CDM Camp Dresser & McKee

Report

Nassau County Department of Public Works Long Island, New York

Remediation Monitoring Plan

Fireman's Training Center Bethpage, New York

September 1994

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Section 1
Introduction

This remediation monitoring plan is to be used as a guidance document for monitoring of the selected remedial technologies that will be implemented at the Fireman's Training Center (FTC), located in Bethpage, New York, under the site remedial action plan (RAP) (Nassau County Department of Public Works [NCDPW] 1993). It establishes the minimum treatment and performance monitoring requirements (e.g., location, media, frequency, methodology) to be followed. This plan does not address physical plant operation and maintenance data collection concerning the mechanical operation of the site treatment facility and its components. The methodologies presented in this document will be used to determine when treatment and remediation performance criteria for the treatment system have been met.

1.1 Objectives of the Monitoring Plan

The remediation monitoring plan was prepared as part of the work described in the FTC RAP (NCDPW 1993). The intent of the monitoring plan is to evaluate the effectiveness, performance, and hydraulic impact of the site groundwater treatment facility.

The monitoring plan addresses the following elements:

- Deep Soils Monitoring.
  - Monitoring of soil quality to determine compliance with New York State Department of Environmental Conservation (NYSDEC) soil cleanup criteria.
- Deep Soils Monitoring Termination Criteria.
  - Criteria used to determine compliance with soil cleanup objectives and termination of soil monitoring.
- Long-Term Groundwater Monitoring.
  - The overall performance of the extraction/treatment process for remediating the site will be evaluated based on the results of long-term groundwater sampling and analysis.
- Floating Product Monitoring.
  - The overall performance of the extraction/treatment process for collecting floating product based on quarterly measurement of product within monitoring wells.

- Hydraulic Monitoring.
  - The hydraulic effectiveness of the extraction system to contain site contaminant migration will be monitored.
- Groundwater Treatment Facility Monitoring.
  - A sampling schedule for the treatment facility effluent will be developed to determine if State Pollutant Discharge Elimination System (NPDES) effluent limitations are being met by the treatment system.
  - Treatment facility performance for the determination of subcontractor compliance with performance guarantees will be evaluated based on the results of water sampling and analysis.
- Air Discharge Monitoring
  - Air discharges will be calculated based on fluid flows and concentrations to the air strippers.
  - Air dispersion modeling has demonstrated facility compliance with applicable standards and, therefore, no emission controls will be required (CDM 1994a). If, at any time, emission controls are deemed necessary, appropriate samples will be collected to monitor control efficiency and the required procedures and methodologies will be incorporated into this document.
- Groundwater Treatment Termination Monitoring and Criteria.
  - A termination monitoring program will be conducted to determine whether termination criteria for the groundwater remedial system have been attained.
- Post-Termination Groundwater Monitoring.
  - Following termination of remedial system operation, a post-termination monitoring program will be conducted to assure that termination criteria continue to be met.

To assist with the evaluation of the site remedial action, a reference center should be provided at the site containing, at a minimum, the following documents:

- Nassau County Department of Public Works, Long Island, New York, Groundwater Treatment Facility, Preliminary Design Report, Fireman's Training Center Remedial Design, Camp Dresser & McKee (CDM) June 24, 1994.

- Fireman's Training Center Remediation Design, Remedial Action Plan, NCDPW December 1993.
- Treatment Facility Engineering Plans and Specifications, CDM 1994.
- Treatment Facility As-Built Drawings.
- Site Health and Safety Plan, CDM 1994
- Nassau County Department of Public Works, Remediation Monitoring Plan, Fireman's Training Center, Bethpage, New York, CDM August 1994.

1.2 Site Description and History

The FTC is located on a 12-acre site on Winding Road near Round Swamp Road, and is bordered on the north and west by the Old Bethpage Landfill, and on the south and east by Bethpage State Park (see Figure 1-1). The site has been used since 1960 to conduct advanced fire fighting training for volunteer firemen, and continues today to serve these activities. Training exercises occurred in open burn areas and in mock-up buildings located across the site (see Figure 1-2).

Between 1970 and 1980, waste solvents, in addition to fuel oil and gasoline, were accepted at the site for use in training exercises. This practice was discontinued in 1980 and, since then, training exercises have been performed using only fuel oil and gasoline to ignite wooden pallets and straw.

On-site contamination occurred primarily in the open burn areas, where fuel was poured directly onto the ground, and in the mock-up fields. In the mock-up buildings, unburned fuel and solvents were washed out of the buildings into drywells after each training session. These unlined drywells inadvertently served as conduits, carrying contamination down to the groundwater and contaminating the soils beneath the site.

In 1984, site improvements were made to cap the burn areas and seal the drainage system leading to the drywells. A new drainage system was installed, including an oil/water separator to treat runoff prior to discharge to the sanitary sewer system.

Based on NCDPW investigations conducted at the site, the NYSDEC added the site to the Registry of Inactive Hazardous Waste Disposal Sites in December 1987, and upgraded the site classification to Class 2 in March 1988. An Order of Consent was signed in February 1989, requiring a Remedial Investigation/Feasibility Study (RI/FS) to be performed. The RI/FS was completed in 1992.

A record of decision (ROD) that described the remedial program for the site was subsequently approved by the NYSDEC in February 1993. The program

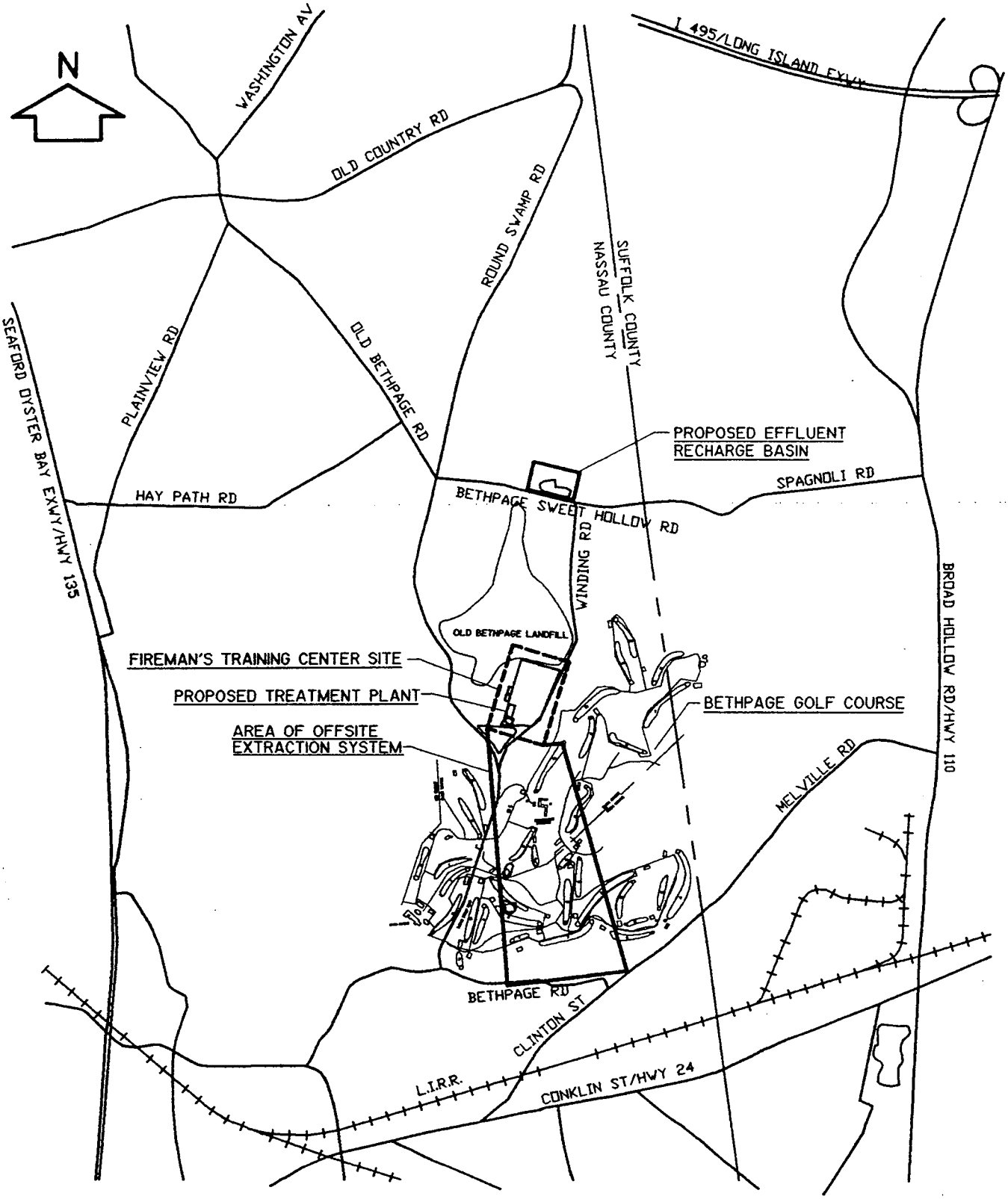

Figure No.1-1

Site Location

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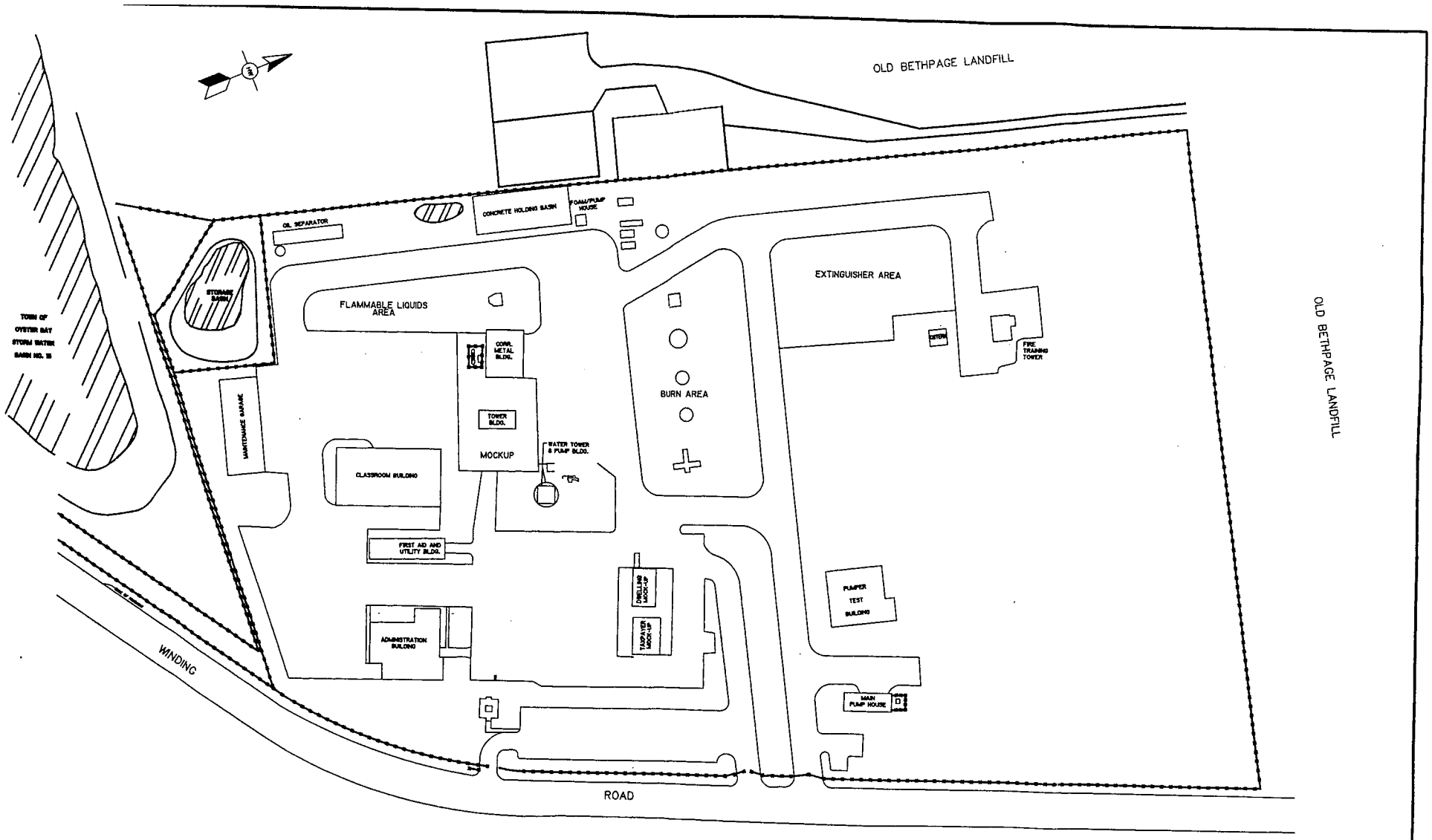

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Figure 1-2

Site Plan

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includes an asphalt/concrete cap with institutional controls for shallow soils, pumping and treating on-site groundwater using three extraction wells, and pumping and treating off-site groundwater using seven extraction wells.

1.3 Environmental Conditions

Open burn exercises were conducted at three on-site locations and the interconnected, unlined drywells in these areas have been identified as causing contamination at the site. Based on the RI/FS report, ROD, and the RAP, the following brief summary of site contamination is provided. Data has been gathered from 31 on-site and 23 off-site wells.

1.3.1 On-Site Soil

Areas of soil contamination were identified in the Mock-up Field (MUF), Corrugated Metal Building (CMB), and Burn Area Field (BAF) drywell fields. The extent of the site soil contamination during the early RI phase is shown on Figure 1-3. Soils in the vicinity of the MUF and BAF fields are contaminated with total petroleum hydrocarbons (TPH) and benzene, toluene, ethylbenzene, and xylene (BTEX) from the bottoms of the drywells down to the water table. The historic high concentrations are listed here. In the MUF area, historical TPH concentrations ranged from greater than 100 milligrams per kilogram (mg/kg) to 130,000 mg/kg, and BTEX concentrations ranged from greater than 100 mg/kg to 7,830 mg/kg. In the BAF area, TPH ranged from 100 to 19,000 mg/kg and BTEX from greater than 100 mg/kg to 9,600 mg/kg. In the CMB area, TPH concentrations ranged from 61 to 1,500 mg/kg and BTEX concentrations ranged from not detected to 110,000 mg/kg. The areas of contaminated soil extend laterally about six feet from each MUF drywell and about 12 feet from each BAF drywell. In the CMB area, soil contaminated with TPH and BTEX extends to a depth of 8 feet below the bottoms of the drywells and 8 feet laterally.

Additional soil contamination has resulted from contact of three former floating bodies of petroleum product with soil (see Section 1.3.4). Monthly water levels collected during the RI from April 1990 to April 1991 indicate that water levels fluctuated during that period by approximately 2 feet. These fluctuations result in exposing the soil to contamination from the former bodies of floating product. The RI report estimated that a 10-foot thick band of contaminated soil (currently masked by the higher water table) above the water table exists in the areas at the FTC.

1.3.2 On-Site Groundwater

There are 2 distinct plumes of groundwater contamination beneath the FTC site. Figure 1-4 shows the extent of both on-site plumes as defined in the RI/FS report. An isolated plume associated with the MUF drywell field extends approximately 300 feet by 150 feet from the mock-up buildings southeast towards the site perimeter. This plume contains some dissolved

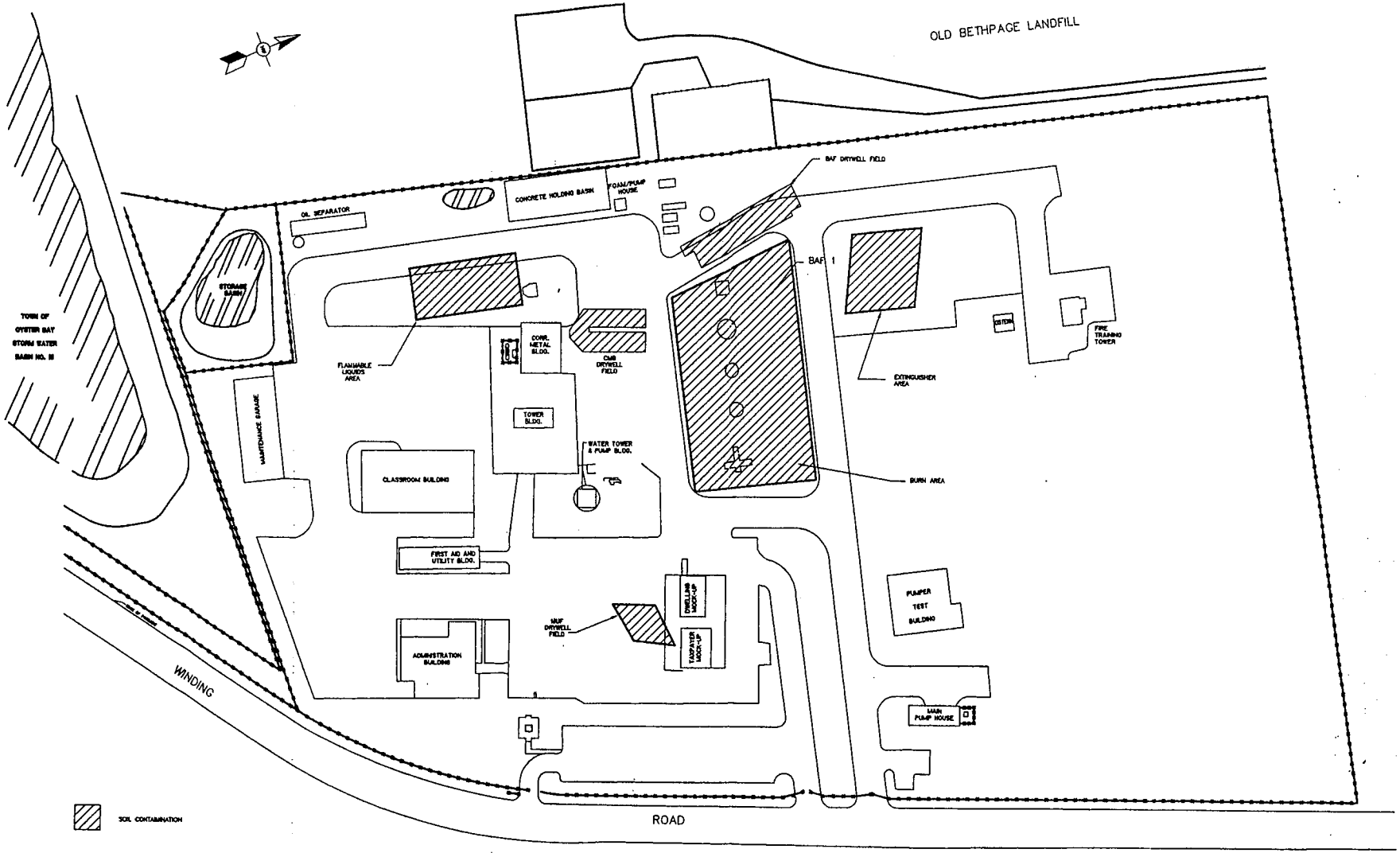

Figure 1-3

Extent of Soil Contamination Shallow And Deep Soils

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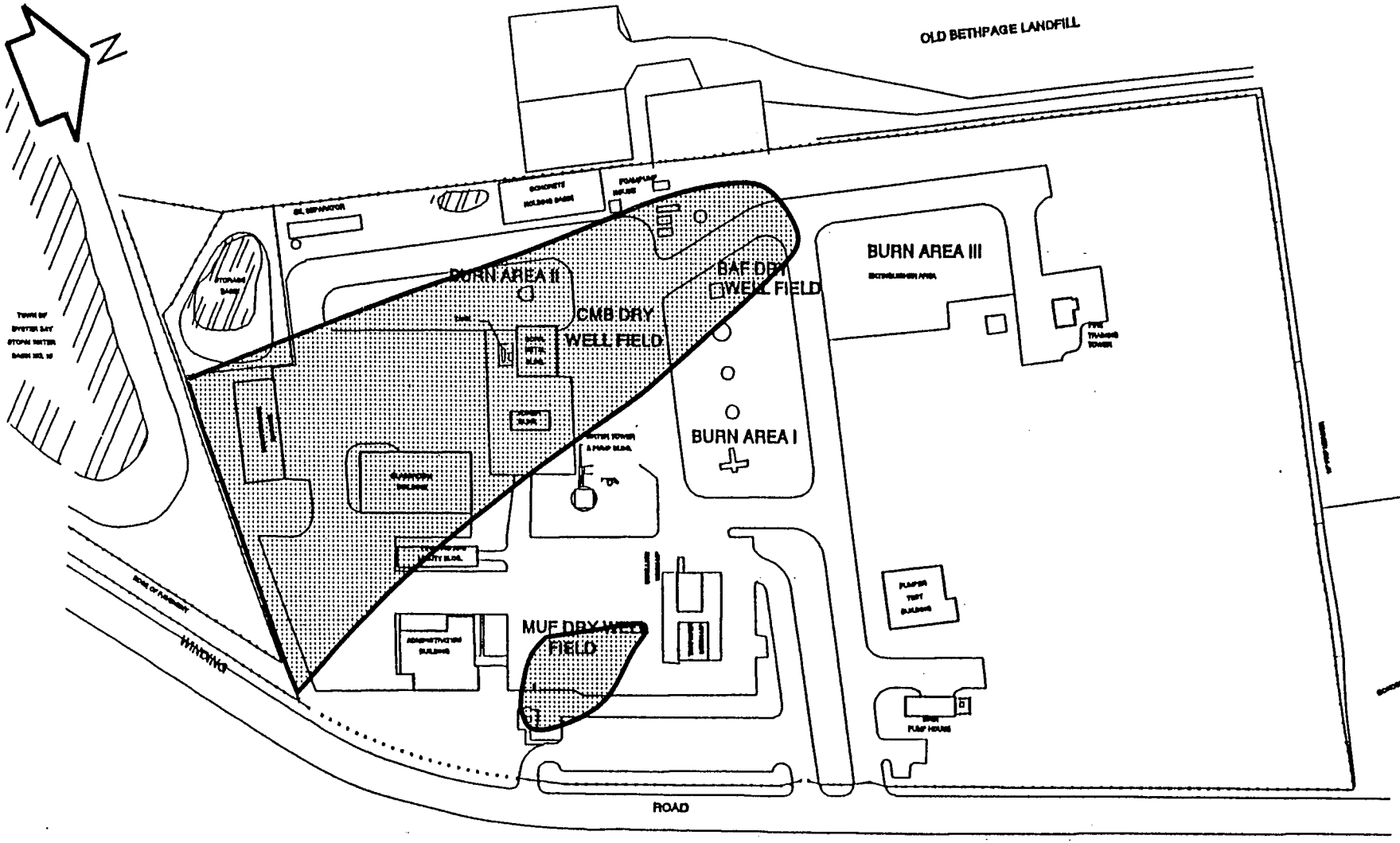

Adapted from Malcolm Pirnie, Inc. figure.

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Figure 1-4

On-Site Groundwater Contamination

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BTEX, with historical concentrations ranging up to 63 micrograms per liter (ug/l).

A second plume originates in the BAF and CMB, and extends downgradient of the site. It was reported in the RI to be 780 feet long and 380 feet wide. The on-site portion of the plume is associated with the larger floating product area and historically showed BTEX concentrations up to 27,850 ug/l, methyl ethylketone (MEK) up to 1,200 ug/l, and acetone up to 6,050 ug/l. Another plume overlaps the larger plume, and contains dissolved chlorinated hydrocarbons with a historical maximum concentration of 2,807 ug/l. The latter plume extends to the southern boundary of the site, and is estimated to be 480 feet long and 300 feet wide.

Semivolatile organic compounds (semi-VOCs) have been detected in both on-site groundwater plumes. Specifically, the following semi-VOCs were detected:

- phenanthrene
- fluorene
- naphthalene
- di-n-octyl-phthalate
- methylnaphthalene
- pyrene

The FTC also contains groundwater contaminated by leachate from the Old Bethpage Landfill, which is located north and northwest of the FTC. Landfill indicator parameters detected at the FTC include specific conductance, alkalinity, chlorides, hardness, ammonia, and some chlorinated organic compounds. Ammonia concentrations range from greater than 0.02 ug/1 to 65 ug/1. Generally, the highest concentrations of these parameters were found in the northern part of the FTC closer to the landfill. With the exception of chlorides, the landfill indicator parameters have been detected at concentrations above the landfill's action levels in a large portion of the FTC site extending from the northwest to the southeast corner of the site.

The following metals, either associated with the landfill leachate plume or naturally occurring, were also detected in on-site groundwater:

- Aluminum
- Chromium
- Iron
- Manganese
- Nickel
- Arsenic
- Lead

1.3.3 Off-Site Groundwater

A plume of dissolved groundwater contamination has migrated beyond the southern boundary of the FTC site into the Bethpage State Park (see Figure 1-5). The leading edge of the plume is reported to be approximately 4,000 feet downgradient of the site. Most of the plume extends from 40 feet above mean 1-5 sea level (msl) to 120 feet below msl.

Only highly mobile solvents have migrated off-site. The highest measured concentrations of volatile organic compounds (VOCs) occur in the off-site plume south of two irrigation wells in Bethpage State Park, with concentrations of total VOCs measured at more than 1,500 ug/l. The major constituents of the off-site plume are:

- vinyl chloride
- tetrachloroethene
- 1,1-dichloroethene
- 1,2-dichloroethane
- 1,1,1-trichloroethane
- trichloroethene
- benzene
- xylene

1.3.4 Floating Product

Historically, floating product has been detected in monitoring wells at three areas of the FTC site, as shown on Figure 1-6. This product, associated with the drywells, has contributed to soil and groundwater contamination at the site.

In the MUF, floating product was measured in wells near the mock-up buildings, primarily #2 fuel oil. In the BAF, floating product was found consisting of #2 fuel oil contaminated with solvents. In the CMB, the floating product was primarily gasoline.

Due to a ten-foot rise in the water table between 1989 and 1992, the floating product plumes disappeared. They are presumed to have been trapped in the pore space of the now saturated soil, creating a smear zone of soil contamination located both above and below the present water table.

With the recent decline in the water table, floating product has reappeared in the MUF. The floating product in the CMB field has not reappeared, and may have been volatilized and extracted by the nearby methane extraction system of the landfill.

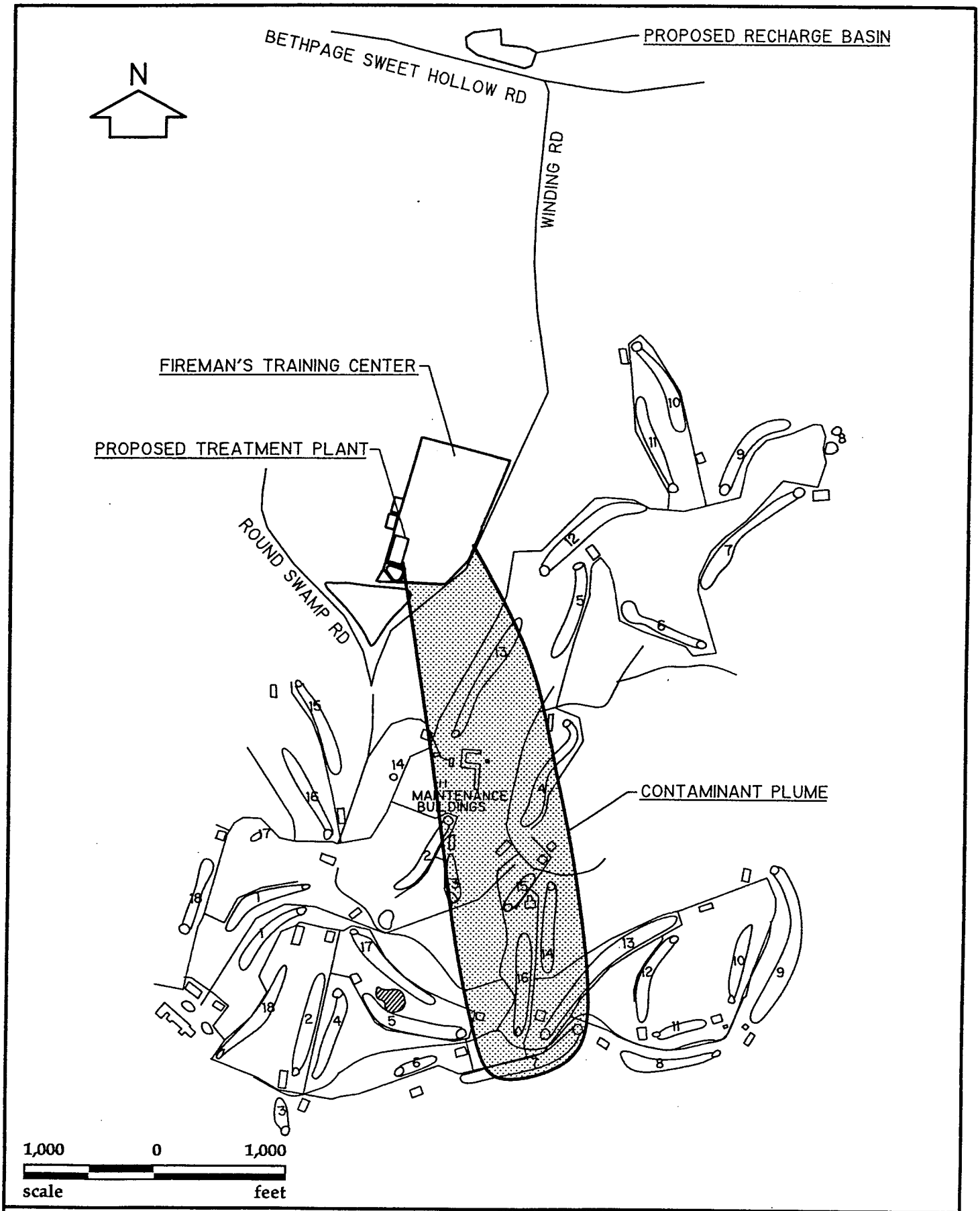

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Figure 1-5

Estimated Extent Of Off-Site Contaminant Plume

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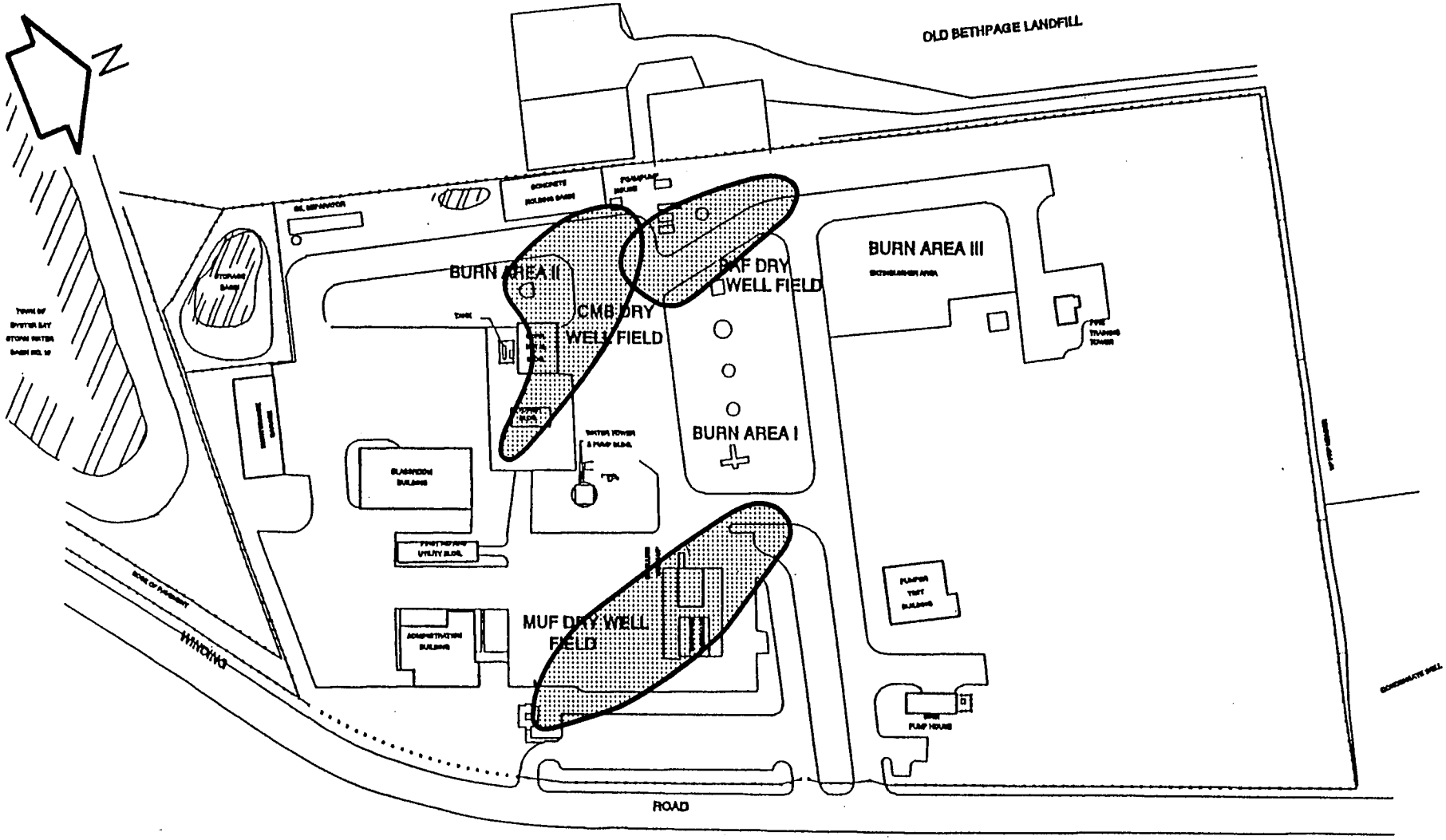

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Figure 1-6

On-Site Floating Product Areas

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Section 2
Monitoring Criteria

The intent of this section is to establish guidelines for the matrices that will be monitored during the site remedial action for the FTC. Some guidelines are designed to monitor the performance of the treatment facility, others will be used to evaluate the success of the remediation.

2.1 Soil Quality

Soils will be evaluated on a 3-year schedule as discussed in Section 3.1. Table 2-1 provides the soil criteria for cleanup.

2.2 Water Quality

Applicable effluent limitations for the site treatment facility are provided in Table 2-2. Applicable groundwater cleanup criteria are provided in Table 2-3.

2.2.1 Treatment Facility

The operation of both the on- and off-site treatment systems must be maintained to assure compliance with (1) applicable air discharge requirements set forth in NYS regulations and Air Guide No. 1 for the control of toxic air contaminants, (2) applicable SPDES requirements, and (3) State Technical and Operational Guidance Series limitations for potable groundwater quality. Upon approval by the NYSDEC, this monitoring program will be deemed incorporated in the FTC RAP.

The effluent from the groundwater treatment facility will be discharged to a Nassau County recharge basin located north of the site and three (3) injection wells to be installed along the Old Bethpage Village Restoration access road near the basin (see Figures 1-1 and 2-1). Discharge criteria were established by the NYSDEC (NYSDEC 1994), based on Federal Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs), NYS groundwater quality standards (6NYCRR Part 703.5), and NYS groundwater effluent standards (6NYCRR Part 703.6). These discharge criteria were compared with applicable or relevant and appropriate requirements (ARARs) for aquifer remediation. The most restrictive values for each constituent were selected, resulting in the effluent limitations presented in Table 2-2 (NYSDEC 1994).

2.2.2 Groundwater

Groundwater cleanup criteria are provided in Table 2-3. The technical feasibility of meeting these goals will be considered throughout remediation (see section 2.5).

TABLE 2-1 NASSAU COUNTY FTC TO BE CONSIDERED SOIL CRITERIA	
Constituents Potentially Present On-Site	NYSDEC Hazardous Waste Remediation Division Technical and Administrative Guidance Memorandum (TAGM) (mg/kg) (1)
VOLATILE COMPOUNDS	
chlorobenzene	1.7
benzene	0.06
toluene	1.5
ethyl benzene	5.5
xylenes	1.2
acetone	0.2
methyl ethyl ketone	0.3
carbon disulfide	2.7
vinyl chloride	0.2
methylene chloride	0.1
1,1-dichloroethene	0.4
1,1-dichloroethane	0.2
trans-1,2-dichloroethene	0.3
1,1,1-trichloroethane	0.8
trichloroethene	0.70
tetrachloroethene	1.4
2-hexanone	7
Total VOCs	10
SEMIVOLATILE COMPOUNDS	
phenanthrene	50
fluorene	50
napthalene	13
di-n-octyl phthalate	50
2-methylnaphthalene	36.4
dibenzofuran	6.2
Total Semi-VOCs	500
Individual Semi-VOCs	50

Notes: (1) Calculations assume a total organic carbon content of 1 %, and a correction factor of 100.

Table 2-2

Treatment Facility Effluent Limitations and Monitoring Requirements

Outfall Number & Effluent Parameter	Discharge Limitations		Units	Minimum Monitoring Requirements	
	Daily Average	Daily Maximum		Measurement Frequency (2)	Sample Type
Outfall 001 – Treated Groundwater:					
Flow	Monitor	Monitor	gpd	Continuous	Meter
Vinyl Chloride	NA	5	ug/l	Weekly	Grab
1,1-Dichloroethane	NA	5	ug/l	Weekly	Grab
1,2-(trans)-Dichloroethylene	NA	5	ug/l	Weekly	Grab
1,2-(cis)-Dichloroethylene	NA	5	ug/l	Weekly	Grab
1,1,1-Trichloroethane	NA	5	ug/l	Weekly	Grab
Trichloroethylene	NA	10	ug/l	Weekly	Grab
Benzene	NA	0.7	ug/l	Weekly	Grab
Tetrachloroethylene	NA	5	ug/l	Weekly	Grab
Toluene	NA	5	ug/l	Weekly	Grab
Xylenes, each isomer	NA	5	ug/l	Weekly	Grab
1,1-Dichloroethene	NA	5	ug/l	Weekly	Grab
Methyl Ethyl Ketone	NA	50	ug/l	Weekly	Grab
Acetone	NA	50	ug/l	Weekly	Grab
Chloroform	NA	7	ug/l	Weekly	Grab
Dichlorobromomethane	NA	50	ug/l	Weekly	Grab
Dibromochloromethane	NA	50	ug/l	Weekly	Grab
Naphthalene	NA	10	ug/l	Weekly	Grab
Phenanthrene	NA	50	ug/l	Weekly	Grab
Fluorene	NA	50	ug/l	Weekly	Grab
Pyrene	NA	50	ug/l	Weekly	Grab
Bis (2-ethylhexyl) phthalate	NA	4.3	mg/l	Weekly	Grab
Di-n-octyl phthalate	NA	50	ug/l	Weekly	Grab
Dimethyl phthalate	NA	50	ug/l	Weekly	Grab
Diethyl phthalate	NA	50	ug/l	Weekly	Grab
Iron, Total	NA	600	ug/l	Weekly	Grab
Manganese, Total	NA	600	ug/l	Weekly	Grab
Nickel, Total	NA	2000	ug/l	Weekly	Grab
Arsenic, Total	NA	50	ug/l	Weekly	Grab
Aluminum, Total	NA	2000	ug/l	Weekly	Grab
Chromium, Total	NA	50	ug/l	Weekly	Grab

Notes: (1) The sum of iron (total) and manganese (total) shall not exceed 1.0 mg/l.

(2) The minimum measurement frequency for all the parameters (except flow) shall be monthly following a period of twenty-four (24) consecutive sampling events showing no exceedances of the stated discharge limitations. If a discharge limitation for any parameter is exceeded the measurement frequency for all parameters shall again be weekly, until a period of eight (8) consecutive sampling events shows no exceedances at which point monthly monitoring may resume.

TABLE 2–3 NASSAU COUNTY FTC GROUNDWATER CLEANUP CRITERIA	
Constituents Identified In Risk Assessment	NY State Ground Water Standards 6 NYCRR 703.5 (ug/1)
VOLATILE COMPOUNDS	
benzene	0.7
toluene	5
ethyl benzene	5
xylenes (each isomer)	5
acetone	50*
methyl ethyl ketone	50*
carbon disulfide	50*
vinyl chloride	2
methylene chloride	5
1,1–dichloroethene	5
1,1–dichloroethane	5
trans–1,2–dichloroethene	5
1,1,1–trichloroethane	5
trichloroethene	5
tetrachloroethene	5
2–hexanone	50
Total Volatiles	50
SEMIVOLATILE COMPOUNDS	
phenanthrene	50*
fluorene	50*
naphthalene	50*
di–n–octyl phthalate	50
2–methylnaphthalene	50*

* – NYS Drinking Water Standards 10 NYCRR 5–1 (ug/l)

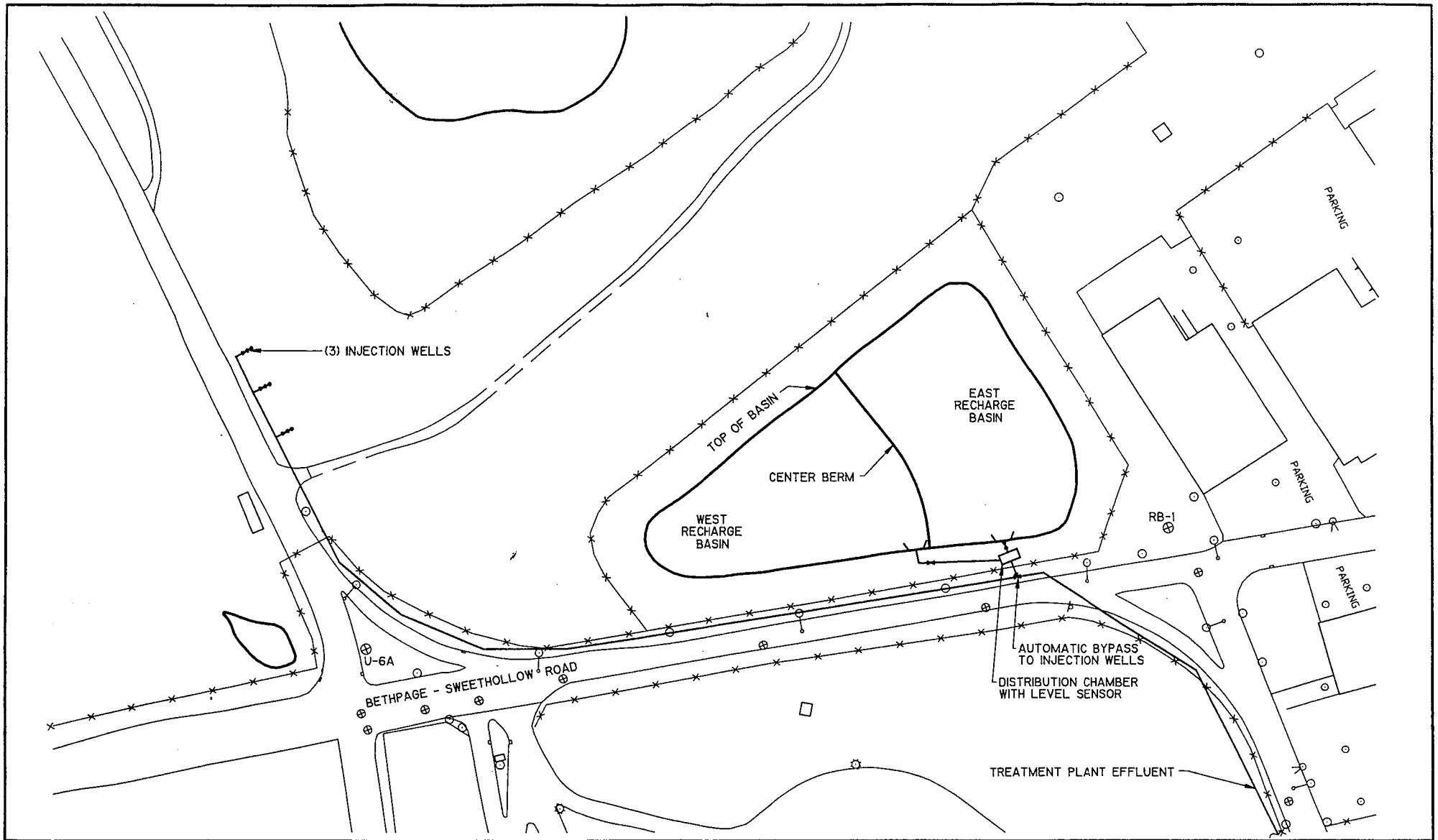

Figure 2-1

Recharge Basin And Wells

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2.3 Hydraulic Controls

The objective of the treatment facility extraction scheme is to create a groundwater capture zone that achieves the following:

- prevents further migration of contaminated groundwater within the FTC plume;
- recovers contaminated groundwater for treatment to applicable standards and, therefore, significantly reduces the volume of contaminated groundwater.

To evaluate the effectiveness of the site groundwater treatment facility in the containment or capture of the groundwater contaminant plume, water levels in selected on- and off-site monitoring wells, as well as in on- and off-site extraction wells, will be measured (see Section 3.4). The measured elevation heads will be evaluated to determine if hydraulic gradients are sufficient to provide containment of all areas of contamination.

2.4 Air Emissions

The NYS Air Pollution Control Regulations (6 NYCRR Parts 201 and 202) require an air permit to construct, as well as a certificate to operate, for an air contaminant source such as a groundwater treatment facility. Table 2-4 contains applicable air standards that will have to be met during site remediation. No air emissions sampling will be conducted at the treatment facility. Instead, air emission calculations will be based on influent concentrations and fluid flow rates to the air stripping tower from the combined offsite and onsite groundwater. Air dispersion modeling analysis (CDM 1994a and June 20, 1994 letter from CDM to NCDPW) has shown that benzene, vinyl chloride, and tetrachloroethene are the controlling contaminants for air emissions. Based upon expected influent concentrations, air modeling has shown no expected exceedances of air quality guidelines offsite due to air stripping tower emissions.

Air monitoring criteria will be based on the results of influent concentration monitoring to the air stripper. Concentrations of benzene, PCE, and vinyl chloride must be below the values shown below to avoid offsite exeedances of air guidelines.

Compound	Expected Concentration	Maximum Allowable Concentration (ug/l)
Benzene	197.5	438.8
Vinyl Chloride	13.9	69.5
PCE	434.6	4,346

TABLE 2–4

NASSAU COUNTY FTC
TO BE CONSIDERED AMBIENT AIR GUIDELINE CONCENTRATIONS (1)

Constituents Identified In Risk Assessment	SCG (2) (ug/cu m)	AGC (3) (ug/cu m)
VOLATILE COMPOUNDS		
benzene	30	0.12
toluene	89,000	2,000
ethyl benzene	100,000	1,000
xylenes	100,000	300
acetone	140,000	14,000
methyl ethyl ketone (2–butanone)	140,000	300
carbon disulfide	710	7
vinyl chloride	1,300	0.02
methylene chloride	41,000	27
1,1 – dichloroethane	190,000	500
trans–1,2–dichloroethene	– –	360
1,1,1 – trichloroethane	450,000	1,000
trichloroethene	33,000	0.45
tetrachloroethene	81,000	0.075
1,1 – dichloroethene	2,000	0.02
1,2 – dichloroethene	190,000	1,900
SEMIVOLATILE COMPOUNDS		
naphthalene	12,000	120
SECONDARY COMPOUNDS		
ammonia (as N)	4,000	360

(1) From the draft New York State Air Guide – 1, 1991 Edition

(2) Short–term Guideline Concentration

(3) Annual Guideline Concentration

2.5 Remedial System Termination

The standards/guideline values for VOCs and semi-VOCs presented in Table 2-3 are the criteria that must be achieved in the monitoring wells for termination of site remedial system operation. These criteria must be met for a period of 2 years (8 quarters) prior to termination of system operation, unless the zero slope condition for groundwater remediation is demonstrated.

The zero slope condition refers to a demonstrated condition at which contaminant concentrations in all termination monitoring wells (see Section 3.6) are lowered by the remediation, but do not achieve required standards and/or guidance values (see Table 2-5). Instead of continuing to be lowered, the concentrations reach a certain level and remain at that level during the two-year termination monitoring period. This condition is demonstrated if a plot of concentration versus time data for the two-year termination monitoring period indicates that the slope of the line is statistically indistinguishable from zero.

For the purposes of determining the zero slope condition, organic compound concentrations will be summed over each quarter to produce a total VOC (TVOC) concentration versus time plot for each termination monitoring well (i.e., 21 plots). It will be required that the zero slope condition exists in each termination monitoring well (see Section 3.6.2).

To determine whether the zero slope condition has been achieved, termination monitoring data will be tested for normality. The selected statistical test will be determined as follows:

1. Plot concentrations obtained over time on probability paper.
2. Evaluate for normality by an agreed-upon objective method.
3. If data is not normally distributed, transformations such as lognormal may be employed in an attempt to obtain a normal distribution. Transformed data will be tested for normality.
4. If the data is normally distributed, the most powerful parametric test will be used.
5. If the data is not normally distributed, an appropriate non-parametric test will be applied.

In addition, if one or more of the sample analytical results for termination monitoring do not meet the required criteria, the NCDPW may still seek termination of the remediation if all other data meets the criteria and it can be demonstrated, subject to NYSDEC concurrence, that the contamination in the non-complying wells is attributable to sources of contamination other than the FTC site. The NYSDEC will continue to make available to the NCDPW all data it obtains with respect to other potential sources of contamination including, without limitation, the Oyster Bay Solid Waste Disposal Complex (OBSWDC) (i.e., the Old Bethpage Landfill) and the Claremont Polychemical Site.

Section 3
Monitoring Network

This section establishes the minimum monitoring requirements in terms of media, location, analytical parameters, and frequency to meet the objectives of this monitoring plan. The data collected at the monitoring points described in this section will be compared against the criteria established in Section 2. Tables 3-1 and 3-2 summarize the minimum monitoring/sampling parameters and frequency of sample collection. Laboratory analyses will be completed by a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certified laboratory. Process control samples will be analyzed on-site.

3.1 Soil Quality

Nassau County and NYSDEC have agreed that natural aeration of the contaminated deep soils is providing the necessary oxygen to maintain biological activity and breakdown of the volatiles and semi-volatiles at the FTC site. To monitor soils and determine if the soil cleanup criteria listed in table 2-1 have been achieved, soils will be tested on a 3-year schedule. The initial round of sampling occurred in June, 1994, with a subsequent round scheduled for June, 1997.

Soil samples will be taken at the following locations and depths (figures 3-1, 3-2 and 3-3).

Sample Location	Depth Below Grade (ft)
MUF-1	25-27
MUF-3	32-34
MUF-4	25-27
MUF-5	33-35
CMB-1	16-18
CMB-2	34-36
CMB-5	26-28
BAF-1	34-36
BAF-2	34-36
BAF-3	35-37
BAF-4	30-32
BAF-5	30-32

Collected samples will be tested for the semi-volatiles and BTEX compounds listed in table 2-1, using Standard Method 8240 for VOCA (1x120 ml amber jar, 14 day holding time) and Method 8270 for SVOC (1x4 oz jar, 7 day extraction and 40 days analysis holding times).

Table 3-1

TREATMENT FACILITY MONITORING PARAMETERS AND FREQUENCY OF SAMPLE COLLECTION

Monitoring/ Sampling Location	Sample Port Number (Appendix B)	Sample Type	Sample Matrix	Analytical Parameters	Sampling Frequency
TREATMENT FACILITY SAMPLING					
Plant Influent (2 locations; 1 on-site and 1 off-site)	1	Grab	Water	VOCs, semi-VOCs, Target Metals(a), BOD, Alkalinity, Hardness, Sodium, TSS, TDS	1 per week per location
				pH, COD, Ammonia, Nitrate/Nitrite, Phosphorus	(f) 1 per week per location
Plant Effluent	2	Grab	Water	VOCs, semi-VOCs, Target Metals(a)	1 per week per location (b)(i)
				pH	1 per week per location (b)(f)
				Alkalinity, Hardness, Sodium,TSS,TDS	1 per week per location (b)
Off-Site Static Mixer Effluent	3	Grab	Water	pH	(e)(f)
Off-Site Flocculator Effluent	4	Grab	Water	pH,TSS,TDS	(e)(f)
Off-Site Clarifier Effluent	5	Grab	Water	pH,TSS,TDS	(e)(f)
Off-Site Rapid Mix Tank Effluent	6	Grab	Water	Target Metals (a), TSS, TDS, Alkalinity, Hardness	(e)
				pH	(e)(f)
Oil/Water Separator Effluent	7	Grab	Water	pH, TPH	(e)(f)
Waste Product Storage Tank Effluent	8	Grab	Water	VOCs,TPH	(e)
On-Site Flocculator Influent and Effluent	9	Grab	Water	pH,TSS,TDS	(e)(f)
On-Site Rapid Mix Tank/Clarifier Sump Effluent	10	Grab	Water	Target Metals (a), TSS, TDS, Alkalinity, Hardness	1 per week per location
				pH	(e)
On-Site Clarifier Effluent	11	Grab	Water	pH,TSS,TDS	(e)
				TSS	1 per two weeks per location
Fluidized Bed Reactor Influent	12	Grab	Water	pH, DO, COD, Ammonia, Phosphorus, Nitrate/Nitrite	(e)(f)
Fluidized Bed Reactor Effluent	13	Grab	Water	pH, DO, COD, Ammonia, Phosphorus, Nitrate/Nitrite	(e)(f)
				TSS, VSS	(e)
Intermediate Wet Well Effluent	14	Grab	Water	Target Metals (a), TSS, TDS	1 per month per location (e)
Dual Media Filter Backwash	15	Grab	Water	TSS, TDS, Target Metals (a)	1 per month per location (e)
Dual Media Filter Effluent	16	Grab	Water	Target Metals (a), TSS, TDS	(e)
Air Stripper Influent (Effluent *)	17	Grab	Water	VOCs, Target Metals (a), TSS, TDS	1 per week per location (i)
On-Site Sludge Transfer Pump Effluent	18	Grab	Water	TS	(e)
Sludge Thickener Influent and Effluent	19, 20	Grab	Water	TS, VSS, TSS	(e)
Sludge Holding Tank Supernatant	21	Grab	Water	pH,TSS	(e)
Sludge Holding Tank Sludge (to Press)	22	Grab	Solid	TS, VS, Target Metals (a)	(e)
Filter Press Filtrate	23	Grab	Water	TSS, TDS	(e)
Recycle Well Effluent	24	Grab	Water	pH, COD, Ammonia, Nitrate/Nitrite, Phosphorus	(e)(f)

Table 3-1

TREATMENT FACILITY MONITORING PARAMETERS AND FREQUENCY OF SAMPLE COLLECTION

Monitoring/ Sampling Location	Sample Port Number (Appendix B)	Sample Type	Sample Matrix	Analytical Parameters	Sampling Frequency
Off-Site Clarifier Sludge	25	Grab	Solid	TS, VS	(e)
Off-Site Sludge Transfer Pump Effluent	26	Grab	Solid	TS, VS	(e)
Off-Site Sludge Recycle Pump Effluent	27	Grab	Solid	TS, VS	(e)
On-Site Sludge Recycle Pump Effluent	28	Grab	Solid	TS, VS	(e)
On-Site Clarifier Sludge	29	Grab	Solid	% Solids, % VSS	(e)
Sludge Cake from Filter Press	30	Grab	Solid	TS, VS	1 per press run
				VOCs, semi-VOCs, Target Metals (a)	1 per quarter per location
				TCLP	1 per year per location
EXTRACTION WELL SAMPLING					
On-Site Extraction Wells RW-1 through RW-3		Grab	Ground-water	VOCs, semi-VOCs, Target Metals (a), pH, COD, Ammonia, Nitrate/Nitrite, Phosphorus, Chlorides, Alkalinity, Hardness, TSS, TDS	1 per well per month
Off-Site Extraction Wells ORW-1 through ORW-7		Grab	Ground-water	VOCs, semi-VOCs, Target Metals (a), pH, Alkalinity, Hardness, TSS, TDS	1 per well per month
GROUNDWATER MONITORING					
Baseline Groundwater Monitoring		Grab	Ground-water	VOCs	Once per selected well (g)
				Semi-VOCs	Once per selected well (g)
				Alkalinity, BOD, COD, Hardness Nitrate/Nitrite, Phosphorus, Sodium, TKN, Ammonia Sulfate, Chlorides, TOC, TDS, TSS, pH, Conductivity, DO, Temperature, Turbidity	Once per selected well (g)
Quarterly Groundwater Monitoring		Grab	Ground-water	VOCs	1 per selected well per quarter (h)
				Semi-VOCs	1 per selected well per quarter (h)
Annual Groundwater Monitoring		Grab	Ground-water	VOCs	1 per selected well per year (g)
				Semi-VOCs	1 per selected well per year (g)
				Alkalinity, BOD, COD, Hardness Nitrate/Nitrite, Phosphorus, Sodium, TKN, Ammonia Sulfate, Chlorides, TOC, TDS, TSS, pH, Conductivity, DO, Temperature, Turbidity	1 per selected well per year (g)

NOTES: * Same as plant effluent unless liquid phase GAC installed
(a) Target metals includes total aluminum, arsenic, chromium, iron, lead, manganese, and nickel.
(b) The sampling frequency for these samples will be monthly following a period of 24 consecutive weekly sampling events showing no exceedances of the stated limitations (see Table 2-2). If an exceedance occurs, the measurement frequency will again be weekly until a period of 8 consecutive sampling events shows no exceedances at which point monthly sampling may resume.
(c) Target organics are specified in Section 3-5.
(d) These samples are only collected during the initial facility start-up period.
(e) As required for Process Control.
(f) Will be analyzed on-site using appropriate field testing equipment.
(g) See Table 3-3.
(h) See Table 3-4.
(i) During startup, sampling frequency will be daily for the first 2 weeks to monitor air discharges.

Table 3-2

SAMPLE PARAMETER TABLE

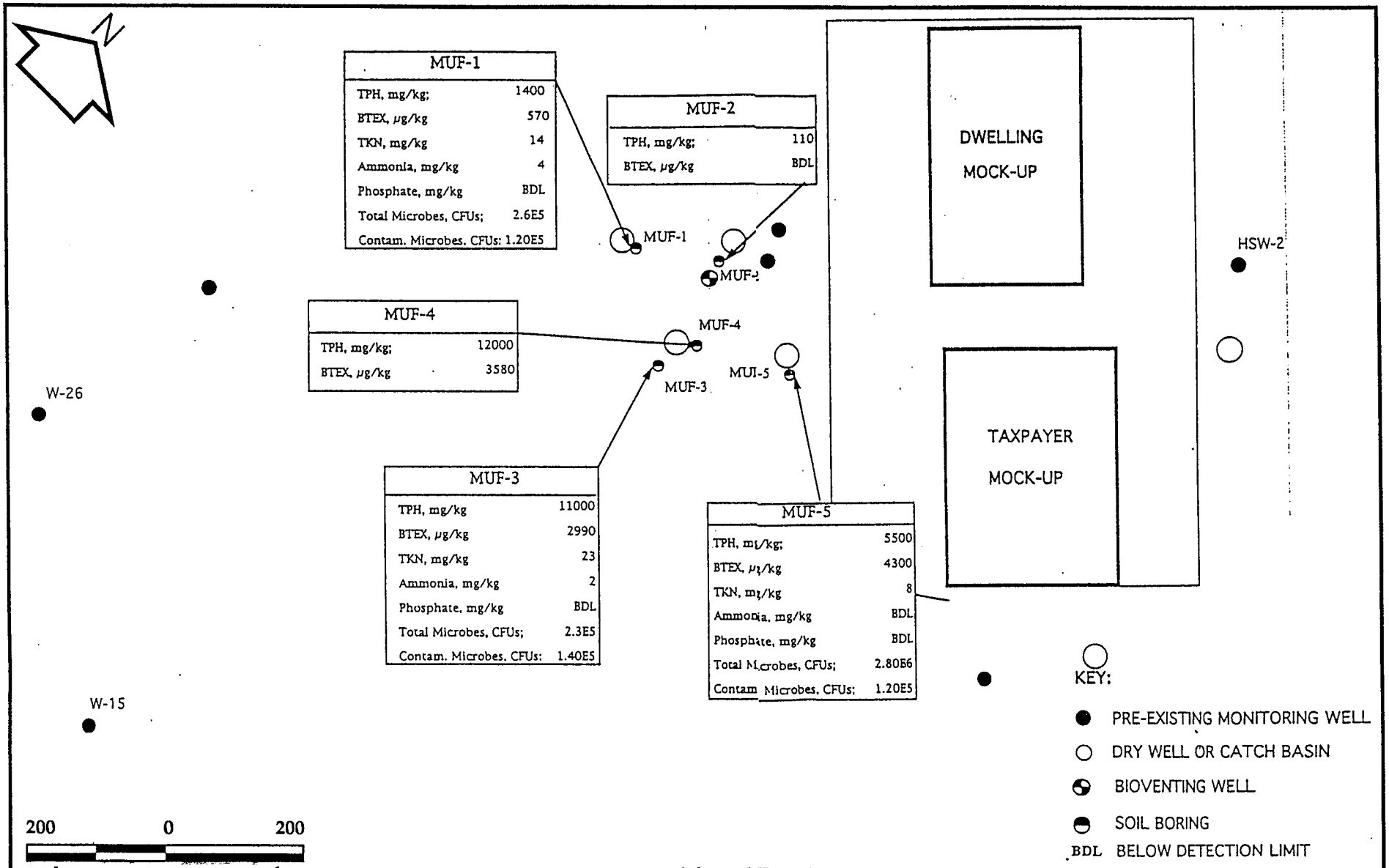
Parameter	USEPA Analytical Reference Method	Sample Preservation	Holding Time (a)	Container
WATER				
VOCs	601/602	HCL to pH < 2	7 days	2 x 40 ml vial
Semi-VOCs	625	cool to 4C	7 days extraction 40 days analysis	2 x 1 liter amber
Target Metals		HNO3 to pH < 2, cool to 4C	6 months	1 liter poly
Al	200.7			
As	206.2			
Cr	200.7			
Fe	200.7			
Pb	239.2			
Mn	200.7			
Ni	200.7			
alkalinity	310.1	cool to 4 C	14 days	1 x 250 ml plastic
ammonia	350.3	H2SO4 to pH < 2 cool to 4 C	28 days	1 x 1 liter plastic
ammonia sulfate				
BOD	405.1	cool to 4 C	48 hrs	1 x 1 liter plastic
COD	410.1	H2SO4 to pH < 2 cool to 4 C	28 days	1 x 250 ml plastic
chlorides	325.3	cool to 4 C	28 days	1 x 150 ml plastic
hardness	130.2	HNO3 or H2SO4 to pH < 2 cool to 4 C	6 months	1 x 250 ml plastic
nitrate/nitrite	353.2	cool to 4 C	48 hrs	1 x 250 ml plastic
phosphorus	365.2	H2SO4 to pH < 2 cool to 4 C	28 days	1 x 250 ml plastic
sodium	6010	HNO3 to pH < 2 cool to 4 C	6 months	1 x 500 ml plastic
% VSS	160.4	cool to 4 C	7 days	1 x 300 ml plastic
TDS	160.1	cool to 4 C	7 days	1 x 300 ml plastic
TSS	160.2	cool to 4 C	7 days	1 x 300 ml plastic
TKN	351.2	H2SO4 to pH < 2 cool to 4 C	28 days	1 x 1 liter plastic
TOC	415.1	H2SO4 to pH < 2	28 days	1 x 500 ml plastic
conductivity	Field testing equipment	—	—	—
DO	Field testing equipment	—	—	—
pH	Field testing equipment	—	—	—
temperature	Field testing equipment	—	—	—
turbidity	Field testing equipment	—	—	—

Table 3-2

SAMPLE PARAMETER TABLE

Parameter	USEPA Analytical Reference Method	Sample Preservation	Holding Time (a)	Container
SOLIDS				
VOCs	8240	cool to 4 C	14 days	1 x 120 ml amber
semi-VOCs	8270	cool to 4 C	7 days extraction 40 days analysis	1 x 4 oz jar
Target Metals		cool to 4 C	6 months	1 x 4 oz jar
Al	6010			
As	6010			
Cr	6010			
Fe	6010			
Pb	6010			
Mn	6010			
Ni	6010			
% solids	160.3	cool to 4 C	7 days	1 x 300 ml plastic
% VSS	160.4	cool to 4 C	7 days	1 x 300 ml plastic
TCLP	1311	Cool to 4 C		2 x 16 oz glass jar teflon-lined lids
VOCs			14 days extraction 14 days analysis	
Semi-VOCs			14 days extraction 40 days analysis	
Target Metals			180 days extraction 180 days analysis	
Al	6010			
As	6010			
Cr	6010			
Fe	6010			
Pb	6010			
Mn	6010			
Ni	6010			
AIR				
Target VOCs (c)	TO-14 (b)	None	24 hours	1 x 6 liter SUMMA cannister

Notes:
(a) The holding times are from the time of sample collection, as per NYS ASP.
(b) Method is from USEPA Compendium Method TO-14, "The Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using SUMMA Passivated Cannister Sampling and Gas Chromatographic Analysis".
(c) Target VOCs are specified in Section 3.5.



Adapted From Drawing Number FTC-100-G1, Dated: 04/24/91, By: NCDPW.

Figure 3-1

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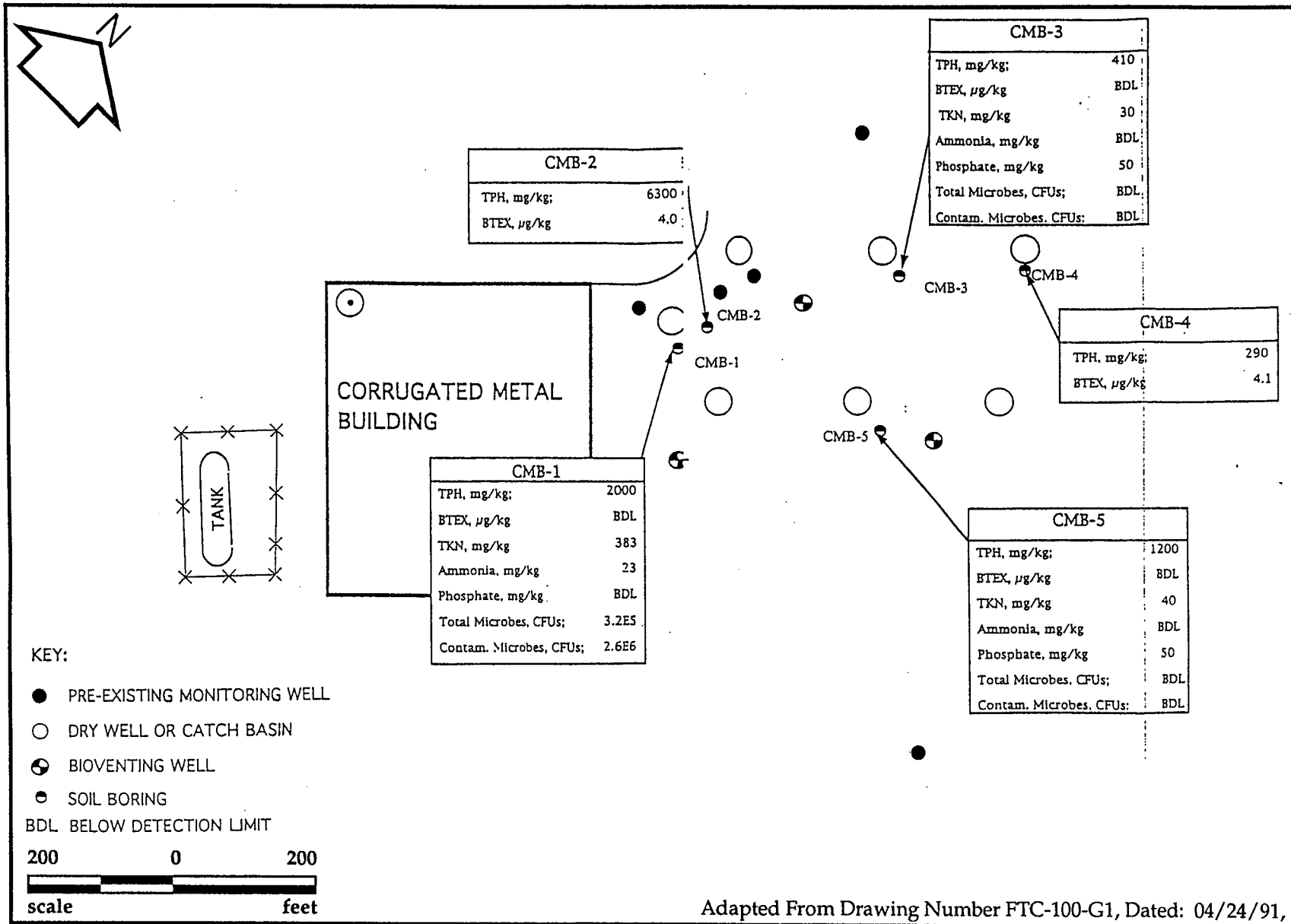
MUF Subsite: Soil Boring Locations And Historical Contaminant Levels

Fireman's Training Center Remedial Design
Nassau County Department Of Public Works



Adapted From Drawing Number FTC-100-G1, Dated: 04/24/91, By: NCDPW.

Figure 3-2

CMB Subsite: Soil Boring Locations And Historical Contaminant Levels

Fireman's Training Center Remedial Design
Nassau County Department Of Public Works

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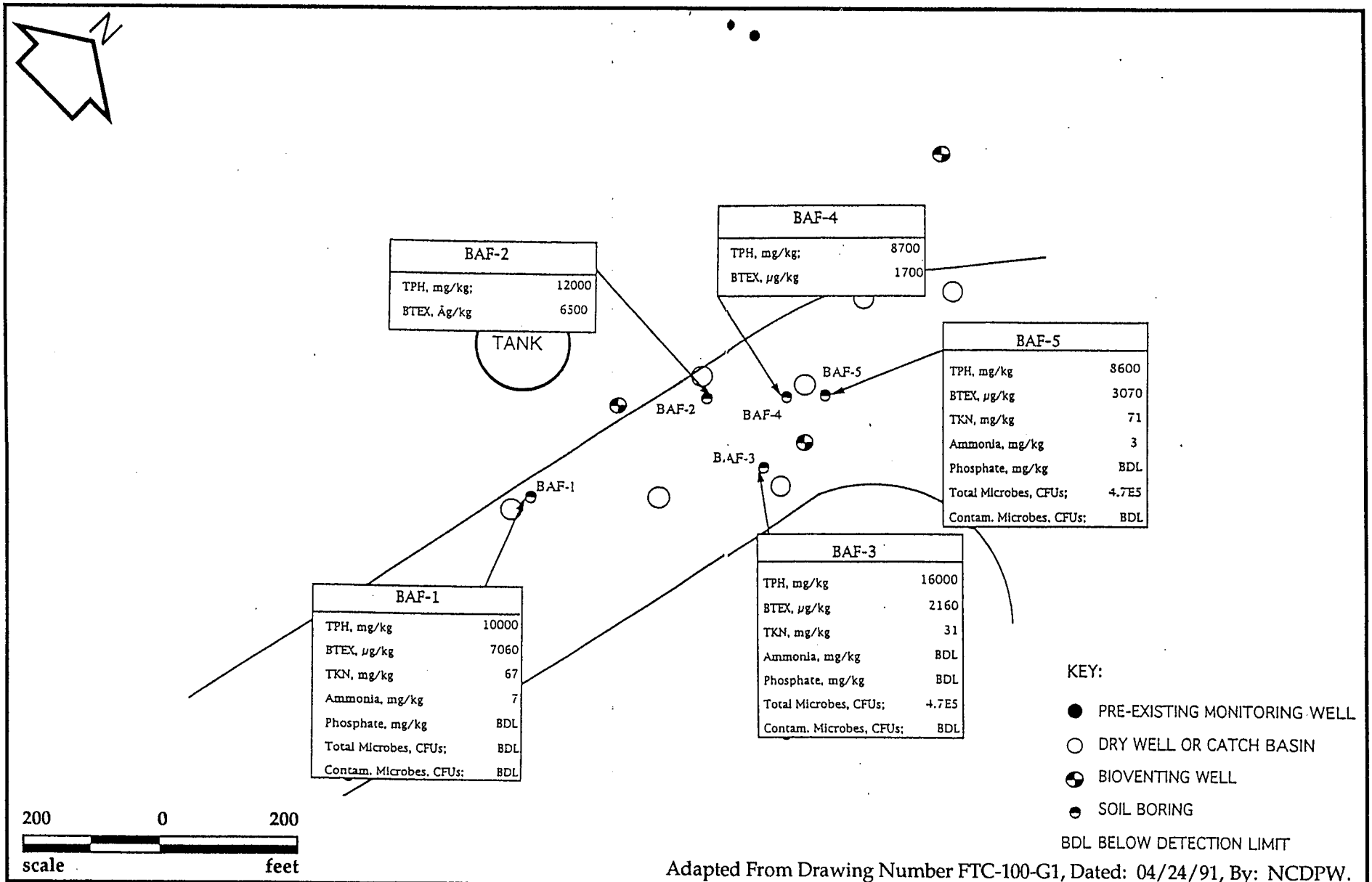

Adapted From Drawing Number FTC-100-G1, Dated: 04/24/91, By: NCDPW.

Figure 3-3

BAF Subsite: Soil Boring Locations And Historical Contaminant Levels

Fireman's Training Center Remedial Design
Nassau County Department Of Public Works

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3.2 Water Quality

Sampling within the groundwater treatment facility at the FTC will be conducted to operate, monitor, and maintain the remedial system and to ensure that regulatory requirements are met. Groundwater sampling of on- and off-site wells will be conducted to monitor the attainment of site remedial action objectives. Collected samples will be analyzed as follows:

VOCs	EPA 601/602
Semi-VOCs	EPA 625
Metals	EPA 200.7
(Arsenic)	EPA 206.2
(Lead)	EPA 239.2

These methods provide the low detection limits necessary to assess compliance with discharge and cleanup criteria (see Section 2).

3.2.1 Treatment Facility

Samples for the treatment facility will be collected by the facility operator from sample ports located on process lines or equipment within the facility. Each sampling port will be located at least 2 feet downstream or upstream from the source (e.g., air stripper influent and effluent line). All sample ports are shown on the process flow and chemical feed schematic (see Appendix B). Each sampling port will have a stainless steel ball valve with a 1/4-inch stainless steel sampling tube that can be inserted into the mouth of a 40 ml volatile organic analyte (VOA) vial. The sampling line should be flush with the interior pipe wall. A removable teflon sleeve and cap will cover the stainless steel tube to protect it from outside contamination. Grab samples will be collected where it is not practical to install this type of sampling port.

The design of the facility was carefully reviewed to determine the most appropriate points for sample collection. Sample ports are located upstream and downstream of a unit operation to determine the efficiency of that unit. To prevent erroneous data, the ports are also located to avoid treated recycled flow or other external sources of water. In addition, adequate space to allow personnel to collect the sample, as well as adequate lighting and ventilation to prevent occupational hazards, were also taken into consideration.

Samples of the influent water to the treatment facility (2 locations; 1 for on-site and 1 for off-site wells) will be collected and analyzed as needed for process control. Samples of the facility effluent will be collected and analyzed on a weekly basis initially and on a monthly basis following a period of twenty-four (24) consecutive weekly sampling events showing no exceedances of required effluent limitations (see Table 2-2). If an exceedance occurs, the effluent sampling frequency will again be weekly until a period of eight (8) consecutive sampling events show no exceedances, at which point monthly

sampling may resume. Influent and effluent samples will be analyzed by a NYSDOH ELAP certified laboratory for VOCs (EPA method 601/602), polycyclic aromatic hydrocarbons (PAHs) (EPA method 625), phthalates (EPA method 625), and target metals (total aluminum, arsenic, chromium, iron, manganese, lead and nickel; EPA methods 200.7, 206.2, and 239.2) (see Tables 3-1 and 3-2). In addition, influent water samples will be collected and analyzed for pH, BOD, COD, ammonia, nitrates, nitrites, phosphorus, alkalinity, hardness, sodium, TSS, and TDS. Biweekly effluent samples will be collected and analyzed for pH, alkalinity, hardness, and sodium. Data from the facility influent and effluent samples will be used to evaluate treatment facility performance for constituent removal and to determine compliance with discharge criteria (see Table 2-2).

In addition, the following locations within the treatment process will be monitored:

Off-Site:
Treatment System Influent
Static Mixer Effluent
Clarifier Effluent
Clarifier Sludge
Flocculator Influent and Effluent
Rapid Mix Tank Influent and Effluent

On-Site:
Treatment System Influent
Oil/Water Separator Effluent
Flocculator Effluent
On-Site Rapid Mix Tank/Clarifier Sump Effluent
Fluidized Bed Influent
Fluidized Bed Effluent
Intermediate Wet Well Influent (from Air stripper Effluent Wet Well)
Intermediate Wet Well Effluent
Recycle Wet Well Influent
Dual Media Filter Effluent
**Air Stripper Influent and Effluent
*Liquid Phase GAC Influent
Treatment System Effluent

* If additional treatment equipment is deemed necessary.

** Air stripping effluent monitored only if GAC filter installed, otherwise just treatment system effluent monitoring required.

Waste byproducts from the plate settler, filtration system, filter presses and air stripper will also be monitored and are as follow:

Off-Site:
Sludge Transfer Pump Effluent

Sludge Recycle Pump Effluent

On-Site:
Dual Media Filter Backwash
Waste Oil Holding Tank Effluent
Sludge Transfer Pump Effluent
Sludge Recycle Pump Effluent
Clarifier Effluent
Clarifier Sludge
Sludge Holding Tank Sludge
Sludge Holding Tank Effluent
Sludge Thickener Influent
Sludge Thickener Effluent
Sludge Cake from Filter Press
Filter Press Filtrate
*Air Stripper Exhaust
*Vapor Phase GAC Exhaust

*If emissions control equipment is deemed necessary.

Tables 3-1 and 3-2 present the monitoring parameters and frequency of sample collection for the above locations.

The pH will be monitored at two locations in the facility: after caustic addition to insure that optimum pH is reached, and after sulfuric acid addition to determine if the pH has sufficiently decreased (see Appendix B). Air emissions sampling is discussed in Section 3.5.

Also, to further assess the operation of the site treatment facility, samples from on-site extraction wells RW-1 through RW-3 and off-site extraction wells ORW-1 through ORW-7 will be collected monthly and analyzed for VOCs, semi-VOCs, target metals, and water quality parameters, as shown in Tables 3-1 and 3-2. As discussed in Sections 3.3 and 3.4, floating product, if any, and water levels will also be measured in these wells.

After the first year of operation, the treatment facility sampling program will be re-evaluated to assess whether sampling frequency or parameters should be modified.

3.2.2 Groundwater

On- and off-site groundwater will be sampled once prior to start-up of the treatment facility. Thereafter, groundwater will be sampled on a quarterly basis for selected wells, and on an annual basis for an expanded list of wells, to monitor remediation of the aquifer. Quarterly sampling will provide insight into the short-term effect of startup and operation of the facility during the first year. Long-term monitoring of groundwater at and in the vicinity of the FTC site will be dependent on the duration that the remedial system will be required to operate to meet groundwater cleanup criteria (see Table 2-3).

Groundwater sampling procedures are discussed in Section 5 of this Monitoring Plan.

Standard hazardous waste site sampling and laboratory techniques will be applied. All development water will be discharged onto the ground within 20 feet of the well as per NYSDEC guidance.

Laboratory analyses will be completed by a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certified laboratory.

3.2.2.1 Baseline

Once the remediation system has been installed and prior to commencement of pumping, a comprehensive baseline groundwater sampling round will be conducted. One round of groundwater samples will be collected for analysis from 26 monitoring wells (see Table 3-3). The locations of these wells are shown on Figures 3-4 and 3-5. These wells were selected based on the presently known nature and extent of both on- and off-site groundwater contamination. As indicated in Table 3-3 and Figure 3-3, a new off-site well, BP-12B, will be installed at a depth of about 230 feet below land surface (bls), with a screened interval of about 80 feet.

Analysis of collected groundwater samples will include:

- VOCs (EPA 601/602)
- Semi-VOCs (625)
- Metals (EPA 200.7, 206.2, 239.2)
- Field parameters (pH, conductivity and temperature)
- Water quality parameters (alkalinity, biochemical oxygen demand [BOD], chemical oxygen demand [COD], hardness, nitrite, nitrate, phosphorus, sodium, total kjeldahl nitrogen [TKN], ammonia sulfate, chlorides, total organic carbon [TOC], total dissolved solids [TDS], and total suspended solids [TSS]).

Sample parameters, analytical methods, and QA/QC requirements are provided in Tables 3-1 and 3-2.

3.2.2.2 Quarterly

A limited site quarterly monitoring program began in May 1994. The full program will continue until termination criteria have been met, as discussed in Section 2.5.

The monitoring wells to be sampled quarterly, as well as analytical parameters, are presented in Table 3-4. On-site monitoring well samples will be analyzed for VOCs and semi-VOCs; off-site monitoring well samples will be analyzed for VOCs. Sample parameters, analytical methods, and QA/QC requirements are provided in Tables 3-1 and 3-2. The locations of these wells

Table 3–3

Monitoring Wells Selected For Baseline and Annual Groundwater Sampling

Fireman's Training Center Remedial Design
Nassau County Department Of Public Works

Monitoring Well	*Analysis*
FTC–W–7A	(1)(2)
FTC–W–7B	(1)(2)
FTC–W–7C	(1)(2)
FTC–W–7D	(1)(2)
FTC–W–9A	(1)(2)
FTC–W–9B	(1)(2)
BP–2A	(1)
BP–2B	(1)
BP–4B	(1)
BP–4C	(1)
BP–9B	(1)
BP–9C	(1)
BP–10B	(1)
BP–10C	(1)
BP–12A	(1)
BP–12B*	(1)
FTC–W–4A	(1)(2)
FTC–W–4B	(1)(2)
FTC–W–14A	(1)(2)
FTC–W–14B	(1)(2)
FTC–W–23	(1)(2)
FTC–W–31	(1)(2)
FTC–W–32	(1)(2)
FTC–W–35	(1)(2)
U–6A	(1)
RB–1 *	(1)

Types of Analysis
(1) VOCs (601/602)
(2) Semi–VOCs (625)
* to be installed

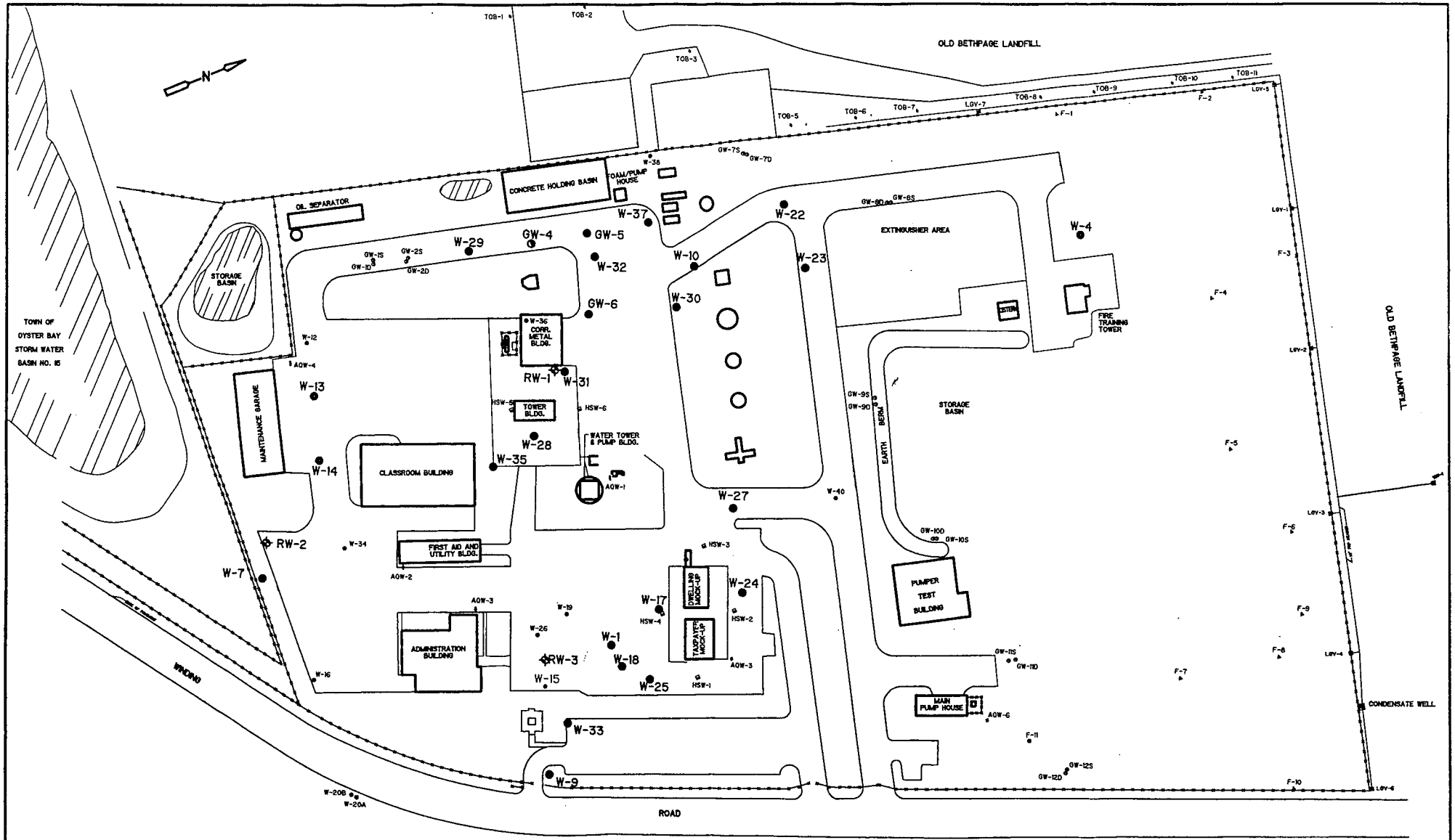

Figure No.3-4

Locations of Onsite Monitoring Wells

Fireman's Training Center Remedial Design
Nassau County Department of Public Works

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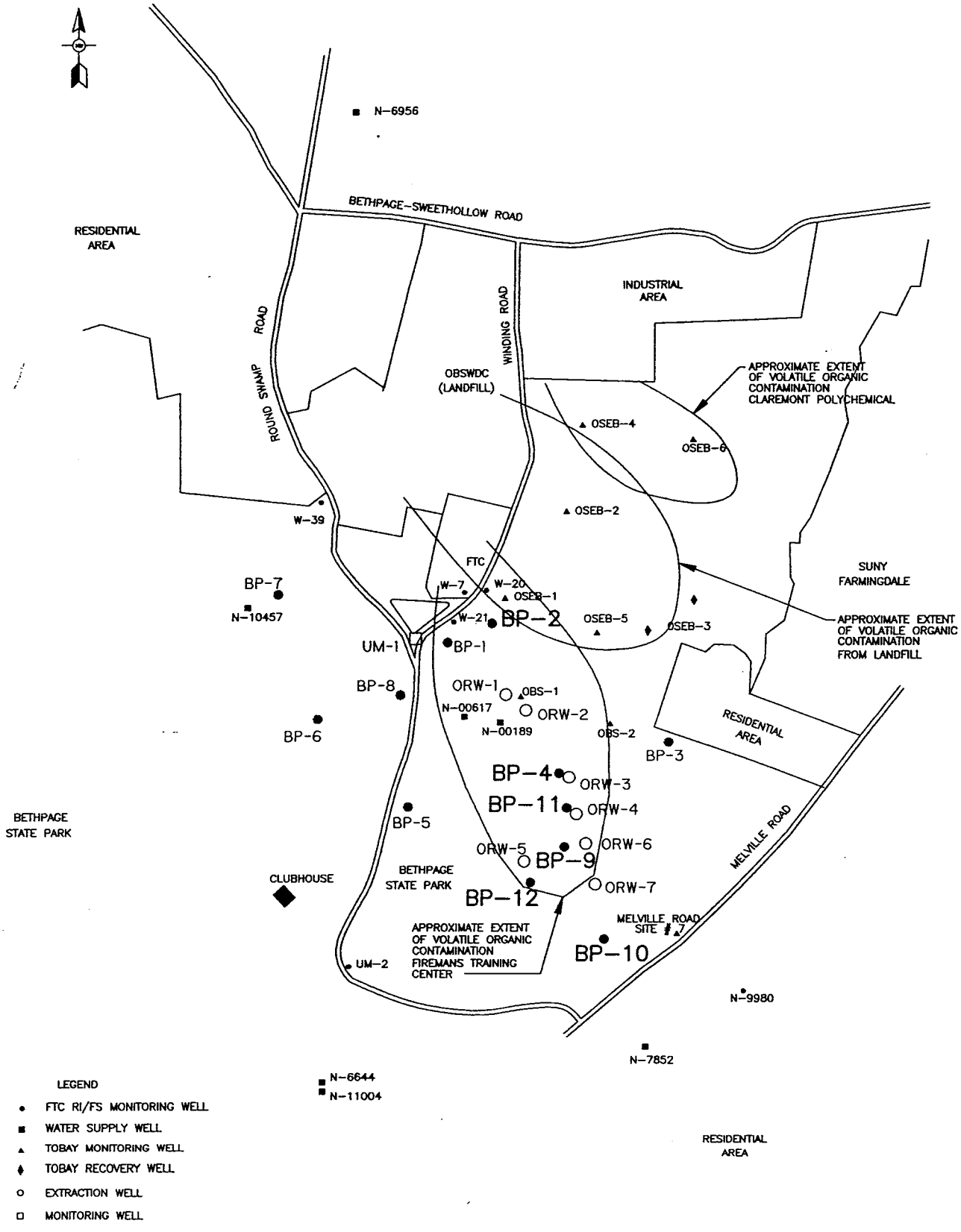

Figure 3-5

Locations of Off-Site Monitoring Wells

Fireman's Training Center Remedial Design
Nassau County Department of Public Works

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Table 3–4

Monitoring Wells Selected For Quarterly Groundwater Sampling

Fireman's Training Center Remedial Design
Nassau County Department Of Public Works

Monitoring Well	*Analysis*
FTC–W–7A	(1)(2)
FTC–W–7B	(1)(2)
FTC–W–7C	(1)(2)
FTC–W–9A	(1)(2)
FTC–W–9B	(1)(2)
FTC–W–14A	(1)(2)
FTC–W–14B	(1)(2)
BP–2B	(1)
BP–4B	(1)
BP–4C	(1)
BP–9B	(1)
BP–9C	(1)
BP–10B	(1)
BP–10C	(1)
BP–12B*	(1)
FTC–W–4A	(1)(2)
FTC–W–4B	(1)(2)
FTC–W–35	(1)(2)
FTC–W–32	(1)(2)

Types Of Analysis
(1) VOCs (601/602)
(2) Semi–VOCs (625)

** – to be installed*

are shown on Figures 3-4 and 3-5. Sampling procedures will be consistent with the procedures outlined in Section 5 of this monitoring plan.

3.2.2.3 Annual

One year after the baseline sampling round (described in Section 3.2.2.1) and in conjunction with the third round of quarterly sampling, the first round of annual groundwater samples will be taken. The monitoring wells to be sampled annually, as well as analytical parameters, are the same as those to be sampled for the baseline groundwater monitoring event (see Section 3.2.2.1 and Table 3-3). Sample parameters, analytical methods, and QA/QC requirements are provided in Tables 3-1 and 3-2. The annual monitoring program includes an expanded list of parameters, with respect to the quarterly sample analytical parameters, that are necessary to evaluate the long-term efficiency of the remediation.

3.3 Floating Product

On a quarterly basis, in conjunction with the quarterly groundwater monitoring, the monitoring and extraction wells presented in Table 3-5 will be checked for product using an ORS interface probe or an acrylic bailer.

3.4 Hydraulic Controls

The effectiveness of the hydraulic containment system in exerting control over the area to be remediated will be demonstrated by measuring water levels in the monitoring wells presented in Table 3-6. Water levels measured in these wells will be referenced to mean sea level. Based on the baseline and first quarterly groundwater monitoring data, water levels will be plotted on a base map, according to depth. Contour lines (indicating areas of equal hydraulic potential) and limiting flow lines will then be drawn to indicate the effective capture zone. Water levels will be measured using a steel tape and chalk or an electronic water level meter.

Water levels will be measured prior to startup of the treatment facility and then monthly during the first quarter of remedial system operation. Subsequently, water levels will be monitored on a quarterly basis. Based on these water level measurements, extraction well pumping rates will be adjusted until hydraulic containment is achieved and maintained such that equilibrium is established regardless of seasonal water level fluctuations.

The groundwater recovery system will be monitored to confirm the effectiveness of the hydraulic containment under any conditions and to adjust and modify the recovery well system to maintain hydraulic containment until termination criteria are met. After the initial determinations of equilibrium and appropriate drawdown are reached, annual potentiometric surface maps will be developed.

Table 3–5

Monitoring Wells Selected for Floating Product Monitoring

Fireman's Training Center Remedial Design
Nassau County Department Of Public Works

Monitoring Well	*Type of Product*
FTC–W–33	*#2 Fuel Oil*
FTC–W–15	*#2 Fuel Oil*
FTC–W–17	*#2 Fuel Oil*
FTC–W–1	*#2 Fuel Oil*
FTC–W–18	*#2 Fuel Oil*
FTC–W–25	*#2 Fuel Oil*
FTC–W–24	*#2 Fuel Oil*
FTC–W–27	*#2 Fuel Oil*
FTC–W–35	– – –
FTC–W–28	*Gasoline*
FTC–W–31	*Gasoline*
FTC–GW–6D	*Gasoline*
FTC–W–29	*Gasoline*
FTC–GW–4D	*Gasoline*
FTC–GW–5D	*Gasoline*
FTC–W–37	*Gasoline/#2 Fuel Oil*
FTC–W–22	*#2 Fuel Oil*
FTC–W–10	*#2 Fuel Oil*
FTC–W–30	*#2 Fuel Oil*
FTC–W–32	*Gasoline*
EXTRACTION WELLS	
RW–1	*#2 Fuel Oil*
RW–2*	– – –
RW–3*	– – –

* to be installed

Table 3–6

Monitoring Wells Selected For Hydraulic Monitoring

Fireman's Training Center Remedial Design
Nassau County Department Of Public Works

Monitoring Well	Measuring Pt. Elev.
BP–1A	109.77
BP–1B	109.53
BP–1C	109.37
BP–2A	151.00
BP–2B	151.13
BP–3A	124.54
BP–3B	123.57
BP–3C	123.68
BP–4A	92.69
BP–4B	91.72
BP–4C	91.57
BP–5A	96.34
BP–5B	96.48
BP–5C	96.28
BP–6A	102.55
BP–6B	102.58
BP–6C	102.35
BP–7A	147.54
BP–7B	148.76
BP–7C	148.40
BP–8A	92.29
BP–8B	91.43
BP–8C	91.48
BP–9B	84.96
BP–9C	84.77
BP–10B	81.16
BP–10C	80.88
BP–11	81.76
BP–12A	78.21
BP–12B	–––
UM–1	115.64
W–7A	104.44
W–7B	104.52
W–7C	104.68
W–7D	104.58
W–9A	115.30
W–9B	115.20
W–13	102.80
W–4A	109.20
W–4B	109.70
W–14A	103.50
W–14B	103.3
W–35	104.2
W–32	103.1
W–31	103.1
W–1	105.6
W–29	101.8
W–37	102.9
U–6A	153.94
RB–1	–––
EXTRACTION WELLS	
RW–1	103.1
RW–2	–––
RW–3	–––
ORW–1	–––
ORW–2	–––
ORW–3	–––
ORW–4	–––
ORW–5	–––
ORW–6	–––
ORW–7	–––

Notes: ––– to be surveyed

3.5 Air Emissions

No air emission monitoring will be performed. Water samples taken from the influent to the air striper will be monitored daily for the first two weeks during startup. Thereafter, weekly monitoring will occur. Measured fluid concentrations and flows will be used to estimate air emissions (see section 2.4).

Air Emissions Control Equipment

As previously discussed, air dispersion modeling has demonstrated compliance with applicable NYS air emission standards and, therefore, emissions control equipment is not required at the facility (CDM 1994a). However, if deemed necessary in the future, the air discharged from the air stripper towers at the FTC treatment facility could be passed through vapor phase carbon adsorption unit(s).

If emissions control should be deemed necessary in the future, weekly samples from the air stripper and stack exhaust, and from the exhaust of the lead and lag adsorbers (each) on only one of the parallel trains (assuming there are 2 parallel trains of vapor phase carbon adsorption units, each train having 2 adsorption units in series), will be collected for laboratory analysis. The results of these samples will be used to determine when breakthrough occurs on the adsorbers. This breakthrough sampling will be performed until the lead adsorber reaches exhaustion or until contaminant breakthrough occurs on the lag adsorber. If the initial results of this testing are insufficient to determine the point of breakthrough to the satisfaction of the NYSDEC, this procedure may be repeated at a higher frequency.

3.6 Remedial System Termination

The time at which site remedial action may be terminated will be determined as follows.

3.6.1 Soil

Soil boring samples will be collected, as specified in Section 5, to demonstrate compliance with State guidelines, and thus termination of soil monitoring.

3.6.2 Groundwater

To determine whether termination criteria for the groundwater remedial system have been attained, a groundwater termination monitoring program will be conducted. Monitoring wells used in the quarterly groundwater monitoring program, as discussed in Section 3.2.2, will be used in this program.

Following NCDPW notification to the NYSDEC of the commencement of termination monitoring, an initial termination monitoring program identical to the baseline groundwater monitoring event, described in Section 3.2.2.1, will be conducted.

After analytical results from initial termination monitoring are obtained, quarterly termination monitoring will commence. This quarterly monitoring will be conducted for a minimum of 2 years (8 quarters). Based on analytical data from the initial termination monitoring round, the NYSDEC and NCDPW will negotiate whether the final year of quarterly groundwater monitoring, discussed in Section 3.2.2.2, may be substituted for the first year of quarterly termination monitoring.

The wells to be sampled and specific parameters to be analyzed as part of the termination monitoring program will be proposed by the NCDPW, subject to NYSDEC approval.

At a minimum, the wells to be sampled will include the wells sampled for the two years of quarterly monitoring immediately prior to NCDPW's request for termination monitoring. Analytical parameters will be based on the results of the initial termination monitoring.

Based on 2 years (8 quarters) of termination monitoring results, the NCDPW may submit a Petition for Termination to demonstrate that termination criteria have been met. If the NYSDEC agrees with the NCDPWS's Petition for Termination, operation of the remedial system may be terminated. If the NYSDEC and NCDPW cannot agree, disputes will be resolved pursuant to the dispute resolution mechanism of the Consent Decree. The NCDPW will continue to operate the remedial system and conduct quarterly groundwater sampling until such dispute is resolved or an order from the court is issued. If the remedial system is shut down, pursuant to either agreement or court order, post-termination monitoring, as discussed in Section 3.7, will commence.

3.7 Post-Termination

Following termination of remedial system operation, a post-termination monitoring program will be conducted. This program will consist of semi-annual sampling of the wells sampled during the quarterly termination monitoring program, and analysis of collected samples for the same parameters monitored in that program. The actual duration of the program will be negotiated by the NCDPW and NYSDEC after the remedial system has met applicable cleanup criteria.

Post-termination sampling data will continue to be evaluated to determine if termination criteria is met. If post-termination monitoring analytical results indicate that groundwater quality is no longer meeting termination criteria, the remedial system will be re-started within 30 days. After startup, the NCDPW can seek to demonstrate to the NYSDEC, subject to NYSDEC concurrence, that

termination criteria are being met, or that the groundwater contamination discovered is attributable to a source other than the FTC site.

Section 4
Data Quality Requirements and Assessment

This section addresses the data quality requirements for the samples to be collected at and in the vicinity of the FTC during the site remedial action including treatment facility sampling, groundwater monitoring well sampling, and well boring soil sampling activities based on the intended use of the data and the data quality objectives.

4.1 QA/QC Requirements

The following describes the quality assurance/quality control (QA/QC) requirements for the collection and analysis of water and soil samples for laboratory analysis:

- Duplicate Samples. Duplicate samples help to evaluate field and laboratory precision. Duplicate samples will be collected at a rate of 5 percent (%) per matrix for this assignment or one duplicate for every 20 samples collected. If less than 20 samples are collected per matrix, one duplicate sample will be collected and analyzed.

- Trip Blank. An aqueous trip blank consists of 2, laboratory-cleaned, 40-ml vials filled with preserved demonstrated analyte-free water. An air trip blank consists of an evacuated, precleaned SUMMA canister. The trip blanks will be preserved, handled, and transported in the same manner as the samples acquired that day. The blanks will be kept in close proximity to the samples being collected. One trip blank per matrix will be supplied for each day that aqueous samples for VOC analysis are collected. The trip blank will be analyzed for VOCs only.

- Field Blank. Field blanks are used to determine if decontamination procedures have been sufficient. A field blank consists of a group of laboratory-cleaned sample containers that are transported empty into the field. At the field location for an aqueous or soil field blank, demonstrated analyte-free water will be passed through the pre-cleaned and/or decontaminated sampling equipment and placed in the empty group of containers for analysis. One field blank will be collected for each type of equipment used, each time a decontamination event is conducted, whether decontamination occurs weekly or daily. One field blank will be collected for each set of precleaned bailers. Field blanks will be collected at the beginning of the day prior to a sampling event and shipped with environmental samples collected that day. Field blanks will be analyzed for the same group of parameters analyzed for environmental samples.

Field blanks will be preserved, handled, and transported in the same manner as environmental samples collected that day. Field blanks will not be collected when environmental samples are collected directly into a sample container (i.e., the sample container is used as the collection device).

- Matrix Spike/Matrix Spike Duplicates (MS/MSDs). MS/MSDs are used to assess laboratory accuracy and precision. For the laboratory to perform a matrix spike/matrix spike duplicate for routine analytical services (RAS) parameters, the laboratory must be supplied with triple the sample volume for aqueous extractables (base neutral and acid extractable [BNA]/pesticides/polychlorinated biphenyls [PCBs]) and one additional 40 ml VOA vial for aqueous VOC analysis . No additional sample volume is required for target analyte list (TAL) inorganic analysis for aqueous samples or for RAS parameters for non-aqueous samples. However, the sample that is to be used for MS/MSD analysis must be listed on sample paperwork (i.e. sample chain of custody forms).

  MS/MSD frequency of analysis is designated by the USEPA Region II CERCLA Quality Assurance Manual (October 1989) at a rate of one per environmental sample for (1) every 20 samples or less shipped or (2) each successive 14 calendar day period during a sampling event.

- Blank Water. The blank water used for field and trip blanks, as well as for decontamination purposes, will be analyzed to determine the presence of contaminants and the concentrations at which they occur. Blank water will be analyzed one to two weeks prior to the start of field events. Blank water analytical results will be compared to trip and field blank results to determine the integrity of the trip and field blanks.

- Performance Audit (or Evaluation) Samples. Performance audit samples are used to formally assess laboratory performance. A performance audit sample consists of a blind, spiked sample in the appropriate sample matrix (e.g., soil, groundwater, or air). The sample is analyzed according to the appropriate protocol and the result is compared with known spiked concentrations. Samples that fail to meet performance audit criteria will require corrective action and reanalysis of the samples by the contract laboratory.

  Table 4-1 lists the minimum number of QA/QC samples that will be collected for each matrix. QA/QC requirements for the field measurements of pH and specific conductivity will be as follow:

- pH Meter. Field measurements of pH will consist of a premeasurement calibration using two standard reference solutions, appropriate to the sample pH, each time pH is measured.

Table 4-1

QA/QC Sample Parameter Table

Matrix	Minimum Number Of Samples Per Event	Duplicates	Field Blanks	Trip Blanks
TREATMENT FACILITY SAMPLING				
Plant Influent (2 locations; 1 on-site and 1 off-site)	2	2/year	1/event	1/event
Plant Effluent	1	1/year	1/event	1/event
Stack Exhaust	1	1/event	1/event	1/event
EXTRACTION WELL SAMPLING				
On-Site Extraction Wells RW-1 through RW-3	3	1/event	1/decon/event	1/day/event
Off-Site Extraction Wells ORW-1 through ORW-7	7	1/event	1/decon/event	1/day/event
GROUNDWATER MONITORING				
Baseline Groundwater Monitoring	32	1/event	1/decon/event	1/day/event
Quarterly Groundwater Monitoring	22	1/event	1/decon/event	1/day/event
Annual Groundwater Monitoring	32	1/event	1/decon/event	1/day/event

- Conductivity Meter. For field conductivity measurements, the QA/QC level of effort will consist of a daily calibration of the instrument using known solutions of known conductivity.

4.2 Accuracy and Precision

Accuracy and precision requirements for sample analytical parameters will be as specified in the NYSDOH ELAP. The quantitation limits for the analytical parameters will also be those specified in the ELAP.

The precision of the field pH and specific conductivity measurements will be +/- 25 percent. Precision for these two parameters will be assessed by the collection and analysis of duplicate samples in the field. If this precision requirement is not met, the pH and/or the conductivity meter will be recalibrated until it is met. As appropriate, samples will be recollected and reanalyzed from affected locations.

4.3 Representativeness

The criteria of representativeness is defined by the sampling method utilized. Blind duplicate samples will be collected as part of the field program to monitor the reproducibility of the sampling technique and to determine field sampling precision.

The data will provide a "snapshot" of the conditions at the time and place of sampling. Groundwater monitoring well samples will not be collected until wells have been purged to allow water that is representative of the aquifer conditions to be collected.

4.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to occur under normal conditions. Completeness is usually expressed as a percentage. Site access, sampling and analytical problems, and the data validation process can all contribute to less data being obtained than originally anticipated. Although a goal of 100% is always desired, a more realistic goal of 90 to 95% valid data has been set. The acceptability of less than 95% valid data will be evaluated on a case-by-case basis. The NYSDEC will be informed if additional samples should be collected to supplement collected data on the basis of completeness.

4.5 Comparability

Comparability expresses the confidence with which one data set can be compared to another and to itself. In most circumstances, this refers to the standard filed analytical techniques and the reporting of the analytical data in the same units. The procedures to obtain this data are defined in this Monitoring Plan and in the analytical methodologies listed in Section 3, and

are expected to provide comparable data. These new analytical data may not be directly comparable to existing RI or remedial design (RD) data because there may be differences in the analytical and sampling procedures.

The units of measurement for soil sample analytical parameters are expressed in ug/kg and for water parameters in ug/1.

4.6 Reporting

All pertinent treatment plant sampling information will be recorded and maintained in a dedicated sampling log book. The following information will be recorded when samples are collected:

- Sample location.
- Sample description.
- Date and time of collection.
- Unit process.
- QC samples collected.
- Sampling method, preservation, and shipment techniques.
- Type, volume, and number of containers.
- Sample number.
- Sample matrix.
- Type of analysis, results, and detection limits.
- Temperature (if applicable).
- pH (if applicable).
- Flowrate (if applicable).
- Sampling team.
- Level of personnel protection used.

The treatment plant operator will review the site data base to see if any of the effluent guidelines, as provided in Table 2-2 or as granted in the permit, have been exceeded.

Section 5
Sampling Procedures

This section outlines the procedures that will be followed when conducting monitoring activities.

5.1 Mobilization/Field Activities

Prior to initiating monitoring activities, the following preparatory activities will be completed:

- Conduct a field activity planning meeting including a health and safety plan (HASP) briefing and a review of sampling procedures.
- Confirm that subcontractor, contractor, NCDPW, or NYSDEC has obtained required access permission for specific field activities.
- Ensure that all sample analyses are scheduled with the contract laboratory.
- Obtain sample containers and preservatives for the specified sample parameters. Additional sample bottles will be taken to the field to account for breakage.
- Obtain trip and field blank water.
- Schedule necessary equipment and make sure that the equipment is available and has been properly calibrated, maintained, or decontaminated.
- Obtain all materials necessary for personnel protection and decontamination.
- As needed, locate the overnight delivery service office nearest the site and note its hours of operation. Determine whether the office will provide sample pickup service.
- Arrange for pick up or containerization of disposable material and clothing.

5.2 Decontamination Procedures

The following decontamination procedures will be employed for equipment used during monitoring activities.

5.2.1 Personal Protective Equipment

Personal protective equipment will be decontaminated as follows:

- Rinse with non-residual detergent (alconox).
- If cleaning respirator, spray with manufacturer's sanitizer.
- Rinse with tap water.
- Air dry.

5.2.2 Field Monitoring Equipment

Field monitoring equipment will be decontaminated in accordance with manufacturer's instructions.

The pH meter and conductivity probes cannot be rinsed with solvents. These instruments will be rinsed after each use with deionized/distilled water only.

5.2.3 Well Evacuation Equipment

All tubing and evacuation equipment that are put into the borehole, such as submersible pumps, will be rinsed with soapy (alconox) water and deionized water before use. All tubing used during groundwater sampling will be dedicated to individual wells (i.e., tubing cannot be reused). If bailers are used to evacuate wells, they will be decontaminated as specified for sampling apparatus (see Section 5.2.5).

5.2.4 Drilling and Other Large Pieces of Equipment

All drilling equipment that comes in contact with site soil must be steam-cleaned before use, between and after each borehole. This includes drill rods, bits and augers, dredges, or any other large piece of equipment. Sampling devices, such as split spoons, must be decontaminated between boreholes as described in Section 5.2.5. Within the same borehole, split spoons will be cleaned/decontaminated using an alconox and tap water wash followed by a tap water rinse.

5.2.5 Sampling Apparatus

All sampling equipment will be properly decontaminated prior to its use in the field to prevent cross-contamination. The equipment should be precleaned in a laboratory. If the duration of the sampling event prohibits the precleaning of equipment in a laboratory, then equipment will be decontaminated once a day in an area outside of the designated site contaminated zone. Each day, enough equipment will be available for the dedication of equipment to sampling points.

The required decontamination procedure for all sampling equipment is:

- Wash and scrub with low phosphate detergent.
- Rinse with tap water.
- Rinse with deionized, demonstrated analyte-free water.
- Air dry.
- Wrap in aluminum foil for transport.

Tap water may be used from any municipal water treatment system. The use of an untreated potable water supply is not an acceptable substitute.

Bailer cord will be dedicated to individual wells.

5.3 Treatment Facility

Monitoring activities will be conducted at the site treatment facility as follows.

5.3.1 Field Equipment

The following equipment will be required:

- Metal or plastic buckets
- Field logbook
- Sample coolers
- Bags of vermiculite
- Package ice
- Sample bottles
- Preservatives (HNO_3, NaOH, HCl, and H_2SO_4)
- pH paper
- Personal protective equipment and clothing as required by the site HASP (see Section 5.7)
- Sample paperwork
- Plastic baggies
- Clear tape

5.3.2 Procedures

Samples will be collected at the treatment facility as follows:

- Remove the teflon sleeve and cap from the sampling port.

- Open the sampling valve and purge the sampling port with at least two volumes of water, each equivalent to the dead volume of the sampling port (i.e., the internal volume of the sampling port as measured from the process pipe to the port discharge).

- Adjust the sampling valve so that a slow, steady stream is produced, and collect the sample while minimizing aeration of the water. The sample bottle will be filled according to the procedures described below.

- Preserve the samples as described below and as specified in Table 3-2. When fixing samples with preservatives, do not place the pH paper directly into the sample bottle. Test pH by pouring excess sample over pH paper, over a container.

- The treatment facility will be sampled sequentially from the end of the treatment process (point of least contamination) to the beginning of the

treatment process (point of highest contamination) to minimize cross contamination and to ensure reliable results.

- The sampler will change gloves prior to sampling at each sampling port.
- For each sample collected, complete the sample paperwork and attach sample labels and/or tags to each sample container. Indicate sample concentration and matrix on the appropriate forms to provide the designated laboratory with information for determining the specific analytical protocols to be followed.
- Add ice and vermiculite, and seal for shipment. The quantity of ice packed in the sample coolers, containing samples requiring preservation to 4 degrees celsius (C), will be sufficient to achieve and maintain the required temperature after collection and throughout transit. All samples will be placed in ice-packed coolers immediately upon collection.
- For each shipment of samples, group all corresponding sample paperwork and pack in a waterproof bag, and include with the samples.
- Ship samples according to Department of Transportation (DOT) regulations specified for environmental samples. Place custody seals on the outside of each sample cooler.

Containers required for collected samples are presented in Table 3-2.

VOC water samples will be collected as follows:

- Remove the cap from a 40-ml septum vial. Avoid contact with the inner surface and fill 4 vials from the sample port. Samples designated for MS/MSD analysis will require 5 vials.
- The first VOA vial will be used to check the pH.
- Add 1:1 HCl drop by drop to the VOA vial and test pH until it is less than 2. Then record the amount of HCl added to reach pH 2, and dispose of the first VOA vial.
- Add the appropriate amount of HCl to each VOA vial and rapidly place the cap (containing a Teflon-faced silicone rubber septum) back on the vial and screw it on tightly.
- When sealing the vial, be sure that the silicone rubber septum is positioned in the cap so that the Teflon side will lie face down on the water sample.
- Turn the vial upside down and inspect the vial for air bubbles. If air bubbles are present, remove the cap and add more water to the vial.

- Place the cap back on and inspect for bubbles again.
- Each field duplicate sample will be appropriately identified in the sample logbook as such and submitted for analysis along with the vials containing the sample. The trip blank, field blank, and MS/MSD must be identified as such on the sample label and paperwork. The field duplicate will not be identified as such on the sample label and paperwork, but rather will be assigned a false sample location number.

Semi-VOC water samples will be collected as follows:

- Remove the Teflon-lined cap from a 1-liter amber bottle. Avoid contact with the inner surface of the cap.
- Fill the bottle approximately 80% (to the neck) with water.
- Replace the cap on the sample bottle and place the sample in a cooler, on ice sufficient to cool the media to 4 degrees C. Triple sample volume (three 1-liter amber bottles) will be required for the MS/MSD designated sample.
- Record all appropriate data in a field logbook.

Inorganic water samples will be collected as follows:

- This sample will be used to obtain data on total metals; it will not be filtered but will be preserved with HNO_3 to a pH less than 2 and stored on ice.
- Fill the bottle approximately 90% full with water and preserve to a pH of less than 2 with HNO_3. After adding the preservative, mix sample thoroughly by shaking, then test the pH using pH paper by pouring excess sample into a separate container. If the pH is greater than 2, follow this procedure again. If the pH is not lowered (due to possible buffering properties of the water) note this on sample paperwork.
- Replace the cap on the sample bottle and place the sample in the cooler.
- Record all appropriate data in field logbook.

5.4 Groundwater

Groundwater samples will be collected to determine groundwater quality at and in the vicinity of the site.

5.4.1 Portable Sampling System

The following discusses the collection of groundwater samples using a portable sampling system.

5.4.1.1 Preparatory Activities

The following procedures will be followed prior to the collection of groundwater samples:

- All bailers and check valves will be precleaned under laboratory conditions if possible. The cleaning procedures for bailers will be as follow:
  - Wash with a low phosphate tap water solution.
  - Rinse with tap water.
  - Rinse with deionized water.
  - Air dry and wrap in aluminum foil.
- All other field equipment that will be used for "contact" purposes will be cleaned on-site prior to sample collection. Cleaning procedures listed above will be used where appropriate.
- Calibrate the field pH and conductivity meters.

5.4.1.2 Field Equipment

The following equipment will be required:

- Weighted steel measuring tape (300')
- Electric water-level indicator
- Plastic buckets; 1, 3, and 5-gallon capacity
- HNu with 11.7 eV lamp
- Field logbook
- Key to well locks and site gate locks
- Stainless steel submersible and centrifugal pumps
- Hose clamps
- Field measurement instruments for specific conductance, pH, temperature
- Duct tape
- Combustible gas indicator
- Coolers for samples
- Vermiculite
- 3/4-in. and 1/2-in. diameter polyvinylchloride (PVC) hose
- 220 volt, 8 amp generator (two)
- 3/4-in. and 1/2-in. gate valves
- Teflon bailers (decontaminated)
- Electrical line clamps (stay ties)
- Stainless steel or aluminum sheeting
- Laboratory surfactant cleanser (Alconox)
- Bottled deionized/distilled water
- Gasoline cans
- Polypropylene rope
- Knife
- Rope clamp and hexagon wrench

- Scrub brush
- Polyethylene plastic sheeting
- Sample bottles (to be provided by contract laboratory)
- Personal protective gear
- Ice packs
- Teflon check valves
- Decontamination equipment
- Garbage cans
- pH litmus paper
- Surgical gloves/nitrile gloves
- Camera and film
- Chain of custody forms and seals

5.4.1.3 Procedures

Prior to sampling, each well will be purged as follows:

- Unlock the well and use HNu to measure the well headspace. Select proper personal protection.

- Measure the static water level from the top of the inner casing and measure the total depth of the well.

- Prior to sampling, calculate casing radius (ft), total casing and screen length (ft), depth of water (ft), height of water column (ft), and volume (gallons).

- Rinse the submersible pump or centrifugal pump with laboratory surfactant cleanser and deionized water. All decontaminated equipment, as such, must be stored on polyethylene sheeting and should not touch the ground adjacent to the well.

- Attach riser pipe to the submersible or centrifugal pump and tighten the hose clamp securely.

- When using a submersible pump, attach the security line firmly to the pump with bowline and clamp. At 10-foot intervals, attach electrical cables to PVC riser pipe with plastic stay ties.

- When using a submersible pump, lower the pump assembly to a depth that results in the pump intake being located no less than one foot above the top of the well screen. As the pump is being lowered into the well, rinse the exterior of the PVC hose and electrical cable with bottled spring water and distilled water. The hose will be wiped with a clean, non-dyed, cotton cloth before entering the casing. It is anticipated that most shallow and deep monitoring wells will be purged using a submersible pump.

- Trim excess PVC hose such that a gate valve can be attached to regulate the pump discharge if the rated pump capacity exceeds the well yield.
- Attach a spare piece of PVC hose to the discharge of the gate valve to minimize additional spraying.
- Start the generator or centrifugal pump.
- Start pumping and record time.
- Monitor the water level, using an electric water level indicator, and monitor the yield using buckets of known volume. Increase the pumping rate by adjusting the gate valve. The objective is to closely approximate the maximum yield of the well with the top of the water column as close to the pump intake as possible.
- Once the maximum yield of the well is determined, pump a minimum of three casing volumes from the well. Periodically check and record the water level and yield, and make necessary adjustments.
- Periodically monitor temperature, pH, specific conductance and temperature of the pump discharge and record measurements in field logbook. After three casing volumes have been purged, evacuation may be stopped if these measurements have stabilized to within 10% between two successive readings. Otherwise, purging will continue until these measurements have stabilized or until a maximum of five well volumes have been removed.
- Remove the pump assembly from the well. Continue to evacuate the well until pump is raised above the water surface. The well must be sampled within three hours of evacuation. If the well sits more than three hours, it will be repurged.
- All development water will be discharged onto the ground within 20 feet of the well as per NYSDEC guidance
- Don a clean pair of surgical gloves, remove the decontaminated bailer and check valve from the wrapping, and screw the check valve into the bottom of the bailer.
- Attach a line securely to the bailer with a bowline and play out enough line to submerge the bailer. After filling the bailer, carefully remove the bailer from the well in preparation of filling the VOC sample containers.
- Repeat the procedure using a bailer for semi-VOC, inorganic, and conventional parameter samples.

VOC groundwater samples will be collected as follows:

- Remove the cap from a 40-ml septum (Teflon-faced silicone rubber) vial (VOA vial). Avoid contact with the inner surface.
- Carefully pour the sample from a full bailer directly into the VOA vial.
- After adding the water from the bailer, quickly replace the cap making sure it is screwed on tightly. Zero headspace should be achieved.
- Inspect the vial for air bubbles. If air bubbles are present, the vial will be discarded and a new vial will be prepared as detailed above.
- Attach a number label and tag to the vial, seal it in a zip-lock bag and place it into a cooler with ice. Place sufficient ice bags in the cooler to completely surround the samples and to maintain a temperature of 4 degrees C until samples are received by the lab.
- Record all appropriate data in a field logbook.

Semi-VOC and pesticide/PCB groundwater samples will be collected as follows:

- Remove the Teflon-lined cap from a 1-liter amber bottle. Avoid contact with the inner surface of the cap.
- Fill the bottle about 80% (to the neck) with groundwater.
- Replace the cap tightly, attach sample label, and place the sample bottle in a cooler with bagged ice sufficient to cool the media to 4 degrees C.
- Fill additional bottles by repeating the above steps.
- Record all appropriate data in a field logbook.

Inorganic groundwater samples will be collected as follows:

- The majority of water samples collected for metal analysis will not be filtered.
- Fill the metals bottle to about 90% capacity and preserve to a pH of less than 2 with HNO_3. Pour excess sample into a separate container to test the pH (using pH paper).
- Replace the cap tightly, attach the sample label seal in a zip-lock bag, and place the sample bottle in a cooler with bagged ice sufficient to cool the media to 4 degrees C.
- Fill the cyanide bottle to about 90% capacity. Preserve to pH greater than 12 with NaOH. Repeat the step above.

- Record all appropriate data in field logbook.
- Pack and ship samples as described above for VOA sample collection.

Ion speciation and conventional parameter (i.e., TOC, TSS, TDS, COD, alkalinity, chlorides) groundwater samples will be collected as follows:

- Remove caps from the bottles. Completely fill containers for BOD first, leaving no air space.
- Fill remaining bottles to about 90% capacity.
- Add appropriate preservatives. Test pH (using pH paper) by pouring excess sample into a separate container.
- Replace caps tightly, attach labels and tags, seal in zip-lock bags, and place sample bottles in a cooler with bagged ice sufficient enough to cool the media to 4 degrees C.
- Record all appropriate data in a field logbook.

Upon completion of sampling activities, the locking cap will be placed on the wellhead and locked. The sampling area will be cleaned of all sampling equipment and related debris.

5.4.2 Dedicated Sampling System

Nassau County proposes to use a Grundfos Redi-Flo 2 sampling system for use as a long-term dedicated system in each of the wells selected as part of the final groundwater monitoring program. The following procedures for groundwater sampling will be implemented for the wells using the dedicated system.

5.4.2.1 Preparatory Activities

The procedures outlined in Section 5.4.1.1 will be followed prior to the collection of groundwater samples.

5.4.2.2 Field Equipment

In addition to the Grundfos Redi-Flo 2 sampling system, equipment outlined in Section 5.4.1.2 will be required.

5.4.2.3 Procedures

Prior to sampling, each well will be purged as follows:

- Unlock the well and use an HNu to measure the well headspace. Select proper personal protection.

- Remove the dedicated sample tube from its port in the well cap and attach it to the discharge fitting in the well cap.
- Measure the static water level through the sample tube port and measure the total depth of the well.
- Prior to purging, calculate casing radius (ft), total casing and screen length (ft), depth of water (ft), height of water column (ft), and volume (gallons).
- Connect the electrical fitting on the well cap to the portable converter box.
- Start the generator.
- Plug the converter box into the generator.
- Start the pump and record time.
- Monitor the water level, using an electric level indicator, and monitor the yield using buckets of known volume. Increase the pumping rate by adjusting the speed dial on the converter box. Refer to the converter box's Operation and Maintenance (O & M) manual for safe operation. The objective is to closely approximate the maximum yield of the well with the top of the water column as close to the pump intake as possible.
- Once the maximum yield of the well is determined, pump a minimum of three casing volumes from the well. Periodically check and record the water level and yield and make necessary adjustments.
- Periodically monitor temperature, pH and specific conductance of the pump discharge and record measurements in field logbook. After three casing volumes have been purged, evacuation may be stopped if these measurements have stabilized to within 10% between two successive readings. Otherwise, purging will continue until these measurements have stabilized or until a maximum of five well volumes have been removed.
- All development water will be discharged onto the ground within twenty feet of the well as per NYSDEC guidance.

VOC groundwater samples will be collected as follows:

- Reduce the flow from the sample tube by adjusting the speed control dial, until a slow steady flow is achieved.

- Don a pair of surgical gloves and remove the cap from a 40 ml septum (teflon-faced silicon rubber) vial (VOA vial). Avoid contact with inner surface.

- Carefully collect the sample from the end of the sample tube directly into the VOA vial.

- After collecting the water from the sample tube, quickly replace the cap making sure it is screwed on tightly. Zero headspace should be achieved.

- Inspect the vial for air bubbles. If air bubbles are present, the vial will be discarded and a new vial will be prepared as detailed above.

- Attach a number label and tag to the vial, seal it in a zip-lock bag, and place it in a cooler with ice. Place sufficient ice bags in the cooler to completely surround the samples and maintain a temperature of 4 degrees C until samples are received by the laboratory.

- Record all appropriate data in a field logbook.

Sampling procedures for semi-VOC, pesticide/PCB, inorganic, and ion speciation and conventional parameters will follow those outlined Section 5.4.1.3.

Upon completion of sampling activities, shut the pump off at the converter box. Remove the converter box plug from the generator and shut off the generator. Disconnect the electrical fitting at the well cap. Disconnect the sample tube from the discharge fitting and return the sample tube to its storage port in the well cap. Replace the locking well cap on the well and clean the sampling area of all sampling equipment and related debris.

5.5 Water Level

Water level measurements will be taken at and in the vicinity of the site as follows.

5.5.1 Field Equipment

The following equipment will be required:

- Field logbook
- Electric water-level indicators or 100-foot steel tape and chalk
- Engineer's scale
- Decontamination equipment
- Personal protective clothing and equipment as required by the site HASP.

5.5.2 Procedures

The following procedures will be followed:

- Prior to initiating any field activities, the field team will review and discuss the HASP and field procedures. All monitoring and protective equipment will be checked thoroughly at this time.
- Static water levels will be measured to the nearest 0.01 foot and from the top of the inner riser pipe of all wells. Measurements will be taken from a surveyor's mark, such as a groove filed into the riser, whenever possible.
- All measurements will be recorded in the field logbook. The time, depth to water, and remarks will be entered in appropriate columns. If one measurement is derived from another, the base measurement will be recorded.
- The sequences of measurements will be closed out by taking a second measurement at the first well measured during this activity to identify any regional fluctuations in water levels throughout the duration of the activity.
- All instrumentation will be cleaned with distilled/deionized water and liquinox, as appropriate, prior to taking water level measurements at each well.

5.6 Soil

5.6.1 Decontamination

All drilling equipment that comes in contact with the soil must be steam cleaned before use, between and after each borehole. This includes drill rods, bits and augers, dredges, or any other large piece of equipment. Sampling devices such as split spoons must be decontaminated between boreholes as described below. Within the same borehole, split spoons will be cleaned/decontaminated using an alconox and tap water wash followed by a tap water rinse.

5.6.2 Sampling Apparatus:

All sampling apparatus must be properly decontaminated prior to its use in the field to prevent cross-contamination. The equipment should be precleaned in a laboratory situation, or if the duration of the sampling event prohibits precleaning in a laboratory situation, then equipment should be decontaminated once a day in an area outside of the contaminated zone. Enough equipment must be available to be dedicated to sampling points each day.

The required decontamination procedure for all sampling equipment is:

- wash and scrub with low phosphate detergent
- tap water rinse
- air dry, and
- wrap in aluminum foil (shiny side out) for transport

Tap water may be used from any municipal water treatment system. The use of an untreated potable water supply is not an acceptable substitute.

5.6.3 Sampling Procedures

- Standard test borings will be advanced using the hollow steam auger method.

- Split spoon samples will be collected in accordance with ASTM D1586-67 (1984).

- The most representative and least disturbed portion of the split spoon sample shall be bisected with a decontaminated stainless steel knife.

- The spoon will be photographed and quickly scanned with HNu and/or OVA. Sample recovery shall be measured. All information will be entered in the field log book.

- The required volume of split spoon sample will be collected with a decontaminated stainless steel sampling knife (or other stainless steel utensil). OVA samples will be collected first, then the field screening sample. All VOA samples should be preserved on ice as soon as possible.

Sample container filling and screening procedures follow:

- After collection of the VOA and field screening sample fractions, the remaining soil from the split spoon will be placed in a separate, labeled, pre-cleaned stainless steel pan or bowl. The pan or bowl containing the soil will be covered with aluminum foil (shiny side out) to await the results of the field screening.

- All soil samples will be field screened with an HNu and OVA. Results from the field screening will be used to select one of the two samples to be sent for laboratory analysis.

- Following the collection of all the split spoon samples from the boring and the completion of field sample screening, the semi-volatile organic fraction samples will be prepared from homogenized soil in labelled stainless steel bowls which represent the selected soil sample depths for laboratory analysis.

- For each laboratory sample collected, complete Traffic Reports or SAS packing lists, chain-of-custody records, and attach sample labels and tags

to each sample container. Indicate sample concentration and matrix on each Traffic Report to provide the designated laboratory with information for determining the specific analytical protocols to be followed.

- Add ice and vermiculite and seal for shipment. The quantity of ice packed in the sample coolers containing samples requiring preservation to 4°C shall be sufficient to achieve and maintain the temperature of those samples at 4°C after collection and throughout transit.

- For each shipment of samples, group all corresponding chain-of-custody records and Traffic Reports, pack in a waterproof bag, and include with the samples.

- Ship samples according to DOT regulations specified for environmental samples. Place two custody seals on the outside of each sample cooler.

- Split spoon samplers, sampling knives, and drilling equipment will be cleaned before and between uses.

- Drilling cuttings will be temporarily placed in 55 gallon drums.

- After final sample collection, the borings will be back-filled with drill cuttings for closure. Areas where borings penetrated through pavement will be appropriately surface patched by the drilling Subcontractor.

- Residual drill cuttings and pavement will be containerized in 55 gallon drums and disposed of by the drilling subcontractor in accordance with RCRA, TSCA or other applicable regulations.

5.6.4 Sample Bottle Filling Procedures

Sampling for Volatile Organics

- Remove the cap from one set of 40-ml sample containers.

- Fill the sample containers one after the other as completely as possible by transferring the sample from the split spoon with a stainless steel sampling knife or equivalent (spoon, trowel) to the container immediately after opening the split spoon and screening the split spoon with an OVA or HNu.

- Close the 40-ml sample bottle tightly and place on ice.

- Log the description of the soil sample sent for analysis in the log book.

Sampling for Other Chemical Parameters

All samples for semi-volatile organics will be homogenized before being put into sample containers. The following coning and quartering procedure must be used to homogenize the samples:

- Remove any rocks, twigs, leaves, and other debris that are not considered part of the sample.
- Thoroughly mix the soil in the stainless steel pan/bowl with pre-cleaned stainless steel spoon, or other pre-cleaned stainless steel utensil.
- Scrape any sediment in the pan from the sides, corners, and bottom of the pan, then roll it to the middle of the pan and initially mix.
- Divide the sample into quarters and move each quarter to a separate corner of the pan/bowl.
- Mix each quarter individually, then roll it to the center of the container and mix the entire sample again.
- Fill appropriate sample containers to rim and close tightly.
- Place on ice.

5.7 Air Emissions

No air emission samples will be collected at the treatment facility.

5.8 Health and Safety Plan

A site Health and Safety Plan (HASP) has been developed for project personnel to conduct the monitoring activities described in this monitoring plan (see Appendix A).

All personnel who perform work on or adjacent to the FTC site must conform with applicable provisions of the following Federal regulations and guidelines:

- Occupational Safety and Health Administration (OSHA) Safety and Health Standards 29 Code of Federal Regulations (CFR)1910 (General Industry), US Department of Labor, Occupational Safety and Health Administration, especially OSHA 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response.
- OSHA Safety and Health Standards 29 CFR 1926 (Construction Industry), US Department of Labor, Occupational Safety and Health Administration.
- Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, US Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health.

- CDM Health and Safety Assurance Manual (HSAM). This HSAM is the controlling document for the project in terms of project health and safety, and training policies and procedures.

The site HASP includes lines of authority and responsibility for health and safety, medical monitoring, training, and equipment programs, safety inspections, and health and safety record keeping. This site specific HASP addresses each of the topics or concerns OSHA requires in a HASP for a hazardous waste operation.

APPENDIX A

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN FORM

CDM Health and Safety Program

This document is for the exclusive use of CDM and its subcontractors

CAMP DRESSER & McKEE INC.

PROJECT DOCUMENT #: _____

PROJECT NAME: **Fireman's Training Center Remediation Monitoring** *PROJECT* # 5044-47-CG-HSP *REGION:* II

JOBSITE ADDRESS: Nassau County Fire Service Academy
Winding Road
Old Bethpage, New York 11804

CLIENT: Nassau County Department Of Public Works

CLIENT CONTACT: Peter Witkowski

CLIENT CONTACT PHONE # (516) 571-9600

( ) *AMENDMENT TO EXISTING APPROVED H&SP?* Yes

DATE EXISTING H&SP WAS APPROVED? NA

( ) *H&SP AMENDMENT NUMBER?* One

OBJECTIVES OF FIELD WORK:

To monitor and sample the remedial technologies implemented under the site remedial action plan (RAP) including:
- deep soils monitoring
- long-term groundwater monitoring
- floating product monitoring
- hydraulic monitoring

TYPE: Check as many as applicable

Active	(√)	Landfill	( )	Unknown	( )
Inactive	( )	Uncontrolled	( )	Military	( )
Secure	( )	Industrial	( )	Other	(*specify*)
Unsecure	( )	Recovery	( )	Residential	( )
Enclosed space	( )	Well Field	( )		

All requirements described in the **CDM Health and Safety Assurance Manual for Hazardous Waste Operations** are incorporated in this health and safety plan by reference.

DESCRIPTION AND FEATURES: Include principal operations and unusual features (containers, buildings, dikes, power lines, hills, slopes, rivers, etc.)

The Fireman's Training Center (FTC) is located in Bethpage, New York, near the Nassau/Suffolk border. It is an active 12 acre parcel which is bordered on the east, south and southwest by the golf courses and wooded areas of Bethpage State Park and on the north and northwest by the Oyster Bay Solid Waste Disposal Complex (OBSWDC). The OBSWDC in an inactive landfill site which is a New York State Superfund site which has both a landfill gas collection system and a groundwater extraction system to collect contaminated groundwater. The Claremont Industrial Park, located approximately 2000 feet northeast of the FTC, is a listed Federal Superfund site and is a groundwater contamination site.

The FTC site consists of office and classroom buildings, fire training tower, mock-up buildings used for test burns, water tower, pump houses, an oil-water separator, open burn areas, maintenance garage, storage basins, concrete storage basin, three drywell fields and an undeveloped section. The site also has numerous gas monitoring wells, groundwater monitoring wells and OBSWDC landfill gas collection system extends to the north, northwest perimeter of the site. The site also has an extensive underground piping network.

The land surface on the FTC is relatively flat with surface elevations ranging from about 95 to 110 feet above sea level. The southern two-thirds of the site is almost entirely paved and the undeveloped northern third of the site is currently unpaved.

SURROUNDING POPULATION: ( ) **Residential** (√) **Industrial** ( ) **Commercial** ( ) **Rural** ( ) **Urban** **OTHER:** Recreational

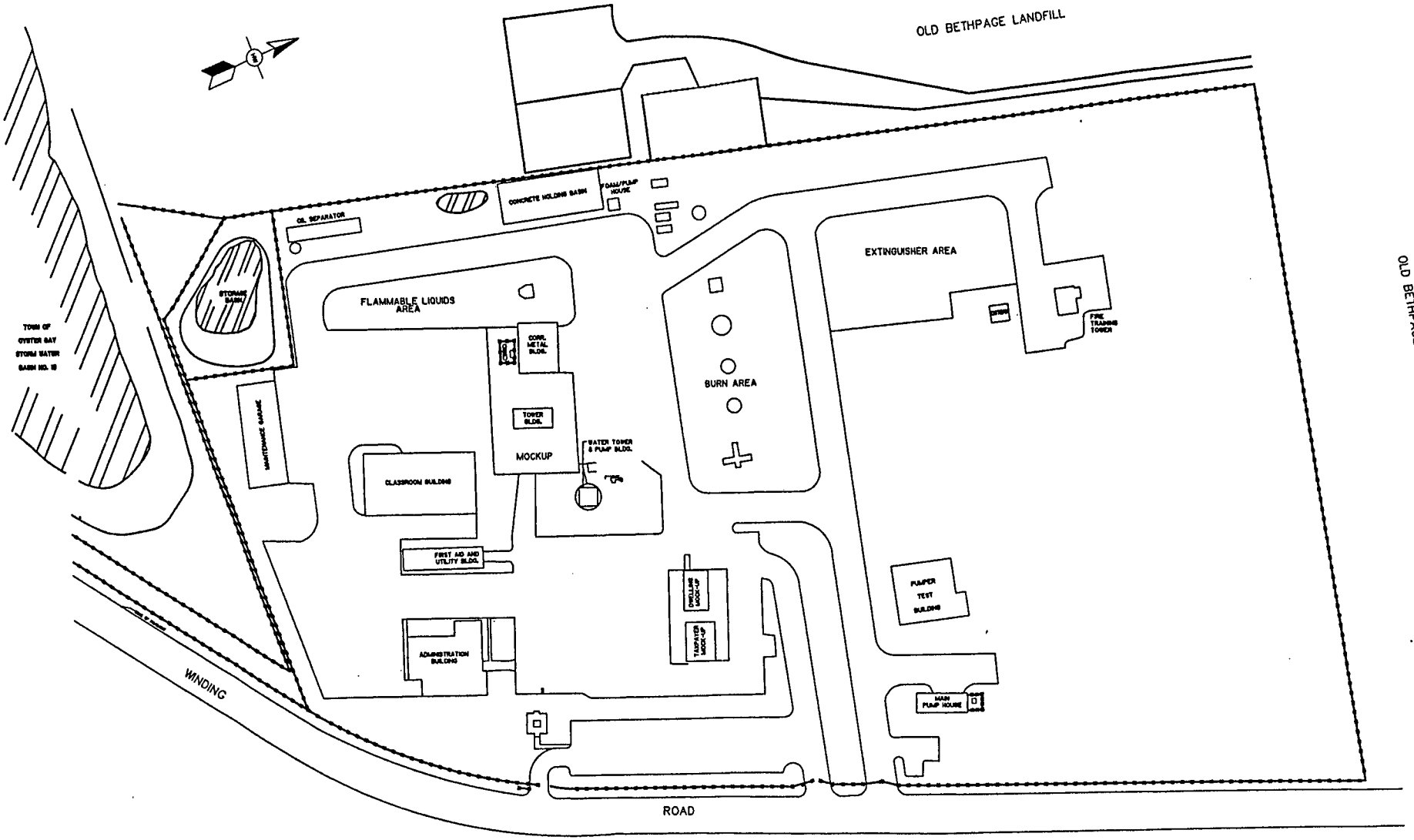

Figure 1-2

Site Plan

Fireman's Training Center Remedial Design
Nassau County Department of Public Works

CDM
environmental engineers, scientists, planners, & management consultants

HISTORY: Summarize below. Include complaints from public, previous agency actions, known exposures or injuries, etc.

FTC has been used since 1960 to conduct advanced fire fighting training for volunteer firemen, and continues today to serve these activities. Training exercises occurred in open burn areas and in mock-up buildings located across the site. Between 1970 and 1980, waste solvents, in addition to fuel oil and gasoline, were accepted at the site for use in training exercises. This practice was discontinued in 1980 and, since then, training exercises have been performed using only fuel oil and gasoline to ignite wooden pallets and straw. On-site contamination occurred primarily in the open burn areas, where fuel was poured directly onto the ground, and in the mock-up fields. In the mock-up buildings, unburned fuel and solvents were washed out of the buildings into drywells after each training session. These unlined drywells inadvertently served as conduits, carrying contamination down to the groundwater and contaminating the soils beneath the site. In 1984, site improvements were made to cap the burn areas and seal the drainage system leading to the drywells. A new drainage system was installed, including an oil/water separator to treat runoff prior to discharge to the sanitary sewer system. (Continued on next page).

WASTE TYPES: (√) Liquid ( ) Solid ( ) Sludge ( ) Gas ( ) Unknown ( ) Other *specify:*

WASTE CHARACTERISTICS: Check as many as applicable.

( ) Corrosive	(√) Flammable	( ) Radioactive
(√) Toxic	(√) Volatile	( ) Reactive
( ) Inert Gas	( ) Unknown	( ) Other *specify:*

WORK ZONES: Describe the Exclusion, Contamination Reduction, and Support Zones in terms on-site personnel will recognize

Work zones will be established based on site activities and conditions and will comply with the following:
Exclusion Zone (EZ): The EX consists of all sample locations and the surrounding 15 feet. An EZ will be established to include the groundwater treatment facility and surrounding 20 feet.
Contamination Reduction Zone (CRZ): The CRZ will be established upwind and adjacent to the EZ. The CRZ is a 10 foot (minimum) zone through which personnel and equipment pass through for decontamination.
Support Zone (SZ): The SZ consists of a 5 foot by 5 foot area upwind of the CRZ.

HAZARDS OF CONCERN:

(√) Heat Stress *attach guidelines*	( ) Noise
(√) Cold Stress *attach guidelines*	( ) Inorganic Chemicals
(√) Explosive/Flammable	(√) Organic Chemicals
( ) Oxygen Deficient	( ) Motorized Traffic
( ) Radiological	( ) Heavy Machinery
( ) Biological	(√) Slips, Trips, & Falls
( ) Other - *specify*	

FACILITY'S DISPOSAL METHODS AND PRACTICES: Summarize below.

Until 1984, unburned fuel and organic chemicals mixed with fire fighting water were washed over the FTC surface or to unlined, open bottom drywells by a system of drains interconnected by overflow pipes, causing contamination of the subsurface soils and groundwater beneath the three drywell fields and unpaved portions of the site. Additional contamination was due to shallow underground pipes carrying gasoline and fuel oil to the burn areas that were known to have leaked. Currently, runoff is diverted to an oil/water separator on-site from concrete pads in the burn areas.

Based on NCDPW investigations conducted at the site, the NYSDEC added the site to the Registry of Inactive Hazardous Waste Disposal Sites in December 1987, and upgraded the site classification to Class 2 in March 1988. An Order of Consent signed in February 1989, required a Remedial Investigation/Feasibility Study (RI/FS), which was completed in 1992. On-site and off-site contamination has been characterized and delineated by drilling and sampling activities. See Appendix A.

HEALTH AND SAFETY PLAN FORM

CDM Health and Safety Program

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CAMP DRESSER & McKEE INC.

PROJECT DOCUMENT #: _____

HAZARDOUS MATERIAL SUMMARY: Circle waste type and estimate amounts by category

CHEMICALS: Amount/Units:	SOLIDS: Amount/Units:	SLUDGES: Amount/Units:	SOLVENTS: Amount/Units:	OILS: Amount/Units:	OTHER: Amount/Units:
Acids	Flyash	Paints	(Halogenated (chloro, bromo) Solvents)	(Oily Wastes)	Laboratory
Pickling Liquors	Mine or Mill Tailings	Pigments		(Gasoline)	Pharmaceutical
Caustics	Asbestos	Metals Sludges	(Hydrocarbons)	(Diesel Oil)	Hospital
Pesticides	Ferrous Smelter	POTW Sludge	Alcohols	Lubricants	Radiological
Dyes / Inks	Non-Ferrous Smelter	Aluminum	(Ketones)	PCBs	Municipal
Cyanides	Metals	Distillation Bottoms	Esters	(Polynuclear Aromatics)	Construction
Phenols	Other *specify:*	Other *specify:*	Ethers	Other *specify:*	Munitions
Halogens			Other *specify:*		Other *specify:*
Other *specify:*					

OVERALL HAZARD EVALUATION: ( ) High ( ) Medium (√) Low ( ) Unknown *(Where tasks have different hazards, evaluate each)*

JUSTIFICATION: Low for non-intrusive work since a majority of the site is paved and contamination encountered in unpaved areas is below grade covered by soil. Medium for intrusive work since pure product (gasoline and deisel fuel) and elevated VOC concentrations may be encountered.

FIRE/EXPLOSION POTENTIAL: ( ) High (√) Medium ( ) Low ( ) Unknown

BACKGROUND REVIEW: (√) COMPLETE ( ) INCOMPLETE Refer to Appendix A for discussion of contaminants and locations

KNOWN CONTAMINANTS	*HIGHEST OBSERVED CONCENTRATION (specify units and media)*	*PEL/TLV ppm or mg/m³ (specify)*	*IDLH ppm or mg/m³ (specify)*	*WARNING CONCENTRATION (in ppm)*	*SYMPTOMS & EFFECTS OF ACUTE EXPOSURE*	*PHOTO IONIZATION POTENTIAL*
Gasoline	Pure Product	300 ppm In Air (ACGIH)	NE	10 ppm	Vomiting, diarrhea, insomnia, dizziness headache.	NA
Benzene	1.5 mg/l - GW 1.3 mg/kg - S	1 ppm	Ca 3,000 ppm	61 ppm	Irrit. to eyes, nose. Headache, dizziness, nausea, fatigue	9.25
Ethylbenzene	3.0 mg/l - GW 2.5 mg/kg - S	100 ppm	2,000 ppm	200 ppm	Irrit. to eyes and nose. Headache, narcosis.	8.71
Toluene	12 mg/l - GW 7.1 mg/kg - S	50 ppm	2,000 ppm	1.7 ppm	Fatigue, confusion, euphoria, dizziness, headache, tears.	8.80
Xylene	16 mg/l - GW 28 mg/kg - S	100 ppm	1,000 ppm	5 ppm	Irrit. to eyes, nose and throat. Drowsiness, nausea, uncoordination.	8.50
Methylene Chloride	3.7 mg/l - GW	50 ppm	5,000 ppm	160 ppm	Weakness, tingling and numbness, vertigo, nausea.	11.35
Trichloroethylene	9.2 mg/l - GW	50 ppm	1,000 ppm	82 ppm	Vertigo, headache, drowsiness, visual disturbances.	9.45
Methylethylketone (MEK)	1.2 mg/l - GW	200 ppm	3,000 ppm	5.5 ppm	Irrit. to eyes, dizziness vomiting.	9.53

NA - Not Available **NE** - None Established **U** - Unknown **Ca** - NIOSH has recommended that the substance be treated as a potential human carcinogen

S - Soil **SW** - Surface Water **T** - Tailings **W** - Waste **TK** - Tanks **SD** - Sediment

A - Air **GW** - Groundwater **SL** - Sludge **D** - Drums **L** - Lagoon **OFF** - Off-site

KNOWN CONTAMINANTS	*HIGHEST OBSERVED CONCENTRATION (specify units and media)*	*PEL/TLV ppm or mg/m³ (specify)*	*IDLH ppm or mg/m³ (specify)*	*WARNING CONCENTRATION (in ppm)*	*SYMPTOMS & EFFECTS OF ACUTE EXPOSURE*	*PHOTO IONIZATION POTENTIAL*
Acetone	6.1 mg/l - GW 0.073 mg/kg - S	750 ppm	20,000 ppm	62 ppm	Irrit. to eyes, headache, dizziness.	9.69
1,2-Dichloroethene	1.6 mg/l - GW	200 ppm	4,000 ppm	1.1 ppm	Irrit. to eyes, CNS depression.	10.00
1,1-Dichloroethane	0.015 mg/l - GW	100 ppm	4,000 ppm	120 ppm	Irrit. to skin, drowsiness.	11.10
Vinyl Chloride	0.210 mg/l - GW	1 ppm	Ca	NA	Weakness, stomach pain, cancer.	10.00
Tetrachloroethene	0.91 mg/l - GW 0.010 mg/kg - S	25 ppm	500 ppm	47 ppm	Irrit. to eyes, nose and throat, dizziness, flushed face and neck.	9.32
Chloroform	0.009 mg/l - GW	2 ppm	1,000 ppm	192 ppm	Mental dullness, headaches, anethesia, dizziness.	11.40
Petroleum Distillales (Naptha-Deisel Fuel)	Pure Product	300 ppm	3,000 ppm	NA	Irrit. to eyes, nose and throat, dizziness, drowsiness, headache.	NA
1,2-Dichloroethane	0.015 mg/l - GW	10 ppm	1,000 ppm	26 ppm	Nervous system depression, irrit. to eyes, corneal opacity.	11.05
2-Hexanone	0.210 mg/l - GW	5 ppm	5,000 ppm	NA	Wrist and foot drop, headache, drowsiness, numb feet and hands.	9.34
Naphthalene	1.5 mg/l - GW 23 mg/kg - S	10 ppm	500 ppm	38 ppm	Irrit. to eyes, headache, confusion, excitement, nausea.	8.12

NA - Not Available **NE** - None Established **U** - Unknown **Ca** - NIOSH has recommended that the substance be treated as a potential human carcinogen

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KNOWN CONTAMINANTS	*HIGHEST OBSERVED CONCENTRATION (specify units and media)*	*PEL/TLV ppm or mg/m³ (specify)*	*IDLH ppm or mg/m³ (specify)*	*WARNING CONCENTRATION (in ppm)*	*SYMPTOMS & EFFECTS OF ACUTE EXPOSURE*	*PHOTO IONIZATION POTENTIAL*
Styrene	3.3 mg/kg - S	50 ppm	5,000 ppm	0.15 ppm	Irrit. to eyes and nose, drowsiness, weakness, unsteady gait.	8.47
3,3-Dichlorobenzidine	2.7 mg/kg - S	NE	Ca	NA	Skin sensitivity, headache, dizziness, frequent urination.	NA
Isophorone	1.5 mg/kg - S	4 ppm	800 ppm	0.19 ppm	Irrit. to eyes, nose and throat, headache, narcosis.	9.07
Polynuclear Aromatic Hydrocarbons	2.8 mg/l - GW 88.6 mg/kg - S	200 ug/m³	700 mg/m³	Dust	Confusion, nausea, irrit. to eyes, headaches, stomach pain.	Dust
Di-n-Octyl Phthalate	0.1 mg/l - GW 0.59 mg/kg - S	5 mg/m³	Ca	NA	Irrit. to eyes, nausea, diarrhea.	NA

NA - Not Available **NE** - None Established **U** - Unknown **Ca** - NIOSH has recommended that the substance be treated as a potential human carcinogen

S - Soil **SW** - Surface Water **T** - Tailings **W** - Waste **TK** - Tanks **SD** - Sediment

A - Air **GW** - Groundwater **SL** - Sludge **D** - Drums **L** - Lagoon **OFF** - Off-site

HEALTH AND SAFETY PLAN FORM

CDM Health and Safety Program

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CAMP DRESSER & McKEE INC.

PROJECT DOCUMENT #: _____

TASK DESCRIPTION/SPECIFIC TECHNIQUE/SITE LOCATION *(attach additional sheets as necessary)*	TYPE	Primary	Contingency	HAZARD & SCHEDULE
1. Intrusive activities, including: groundwater monitoring, product level measurements, soil sampling.	(Intrusive) Non-intrusive	A B C (D) Modified	A B (C) D Exit Area	Hi (Med) Low 11/93 - 03/94
2.	Intrusive Non-intrusive	A B C D Modified	A B C D Exit Area	Hi Med Low 11/93 - 01/94
3.	Intrusive Non-intrusive	A B C D Modified	A B C D Exit Area	Hi Med Low 11/93 - 04/94
4. .	Intrusive Non-intrusive	A B C D Modified	A B C D Exit Area	Hi Med Low
5. .	Intrusive Non-intrusive	A B C D Modified	A B C D Exit Area	Hi Med Low
6.	Intrusive Non-intrusive	A B C D Modified	A B C D Exit Area	Hi Med Low

PERSONNEL AND RESPONSIBLITIES

NAME	FIRM/DIVISION	CLEARANCE	CDM HEALTH RESPONSIBILITIES	On site?
Robert Burns	CDM/MAD	C - T/D - S	SHSC	(1) - 2 - 3 - 4 - 5
Kenneth Smith	CDM/MAD	B - T/D - S	Alternate SHSC/Task Manager	(1) - 2 - 3 - 4 - 5
Noelle Clarke	CDM/MAD	D - T/D - S	Field Engineer	(1) - 2 - 3 - 4 - 5
David Keil	CDM/MAD	B - T	Geologist	(1) - 2 - 3 - 4 - 5
Donna Potorti	CDM/MAD	D - T/D - S	Field Engineer	(1) - 2 - 3 - 4 - 5
Thomas McGovern	CDM/MAD	C - T	Field Engineer	(1) - 2 - 3 - 4 - 5

HEALTH AND SAFETY PLAN FORM

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PROJECT DOCUMENT #: _____

PROTECTIVE EQUIPMENT: Specify by task. Indicate type and/or material, as necessary. Group tasks if possible. Use copies of this sheet if needed.

BLOCK A

TASKS: (1) - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10
LEVEL: A - B - C (D) - Modified
(x) Primary ( ) Contingency

Respiratory: (x) Not needed
( ) SCBA, Airline: _____
( ) APR: _____
( ) Cartridge: _____
( ) Escape Mask: _____
( ) Other: _____

Head and Eye: ( ) Not needed
(x) Safety Glasses: _____
( ) Face Shield: _____
( ) Goggles: _____
(x) Hard Hat: when overhead hazards exist
( ) Other: _____
( ) Other: _____

Boots: ( ) Not Needed
(x) Steel-Toe (x) Steel Shank
( ) Rubber (x) Leather
( ) Overboots:

Prot. Clothing ( ) Not needed
( ) Encapsulated Suit: _____
( ) Splash Suit: _____
( ) Apron: _____
( ) Tyvek Coverall*
( ) Saranex Coverall
( ) Cloth Coverall: _____
( ) Other: _____

Gloves: ( ) Not Needed
(x) Undergloves: Surgical PVC when handling soil.
(x) Gloves: Nitrile
( ) Overgloves: _____

Other: *Specify below*
( )

BLOCK B

TASKS: (1) - 2 - 3 - (C) - 5 - 6 - 7 - 8 - 9 - 10
LEVEL: A - B - D - Modified
( ) Primary (x) Contingency

Respiratory: ( ) Not needed
( ) SCBA, Airline: _____
(x) APR: Full Face
(x) Cartridge: GMC-H for Organics
( ) Escape Mask: _____
( ) Other: _____

Head and Eye: ( ) Not needed
( ) Safety Glasses: _____
( ) Face Shield: _____
( ) Goggles: _____
(x) Hard Hat: when overhead hazards exist
( ) Other: _____

Boots: ( ) Not Needed
(x) Steel-Toe (x) Steel Shank
( ) Rubber (x) Leather
(x) Overboots: PVC

Prot. Clothing ( ) Not needed
( ) Encapsulated Suit: _____
( ) Splash Suit: _____
( ) Apron: _____
(x) Tyvek Coverall*
( ) Saranex Coverall
( ) Cloth Coverall: _____
( ) Other: _____

Gloves: (x) Not Needed
(x) Undergloves: Surgical PVC
(x) Gloves: Nitrile
( ) Overgloves: _____

Other: *Specify below*

* Wear polycoated Tyvek if splash potential exists.

BLOCK C

TASKS: 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10
LEVEL: A - B - C - D - Modified
( ) Primary ( ) Contingency-Evacuate

Respiratory: ( ) Not needed
( ) SCBA, Airline: _____
( ) APR: _____
( ) Cartridge: _____
( ) Escape Mask: _____
( ) Other: _____

Head and Eye: ( ) Not needed
( ) Safety Glasses: _____
( ) Face Shield: _____
( ) Goggles: _____
( ) Hard Hat:
( ) Other: _____

Boots: ( ) Not Needed
( ) Steel-Toe ( ) Steel Shank
( ) Rubber ( ) Leather
( ) Overboots: _____

Prot. Clothing ( ) Not needed
( ) Encapsulated Suit: _____
( ) Splash Suit: _____
( ) Apron: _____
( ) Tyvek Coverall
( ) Saranex Coverall
( ) Cloth Coverall: _____
( ) Other: _____

Gloves: ( ) Not Needed
( ) Undergloves: _____
( ) Gloves: _____
( ) Overgloves: _____

Other: *Specify below*

BLOCK D

TASKS: 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10
LEVEL: A - B - C - D - Modified
( ) Primary ( ) Contingency-Evacuate

Respiratory: ( ) Not needed
( ) SCBA, Airline: _____
( ) APR:
( ) Cartridge:
( ) Escape Mask: _____
( ) Other: _____

Head and Eye: ( ) Not needed
( ) Safety Glasses: _____
( ) Face Shield: _____
( ) Goggles: _____
( ) Hard Hat: _____
( ) Other: _____

Boots: ( ) Not Needed
( ) Steel-Toe ( ) Steel Shank
( ) Rubber ( ) Leather
( ) Overboots: _____

Prot. Clothing ( ) Not needed
( ) Encapsulated Suit: _____
( ) Splash Suit: _____
( ) Apron: _____
( ) Tyvek Coverall
( ) Saranex Coverall
( ) Cloth Coverall: _____
( ) Other: _____

Gloves: ( ) Not Needed
( ) Undergloves: _____
( ) Gloves: _____
( ) Overgloves: _____

Other: *Specify below*

NOTE: ***Changes made by Noelle Clarke per verbal approval by Lisa Granados, November 30, 1993.*** Tyvek coveralls and rubber overboots not required on paved work areas or in the fluidized bed treatability trailer unless potential for dust generation exists. Gloves not required unless handling soil or groundwater samples. Hard Hat required for construction activities only (i.e. well drilling or soil borings).

MONITORING EQUIPMENT: Specify by task. Indicate type as necessary. Attach additional sheets if needed.

INSTRUMENT	*TASK*	*ACTION GUIDELINES*		*COMMENTS (When and how will you use the monitor?)*
Combustible Gas Indicator	(1) 2-3-4-5-6-7-8	0-10%LEL 10-25%LEL >25%LEL 21.0%O_2 <21.0%O_2 <19.5%O_2	No explosion hazard. Potential explosion hazard; notify SHSC. Explosion hazard; interupt task/evacuate. Oxygen normal. Oxygen Deficient; notify SHSC. Interrupt task/evacuate.	Monitor wells when initially opened. ( ) Not Needed Open wells from upwind direction. Crack well open and insert probe to monitor prior to opening.
Radiation Survey Meter	1-2-3-4-5-6-7-8	3 x Background: > 2mR/hr:	Notify HSM. Establish REZ.	(√) Not Needed
Photoionization Detector eV Lamp Type:	1-2-3-4-5-6-7-8	*Specify:*		(√) Not Needed
Flame Ionization Detector Type: OVA	(1) 2-3-4-5-6-7-8	*Specify:* 0-25 ppm: 25-250 ppm: > 250 ppm:	 Level D, take drager tubes at 1 ppm Level C, take dragers - see below Exit area, notify HSM.	Monitor breakthing zone. Take drager tubes if level exceeds 1 ppm. ( ) Not Needed
Detector Tubes Type: Drager Type_____	(1) 2-3-4-5-6-7-8	*Specify:* Anytime > 1 ppm, monitor breathing zone with: 0-1 ppm: Level D > 1 ppm: exit area	 - Benzene tube 0.5/a (Part #6728561) - Vinyl chloride 0.5/a (Part #6728061)	Monitor breathing zone. Notify HSM if levels of benzene and vinyl chloride exceed 1 ppm. ( ) Not Needed
Respirable Dust Monitor Type_____ Type_____	1-2-3-4-5-6-7-8	*Specify:* If work team observes dust in the breathing zone, exit area.		(√) Not Needed
Other *Specify:*	1-2-3-4-5-6-7-8	*Specify:*		

DECONTAMINATION PROCEDURES

ATTACH SITE MAP INDICATING EXCLUSION, DECONTAMINATION, AND SUPPORT ZONES AS PAGE TWO

Personnel Decontamination *Summarize below or attach diagram;*	*Sampling Equipment Decontamination* *Summarize below or attach diagram;*	*Heavy Equipment Decontamination* *Summarize below or attach diagram;*
• Equipment Drop • Hard Hat Removal • Boot Cover Wash (Alconox and Water) • Boot Cover Rinse (Water) • Boot Cover Removal • Outer Glove Wash (Alconox and Water) • Outer Glove Rinse (Water) • Outer Glove Removal • Tyvek/Coverall Removal/Disposal • Safety Glass Removal • Inner Glove Removal/Disposal • Face and Hands Wash For contingency (Level C): Respirator cartidge removal will follow tyvek/coverall removal. ( ) Not needed	• Wash and scrub with low phosphate detergent (alconox and water) • Tap water rinse • Rinse with 10% HNO3, ultrapure • Tap water rinse • An acetone rinse (solvents must be pesticide grade or better) • Deionized demonstrated analyte free water rinse • Air dry • Wrap in aluminum foil (shiny side out) for transport Tap water may be used from municipal water treatment system. The use of an untreated potable water supply is not an acceptable substitute. If metals samples are not being collected, the 10% nitric acid (HNO3) rinse may be omitted, and, conversely, if organic samples are not being taken, the solvent rinse may be omitted. ( ) Not needed	N/A ( ) Not needed
Containment and Disposal Method Decontamination solutions (alconox and water) will be discharged on the soils/paved areas of the exclusion zone. Protective clothing will be sealed in plastic bags and disposed of in an approved landfill.	*Containment and Disposal Method* Sampling equipment decontamination solvents will be contained and disposed of in the oil/water separator on-site.	*Containment and Disposal Method* N/A

HEALTH AND SAFETY PLAN FORM

CDM Health and Safety Program

This document is for the exclusive use of CDM and its subcontractors

CAMP DRESSER & McKEE INC.

PROJECT DOCUMENT #: _____

EMERGENCY CONTACTS

Water Supply:	Site Potable Water Supply	
Site Telephone:	Number not currently available	
EPA Release Report #:		1(800) 424-8802
CDM 24-Hour Emergency #:		1(800) SKY-PAGE 31821#
Facility Management:	Chief John Baroni	(516) 694-1234
Other *(specify)*	LILCO	(516) 661-6000
CHEMTREC Emergency #:		1(800) 424-9300

CONTINGENCY PLANS: Summarize below

Personnel may choose to wear more protection than directed by this plan. When air contaminant levels exceed those at which Level C is needed, CDM Personnel will leave the contaminated area. The buddy system will be used at all times.

If team sees dust generated in the breathing zone, exit area

HEALTH AND SAFETY PLAN APPROVALS

Prepared by: **Date**

DHSC Signature _____ **Date** _____

HSM Signature Lisa Granados **Date** 9/17/94

Revision 1

EMERGENCY CONTACTS	*NAME*	*PHONE*
Health and Safety Manager	Lisa Granados	(908) 225-7000
Project Manager	Michael Memoli	(516) 496-8400
Site Safety Coordinator	Robert Burns	(516) 496-8400
Client Contact	Peter Witkowski	(516) 571-9600
Other *(specify)*		
Environmental Agency	George Heitzman (NYSDEC)	(518) 457-1641
State Spill Number	NYSDEC	1 (800) 457-7362
Fire Department		911
Police Department	8th Precint (Emergency)	911
	8th Precint (Non-Emergency)	(516) 573-6800
State Police	Farmingdale	(516) 756-3300
Health Department	NCDH	(516) 571-3410
Poison Control Center	Winthrop Hospital	(516) 542-2323
Occupational Physician	David Barnes	1 (800) 229-3674

MEDICAL EMERGENCY *PHONE*

Hospital Name: Central General Hospital (516) 681-8900

Hospital Address: 888 Old Country Road, Plainview, New York

Name of 24-Hour Ambulance: 911

Route to Hospital: Make a right out of site onto Winding Road. Proceed approximately 1/10 mile to Round Swamp Road and make a right. Proceed approximately 1 mile to Old Bethpage Road and make a left. Continue for approximately 1 mile and make a right onto Plainview Road and continue for approximately 2/10 of a mile to Old Country Road. Make a left onto Old Contry Road. Continue for approximately 3/4 of a mile. The hospital and emergency room are on the right. (See map, page 11 of 11).

Distance to hospital: 4 miles

Attach map with route to hospital

Appendix A

On-Site Soil

Areas of soil contamination have been identified in the Mock-up Field (MUF), Corrugated Metal Building (CMB), and Burn Area Field (BAF) drywell fields. The extent of the site soil contamination is shown on Figure 1-3. Soils in the vicinity of the MUF and BAF fields are contaminated with total petroleum hydrocarbons (TPH) and benzene, toluene, ethylbenzene, and xylene (BTEX) from the bottoms of the drywells down to the water table. In the MUF area, TPH concentrations range from greater than 100 milligrams per kilogram (mg/kg) to 130,000 mg/kg, and BTEX concentrations range from not detected to 110,000 mg/kg. The areas of contaminated soil extend laterally about six feet from each MUF drywell and about 12 feet from each BAF drywell. In the CMB area, soil contaminated with TPH and BTEX extends to a depth of 8 feet below the bottom of the drywells and 8 feet laterally.

The volume of contaminated soil has been estimated at 2,200 cubic yards (cy) in the MUF drywell area, 5,100 cy in the CMB drywell areas, and 5,500 cy in the BAF drywell area. In each area, contaminated soil occurs in columns extending vertically downward from the bottom of the drywells.

In addition to the three drywell fields, an estimated 7,500 cy of contaminated soil has been identified beneath the three burn area fields; CMB, MUF and BAF. Most of this soil contamination occurs between land surface and a depth of 5 feet.

Additional soil contamination has resulted from contact of three former floating bodies of petroleum product with soil (see Section 1.3.4). Monthly water levels collected during the RI from April 1990 to April 1991 indicate that water levels fluctuated during that period by approximately 2 feet. These fluctuations result in exposing the soil to contamination from the former bodies of floating product. The RI report estimated that a 10-foot thick band of contaminated soil (currently masked by the higher water table) above the water table exists in the areas at the FTC that were identified as containing product bodies. This results in an estimated 17,000 cy of contaminated soil. Therefore, the total extend of soil contamination has

been estimated as 37,300 cy. Refer to site map delineating the extent of shallow and deep soil contamination (page A-1).

On-Site Groundwater

There are 2 distinct plumes of groundwater contamination beneath the FTC site. Figure 1-4 shows the extent of both on-site plumes as defined in the RI/FS report. An isolated plume associated with the MUF drywell field extends approximately 300 feet by 150 feet from the mock-up buildings southeast towards the site perimeter. This plume contains some dissolved BTEX in concentrations ranging up to 63 micrograms per liter (ug/l).

A second plume originates in the BAF and CMB, and extends downgradient of the site. It is reported to be 780 feet long and 380 feet wide. The on-site portion of the plume is associated with the larger floating product area and contains BTEX up to 27,850 ug/l, methyl ethylketone (MEK) up to 1,200 ug/l, and acetone up to 6,050 ug/l. Another plume overlaps the larger plume, and contains dissolved chlorinated hydrocarbons with a maximum concentration of 2,807 ug/l. The latter plume extends to the southern boundary of the site, and is estimated to be 480 feet long and 300 feet wide.

Semivolatile organic compounds (semi-VOCs) have been detected in both onsite groundwater plumes. Specifically, the following semi-VOCs were detected:

- phenanthrene
- fluorene
- naphthalene
- di-n-octyl-phthalate
- methylnaphthalene
- pyrene

The FTC also contains groundwater contaminated by leachate from the Old Bethpage Landfill, which is located north and northwest of the FTC. Landfill indicator parameters detected at the FTC include specific conductance, alkalinity, chlorides, hardness, ammonia, and some chlorinated

organic compounds. Ammonia concentrations range from greater than 0.02 ug/1 to 65 ug/1. Generally, the highest concentrations of these parameters were found in the northern part of the FTC closer to the landfill. With the exception of chlorides, the landfill indicator parameters have been detected at concentrations above the landfill's action levels in a large portion of the FTC site extending from the northwest to the southeast corner of the site.

The following metals, either associated with the landfill leachate plume or naturally occurring, were also detected in on-site groundwater.

- Aluminum
- Chromium
- Iron
- Manganese
- Nickel
- Arsenic
- Lead

Refer to site map delineating on-site groundwater contamination (page A-2).

Off-Site Groundwater

A plume of dissolved groundwater contamination has migrated beyond the southern boundary of the FTC site into the Bethpage State Park (see Figure 1-5). The leading, edge of the plume is reported to be approximately 4,000 feet downgradient of the site. Most of the plume extends from 40 feet above mean sea level (msl) to 120 feet below msl.

Only highly mobile solvents have migrated off-site. The highest measured concentrations of volatile organic compounds (VOCs) occur in the off-site plume south of two irrigation wells in Bethpage State Park, with concentrations of total VOCs measured at more than 1,500 ug/l. The major constituents of the off-site plume are:

- vinyl chloride
- tetrachloroethene

- 1,1-dichloroethene
- 1,2-dichloroethane
- 1,1,1-trichloroethane
- trichloroethene
- benzene

Refer to site map delineating the off-site contaminant plume (page A-3).

Floating Product

Floating product has been detected in monitoring wells, at three areas of the FTC site, as shown on Figure 1-6. This product, associated with the drywells, has contributed to soil and groundwater contamination at the site.

In the MUF, floating product was measured in wells near the mock-up buildings, primarily #2 fuel oil. In the BAF, floating product was found consisting of #2 fuel oil contaminated with solvents. In the CMB, the floating product was primarily gasoline.

Due to a ten-foot rise in the water table between 1989 and 1992, the floating product plumes disappeared. They are presumed to have been trapped in the pore space of the now saturated soil, creating a smear zone of soil contamination located both above and below the present water table.

With the recent decline in the water table, floating product has reappeared in the MUF. The floating product in the CMB field has not reappeared, and may have been volatilized and extracted by the nearby methane extraction system of the landfill.

Refer to site map delineating on-site floating product areas) page A-4).

[w:\docs\h&s\appenda]

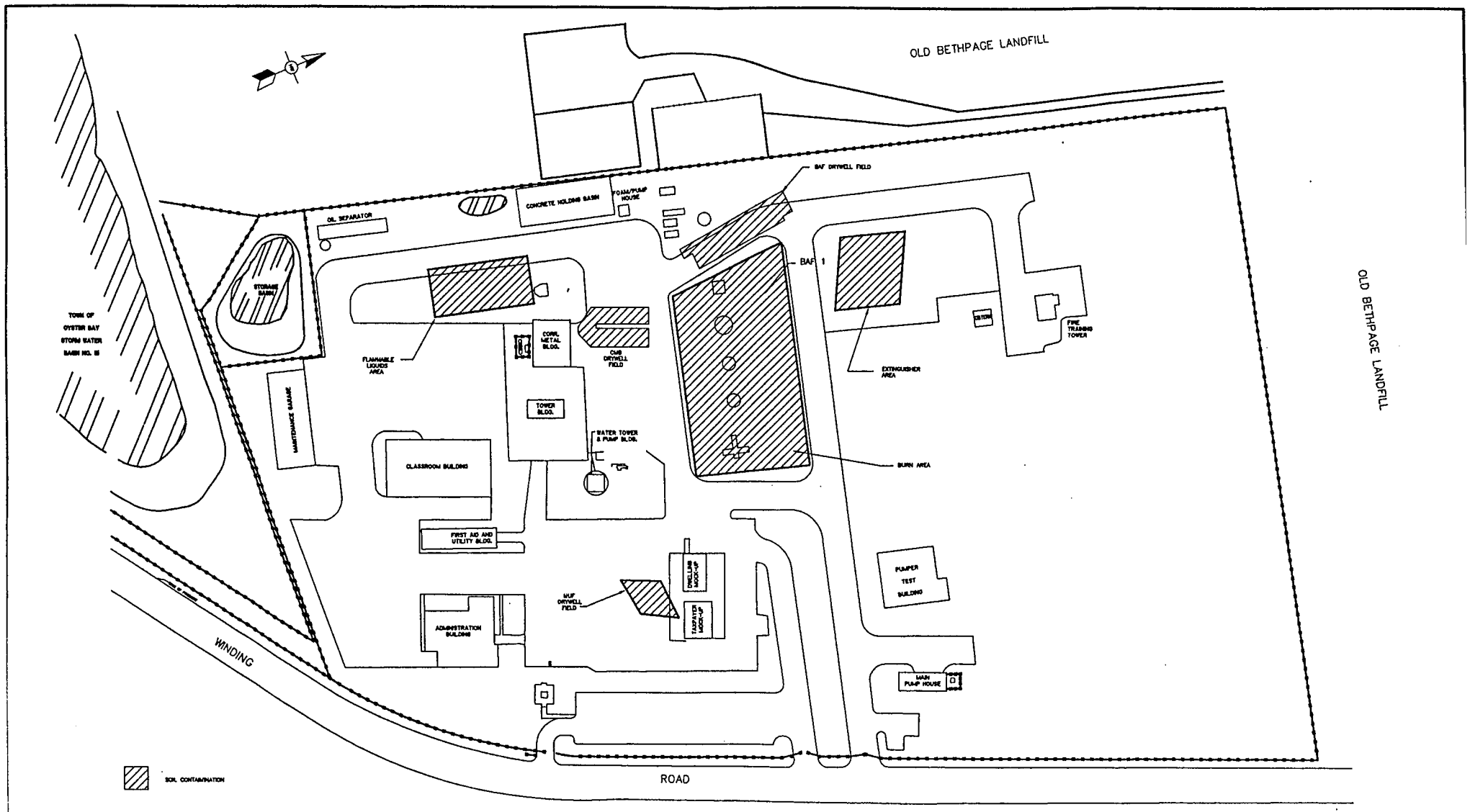
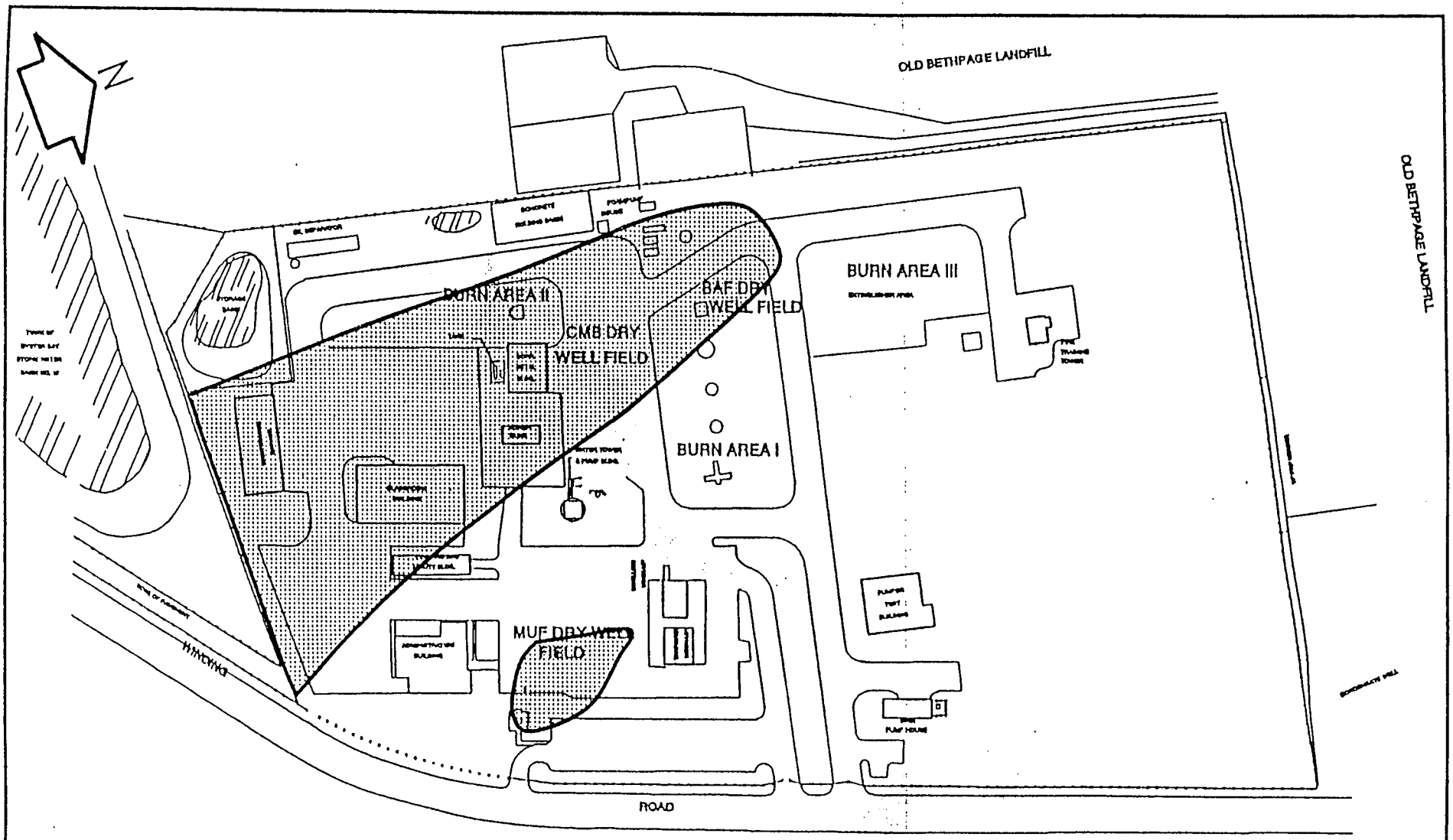


Figure 1-3

Extent of Soil Contamination
Shallow And Deep Soils

Fireman's Training Center Remedial Design
Nassau County Department of Public Works

CDM
environmental engineers, scientists, planners, & management consultants



Adapted from Malcolm Pirnie, Inc. figure.

CDM

onvironmental engineers, scientists, planners & management consultants

Figure 1-4

On-Site Groundwater Contamination

Fireman's Training Center Remedial Design
Nassau County Department Of Public Works

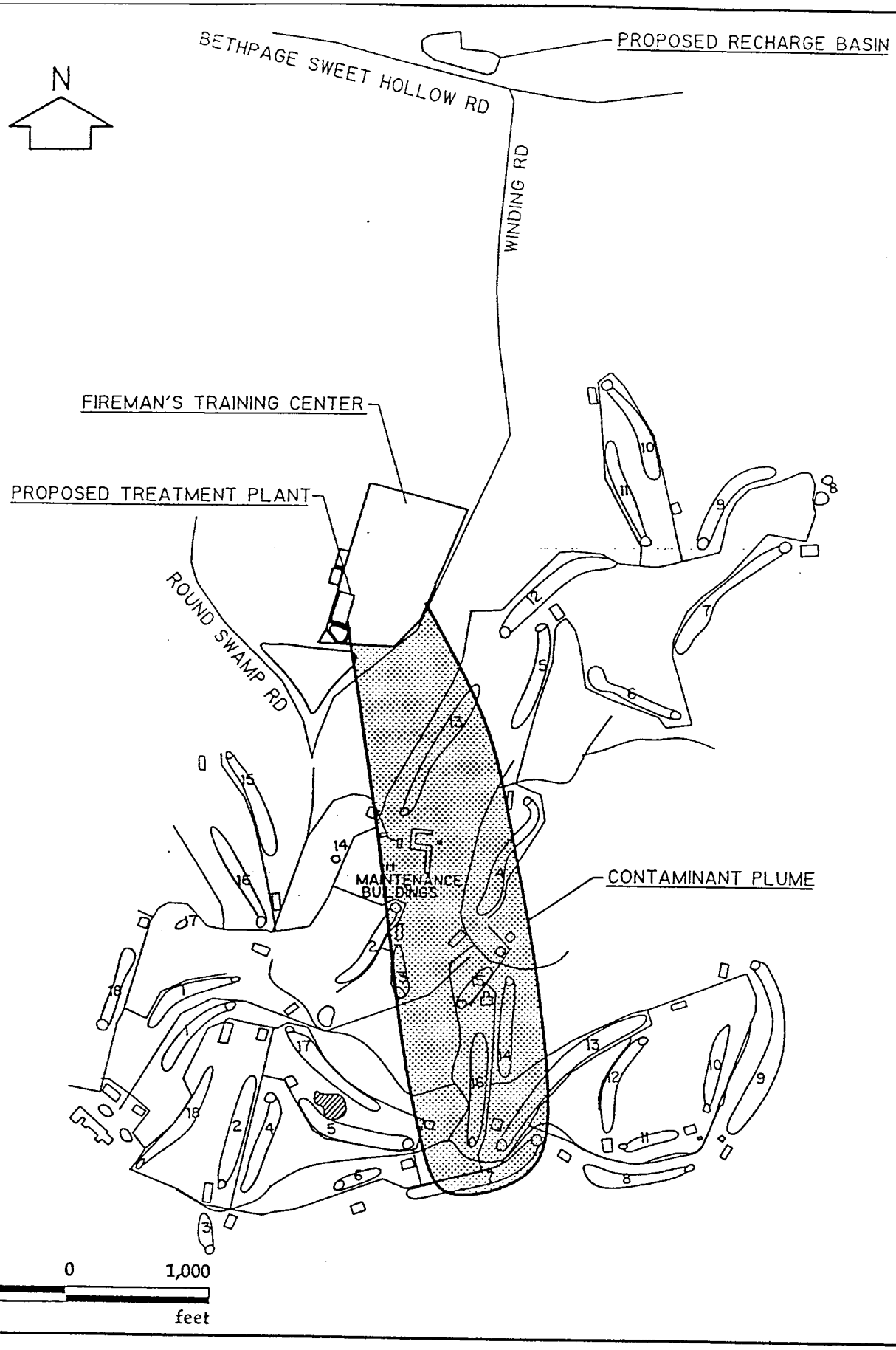


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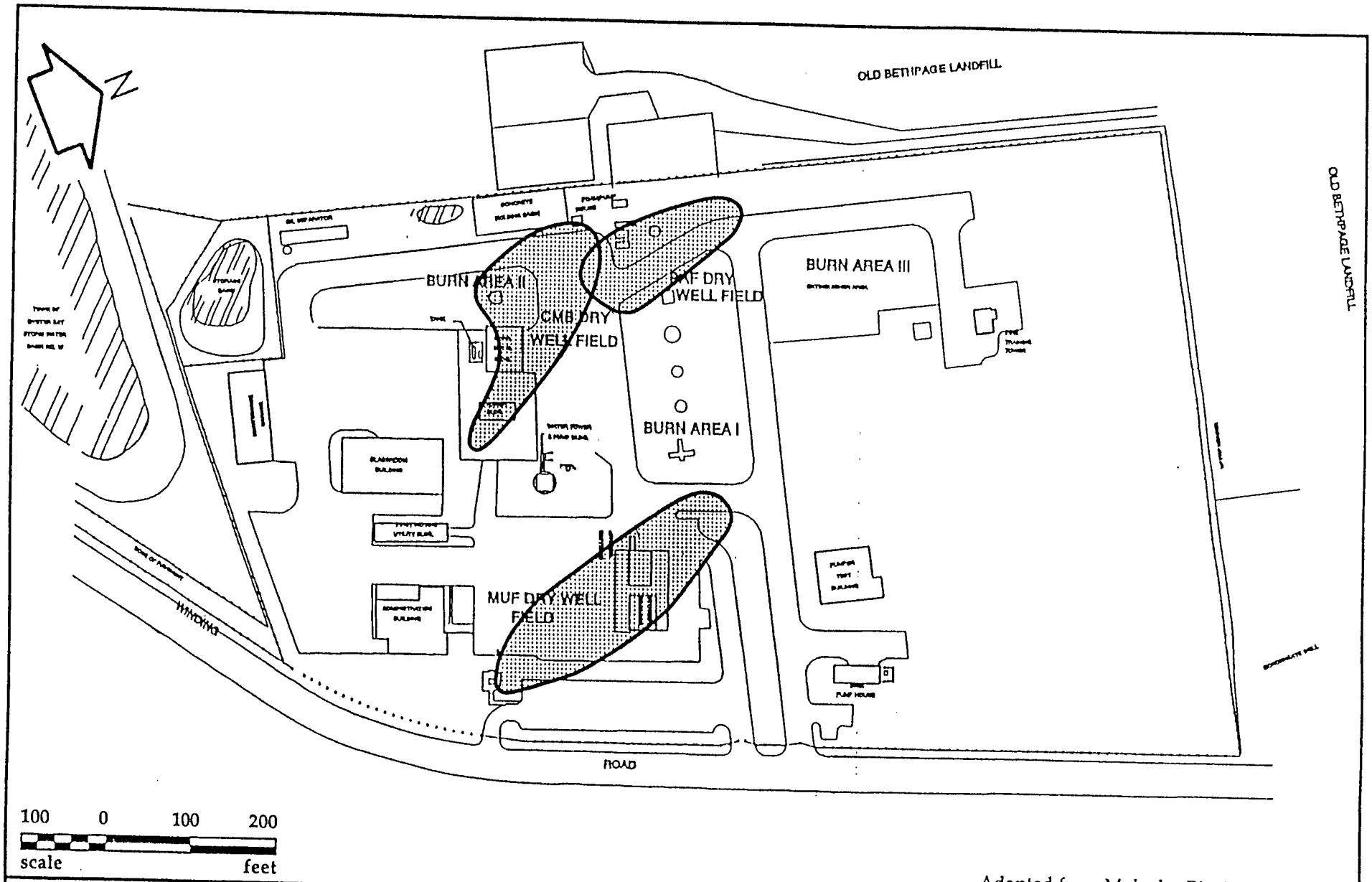
Figure 1-5
Estimated Extent Of
Off-Site Contaminant Plume
Fireman's Training Center Remedial Design
Nassau County Department Of Public Works



Adapted from Malcolm Pirnie, Inc. figure.

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Figure 1-6

On-Site Floating Product Areas

Fireman's Training Center Remedial Design
Nassau County Department Of Public Works

HEAT AND COLD STRESS

Heat Stress

Heat stress frequently occurs during hazardous waste operations because chemical protective clothing decreases natural body ventilation. It may occur any time work is being performed at elevated temperatures. This section presents guidelines for the SHSC to follow to evaluate and address heat stress conditions. The SHSC should consider weather conditions, the nature and duration of the work and the extent of employee acclimatization to determine a work/rest schedule. The schedule should be discussed with crew members and the crew should be educated on heat stress signs and symptoms and control measures. Crew members will immediately notify the SHSC of any signs or symptoms of heat stress. Crew members will observe their coworkers, as well as themselves, for signs or symptoms of heat stress.

When CDM employees perform a hazardous waste operation in ambient air temperatures above 80°F or, if they perform heavy physical labor or wear chemical protective clothing above 70°F, they will:

- Monitor temperature, humidity, radiative heat load, or subjective heat stress conditions by a method described in Section 9.1.1.
- Implement heat stress control procedures as described in Section 9.1.2 and 9.1.3, and
- Prepare to implement the first aid procedures described in Section 9.1.4

Heat Stress Monitoring

When CDM employees perform a hazardous waste operation in ambient air temperatures above 80°F or, if they perform physical labor or wear chemical protective clothing above 70°F, they will monitor heat stress, or subjective heat strain, by one of the following procedures.

- **Measure team members' heart rates** by the radial pulse for 30 seconds before they begin working. Measure it again as soon as possible after they begin a break.
- **Measure team members' body temperature** with an oral clinical thermometer before they begin working. Measure it again as soon as possible after they begin a break.
- **Measure air temperature, humidity, and radiative heat load** with a commercial heat stress monitor like the Reuter - Stokes WBGT or the Metrosonics Model 371.

Work / Rest Guidelines for Heat Stress

Work teams shall compare the heat stress measurements to the action levels described in this section. When their readings indicate a heat

stress hazard, the work team will decrease the length of the work period as described below.

Any break taken for control of heat stress must be at least 30 minutes long. When the heat stress potential is high and workers must maintain a continuing presence on the site, they should work in rotating shifts.

- If the team monitors heat stress with a commercial heat stress monitoring device, observe the work/rest schedule specified in its manual for the temperature, humidity, radiative heat, protective clothing and work load conditions.

- If the team measures heat strain by monitoring the workers' heart rates, control the length of the work and rest periods as follows. If the heart rate at the end of a work period exceeds the action level (110 beats/ minute or 40 bpm over the employee's initial rate, if that is higher), the next work period should be shortened by 33%, while the length of the rest period stays the same. If the pulse rate still exceeds the action level, at the end or the next work period, the following work cycle should be further shortened by 33%. Continue this procedure until the heart rate stays below the action level.

- If the team measures heat strain by monitoring body temperature, control the length of the work and rest periods as follows. If body temperature at the end of a work period exceeds the action level (the reading at the start of the day plus 1°F), the next work period should be shortened by 33%, while the length of the rest period stays the same. If the team member's temperature is elevated at the end of the next work period, the following work cycle should be further shortened by 33%. Continue this procedure until the body temperature stays below the action level.

Other Heat Stress Control Measures

When their heat stress measurements indicate a heat stress hazard, the work team will implement as many of the following procedures as are feasible in the circumstances. Field team members should endeavor to:

- Drink 16 ounces of water in the morning and after lunch. Do not take salt tablets unless so instructed by a physician.

- Avoid use of coffee during working hours and the consumption of alcohol during working and non-working hours. Avoid the use of prescription or recreational that reduce their capacity to withstand heat. Notify the SHSC if any of these factors need be considered.

- Acclimate to site work conditions by performing relatively non-strenuous activities the first three to five days on site. Schedule the most demanding site activities after the workers have a chance to acclimate.

- Use cooling devices to aid natural body ventilation. For example,

long cotton underwear acts as a wick to help absorb moisture and protect the skin from direct contact with hot protective clothing. These devices, however, add weight, and their use should be balanced against worker efficiency.

- o Use mobile showers and/or hose-down facilities to cool workers' or their waterproof protective clothing if a source of uncontaminated water is available.

- o Conduct field activities in the early morning or evening in very hot weather.

- o Erect break shelters to protect workers from heat. (Note: tent-like structures can intensify heat stress in some conditions). If possible, set up the site command post in the shade.

- o Consider the use of cooling devices, such as ice vests, for extreme conditions.

- o Maintain good personal hygiene by frequently changing of clothing and showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should immediately notify the SHSC.

Heat Stress Symptoms and First Aid

If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur ranging from mild (such as fatigue, irritability, anxiety, and decreased concentration, dexterity, or movement) to fatal. Because heat stress is one of the most common and potentially serious illnesses at hazardous waste sites, site workers must learn to recognize and treat the various forms of heat stress. Important types of heat illness include; heat stroke, heat exhaustion, heat fainting, and heat cramps.

Heat Stroke

Heat stroke is the most dangerous heat-related emergency. The death rate from this condition approaches 50%, even with appropriate medical care. Untreated victims almost always die.

Heat stroke is an acute and dangerous reaction to heat stress caused by a combination of a hot environment and failure of heat regulating mechanisms of the body. Persons who are elderly, obese, chronically ill, alcoholic, diabetic or those with circulatory problems are at greater risk. Brain damage and death result if the person is not cooled quickly. Team members shall implement the treatment described below immediately. A person with the following symptoms may have heat stroke.

- o Symptoms: Red, hot, dry skin, nausea, weakness, headache, dizziness, confusion, high body temperature, and rapid respiratory and pulse rates, coma, or unconsciousness. Victims do not sweat

because the sweating mechanism is overwhelmed.

- o Treatment: Get the victim to a cool place. Remove heavy clothing; light clothing can be left in place. Cool the victim quickly by any available means. If using ice, place ice packs at areas with abundant blood supply (neck, armpits, groin). If no ice is available, an effective method is to wrap victims in wet towels or sheets, and fan them. Keep the cloths wet with cool water. Cool victims until their temperature drops to 102°F. Stop at this point to prevent seizures and hypothermia. Keep head and shoulders slightly elevated. Keep the victims airway open, check breathing and circulation. Obtain medical help as soon as possible. Do not give coffee, tea or alcoholic beverages.

Heat Exhaustion and Heat Fainting

Heat exhaustion is a state of exhaustion or deep weakness caused by the loss of fluids through excessive sweating and inadequate fluid replacement. Heat exhaustion can quickly progress to heat stroke if left untreated. Team members shall implement the described treatment quickly. A person with the following symptoms may have heat exhaustion.

- o Symptoms: Pale, clammy, moist skin, profuse perspiration and extreme weakness. Body temperature is normal, pulse is weak and rapid, breathing is shallow. The person may have a headache and nausea, may vomit, and may be dizzy.

- o Treatment: Remove the person to a cool place, loosen clothing, keep victim lying down with legs up. Cool the victim by applying cold packs or wet towels or cloths. Get medical treatment. If the victim is conscious, give 1 - 2 cups water immediately, and every 20 minutes thereafter, until symptoms subside. Total water consumption should be about 1 - 2 gallons per day. Consult a physician prior to returning to work.

Heat fainting is an extreme example of heat exhaustion. This condition resembles fainting and is usually self-correcting. Treatment is similar to heat exhaustion. Victims who are not nauseated can drink water.

Heat Cramps

Heat cramps are often the first sign of a condition that can lead to heat stroke. Team members shall implement the described treatment quickly. A person with the following symptoms may have heat cramps.

- o Symptoms: Severe cramping, usually affecting arms, legs and abdomen.

- o Treatment: Remove victim to a cool area and loosen clothing. Rest the cramping muscle. Give victim cold water and do not massage the cramping muscle. Consult with physician.

Heat Rash

A person with the following symptoms may have heat rash. That person should implement the described treatment.

- Symptoms: Mild red rash, especially in areas of the body in contact with protective gear.

- Treatment: Decrease amount of time in protective gear, and apply powder to help absorb moisture and decrease chafing. Wear cotton, as opposed to synthetic, clothing.

Cold Stress

Field teams working at temperatures at or below freezing must address the hazard of cold stress. Exposure to cold can cause frostnip, frostbite or hypothermia. Fingers, toes, and ears are the most susceptible to injury.
The SHSC will ensure that employees are trained on the signs and symptoms of cold stress and employees shall notify the SHSC immediately if they experience any signs or symptoms.

When field teams operate outdoors in temperatures below 32°F, they will:

- Monitor their cold stress exposure by the methods described in Section 9.2.1.
- Implement cold stress control procedures described in Section 9.2.2
- Prepare to implement the first aid procedures described in Section 9.2.3

Cold Stress Monitoring

Whenever the outdoor temperature is below 32°F, CDM teams shall monitor cold stress conditions or their bodies' response to cold by one of the following methods. The SHSC shall discuss field conditions with the crew prior to determining the work/rest schedule and control measures.

- **Measure team members' body temperature** with an oral clinical thermometer as soon as possible after they begin a break.
- **Measure air temperature** with a thermometer and wind speed with an anemometer. Estimate the equivalent wind chill temperature from Exhibit 9-1.
- **Measure air temperature** with a standard thermometer. Subtract ten degrees from the measured temperature to adjust for wind chill.

Controls for Cold Stress

The following cold stress control procedures shall be implemented to control exposures. Field team members shall:

- Wear dry insulated clothing. Team members may wear weatherproof coveralls for their wind-breaking capacity.
- Wear one or more pairs of heavy socks in their work shoes. Properly insulated steel-toe safety boots do not represent a cold hazard.
- Avoid contact with water, metals, and organic liquids, like gasoline.

- o Advise the SHSC of any warnings of cold sensitivity printed on the pharmaceutical preparations they are taking.

- o Station or erect shelters to protect themselves from wind.

- o Take frequent breaks (15 to 30 minutes in length) when the wind chill equivalent temperature is 15°F or below.

- o Curtail field activities when the wind chill equivalent temperature is 0°F, or below.

- o Bring a spare set of dry clothing to the site so they can re-dress if their clothing gets wet.

- o Use a nose cup in any full face respirator they wear.

Cold Stress Symptoms and First Aid

If the body's physiological processes fail to maintain a normal body temperature because of excessive cold, a number of physical reactions can occur ranging from mild (such as fatigue, depression, or decreased concentration, dexterity, or movement) to fatal. Because cold stress conditions are common on hazardous waste sites, site workers must learn to recognize and control the various cold stress hazards.

Hypothermia

Systemic hypothermia results from a cooling of the body's core temperature. Hypothermia can occur at temperatures above freezing as well as below it. Field team members will immediately implement treatment as described in this section. A person with the following symptoms may have hypothermia.

- o **Symptoms:** Mild hypothermia - shivering, slurred speech, memory lapses, fumbling hands, apathy, listlessness, sleepiness, unconsciou freezing of the extremities. Profound hypothermia - Shivering has stopped. Muscles become stiff and rigid. The victim's skin has a blue appearance and doesn't respond to pain; pulse and respirations slow down, and pupils dilate. The victim may appear to be dead. More than half of all profound hypothermia victims die.

- o **Treatment:** Get the victim to a warm space. Add insulation beneath and around the victim. Cover the victim's head. Replace wet clothing with dry clothing. Handle the victim gently. If possible, place the victim in water between 100° and 105°F. For mild hypothermia, raise core temperature by using a tub of hot water (no greater than 108°F) or electric blanket (leave victim's legs and arms out). Place hot packs against areas of high heat loss, like the head, neck, chest, or groin. Do not burn the victim. The victim must not smoke. **Get immediate medical care.** If the victim is suffering from profound hypothermia (core temperature below 90°F), do **not** re-warm the victim if he or she can be transported within 12 hours. Keep the victim from getting

colder and handle gently. Avoid CPR unless the victim has no pulse.

Frostbite

Persons who have the following symptoms may have frostbite, which is any local injury resulting from cold. Team members will provide the first aid described.

o **Symptoms:**

Superficial Frostbite.

- Sudden blanching or whitening of skin may indicate frost nip or incipient frostbite. Pain may occur early and later subside. Affected part may feel only very cold and numb. There may be tingling, stinging or aching.

- Skin with a waxy or white appearance that is firm to the touch, over lower tissue that is resilient indicate superficial frostbite.

Deep Frostbite.

- Affected part feels hard, solid, and cannot be depressed.

- Blisters appear in 12 to 36 hours.

- Affected part is cold with pale, waxy skin.

- A painfully cold part stops hurting.

o**Treatment:** **Do NOT** attempt to re-warm the victim if a medical facility is nearby or if there is a chance that the part may re-freeze. Warm the victim quickly by any means at hand. If possible, place the victim in water between 102° and 106°F. Remove any clothing or constricting items that could impair blood circulation. The victim must not smoke. Keep victim warm and get **immediate medical care.** Keep the frozen parts in warm water or covered with warm clothes for 30 minutes, even though the tissue will be very painful as it thaws. Then elevate the injured area and protect it from injury. Do not allow any blisters to be broken. Use sterile, soft, dry material to cover the injured areas.

CAUTIONS:

- o Do not rub the frostbitten part, (this may cause gangrene).
- o Do not use ice, snow, gasoline or anything cold on the frostbitten area.
- o Do not give alcohol, drink or allow the victim to smoke.
- o Do not put an unconscious victim in a bathtub.
- o Do not use hot stove, radiator, heat lamp, hot water bottle, exhaust pipe or over a fire since this produces excessive temperatures and cannot be controlled, thus resulting in burns..

Immersion Foot

Immersion foot (trench foot) is caused by low oxygen levels in tissues that are frequently cold. Persons with the following symptoms may have immersion foot.

- o Symptoms: feet or fingers that remain white and painful for hours after they have been warmed up.
- o **Treatment:** The team member affected should get medical care quickly.

WIND CHILL EQUIVALENT TEMPERATURE

- If the team monitors heat stress by the adjusted temperature procedure, use this work/rest schedule (from the NIOSH/OSHA/USCG/EPA Guidance Manual) as a guideline to determine the maximum length of work periods between breaks.

Adjusted Temperature	Duration of Active Work Time (minutes) Cloth Clothing	Impermeable Clothing
~75° F	150	120
~80° F	120	90
~85° F	90	60
~90° F	60	30
≥95° F	30	15

ATTACHMENT B

TREATMENT FACILITY PROCESS FLOW AND CHEMICAL FEED SCHEMATIC