the last acceptable calibration check are reanalyzed. All samples are spiked to verify the absence of matrix effects or interferences. The method of standard additions is used when matrix interferences are present.

Conventional Wet Chemistry Techniques

The field of conventional, non-metals analysis involves a variety of instrumental and wet chemical techniques. While calibration and standardization procedures vary depending on the type of system and analytical methodology required for a specific analysis, the general principles of calibration apply universally. Each system or method is calibrated prior to analyses being conducted. Calibration is checked on an ongoing basis to ensure that the system remains within specifications. If the ongoing calibration check does not meet established criteria, the system is recalibrated and all samples analyzed since the last acceptable calibration check are reanalyzed.

ANALYTICAL PROCEDURES

Most analyses performed by HES are driven by regulatory concerns; therefore, methods used by HES predominantly originate from governmental regulatory agencies. Generally the methods used are those specified by the U.S. EPA and other federal agencies, state agencies, and professional organizations, as provided in the following *references*:

- EPA (CLP) protocols for the analysis of organic and inorganic hazardous substances as outlined in the current Statement of Work (SOW) for that program.

- "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act," 40 CFR, Part 136.

- "Methods for Chemical Analysis of Water and Wastes," EPA-600/4-79-020 (revised March, 1983).

- "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater," EPA-600-4-82-057 (July,1982)

- "Test Methods for Evaluating Solid Waste" (SW-846), 2nd Edition (revised), Update I (1984), Update II (1985), 3rd Edition (1986), Office of Solid Waste and Emergency Response. U. S. EPA.

- "Standard Methods for the Examination of Water and Wastewater," 18th Edition, American Public Health Association, American Water Works Association, Water Pollution Control Federation, Washington, DC (1992).

- "Official Methods of Analysis," 15th Edition, Association of Official Analytical Chemists, Arlington, VA (1990).

- "Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water," U.S.EPA, Environmental Monitoring and Support Laboratory - Cincinnati (September,1986).

- "Annual Book of ASTM Standards,"Volumes 11.01 and 11.02, American Society for Testing and Materials (ASTM), Philadelphia, PA (1987).

- "Manual of Analytical Methods for the Analysis of Pesticides in Humans and Environmental Samples,"EPA-600/8-80-038 (June 1980).

- "Pesticide Analytical Manual," Volumes I and II, U.S. Food and Drug Administration, Rockville MD, (1987).

"Analytical Methods for the National Sewage Sludge Survey," EPA Contract No. 68-01-6990, U.S.EPA (August 1988).

Each method routinely used, is documented in the form of an SOP as described earlier in this document. Any deviations from published methodology are documented and explained in the SOP.

DATA REDUCTION, VALIDATION, AND REPORTING

HES' review and validation of laboratory data generated for environmental investigation and monitoring programs are routinely performed as a three-step process to ensure that all data reported are accurate, complete and meet the data quality objectives established by the project sponsor.

The first two steps of the review process, and the most critical for the success of any program, are performed at the bench scientist and supervisor levels.

First, the analyst who generates the analytical data has the prime responsibility for the correctness and completeness of the data. All data are to be generated, reduced and documented following the protocols outlined in the laboratory's Method Procedures and Standard Operating Procedures. All sample preparation, instrumental calibration, calculations and quality control results are to be reviewed to ensure they are accurate and consistent with the protocols established for the project.

Second, the supervisor has the responsibility to review and sign off on the worksheets generated by those laboratory analysts reporting to him/her. As part of that process the supervisor is expected, at a minimum, to cover the following items:

- Review client request and verify that the data meets the specific client requirements, i.e., target list of compounds, any special QC requirements, reporting requirements.

- Verify that holding times were met (review date received and date analyzed).

- Assure adequate documentation of extractions, cleanups, spiking and calibration standards on worksheets.

- Check both initial and ongoing calibrations for compliance with established criteria (including frequency and acceptance criteria). All data used must be associated with an acceptable calibration.

- Verify that method blanks were prepared and analyzed at the proper frequency and are free of any interferences or target compounds (above the reported MDL).

- Surrogate and matrix spike recoveries should be reviewed to assure they were run at the proper frequency and meet the current established QC criteria for the matrix analyzed.

- All calculations should be spot checked; if any errors are noted in a data set a more thorough review of all calculations must be made.

- Overall documentation on laboratory benchsheets, logbooks, worksheets, chromatograms, area reports etc., must be reviewed for compliance with HES SOPs.

- Lastly, if any problems are noted during the analysis of samples or deviations to established QC criteria found, the reviewing supervisor must clearly document those problems or exceptions and their impact on the resulting data.

The final step in the review process is performed by an analyst in QAU. All data submitted to this group is again reviewed to ensure that the quality control criteria established for each assay were met, appropriate corrective action was taken when needed, any unusual problems with the samples or data are completely explained, and that all data are accompanied with complete and proper support documentation. Additional responsibilities of this group include:

- Compilation of data for final reports

  Three Basic Types of Reports:

  1. Results only, with case narrative explaining any QC deficiencies.
  2. Data summary packages consisting of results and QC information, with a case narrative.
  3. Full supporting data package consisting of results and all raw data needed to complete a full third party validation, with a case narrative. This package should be "CLP-like" or as close to CLP as possible.

- Preparation of case narratives based on analyst and supervisor notes and comments.
- Maintenance of project files and quality control data bases.
- Assistance with project tracking.

INTERNAL QUALITY CONTROL CHECKS

HES's QA/QC program is designed to establish a continuous monitoring system by which to verify that each analytical system used in the generation of laboratory data is operated " In control" **(Laboratory performance QC)** and to establish that the data generated by each method falls within the expected range of precision and accuracy for each matrix tested by that method **(Matrix specific QC)**.

Laboratory performance QC

Laboratory performance QC is defined and included in every Method Procedure used to routinely analyze samples at HES. The following types of QC audits are routinely included (when appropriate to the method):

- Instrument calibration is performed, at a minimum, daily when samples are being analyzed and may be in the form of an initial calibration or a continuing calibration.

- An initial calibration is performed by the analysis of a calibration curve, consisting of three or more concentrations, which defines the working range of all compounds (or elements) being measured by a method. The subsequent quantitation of unknowns in the samples analyzed by the method are based on this calibration.

- A continuing calibration is used when an initial calibration has already been established and is performed by the analysis of a mid-range standard. The response of that mid-range standard must fall within the established QC criteria to verify that the initial calibration is still valid. Failure to meet all established criteria would require the instrument to be re-calibrated prior to the continued analysis of samples.

Laboratory blanks of various types are routinely prepared and analyzed to monitor and identify the potential sources of laboratory introduced contamination of samples and provide a mechanism for taking corrective action when a problem is identified.

Trip Blanks are prepared for volatile organics when the laboratory provides bottles for sampling to it's clients. Trip Blanks are prepared by filling a 40-mL sampling vial, of the same lot to be used to collect samples, with organic free water. The trip blank follows the sample bottles from the laboratory to the field and are returned to the laboratory with the field samples. Trip Blanks are used monitor the potential for contamination introduced during the transportation of the bottles to the field and the return of the samples from the field to the laboratory.

Holding Blanks (for samples to be analyzed for volatile organics) are similar to Trip Blanks but are prepared at the time samples are received at the laboratory and are

stored with the samples until the time of their analysis. Their purpose is to monitor any potential laboratory introduced contamination during storage prior to analysis.

Method Blanks are prepared and analyzed with every set of 20 samples or less, or whenever samples are extracted, digested or directly analyzed (when preliminary preparative steps are not required). Each method blank is carried through every aspect of the procedure, including preparation steps, the addition of reagents, cleanup steps and instrumental analysis.

Their purpose is to monitor any potential laboratory contamination introduced during sample manipulations performed as part of any aspect of the analytical method.

Instrument Blanks are reagent blanks that are analyzed directly on the instrument used to generate analytical measurements. Instrument blanks are used to assure that the instrumentation itself (i.e.column, trap, or a transfer line) is not a source of contamination. Instrument blanks may also be used as an ongoing verification that no sample carryover is occurring, particularly following the analysis of a sample containing a high concentration of analyte.

Matrix Specific QC

Surrogate Spiking Compounds are generally organic compounds which are similar in nature to those compounds of interest, but are not usually found in environmental samples (GCMS surrogate compounds frequently use a target compound which has been labeled with deuterated hydrogen i.e. d_5-Phenol).

Surrogates are added to samples prior to beginning any sample processing steps to monitor both the performance of the analytical system as well as the effect of the sample matrix on the accuracy of the analysis. Results are reported in terms of percent recovery.

HES routinely adds surrogate compounds to all samples requiring them as per the method.

Laboratory Control Spikes (LCS) are routinely incorporated into all method procedures (when appropriate) as an independent measure of the performance and accuracy of the analytical system. Laboratory control spikes are obtained by either purchasing standard reference materials (SRMs), such as those available from the National Bureau of Standards, or by preparation in the laboratory by spiking a laboratory control matrix (Milli-Q® water, control soil, tuna fish) with a representative number of target analytes at known concentrations.

Matrix Duplicates (DUP) are actual field samples, where two separate aliquots are taken from a single sample and processed separately through the entire method. The results generated are compared to determine the effect of the matrix on the precision of

the analysis. The precision of the analysis is calculated and reported as Relative Percent Difference (RPD).

Matrix duplicates are most frequently used for the determination of precision when there is a high expectation of a positive result for the analyte(s) to be measured.

Matrix Spikes (MS) are field samples to which a known concentration of analyte(s) is added. The MS is processed through the entire method and is used to evaluate the effect of the matrix on the accuracy of the method. The recovery of the spiked analyte(s) is calculated and reported as Percent recovery.

Matrix Spike/Matrix Spike Duplicates (MS/MSD) are actual field samples, where two separate aliquots are taken from a single sample, each of which is spiked with a known concentration of analytes. The two spiked aliquots are processed separately through the entire method and the results compared to determine the effects of the matrix on both the precision and accuracy of the analysis. Precision is calculated and reported as RPD and the accuracy as Percent recovery.

MS/MSDs are most frequently used when a multi-compound analysis is performed. Their use guarantees the collection data for the measurement of precision, when the field sample itself has a lesser expectation of producing positive results (resulting in the measurement of precision) and also increases the number of data points for the measurement of accuracy.

PERFORMANCE AND SYSTEM AUDITS

A system audit is a qualitative evaluation of a laboratory's operations conducted to verify that the laboratory has the necessary facilities, equipment, staff and procedures in place to generate acceptable data.

HES's Environmental Chemistry departments are approved to perform environmental analyses under programs administered by the U.S. EPA (including the U.S. EPA CLP), U.S. Fish and Wildlife Service, U.S. Corps of Engineers and several State environmental agencies.

Each of the above agencies, as part of their certification or program approval process, subject participants in their program to regular system and performance audits.

HES's QAU additionally performs (at a minimum) one Departmental inspection annually.

A performance audit is a quantitative evaluation of the measurement systems of a program, used to verify that a laboratory has the ability to correctly identify and quantitate those compounds or elements, it is responsible for measuring, by the analysis of blind check samples.

HES currently participates in the EPA's semiannual Water Pollution (WP) and Water Supply (WS) performance evaluation (PE) studies administered by EPA's Environmental Monitoring Support Laboratory in Cincinnati (EMSL-Ci). Blind PE samples are also received from the State of New York's Department of Health and Wisconsin's Department of Natural Resources as part of their certification programs. Internal PE samples are also analyzed three times each year as part of our QA program.

PREVENTIVE MAINTENANCE

As part of the QA/QC Program, a routine preventive maintenance program is conducted by HES to minimize the occurrence of instrument failure and other system malfunctions. Routine maintenance for each instrument is outlined in the Instrument Operating Procedure (IOP) prepared for each instrument used in making analytical measurements.

Each instrument is required to have a Maintenance/Repair Log in which all maintenance or repair activities are documented, dated and signed by the HES scientist or outside vendor performing the activity. Examples of routine maintenance procedures performed, and a listing of critical spare parts kept in stock, are presented in Attachment I, for major laboratory instruments. Components not maintained as part of a spare parts inventory are ordered from the manufacturer and shipped using priority overnight delivery.

HES has an internal metrology department responsible for routine scheduled maintenance and to repair or coordinate with an outside vendor the repair of all instruments. HES has multiple instruments and detectors which provide redundancy and backup to all equipment used in the routine analysis of samples.

PROCEDURES USED TO ACCESS DATA PRECISION, ACCURACY AND COMPLETENESS

The effectiveness of a QA program is measured by the quality of data generated by the laboratory. Data quality is judged in terms of its precision, accuracy, representativeness, completeness and comparability. These terms are defined as follows:

Precision is the degree to which a measurement is reproducible. Precision can be assessed by replicate measurements of reference materials, environmental samples or laboratory control spikes, or matrix spikes.

Precision between individual pairs of replicate measurements is most commonly calculated and expressed as a Relative Percent Difference (RPD). The RPD is reported as an absolute value, i.e., always expressed as a positive number or zero and is calculated as:

$$\%RPD = \frac{|A - B| \times 100}{(A + B)/2}$$

When dealing with larger sets of data (e.g., a set of control spike recoveries collected over a set period of time), precision is most frequently expressed as a standard deviation.

Sample standard deviation (S) is calculated as follows:

$$StandardDeviation = \left| \sqrt{\frac{\sum_{i=1}^{n} (x_i - x)^2}{n-1}} \right|$$

where a quantity x (e.g., a concentration) is measured n times.

The relative standard deviation or sample coefficient of variation (CV), which expresses standard deviation as a percentage of the mean, is generally useful in the comparison of three or more replicates (although it may be applied in the case of n = 2).

$$\% RSD = (S/X)\ 100$$

where % RSD = Percent relative standard deviation
S = Standard deviation
X = Mean

Accuracy is a determination of how close the measurement is to the true value. Accuracy can be assessed using standard reference materials, laboratory control spikes, or matrix spikes. Unless specified otherwise in special contracts, HES monitors accuracy by comparing the recovery of laboratory control spikes to control limits based on laboratory-derived historical data.

The determination of the accuracy of a measurement requires a knowledge of the true or accepted value for the signal being measured. Accuracy may be calculated in terms of percent recovery as follows:

$$\text{Percent recovery} = (X/T)100$$

Where X = the observed value of measurement
T = "true value"

Control limits are defined as follows:

Warning limits = $P \pm 2S$
Control limits = $P \pm 3S$

Where P = Average percent recovery
S = Standard deviation

Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Analytical data should represent the sample analyzed regardless of the heterogeneity of the original sample matrix. Some samples may require analysis of multiple phases to obtain representative results.

Completeness is a measure of the amount of valid data obtained from a measurement system compared with the amount that was expected to be obtained under normal conditions.

To be considered complete, the data set must contain all QC check analyses verifying precision and accuracy for the analytical protocol. In addition, all data are reviewed in terms of stated goals in order to determine if the data base is sufficient.

When possible, the percent completeness for each set of samples is calculated as follows:

$$\% \text{ Completeness} = \frac{\text{Valid data obtained} \times 100}{\text{Total data planned}}$$

Comparability expresses the confidence with which one data set can be compared to another data set measuring the same property. Comparability is ensured through the use of established and approved analytical methods, consistency in the basis of analysis (wet weight or dry weight, volume, etc.), and consistency in reporting units (ppm, ppb, etc.).

CORRECTIVE ACTION

Quality control limits are established and documented in all methods used by HES. Those control limits define the acceptance windows for instrumental calibrations, method and instrument blanks, as well as the precision and accuracy of the data generated by those methods.

Nonconformance with any established quality control limit or procedure alert laboratory personnel that corrective action may be needed (OP-GEN.35). No additional work which is dependent on the non-conforming activity will be performed until the non-conformance is corrected or verified to be outside the laboratory's control.

Need for corrective action may be also indicated if:

- Undesirable trends are detected in spike recoveries or RPD between duplicates
- Severe matrix interferences are encountered
- Deficiencies are detected by the QAU during an internal inspection or an audit performed by an external client or agency
- Unacceptable or marginal performance on Blind Performance evaluation samples
- Inquires concerning data quality are received from clients

Corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike and calibration mixes, instrument sensitivity, etc. If the problem persists or cannot be identified, the matter is referred to the Group leader, Department manager, Director and/or the QAU for further investigation.

Corrective action measures taken as a result of any of the preceding circumstances may include, but not limited to:

- Recalibration of an instrument
- Re-extraction and/or reanalysis of affected samples
- Employ additional sample cleanup steps, if possible
- Preparation of new standards (calibration or spiking)
- Servicing of instrument hardware
- A recommendation for resampling if possible
- Evaluating and possibly amending sampling or analytical procedures used
- Accepting data with an acknowledged level of uncertainty

Routine Preventative Maintenance Procedures and Schedules

Instrument	Maintenence Procedures/Schedule	Spare Parts in Stock
Gas Chromatograph/ Mass Spectrometry (GC/MS)	1. Replace pump oil as needed. 2. Change septa weekly or as often as needed. 3. Change gas line dryers as needed. 4. Replace electron multiplier as often as needed. 5. Replace glass jet splitter as often as needed. 6. Replace GC injector glass liner weekly or as often as needed. 7. Replace GC column as needed. 8. Check to ensure the gas supply is sufficient for the day's activity, and the delivery pressures are set as described in the SOP. 9. Check to ensure the pressure on the primary regulator never runs below 100 psi.	1. Syringes 2. Septa 3. Various electronic components 4. Glass jet splitter 5. GC column 6. Glass liner
Gas Chromatograph	1. Replace pump oil as needed. 2. Change septa weekly or as often as needed. 3. Change gas line dryers as needed. 4. Replace GC injector glass liner weekly or as often as needed. 5. Replace GC column as needed. 6. Clean/replace GC detector as needed. 7. Check to ensure the gas supply is sufficient for the day's activity, and the delivery pressures are set as described in the SOP. 8. Check to ensure the pressure on the primary regulator never runs below 100 psi.	1. Syringes 2. Septa 3. Detectors 4. Glass liner 5. GC column

Instrument	Maintenence Procedures/Schedule	Spare Parts in Stock
Purge and Trap Sample Collector	1. Replace trap as needed. 2. Decontaminate the system after running high concentration samples or as required by blank analysis. 3. Check system leak daily and as often as needed. 4. Check to ensure the gas supply is sufficient for the day's activity, and the delivery pressures are set as described in the SOP. 5. Check to ensure the pressure on the primary regulator nevers runs below 100 psi.	1. Spare traps 2. Spare sparger 3. Various electronic components/circuit boards. 4. Plumbing supplies; tubing & fittings.
Inductively Coupled Plasma Spectrometer (ICP)	1. Clean torch assembly and mixing chamber when discolored or after 8 hours of running high dissolved-solids samples. 2. Clean nebulizer as needed. 3. Check to ensure the gas supply is sufficient for the day's activity, and the delivery pressures are set as described in the SOP.	1. Spare torch & mixing chamber 2. Spare nebulizer
Graphite Furnace Atomic Absorption Spectrophotometer (GFAA)	1. Change graphite contact rings as needed. 2. Change D_2 background connection lamp. 3. Clean quartz window as necessary. 4. Check to ensure the gas supply is sufficient for the day's activity, and the delivery pressures are set as described in the SOP.	1. Contact Rings 2. D_2 arc lamp
Mercury Analyzer	1. Clean tubing and quartz cell weekly or as often as needed. 2. Clean aspirator as necessary. 3. Check to ensure the gas supply is sufficient for the day's activity, and the delivery pressures are set as described in the SOP.	1. Quartz cells 2. Aspirator
Total Organic Carbon Analyzer	1. Replace tubing as needed. 2. replace injection septum every 50 samples or as often as needed when a leak is suspected. 3. Prepare fresh reagent daily. 4. Check scrubber daily, repack tube when tin is one-half consumed.	1. Tubing 2. Septa 3. Spare scrubber 4. 20 mesh granular tin

Instrument	Maintenence Procedures/Schedule	Spare Parts in Stock
pH Meter	1. Check battery (if used in field) and replace if discharged. 2. After use in samples containing free oil, wash the electrode in soap and rinse thoproughly with water. Immerse the lower third of the elctrode in diluted Hcl (1:9) solution for 10 minutes to remove any film formed. Rinse thoroughly with water. 3. Keep electrode propoerly filled with appropriate filling electrolyte solution.	1. Standard buffer solutions. 2. Filling electrolyte solution 3. Spare electrodes
Specific Conductivity	1. Check battery if used in filed and replace if discharged. 2. After use in samples containing free oil, wash the electrode in soap and rinse thoproughly with water. Immerse the lower third of the elctrode in diluted Hcl (1:9) solution for 10 minutes to remove any film formed. Rinse thoroughly with water. 3. Keep electrode propoerly filled with appropriate filling electrolyte solution.	1. Standard buffer solutions. 2. Filling electrolyte solution Spare electrodes

Hazleton Environmental Services

QAU - DO NOT DUPLICATE

ASSAY TITLE: Determination of Polynuclear Aromatic Hydrocarbons (PNAs) in Biological Matrices

AREA OF APPLICABILITY: HES, Inc.
General Organics

SCOPE:

This method covers the determination of the following polynuclear aromatic hydrocarbons in biological tissues using High-Performance Liquid Chromatography (HPLC). The following compounds are calibrated and analyzed under this method and others may be included if validated via this method:

Analyte	CAS Number
Acenaphthene	83-32-9
Acenaphthylene	208-96-8
Anthracene	120-12-7
Benzo(a)anthracene	56-55-3
Benzo(a)pyrene	50-32-8
Benzo(b)fluoranthene	205-99-2
Benzo(g,h,i)perylene	191-24-2
Benzo(k)fluoranthene	207-08-9
Chrysene	218-01-9
Dibenzo(a,h)anthracene	53-70-3
Fluoranthene	206-44-0
Fluorene	86-73-7
Indeno(1,2,3-c,d)pyrene	193-39-5
Naphthalene	91-20-3
Phenanthrene	85-01-8
Pyrene	129-00-0
1-methylnaphthalene	90-12-0
2-methylnaphthalene	91-57-6

PRINCIPLE:

Biological matrices are dried using anhydrous sodium sulfate and extracted for 16 hours with methylene chloride in soxhlet extractors. The sample extracts are then concentrated and injected onto a GPC to remove lipids. This method also provides a silica gel cleanup procedure to aid in the elimination of interferences attributable to the matrix. The extract is exchanged to acetonitrile before separation by high-performance liquid chromatography (HPLC). Compounds of interest are identified and quantified by ultraviolet (UV) and fluorescence detection.

SENSITIVITY, PRECISION, AND ACCURACY:

The method detection limits (Attachment 1) represent the target detection limits that can be achieved in biological tissues using this method if no interferences exist.

The precision, accuracy, and control limits for PNAs in biological samples are presented in Attachment 2.

REFERENCE:

Environmental Protection Agency (EPA). "Test Methods for Evaluating Solid Waste". SW-846. Methods 3540, 3630, 3640 and 8310. (September 1986)

Hazleton Environmental Services

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