

FINAL PLAN OF REMEDIAL ACTION

Kenton Landfill OU1
Kenton, DE

DNREC Project No. DE-0108

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

The Kenton Landfill (site) consists of approximately 98 acres and is located 1.5 miles south of Kenton, Delaware. The site is located 1,300 feet north of the intersection of Delaware Route 11 and Shorts Corner Road or Road 169 (Figure 1). Route 11 immediately borders the site to the south and west, and wooded open space to the north and east. A small trailer park is located to the south, beyond several hundred yards of forested land. The site is divided into two sections by a railroad right-of-way. The western portion is approximately 45 acres, in size and was designated as Operable Unit 1 (OU1) during the initial investigations, with the remaining 53 acres in the eastern portion, designated as OU2.

The site owner, the Delaware Department of Transportation (DelDOT), entered into the Voluntary Cleanup Program (VCP) under the provisions of the Delaware Hazardous Substance Cleanup Act, 7 Del. C. Chapter 91 (HSCA), as administered by the Delaware Department of Natural Resources and Environmental Control-Site Investigation and Restoration Branch (DNREC). Through a VCP Agreement, DelDOT agreed to investigate the potential risks posed to the public health, welfare, and the environment at the site.

A facility evaluation (FE) conducted by DNREC, and completed in 1994, identified low concentrations of metals, pesticides and volatile organic compounds (VOCs) in on-site soils, and elevated concentrations of several metals and organic solvents in shallow groundwater. Based upon the results of the FE, a RI was recommended.

In 1995, an additional environmental investigation was conducted on behalf of DelDOT by EA Engineering, Inc. (EA), the scope of which concentrated on the groundwater medium. Additional wells were installed, and slug tests were performed to better characterize the groundwater flow direction and rate. Based upon the results of these investigations, DelDOT entered into the VCP, and contracted Tetra Tech, Inc. (Tetra Tech) of Christiana, Delaware, to perform a remedial investigation (RI) of the site.

This document is DNREC's final plan of remedial action (final plan) for the site. It is based on the results of the previous investigations performed at the site and the proposed plan of remedial action for the site dated April 21, 2003. This final plan is issued under the provisions of the HSCA and the Regulations Governing Hazardous Substance Cleanup (Regulations). It presents the Department's assessment of the potential health and environmental risks posed by the site.

The Department actively solicited public comments and suggestions on the proposed plan of remedial action. The comment period began April 30, 2003, and ended on May 20, 2003. No comments were received. All previous investigations of the site, the proposed plan, and the final plan, will constitute the remedial decision record for the site.

Section 2.0 presents a summary of the site description and history. Section 3.0 provides a description of the RI results. Section 4.0 presents a discussion of the remedial action objectives. Section 5.0 presents the final plan. Section 6.0 discusses public participation requirements. Section 7.0 presents the Director's Declaration.

2.0 SITE DESCRIPTION AND HISTORY

2.1 *Site Setting*

The site consists of approximately 98 acres and is located 1.5 miles south of Kenton, Delaware. The site is located 1,300 feet north of the intersection of Delaware Route 11 and Shorts Corner Road (Road 169). Route 11 immediately borders the site to the south and west, and wooded open land to the north and east. A small trailer park is located to the south, beyond several hundred yards of forested land (Figure 2).

The site is divided into two sections, known as operable units, by a railroad right-of-way. The western portion is approximately 45 acres in size, and was designated as OU1 during the initial investigations, with the eastern portion designated as OU2. Access by vehicle is limited in OU1 by a locked cable barrier onto the only dirt path/road into the landfill. Pedestrian access is not restricted. A fence with two gates surrounds a portion of OU2.

2.2 *Site and Project History*

DelDOT operated the site as a sand and gravel borrow pit from 1951 until 1964, after which DelDOT disposed of road debris and tree clippings on OU1. During that time, it has been confirmed that local residents disposed of various domestic refuse into the pit. It is also suspected that illegal dumping of industrial waste may also have taken place. Dumping activities were curtailed in the late 1960s. In 1969, DelDOT leased OU2 to Kent County, which erected a transfer station in 1979 that was operated by the Delaware Solid Waste Authority.

As part of a FE conducted by DNREC in 1994, soil and groundwater samples were collected from seven test pits and four newly installed monitoring wells (MW-1 through MW-4). A follow-up investigation by EA on behalf of DelDOT was performed in 1995, which involved the collection of soil and groundwater samples from three new wells (MW-5 through MW-7). The results of these investigations confirmed the presence of both domestic and industrial waste in OU1. Soil samples contained low concentrations of VOCs, metals and pesticides. Groundwater samples from a number of the monitoring wells contained elevated concentrations of vinyl chloride, 1,2-dichloroethene (DCE) and trichloroethene (TCE) above their respective EPA Maximum Contaminant Levels (MCLs) for Drinking Water. The EA investigation also conducted slug tests on six wells in order to assess the characteristics of the shallow Columbia Aquifer. A rare-species information search requested by EA, and conducted by DNREC's Division of Fish and Wildlife identified the presence of two rare Delaware plants within the OU1 site boundaries, both located in shallow wetlands near Route 11.

As a consequence of these investigations, DNREC contacted DelDOT who entered into a VCP Agreement to perform a RI at the Kenton Landfill OU1 site. The purpose of the RI was to: 1) assess potential contaminant exposure to nearby residents and potential future construction workers; 2) delineate the extent of the groundwater contaminant plume; 3) identify and assess potential impacts to nearby surface water bodies; 4) assess potential impacts of the site on rare and endangered species; and 5) investigate the potential for the migration of contaminants in surface soils, such that the migration of contaminants does not cause a violation of state and federal water quality standards for surface water bodies.

3.0 INVESTIGATION RESULTS/FEASIBILITY STUDY

Concentrations of dissolved VOCs, in particular DCE (up to 310 micrograms/liter ($\mu\text{g/L}$) in MW-3), TCE (up to 67 $\mu\text{g/L}$, in MW-3) and vinyl chloride (up to 170 $\mu\text{g/L}$ in MW-3), were detected in groundwater samples above their Delaware Uniform Risk-Based Standards (URS) of 5 $\mu\text{g/L}$, 5 $\mu\text{g/L}$ and 2 $\mu\text{g/L}$ respectively. Concentrations of dissolved metals were all below their URS for groundwater except aluminum, iron and manganese. However, standards for these three metals are based upon aesthetic, not health based, concerns.

Analytical and field screening data indicate that low concentrations of VOCs, semivolatile organic compounds (SVOCs), pesticides and PCBs remain in on-site soils, below remediation standards, with no “hot spot” areas identified. Concentrations of several metals, including copper, nickel and thallium were slightly elevated above site-specific background values, but did not exceed any URS values. Complete analytical results from the RI are presented in table format in Appendix A.

No VOCs, semivolatile organic compounds (SVOCs), pesticides or PCBs were detected in surface water samples. Elevated concentrations of eleven metals, particularly iron (up to 94,300 $\mu\text{g/L}$, URS of 1,000 $\mu\text{g/L}$) and manganese (up to 11,300 $\mu\text{g/L}$; URS of 80 $\mu\text{g/L}$), were detected at levels above their respective URS values for the protection of the environment, and above the levels from an upstream, background, sampling location. Concentrations of dissolved metals appeared to increase at locations adjacent and downstream from the landfill, indicating potential site impacts. Subsequently, an ecological assessment of the stream was conducted to evaluate the potential impact that the elevated metals in surface water may have on the benthic macroinvertebrates within the stream. The ecological assessment was conducted in accordance with both DNREC and the U.S. Environmental Protection Agency (EPA) Rapid Bioassessment Protocols. Results of the assessment indicated that there were no deleterious effects on the benthic macrofauna as a result of the elevated metals in surface water.

No formal human health risk assessment was performed. In place of the risk assessment, contaminant concentrations were directly compared to the Delaware’s URS or U.S. EPA’s MCL values. The results of this comparison indicated that potential human health risk existed in the potential use of groundwater, due principally to the presence of vinyl chloride, and to a lesser extent, TCE and DCE.

Upon completion of the RI, and after establishing remedial action objectives, DNREC usually requires a feasibility study (FS) to be performed in order to evaluate the various options available to remediate a site. However, for some categories of sites with similar environmental problems, the EPA has developed presumptive remedies. Presumptive remedies are based on historical patterns of remedy selection and the preferred technologies typically implemented at sites with similar characteristics.

In the case of landfills, the EPA’s Office of Solid Waste and Emergency Response has developed a presumptive remedy policy entitled *EPA’s Presumptive Remedy for CERCLA Municipal Landfill Sites*. It was concluded by EPA that containment technologies generally would be appropriate for municipal landfill waste because the volume and heterogeneity of the waste

generally make treatment impracticable. DNREC has previously reviewed this policy and concurs with EPA's approach, and has adopted EPA's presumptive remedy of containment for municipal landfills. By using this approach, DNREC has determined that this will streamline the remedial process and, at the same time, provide protectiveness to public health, welfare, and the environment.

The Department has placed a copy of *EPA's Presumptive Remedy for CERCLA Municipal Landfill Sites* and a supporting document entitled *Conducting Remedial Investigations/ Feasibility Studies for CERCLA Landfill Sites* at the DNREC office location located in Section 6.0.

4.0 REMEDIAL ACTION OBJECTIVES

According to Section 8.4 (1) of the Regulations, site-specific remedial action objectives must be established for all plans of remedial action. The Regulations provide that DNREC set objectives for land use, resource use and cleanup levels that are protective of human health and the environment.

Qualitative objectives describe in general terms what the ultimate result of the remedial action, if necessary, should be. In view of the presumptive remedy policy developed for landfill sites, and in consideration of the commercial land use scenario and the DNREC *Regulations Governing Solid Waste*, the following qualitative objectives are determined to be appropriate for the site:

1. Prevent human exposure to impacted media.
2. Prevent migration of contaminants off-site.
3. Prevent environmental impacts to surface water bodies due to impacted media at the site.
4. Minimize ecological exposure to impacted media.
5. Protect and preserve threatened or endangered species and maintain habitats that presently support threatened or endangered species.

These objectives are consistent with the current and proposed use of the site as a former landfill in a rural setting, Kent County zoning policies, and state regulations governing water supply.

Based on the qualitative objectives, the quantitative objectives are:

1. Prevent human exposure to landfill waste and associated contaminated soils through maintenance of soil and vegetative cover and through institutional controls.
2. Prevent human exposure to groundwater contaminated by TCE, 1,2-DCE and vinyl chloride above their U.S. EPA MCLs of 5 µg/l, 5 µg/l, and 2 µg/l, respectively, through a combination of institutional controls and monitored natural attenuation.
3. Direct surface water drainage off and away from the landfill and minimize precipitation percolation through the landfill waste that could leach soil contaminants into groundwater

through maintenance of soil and vegetative cover, and elimination of areas of standing water on the surface of the landfill.

4. Prevent ecological exposure to soils with concentrations of VOCs, SVOCs, and metals above ecological thresholds through maintenance of soil and vegetative cover.
5. Monitor groundwater and surface water quality so as to assure that no further degradation of these media occur.
6. Protect and preserve threatened or endangered species, and the habitat, which presently supports threatened or endangered species, through institutional controls.

5.0 FINAL PLAN OF REMEDIAL ACTION

Based on the presumptive containment remedy, the existing and proposed land use scenario, the *Regulations Governing Solid Waste*, and *Regulations Governing Water Supply*, the recommended remedial actions for the site consist of the following activities as described below:

- 1) Maintain the integrity and effectiveness of the existing soil cover, including making repairs as necessary to correct the effects of settling, subsidence and erosion so as to promote the establishment of vegetative cover, minimize infiltration and percolation of water into, and prevent erosion of, landfill waste. Maintenance of the existing soil cover would be conducted in accordance with a DNREC-approved O & M plan and schedule.
 - a. Note that the land has been used as a solid waste disposal site, a description of which shall include a detailed map of the area(s) that were used for solid waste disposal, and
- 2) Placement of a deed restriction which will:
 - a. Prohibit further development of the site, and designate the property as "Open Space."
 - b. Note that the site is included in a Groundwater Management Zone (GMZ) which prohibits the installation of any water well on, or groundwater use at, the site without the written approval of DNREC.
 - c. Prohibit digging, excavation or any disturbance of the soil cap without the written approval of DNREC.
- 3) Establishment of a long-term groundwater and surface water monitoring plan. The scope and frequency of monitoring would be conducted in accordance with a DNREC-approved O & M plan and schedule.

In addition, DNREC will place the site within a GMZ, which is an internal document that restricts groundwater withdrawals at the site.

6.0 PUBLIC PARTICIPATION

DNREC actively solicited public comments or suggestions on the proposed plan of remedial action. The comment period began on April 30, 2003, and ended on May 20, 2003. No comments were received.

7.0 DECLARATION

This final plan of remedial action for the Kenton Landfill OU1 site is protective of human health, welfare and the environment, and is consistent with the requirements of the Delaware Hazardous Substance Cleanup Act.

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John Blevins

Director, Division of Air and Waste Management

7/1/03

Date

Figures 1 - 3 from the 1998 Tetra Tech Remedial Investigation Report

Figures 1 - 3 from the 1998 Tetra Tech Remedial Investigation Report

Figure 1: Site Location Map

Scale: 1 inch = 2,000 feet

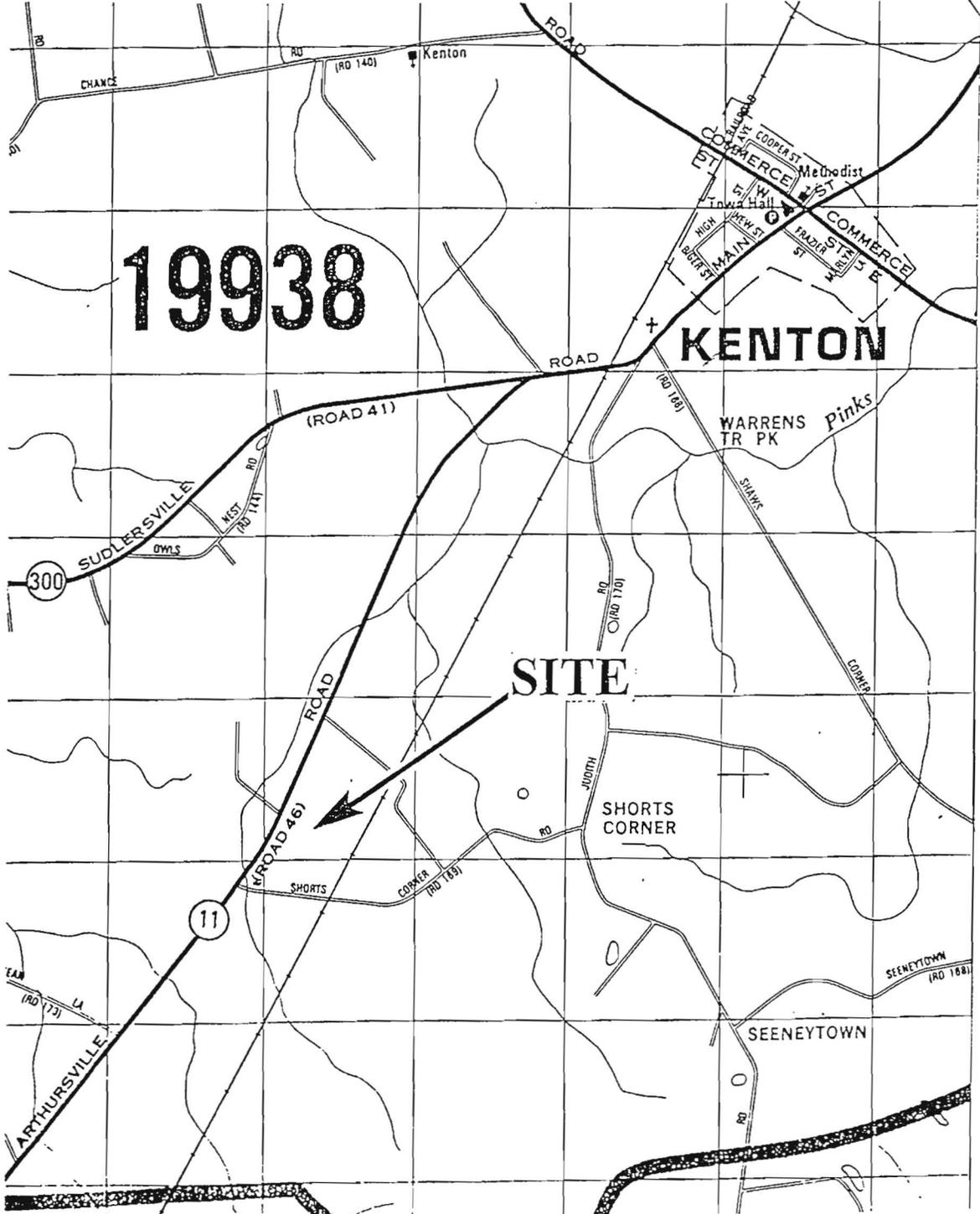


Figure 1-1. Site location map, Kenton Landfill, Kenton, Delaware.
(Source: ADC Street Map Book, Kent County, Delaware, 5th Edition)



Figure 2: Site Location Map Showing OU1 and OU2

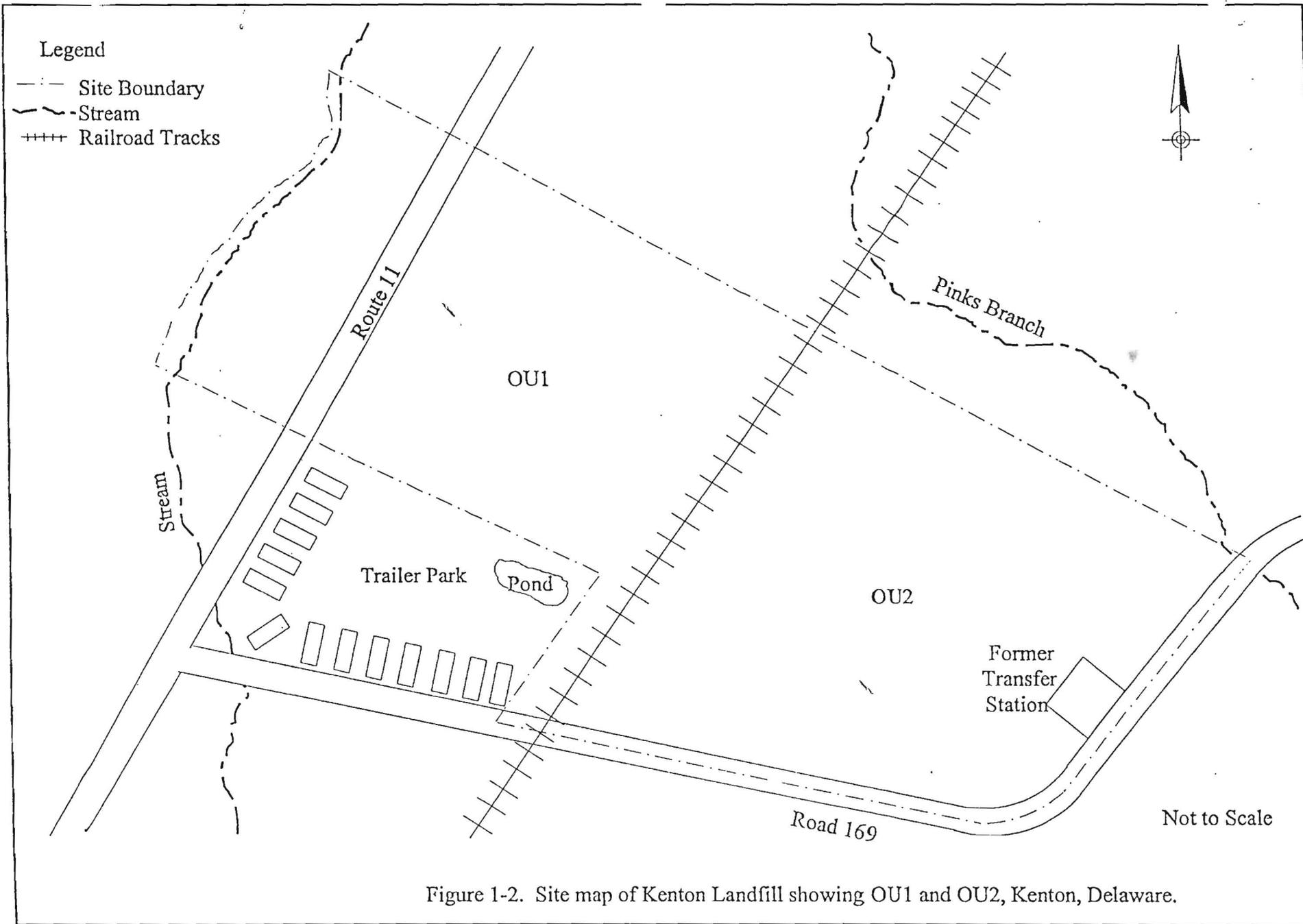
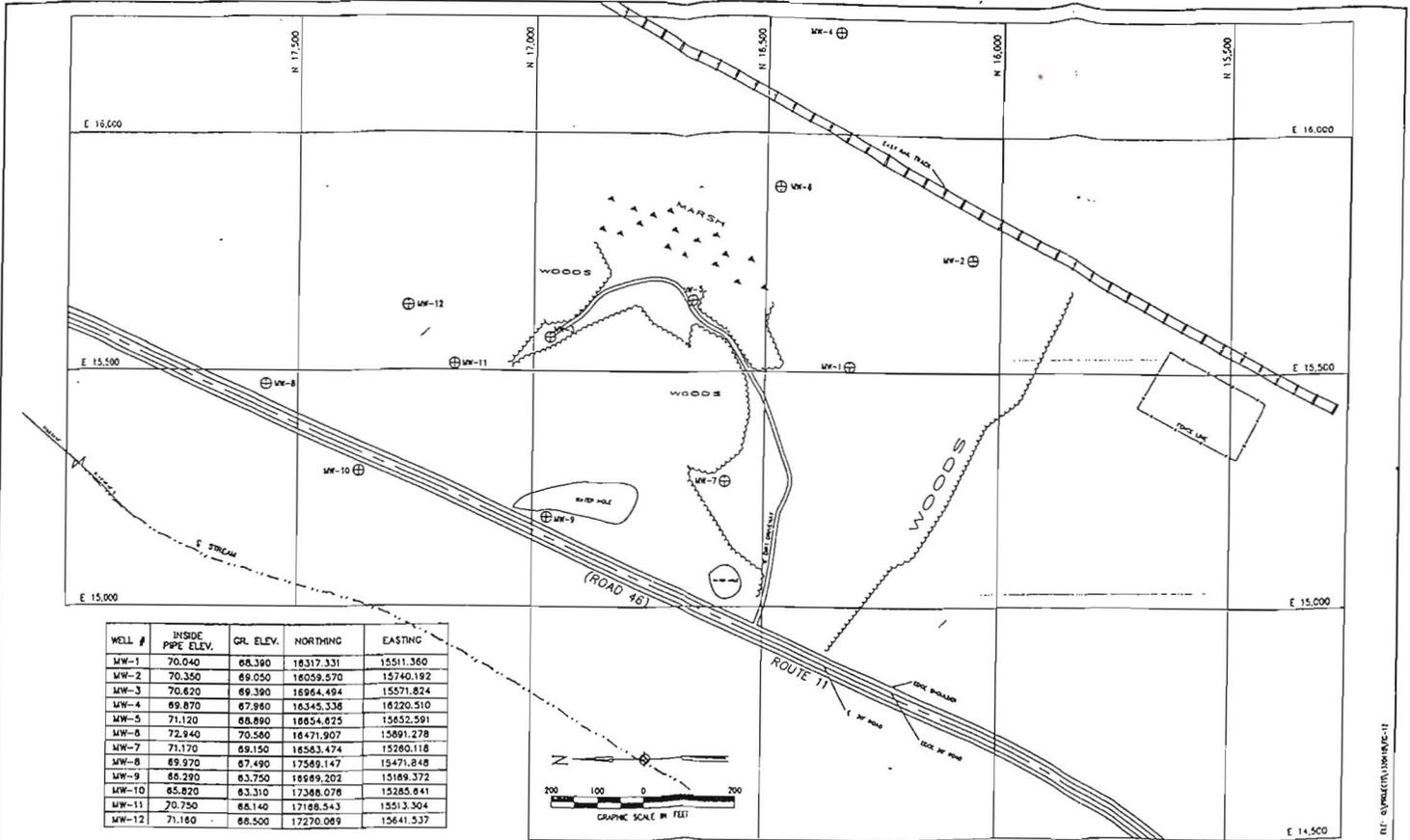


Figure 3: Site Plan Showing Monitoring Well Locations



Appendix

TABLE 4
 DISSOLVED VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS
 DETECTED ABOVE THE LABORATORY QUANTITATION LEVELS
 FROM MONITORING WELL SAMPLING
 KENTON LANDFILL

WELL NUMBER	SAMPLE DATE	BENZENE (ug/l)	CARBON DISULFIDE (ug/l)	VINYL CHLORIDE (ug/l)	TOTAL 1,2-DCE (ug/l)	Trichloroethene (ug/l)	Tetrachloroethene (ug/l)
MW-1	27-Jan-94	<1	NA	<2	<1	<1	<1
	16-Aug-95	<10	<10	<5	<10	<10	<10
	05-Dec-96	<5	<25	<5	<5	<5	<5
MW-2	27-Jan-94	<1	NA	<2	<1	<1	<1
	16-Aug-95	<10	<10	<5	<10	<10	<10
	05-Dec-96	<5	<25	<5	<5	<5	<5
MW-3	27-Jan-94	1.4	NA	142	200	52	<1
	16-Aug-95	<10	<10	150	380	80	<10
	05-Dec-96	<5	<25	390 E (200)	310 E (390)	67	<5
MW-4	27-Jan-94	<1	NA	<2	<1	<1	<1
	25-Aug-95	<10	<10	<5	<10	<10	<10
	05-Dec-96	<5	<25	<5	<5	<5	<5
MW-5	16-Aug-95	<10	<10	<5	<10	<10	<10
	05-Dec-96	<5	<25	<5	<5	<5	<5
MW-6	16-Aug-95	<10	<10	<5	<10	<10	<10
	05-Dec-96	<5	12 J	<5	<5	<5	<5
MW-7	16-Aug-95	<10	<10	<5	<10	<10	<10
	05-Dec-96	<5	6 J	<5	<5	<5	<5
MW-8	05-Dec-96	<5	<25	<5	<5	<5	<5
MW-9	05-Dec-96	<5	<25	65	81	17	<5
MW-10	05-Dec-96	<5	<25	<5	<5	<5	<5
MW-11	05-Dec-96	<5	14 J	<5	<5	<5	<5
MW-12	05-Dec-96	<5	3 J	<5	22	5	<5

NA No data

< Analyte was below the stated quantitation limit

J Estimated concentration less than method detection limit

E Concentrations exceeded the calibration range of the GC/MS instrument for that specific analyte

ALL NOTES IN PARENTHESIS () ARE DATA VALIDATOR'S COMMENTS:

(200) Data Validator's detected concentration value.

TABLE 4-14
GROUND-WATER ANALYTICAL RESULTS
MONITORING WELLS MW-8, MW-10, MW-11
KENTON LANDFILL
5 AND 6 DECEMBER 1996

TOTAL AND DISSOLVED TAL METALS

Sample Number	Aluminum (ug/l)	Antimony (ug/l)	Arsenic (ug/l)	Barium (ug/l)	Beryllium (ug/l)	Cadmium (ug/l)	Calcium (ug/l)	Chromium (ug/l)	Cobalt (ug/l)	Copper (ug/l)	Iron (ug/l)
URS for Protection of Human Health*	200	6	1	2,000	0.02	5	NA	18	220	1,000	300
MW-8 (total)	57.8 B	<5.0	<2.0	32.1 B	<1.0	<1.0	5200	<6.0	<11.0	<6.0 (UL)	<40.0
MW-8 (dissolved)	<25.0	<5.0	<2.0	35.5 B	<1.0	<1.0	5330	<6.0	<11.0	<6.0 (UL)	<40.0
MW-10 (total)	268	<5.0	<2.0	522	<1.0	<1.0	17300	<6.0	<11.0	<6.0 (UL)	11000
MW-10 (dissolved)	217	<5.0	<2.0	500	<1.0	<1.0	16800	<6.0	<11.0	<6.0 (UL)	6650
MW-11 (total)	176 B	<5.0	<2.0	45.8 B	<1.0	<1.0	6330	<6.0	<11.0	<6.0 (UL)	164
MW-11 (dissolved)	26.4 B	<5.0	2.5 B	37.5 B	<1.0	<1.0	5640	<6.0	<11.0	<6.0 (UL)	<40.0

Sample Number	Lead (ug/l)	Magnesium (ug/l)	Manganese (ug/l)	Mercury (ug/l)	Nickel (ug/l)	Potassium (ug/l)	Selenium (ug/l)	Silver (ug/l)	Sodium (ug/l)	Thallium (ug/l)	Vanadium (ug/l)	Zinc (ug/l)
URS for Protection of Human Health*	15	NA	50	2	100	NA	50	100	NA	2	26	2,000
MW-8 (total)	<1.0 (UL)	2360	11.7 B (L)	<0.20	<15.0	938 B	<1.0 (UL)	<4.0 (UL)	4810	<1.0	<8.0	<12.0
MW-8 (dissolved)	<1.0 (UL)	2420	12.7 B (L)	<0.20	<15.0	929 B	<1.0 (UL)	<4.0 (UL)	4580	<1.0	<8.0	<12.0
MW-10 (total)	<1.0 (UL)	3940	186	<0.20	<15.0	1120	<1.0 (UL)	<4.0 (UL)	51100	<1.0	<8.0	<12.0
MW-10 (dissolved)	<1.0 (UL)	3800	181	<0.20	<15.0	1020	<1.0 (UL)	<4.0 (UL)	49900	<1.0	<8.0	<12.0
MW-11 (total)	<1.0 (UL)	3010	92.1	<0.20	<15.0	1160	<1.0 (UL)	<4.0 (UL)	4110	<1.0	<8.0	<12.0
MW-11 (dissolved)	<1.0 (UL)	2750	76.6	<0.20	<15.0	1030	<1.0 (UL)	<4.0 (UL)	3940	<1.0	<8.0	<12.0

Notes:

* Delaware Uniform Risk-Based Remediation Standards, URS for Protection of Human Health, Ground Water, February 1998

< = Analyte was detected below the stated quantitation limit

B = Reported value less than the contract required detection limit, but greater than the instrument detection limit

NA = No URS reporting levels for analyte

(L) Analyte present. Reported value may be biased low. Actual value is expected to be higher.

(UL) Not detected. Quantitation limit is probably higher.

TABLE
SURFACE SOIL ANALYTICAL RESULTS
DETECTED ABOVE THE LABORATORY QUANTITATION LEVELS
SEMIVOLATILE AND VOLATILE ORGANIC COMPOUNDS
KENTON LANDFILL
1 AND 2 OCTOBER 1996

SEMIVOLATILE ORGANIC COMPOUNDS							
Sample Number	Phenol µg/kg	Pentachloro- phenol µg/kg	Phenanthrene µg/kg	Di-n-butyl phthalate µg/kg	Fluoranthene µg/kg	Pyrene µg/kg	Benzo (a) anthracene µg/kg
COMPOUND CAS NO.	108-95-2	87-86-5	85-01-8	84-74-2	208-44-0	129-00-0	56-55-3
URS for Protection of Human Health*	400000	5000	1,000,000	NA	310000	230000	NA
URS for Protection of the Environment*	30000	3000	NA	NA	NA	NA	NA
SS #2	<390	<940	<390	<390	<390	<390	<390
SS #14	<400	<960	<400	<400	<400	<400	<400
SS #18	<390	<940	140 J	46 J	180 J	190 J	79 J
SS #18 (diluted 2x)	<780	<1900	92 DJ	<780	110 DJ	130 DJ	<780
SS #19	<400	<960	<400	<400	<400	<400	<400
SS #19 (diluted 2x)	<800	<2000	<800	<800	<800	<800	<800
SS #20	<420	<1000	<420	<420	<420	<420	<420
SS #20 (diluted 2x)	<850	<2100	<850	<850	<850	<850	<850
SS #21	56 J	90 J	86 J	41 J	140 J	240 J	94 J
SS #21 (diluted 2x)	<750	<1800	95 DJ	<750	170 DJ	180 DJ	89 DJ
Sample Number	bis (2-ethylhexyl) phthalate µg/kg	Chrysene µg/kg	Benzo (b) Fluoranthene µg/kg	Benzo (k) Fluoranthene µg/kg	Benzo (a) Pyrene µg/kg	4-Methylphenol µg/kg	
COMPOUND CAS NO.	117-81-7	218-01-9	205-99-2	207-08-9	50-32-8	106-44-5	
URS For Protection of Human Health*	46,000	88000	900	9000	90	2000	
URS for Protection of the Environment*	NA	NA	NA	NA	NA	NA	
SS #2	54 J	<390	<390	<390	<390	<390	
SS #14	160 J	<400	<400	<400	<400	<400	
SS #18	49 J	86 J	120 J	44 J	78 J	<390	
SS #18 (diluted 2x)	<780	<780	<780	<780	<780	<780	
SS #19	88 J	<400	<400	<400	<400	<400	
SS #19 (diluted 2x)	140 DJ	<800	<800	<800	<800	<800	
SS #20	180 J	<420	<420	<420	<420	<420	
SS #20 (diluted 2x)	180 DJ	<850	<850	<850	<850	<850	
SS #21	300 J	110 J	170 J	63 J	120 J	<380	
SS #21 (diluted 2x)	350 DJ	120 DJ	170 DJ	<750	<750	<750	

VOLATILE ORGANIC COMPOUNDS	
Sample Number	Toluene µg/kg
COMPOUND CAS NO.	108-88-3
URS For Protection of Human Health	5,000
URS for Protection of the Environment*	200,000
SS #17	280 J

Notes:

SS = Surficial soil sample

* Delaware Uniform Risk-Based Remediation Standards, Protection of Human Health, Critical Water Resource Area, Unrestricted use, and Protection of Environment, February 1998

J = Estimated concentration less than method detection limit

DJ = Estimated concentration less than method detection limit at a dilution of 2x

< = Analyte was detected below the stated quantitation limit

NA = No URS reporting levels for analyte

TABLE 4-16
SURFACE SOIL ANALYTICAL RESULTS
DETECTED ABOVE THE LABORATORY QUANTITATION LEVELS
PESTICIDES and PCBs
KENTON LANDFILL
1 AND 2 OCTOBER 1996

PESTICIDES										
Sample Number	gamma-chlordane µg/kg	4,4'-DDT µg/kg	4,4'-DDE µg/kg	4,4'-DDD µg/kg	Endrin µg/kg	beta-BHC µg/kg	Heptachlor Epoxide µg/kg	Endosulfan I µg/kg	Dieldrin µg/kg	Endrin Aldehyde µg/kg
COMPOUND CAS NO.	5103-74-2	50-29-3	72-55-9	72-54-8	72-20-8	319-85-7	1024-57-3	959-98-8	60-57-1	7421-36-3
URS for Protection of Human Health*	NA	2000	2000	3000	2000	NA	70	47000	40	NA
URS for Protection of the Environment**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS #18	4.1	4.9 P (J)	<3.9	<3.9	<3.9	<2.0	<2.0	<2.0	<3.9	<3.9
SS #19	<2.1	280 (J250)	26 (J)	35 (J)	<4.0	<2.1	<2.1	<2.1	<4.0	<4.0
SS #20	<2.2	27 P (J)	9.6 (J)	<4.2	10 P (J)	<2.2	<2.2	<2.2	<4.2	<4.2
SS #21	25	570 E (530)	140 PE (99)	310 E (J230)	<3.8	6.9 P (J)	8.5 P (J)	33 PD (27)	26	30

PCBs		
Sample Number	Aroclor 1254 µg/kg	Aroclor 1260 µg/kg
COMPOUND CAS NO.	11097-69-1	11096-82-5
URS for Protection of Human Health*	200	3000
URS for Protection of the Environment**	40000	40000
SS #14	70	<40
SS #19	<40	100 P (J)
SS #20	<42	61 P (J)
SS #21	<38	68 P

Notes:

SS = Surface soil sample

- * Delaware Uniform Risk-Based Remediation Standards, Protection of Human Health, Critical Water Resource Area, Unrestricted use, February 1998
- * Delaware Uniform Risk-Based Remediation Standards, Protection of Human Health,
- ** Delaware Uniform Risk-Based Remediation Standards, Protection of Environment, Feb 1998
- *** URS of PCB of 40,000 ug/kg is for all PCB, not subdivided by aroclor.

E = Concentrations exceeded the calibration range of the GC/MS instrument

P = Greater than 25% difference for detected concentrations between the two GC columns

D = Dilution factor at 10x

< = Analyte was detected below the stated quantitation limit

NA = No URS reporting levels for analyte

J Estimated concentration less than method detection limit

(250) Data Validator's detected concentration value

TAL 1-17
SURFACE SOIL ANALYTICAL RESULTS
KENTON LANDFILL
1 AND 2 OCTOBER 1996

TAL METALS

Sample Number	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Cadmium mg/kg	Calcium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg
URS for Protection of Human Health*	20,000	3	0.4	550	0.5	4	NA	35	22	1,000	23,000	400
URS for Protection of the Env.**	NA	5	NA	500	10	3	NA	0.4***	NA	50	NA	50
SS #1	5620 (J)	<0.11 (UL)	1.4 (K)	30.7	0.35 B	0.16 B	83.6 B	5.3	1.8 B	2.9 (K)	4370	15.1 (J)
SS #2	13700 (J)	<0.12 (UL)	1.4 (K)	62.8	0.69	0.50 B	1170	16.3	8.8	8.6 (K)	16500	66.2 (J)
SS #3	7220	0.12 B	2.2 (J)	38	0.46 B	0.20 B	128 B	7.4	2.0 B	2.2 B (K)	7020 (J)	15.2
SS #4	5910	<0.12 (UL)	1.6 (J)	39.9	0.50 B	0.24 B	591 B	6.7	2.4 B	3.7 (K)	6860 (J)	36.2
SS #5	5030	<0.11 (UL)	1.9 (J)	24.8	0.33 B	0.15 B	77.5 B	5.9	1.7 B	2.1 B (K)	6020 (J)	16.7
SS #6	8060	0.25 B	2.5 (J)	45.4	0.47 B	0.20 B	159 B	7.3	2.0 B	4.8 (K)	6290 (J)	25
SS #7	5400	0.16 B	1.6 (J)	31.2	0.35 B	0.19 B	220 B	4.7	1.9 B	2.6 B (K)	5000 (J)	21.7
SS #8	2610 (J)	<0.11 (UL)	1.1	13.1 B	0.14 B	<0.11	95.4 B	3.0	1.2 B	1.8 B (K)	2530	9.6
SS #9	2520 (J)	0.22 B	3.1	25	0.22 B	0.18 B	847	9.1	14	2.9 (K)	6130	11.2
SS #9 Field Dup	4580 (J)	<0.11 (UL)	2.1	41.8	0.39 B	0.18 B	559	7.2	3.9 B	3.5 (K)	5480	13.8
SS #10	8070	<0.11 (UL)	4.3 (J)	41.7	0.45 B	0.23 B	130 B	8.6	3.0 B	2.5 B (K)	8000 (J)	7.4
SS #11	5410 (J)	<0.11 (UL)	1.2 (K)	24.4	0.27 B	0.11 B	198 B	5.4	1.8 B	7.4 (K)	4100	8.5
SS #12	4880 (J)	<0.10 (UL)	1.2 (K)	17.1 B	0.19 B	0.15 B	277 B	5.6	1.5 B	1.6 B (K)	4510	5.9
SS #13	10300	0.17 B	2.5 (J)	45.3	0.30 B	0.34 B	240 B	11.2	3.8 B	3.2 (K)	11900 (J)	11.5
SS #14	4300	0.26 B	2 (J)	41.7	0.35 B	0.41 B	971	10.9	2.6 B	6.6	9080 (J)	43.1
SS #15	8610	<0.11 (UL)	1.6 (J)	61.1	0.47 B	0.20 B	230 B	8.7	4.3 B	1.8 B (K)	8840	6.7
SS #16	8030	<0.12 (UL)	1.5 (J)	46.4	0.35 B	0.27 B	361 B	10	3.3 B	5.4 (K)	10200 (J)	11.3
SS #17	6510	1.7 B	3.1 (J)	107	0.42 B	3.0	1800	13.1	6.8	285	24700 (J)	182
SS #18	8920	0.22 B	2.4 (J)	63.1	0.48 B	0.56	753	12.3	3.8 B	5.8 (K)	11100 (J)	37.5
SS #19	4240	0.39 B	2.1 (J)	61.1	0.33 B	0.72	1030	9.0	3.0 B	16.5	6620 (J)	58.2
SS #20	11100	<0.13 (UL)	3.9 (J)	125	1.20	2.9	582 B	10.7	4.8 B	5.6 (K)	10900 (J)	32.9
SS #21	5800 (J)	0.59 B	1.9 (K)	196	0.26 B	0.95	1100	19.8	2.8 B	28.1	7190	194
SS #22	12700 (J)	0.22 B	5.0 (K)	82.2	0.39 B	0.43 B	669	15.4	3.8 B	4.1 (K)	16000	9.1
SS #22 Field Dup	12000 (J)	0.13 B	3.5 (K)	69	0.43 B	0.38 B	588	13.6	4.8 B	5.2 (K)	14000	11.7
SS #23	6960	0.83 B	3.0 (J)	124	0.45 B	2.5	1960	10.4	3.6 B	30.9	9710 (J)	170
SS #24	5440 (J)	<0.09 (UL)	1.7 (K)	48.3	0.50	0.11 B	254 B	4.7	2.2 B	2.5 (K)	3920	17.6 (J)
SS #25	6300 (J)	<0.11 (UL)	6.8 (K)	47.9	0.16 B	<0.11	68.6 B	5.0	1.9 B	2.5 B (K)	3610	4.9

Notes:

SS = Surface soil sample

* Delaware Uniform Risk-Based Remediation Standards, URS for Protection of Human Health, Critical Water Resource Area, Unrestricted Use, Surface Soil, February 1998

< = Analyte was detected below the stated quantitation limit

B = Reported value less than the contract required detection limit, but greater than the instrument detection limit

NA = No URS reporting levels for analyte

** February 1998 Delaware Uniform Risk-Based Remediations Standards, Surface Soil, URS for Protection of the Environment

*** Criteria is for trivalent chromium, no criteria for hexavalent form

(J) Analyte present. Reported value may not be accurate or precise (estimated value).

(L) Analyte present. Reported value may be biased low. Actual value is expected to be higher.

(K) Analyte present. Reported value may be biased high. Actual value is expected to be lower.

(UL) Not detected. Quantitation limit is probably higher.

TABLE 4-17 (cont)
SURFACE SOIL ANALYTICAL RESULTS
KENTON LA. FILL
1 AND 2 OCTOBER 1996

TAL METALS

Sample Number	Magnesium mg/kg	Manganese mg/kg	Mercury mg/kg	Nickel mg/kg	Potassium mg/kg	Selenium mg/kg	Silver mg/kg	Sodium mg/kg	Thallium mg/kg	Vanadium mg/kg	Zinc mg/kg
URS for Protection of Human Health*	NA	180	10	160	NA	26	39	NA	14	55	1,000
URS for Protection of the Env.**	NA	NA	0.1	30	NA	1	NA	NA	1	2	50
SS #1	407 B	27.9	<0.10	3.3 B	123 B (L)	0.17 B	<0.79 (UL)	26.6 B	<0.11	8.5	16.8
SS #2	1220	306	<0.11	16.8	361 B (L)	0.14 B	<0.93 (UL)	83.2 B	<0.11	27	49.7
SS #3	716	62.9	0.12	4.7	182 B	0.12 B	<0.89	91.4 B (L)	<0.12	12.8	18
SS #4	673	77	0.13	5.4	199 B	0.31 B	<0.87	99.4 B (L)	<0.12	13.1	21.4 (J)
SS #5	535 B	40.3	<0.13	3.4 B	132 B	0.18 B	<0.87	86.4 B (L)	<0.11	10.6	11.9 (J)
SS #6	523 B	49.8	<0.28	4.8 B	157 B (L)	0.31 B	<0.99	70.6 B	0.16 B	12.1	16.7 (J)
SS #7	365 B	88.4	<0.14	2.7 B	114 B	0.29 B	<0.99	93.5 B (L)	<0.13	9.9	18.8 (J)
SS #8	206 B	21.9	<0.09	2.3 B	68.3 B	0.14 B	<0.81 (UL)	11.1 B	<0.11	5.4	9.0 (K)
SS #9	19300 (J)	147 (J)	<0.09	308 (J)	68.6 B (L)	0.11 B	<1.6 (UL)	56.8 B (L)	0.14 B	5.4 B	20.7
SS #9 Field Dup	4060 (J)	78.6 (J)	<0.11	75.7 (J)	129 B (L)	<0.11	<1.6 (UL)	58.2 B	0.14 B	8.4	23.8
SS #10	813	56.1	0.14	5.4	221 B	0.22 B	<0.91	81.2 B (L)	<0.12	14	13 (J)
SS #11	419 B	53.4	<0.10	3.4 B	170 B	0.11 B	<0.84 (UL)	16.8 B	<0.11	8.2	13.7
SS #12	428 B	30.3	<0.09	3.2 B	162 B	<0.10 (UL)	<0.65 (UL)	31.9 B	<0.10	9.0	13.2
SS #13	749	74.7	<0.13	6.5	263 B (L)	0.15 B	<0.83	54.1 B	<0.11	18.5	13.4 (J)
SS #14	509 B	171	0.18	3.9 B	172 B	<0.12 (UL)	<0.95	80.1 B (L)	<0.12	16.2	82.2 (J)
SS #15	873	106	<0.11	5.4	215 B	0.15 B	<0.78	72.7 B	<0.12	14.7	13.3 (J)
SS #16	897	77.1	<0.13	5.1	212 B	<0.11 (UL)	<0.81	82.1 B (L)	<0.11	16.3	23.7 (J)
SS #17	664	202	0.2	570	227 B	<0.11 (UL)	<0.84	97.9 B (L)	<0.11	10.1	291 (J)
SS #18	937	116	0.29	6.6	340 B	0.27 B	<0.92	90.1 B (L)	<0.12	17.9	81.5 (J)
SS #19	871	102	0.23	20.1	186 B	0.21 B	<0.95	67.9 B	<0.12	9.0	224 (J)
SS #20	1030	226	0.18	8.8	307 B	0.38 B	<0.91	85.7 B (L)	0.21 B	17.5	50.7 (J)
SS #21	560	104	4.3	7.7	237 B	0.19 B	<0.90 (UL)	42.8 B	<0.11	8.8	503
SS #22	912	125	<0.10	6.6	440 B	0.34 B	<0.74	24.0 B	0.14 B	24.5	31.7
SS #22 Field Dup	976	132	<0.11	7	429 B	0.31 B	<0.92 (UL)	36.6 B	0.12 B	22.4	38.2
SS #23	619	164	0.28	11.5	215 B	0.13 B	<0.83	86.2 B (L)	<0.11	11.1	233 (J)
SS #24	460 B	170	<0.10	3.6 B	156 B (L)	0.10 B	<0.83 (UL)	20.3 B	<0.09	8.1	21.6
SS #25	227 B	40.6	<0.10	3.4 B	122 B	<0.10 (UL)	<0.77 (UL)	20 B	<0.10	6.6	9.6 (K)

Notes:

SS = Surficial soil sample

* Delaware Uniform Risk-Based Remediation Standards, URS for Protection of Human Health, Critical Water Resource Area, Unrestricted Use, Surface Soil, February 1998

< = Analyte was detected below the stated quantitation limit

B = Reported value less than the contract required detection limit, but greater than the instrument detection limit

NA = No URS reporting levels for analyte

** February 1998 Delaware Uniform Risk-Based Remediations Standards, Surface Soil, URS for Protection of the Environment

*** Criteria is for trivalent chromium, no criteria for hexavalent form

(J) Analyte present. Reported value may not be accurate or precise (estimated value).

(L) Analyte present. Reported value may be biased low. Actual value is expected to be higher.

(K) Analyte present. Reported value may be biased high. Actual value is expected to be lower.

(UL) Not detected. Quantitation limit is probably higher.

TABLE 4-19
 SURFACE WATER ANALYTICAL RESULTS
 DETECTED ABOVE THE LABORATORY QUANTITATION LEVELS
 VOLATILE AND SEMIVOLATILE ORGANIC COMPOUNDS
 KENTON LANDFILL
 1 AND 2 OCTOBER 1996

VOLATILE ORGANIC COMPOUNDS		
Sample Number	Acetone µg/L	2-Butanone µg/L
COMPOUND CAS NO.	67-64-1	78-93-3
URS Protection of the Environment	NC	NC
SW #1	48	29

SEMIVOLATILE ORGANIC COMPOUNDS	
Sample Number	4-Methylphenol µg/L
COMPOUND CAS NO.	106-44-5
URS Protection of the Environment	NC
SW #1 (duplicate)	4 J

Notes:

SW = Surface water sample

* February 1998 Delaware Uniform Risk-Based Remediations Standards,
 Surface Water, Unrestricted use, URS for the Protection of the
 Environment

J = Estimated concentration less than method detection limit

TAB -20
SURFACE WATER ANALYTICAL RESULTS
KENTON LANDFILL
1 AND 2 OCTOBER 1996

TAL METALS (Total)

Sample Number	Aluminum µg/L	Antimony µg/L	Arsenic µg/L	Barium µg/L	Beryllium µg/L	Cadmium µg/L	Calcium µg/L	Chromium µg/L	Cobalt µg/L	Copper µg/L	Iron µg/L	Lead µg/L
Fish Ingestion												
Human Health Criteria*	NA	5400	NA	NA	0.08	NA	NA	4,200	NA	NA	NA	NA
URS for Protection of the Env.**	NA	104	8	4	5	3.9	NA	16***	NA	18	1000	82 (L)
SW #1	2800	<1.0	<2.0	259	<1.0	1.6 B	5630	8.5 B	<10.0	18.6 B	18400	32.6 (L)
SW #2	48900	<1.0	11.1	1170	12.5	<1.0	50800	52.4	89.7	32.4 (K)	94300	76.8 (L)
SW #3	8350	<1.0	5.0 B	458	3.6 B	<1.0	34800	14.6	30.3 B	<9.0	60700	19.1 (L)
SW #4	7350	1.0 B	2.1 B	270	2.6 B	<1.0	25000	8.4 B	12.6 B	<9.0	24000	22.2 (L)
SW #5	387	<1.0	<2.0	92.5 B	<1.0	<1.0	22100	<7.0	<10.0	<9.0	2430	3.6 (L)

Sample Number	Magnesium µg/L	Manganese µg/L	Mercury µg/L	Nickel µg/L	Potassium µg/L	Selenium µg/L	Silver µg/L	Sodium µg/L	Thallium µg/L	Vanadium µg/L	Zinc µg/L
Fish Ingestion											
Human Health Criteria*	NA	NA	7.1	5,700	NA	1,100	40,000	NA	NA	NA	NA
URS for Protection of the Env.**	NA	80	2	1,418	NA	20	4	NA	18	19	117
SW #1	1780 B	484	<0.20	17.7 B	2580 B	1.4 B	<7.0	8190	<2.0	15.5 B	205
SW #2	11400	11300	<0.20	58.8	5580	2.1 B	<7.0	9760	<2.0	84.8	340
SW #3	7060	6280	<0.20	16.2 B	3730 B	1.2 B	<7.0	9120	<2.0	25.4 B	100
SW #4	6220	310	0.31	<11.0	3030 B	1.4 B	<7.0	8450	<2.0	20.2 B	50.4
SW #5	6230	238	<0.20	<11.0	4220 B	<1.0	<7.0	9390	<2.0	<9.0	<12.0

Notes:

SW = Surface water sample

* State of Delaware Surface Water Quality Standards, as amended February 2, 1990

Human Health Criteria For Fish Ingestion

< = Analyte was detected below the stated quantitation limit

B = Reported value less than the contract required detection limit, but greater than the instrument detection limit

NA = No surface water criteria set for this analyte

** February 1998 Delaware Uniform Risk-Based Remediations Standards, Surface Water, URS for Protection of the Environment

*** Based on hexavalent chromium, the most toxic form. Criteria for trivalent chromium is 1,736 µg/L

(L) Analyte present. Reported value may be biased low. Actual value is expected to be higher.

(K) Analyte present. Reported value may be biased high. Actual value is expected to be lower.

TABLE 4-22
 SEDIMENT ANALYTICAL RESULTS
 DETECTED ABOVE THE LABORATORY QUANTITATION LEVELS
 SEMIVOLATILE ORGANIC COMPOUNDS
 KENTON LANDFILL
 1 AND 2 OCTOBER 1996

SEMIVOLATILE ORGANIC COMPOUNDS	
Sample Number	bis (2-ethylhexyl) phthalate µg/kg
COMPOUND CAS NO.	117-81-7
URS for Protection of the Environment*	1,000,000
SD #2 (re-analyzed)	170 J

Notes:

SD = Sediment soil sample

* Delaware Uniform Risk Based Remediation Standards, Protection of the Environment, February 1998

J = Estimated concentration less than method detection limit

TABLE 4-23
 SEDIMENT ANALYTICAL RESULTS
 KENTON LANDFILL
 1 AND 2 OCTOBER 1996

TAL METALS

Sample Number	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Cadmium mg/kg	Calcium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg
URS for Protection of the Env.**	NA	2.0	NA	20	NA	1	NA	81***	NA	34	NA	47
SD #1	5,980	0.24 B	1.3 B	77.3	0.51 B	0.16 B	236 B	5.9	2.0 B	5.3 (K)	3,100	21.4
SD #2	1,650	<0.14 (UL)	0.39 B	16.4 B	0.25 B	<0.14	449 B	2.0 (K)	<1.4	<1.3	1,030	4.1
SD #3	3,710	<0.13 (UL)	0.15 B	44.1	0.62 B	0.14 B	797	5.4	<1.3	1.3 B (K)	1,050	3.7
SD #4	8,190	0.18 B	1.6 (J)	41.8	0.56 B	0.19 B	1,270	12.2	4.2 B	6.8 (K)	5,420	6.7
SD #5	3,040	<0.14 (UL)	0.69 B	33.2	0.66 B	0.24 B	1,370	4.5 (K)	1.8 B	1.4 B (K)	5,090	4.9

Sample Number	Magnesium mg/kg	Manganese mg/kg	Mercury mg/kg	Nickel mg/kg	Potassium mg/kg	Selenium mg/kg	Silver mg/kg	Sodium mg/kg	Thallium mg/kg	Vanadium mg/kg	Zinc mg/kg
URS for Protection of the Env.**	NA	NA	0.2	21	NA	NA	1	NA	NA	NA	150
SD #1	374 B	29.0	<0.12	2.5 B	162 B (L)	0.62 B	<2.1 (UL)	100 B (L)	0.19 B	10.5	18.8
SD #2	72.1 B	9.5	<0.13	1.6 B	<18.5 (UL)	<0.13	<0.97 (UL)	82.9 B	<0.13	2.3 B	11.0 (K)
SD #3	175 B	12.6	<0.11	2.5 B	106 B	0.18 B	<1.8 (UL)	64.1 B	<0.12	4.7 B	12.3
SD #4	1,310	49.9	<0.11	8.4	438 B	<0.12 (UL)	<0.81	111 B (L)	0.15 B	17.0	18.1 (J)
SD #5	361 B	25.2	<0.13	3.0 B	75.8 B (L)	<0.13	<1.9 (UL)	67.8 B	<0.13	6.2 B	11.4 (K)

Notes:

SD = Sediment soil sample

< = Analyte was detected below the stated quantitation limit

B = Reported value less than the contract required detection limit, but greater than the instrument detection limit

NA = No URS reporting levels for analyte

** February 1998 Delaware Uniform Risk-Based Remediations Standards, Sediment, URS for Protection of the Environment

*** Criteria is for trivalent chromium, no criteria for hexavalent form

(J) Analyte present. Reported value may not be accurate or precise (estimated value).

(L) Analyte present. Reported value may be biased low. Actual value is expected to be higher.

(K) Analyte present. Reported value may be biased high. Actual value is expected to be lower.

(UL) Not detected. Quantitation limit is probably higher.