THE ESTATE OF LESTER NOLAN LANDFILL SITE

PROPOSED PLAN OF REMEDIAL ACTION

June, 1997

Department of Natural Resources and Environmental Control
Division of Air and Waste Management
Site Investigation & Restoration Branch

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Estate of Lester Nolan Landfill Site
Proposed Plan of Remedial Action

1. INTRODUCTION

In October 1995, The Department of Natural Resources and Environmental Control (DNREC or Department) under the authority granted by the Hazardous Substance Cleanup Act (7 Del. C., Chapter 91) reached an agreement with the executor of the estate of Lester A. Nolan, Michael A. Dribin, Esquire to perform a Remedial Investigation/Focused Feasibility Study (RI/FFS) of the soil, sediment, surface water and groundwater at the Estate of Lester Nolan Landfill site (hereinafter the "the site").

The property is located north and east of the intersection of New Castle Avenue and New York Avenue, just north of Route 495, in Wilmington, Delaware (Figure 1). The RI/FFS was conducted consistent with the Delaware Regulations Governing Hazardous Substance Cleanup (HSCA), Delaware Standard Operating Procedures (SOP) for Chemical Analytical Programs (CAP), the Guidance Document and other Departmental policies or procedures.

The overall purpose of the RI/FFS process was to determine the nature and extent of surface and subsurface contamination at the site, identify potential sources of contamination, evaluate risks to the public health and environment associated with identified contamination, and perform a focused feasibility study that would identify, evaluate and recommend a remedial action, if required, that would be protective of public health, welfare and the environment.

This document is the Department's Proposed Plan of Remedial Action for the site. It is based on the results of the RI/FFS for the site. This Proposed Plan is issued under the provisions of the Delaware Hazardous Substance Cleanup Act (HSCA) and the Regulations Governing Hazardous Substance Cleanup (Regulations). It presents the Department's assessment of the potential unacceptable health and environmental risks posed by the site.

Section 2 presents a summary of the background and history of the site. Section 3 discusses the remedial investigation objectives for the site. Section 4 provides a description of the remedial investigation results. Section 5 presents a discussion of the remedial action objectives, a review of applicable local, state and federal regulations, and a discussion of the areas of concern. Section 6 presents a detailed analysis of remedial alternatives, including identification of and rationale for selection of alternatives and description of alternatives.

The Proposed Plan of Remedial Action also includes a comparison of the remedial alternatives with respect to the following criteria: protection of public health; welfare and the environment; compliance with applicable laws and regulations; community acceptance; compliance monitoring requirements; technical practicality; restoration time frame; reduction of toxicity, mobility and volume of contamination, long-term effectiveness; short-term effectiveness, capital and operation and maintenance cost.

The Department will provide public notice and opportunity to comment on the Proposed Plan in accordance with Section 12 of the Regulations. At the conclusion of the comment period, the Department, after review and consideration of the comments received, shall issue a final plan of remedial action, which shall designate the remedial action. The Proposed Plan, the comments received from the public, responses to the comments and the Final Plan will constitute the "Remedial Decision Record".

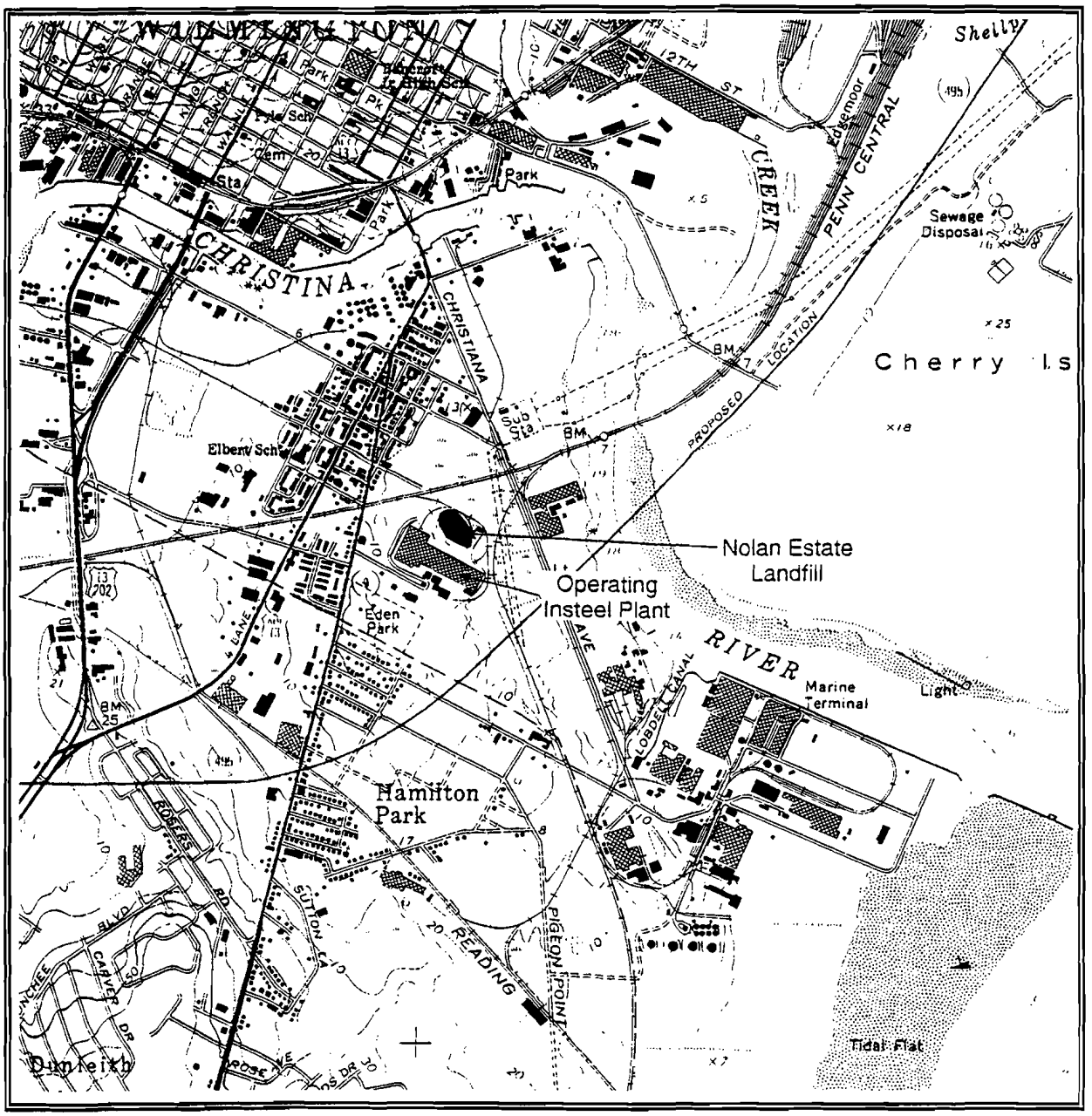


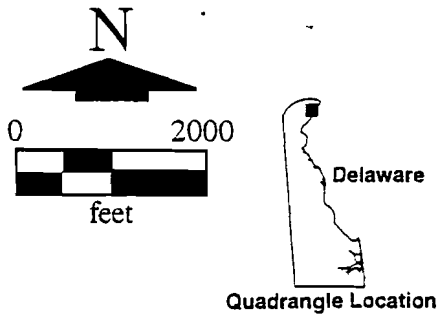
Figure 1
Site Location Map

Base Map is from ADC's Street Map of New Castle County

Estate of Lester Nolan

Wilmington, Delaware

File: (462.15.21)



2. SITE DESCRIPTION AND FACILITY HISTORY

The entire Nolan Estate property is approximately 35 acres in size and has been used as an industrial facility since the early 1900s.

Currently, the Estate of Lester Nolan property is the site of an operating wire fabricating plant, Insteel Wire Products, Inc. (Insteel). Insteel uses spooled steel wire to manufacture a variety of products including fencing, screening and concrete reinforcing nets (rebar). Insteel owns the factory in which they operate and holds a purchase option from the Nolan Estate on the land.

The subject of this investigation, an unauthorized landfill, is located on the northeast side of the Insteel Wire Fabricating building. The site, as defined by the Nolan Estate/DNREC VCP Settlement Agreement, covers approximately four (4) acres and is generally bounded by the Insteel manufacturing facility and a wetland area. The actual extent of the landfill, based on the RI results, is approximately 2.9 acres. Figure 2 defines the area of investigation.

According to DNREC's Preliminary Assessment Report, the landfill was reportedly operated by the Forbes Steel and Wire Corporation without a permit for over twenty (20) years. The landfill surface is relatively flat with pieces of wood and metal exposed across the surface. The landfill supports sparse vegetative growth over the main fill area and thick growth at the edges.

Based on a 1993 investigation, the average thickness of the fill materials is about 8 feet in the central portion of the landfill. The landfill contains scrap metal, wood and miscellaneous plastic and trash. The fill was apparently placed into a swampy area to bring the land surface up to grade with the factory building. There are two areas within the landfill perimeter where filling is incomplete. One area, located in the western portion of the site, is approximately 2 feet lower than the remainder of the landfill and contains some steel and wood debris. The second area, located in the northeastern portion of the landfill, is a pond. The pond contains some solid waste, including wood and tires.

Based on the historical information reviewed, it appears that the main factory building was constructed sometime in 1904 with an addition constructed in the early 1970s. The site has been used for heavy industrial manufacturing since its development in 1904. Aerial photographs indicate the landfilling may have begun in the 1950s and continued until the 1980s.

2.1 Topography, Wetlands and Surface Water

The site is relatively flat with elevations ranging between 6 and 12 feet above sea level. The topography appears to slope slightly toward the northeast. There are no drainage channels within the site, although there is a small relict channel that may have historically been part of a larger tributary system.

Two isolated wetlands, totaling approximately 0.7 acres, were delineated within the site. The topographic pattern suggests that, historically, these wetlands drained to the tidal marshes that border the Christina River. Construction of the railroad right-of-way along the northern and eastern boundaries severed any hydrologic connection between the site and tidal marshes, isolating the site wetlands. Because they are isolated from any tributary system, recharge to

site wetlands would primarily be precipitation and run-off from surrounding developed areas (See Figure 2).

Hydrogeologic Setting

The Atlantic Coastal Plain is the emerged portion of the continental shelf and extends from New England to central Georgia. The Coastal Plain sediments directly overlie the crystalline basement complex as well as its weathering products. The Lester Nolan Estate property is located in the Atlantic Coastal Plain Province. The Coastal Plain units in New Castle County include the unconsolidated sediments of the Potomac Formation of Early and Late Cretaceous age, the overlying Columbia Formation of Pleistocene age and younger deposits of Holocene (Recent) age.

Regionally, both the Potomac and the Columbia Formation are developed as groundwater supply sources. The Columbia Formation is of Pleistocene age and lies unconformably above the Potomac Formation of Cretaceous age. There are three distinct water-bearing sand aquifers in the Columbia and Potomac Formations: The Columbia, the upper Potomac, and the lower Potomac aquifers.

3. REMEDIAL INVESTIGATION OBJECTIVES

The objectives of the RI were to verify the results of previous studies that had been performed at the site, to obtain information about areas of the site that may have not been fully characterized and to use this information to identify areas of the site that would require remediation.

The RI field work began on June 15, 1995 and was completed on November 16, 1995. The field work consisted of the following:

- Performance of a survey to delineate on-site wetlands;
- Performance of a preliminary topographic site survey, including establishment of a grid across the landfill;
- Excavation of twenty-two (22) test pits in the landfill area;
- Excavation of three (3) test pits outside of the landfill area to characterize soil background conditions;
- Collection and analysis of forty-one (41) soil samples from the test pits and three surficial soil sample locations;
- Installation of nine (9) piezometers to monitor groundwater elevation within the East Landfill;
- Installation of two (2) piezometers to monitor groundwater elevation within Wetland B;

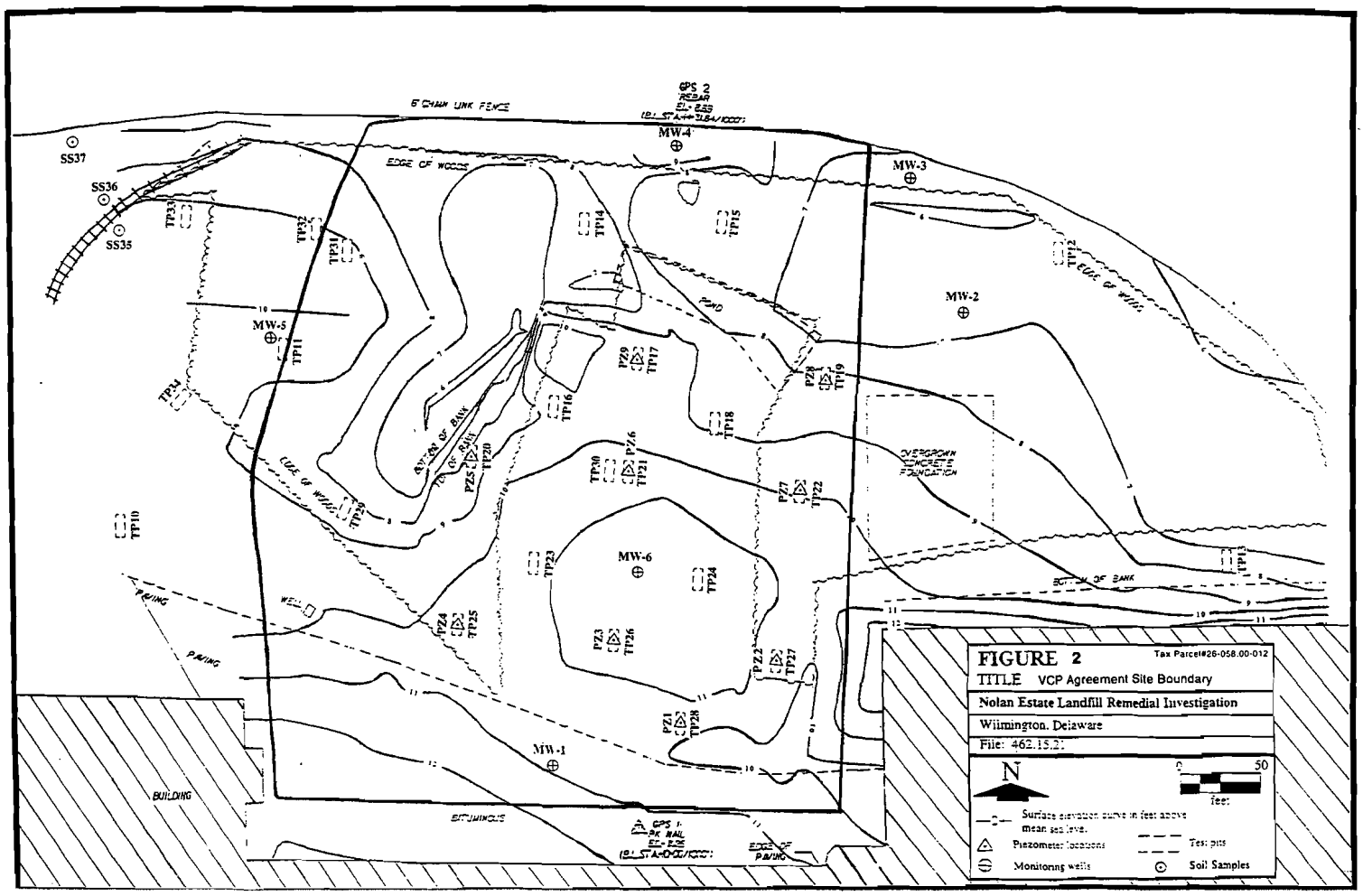


FIGURE 2
Tax Parcel#26-058.00-012
TITLE VCP Agreement Site Boundary
Nolan Estate Landfill Remedial Investigation
Wilmington, Delaware
File: 462.15.21
N
0
50
feet
Surface elevation curve in feet above mean sea level.
Piezometer locations
Test pits
Monitoring wells
Soil Samples
6' CHAIN LINK FENCE
EDGE OF WOODS
POND
OVERGROWN CONCRETE FOUNDATION
BOTTOM OF BANK
BUILDING
BITUMINOUS
WELL
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
SS35
SS36
SS37
TP10
TP11
TP12
TP13
TP14
TP15
TP16
TP17
TP18
TP19
TP20
TP21
TP22
TP23
TP24
TP25
TP26
TP27
TP28
TP29
TP30
TP31
TP32
TP33
PZ1
PZ2
PZ3
PZ4
PZ5
PZ6
PZ7
PZ8
PZ9

- Installation of six (6) monitoring wells (1 screened through the East Landfill, 1 screened through the West Landfill, 1 upgradient and 4 downgradient of the landfill);

- Collection and analysis of nine (9) groundwater samples. Samples were collected from the six (6) new monitoring wells, the on-site production well and two (2) monitoring wells installed by DNREC as part of the salt pile investigation.

- Collection of four (4) surface water and four (4) sediment samples from the ponded areas within and adjacent to the landfill;

- Performance of a survey to map on-site monitoring wells, piezometers and selected test pits; and

- Collection of eleven (11) rounds of water elevation measurements.

4. REMEDIAL INVESTIGATION RESULTS

The laboratory analytical results were submitted to the Department in a draft RI report from WIK Associates, Inc. dated August 26, 1996. Soil analytical results for lead, TPH, VOCs, SVOCs, PCBs and asbestos are summarized in Tables 1-5. Contaminants exceeding Risk-Based Concentration values included:

1)	Lead	1,240 to 57,400 mg/kg (ppm)
2)	Aroclor 1260	1.700 mg/kg (ppm)
3)	Benzo(a)pyrene	0.78 to 1.1 mg/kg (ppm)

Based on the hydrogeologic and analytic data collected during the Remedial Investigation, the following conclusions were drawn regarding the landfill at the Estate of Lester Nolan:

1. The East and West Landfills contain solid waste and asbestos.

2. Surficial soil in the East and West Landfills has been impacted by lead and petroleum hydrocarbons.

3. An isolated area of surficial soil west of the West Landfill has been impacted by lead and petroleum hydrocarbons.

4. Throughout most of the East and West Landfills, lead and petroleum hydrocarbon concentrations decrease rapidly with depth. Isolated hot spots exist at depth in both landfills.

5. REMEDIAL ACTION OBJECTIVES

5.1 Current and Proposed Use

As stated previously, the landfill is located adjacent to a wire manufacturing plant operated by Insteel. Insteel uses spooled steel wire to manufacture a variety of products including fencing, screening and concrete reinforcing nets (rebar). Insteel owns the operating plant and holds a purchase option from the Nolan Estate on the land. Surrounding land uses include: Conrail railroad tracks bordering the site to the north and northeast and west; Highway 495 bordering the site to the east; New Castle Avenue bordering the site to the west; and New York Avenue bordering the site to the south.

A possible future use of the landfill area would be a storage location/facility to be used by Insteel. This proposed use requires the area currently under investigation to be able to support heavy equipment and bundles of bulk wire after remedial actions have been completed. Heavy equipment would consist of tractor trailers delivering spools of raw wire to the plant and forklifts for transporting the wire to and from the manufacturing processes.

5.2 Applicable Requirements

The overall objective of the remedial action is to protect human health and the environment. Remedial action objectives must consider applicable requirements in accordance with HSCA 8.4(5). This section is a compilation and description of the applicable federal, state, and local regulations that could apply to the Nolan Landfill site.

5.2.1 Federal Regulations

- Resource Conservation and Recovery Act (RCRA) – Regulations promulgated under RCRA generally provide the basis for management of hazardous waste. Hazardous waste identification under RCRA is detailed in 40 CFR 261. The two basic classifications of RCRA hazardous waste are as follows:

  - Characteristic Hazardous Wastes (defined under Subpart C of 40 CFR 261) – If a waste is not listed as hazardous, it may still be a hazardous waste if it meets any of the four characteristics below:

    - Ignitability (D001 waste).
    - Corrosivity (D002 waste).
    - Reactivity (D003 waste).
    - Toxicity (D004 to D043 wastes).

RCRA requirements for treatment, storage or disposal of hazardous wastes apply to a site if the site contains RCRA listed or characteristic hazardous waste that was treated or disposed of after the effective date of the RCRA regulations or if the activity at the site constitutes current treatment, storage or disposal of RCRA hazardous waste. In the case of the Nolan Landfill, the landfill materials were determined to be above the Toxicity Characteristic Leaching Procedure (TCLP) level for lead. Furthermore, it was reported to have concluded in the early to mid-1980s, after the effective date of the RCRA Subtitle C regulations on 19 November, 1980. Therefore, RCRA Subtitle C regulations are applicable to the closure of the landfill.

Table 1
Remedial Investigation
Estate of Lester Nolan
Wilmington, Delaware
Soil Analytical Data
Lead and Total Petroleum Hydrocarbons

Sample ID	Date	Unit	Depth (ft)	Lead (mg/Kg)	TPH (mg/Kg)
TP10-S001	10/13/95	BRN	2.5	516	132 K
TP10-S002	10/13/95	COL	8.5	9.4	ND (62)
TP11-S001	10/13/95	BRN	4	1,580	50,800 K
TP11-S002	10/13/95	COL	8.5	1,240	117,000 K
TP12-S001	10/13/95	BRN	1-3	51.5	363 K
TP12-S101	10/13/95	BRN	1-3	90.3	214 K
TP13-S001	10/13/95	BLK	3	75.6	366 K
TP14-S001	10/13/95	BRN	1	53.5	163 K
TP14-S002	10/13/95	BLK	2.5	50.4	147 K
TP15-S001	10/13/95	BLK	2	79.6	110 K
TP15-S102	10/13/95	BLK	2	87.2	143 K
TP16-S001	10/11/95	BLK	1.5	18,200	36,700
TP16-S002	10/11/95	BLK	3.5	12,900	28,600
TP17-S001	10/11/95	BRN	2	5,410	12,300
TP17-S002	10/11/95	BLK	5	26.1 U	156 K
TP17-S003	10/11/95	COL	9	41.2 U	ND (67)
TP18-S001	10/11/95	BRN	1-2	57,400	17,900
TP18-S002	10/11/95	BLK	4	4,290	16,000
TP19-S001	10/11/95	BRN	1	33.4 U	ND (55)
TP19-S002	10/11/95	BLK	4	18.1 U	306 K
TP19-S003	10/11/95	COL	8	69.2 U	84
TP20-S001	10/12/95	BRN	1	30,500	6,500 L
TP20-S002	10/12/95	BLK	7	522	290 K
TP20-S003	10/12/95	COL	9.5	2.4 U	64 L
TP21-S001	10/12/95	BRN	1	14,000	38,600 L
TP21-S002	10/12/95	BLK	5.5	179 U	774 L
TP21-S102	10/12/95	BLK	5.5	469	4,000 L
TP22-S001	10/11/95	BRN	1	37.9 U	ND (56)
TP22-S002	10/11/95	BLK	8	36.3 U	183
TP23-S002	10/12/95	BLK	3.5	4,550	12,000
TP24-S001	10/12/95	BLK	2.5	5,140	101,000
TP24-S002	10/12/95	BLK	4	3,960	98,900
TP25-S001	10/12/95	BRN	1	4,180	1,290
TP25-S002	10/12/95	BLK	6.5	194 U	696
TP26-S001	10/12/95	BRN	1.5	7,200	35,900 L
TP27-S001	10/12/95	BRN	2	24.9 U	646 L
TP28-S002	10/12/95	BLK	5	15.3 U	6,600 L
TP28-S003	10/12/95	COL	8.5	29.5 U	69 L
TP29-S001	3/19/96	BLK	3.5	289	18,300
TP31-S001	3/19/96	BRN	0.5	5,930	1,300
TP31-S002	3/19/96	BLK	6	141	341
TP33-S001	3/19/96	NA	2	5,900	22,100
TP34-S001	3/19/96	BRN	6.5	91	ND (60)
TP34-S002	3/19/96	COL	8.5	29.3	ND (60)
SS35-S001	4/24/96	BLK	2	8,160	6,640
SS36-S001	5/2/96	BLK	2.5	32.7	60
SS37-S001	5/2/96	BLK	3	31.7	ND (66)
Selected Nolan Estate Surface Soil Screening Level				1,000	nca
Selected Nolan Estate Subsurface Soil Screening Level				nca	nca

nca - No criteria available
ND - not detected; detection limit shown in parenthesis
Bold type indicates the results exceed Screening Levels
K - Value biased high, actual value expected to be lower
L - Value biased low, actual value expected to be higher
U - Compound detected below action limit
BRN - Brown Sand Unit
BLK - Black Sand Unit
COL - Columbia Formation

Table 2
Remedial Investigation
Estate of Lester Nolan
Wilmington, Delaware
Soil Analytical Results

Date Sampled Depth (ft)	TP11-S001 10/13/95 4	TP16-S001 10/11/95 1.5	TP18-S001 10/11/95 1-2	TP18-S002 10/11/95 4	SS18-S001 2/15/96 0.5-1.5	SS26-S001 2/15/96 0.5-1.5	Selected Nolan Estate Surface Soil Screening Level	Selected Nolan Estate Subsurface Soil Screening Level
Total Metals (mg/Kg)								
Antimony	ND (10.7)	ND (12)	ND (11.3)	ND (12.9)	NA	NA	820	nca
Arsenic	12.8	22.9	12.9	11.7	NA	NA	610	15
Beryllium	**2.8**	0.57 B	0.81 B	0.31 B	NA	NA	1.3	180
Cadmium	ND (1.3)	2.0	1.3	ND (1.5)	NA	NA	1,000	6
Chromium	**25.4**	37.4	30.3	**21.5**	NA	NA	10,000 †	19 †
Copper	198	580	932	561	NA	NA	82,000	nca
Lead	**2,590***	**16,200***	**32,500***	**6,990***	NA	NA	1,000	nca
Mercury	36.1	0.45	0.27	0.15 B	NA	NA	610	3
Nickel	**35.3**	76.3	110	**72.7**	NA	NA	41,000	21
Selenium	ND (0.27)	ND (0.29)	ND (0.27)	ND (0.27)	NA	NA	10,000	3
Silver	ND (2.3)	ND (2.6)	ND (2.4)	ND (2.8)	NA	NA	10,000	nca
Thallium	ND (0.27)	ND (0.29)	ND (0.27)	ND (0.27)	NA	NA	nca	0.4
Zinc	5,790	7,690	10,800	3,770	NA	NA	610,000	42,000
SPLP (mg/L)	**(Synthetic Precipitation Leaching Procedure - pH of 4)**							
Lead	ND (0.100)	ND (0.100)	ND (0.100)	ND (0.100)	NA	NA	nca	nca
TCLP (mg/L)	**(Toxicity Characteristic Leaching Procedure - pH of 2)**							TCLP Regulatory Levels (10/95)
Metals								
Arsenic	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	NA	5.0
Barium	0.710	1.79	0.895	0.700	1.14	2.05	NA	100.0
Cadmium	ND (0.025)	0.045	0.085	ND (0.025)	0.0650	0.100	NA	1.0
Chromium	ND (0.050)	ND (0.050)	ND (0.050)	0.135	ND (0.050)	ND (0.050)	NA	5.0
Lead	**26.6**	**64.9**	**190.0**	**74.4**	**79.5**	**136**	NA	5.0
Mercury	ND (0.00020)	ND (0.00020)	ND (0.00020)	ND (0.00020)	ND (0.00020)	ND (0.00020)	NA	0.2
Selenium	ND (0.250)	ND (0.250)	ND (0.250)	ND (0.250)	ND (0.25)	ND (0.25)	NA	1.0
Silver	ND (0.050)	ND (0.050)	ND (0.050)	ND (0.050)	ND (0.050)	ND (0.050)	NA	5.0
Zinc	18.2	56.0	409	30.3	NA	NA	NA	NA
VOCs	NA	NA	NA	NA	ND	ND	NA	NRL
SVOCs	NA	NA	NA	NA	ND	ND	NA	NRL
PEST/HERB	NA	NA	NA	NA	ND	ND	NA	NRL

nca - No criteria available
ND - not detected; detection limit shown in parenthesis
NA - Not Applicable
Bold type indicates the results exceed Screening Levels
B - Result falls between the IDL and the CRDL
† - Reporting level for hexavalent chromium
* - Lead was analyzed two times in the sample, initial results shown on Table 1

Table 3
Remedial Investigation
Estate of Lester Nolan
Wilmington, Delaware
Soil Analytical Results

Date Sampled	SS16-S001 2/15/96	SS18-S001 2/15/96	SS18-S101 2/15/96	SS25-S001 2/15/96	SS26-S001 2/15/96	Selected Nolan Estate Surface Soil Screening Level
Metals (mg/Kg)						
Aluminum	3,500	4,310	4,180	2,100	4,510	1E-6
Antimony	ND (11.1)	ND (11.2)	ND (11.0)	ND (12.0)	ND (12.0)	820
Arsenic	22.2 B	13.9 B	15.3 B	8.0	21.0 B	610
Barium	69.9	65.3	67.6	42.7 B	64.9	140,000
Beryllium	0.26 B	0.53 B	0.52 B	ND (0.29)	0.57 B	1.30
Cadmium	4.2	13.9	10.0	1.7	5.1	1,000
Calcium	131,000	72,800	69,800	19,200	68,300	nca
Chromium	31.1	38.1	33.0	22.6	49.7	10,000†
Cobalt	5.3 B	11.5 B	7.1 B	4.3 B	6.9 B	120,000
Copper	468	697	546	228	591	82,000
Iron	44,300	51,200	46,000	29,800	61,400	610,000
Lead	**24,600**	**17,100**	**18,500**	3,620	**22,500**	1,000
Magnesium	6,320	7,310	8,640	1,170 B	3,810	nca
Manganese	345	402	363	252	552	10,000
Mercury	0.33	0.64	0.46	0.26	0.44	610
Nickel	79.7	83.6	73.4	25.5	80.6	41,000
Potassium	281 B	308 B	327 B	162 B	496 B	nca
Selenium	ND (0.28)	ND (0.25)	ND (0.29)	ND (0.29)	ND (0.26)	10,000
Silver	ND (2.5)	ND (2.5)	ND (2.5)	ND (2.6)	ND (2.6)	10,000
Sodium	597 B	535 B	528 B	63.0 B	1,400 B	nca
Thallium	ND (0.28)	ND (0.25)	ND (0.28)	ND (0.29)	ND (0.26)	nca
Vanadium	12.1 B	13.3	13.1	17.2	17.7	14,000
Zinc	6,120	21,300	16,400	2,350	11,100	610,000
Cyanide	ND (1.4)	ND (1.4)	ND (1.4)	ND (1.4)	ND (1.4)	41,000
VOCs (mg/Kg)						
VOC Compounds	ND	ND	ND	ND	ND	nca
SVOCs (mg/Kg)						
Acenaphthene	ND (1.80)	ND (1.80)	ND (1.80)	0.086 J	ND (1.90)	10,000
Dibenzofuran	ND (1.80)	ND (1.80)	ND (1.80)	0.048 J	ND (1.90)	8,200
Fluorene	ND (1.80)	ND (1.80)	ND (1.80)	0.066 J	ND (1.90)	10,000
Phenanthrene	0.340 J	0.310 J	ND (1.80)	1.200	0.200 J	nca
Anthracene	ND (1.80)	ND (1.80)	ND (1.80)	0.250 J	ND (1.90)	10,000
Carbazole	ND (1.80)	ND (1.80)	ND (1.80)	0.200 J	ND (1.90)	290
Di-n-Butylphthalate	ND (1.80)	ND (1.80)	ND (1.80)	0.100 J	ND (1.90)	1,000
Fluoranthene	0.470 J	0.330 J	0.200 J	2.300	0.190 J	10,000
Pyrene	0.810 J	0.550 J	0.340 J	2.200	0.880 J	10,000
Butylbenzylphthalate	0.200 J	ND (1.80)	ND (1.80)	ND (0.47)	ND (1.90)	5,300
Benzo (a) Anthracene	0.280 J	0.190 J	ND (1.80)	1.100	ND (1.90)	7.8
Chrysene	0.360 J	0.250 J	ND (1.80)	1.300	0.230 J	780
bis(2-Ethylhexyl)Phthalate	ND (1.80)	0.260 J	ND (1.80)	0.055 J	0.340 J	410
Benzo (b)Fluoranthene	0.390 J	0.200 J	ND (1.80)	1.300	ND (1.90)	7.8
Benzo (k)Fluoranthene	0.450 J	0.250 J	ND (1.80)	0.750	ND (1.90)	78
Benzo(a)Pyrene	0.360 J	0.200 J	ND (1.80)	1.000	0.210 J	0.78
Ideno(1,2,3-cd)Pyrene	0.180 J	ND (1.80)	ND (1.80)	0.630	ND (1.90)	7.8
Dibenz(a,h)Anthracene	ND (1.80)	ND (1.80)	ND (1.80)	0.270 J	ND (1.90)	0.78
Benzo(g,h,i)Perylene	ND (1.80)	ND (1.80)	ND (1.80)	0.670	ND (1.90)	nca
Total TICs	ND	ND	ND	ND	ND	nca
PESTICIDES (mg/Kg)						
alpha-BHC	0.0014 JP	ND (0.019)	ND (0.019)	0.0011 JP	ND (0.019)	0.91
beta-BHC	0.019 P	0.0058 JP	0.011 J	0.0024	0.0058 JP	3.2
gamma-BHC (Lindane)	ND (0.019)	ND (0.019)	ND (0.019)	0.00025 JP	ND (0.019)	4.4
Heptachlor	ND (0.019)	ND (0.019)	ND (0.019)	0.00069 JP	ND (0.019)	1.3
4,4'-DDE	ND (0.037)	ND (0.037)	ND (0.037)	0.0020 JP	ND (0.038)	17
Endosulfan II	0.0079 JP	ND (0.037)	0.0053 JP	0.0092	0.0068 JP	10,000
4,4'-DDD	0.023 JP	0.037 P	0.034 JP	0.031 P	0.038 P	24
4,4'-DDT	0.010 JP	ND (0.037)	ND (0.037)	ND (0.0047)	ND (0.038)	17
Methoxychlor	ND (0.19)	ND (0.19)	ND (0.19)	0.0090 BP	ND (0.19)	10,000
Endrin-Ketone	ND (0.037)	ND (0.037)	0.007 JP	ND (0.0047)	ND (0.038)	610
alpha-Chlordane	ND (0.019)	0.013 BJP	0.012 BJ	0.022 JP	0.014 BJP	nca
gamma-Chlordane	0.012 J	0.012 JP	0.011 JP	0.029 P	0.015 J	nca
Total Chloridane	0.012	0.025	0.023	0.051	0.029	4.4
Aroclor-1260	0.480	0.480	0.350 J	**1.700**	0.440	0.74

nca - No criteria available
ND - not detected; detection limit shown in parenthesis
Bold type indicates the results exceed Screening Levels
B - Result falls between the IDL and the CRDL
J - Result is below the detection limit and is an estimated value
P - Greater than 25% difference for the detected compound between the two GC columns. The lower value has been reported.
† - Regulatory standard for hexavalent chromium

Table 4
Remedial Investigation
Estate of Lester Nolan
Wilmington, Delaware
Soil Analytical Data
Volatile Organic Compounds (mg/Kg)

Sample ID	Date	Depth	Toluene	Ethylbenzene	Total TICs	Major TIC Component
TP11-S001	10/13/95	4	ND (0.23)	ND (0.23)	ND	
TP11-S002	10/13/95	8.5	0.049J	ND (0.32)	49.5	Napthalene, 2-methyl
TP12-S001	10/13/95	1-3	0.039 J	ND (0.18)	ND	
TP12-S101	10/13/95	1-3	ND (0.16)	ND (0.16)	ND	
TP13-S001	10/13/95	3	ND (0.18)	ND (0.18)	ND	
TP14-S001	10/13/95	1	0.025 J	ND (0.17)	ND	
TP15-S001	10/13/95	2	0.024 J	ND (0.17)	ND	
TP15-S102	10/13/95	2	ND (0.18)	ND (0.18)	ND	
TP16-S002	10/11/95	3.5	ND (0.25)	ND (0.25)	2.99	Naphthalene, 2-methyl
TP18-S002	10/11/95	4	ND (0.20)	0.067 J	3.26	Benzene Dimethyl Methylethyl
TP20-S001	10/12/95	1	ND (0.21)	ND (0.21)	ND	
TP21-S002	10/12/95	5.5	ND (0.18)	ND (0.18)	6.6	Ideno Dihydro Dimethyl Isomer
TP21-S102	10/12/95	5.5	0.02 J	ND (0.17)	0.36	Benzene Ethyl Methylethyl Isomer
TP24-S002	10/12/95	4	ND (0.24)	ND (0.24)	1.44	Ideno Dihydro Dimethyl Isomer
TP28-S002	10/12/95	5	0.023 J	ND (0.18)	7.7	Benzene Dimethyl Methylethyl
TP29-S001	3/19/96	3.5	ND (0.36)	ND (0.36)	2.14	Unknown Alkane
Selected Nolan Estate Surface Soil Screening Level			5	5	nca	
Selected Nolan Estate Subsurface Soil Screening Level			5	5	nca	

nca - No criteria available
ND - Not Detected. Detection limit shown in parenthesis
J = Result is below the detection limit and is an estimated value

Table 5
Remedial Investigation
Estate of Lester Nolan
Wilmington, Delaware
Soil Analytical Data
Semi-Volatile Organic Compounds (mg/Kg)

Sample ID	Date Sampled	Depth (ft)	Naphthalene	2-Methylnaphthalene	Acenaphthylene	Acenaphthene
TP11-S001	10/13/95	4	ND (43.0)	ND (43.0)	ND (43.0)	ND (43.0)
TP11-S002	10/13/95	8.5	ND (110.0)	120	ND (110.0)	19.0 J
TP12-S001	10/13/95	1-3	0.063 J	0.072 J	0.17 J	0.14 J
TP12-S101	10/13/95	1-3	0.038 J	0.046 J	0.11 J	0.066 J
TP13-S001	10/13/95	3	0.093 J	0.091 J	0.25 J	0.12 J
TP14-S001	10/13/95	1	ND (1.2)	0.13 J	0.12 J	0.65 J
TP15-S001	10/13/95	2	0.058 J	ND (0.40)	0.045 J	0.11 J
TP15-S102	10/13/95	2	0.26 J	0.18 J	0.11 J	0.31 J
TP16-S002	10/11/95	3.5	ND (9.4)	4.3 J	ND (9.4)	1.2 J
TP18-S002	10/11/95	4	0.45 J	2.7 J	ND (4.5)	ND (4.5)
TP20-S001	10/12/95	1	ND (2.1)	ND (2.1)	ND (2.1)	ND (2.1)
TP21-S002	10/12/95	5.5	0.13 J	0.43	ND (0.38)	0.13 J
TP21-S102	10/12/95	5.5	0.84 J	4.8	ND (4.0)	0.84 J
TP23-S002	10/12/95	3.5	ND (13.0)	ND (13.0)	ND (13.0)	ND (13.0)
TP24-S002	10/12/95	4	ND (24.0)	20.0 J	ND (24.0)	3.1 J
TP26-S001	10/12/95	1	3.8 J	25.0 J	ND (27.0)	ND (27.0)
TP28-S002	10/12/95	5	ND (12.0)	2.3 J	ND (12.0)	2.9 J
TP29-S001	3/19/96	3.5	0.650 J	0.470 J	ND (4.30)	ND (4.30)
Selected Nolan Estate Surface Soil Screening Level			30	nca	nca	10,000
Selected Nolan Estate Subsurface Soil Screening Level			30	nca	nca	200

nca - No criteria available

ND - not detected; detection limit shown in parenthesis

Bold type indicates the results exceed Screening Levels

J - Result is below the detection limit and is an estimated value

† - Screening Level modified based on acreage

Table 15
Remedial Investigation
Estate of Lester Nolan
Wilmington, Delaware
Soil Analytical Data
Semi-Volatile Organic Compounds (mg/Kg)

Sample ID	Date Sampled	Depth (ft)	Dibenzofuran	Fluorene	Phenanthrene	Anthracene
TP11-S001	10/13/95	4	ND (43.0)	ND (43.0)	ND (43.0)	ND (43.0)
TP11-S002	10/13/95	8.5	ND (110.0)	30.0 J	76.0 J	13.0 J
TP12-S001	10/13/95	1-3	0.093 J	0.17	1.7	0.46
TP12-S101	10/13/95	1-3	0.042 J	0.081 J	0.95	0.29 J
TP13-S001	10/13/95	3	0.077 J	0.16 J	1.2	0.37 J
TP14-S001	10/13/95	1	0.29 J	0.58 J	6.2	1.6
TP15-S001	10/13/95	2	0.066 J	0.15 J	1.3	0.32 J
TP15-S102	10/13/95	2	0.25 J	0.37 J	2.9	0.56
TP16-S002	10/11/95	3.5	1.2 J	3.4 J	7.0 J	1.2 J
TP18-S002	10/11/95	4	ND (4.5)	ND (4.5)	3.9 J	0.78 J
TP20-S001	10/12/95	1	ND (2.1)	ND (2.1)	1.8 J	0.35 J
TP21-S002	10/12/95	5.5	0.069 J	0.19 J	0.71	0.098 J
TP21-S102	10/12/95	5.5	ND (4.0)	2.0 J	ND (4.0)	ND (4.0)
TP23-S002	10/12/95	3.5	ND (13.0)	ND (13.0)	1.4 J	ND (13.0)
TP24-S002	10/12/95	4	ND (24.0)	6.4 J	12.0 J	ND (24.0)
TP26-S001	10/12/95	1	ND (27.0)	9.5 J	18.0 J	ND (27.0)
TP28-S002	10/12/95	5	ND (12.0)	2.8 J	7.4 J	ND (12.0)
TP29-S001	3/19/96	3.5	ND (4.30)	0.680 J	1.20 J	ND (4.30)
Selected Nolan Estate Surface Soil Screening Level			8,200	10,000	nca	10,000
Selected Nolan Estate Subsurface Soil Screening Level			120	160	nca	4,300

nca - No criteria available

ND - not detected; detection limit shown in parenthesis

Bold type indicates the results exceed Screening Levels

J - Result is below the detection limit and is an estimated value

† - Screening Level modified based on acreage

Table 5
Remedial Investigation
Estate of Lester Nolan
Wilmington, Delaware
Soil Analytical Data
Semi-Volatile Organic Compounds (mg/Kg)

Sample ID	Date Sampled	Depth (ft)	Fluoranthene	Pyrene	Benzo (a)anthracene	Chrysene
TP11-S001	10/13/95	4	ND (43.0)	ND (43.0)	ND (43.0)	ND (43.0)
TP11-S002	10/13/95	8.5	ND (110.0)	ND (110.0)	ND (110.0)	ND (110.0)
TP12-S001	10/13/95	1-3	2.2	1.9	1.3	1.2
TP12-S101	10/13/95	1-3	1.6	1.7	1.1	1.1
TP13-S001	10/13/95	3	1.9	2.1	0.98	1.1
TP14-S001	10/13/95	1	8.0	6.3	4.2	4.2
TP15-S001	10/13/95	2	1.6	1.6	0.97	1.0
TP15-S102	10/13/95	2	2.9	2.5	1.5	1.5
TP16-S002	10/11/95	3.5	3.2 J	3.7 J	1.1 J	1.3 J
TP18-S002	10/11/95	4	2.8 J	2.0 J	1.1 J	1.1 J
TP20-S001	10/12/95	1	1.8 J	1.7 J	0.83 J	0.85 J
TP21-S002	10/12/95	5.5	0.32 J	0.7	0.17 J	0.2
TP21-S102	10/12/95	5.5	1.1 J	0.95 J	0.48 J	0.55 J
TP23-S002	10/12/95	3.5	ND (13.0)	ND (13.0)	ND (6.4)	ND (6.4)
TP24-S002	10/12/95	4	ND (24.0)	ND (24.0)	ND (12.0)	ND (12.0)
TP26-S001	10/12/95	1	ND (27.0)	3.0 J	ND (13.0)	ND (13.0)
TP28-S002	10/12/95	5	ND (12.0)	ND (12.0)	ND (6.0)	ND (6.0)
TP29-S001	3/19/96	3.5	2.80 J	4.60	1.60 J	1.90 J
Selected Nolan Estate Surface Soil Screening Level			10,000	10,000	7.8	780
Selected Nolan Estate Subsurface Soil Screening Level			980	1,400	2.1†	3†

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Bold type indicates the results exceed Screening Levels
J - Result is below the detection limit and is an estimated value
† - Screening Level modified based on acreage

Table 5
Remedial Investigation
Estate of Lester Nolan
Wilmington, Delaware
Soil Analytical Data
Semi-Volatile Organic Compounds (mg/Kg)

Sample ID	Date Sampled	Depth (ft)	Benzo (b)fluoranthene	Benzo (k)fluoranthene	Benzo (a)pyrene	Ideno (1,2,3-cd)pyrene
TP11-S001	10/13/95	4	ND (43.0)	ND (43.0)	ND (43.0)	ND (43.0)
TP11-S002	10/13/95	8.5	ND (110.0)	ND (110.0)	ND (110.0)	ND (110.0)
TP12-S001	10/13/95	1-3	1.2	0.82	**0.90**	0.45
TP12-S101	10/13/95	1-3	0.88	0.77	**0.78**	0.30 J
TP13-S001	10/13/95	3	1.4	0.86	0.87	0.37 J
TP14-S001	10/13/95	1	4.9	2.6	**3.3**	1.5
TP15-S001	10/13/95	2	0.78	0.63	0.67	0.28 J
TP15-S102	10/13/95	2	1.5	0.84	**1.1**	0.50
TP16-S002	10/11/95	3.5	1.1 J	0.96 J	ND (4.7)	ND (4.7)
TP18-S002	10/11/95	4	0.85 J	0.9 J	ND (2.3)	ND (2.3)
TP20-S001	10/12/95	1	0.70 J	0.52 J	0.59 J	0.35 J
TP21-S002	10/12/95	5.5	0.13 J	0.11 J	0.13 J	0.088 J
TP21-S102	10/12/95	5.5	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)
TP23-S002	10/12/95	3.5	ND (6.4)	ND (6.4)	ND (6.4)	ND (6.4)
TP24-S002	10/12/95	4	ND (12.0)	ND (12.0)	ND (12.0)	ND (12.0)
TP26-S001	10/12/95	1	ND (13.0)	ND (13.0)	ND (13.0)	ND (13.0)
TP28-S002	10/12/95	5	ND (6.0)	ND (6.0)	ND (6.0)	ND (6.0)
TP29-S001	8/19/96	3.5	2.30 J	1.20 J	1.40 J	0.48 J
Selected Nolan Estate Surface Soil Screening Level			7.8	78	0.78	7.8
Selected Nolan Estate Subsurface Soil Screening Level			4	4	4	35

nca - No criteria available
ND - not detected; detection limit shown in parenthesis
Bold type indicates the results exceed Screening Levels
J - Result is below the detection limit and is an estimated value
† - Screening Level modified based on acreage

Table 5
Remedial Investigation
Estate of Lester Nolan
Wilmington, Delaware
Soil Analytical Data
Semi-Volatile Organic Compounds (mg/Kg)

Sample ID	Date Sampled	Depth (ft)	Dibenzo(a,h)anthracene	Benzo (g,h,i)perylene	Carbazole
TP11-S001	10/13/95	4	ND (43.0)	ND (43.0)	ND (43.0)
TP11-S002	10/13/95	8.5	ND (110.0)	ND (110.0)	ND (110.0)
TP12-S001	10/13/95	1-3	0.24 J	ND (0.13)	0.2 J
TP12-S101	10/13/95	1-3	0.16 J	ND (0.11)	0.1 J
TP13-S001	10/13/95	3	0.17 J	ND (0.14)	0.1 J
TP14-S001	10/13/95	1	0.75 J	ND (0.44)	0.94 J
TP15-S001	10/13/95	2	0.14 J	ND (0.11)	0.16 J
TP15-S102	10/13/95	2	0.23 J	0.44	0.41
TP16-S002	10/11/95	3.5	ND (4.7)	ND (9.4)	ND (9.4)
TP18-S002	10/11/95	4	ND (2.3)	ND (4.5)	ND (4.5)
TP20-S001	10/12/95	1	ND (1.0)	0.3 J	0.29 J
TP21-S002	10/12/95	5.5	0.04 J	0.11 J	ND (0.38)
TP21-S102	10/12/95	5.5	ND (2.0)	ND (4.0)	ND (4.0)
TP23-S002	10/12/95	3.5	ND (6.4)	ND (13.0)	ND (13.0)
TP24-S002	10/12/95	4	ND (12.0)	ND (24.0)	ND (24.0)
TP26-S001	10/12/95	1	ND (13.0)	ND (27.0)	ND (27.0)
TP28-S002	10/12/95	5	ND (6.0)	ND (12.0)	ND (12.0)
TP29-S001	3/19/96	3.5	ND (4.30)	0.62 J	ND (4.30)
Selected Nolan Estate Surface Soil Screening Level			0.78	nca	290
Selected Nolan Estate Subsurface Soil Screening Level			11	nca	0.2

nca - No criteria available
ND - not detected; detection limit shown in parenthesis
Bold type indicates the results exceed Screening Levels
J - Result is below the detection limit and is an estimated value
† - Screening Level modified based on acreage

Table 5
Remedial Investigation
Estate of Lester Nolan
Wilmington, Delaware
Soil Analytical Data
Semi-Volatile Organic Compounds (mg/Kg)

Sample ID	Date Sampled	Depth (ft)	Diethylphthalate	Di-n-butylphthalate	bis(2-Ethylhexyl)phthalate
TP11-S001	10/13/95	4	ND (43.0)	ND (43.0)	ND (43.0)
TP11-S002	10/13/95	8.5	ND (110.0)	ND (110.0)	ND (110.0)
TP12-S001	10/13/95	1-3	ND (0.40)	ND (0.40)	ND (0.40)
TP12-S101	10/13/95	1-3	ND (0.39)	ND (0.39)	ND (0.39)
TP13-S001	10/13/95	3	ND (0.40)	ND (0.40)	ND (0.40)
TP14-S001	10/13/95	1	ND (1.2)	ND (1.2)	ND (1.2)
TP15-S001	10/13/95	2	ND (0.40)	0.21 J	ND (0.40)
TP15-S102	10/13/95	2	ND (0.39)	ND (0.39)	ND (0.39)
TP16-S002	10/11/95	3.5	ND (9.4)	ND (9.4)	1.30 J
TP18-S002	10/11/95	4	ND (4.5)	ND (4.5)	0.89 J
TP20-S001	10/12/95	1	ND (2.1)	ND (2.1)	ND (2.1)
TP21-S002	10/12/95	5.5	0.042 J	0.049 J	0.073 J
TP21-S102	10/12/95	5.5	ND (4.0)	ND (4.0)	ND (4.0)
TP23-S002	10/12/95	3.5	ND (13.0)	ND (13.0)	ND (13.0)
TP24-S002	10/12/95	4	ND (24.0)	ND (24.0)	ND (24.0)
TP26-S001	10/12/95	1	ND (27.0)	ND (27.0)	ND (27.0)
TP28-S002	10/12/95	5	ND (12.0)	ND (12.0)	ND (12.0)
TP29-S001	8/19/96	3.5	ND (4.30)	ND (4.30)	ND (4.30)
Selected Nolan Estate Surface Soil Screening Level			5,200	1,000	410
Selected Nolan Estate Subsurface Soil Screening Level			110	120	11

nca - No criteria available
ND - not detected; detection limit shown in parenthesis
Bold type indicates the results exceed Screening Levels
J - Result is below the detection limit and is an estimated value
† - Screening Level modified based on acreage

Table 5
Remedial Investigation
Estate of Lester Nolan
Wilmington, Delaware
Soil Analytical Data
Semi-Volatile Organic Compounds (mg/Kg)

Sample ID	Date Sampled	Depth (ft)	Total TICs	Major TIC Components
TP11-S001	10/13/95	4	1,453	UNKNOWN ALKANE
TP11-S002	10/13/95	8.5	4,690	UNKNOWN ALKANE
TP12-S001	10/13/95	1-3	7.76	UNKNOWN ALKANE
TP12-S101	10/13/95	1-3	7.72	UNKNOWN ALKANE
TP13-S001	10/13/95	3	27.34	UNKNOWN
TP14-S001	10/13/95	1	17.46	UNKNOWN PAH
TP15-S001	10/13/95	2	7.82	UNKNOWN PAH
TP15-S102	10/13/95	2	5.68	UNKNOWN PAH
TP16-S002	10/11/95	3.5	1,050	UNKNOWN ALKANE
TP18-S002	10/11/95	4	537	UNKNOWN ALKANE
TP20-S001	10/12/95	1	188.5	UNKNOWN
TP21-S002	10/12/95	5.5	82.8	Pentane Hydroxy Methyl Iso
TP21-S102	10/12/95	5.5	315.3	UNKNOWN
TP23-S002	10/12/95	3.5	173.8	UNKNOWN / 2-Pentanone, 4-hydroxy-4-met
TP24-S002	10/12/95	4	1,094	UNKNOWN ALKANE
TP26-S001	10/12/95	1	1,241	UNKNOWN ALKANE
TP28-S002	10/12/95	5	369	UNKNOWN
TP29-S001	3/19/96	3.5	ND	
Selected Nolan Estate Surface Soil Screening Level			nca	
Selected Nolan Estate Subsurface Soil Screening Level			nca	

nca - No criteria available
ND - not detected; detection limit shown in parenthesis
Bold type indicates the results exceed Screening Levels
J - Result is below the detection limit and is an estimated value
† - Screening Level modified based on acreage

- National Emission Standard for Asbestos (NESHAPs) 40 CFR Subpart M – This Standard may be applicable because it applies to owners of inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations. The regulations require the owner to comply with one of the following: (1) discharge no visible emissions to the outside air from the site; (2) provide a 6-inch cover of compacted non-asbestos-containing material and grow a cover of vegetation; (3) provide a 2-foot cover of compacted non-asbestos-containing material and maintain it; or (4) use a resinous or petroleum-based dust suppression agent. This regulation is applicable because the site is an inactive waste disposal site containing asbestos.

- Safe Drinking Water Act (SDWA) – The Safe Drinking Water Act (42 USC 300f et seq.) mandates the United States Environmental Protection Agency (U.S. EPA) to establish regulations to protect the public from contaminants in drinking water.

  Under the SDWA, EPA has promulgated primary and secondary drinking water regulations and standards applicable to public water systems. National Primary Drinking Water Standards (NPDWS 40 CFR 141), expressed a Maximum Contaminant Levels (MCLs), are not to be exceeded in public water supplies. The MCLs are enforceable, human health-based standards that consider available treatment technologies and treatment costs. A primary drinking water MCL for lead currently does not exist. However, the current action level for lead is 0.015 mg/L. Treatment of the effluent stream is dependent on whether the contaminant is above the action level. NPDWS are not applicable, because the groundwater below the site in the Columbia Formation is not currently used as a drinking water source. The action level for lead in groundwater may be used as a guideline to assess the groundwater quality data.

- Section 404 U.S. Army Corps of Engineers Regulations – Non-tidal isolated freshwater wetlands in Delaware, such as those within the landfill site, are regulated by the U.S. Army Corps of Engineers, Philadelphia District, under Section 404 of the Clean Water Act. Remedial actions, such as those proposed to affect wetlands within the landfill site, are generally permitted through the Nationwide Permit Program. Permit conditions include no involvement of protected species or historic structures on the site. Nationwide Permit No. 38-Cleanup of Hazardous and Toxic Waste, specifically addresses actions on hazardous material sites and may also be used to permit the proposed remedial actions. Discussions with Philadelphia District Corps staff have led to a recommendation to file notification for NWP No. 38.

- Executive Order 11990, protection of Wetlands, May 24, 1977 – The Executive Order for the Protection of Wetlands was given to avoid to the extent possible the long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there are practicable alternatives. The Executive Order minimizes the impact development can have on the natural wetland environment. Naturally occurring wetlands enhance the environment in the following ways: they provide natural shelter for migratory animals, act as groundwater recharge and discharge zones, create unique wildlife habitats, and may naturally degrade environmental pollutants. Under the Executive Order, each agency will provide leadership and take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. Wetlands within the Nolan Landfill site are regulated through Section 404 of the Clean

Water Act and any proposed remedial actions will therefore comply with applicable federal regulations.

5.2.2 State Regulations

- Delaware Regulations Governing Hazardous Substance Cleanup: Amended April 1995 – The Regulations governing the cleanup of hazardous substances were established to identify, investigate, and cleanup facilities with a release or imminent threat of release of hazardous substances. The goal of the hazardous substance cleanup act is to implement the policy declared in 7 Del. C., Chapter 91, the Delaware Hazardous Substance Cleanup Act. These regulations provide a workable process to accomplish effective and expeditious cleanups to protect public health, welfare, and the environment (DNREC Division of Air and Waste Management Site Investigation & Restoration Branch, Amended April 1995). The RI/FS for the Nolan Landfill was conducted in accordance with these regulations.

- Delaware Regulations Governing Solid Waste: Amended March 1990 – The State of Delaware has promulgated its own set of solid waste regulations. State of Delaware regulations governing solid waste establish the basis for the management of solid waste and provide design requirements for sanitary and industrial landfills, dry waste disposal facilities, resource recovery facilities, and transfer stations. For the Nolan Landfill site, the removal of non-hazardous waste materials (if any) must comply with the Delaware solid waste management and disposal regulations.

- Delaware Sediment and Stormwater Regulations – Under these regulations, no activities that disturb land can be performed (unless exempted by these regulations) without an approved sediment and stormwater management plan. This plan must be consistent with these regulations, the Delaware Erosion and Sedimentation Control Law, and any adopted county or municipal ordinances. This plan must be approved before any building or grading permits are issued. The regulations outline the requirements for the management plans. These regulations do not apply if the site land development activities are regulated under other state or federal laws that provide for managing sediment control and stormwater runoff (e.g., NPDES permit for stormwater runoff). For the Nolan Landfill site, this regulation would be applicable if any disturbance of the landfill is planned, in this case, an application for a permit would be required.

- Delaware Wetlands Regulations – The regulations require the acquisition of a DNREC permit before conducting any activity within a coastal/tidal wetland area. These activities include but are not limited to dredging, draining, drilling, filling and construction. Permits granted by the DNREC are divided into the following two categories:

  - Type I Permits – required for projects which affect a total of one acre of wetlands or less, with no building of structures.

  - Type II Permits – required for projects involving more than one acre of wetlands, or that include the building of structures.

  The State of Delaware regulates coastal (tidal) wetlands, but has limited review of non-tidal isolated freshwater wetlands such as those within the landfill site. No hydrologic connection has been found through the rail line embankment barrier to the nearby tidal waters of the Christina River and therefore, the wetlands within the landfill site are

considered to be isolated. No State wetlands permit is expected for the proposed remedial actions affecting wetlands within the landfill site.

5.3 Summary of Remedial Action Objectives

Remedial action objectives are established during the RI phase as per regulation HSCA 8.4(1) and take into consideration current and future land use, proximity of human populations and type and level of contamination. The remedial action objectives for the Nolan Landfill were designed based on the following factors:

- The contaminants of concern are lead, asbestos and TPH.
- The primary contaminant migration pathways are air, groundwater, surface water and direct contact.
- The potential receptors are facility personnel, local communities and fauna attracted to the on-site wetland.
- The potential exposure routes for receptors are inhalation and ingestion.

Based on the above factors, the results of the RI and consideration of identified applicable requirements, the qualitative/quantitative remedial action objectives are as follows:

- Prevent potential human exposure (primarily ingestion and inhalation) of those lead contaminated soils, through fugitive dust emissions (air) or direct contact, greater than 1,000 ppm.
- Prevent potential human exposure (primarily inhalation) of fugitive asbestos emissions by discharging no visible or measurable emissions to the outside air from the regrading activities.
- Prevent the transport of those lead and TPH contaminated soils to the wetland areas, which are greater than 1,000 ppm.
- Control leachate generation by minimizing infiltration and the potential long-term downward movement of contaminants, thereby protecting the underlying groundwater systems.
- Prevent potential exposure of biota to lead contaminated wetlands sediment in excess of 1,000 ppm.
- Prevent potential human exposure (primarily ingestion and inhalation) of those soils containing 0.74 ppm or greater of polychlorinated biphenyl's (PCBs).

6. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

6.1 Introduction

The objective of the detailed analysis of remedial alternatives is to present the relative advantages and disadvantages of contaminant management approaches for the site (DNREC HSCA Guidance, October 1994). This is accomplished by evaluating each remedial alternative against the following criteria:

- Protection of public health, welfare and the environment;
- Compliance with applicable laws and regulations;
- Community acceptance;
- Compliance monitoring requirements;
- Technical practicality;
- Restoration time frame;
- Reduction of toxicity, mobility and volume of contamination;
- Long-term effectiveness; and
- Short-term effectiveness.

Capital equipment and operation and maintenance costs were also considered in the evaluation of each alternative.

6.2 Identification of and Rationale for Selection of Alternatives

A focused feasibility study was conducted to compare and evaluate potential remedial actions that could be taken at the site based on the apparent risks identified during the RI and previous investigations. The candidate remedial actions were considered based on their ability to reduce the risks to human health and the environment as determined in the remedial action objectives (RAOs).

The options presented in the Preliminary Review of Remedial Alternatives for remediation of site soils were as follows:

- <u>Alternative 1 – Excavation and off-site disposal (removal)</u>

This alternative would excavate all landfill materials and dispose of them at a permitted disposal facility. It is assumed that the permitted facility would stabilize the materials prior to disposal. Excavation would be conducted with readily available construction equipment using common construction techniques. After completion of excavation activities, clean fill would be used to backfill the excavated areas. The surface would be graded to match the surrounding environment and positive drainage would be established.

- Alternative 2 – Closure cover system (containment)

  Closure cover systems involve covering an area of concern with a barrier to prevent direct contact, control migration of landfill materials via stormwater runoff, reduce precipitation infiltration and thus the generation of leachate into the underlying groundwater. The closure cover alternative at the Nolan Landfill site would include regrading the southwestern corner of the West Landfill. This will include grading of shallow landfill materials located in the area on the 2.23 acre landfill footprint. The objectives of the proposed regrading of the southwestern corner of the landfill are to:

  - Improve stormwater management in this area by directing surface water away from the cover and direct it through a proposed swale running between the existing parking area and the proposed closure cover area, to areas east and west of the landfill.

  - Provide material to establish positive grades for proper drainage across the landfill instead of using clean fill under the covered area.

  - Open up new areas for use by the property owner.

  - Limit the areas that will require long-term maintenance of the cover system.

The potential short-term risks associated with airborne releases of asbestos are less of a concern with regard to consolidation of this area, because there was no asbestos material observed in this portion of the Landfill. Strict dust control measures will be used to minimize the generation of fugitive dust during regarding activities. Prior to installation of the cover, the existing landfill materials will be graded to establish a uniform grade across the landfill. Large debris will be removed from the surface and placed in low lying areas of the landfill to be buried during this grading activity. The landfill materials will be proof rolled with a heavy roller to provide a stable foundation for the cover system. The landfill surface will be compacted with the heavy roller prior to installation of the cover system. After the closure cover has been constructed, stormwater management controls will be installed to address potential erosion damage to the cover.

The existing small wetlands on the landfill would be covered as part of this alternative.

Two separate cover systems have been developed. Because the landfill is an existing landfill that was not permitted under solid waste state regulations and was not operating after 1988, the closure of the landfill is regulated in accordance with the RCRA requirements. The approach to the cover system design must meet the minimum technology standards of the Subtitle C regulations with regard to providing a low permeability layer that limits precipitation infiltration into the landfill. This approach is also consistent with the remedial action objectives.

The proposed cover system options, therefore, include a low permeability geomembrane component overlain by a protective cover. The protective cover thickness was developed based on the need to protect the integrity of the

geomembrane from freeze/thaw and erosion effects. The geomembrane will be overlain and underlain by a protective/bedding non-woven geotextile. A geocomposite drainage net will be installed above the geomembrane to provide lateral drainage of precipitation infiltration through the protective cover.

The proposed cover system would consist of a minimum 40 mil geomembrane below a geocomposite drainage layer overlain by a 18-inch thick protective cover. The protective cover provides protection of the geomembrane from freeze/thaw effects. Additional frost and erosion protection is provided by either a pavement section including a 6-inch aggregate subbase (Option 2b), or a 6-inch vegetated top soil layer (Option 2a). The geocomposite drainage layer is not included in the pavement section option.

6.3 Analysis of Alternatives

6.3.1 Alternative 1 – Excavation and Off-Site Disposal

- Overall Protection of Public Health, Welfare and the Environment – Alternative 1 provides protection of public health, welfare and the environment because the contaminants would be permanently removed from the site and transported to a permitted facility for stabilization and disposal. On-site personnel, and potentially the local community, would have an increased risk of exposure during excavation and transportation because of increased materials handling. This risk could be addressed in part with the use of engineering controls such as dust suppression techniques during excavation and the use of covered trucks for transportation. However, because of the large quantities of materials being disturbed, airborne releases of asbestos and lead-containing materials cannot be entirely avoided. Air monitoring during excavation activities could provide an indication when airborne concentrations exceed health-based criteria in order to identify the need for additional engineering controls and/or modification of excavation techniques. This potential increase in the air migration risk because of the excavation of the landfill may offset the long term reduction of risk offered by this alternative.

- Compliance with All Applicable Federal, State and Local Laws and Regulations – Alternative 1 would comply with all applicable requirements.

- Community Acceptance – Alternative 1 is anticipated to be acceptable to the community because the contaminated material would be removed permanently from the site. This criterion will be fully evaluated during the public comment period.

- Monitoring Requirements – Long-term monitoring would not be required after the completion of excavation and backfill activities because the contaminated material would be removed.

- Technical Practicability – Alternative 1 is technically feasible. However, because of the potential risks to on-site workers at Insteel and the surrounding communities of airborne release of asbestos and lead-containing materials during extensive excavation activities, implementation would require special dust control/suppression procedures. During excavation and loading of the landfill materials into trucks for off-site disposal, dust control measures such as the use of a wetting agent or foam will be required to limit airborne releases. The use of water as a dust suppressant will need to be controlled to limit

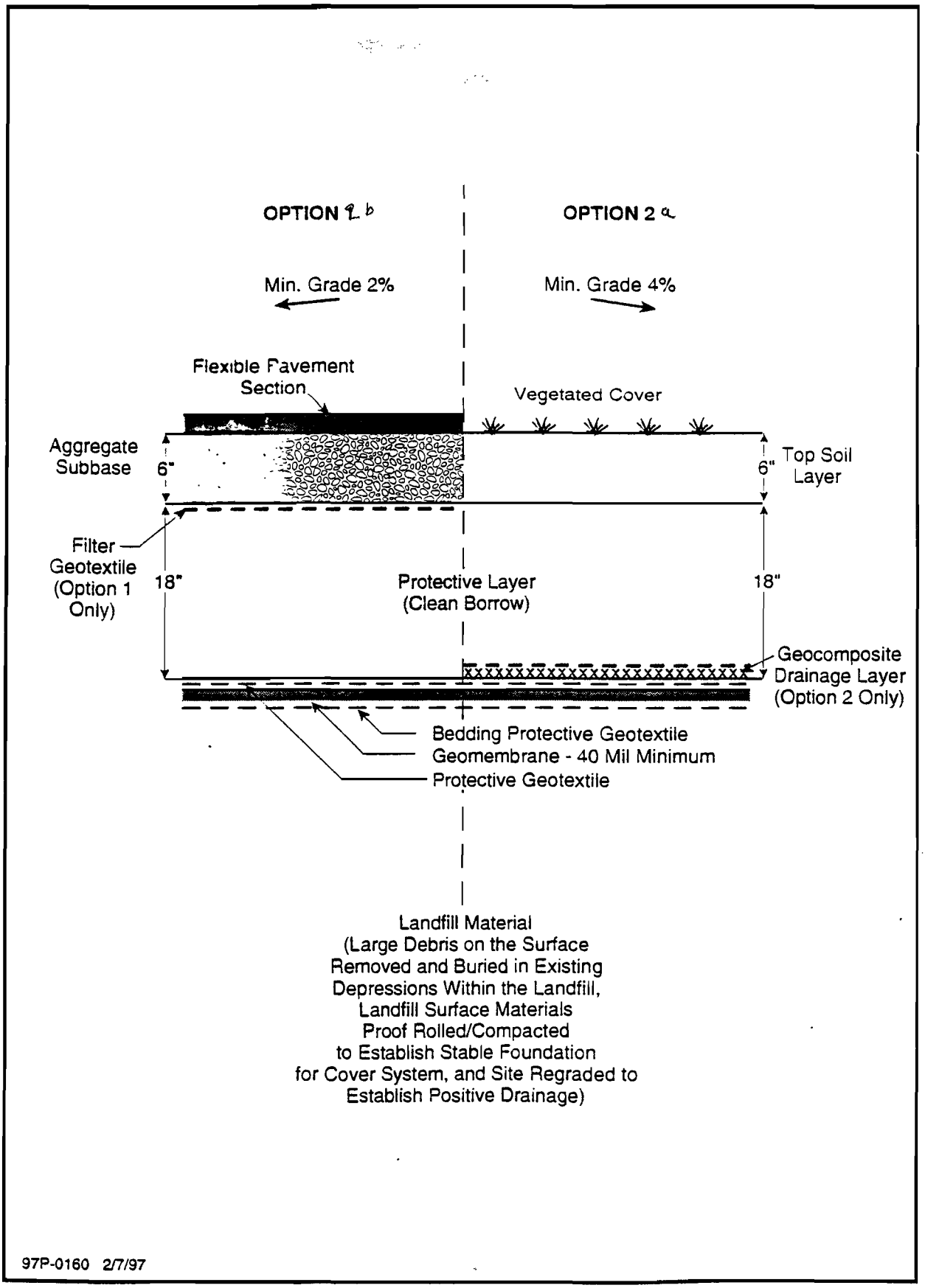

FIGURE 3 COVER SYSTEM CROSS SECTION OPTIONS 1 AND 2

personnel and potentially the surrounding community would have an increased risk of exposure during regrading activities because of the disturbance of asbestos and lead-containing materials. This risk is significantly lower than the excavation alternative because of the much smaller quantity of material being disturbed, and could be minimized with the use of engineering controls such as dust suppression techniques.

- Compliance with all Applicable Federal, State and Local Laws and Regulations – Alternative 2 would comply with all applicable federal, state and local laws. This alternative addresses the technology guidelines of RCRA Subtitle C (hazardous wastes) covers by providing a vegetative top cover or flexible pavement a middle drainage layer (option 2b only) and a low permeability layer with a minimum hydraulic conductivity of 10^{-7} cm/sec. The approach to the cover system is to meet the Subtitle C minimum technology standards because the TCLP results indicate that lead is leachable under extremely aggressive pH conditions. The cover system would address National Emission Standards for Hazardous Air Pollutants (NESHAPS) by reducing the potential of asbestos-containing dust after the cover has been installed.

  Although the groundwater is not currently used for drinking water, the SDWA would be addressed (both primary and secondary). Asbestos is immobile in the soil and would not be expected to migrate into the groundwater. The action level for lead was slightly exceeded in the old on-supply well and was not exceeded in any of the groundwater monitoring wells sampled. The cover system would further decrease the potential of lead leaching into the groundwater by significantly reducing the infiltration of precipitation and thus the leachate generated from the landfill.

  The small wetland areas located within the landfill site (Wetland areas A and B) would be covered as part of Alternative 2. These wetland areas developed in low-lying, poorly drained areas created during the operation of the currently inactive landfill. The total acreage of wetlands to be backfilled is 0.7 acre.

  After review of the proposed remedial alternatives for Nolan Estate landfill, Delaware DNREC's Division of Water Resources determined that their agency does not have jurisdiction regarding the on-site wetlands, because they are isolated wetlands. Further, DNREC determined that the statutory wetlands regulations and sub-aqueous lands regulations are not applicable to this project.

  After review of the proposed remedial alternatives for the landfill, the U.S. Army Corps of Engineers, Philadelphia District has advised that filling of the 0.7 acres of wetlands within the landfill be accomplished under Nationwide Permit Number 38, which is specifically designed to address the cleanup of hazardous and toxic waste. The NWP No. 38 permit conditions require that the specific activities required to effect the containment, stabilization or removal of hazardous or toxic waste materials be performed, ordered or sponsored by a government agency with established legal or regulatory authority. In this case, DNREC would be the sponsoring agency under the Hazardous Substance Cleanup Act. A notification under NWP No. 38 must be submitted to the Corps District Engineer on behalf of the Estate of Lester Nolan, prior to implementation of the remedy.

- Community Acceptance – Alternative 2 is anticipated to be acceptable to the community because the cover would prevent exposure to and migration of the contaminated material. This criterion will be able to be fully evaluated during the public comment period.

- Monitoring Requirements – Alternative 2 would require limited O&M and long-term monitoring. Limited monitoring would be required to ensure proper maintenance of the cover system and to routinely inspect the integrity of the cover system. Annual groundwater of four wells (existing groundwater monitoring wells) would be conducted for 10 years to ensure that the underlying groundwater has not been further impacted.

- Technical Practicability – Alternative 2 is technically feasible and readily implemented. Grading, required for regrading activities, and construction of the cover system, would use conventional construction and materials handling techniques. The equipment necessary to implement the alternative would be readily available and consists of conventional construction equipment such as dump trucks, front-end loaders and backhoes. Cover system technology has been used at numerous solid waste sites and has been proven effective as a containment technology to reduce precipitation infiltration, and thus leachate generation, in addition to addressing direct exposure.

- Restoration Timeframe – The time estimated to complete consolidation and cover system construction activities is 2 months. This timeframe applies whether option 2a or 2b is implemented.

- Reduction in Toxicity, Mobility and Volume – The toxicity and volume of contaminated material would not be reduced by Alternative 2. The mobility of the contaminated material would be reduced by controlling the potential contaminant pathways, thus reducing migration of the contaminated material to the surrounding environment.

- Long-Term Effectiveness – Alternative 2 would be a permanent remedy. Closure cover system technologies have been shown to be reliable at other landfill sites. The long-term risk of exposure would be substantially reduced because the cover would eliminate the pathways for contaminant migration and thus reduce the potential of receptors encountering the contaminated material.

- Short-Term Effectiveness – The short-term risk of exposure would increase because of consolidation and materials handling activities required to implement Alternative 2. Engineering controls, such as dust suppression techniques, would have to be initiated during the implementation to reduce the risk of exposure and the potential of off-site contaminant migration.

6.4 Preferred Remedial Alternative

Based on the detailed evaluation, both alternatives 1 and 2 satisfy the criteria in HSCA 8.5

(3)(b). Alternative 1 (excavation and disposal) has the potential to increase the exposure risk to on-site personnel at Insteel and the surrounding communities because of airborne releases of asbestos and lead-containing materials during remedial activities. This increase in risk may offset the long-term elimination of risk offered by this alternative. In addition, implementation costs for this alternative are significantly higher because of labor, excavation costs and disposal costs as shown in Table 6.

Alternative 2 (closure cover system options 2a and 2b) addresses all the remedial action objectives at a lower cost compared to Alternative 1. Additionally, based on the volume of material required to be removed for Alternative 1 (which would require the removal of 29,450 yd^3 compared to only surficial regrading and limited consolidation under Alternative 2), the short-term risks would be lower. According to HSCA 8.5 (3)(c), "For remedial action alternatives which meet the requirements of subsection 8.5 (3)(b), preference shall be given to the remedial action which is most cost effective." Since both alternatives evaluated satisfy the criteria, Alternative 2, the closure system, is preferred as the most cost effective alternative over Alternative 1, the excavation and removal.

Both closure cover system options, 2a and 2b, are equivalent based on the criteria used to evaluate the alternatives. However, a functional difference exists because the flexible pavement option addresses the potential future use of the area of concern as a storage area for Insteel. Insteel would not be able to use the land as a storage area under the vegetative top soil cover option.

Table 6
Summary of Alternative Evaluation

Evaluation Criteria	Alternative 1 - Excavation and Removal	Alternative 2 - Closure Cover System
Protection of Public Health, Welfare and the Environment	Yes. Potential for exposure during excavation and transportation activities.	Yes. Potential for exposure during grading activities, but significantly lower risk than the excavation alternative.
Compliance with all applicable federal, state, and local laws	Yes	Yes
Community Acceptance	Expected to be accepted	Expected to be accepted
Monitoring Requirements	No	Inspection and maintenance of cap and groundwater monitoring.
Technical Practicability	Yes	Yes
Restoration Time Frame	Estimated at 5 months	Estimated at 2 months for both cover options
Reduction in Toxicity, Mobility, and Volume Through Treatment	Reduces toxicity, mobility, and volume of contaminants on-site.	Reduces potential mobility and exposure to the material.
Long-Term Effectiveness	Yes	Yes
Short-Term Effectiveness	Yes - higher potential from exposure	Yes
Preliminary Cost Estimate (Backup information for cost estimates is presented in Appendix B)	$11,129,000	$ 407,365 for the vegetated top soil option and $ 502,045 for the flexible pavement option.

7. PUBLIC PARTICIPATION

The Department actively solicits public comments or suggestions on the Proposed Plan and welcomes opportunities to answer questions. Please direct written comments to:

DNREC, Site Investigation & Restoration Branch
Attn: Paul W. Will
715 Grantham Lane
New Castle, Delaware 19720

or call (302) 323-4540. The public comment period for this Proposed Plan of Remedial Action closes on Monday, July 7, 1997. If so requested, a public meeting will be held on the Proposed Plan. The meeting time and place will be announced if said meeting is requested.

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