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Report

MAMARONECK TAYLOR LANE LEAF COMPOST SITE DRAFT FEASIBILITY STUDY

Village of Mamaroneck, New York

OCT 1992

October 1992
PROJECT 1547-01-1

MALCOLM PIRNIE

ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

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EXECUTIVE SUMMARY

ES.1 INTRODUCTION

The Taylor Lane Leaf Compost site, owned by the Village of Mamaroneck (Village), is currently listed in the New York State Registry of Inactive Hazardous Waste Disposal sites. In 1987, the Washington Housing alliance, a non-profit organization located in Mamaroneck, New York, proposed to develop a Senior Citizens' housing project on 1.85 acres of the site in the northeast corner. Under the requirements of pre-construction standards (New York State Environmental Quality Review Act), a draft Environmental Impact Statement (EIS) was completed by Malcolm Pirnie in July 1987 for the proposed housing project. Discussions with the Village and nearby businesses during the preparation of the EIS indicated that the site had been used as a landfill prior to 1970. As a result, Malcolm Pirnie and the NYSDEC conducted field studies to assess the subsurface environmental conditions on and adjacent to the proposed housing property. An Administrative Order of Consent between the Village and the New York State Department of Environmental Conservation (NYSDEC) was executed in August 1989 and set forth the performance standards and schedule for work at the site. Extensive ground water, surface water, soil and sediment sampling were conducted over a period to better characterize the present site conditions, leading to the site being classified as an inactive hazardous waste site.

The Village implemented Phase I of the remedial program in April 1990, and the results were compiled by Malcolm Pirnie, Inc. and presented in the "Mamaroneck Taylor Lane Leaf Compost Site Final Remedial Investigation (RI) Report (Volume 1)," submitted to the NYSDEC in June 1992. As detailed in the RI report, contamination at the site is concentrated in fill material, which is partially saturated, and is composed primarily of a matrix of silt, fine sands, ash, and miscellaneous debris. Between January and April 1992, Malcolm Pirnie, Inc. conducted additional field activities. A compilation of the results from this additional work are presented in the "Mamaroneck Taylor Lane Leaf Compost Site Supplemental Remedial Investigation (Volume 2)." In this Feasibility Study report (FS), data obtained during the RI (Volume 1) are used in conjunction with data collected during the Supplemental RI (Volume 2) to evaluate and select remedial technologies for use at the site.

ES.2 PURPOSE

This Feasibility Study (FS) has been prepared in accordance with the requirements set forth under the New York Code of Rules and Regulations of the State of New York (NYCRR) Part 375 Inactive Hazardous Waste Sites. The format of the report is generally based on the United States Environmental Protection Agency (USEPA) document, "Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA, Interim Final, October 1988." The objective of the FS report was to identify remedial alternatives which are capable of containing or remediating isolated "hot spots" of fill along the eastern borders, fill material down to a depth of 15 feet, leachate contained within the fill, and ground water beneath the fill.

ES.3 HAZARDOUS WASTE CHARACTERIZATION

The primary constituents of concern at the site are volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and heavy metals. A clear distribution or pattern of contaminants was not found in the fill, leachate or ground water data. Rather, the sampling results are consistent with a random deposition of commercial, residential, and small volumes of industrial waste, which were allegedly disposed of at the site. Table E-1 summarized the primary constituents of concern found in the "hot spots" at the berm of the site, fill, leachate, and ground water.

TABLE E-1
PRIMARY CONSTITUENTS OF CONCERN
Mamaroneck Taylor Lane Leaf Compost Site

Contaminants	"Hot Spots at Berm"	Fill	Leachate	Ground Water
VOCs	X	X	X	X (1)
SVOCs	X	X	X	
Pesticides	X	X	X	X (2)
PCBs		X		
Metals	X	X	X	X (3)

NOTES:
(1) vinylchloride, 1,2-DCE
(2) alpha-BHC, beta-BHC, gamma-BHC, Dieldrin, alpha-chlordane
(3) chromium, iron, lead, manganese, nickel, cyanide

A detailed analysis of the nature and extent of contamination is discussed in Section 1.4.

ES.4 REMEDIAL ACTION OBJECTIVES

As required under the 6 NYCRR Part 375 for inactive hazardous waste sites, remedial alternatives for the Mamaroneck Site were developed with the objective of being protective of human health and the environment. The remedial action objective will be achieved by controlling the source of contamination and eliminating the potential exposure pathway where possible. As indicated in Table E-1, the primary constituents of concern at the site are volatile, semi-volatile organic compounds, pesticides, PCBs, and metals.

The fill contaminants and isolated "hot spots" represent a potential health hazard due to the potential for exposure to contaminants via surface soils (dermal exposure) or ingestion. The preliminary objective of the remedial action for the fill and isolated "hot spots" is to reduce or eliminate the potential for exposure to contaminants via dermal contact or ingestion, and to control the source of migration from the leachate and into the ground water.

Minimal ground water contamination at the site has resulted from migration of contaminants in the leachate to the sands. However, much lower levels of the more mobile contaminants have migrated from the upper fill layers downward into the ground water within the sand layer beneath the fill. The remedial action objective for ground water is to decrease, to the extent feasible, further generation of leachate (source control), and to control the migration of contaminants that are already in the sands from farther migrating off-site.

ES.5 ALTERNATIVES THAT WILL BE FURTHER EVALUATED

Seven of the nine National Contingency Plan (NCP) criteria were used in evaluating the screened alternatives, and include the following: overall protection of human health and the environment; compliance with applicable, relevant or appropriate requirements; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost. The remaining two criteria, state and community acceptance will be considered upon the completion of the FS.

The following alternatives were retained for consideration, and further developed:

Alternative 1	No-action with Continued Monitoring and Institutional Controls.	
Alternative 2	Installation of 6 NYCRR Part 360 Cap over entire site area, with the following modifications.	
	2A	No hydrological control or containment of leachate/ground water.
	2B	With hydrologic control of the leachate/ground water via slurry walls and two containment wells. On-site pretreatment of leachate/ground water and disposal at POTW.
	2C	With hydrologic control of the leachate/ground water via trenches with two containment wells. On-site treatment of leachate/ground water and disposal at POTW.
Alternative 3	Excavation of Fill with On-Site Solidification/Stabilization with the following modifications.	
	3A	Dewatering of excavation area via trenches with temporary pretreatment and discharge to POTW.
	3B	Dewatering of excavation area via trenches and containment of ground water via containment wells. On-site treatment of leachate/ground water and disposal at POTW.
Alternative 4	Excavation of Fill with Off-Site Solidification with the following modifications.	
	4A	Dewatering of excavation area via trenches with temporary pretreatment and discharge to POTW.
	4B	Dewatering of excavation area via trenches and containment of ground water via containment wells. On-site treatment of leachate/ground water and disposal at POTW.

As indicated, each of the above alternatives were screened on the basis of the NCP criteria. A summary of the results are presented in Table E-2.

ES.6 POTENTIAL LAND USE CONSIDERATIONS

Each of the four alternatives, evaluated, with respect to future land use are discussed in detail in Table 5-1. Table E-2 summarizes the pertinent issues with respect to public access and usage, economic desirability, and future liability.

TABLE E-2
DETAILED ANALYSIS OF ALTERNATIVES

Alternative #	Overall Protection of Health and Environment	Compliance with ARARs	Long Term Effectiveness	Reduction of Toxicity Mobility or Volume	Short Term Effective	Implementable	Capital Cost/ (O&M) (Thousands)	PUBLIC ACCESS AND USAGE	ECONOMIC DESIRABILITY	FUTURE LIABILITY
1	0	–	–	–	0	+	116 (9.6)	· No public access. · Site remains vacant. · Authorized personnel only permitted on-site.	· Neighboring properties detracted by proximity to inactive hazardous waste site.	· Authorized personnel only on-site. · Future liability from potential dermal contact/ ingestion of fill. · Leachate generated; continued ground water contamination. · Village potentially receive fines for failure to remediate site.
2A	0/+(1)	0/+(1)	0	0/+	+	+	862 (49.6)	· Limited public access and usage. · Depending on site improvements, site could be used for park area, playground tennis, basketball courts, jogging.	· Neighboring properties improved. · Improvement of site by capping. · Site improvements such as park lands would create economic desirability for neighbors property and community.	· No future liability from public contact with fill material. · Alternative 2B/2C comply with ARARs for ground water; leachate contaminated.
2B	+	+	0	0/+	+	+	3,176 (383)			
2C	+	+	0	0/+	+	+	2,009 (603)			
3A	0/+	+	+	+	0/+	–	13,362 (342)	· Unlimited public access and usage depending on land improvements. · Land could be sold; used for residential commercial, or other usages, based on zoning or village ordinances.	· Once remediated, site improvements such as residential & commercial improvements could be made; increased value of neighborhood and community.	· Remediation of site complete. · Eliminate potential dermal contact or ingestion. · Protection of ground water.
3B	+	+	+	+	0/+	–	14,135 (349)			
4A	0	+	+	+	0/+	–	63,349 (333)			
4B	0	+	+	+	0/+	–	63,392 (339)			

1.0 INTRODUCTION

The Taylor Lane Leaf Compost site, owned by the Village of Mamaroneck (Village), is currently listed in the New York State Registry of Inactive Hazardous Waste Disposal sites. An Administrative Order of Consent between the Village and the New York State Department of Environmental Conservation (NYSDEC) was executed in August 1989 and set forth the performance standards and schedule for work at the site.

The Village implemented Phase I of the remedial program in April 1990, and the results were compiled by Malcolm Pirnie, Inc. and presented in the "Mamaroneck Taylor Lane Leaf Compost Site Final Remedial Investigation (RI) Report (Volume 1)," submitted to the NYSDEC in June 1992. As detailed in the RI report, contamination at the site is concentrated in fill material, which is partially saturated, and is composed primarily of a matrix of silt, fine sands, ash, and miscellaneous debris.

Between January and April 1992, Malcolm Pirnie, Inc. conducted additional field activities to better define the nature and extent of contamination in areas identified as having elevated contaminant concentrations during the RI (Volume 1). A compilation of the results from this additional work are presented in the "Mamaroneck Taylor Lane Leaf Compost Site Supplemental Remedial Investigation (Volume 2)."

In this Feasibility Study report (FS), data obtained during the RI (Volume 1) are used in conjunction with data collected during the Supplemental RI (Volume 2) to evaluate and select remedial technologies for use at the site.

1.1 PURPOSE AND ORGANIZATION OF REPORT

This Feasibility Study (FS) has been prepared in accordance with the requirements set forth under the New York Code of Rules and Regulations of the State of New York (NYCRR) Part 375 Inactive Hazardous Waste Sites. The format of the report is generally based on the United States Environmental Protection Agency (USEPA) document, "Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA, Interim Final, October 1988."

The objective of the FS report is to identify remedial alternatives which are capable of containing or remediating isolated "hot spots" of fill along the eastern borders, fill material down to a depth of 15 feet, leachate contained within the fill, and ground water beneath the fill. For the purposes of this report, the ground water contained within the fill layer is referred to as leachate. As indicated in Table 1-1, the primary constituents of concern at the site are volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and heavy metals. A more detailed analysis of the nature and extent of contamination is discussed in Section 1.4.

The ecological risk assessment presented in the RI determined that several pesticides and inorganic compounds (heavy metals) were of concern in the sediments in Magid Pond, a wetland area located west of the site. Although contaminant levels were elevated relative to sediment guidelines, it was determined that the contaminants were not directly related to the site. As indicated in Table 1-2, a comparison of sediment data from Magid Pond was made to data from similar aquatic wetlands located in nearby residential and commercial areas. Based on an analysis of the results, it appears that contaminant levels detected in Magid Pond sediments do not reflect input from the site, but rather are indicative of an area-wide condition resulting from anthropogenic non-point sources. Therefore, the FS does not address remediation alternatives for sediments in Magid Pond.

Numerous remedial technologies have been evaluated and screened on the basis of following three criteria: implementability, cost, and effectiveness. Technologies that were not eliminated during the first round of screening have been further developed into remedial alternatives according to site specific conditions. After completing a detailed evaluation for each remedial alternative, a final comparison of the alternatives was made, and the most feasible alternatives identified. Remediation alternatives have been evaluated according to seven of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) criteria, including:

- Overall protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements (ARARs) of federal and state environmental and public health laws
- Long-term effectiveness and permanence or, consistency with the remedy
- Reduction of toxicity, mobility, or volume of contaminated soils
- Short-term effectiveness
- Implementability
- Cost

Two additional NCP criteria, state acceptance and community acceptance, will be considered at the completion of the FS Report. State acceptance will be evaluated by the

TABLE 1-1

PRIMARY CONSTITUENTS OF CONCERN

CONTAMINANTS	"HOT SPOTS AT BERM"	FILL	LEACHATE	GROUNDWATER
VOCs	X	X	X	X (1)
SVOCs (paHs)	X	X	X	
Pesticides	X	X	X	X (2)
PCBs		X		
Metals	X	X	X	X (3)

(1) Vinyl Chloride; 1,2 DCE

(2) alpha-BHC, beta-BHC, gamma-BHC, Dieldrin, alpha-Chlordane

(3) Chromium, Iron, Lead, Manganese, Nickel, Cyanide

TABLE 1-2

MAGID POND COMPARATIVE DATA ANALYSIS

	MAGID POND SEDIMENT RANGE	OTTER CREEK SEDIMENT RANGE	PRYER MANOR MARSH SEDIMENT RANGE (1)	PREMIUM RIVER SEDIMENT RANGE (1)	GARDENS LAKE SEDIMENT RANGE (1,2)	NEW YORK SEDIMENT CRITERIA (4)
PESTICIDES	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
4,4'-DDE	96 - 190	43 - 110	230 - 780	<0.05 - <164	<580 - <1100	1,300 / 21.5 (5)
4,4'-DDD	120 - 260	77 - 110	160 - 280	<0.2 - <307	<580 - <1100	1,300 / 21.5 (5)
4,4'-DDT	140 - 310	77	160 - 250	<0.15 - <7,452	<580 - <1100	1,300 / 21.5 (5)
aldrin	33 - 97	14 - 16	<80 - <121.2	<0.10 - <559	<290 - <550	218.4 / 20.02 (5)
alpha-BHC	ND	6.7	<80 - <121.2	<0.05 - <394	<290 - <550	-
alpha-chlordane	35 - 84	25 - 26	180 - <800	<0.05 - <2,642 (3)	<2900 - <5500 (3)	0.156
endosulfan sulfate	ND	86	<160 - <242.4	<0.05 - 15.7 - <329	<580 - <1100	0.78
gamma-chlordane	34 - 120	29 - 47	140 - <800	<0.05 - <2,642 (3)	<2900 - <5500 (3)	0.156
INORGANICS	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
aluminum	4590 - 20,200	11,600 - 20,800	-	-	12,578	-
arsenic	6.0 - 19.7	4.4 - 13.3	-	4.1 - 13.1	25.0	5
barium	150 - 368	58.2 - 190	-	-	-	-
beryllium	ND	0.48	-	-	<0.3	-
cadmium	3.7 - 7.2	2.6 - 4.6	-	3.5 - 4.7	1.3	0.8
calcium	12,200 - 27,300	1400 - 79,300	-	-	-	-
chromium	17.3 - 62.9	37.2 - 53.9	-	7.6 - 59.2	26.6	26
cobalt	6.50	5.7 - 15.1	-	-	-	-
copper	16.9 - 180.0	33.4 - 111	-	45.0 - 243.8	65.2	19
iron	20,300 - 85,900	30,500 - 40,800	-	-	15,316	2.4%
lead	36.1 - 406.0	43 - 161	-	35.8 - 863.7	151.1	27
magnesium	3130 - 10,100	8260 - 9000	-	-	-	-
manganese	459 - 2370	261 - 424	-	-	466	428
mercury	0.32 - 0.93	0.24 - 1.2	-	2.55	0.5	0.11
nickel	12.8 - 58.7	19.2 - 29.3	-	15.9 - 53.4	17.6	22
potassium	616 - 2990	3760 - 9560	-	-	1,478	-
selenium	2.4 - 7.9	ND	-	-	1.3	-
silver	ND	ND	-	-	<0.6	-
sodium	1010 - 8460	948 - 13,000	-	-	-	-
vanadium	27.8 - 99.0	37.5 - 67.4	-	-	-	-
zinc	98.9 - 417	89.7 - 261	-	74.2 - 1,120	163.7	85

(1) For Pesticides, detection limits varied; values with a "<" indicate value was below detection limit.

(2) Inorganics values represent a composite of six samples.

(3) Values are for total chlordane.

(4) Criteria based on NYDEC Guidance Document (1989) used as guidance by the Division of Fish and Wildlife and is neither a standard nor a policy of the Department.

(5) Aquatic toxicity based criterion / Wildlife residue based criterion

- = Data Not Available

ND = Not Detected

NYSDEC in the Proposed Remedial Action Plan (PRAP), and will identify the remedial alternative preferred by the state. Community acceptance will also be evaluated by the NYSDEC in the Record of Decision (ROD) after the public comment period.

Section 1.0 of the report presents a general site description, site history, and the details of previous field investigations. General response actions and ARARs for the site are presented. To better characterize the nature and extent of contamination, detected contaminant concentrations were compared to established ARARs, and illustrated pictorially.

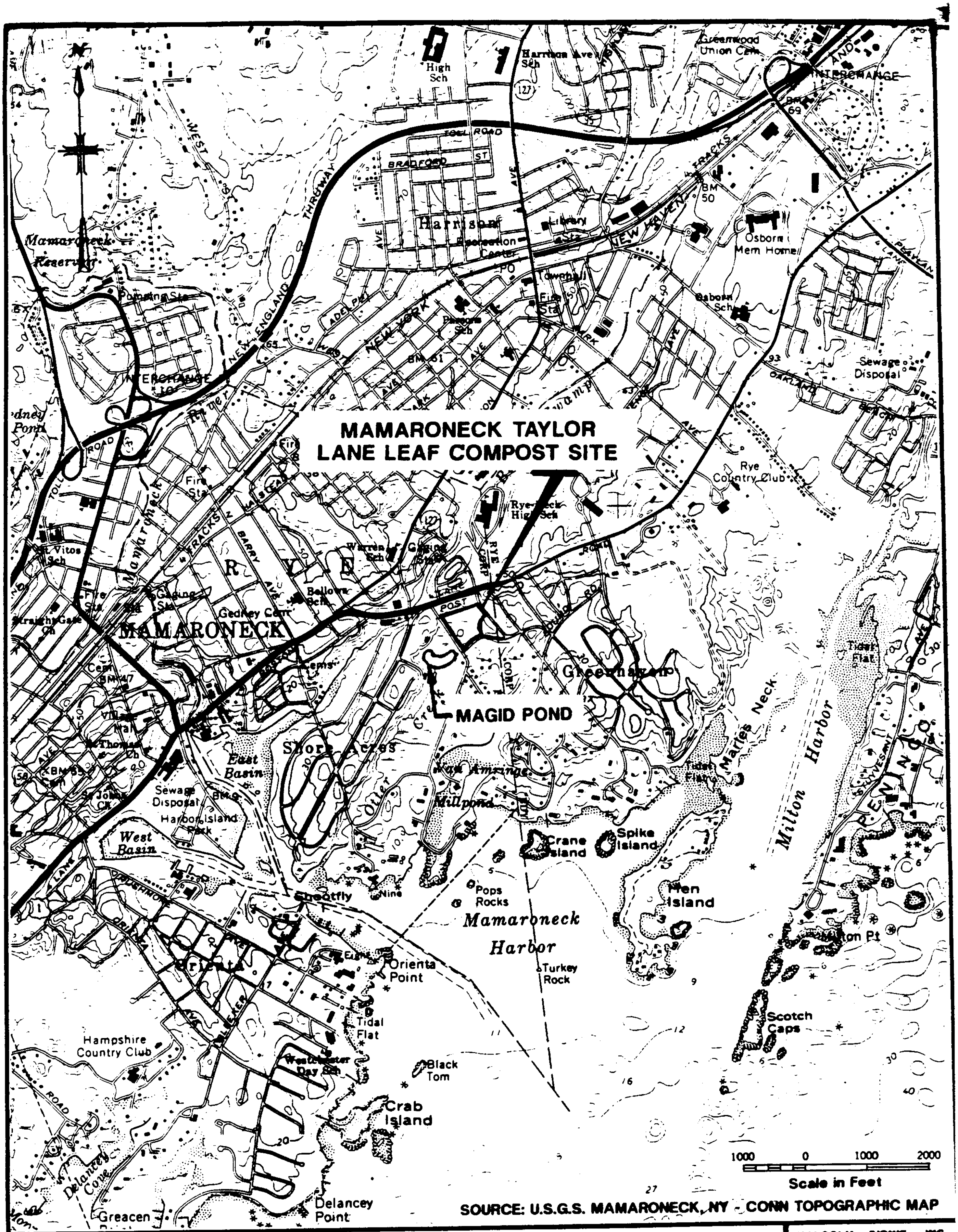
Section 2.0 of the report details the identification and screening process for various remedial technologies. In-situ technologies and excavation with on-site and off-site treatment options are presented as remedial action alternatives. Capping of the site area, with and without ground water containment system were also examined. Extraction and disposal options for leachate and ground water are described, and a summary of the preliminary screening results presented for both media.

The development of the alternatives, including the no action alternative (as required by the NCP), is presented in Section 3.0. Section 4.0 of the report presents a detailed analysis of the remedial action alternatives as compared with the NCP criteria. Section 5.0 evaluates each alternative with respect to future land use considerations.

1.2 SITE BACKGROUND

1.2.1 Site Location and Description

The Mamaroneck Taylor Lane Leaf Compost site is located in the Village of Mamaroneck in Westchester County, New York. A map presenting the geographic location of the site is given in Figure 1-1. The site is situated between Old Boston Post Road to the north, Taylor Lane to the west, Shadow Lane to the south, and Greenhaven Road to the east. A gas station, single family residence, automobile dealership, and a plant nursery are located immediately north of the site between Old Boston Post Road and the site. Single family homes border the site property on the northeast and southeast boundary. The total site area is approximately 7.5 acres and consists of grass and wood debris piles. A wetland area consisting of Magid Pond and Otter Creek is located west of the site, across from Taylor Lane.



SOURCE: U.S.G.S. MAMARONECK, NY - CONN TOPOGRAPHIC MAP

MALCOLM PIRNIE

VILLAGE OF MAMARONECK, NEW YORK

MAMARONECK TAYLOR LANE LEAF COMPOST SITE

LOCATION MAP

MALCOLM PIRNIE, INC.

FIGURE 1-1

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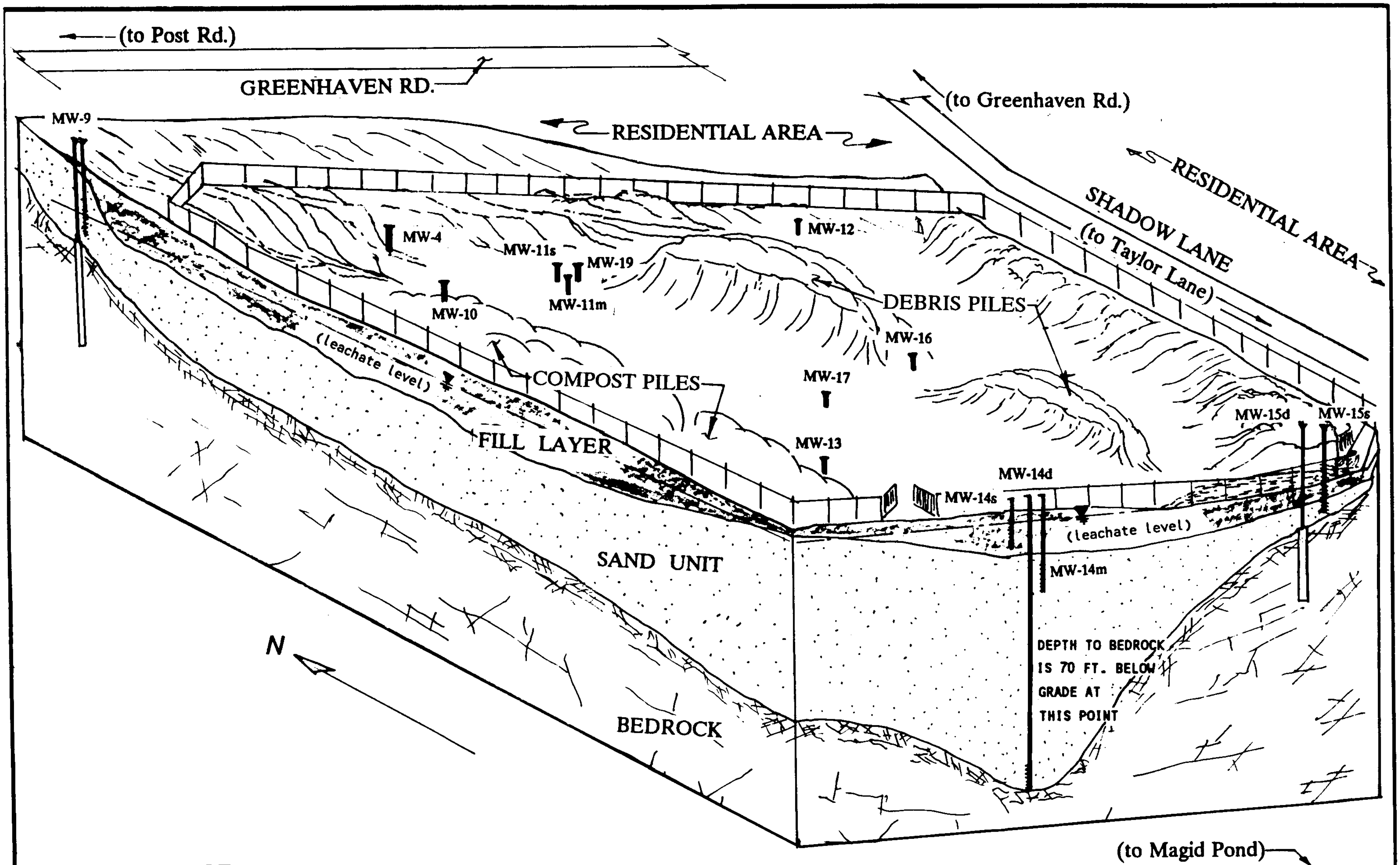

NOT TO SCALE

MALCOLM PIRNIE

MAMARONECK TAYLOR LANE LEAF COMPOST SITE
BLOCK DIAGRAM ILLUSTRATION OF
FILL LAYER, SAND UNIT and BEDROCK

MALCOLM PIRNIE, INC.

FIGURE 1-2

Figure 1-2 provides a general cross-section of the site. In general, topography drains to the site center and ground water flow is from north to south. The fill extends on average from zero to 15-feet below grade. The sands extend on average from below the fill to 40-feet below grade. Bedrock is found on average from eight feet to 80-feet below grade. Additional information on the site topography, climatology, and geology is available in the RI Report Volumes 1 (June 1992) and 2 (September 1992).

1.2.2 Site History

The site is currently owned by the Village of Mamaroneck. Since the late 1970's, approximately six acres of the southern portion of the site have been used to compost leaves and dispose of tree trunks and wood chips. The northeast corner of the site was used as a stockyard pile for a local nursery.

The Washington Housing alliance, a non-profit organization located in Mamaroneck, New York, proposed to develop a Senior Citizens' housing project on 1.85 acres of the site in the northeast corner. Under the requirements of pre-construction standards (New York State Environmental Quality Review Act), a draft Environmental Impact Statement (EIS) was completed by Malcolm Pirnie in July 1987. Discussions with the Village and nearby businesses during the preparation of the EIS indicated that the site had been used as a landfill prior to 1970. As a result, Malcolm Pirnie and the NYSDEC conducted field studies between July 1987 and July 1988, to assess the subsurface environmental conditions.

The Village and nearby businesses reported that the site was a former municipal dump which allegedly received industrial waste from the 1950's through the early 1970's. Open pits were reportedly dug for the purpose of mining gravel. However, drums, industrial liquids, and incinerator ash were allegedly placed in the gravel pits.

Between July 1987 and 1988, Malcolm Pirnie and the NYSDEC conducted initial field activities including a soil gas survey, magnetometer surveys, excavation of trenches and test pits, installation of six monitoring wells, and collection of soil and ground water samples. Based on the results of this initial investigation, the site was classified by the NYSDEC on December 7, 1988, as a Class 2 inactive hazardous waste site and placed on the New York State Superfund Registry List. The Village entered into an Administrative Order on Consent with the NYSDEC on August 14, 1989, which directed the Village to perform a four stage remedial program consisting of the following components: Remedial Investigation, Feasibility Study, Remedial Design and Remedial Action. This document, upon the approval of the NYSDEC, will satisfy the RI/FS requirement of the remedial program. Table 1-3 presents a chronological summary of key events that have occurred at the Mamaroneck site from its inception as a leaf composting facility, to present day conditions.

1.3 PREVIOUS INVESTIGATIONS

All associated field activities at the Mamaroneck Taylor Lane site were conducted by Malcolm Pirnie under the observation of the NYSDEC. The physical setting and extent of leachate and ground water contamination at the site were the focus of the initial RI and Supplemental RI. Details regarding methodology and results of these field activities are available in Volumes 1 and 2 of the "Mamaroneck Taylor Lane Leaf Compost Site Remedial Investigation Reports."

1.3.1 Remedial Investigation (Volume I)

A series of monitoring wells were installed at the site to monitor the ground water flow in both the vertical and horizontal directions, and to provide additional information on subsurface geological conditions. However, monitoring well MW-1 was a previously installed well not under a Work Plan approved by the NYSDEC, and was therefore not sampled by Malcolm Pirnie. In February 1988, Malcolm Pirnie installed three additional monitoring wells, MW-2, MW-3, and MW-4 on the site. Ground water sampling in the wells was performed in March 1988. Three subsequent wells, MW-5, MW-6, and MW-7 were installed in April 1988 and additional ground water samples were collected in June 1988. Between November and December 1990, 12 additional monitoring wells were installed. Six of the 1990 monitoring wells were placed as clusters at the following three locations: MW-9, MW-14, and MW-15. In two of the clusters, the deep well was drilled into bedrock (MW-9 and MW-15); however, at MW-14, the deep well was screened at a depth just above the overburden/bedrock interface. At the remaining six locations on site, MW-10, MW-11, MW-12, MW-13, MW-16, and MW-17, the wells were constructed as shallow ground water monitoring wells.

Surface water and sediment investigations were conducted by Malcolm Pirnie in May and September 1990, and again in October 1991, to characterize the chemical quality of both on-site and off-site water bodies. One surface water and one sediment sample was collected

TABLE 1-3

CHRONOLOGY OF SITE HISTORY ACTIVITIES
Mamaroneck Taylor Lane Leaf Compost Site

Date	Description of Event
Prior to 1970	Site used as a municipal waste landfill. Industrial and incinerator ash allegedly disposed of.
July 1987	Malcolm Pirnie, Inc. conducts field studies to assess the subsurface environmental conditions, under the observation of the NYDSEC.
December 1988	Site classified as a Class 2 hazardous waste site and placed on the New York State Superfund Registry.
August 1989	Village enters into an Administrative Order on Consent with the NYSDEC to perform a four stage remedial program, including: a Remedial Investigation, Feasibility Study, Remedial Design and Implementation.
May 1990	On-site surface water and sediment investigations conducted by Malcolm Pirnie, Inc. One surface water and one sediment sample collected from each of the two standing water areas located in the northern portion of the site. One round of ground water sampling conducted in Magid Pond.
October 1990	Malcolm Pirnie, Inc. conducted excavation of 44 soil trenches, and collected soil samples from eight of the trenches.
November 1990	Nineteen soil borings ranging from a depth of 8 to 78 feet were drilled to determine the depth of fill material, nature of underlying soils, and depth to bedrock in selected areas.
December 1990	Twelve additional monitoring wells were installed, supplementing the six existing wells. Two monitoring wells were placed as clusters in three locations.
January 1991	Two rounds of ground water sampling were collected from the twelve newly installed wells and from two of the previously installed wells. Soil sampling was conducted and consisted of two hand borings on the eastern berm.
August 1991	Supplemental soil sampling was conducted and consisted of seven hand borings.

TABLE 1-3
(Continued)

CHRONOLOGY OF SITE HISTORY ACTIVITIES
Mamaroneck Taylor Lane Leaf Compost Site

Date	Description of Event
January 1992	Malcolm Pirnie, Inc. performed supplemental field work including the installation of three additional wells, and seven piezometer clusters. Draft Remedial Investigation Report submitted to the NYSDEC for their review and comment.
April 1992	Malcolm Pirnie, Inc. and the NYSDEC jointly conducted a pumping test. Water levels were monitored in the pumping well and in the observation wells and at piezometer locations. Pumping test was condujcted for 24-hours at a rate of 1 gpm.
May 1992	Draft Remedial Investigation Report (Volume 2) submitted to the NYSDEC for review.
June 1992	Final Remedial Investigation Report (Volume 1) approved by the NYSDEC.
August 1992	NYSDEC conducts public information meeting to discuss the results of the Remedial Investigation Report.

from each of the two standing water areas located in the northern portion of the site. In addition, one sediment sample and one surface water sample was collected from the ditch located on the east side of Taylor Lane. The samples were analyzed for Target Compound List (TCL) parameters and Target Analyte List (TAL) parameters, landfill leachate parameters (including most conventional water quality parameters as described in the RI), and Total Petroleum Hydrocarbons (TPH). TCL includes the following parameters: volatile organic compounds, acid/base/neutral extractable compounds (semi-volatiles), and pesticides/PCBs (polychlorinated biphenyls). Metals and cyanides are included on the list of TAL parameters. TPH are analyzed individually.

Soil trenching was also conducted during October 1990. Trench locations were selected on the basis of previous geophysical and soil gas survey results. A total of 44 trenches were excavated, and soil samples were collected from eight of the trenches for TCL/TAL and TPH analysis.

Nineteen soil borings ranging from a depth of 8 to 78 feet were drilled from November 5 through 27, 1990 to determine the depth of fill material, nature of underlying soils, and depth to bedrock in selected areas. Continuous split-spoon samples were collected from the ground surface to an approximate depth of 10 to 14 feet, with samples continuing every 5 feet thereafter, to a total depth of approximately 5 feet below the fill material. Four borings on the west side of the site were drilled to refusal to confirm the depth to bedrock indicated from geophysical surveys. Supplemental soil sampling was conducted in August 1991 and consisted of seven hand borings: HB-3 through HB-9. Hand borings HB-1 and HB-2 had been previously dug on the eastern berm in January 1991.

Two ground water sampling rounds were conducted at the site under the initial RI. The first round of sampling was performed during January 1991, and the second round on April 8 and 9, 1991. Samples were collected from the 12 newly installed wells, and from two of the three previously installed wells (MW-4, MW-6). As previously indicated, MW-1 was not sampled due to the lack of inspection at the time of its construction. Samples were collected and analyzed for full TCL/TAL parameters, as well as landfill leachate parameters, and TPH.

1.3.2 Supplemental Remedial Investigation (Volume 2)

Based on the NYSDEC determination that additional information was needed to fully characterize the site, Malcolm Pirnie performed supplemental field work between

January and April 1992. As part of the Supplemental RI, three additional wells, (MW-11M, MW-14M, MW-19) and seven piezometer clusters, (PZ-1, PZ-2, PZ-3, PZ-4, PZ-5, PZ-6, PZ-7) were installed at pre-determined NYSDEC approved locations.

A total of six fill samples and three sand layer samples were collected and analyzed for cation exchange capacity (CEC) and total organic carbon (TOC) from borings at the locations of wells MW-11M, MW-14M, and PZ-4. The CEC and TOC data were evaluated to determine the capacity of the soils to retard the migration of contaminants from the fill into the ground water.

Three ground water samples from MW-11M, MW-14M, and MW-19, and one surface water sample were collected during the Supplemental RI, and analyzed for full TAL/TCL parameters, oil and grease, bicarbonate, carbonate, and TSS. The purpose of performing these analyses was to evaluate treatment and disposal alternatives during the FS. The ground water samples were also analyzed for NYCRR Part 360 landfill leachate parameters, to provide data used in the comparison of ground water quality data collected during the initial RI (Volume 1). Ground water samples were also collected from newly installed wells MW-11M, MW-19, and MW-14M. One surface water sample was collected in the area of staff gage SG-4, in the southern corner of the site.

In April 1992, Malcolm Pirnie and the NYSDEC jointly conducted a pump test on MW-19. Water levels were monitored in the pumping well and in the observation wells, MW-11M, MW-11S, and at piezometer locations, PZ-2S, PZ-2D, PZ-1S, and PZ-1D. Background water levels were collected in MW-17, which screens the same zone as the pumping well and would reflect changes in the natural conditions of the aquifer, but would be outside the zone of influence of pumping. The details of the pumping test can be found in Volume 2 of the RI.

1.4 NATURE AND EXTENT OF CONTAMINATION

The field activities which were previously described in Section 1.3 were conducted to characterize the nature and extent of contamination at the site. Based on an extensive review of the data, it appears that contamination at the Taylor Lane site is concentrated primarily in the fill layer (in the soils and ground water contained within the fill, which is referred to as leachate for purposes of this report), and to a lesser extent in the ground water in the sand unit. A clear distribution or pattern of contaminants was not found in the soils, leachate or ground water data. Rather, the sampling results are consistent with a random deposition of commercial, residential and small volumes of industrial waste, which were all allegedly disposed of at the site.

1.4.1 Nature and Extent of Contaminants in Fill/Soils Material

During field investigations, a total of twenty-four soil (fill) locations were sampled at the Mamaroneck site. Of these 24 locations, 13 samples were taken from soil borings, 6 from trench samples, 4 from monitoring well borings, and 2 from hand boring samples. Each soil (fill) sample was analyzed for full Target Compound List (TCL) and Target Analyte List (TAL) parameters, as well as Total Petroleum Hydrocarbons (TPH).

A review of the data indicates that the spatial distribution of volatile compounds in the fill is sporadic and discontinuous. However, the highest concentrations of total volatile compounds contained in the fill layer were predominantly located near MW-11. In addition to MW-11, volatile compounds were also detected in four fill samples (TR-04, TR-13, SB-03, SB-07). Volatile compounds detected throughout the site are as follows: acetone, ethylbenzene, 4-methyl-2-pentanone, styrene, toluene, xylene, benzene, tetrachloroethene, and methylene chloride.

TCL semi-volatile compounds were also detected sporadically over much of the site. Exceptions occur on the southeastern perimeter of the site where two samples, TR-13, and TR-15, had no detectable semi-volatile compounds. Naphthalene is the major semi-volatile contaminant detected in the fill, with a maximum concentration of 19,000 ug/kg in monitoring well soil boring MW-11. In addition to naphthalene, fluoranthene, chyrsene, and phenanthrene were also detected.

TCL pesticide concentrations were detected throughout the site area at generally low levels. The maximum detected concentration of 4,4'-DDD occurred at the location of soil boring, SB-13, at a value of 7,500 ug/kg. The major pesticides detected in the fill were the following: alpha-chlordane, gamma-chlordane, and 4,4'-DDT, alpha-BHC, gamma-BHC and delta-BHC. Some of the previously listed pesticides may originate from the composting operations conducted on the site prior to the RI investigation, when lawn clippings and leaf collections from throughout the community were brought to the site. The common use of pesticides on lawn and garden debris disposed of at the site may account for the low pesticide concentrations detected.

PCBs were not detected in any trench boring samples. Concentrations of PCBs in the soil borings and monitoring well borings ranged, with the maximum concentration occurring in soil boring location MW-11 at a value of 120,000 ug/kg.

TPH data indicate that detected concentrations were sporadic, but low throughout the site. The maximum concentration detected on-site was in soil boring location MW-11, at a level of 26,000 ug/kg.

TAL inorganic parameters were detected in the fill throughout the site and may result from incomplete burning of the ash, cinder, and slag contained in the fill. Low temperature combustion of coal, wood, and other flammable materials will preferentially concentrate naturally occurring metals in the residue. The overall occurrence of metals shows concentrations above typical NY State background compositions throughout the site. The most frequently detected inorganic compounds in the fill are as follows: arsenic, barium, cadmium, chromium, copper, lead, mercury, zinc, and cyanide.

1.4.2 Nature and Extent of Contaminants in Leachate

A total of 12 monitoring wells were sampled for leachate during field investigations, and were analyzed for the TCL/TAL parameters. TCL volatile compounds were detected during both rounds of ground water sampling, and are concentrated in the vicinity of monitoring well MW-11. Total volatile compound concentrations occur generally in a north-south trending area. The concentrations diminish rapidly with increasing distance from monitoring well MW-11. The primary contaminants detected are as follows: toluene, xylene, 4-methyl-2-pentanone, and ethylbenzene.

TCL semi-volatile compounds were also sporadically detected throughout the site, ranging in concentration from no detect (MW-6, MW-10, MW-12, MW-14 and MW-15) to 130 ppb in MW-11S. The major semi-volatile organic compounds detected on-site were dibenzofuran, bis-2-ethylhexylphthalate, benzylalcohol, and 2-methylnaphthalene.

Low concentrations of TCL pesticides were detected in the leachate over much of the site. Pesticides were detected in concentrations ranging from no detect (ND) in the location of MW-6 and MW-15, to 870 ppb of 4,4'-DDD in MW-11. The most frequently detected pesticides on-site are the following: 4,4'-DDE, alpha-chlordane, and alpha-BHC.

PCBs were detected only in monitoring wells MW-10 and MW-17. In MW-10, the level of Aroclor-1254 was 420 ppb, and in MW-17 the detected concentration was 0.75 ppb.

TAL inorganic parameters in the leachate were heterogeneously detected throughout the site; however, several individual inorganic compounds had localized high concentrations. The following inorganic compounds occurred frequently throughout the site: aluminum, arsenic, beryllium, cadmium, chromium, lead, nickel, zinc, and cyanide.

1.4.3 Nature and Extent of Contaminants in Ground Water

A total of 14 ground water samples and one field duplicate sample were collected from the 12 new monitoring wells and two existing site wells during each sampling event. The only volatile organic compounds detected in the ground water were dichloroethene and vinylchloride. Bis-2-ethylhexylphthalate was the only semi-volatile organic compound detected in the ground water in the lower sand unit, and was detected in the location of MW-14D. No PCBs were detected in any of the monitoring wells. Pesticides were detected in MW-11M and MW-14M, at levels of 0.270 ppb, and 0.039 ppb, respectively. The inorganic compounds detected in the ground water were similar to those observed in the leachate. The maximum concentration of total lead occurred in the location of MW-9D, at a level of 76.3 ppb, and the maximum concentration of cyanide was found in MW-14M, at a level of 70.8 ppb.

1.4.4 Nature and Extent of Contaminants in Magid Pond

The compounds of concern in Magid Pond include: total PAHs; bis (2-ethylhexyl) phthalate; 4,4'- DDT, DDD and DDE; aldrin; chlordane; endosulfan sulfate; aluminum; barium; copper; iron; lead; mercury; and vanadium. Several of the compounds identified, particularly, the PAHs, bis (2-ethylhexyl)phthalate, and inorganics compounds, are ubiquitous in the environment, and are typically found in road runoff and storm water in highly populated areas. As previously indicated, the presence of these compounds in the Magid Pond/Otter Creek area may not be the result of contamination at the Taylor Lane site, but partially or entirely a result of storm water runoff from adjacent roads, and residential and commercial development.

1.4.5 Nature and Extent of Contaminants in Ambient Air

During RI activities, very low levels of volatile gases were detected by the HNu. Background HNu levels appear to equal 0.2 ppm calibration gas equivalents at nearly all times. Occasional HNu readings up to 0.4 equivalents were registered. No Lower Explosive Limit (LEL) readings above zero were registered. It does not appear that the site is offgasing ionizable volatiles, and the low HNu levels appear to represent normal background levels and variability. However, the potential generation of explosive and combustible gases would need to be further monitored during the implementation of any remedial action at the site.

1.4.6 Summary of Fate and Transport of Contaminants and Findings of Human Heath Risk Assessment and Environmental Risk Assessment.

Fate and Transport

The fate of site contaminants appears to be primarily controlled by the high percentage of organic carbon content of the compost, fill, and underlying unconsolidated sediments. Contaminants can be expected to adsorb onto particle surfaces and the overall potential for contaminant migration appears limited. Volatile contaminants show minor movement in the direction of ground water (leachate) flow particularly in the vicinity of monitoring well MW-11. The low frequency of detection of semi-volatile compounds in the ground water indicates the limited potential for leaching from the fill to occur.

Pesticide migration appears limited to the vicinity of monitoring well MW-11, where leaching to the ground water from areas with elevated concentrations in the fill appears to be occurring. PCB migration is very limited and appears concentrated around monitoring well MW-10.

Inorganic contaminants exhibit limited potential for migration. Limited leaching from the fill into the ground water can be expected with re-adsorption back onto other particulates. The CEC and TOC results, detailed in the RI (Volume 2), support the conclusion that the organic and inorganic compounds will preferentially bind and adsorb to the fill material, thus significantly reducing the mobility of the contaminants from the site.

Human Health Risk Assessment

A risk assessment for the site was performed as a supplement to the Remedial Investigation (Volume 1 - Appendix N). The quantitative risk assessment developed "reasonable maximum exposure scenarios" to estimate the magnitude and likelihood of potential risks associated with the unremediated site. Although there were many chemicals detected on site, only a handful effected the risk estimates. These compounds were: arsenic, lead, and polycyclic aromatic hydrocarbons (PAHs). In particular, lead concentrations in the surficial soils, the berm, on-site surface water, and ground water are of concern from a non-cancer standpoint.

From a cancer risk standpoint, the PAHs are cause for some concern. Other chemicals of lesser concern included arsenic and PCBs. Generally, the USEPA sets as a threshold target for remediation, residual risks from 10^{-4} to 10^{-6}. The risks calculated for the Mamaroneck site generally fell within this range.

The human health risk assessment provided an analysis of baseline risks in the absence of any major action to control or mitigate site contamination. In accordance with USEPA guidance, the analysis addressed the consequences of "reasonable maximum exposure" to site contaminants. The USEPA recommends use of this approach, which yields the maximum exposure that is reasonably expected to occur at a site.

Included in the analysis were three exposure scenarios:

1. Exposure to workers in the event that leaf composting operations on the site resume without any remediation. Frequent contact with the most heavily contaminated surficial soils is assumed;

2. Exposure to residents from contaminants in the berm at the site perimeter and in soils on the residential side of the stone wall at the eastern edge of the site. The berm is located partially outside the fence directly adjacent to residential property. Frequent contact with the most heavily contaminated material in the berm is assumed, and a child is assumed to be the most likely individual exposed; and

3. Exposure to trespassers who may gain access to the site in its current condition. Contact with the most heavily contaminated surficial soils is assumed. It is also assumed that the trespasser may also come in contact with sediment and surface waters while on the property.

Elevated concentrations of lead in surficial soils, the berm, sediment, surface and ground water contribute to a health concern from a non-cancer standpoint. The USEPA has an interim soil lead guideline of 500 to 1,000 mg/kg, the lower limit of which is exceeded in on-site soil and berm samples.

From a cancer risk standpoint, the carcinogenic PAHs also are cause for some concern; however, the analysis was heavily weighted due to the fact that all PAHs having some evidence of carcinogenicity were conservatively treated as if they were as potent as benzo(a)pyrene. The residual risks calculated still remain generally within the USEPAs target range of 10^{-4} to 10^{-6}.

Other exposure pathways were also examined. Monitoring data acquired during the remedial investigation indicate that fugitive dusts or vapors are not a problem at this time, and thus the surrounding neighborhood would not be expected to be at risk. There is a potential for basements to flood with ground water from the site; however, no residential properties lie downgradient of the site.

Environmental Risk Assessment

The Environmental Risk Assessment of the Taylor Lane site also included off-site areas. Contamination present in surface water and sediment in the Magid Pond/Otter Creek (off-site) area may present a potential risk to wildlife inhabiting the area. It should be noted however, that field investigations have shown that Magid Pond and Otter Creek appear to be thriving ecosystems, with a variety of wildlife species. Large numbers of waterfowl are known to use the area, and a successful breeding pair of mute swans was observed, with three young. No records exist of fish kills in the area (Nature Conservancy personal communication, 1991) and no signs were seen of stressed conditions.

1.5 SUMMARY OF ARARs/SCGs

This section presents site-specific cleanup criteria to be used in the evaluation of alternatives for remediating of the Taylor Lane site. Three categories of criteria are applicable to this remediation: applicable or relevant and appropriate requirements (ARARs), New York State standards, criteria, and guidelines (SCGs), and criteria to be considered (TBCs).

Chemical-specific ARARs are defined in the NCP, 40 CFR 300.5, as promulgated federal or state standards, requirements, criteria, or limitations that are determined to be legally enforceable and generally applicable for site conditions. ARARs derived from state regulations that are more stringent than comparable federal ARARs will be used in accordance with the requirements of the NCP.

SCGs are criteria specifically related to New York State. These SCGs include promulgated standards as well as State guidelines and procedures. Criteria to be considered (TBCs) category, as defined in 40 CFR 300.400, consists of advisories, criteria, or guidance that were developed by federal or state agencies that may be useful in developing site remedies, and may include New York State SCGs.

1.5.1 Cleanup Criteria for Soil

For the purposes of this report, cleanup criteria for contaminated fill were based on guidance criteria for soil. Table 1-4 presents the soil ARARs/SCGs for the site. The soil parameters listed in this table include the maximum concentration of constituents which have been detected on the site during the RI (Volumes 1 and 2).

Since there are no promulgated Federal or New York State standards available for the cleanup of contaminated soils, the Division of Hazardous Waste Remediation, Proposed Division Technical and Administrative Guidance Memorandum (TAGM) titled "Determination of Cleanup Goals", served as a TBC or SCG, and provided a basis and procedure to determine soil cleanup levels at the site. The TAGM utilizes the following elements to determine soil cleanup goals:

1. Background values for heavy metals.
2. Environmental concentrations which would be protective of ground water/drinking water quality, based on a model for organics.

According to the first TAGM criteria, usage of background values for heavy metals is based on the analysis of background soil samples, which are to be collected near the site at locations free from the influences of the site or other sources of contamination. However, these data were unavailable at the Mamaroneck site and therefore, the NYSDEC Division of Fish and Wildlife soil concentrations for inorganics were used instead. The second element, the model for organics, predicts allowable soil concentrations based on several factors, including: the organic carbon content of the soil, the partition coefficient between water and soil, solubility, and ground water drinking water standards. Based on an organic carbon content of the fill material at the site, soil cleanup goals were calculated for the Taylor Lane Site. These calculated values are presented in Table 1-4. These numbers would need to be refined during the remedial design following additional sampling and analysis for organic carbon at the site.

1.5.2 Cleanup Criteria for Leachate/Ground Water

The ground water contained within the fill layer for the purposes of this study is classified as leachate. However, as a preliminary screening criteria, the concentrations detected in the leachate were compared with NYSDEC Class GA drinking water standards.

TABLE 1-4
MAMARONECK FEASABILITY STUDY
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)/TO BE CONSIDERED(TBCs)
FILL/SOILS

Contaminants of Concern	Highest Level Detected Onsite (mg/kg)	NYSDEC Fish & Wildlife – Background Composition of Soils (mg/kg)	NYSDEC DRAFT TAGM Soil Goals mg/kg)	DATA REQUIRED FOR CALCULATIONS OF NYSDEC DRAFT TAGM					
				Cs (mg/kg)	f	Koc (mg/L)	Cw (ug/L)	Solubility (mg/L)	DAM
VOLATILES									
Acetone	20J		855	462.5	3.7	2500	50	3.42	1.85
Benzene	0.001J		154	1.5355	3.7	83	5	1750	100.00
2-Butanone	0.052				3.7	not listed	50	not listed	
Ethylbenzene	40		2035	20.35	3.7	1100	5	152	100.00
Methylene Chloride	16B		1098	370	3.7	20000	5	8.8	2.97
4-Methyl-2-Pentanone	3.6J				3.7	none	50	none	
Styrene	320				3.7	not listed	5	not listed	
Tetrachloroethene	0.003J		673	6.734	3.7	364	5	150	100.00
Toluene	0.3J		555	5.55	3.7	300	5	535	100.00
Xylenes	270		444	4.44	3.7	240	5	198	100.00
SEMI-VOLATILES									
Acenaphthene	0.71J		1574	851	3.7	4600	50	3.42	1.85
Acenaphthylene	2.6J				3.7	2500	none	3.9	1.97
Anthracene	6.4		25900	25900	3.7	140000	50	0.045	1.00
Benzo (a) Anthracene	21		511	510.6	3.7	1380000	0.1	0.0057	1.00
Benzo (b) Fluoranthene	21		407	407	3.7	550000	0.2	0.0012	1.00
Benzo (k) Fluoranthene	11		407	407	3.7	550000	0.2	0.0043	1.00
Benzo (a) Pyrene	17		4070	4070	3.7	5500000	0.2	0.0012	1.00
Benzo (g,h,l) Perylene	9.8				3.7	1600000	none	0.0007	1.00
Bis (2-Ethylhexyl) Phthalate	8.0				3.7	not listed	50	not listed	
Butylbenzylphthalate	220				3.7	not listed	100	not listed	
Chrysene	18		148	148	3.7	200000	0.2	0.0018	1.00
Dibenzo (a,h) anthracene	1.7J				3.7	not listed	0.3	not listed	
Dibenzofuran	0.14J				3.7	not listed	50	not listed	
Di-n-Butylphthalate	110J		35859	31450	3.7	170000	50	1.3	1.14
Fluoranthene	48		7030	7030	3.7	38000	50	0.0206	1.00
Fluorene	1.7 J		1756	1350.5	3.7	7300	50	1.69	1.30
Indeno (1,2,3-cd) Pyrene	11		2368	2368	3.7	1600000	0.4	0.00053	1.00
2-Methyl Naphthalene	3.3J				3.7	not listed	50	not listed	
Naphthalene	19				3.7	not listed	10	not listed	
4-Nitrophenol	43J				3.7	not listed	1	not listed	
Phenanthrene	23		2590	2590	3.7	14000	50	1	1.00
Pyrene	43		7030	7030	3.7	38000	50	0.132	1.00
1,2,4-Trichlorobenzene	500J				3.7	9200	none	3	1.73
PESTICIDES/PCBs									
Aldrin	0.025		71	71.04	3.7	96000	0.2	0.18	1.00
alpha-BHC	2.1				3.7	not listed	none	not listed	
beta-BHC	0.57				3.7	not listed	none	not listed	
delta-BHC	1.4				3.7	not listed	50	not listed	
gamma-BHC	0.46				3.7	not listed	0.2	not listed	
alpha-Chlordane	2.1		25900	25900	3.7	140000	50	0.56	1.00
gamma-Chlordane	2.4		25900	25900	3.7	140000	50	0.56	1.00
4,4'-DDD	7.5				3.7	770000	none	0.1	1.00
4,4'-DDE	1.2				3.7	4400000	none	0.04	1.00
4,4'-DDT	1.1				3.7	243000	none	0.005	1.00
Dieldrin	1.3				3.7	1700	none	0.195	1.00
Heptachlor	0.004				3.7	12000	none	0.18	1.00
Heptachlor Epoxide	0.011		0.16	0.1626	3.7	220	0.2	0.35	1.00
Aroclor 1016	12				3.7	not listed	none	not listed	
Aroclor 1242	0.075				3.7	not listed	none	not listed	
Aroclor 1254	7.8				3.7	not listed	none	not listed	
Aroclor 1260	2.2				3.7	not listed	none	not listed	
INORGANICS									
Antimony	38.80	0.2 – 10			3.7	none	none	none	
Arsenic	48	3 – 12			3.7	none	25	none	
Barium	1390	15 – 600			3.7	none	1000	none	
Berylium	2.70	0 – 1.75			3.7	none	1	none	
Cadmium	69.60	0.001 – 1.0			3.7	none	5	none	
Calcium	299000	130 – 35,000			3.7	none	10	none	
Chromium	123	1.5 – 40			3.7	none	50	none	
Cobalt	12.40	2.5 – 60			3.7	none	5	none	
Copper	2770	<1 – 15			3.7	none	200	none	
Cyanide	3.8	0.01–1			3.7	none	none	none	
Iron	111000	2,000 – 550,000			3.7	none	300	none	
Lead	4030	1–12.5			3.7	none	15	none	
Magnesium	9710	1,700–6,000			3.7	none	none	none	
Manganese	775	50 – 6,000			3.7	none	50	none	
Mercury	2.20	0.042 – 0.066			3.7	none	2	none	
Nickel	138.0	0.5–25			3.7	none	100	none	
Potassium	3340	8,500 – 43,000			3.7	none	none	none	
Silver	72.6	0.1–1			3.7	none	50	none	
Zinc	1120	37–60			3.7	none	300	none	

NOTES:

f	Fraction of organic carbon of the soil medium (3.7 for Mamoroneck)
Koc	Partition coefficient between water and soil media
Cw	Allowable water concentration (class GA ground water)
Cs	Allowable soil concentration
DAM	Dilution and Attenuation Multiplier

The New York State Water Quality Regulations - Ground Water Classifications and Standards for aquifer classification (GA, 6 NYCRR Part 703.5), are used to protect human health and the environment. These standards are listed in Table 1-5 as NY ground water standards. The standards, determined to be appropriate requirements for the ground water at the site, identify Class GA ground water as fresh ground water within the unconsolidated zone or consolidated rock or bedrock that is suitable as a potable water supply source. Section 703.5(a)(3) provides standards for some of the contaminants found in the ground water at this site. In addition, since one of the treatment options being further evaluated during the FS requires discharge to a POTW, either with or without on-site pretreatment, the contaminant concentrations for regulated pollutants were compared with the daily allowable averages accepted by the local POTW under the Westchester County Environmental Facilities Sewer Act.

For those compounds that did not have published Class GA standards, the New York State Sanitary Code for Drinking Water Supplies (10 NYCRR Subpart 5-1) Maximum Contaminant Levels (MCLs) were used, and are listed in Table 1-5 as NY MCLs. These State MCLs are required under the ground water standards described above. Most of the MCLs will be utilized as chemical-specific ARARs for each of the contaminants identified in the risk assessment.

The Federal Safe Drinking Water Act MCLs also provide standards for the treatment of ground water for use in the public potable water supplies, and was used in those instances were no state guidance was available. These standards are referenced in Table 1-4 as USEPA MCLs. These standards are applicable and relevant for use at this site.

Discharge of leachate and ground water to the Publicly-Owned Treatment Works (POTW) would be regulated by the Westchester County Environmental Facilities Sewer Act, Local Law No. 12-1985, and requires that the maximum daily discharge of volatile organic compounds be less than 2,100 ppb. In addition, there are several inorganic compounds with permissible allowable discharges, and are detailed in Table 1-5.

The New York Ambient Water Quality Criteria, 6 NYCRR 703.5 would apply to surface water discharges. The criteria listed in Table 1-5 detail the standards for Class D surface waters, which are applicable to Magid Pond, based on its surface water classification.

TABLE 1–5
MAMARONECK FEASIBILITY STUDY
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)/TO BE CONSIDERED (TBCs)
GROUND WATER/LEACHATE

Contaminants Concern	Maximum Detected Concentrations (ug/L)	USEPA MCLs 40 CFR 141 (ug/L)	GROUND WATER NYSDEC GW GTDS 6 NYCRR 703.5 (ug/L)	[1], [2] NYSDEC MCLs 10 NYCRR 5–1 (ug/L)	P O C	POTW Westchester County Environmental Facilites Sewer Act 12–1985 (ug/L)	SURFACE WATER NYSDEC Surface Water Criteria – Class D 6 NYCRR 703.5 (ug/L)
VOLATILES							
Acetone	7100			50		[3]	
Benzene	19	5	0.7	5	*	[3]	
Bromomethane	1			5	*	[3]	
Carbon Disulfide	10			50		[3]	
Chloroethane	2			5	*	[3]	
Chloroform	1	100 [4]	7			[3]	
Chloromethane	3			5	*	[3]	
1,1–Dichloroethene	1			5	*	[3]	
1,2–DCE (total)	100			50		[3]	
Ethylbenzene	53	700		5	*	[3]	
4–Methyl–2–Pentanone	280			5		[3]	
Toluene	26,000	1000		5	*	[3]	
1,1,1–TCA	6	200		5		[3]	
Vinyl Chloride	95	2	2			[3]	
Xylenes	260	10,000		5	*	[3]	
SEMI–VOLATILES							
Acenaphthylene	2			50			
Anthracene	5		50	50		[3]	
Benzo (a) Anthracene	10	0.1 (pMCL)		50		[3]	
Benzo (b) Fluoranthene	9	0.2 (pMCL)		50		[3]	
Benzo (k) Fluoranthene	7	0.2 (pMCL)		50		[3]	
Benzo (a) Pyrene	11	0.2 (pMCL)		ND		[3]	
Benzoic Acid	2			50		[3]	
Benzo (g,h,i) Perylene	8			ND		[3]	
Benzyl Alcohol	28			50		[3]	
Bis (2–Ethylhexyl) Phthalate	30		50	50		[3]	
Chrysene	11	0.2		50		[3]	
Di–n–Butylphthalate	4			50		[3]	
Dibenzofuran	12			50		[3]	
Diethyl Phthalate	5			50		[3]	
2,6–Dinitrotoluene	2			50		[3]	
Fluoranthene	23			50		[3]	
Fluorene	28			50		[3]	
Indeno (1,2,3–cd) Pyrene	8	0.4		ND		[3]	
2–Methyl Naphthalene	400			50		[3]	
4–Methylphenol	52			50		[3]	5
Naphthalene	130			50		[3]	
Phenanthrene	57			50		[3]	
Pyrene	21			50		[3]	
PESTICIDES/PCBs							
Aldrin	0.240		ND			[3]	0.001
alpha–BHC	0.550		ND			[3]	
beta–BHC	1.10		ND			[3]	
delta–BHC	0.070		ND			[3]	
alpha–Chlordane	0.250					[3]	
gamma–Chlordane	0.086					[3]	
4,4'–DDD	870		ND			[3]	0.001
4,4'–DDE	0.710		ND			[3]	0.001
4,4'–DDT	0.570		ND			[3]	0.001
Dieldrin	0.084		ND			[3]	0.001
Endosulfan I	8.50					[3]	0.22
Heptachlor Epoxide	0.036	0.2	ND			[3]	0.001
Arochlor 1254	22.0		0.1			[3]	0.001
INORGANICS							
Aluminum	331,000		2000	100 (aquatic)			
Antimony	175						
Arsenic	256	50	25			200	
Barium	18,500	1000	1000			2000	
Berylium	7.9	1(pMCL)	1100 [*]				
Cadmium	221	5	10			700	
Calcium	695,000		10				
Chromium	2,170	50	50			3000	
Cobalt	389		5 (aquatic)	5 (aquatic)			
Copper	10,500	1300	200			2800	
Iron	1,102,000	300(sMCL)	300				300
Lead	31,300	15	25			400	1045 +
Magnesium	191,000						
Manganese	12,100	50(sMCL)	300				
Mercury	14.3	2	2			200	
Nickel	2,400	100(pMCL)				2800	4044 +
Potassium	203,000						
Selenium	5,990	50	10			200	
Silver	203	50	50			800	213+
Sodium	79,500		20000				
Thallium	8.2						20
Vanadium	4,630						190
Zinc	79,600	5000(sMCL)	300			1800	2172+

[1] POCs must not exceed 5 ppb; UOCs must not exceed 50ppb
[2] Total POCs and UOCs must not exceed 100 ppb
[3] Total VOC, SVOCs, Pesticides & PCBs must not exceed 2100 ug/L
[4] As Total Trihalomethanes

* denotes Principal Organic Contaminants (POCs)
UOC = Unspecified Organic Contaminant
ND = Non Detectable
\+ = Derived from equation w/hardness of 1000 mg/L

MCL = Maximum Contaminant Level
pMCL = Proposed MCL
sMCL = Secondary MCL

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1.5.3 Comparison of Contaminant Levels in Fill to ARARs

Volatile Organic Compounds

As depicted in Figures 1-3 through 1-7, VOC contamination within the fill is extremely random throughout the site. As indicated in Table 1-4, the level of volatile organic compounds detected in the fill did not exceed the NYSDEC calculated TAGM cleanup standards. The soil cleanup levels calculated for the site were based on the TAGM model, and are highly reflect of the elevated TOC values for the fill.

Semi-Volatile Organic Compounds

As previously indicated, there are no promulgated standards for semi-volatile organic compounds. Therefore, the detected concentrations have been compared only with the values calculated under the NYSDEC TAGM model. Based on those values, there are no semi-volatile compounds which exceed the cleanup criteria.

Pesticides/PCBs

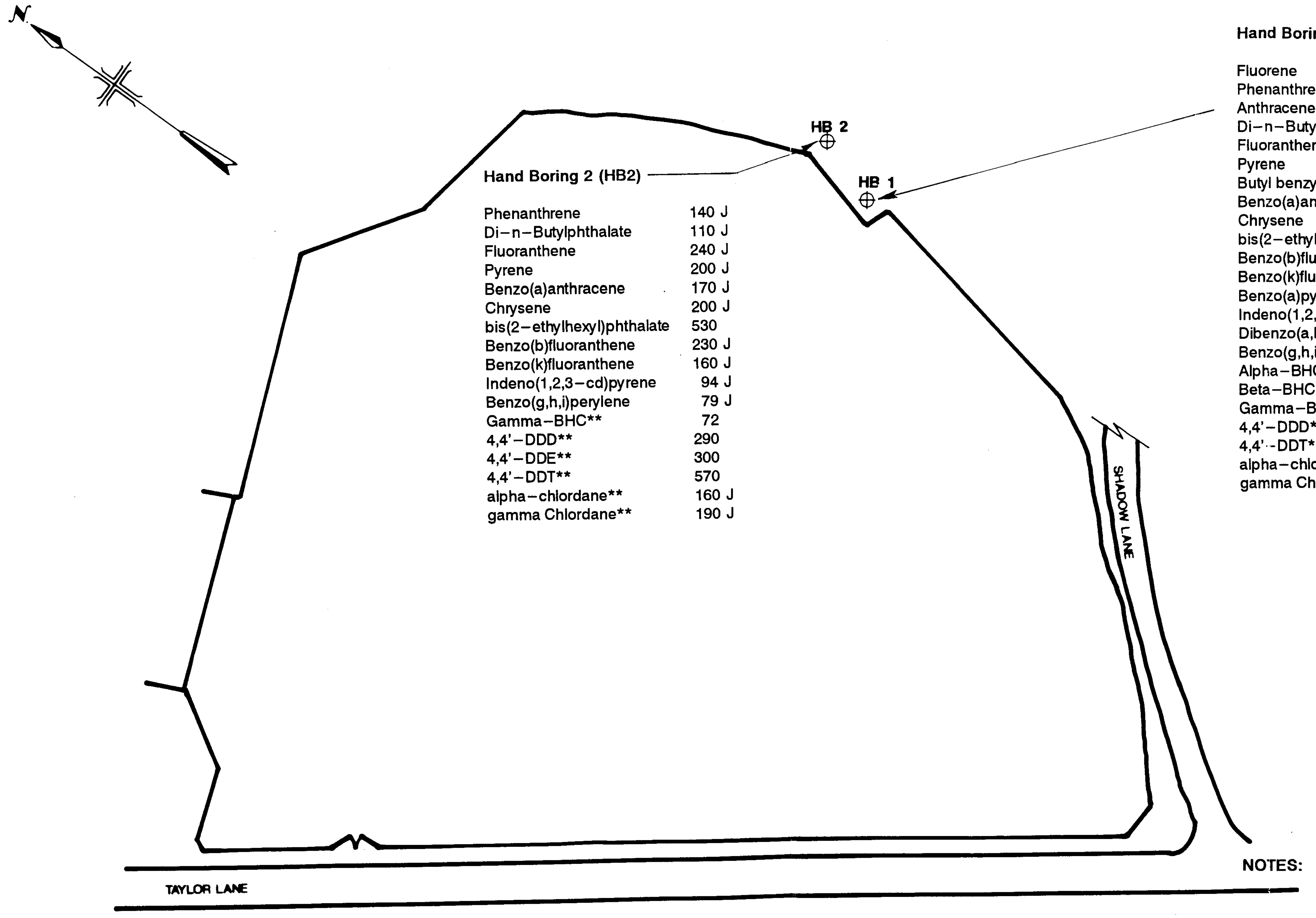
Based on the TAGM values, there are no levels of pesticides which exceed the cleanup criteria.

The regulations governing PCB soil contamination are contained in 40 CFR Part 761. Under the regulation, any substance, mixture, or item with a concentration of 50 mg/kg or greater, is considered to be contaminated. There were no soil concentrations at the Mamaroneck site which exceeded 50 mg/kg for PCBs.

Inorganic Compounds

Inorganic concentrations detected in the fill were compared with typical background soils found in New York State as compiled by the NYSDEC Division of Fish and Wildlife, September 1991. The inorganic concentrations detected above these typical ranges for NY state soils were listed on Figures 1-8 through 1-10. The following chemicals were evaluated for their overall extent of contamination: arsenic, cadmium, chromium, copper, lead, magnesium, mercury, nickel, vanadium, zinc, and cyanide.

Arsenic was detected in 9 of the 24 soil samples collected. The maximum concentration, 48 mg/kg was detected in SB-15. Cadmium was found in 18 out of 24 soil samples, with the maximum concentration occurring SB-15, at a concentration of 69.9 mg/kg. Chromium (total) was detected in 10 of the 24 samples. The maximum



Hand Boring 2 (HB2)

Phenanthrene	140 J
Di-n-Butylphthalate	110 J
Fluoranthene	240 J
Pyrene	200 J
Benzo(a)anthracene	170 J
Chrysene	200 J
bis(2-ethylhexyl)phthalate	530
Benzo(b)fluoranthene	230 J
Benzo(k)fluoranthene	160 J
Indeno(1,2,3-cd)pyrene	94 J
Benzo(g,h,i)perylene	79 J
Gamma-BHC**	72
4,4'-DDD**	290
4,4'-DDE**	300
4,4'-DDT**	570
alpha-chlordane**	160 J
gamma Chlordane**	190 J

Hand Boring 1 (HB1)

Fluorene	51 J
Phenanthrene	660
Anthracene	140 J
Di-n-Butylphthalate	49 J
Fluoranthene	1100
Pyrene	980
Butyl benzyl phthalate	59 J
Benzo(a)anthracene	620
Chrysene	680
bis(2-ethylhexyl)phthalate	180 J
Benzo(b)fluoranthene	670
Benzo(k)fluoranthene	500
Benzo(a)pyrene	190 J
Indeno(1,2,3-cd)pyrene	270 J
Dibenzo(a,h)anthracene	63 J
Benzo(g,h,i)perylene	230 J
Alpha-BHC**	5.8 J
Beta-BHC**	350
Gamma-BHC**	400
4,4'-DDD**	1800
4,4'-DDT**	1100
alpha-chlordane**	2100
gamma Chlordane **	2400

NOTES:

All units expressed in ug/kg.

PCB's not detected in any samples.

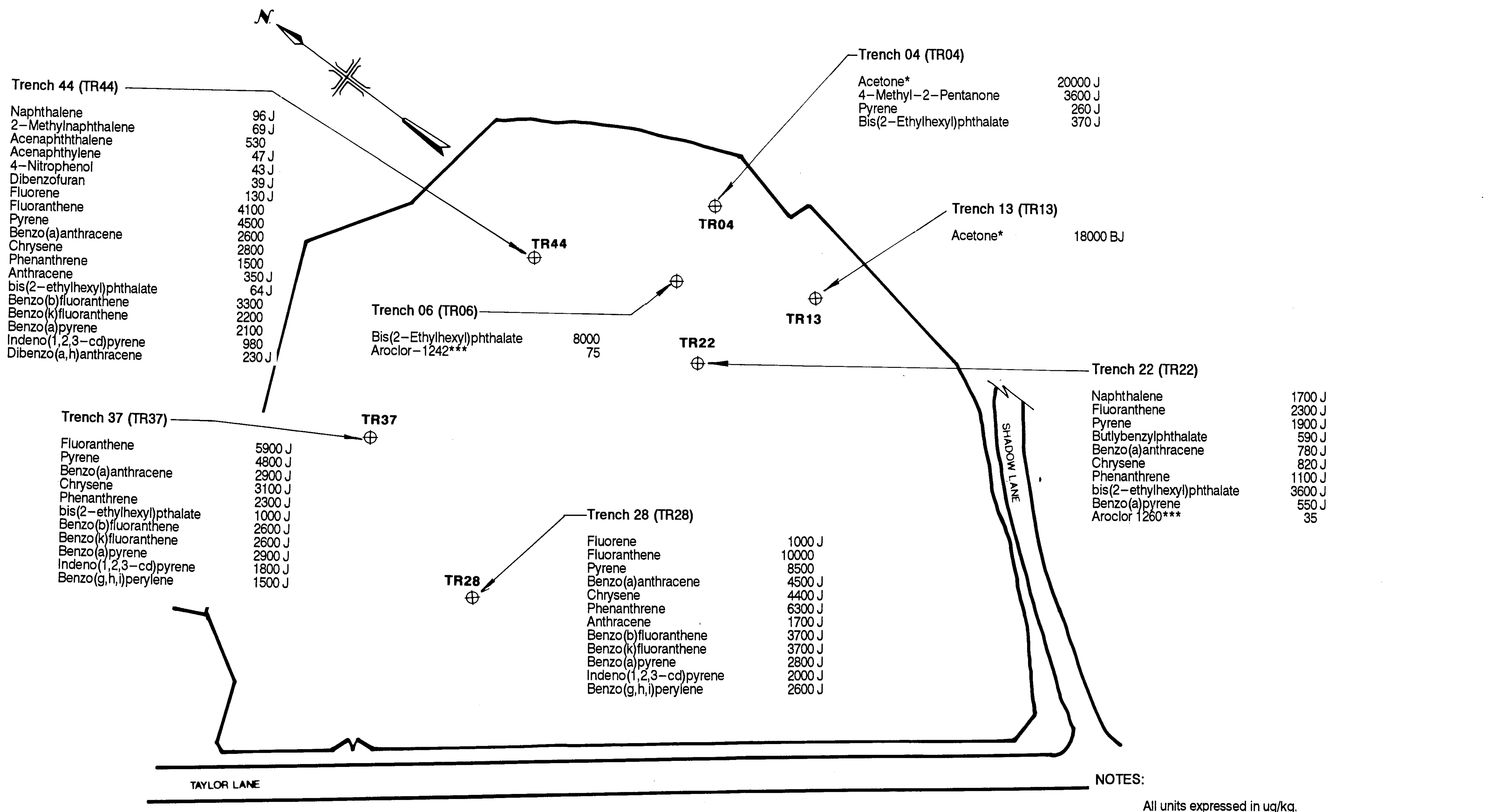
J Indicates estimated value
Indicates Semi-Volatile Compound
* Indicates Volatile Organic Compound
** Indicates Pesticides

MALCOLM PIRNIE

MAMARONECK TAYLOR LEAF COMPOST SITE
VOLATILE ORGANIC COMPOUNDS, SEMI-VOLATILE COMPOUNDS, AND PCB CONCENTRATIONS (ug/kg)
IN BERM HAND BORING SAMPLES

MALCOLM PIRNIE, INC.

FIGURE 1-3



Trench 44 (TR44)

Naphthalene	96 J
2–Methylnaphthalene	69 J
Acenaphththalene	530
Acenaphthylene	47 J
4–Nitrophenol	43 J
Dibenzofuran	39 J
Fluorene	130 J
Fluoranthene	4100
Pyrene	4500
Benzo(a)anthracene	2600
Chrysene	2800
Phenanthrene	1500
Anthracene	350 J
bis(2–ethylhexyl)phthalate	64 J
Benzo(b)fluoranthene	3300
Benzo(k)fluoranthene	2200
Benzo(a)pyrene	2100
Indeno(1,2,3–cd)pyrene	980
Dibenzo(a,h)anthracene	230 J

Trench 04 (TR04)

Acetone*	20000 J
4–Methyl–2–Pentanone	3600 J
Pyrene	260 J
Bis(2–Ethylhexyl)phthalate	370 J

Trench 13 (TR13)

Acetone*	18000 BJ

Trench 06 (TR06)

Bis(2–Ethylhexyl)phthalate	8000
Aroclor–1242***	75

Trench 22 (TR22)

Naphthalene	1700 J
Fluoranthene	2300 J
Pyrene	1900 J
Butlybenzylphthalate	590 J
Benzo(a)anthracene	780 J
Chrysene	820 J
Phenanthrene	1100 J
bis(2–ethylhexyl)phthalate	3600 J
Benzo(a)pyrene	550 J
Aroclor 1260***	35

Trench 37 (TR37)

Fluoranthene	5900 J
Pyrene	4800 J
Benzo(a)anthracene	2900 J
Chrysene	3100 J
Phenanthrene	2300 J
bis(2–ethylhexyl)pthalate	1000 J
Benzo(b)fluoranthene	2600 J
Benzo(k)fluoranthene	2600 J
Benzo(a)pyrene	2900 J
Indeno(1,2,3–cd)pyrene	1800 J
Benzo(g,h,i)perylene	1500 J

Trench 28 (TR28)

Fluorene	1000 J
Fluoranthene	10000
Pyrene	8500
Benzo(a)anthracene	4500 J
Chrysene	4400 J
Phenanthrene	6300 J
Anthracene	1700 J
Benzo(b)fluoranthene	3700 J
Benzo(k)fluoranthene	3700 J
Benzo(a)pyrene	2800 J
Indeno(1,2,3–cd)pyrene	2000 J
Benzo(g,h,i)perylene	2600 J

NOTES:

	All units expressed in ug/kg.
	Pesticides not detected in any samples.
J	Indicates estimated value.
B	Indicates compound was detected in sample as well as blank.
	Indicates semi–volatile organic compounds.
*	Indicates volatile organic compounds.
***	Indicates PCB's.

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MAMAROONECK TAYLOR LEAF COMPOST SITE

VOLATILE ORGANIC COMPOUNDS, SEMI-VOLATILE COMPOUNDS, AND PCB CONCENTRATIONS (ug/L)
IN TRENCH SAMPLES

MALCOLM PIRNIE, INC.

FIGURE 1-4

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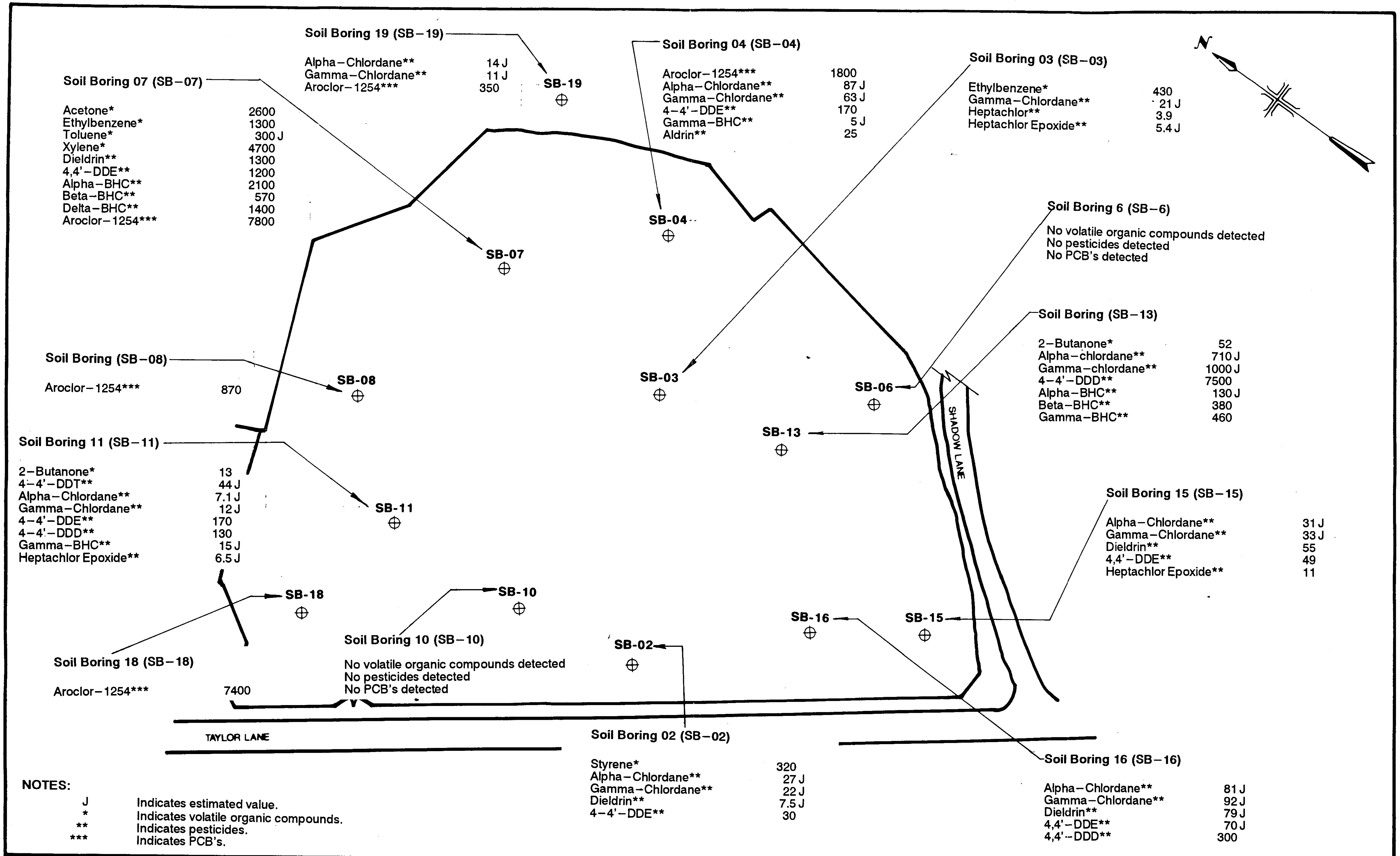


NOTES:

J	Indicates estimated value.
*	Indicates volatile organic compounds.
**	Indicates pesticides.
***	Indicates PCB's.

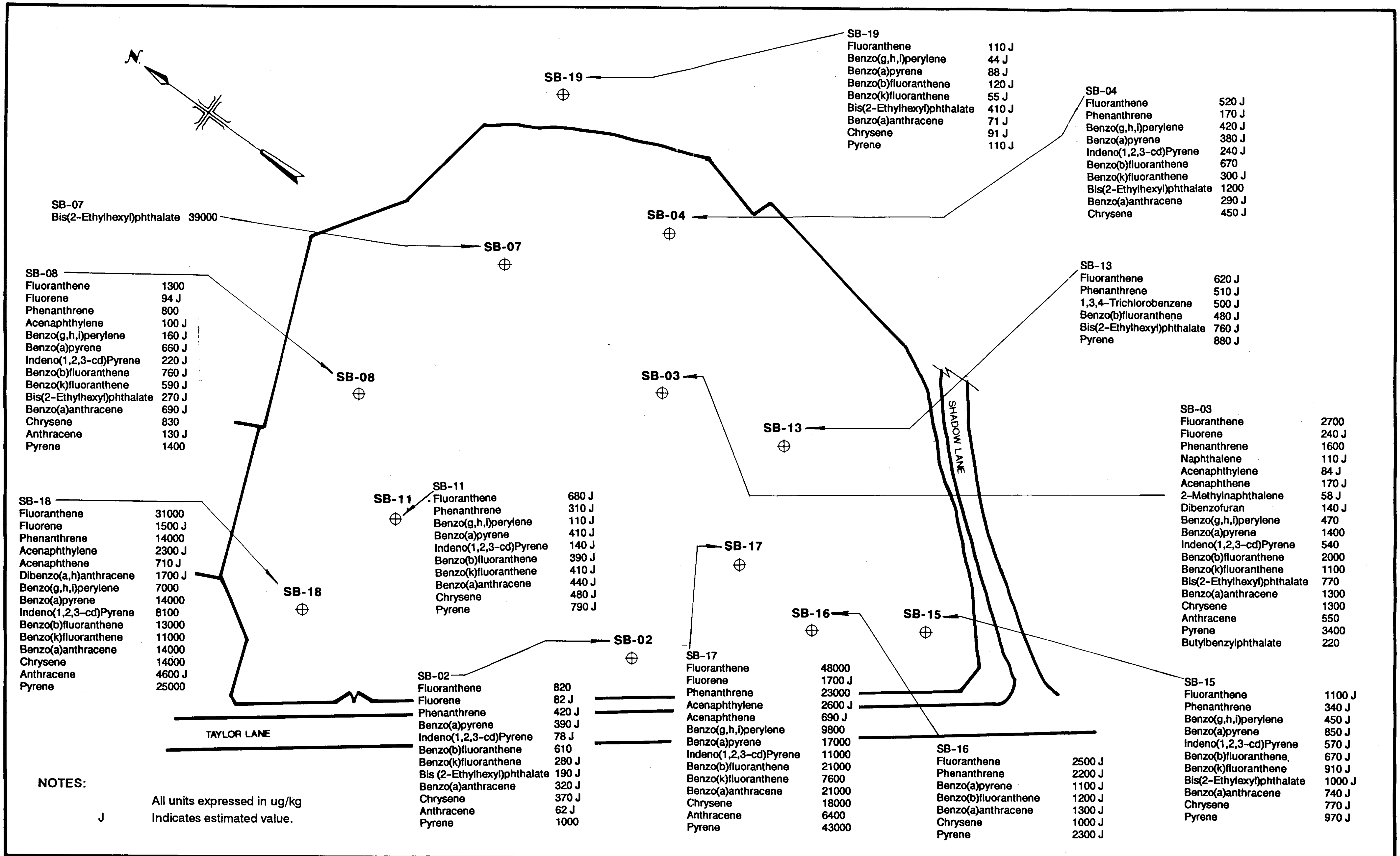
MALCOLM PIRNIE

MAMARONECK TAYLOR LEAF COMPOST SITE
VOLATILE ORGANIC COMPOUNDS, PESTICIDES, AND PCB CONCENTRATIONS (ug/kg) IN SOIL BORINGS

MALCOLM PIRNIE, INC.

FIGURE 1-5

161394



SB-19	
Fluoranthene	110 J
Benzo(g,h,i)perylene	44 J
Benzo(a)pyrene	88 J
Benzo(b)fluoranthene	120 J
Benzo(k)fluoranthene	55 J
Bis(2-Ethylhexyl)phthalate	410 J
Benzo(a)anthracene	71 J
Chrysene	91 J
Pyrene	110 J

SB-04	
Fluoranthene	520 J
Phenanthrene	170 J
Benzo(g,h,i)perylene	420 J
Benzo(a)pyrene	380 J
Indeno(1,2,3-cd)Pyrene	240 J
Benzo(b)fluoranthene	670
Benzo(k)fluoranthene	300 J
Bis(2-Ethylhexyl)phthalate	1200
Benzo(a)anthracene	290 J
Chrysene	450 J

SB-07	
Bis(2-Ethylhexyl)phthalate	39000

SB-08	
Fluoranthene	1300
Fluorene	94 J
Phenanthrene	800
Acenaphthylene	100 J
Benzo(g,h,i)perylene	160 J
Benzo(a)pyrene	660 J
Indeno(1,2,3-cd)Pyrene	220 J
Benzo(b)fluoranthene	760 J
Benzo(k)fluoranthene	590 J
Bis(2-Ethylhexyl)phthalate	270 J
Benzo(a)anthracene	690 J
Chrysene	830
Anthracene	130 J
Pyrene	1400

SB-13	
Fluoranthene	620 J
Phenanthrene	510 J
1,3,4-Trichlorobenzene	500 J
Benzo(b)fluoranthene	480 J
Bis(2-Ethylhexyl)phthalate	760 J
Pyrene	880 J

SB-03	
Fluoranthene	2700
Fluorene	240 J
Phenanthrene	1600
Naphthalene	110 J
Acenaphthylene	84 J
Acenaphthene	170 J
2-Methylnaphthalene	58 J
Dibenzofuran	140 J
Benzo(g,h,i)perylene	470
Benzo(a)pyrene	1400
Indeno(1,2,3-cd)Pyrene	540
Benzo(b)fluoranthene	2000
Benzo(k)fluoranthene	1100
Bis(2-Ethylhexyl)phthalate	770
Benzo(a)anthracene	1300
Chrysene	1300
Anthracene	550
Pyrene	3400
Butylbenzylphthalate	220

SB-11	
Fluoranthene	680 J
Phenanthrene	310 J
Benzo(g,h,i)perylene	110 J
Benzo(a)pyrene	410 J
Indeno(1,2,3-cd)Pyrene	140 J
Benzo(b)fluoranthene	390 J
Benzo(k)fluoranthene	410 J
Benzo(a)anthracene	440 J
Chrysene	480 J
Pyrene	790 J

SB-18	
Fluoranthene	31000
Fluorene	1500 J
Phenanthrene	14000
Acenaphthylene	2300 J
Acenaphthene	710 J
Dibenzo(a,h)anthracene	1700 J
Benzo(g,h,i)perylene	7000
Benzo(a)pyrene	14000
Indeno(1,2,3-cd)Pyrene	8100
Benzo(b)fluoranthene	13000
Benzo(k)fluoranthene	11000
Benzo(a)anthracene	14000
Chrysene	14000
Anthracene	4600 J
Pyrene	25000

SB-02	
Fluoranthene	820
Fluorene	82 J
Phenanthrene	420 J
Benzo(a)pyrene	390 J
Indeno(1,2,3-cd)Pyrene	78 J
Benzo(b)fluoranthene	610
Benzo(k)fluoranthene	280 J
Bis (2-Ethylhexyl)phthalate	190 J
Benzo(a)anthracene	320 J
Chrysene	370 J
Anthracene	62 J
Pyrene	1000

SB-17	
Fluoranthene	48000
Fluorene	1700 J
Phenanthrene	23000
Acenaphthylene	2600 J
Acenaphthene	690 J
Benzo(g,h,i)perylene	9800
Benzo(a)pyrene	17000
Indeno(1,2,3-cd)Pyrene	11000
Benzo(b)fluoranthene	21000
Benzo(k)fluoranthene	7600
Benzo(a)anthracene	21000
Chrysene	18000
Anthracene	6400
Pyrene	43000

SB-16	
Fluoranthene	2500 J
Phenanthrene	2200 J
Benzo(a)pyrene	1100 J
Benzo(b)fluoranthene	1200 J
Benzo(a)anthracene	1300 J
Chrysene	1000 J
Pyrene	2300 J

SB-15	
Fluoranthene	1100 J
Phenanthrene	340 J
Benzo(g,h,i)perylene	450 J
Benzo(a)pyrene	850 J
Indeno(1,2,3-cd)Pyrene	570 J
Benzo(b)fluoranthene	670 J
Benzo(k)fluoranthene	910 J
Bis(2-Ethylexyl)phthalate	1000 J
Benzo(a)anthracene	740 J
Chrysene	770 J
Pyrene	970 J

NOTES:

All units expressed in ug/kg

J Indicates estimated value.

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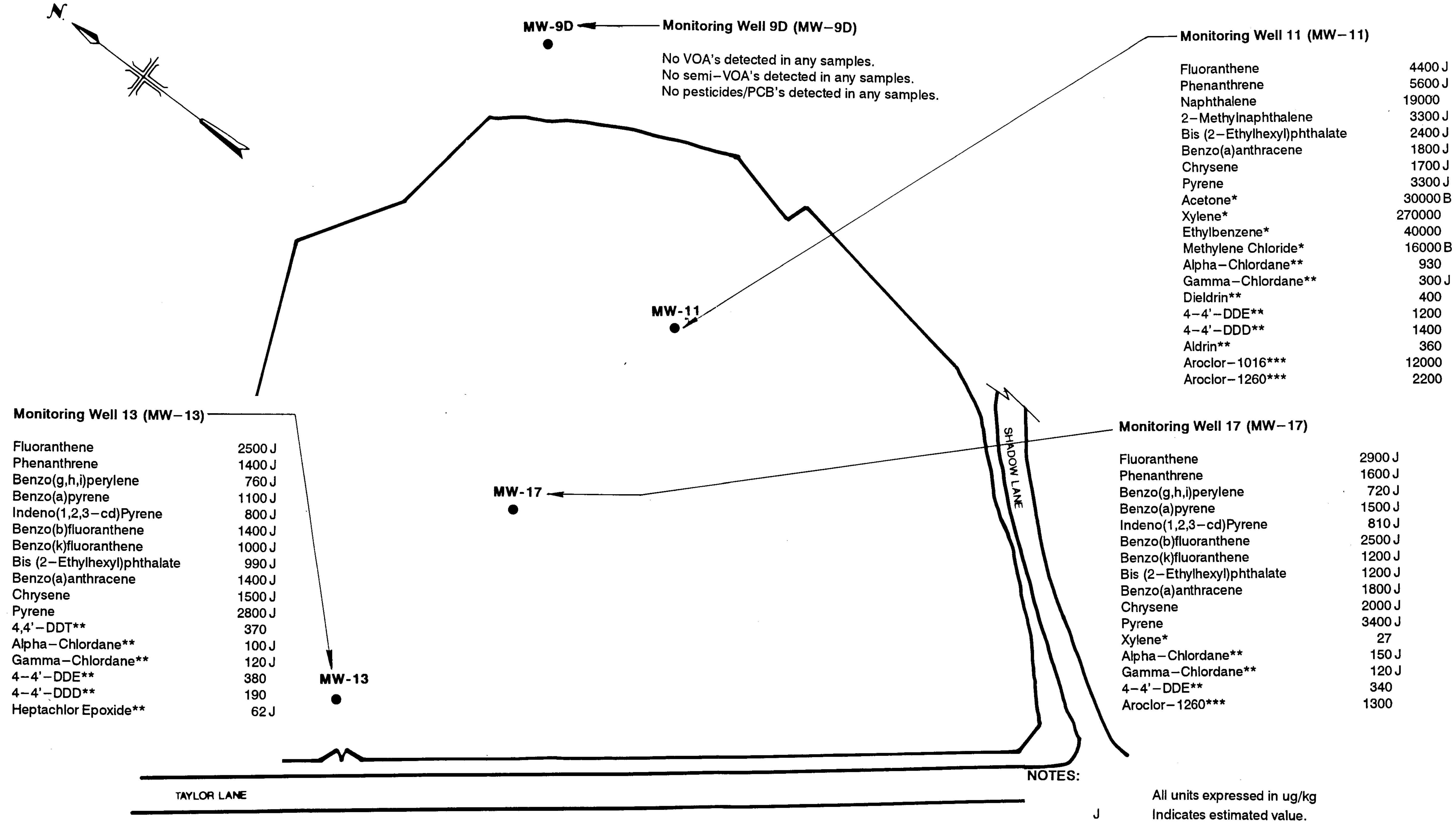
MAMARONECK TAYLOR LEAF COMPOST SITE
SEMI-VOLATILE ORGANIC COMPOUND CONCENTRATIONS (ug/kg) IN SOIL BORINGS

MALCOLM PIRNIE, INC.

FIGURE 1-6



Monitoring Well 9D (MW–9D)

No VOA's detected in any samples.
No semi–VOA's detected in any samples.
No pesticides/PCB's detected in any samples.

Monitoring Well 11 (MW–11)

Fluoranthene	4400 J
Phenanthrene	5600 J
Naphthalene	19000
2–Methylnaphthalene	3300 J
Bis (2–Ethylhexyl)phthalate	2400 J
Benzo(a)anthracene	1800 J
Chrysene	1700 J
Pyrene	3300 J
Acetone*	30000 B
Xylene*	270000
Ethylbenzene*	40000
Methylene Chloride*	16000 B
Alpha–Chlordane**	930
Gamma–Chlordane**	300 J
Dieldrin**	400
4–4'–DDE**	1200
4–4'–DDD**	1400
Aldrin**	360
Aroclor–1016***	12000
Aroclor–1260***	2200

Monitoring Well 13 (MW–13)

Fluoranthene	2500 J
Phenanthrene	1400 J
Benzo(g,h,i)perylene	760 J
Benzo(a)pyrene	1100 J
Indeno(1,2,3–cd)Pyrene	800 J
Benzo(b)fluoranthene	1400 J
Benzo(k)fluoranthene	1000 J
Bis (2–Ethylhexyl)phthalate	990 J
Benzo(a)anthracene	1400 J
Chrysene	1500 J
Pyrene	2800 J
4,4'–DDT**	370
Alpha–Chlordane**	100 J
Gamma–Chlordane**	120 J
4–4'–DDE**	380
4–4'–DDD**	190
Heptachlor Epoxide**	62 J

Monitoring Well 17 (MW–17)

Fluoranthene	2900 J
Phenanthrene	1600 J
Benzo(g,h,i)perylene	720 J
Benzo(a)pyrene	1500 J
Indeno(1,2,3–cd)Pyrene	810 J
Benzo(b)fluoranthene	2500 J
Benzo(k)fluoranthene	1200 J
Bis (2–Ethylhexyl)phthalate	1200 J
Benzo(a)anthracene	1800 J
Chrysene	2000 J
Pyrene	3400 J
Xylene*	27
Alpha–Chlordane**	150 J
Gamma–Chlordane**	120 J
4–4'–DDE**	340
Aroclor–1260***	1300

NOTES:

	All units expressed in ug/kg
J	Indicates estimated value.
B	Indicates compound detected in blank as well as sample.
	Indicates semi–volatile organic compounds.
*	Indicates volatile organic compounds.
**	Indicates pesticides.
***	Indicates PCB's.

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MAMARONECK TAYLOR LEAF COMPOST SITE
VOLATILE ORGANIC COMPOUNDS, SEMI-VOLATILES, PESTICIDES, AND PCB CONCENTRATIONS (ug/kg)
IN MONITORING WELL SOIL BORINGS

MALCOLM PIRNIE, INC.

FIGURE 1-7

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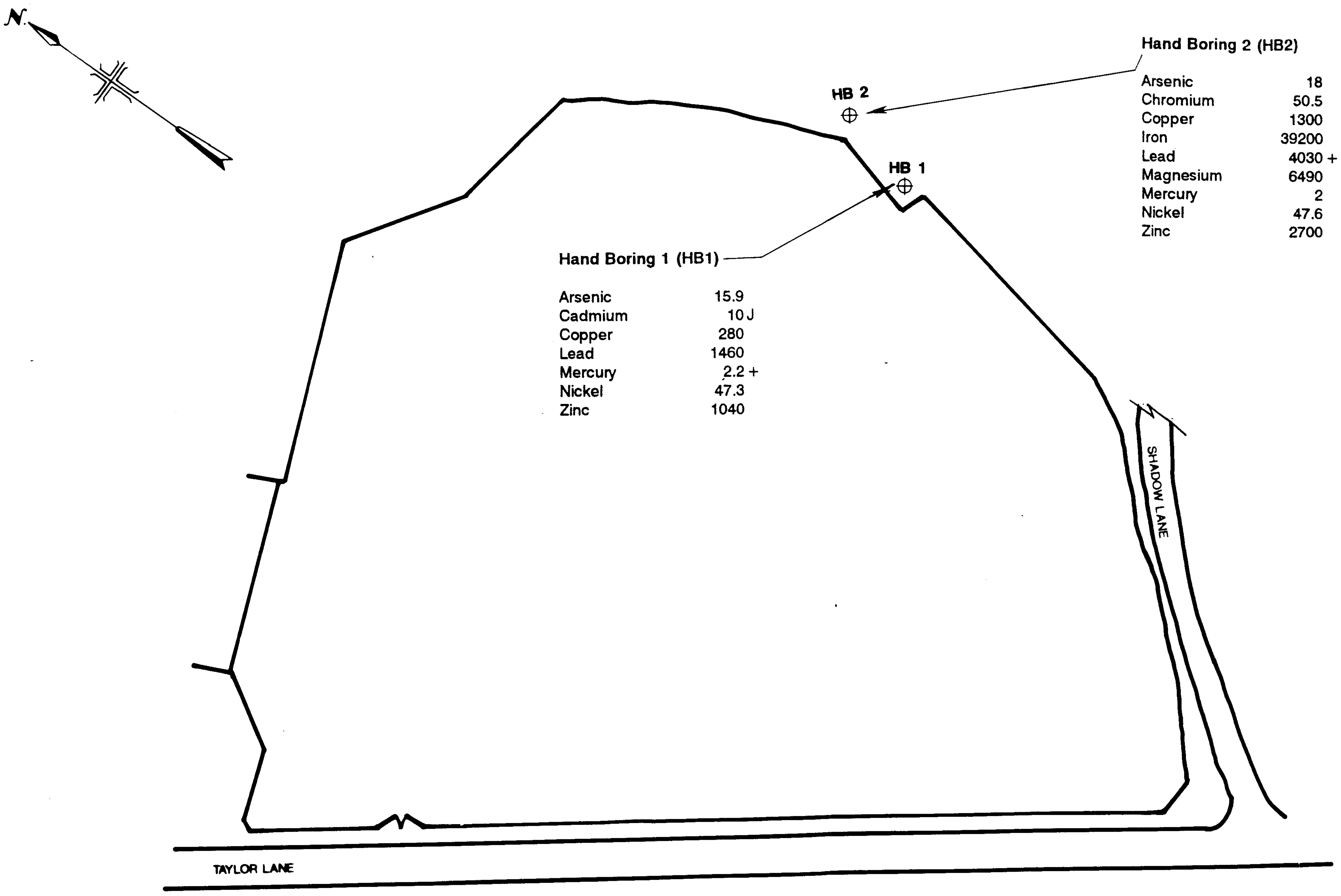

Hand Boring 1 (HB1)

Arsenic	15.9
Cadmium	10 J
Copper	280
Lead	1460
Mercury	2.2 +
Nickel	47.3
Zinc	1040

Hand Boring 2 (HB2)

Arsenic	18
Chromium	50.5
Copper	1300
Iron	39200
Lead	4030 +
Magnesium	6490
Mercury	2
Nickel	47.6
Zinc	2700

NOTES:

All units in mg/kg.

Cyanide was not detected in any samples.

+ Maximuum concentration detected on−site.

J indicates estimated value

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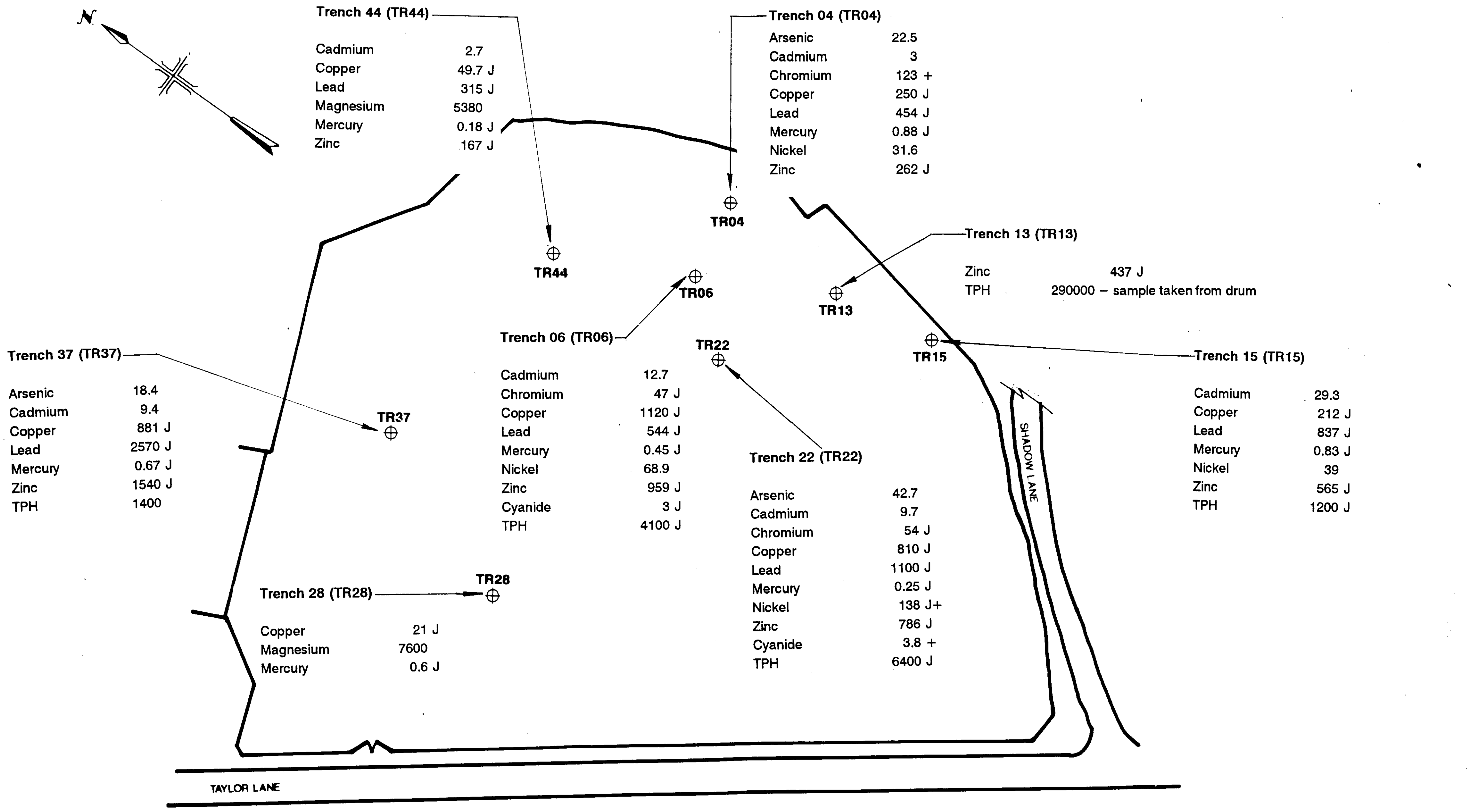
MAMARONECK TAYLOR LEAF COMPOST SITE
INORGANIC SOIL CONCENTRATIONS (mg/kg) IN BERM HAND BORING SAMPLES
EXCEEDING TYPICAL NY STATE BACKGROUND CONCENTRATIONS

MALCOLM PIRNIE, INC.

FIGURE 1-8



Trench 44 (TR44)

Cadmium	2.7
Copper	49.7 J
Lead	315 J
Magnesium	5380
Mercury	0.18 J
Zinc	167 J

Trench 04 (TR04)

Arsenic	22.5
Cadmium	3
Chromium	123 +
Copper	250 J
Lead	454 J
Mercury	0.88 J
Nickel	31.6
Zinc	262 J

Trench 13 (TR13)

Zinc	437 J
TPH	290000 – sample taken from drum

Trench 37 (TR37)

Arsenic	18.4
Cadmium	9.4
Copper	881 J
Lead	2570 J
Mercury	0.67 J
Zinc	1540 J
TPH	1400

Trench 06 (TR06)

Cadmium	12.7
Chromium	47 J
Copper	1120 J
Lead	544 J
Mercury	0.45 J
Nickel	68.9
Zinc	959 J
Cyanide	3 J
TPH	4100 J

Trench 15 (TR15)

Cadmium	29.3
Copper	212 J
Lead	837 J
Mercury	0.83 J
Nickel	39
Zinc	565 J
TPH	1200 J

Trench 22 (TR22)

Arsenic	42.7
Cadmium	9.7
Chromium	54 J
Copper	810 J
Lead	1100 J
Mercury	0.25 J
Nickel	138 J+
Zinc	786 J
Cyanide	3.8 +
TPH	6400 J

Trench 28 (TR28)

Copper	21 J
Magnesium	7600
Mercury	0.6 J

NOTES:

+ Indicates Maximum Concentration Detected On–Site
J Indicates estimated value

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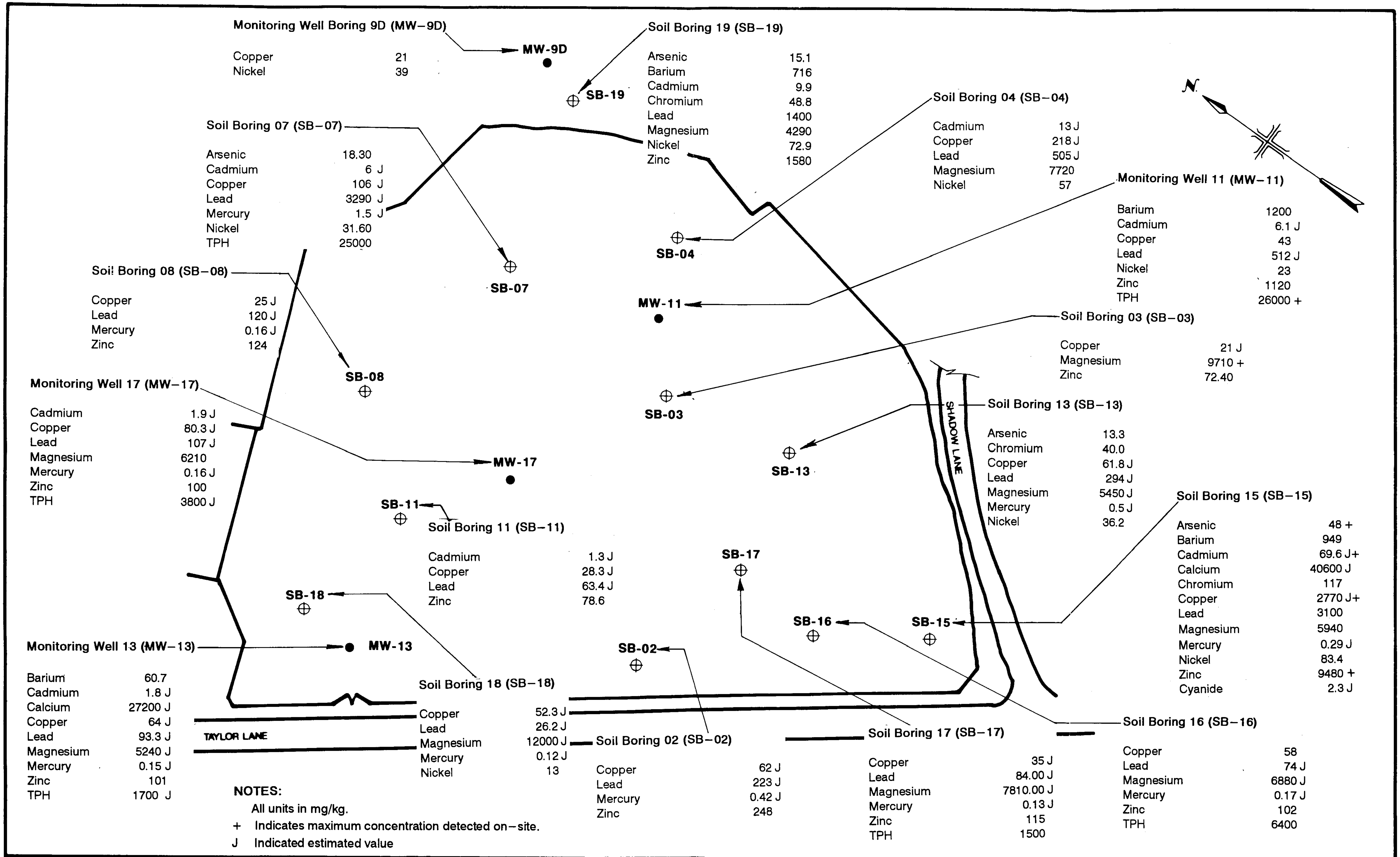
MAMARONECK TAYLOR LEAF COMPOST SITE
INORGANIC SOIL CONCENTRATIONS (mg/kg) IN TRENCHES
EXCEEDING TYPICAL NY STATE BACKGROUND CONCENTRATIONS

MALCOLM PIRNIE, INC.

FIGURE 1-9



Monitoring Well Boring 9D (MW-9D)

Copper	21
Nickel	39

Soil Boring 19 (SB-19)

Arsenic	15.1
Barium	716
Cadmium	9.9
Chromium	48.8
Lead	1400
Magnesium	4290
Nickel	72.9
Zinc	1580

Soil Boring 07 (SB-07)

Arsenic	18.30
Cadmium	6 J
Copper	106 J
Lead	3290 J
Mercury	1.5 J
Nickel	31.60
TPH	25000

Soil Boring 04 (SB-04)

Cadmium	13 J
Copper	218 J
Lead	505 J
Magnesium	7720
Nickel	57

Monitoring Well 11 (MW-11)

Barium	1200
Cadmium	6.1 J
Copper	43
Lead	512 J
Nickel	23
Zinc	1120
TPH	26000 +

Soil Boring 08 (SB-08)

Copper	25 J
Lead	120 J
Mercury	0.16 J
Zinc	124

Soil Boring 03 (SB-03)

Copper	21 J
Magnesium	9710 +
Zinc	72.40

Monitoring Well 17 (MW-17)

Cadmium	1.9 J
Copper	80.3 J
Lead	107 J
Magnesium	6210
Mercury	0.16 J
Zinc	100
TPH	3800 J

Soil Boring 13 (SB-13)

Arsenic	13.3
Chromium	40.0
Copper	61.8 J
Lead	294 J
Magnesium	5450 J
Mercury	0.5 J
Nickel	36.2

Soil Boring 11 (SB-11)

Cadmium	1.3 J
Copper	28.3 J
Lead	63.4 J
Zinc	78.6

Soil Boring 15 (SB-15)

Arsenic	48 +
Barium	949
Cadmium	69.6 J+
Calcium	40600 J
Chromium	117
Copper	2770 J+
Lead	3100
Magnesium	5940
Mercury	0.29 J
Nickel	83.4
Zinc	9480 +
Cyanide	2.3 J

Monitoring Well 13 (MW-13)

Barium	60.7
Cadmium	1.8 J
Calcium	27200 J
Copper	64 J
Lead	93.3 J
Magnesium	5240 J
Mercury	0.15 J
Zinc	101
TPH	1700 J

Soil Boring 18 (SB-18)

Copper	52.3 J
Lead	26.2 J
Magnesium	12000 J
Mercury	0.12 J
Nickel	13

Soil Boring 02 (SB-02)

Copper	62 J
Lead	223 J
Mercury	0.42 J
Zinc	248

Soil Boring 17 (SB-17)

Copper	35 J
Lead	84.00 J
Magnesium	7810.00 J
Mercury	0.13 J
Zinc	115
TPH	1500

Soil Boring 16 (SB-16)

Copper	58
Lead	74 J
Magnesium	6880 J
Mercury	0.17 J
Zinc	102
TPH	6400

NOTES:

All units in mg/kg.
\+ Indicates maximum concentration detected on-site.
J Indicated estimated value

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MAMAROCK TAYLOR LEAF COMPOST SITE
INORGANIC SOIL CONCENTRATIONS (mg/kg) IN SOIL BORINGS AND MONITORING WELL BORINGS
EXCEEDING TYPICAL NY STATE BACKGROUND CONCENTRATIONS

MALCOLM PIRNIE, INC.

FIGURE 1-10

161394

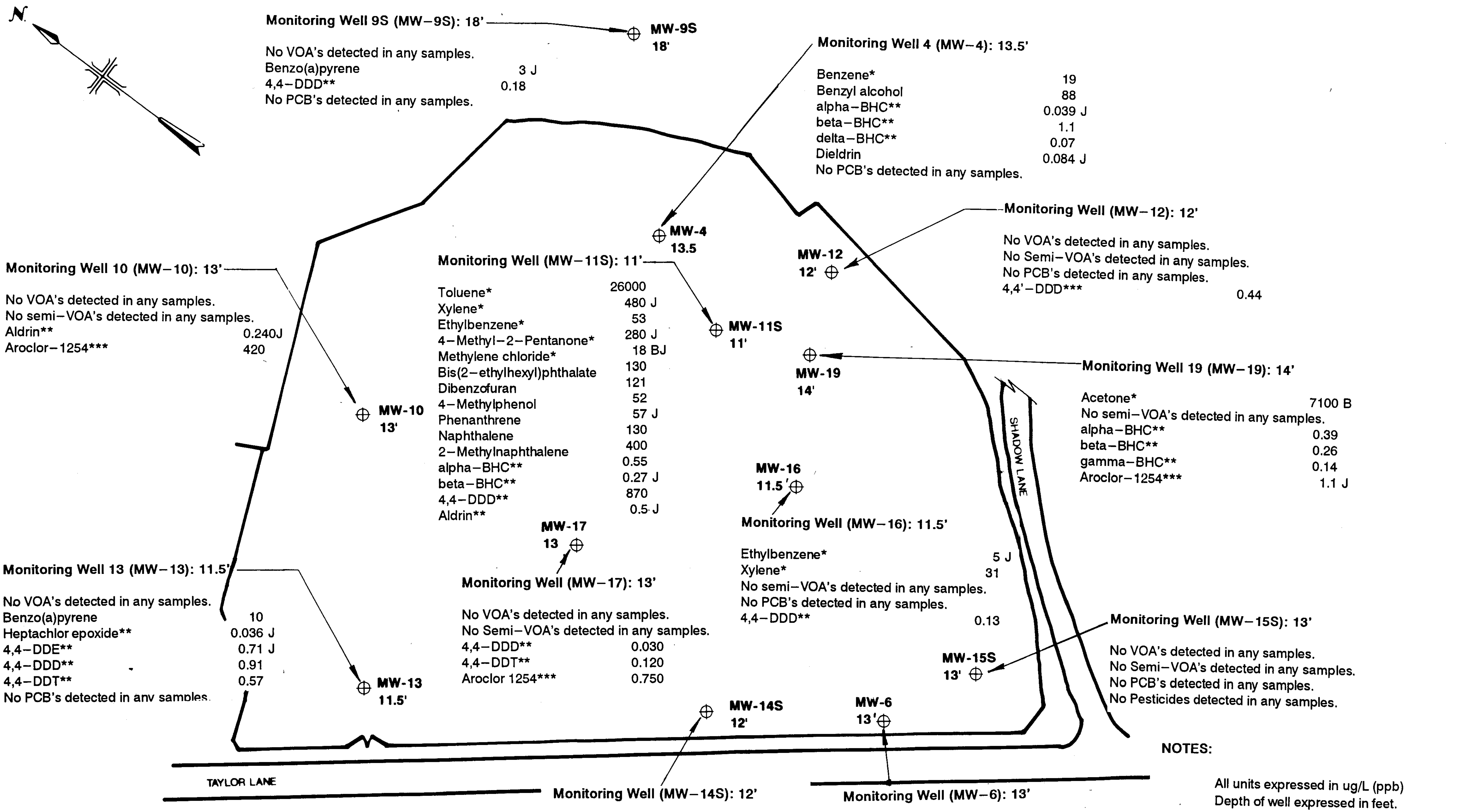
concentration was detected in TR-04, at a concentration of 123 mg/kg. Copper was detected in all 24 samples collected from the site. The maximum concentration was found in SB-15, at a value of 2770 mg/kg. Lead was found in 21 of the 24 soil samples collected at the site. The maximum concentration was detected in HB-02 at level of 4030 mg/kg. Magnesium was detected at a maximum concentration of 12,000 gm/kg at SB-18. Mercury was detected in 18 samples with the maximum concentration in sample HB-01, at a concentration of 2.20 mg/kg. Nickel was found in 11 out of the 24 samples collected and analyzed. The maximum concentration was detected in TR-22, at a level of 138.0 mg/kg. Zinc was detected in 19 of the 24 samples, with the maximum concentration at SB-15 of 9,480 mg/kg. The maximum concentration of cyanide was detected in TR22 at a value of 3.8 mg/kg.

1.5.4 Comparison of Contaminant Levels in Leachate to ARARs

Volatile Organic Compounds

Individual VOCs were detected in several monitoring wells screened in the fill layer, however, the distribution and concentrations were not consistent with a contiguous body (plume) of contamination as depicted in Figure 1-11. VOCs were detected in four of the 10 monitoring wells screened in the fill zone (MW-11S, MW-15S, MW-16, MW-19). VOC contamination appears to be concentrated in the eastern portion of the site in the vicinity of MW-11S. Total maximum contaminant levels ranged from 26,760 ppb in round one, with the major constituent being toluene at 26,000 ppb, and to a lesser extent xylene at 480 ppb and ethylbenzene at 280 ppb, all detected in MW-11S. Total VOC levels decreased significantly in MW-11S to a level of 1,913 ppb in round two, with toluene constituting 1,600 ppb, xylene 260 ppb, and ethylbenzene 53 ppb.

Concentrations also decreased rapidly with increasing radial distance from MW-11S. The next highest total VOC concentrations were detected in MW-16, with a total of 37 ppb in round one, and 26 ppb in round two. The only compounds which were detected consistently in elevated levels in both rounds of sampling were ethylbenzene and xylene, in MW-11S and MW-16. One additional downgradient well, MW-15S, exhibited VOC concentrations at considerably lower levels than that detected in wells MW-11S and MW-16. The total VOC concentrations were 6 ppb in round one sampling, and 2 ppb in round two. The compounds detected in this well were the following: chloromethane, bromomethane, and toluene in Round 1 and 1,1,1-trichloroethane in Round 2.



Monitoring Well 9S (MW-9S): 18'

No VOA's detected in any samples.

Benzo(a)pyrene	3 J
4,4-DDD**	0.18

No PCB's detected in any samples.

Monitoring Well 4 (MW-4): 13.5'

Benzene*	19
Benzyl alcohol	88
alpha-BHC**	0.039 J
beta-BHC**	1.1
delta-BHC**	0.07
Dieldrin	0.084 J

No PCB's detected in any samples.

Monitoring Well 10 (MW-10): 13'

No VOA's detected in any samples.
No semi-VOA's detected in any samples.

Aldrin**	0.240J
Aroclor-1254***	420

Monitoring Well (MW-11S): 11'

Toluene*	26000
Xylene*	480 J
Ethylbenzene*	53
4-Methyl-2-Pentanone*	280 J
Methylene chloride*	18 BJ
Bis(2-ethylhexyl)phthalate	130
Dibenzofuran	121
4-Methylphenol	52
Phenanthrene	57 J
Naphthalene	130
2-Methylnaphthalene	400
alpha-BHC**	0.55
beta-BHC**	0.27 J
4,4-DDD**	870
Aldrin**	0.5 J

Monitoring Well (MW-12): 12'

No VOA's detected in any samples.
No Semi-VOA's detected in any samples.
No PCB's detected in any samples.

4,4'-DDD***	0.44

Monitoring Well 19 (MW-19): 14'

Acetone*	7100 B
No semi-VOA's detected in any samples.	
alpha-BHC**	0.39
beta-BHC**	0.26
gamma-BHC**	0.14
Aroclor-1254***	1.1 J

Monitoring Well (MW-16): 11.5'

Ethylbenzene*	5 J
Xylene*	31
No semi-VOA's detected in any samples.	
No PCB's detected in any samples.	
4,4-DDD**	0.13

Monitoring Well 13 (MW-13): 11.5'

No VOA's detected in any samples.

Benzo(a)pyrene	10
Heptachlor epoxide**	0.036 J
4,4-DDE**	0.71 J
4,4-DDD**	0.91
4,4-DDT**	0.57

No PCB's detected in any samples.

Monitoring Well (MW-17): 13'

No VOA's detected in any samples.
No Semi-VOA's detected in any samples.

4,4-DDD**	0.030
4,4-DDT**	0.120
Aroclor 1254***	0.750

Monitoring Well (MW-15S): 13'

No VOA's detected in any samples.
No Semi-VOA's detected in any samples.
No PCB's detected in any samples.
No Pesticides detected in any samples.

Monitoring Well (MW-14S): 12'

No VOA's detected in any samples.
No Semi-VOA's detected in any samples.
No PCB's detected in any samples.
No Pesticides detected in any samples.

Monitoring Well (MW-6): 13'

No VOA's detected in any samples.
No Semi-VOA's detected in any samples.
No PCB's detected in any samples.
No Pesticides detected in any samples.

NOTES:

All units expressed in ug/L (ppb)
Depth of well expressed in feet.

J	Indicates estimated value.
	Indicates semi-volatile organic compounds.
*	Indicates volatile organic compounds.
**	Indicates pesticides.
***	Indicates PCB's.

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MAMARONECK TAYLOR LEAF COMPOST SITE
VOLATILE ORGANIC COMPOUNDS, SEMI-VOLATILE COMPOUNDS, PESTICIDES AND PCB CONCENTRATIONS (ug/L)
IN LEACHATE SAMPLES (WELLS SCREENED IN THE FILL)

MALCOLM PIRNIE, INC.

FIGURE 1-11

Semi-Volatile Organic Compounds

SVOCs were detected in five (MW-4, MW-9S, MW-11S, MW-13, MW-14S) of the 10 monitoring wells screened in the fill during the first round of sampling, and in 7 monitoring wells (MW-4, MW-9S, MW-10, MW-11, MW-13, MW-14S, MW-17) during the second round of sampling. One well (MW-19) was sampled during the supplemental RI, and was found to contain SVOCs. The distribution of the maximum concentrations of SVOCs on the site are illustrated in Figure 1-11.

SVOCs detected in leachate samples were predominantly centered in the northern half of the site, and are concentrated in the vicinity of MW-11S. The major constituents of SVOC contamination exceeding MCL's detected in the leachate in MW-11S are the following: napthalenes, phenanthrene, bis(2-ethylhexyl)phthalate, and 4-methylphenol. In MW-19, which is located 13 feet downgradient of MW-11S and screened in the same zone, only 4-methylphenol was detected. In addition, benzyl alcohol was also detected at concentrations of 88 ppb and 28 ppb in MW-4 during the first and second rounds of sampling, respectively.

Pesticides

Low concentrations of TCL pesticides were detected in the leachate over much of the central and northern portion of the site, and at slightly higher levels in the MW-11S vicinity. The maximum contaminant concentrations and associated distributions are depicted in Figure 1-11.

Pesticides were detected in seven monitoring wells (MW-4, MW-9S, MW-10, MW-12, MW-16, MW-17) in the first sampling event at total concentrations ranging from 0.078 ppb in MW-17 to 130 ppb in MW-11S. Concentrations decreased rapidly with increasing radial distance from MW-11S. The next highest concentration was detected in MW-10 at a level of 2.74 ppb.

Total pesticides detected in the second round of sampling occurred in similar wells (MW-4, MW-9S, MW-10, MW-11, MW-12, MW-13, MW-14S, MW-17) as the first round of sampling. However, concentrations are slightly higher in two additional wells, MW-13 and MW-14. Concentrations ranged from 0.055 ppb in MW-14S to a maximum of 870 ppb in MW-11S.

PCBs

PCBs were detected in the leachate in monitoring well MW-10 in both sampling events at concentrations of 22 ppb in the first round and 420 ppb in the second round. PCBs were detected in two other ground water samples; one from MW-14S and one from MW-17. The levels detected in MW-17 were 0.75 ppb in the first round. During the second round, 1.3 ppb were detected in MW-14S. PCBs were also detected in MW-19 at a concentration of 1.1 ppb. There were no PCBs detected in MW-11S, located 13 feet upgradient from MW-19M.

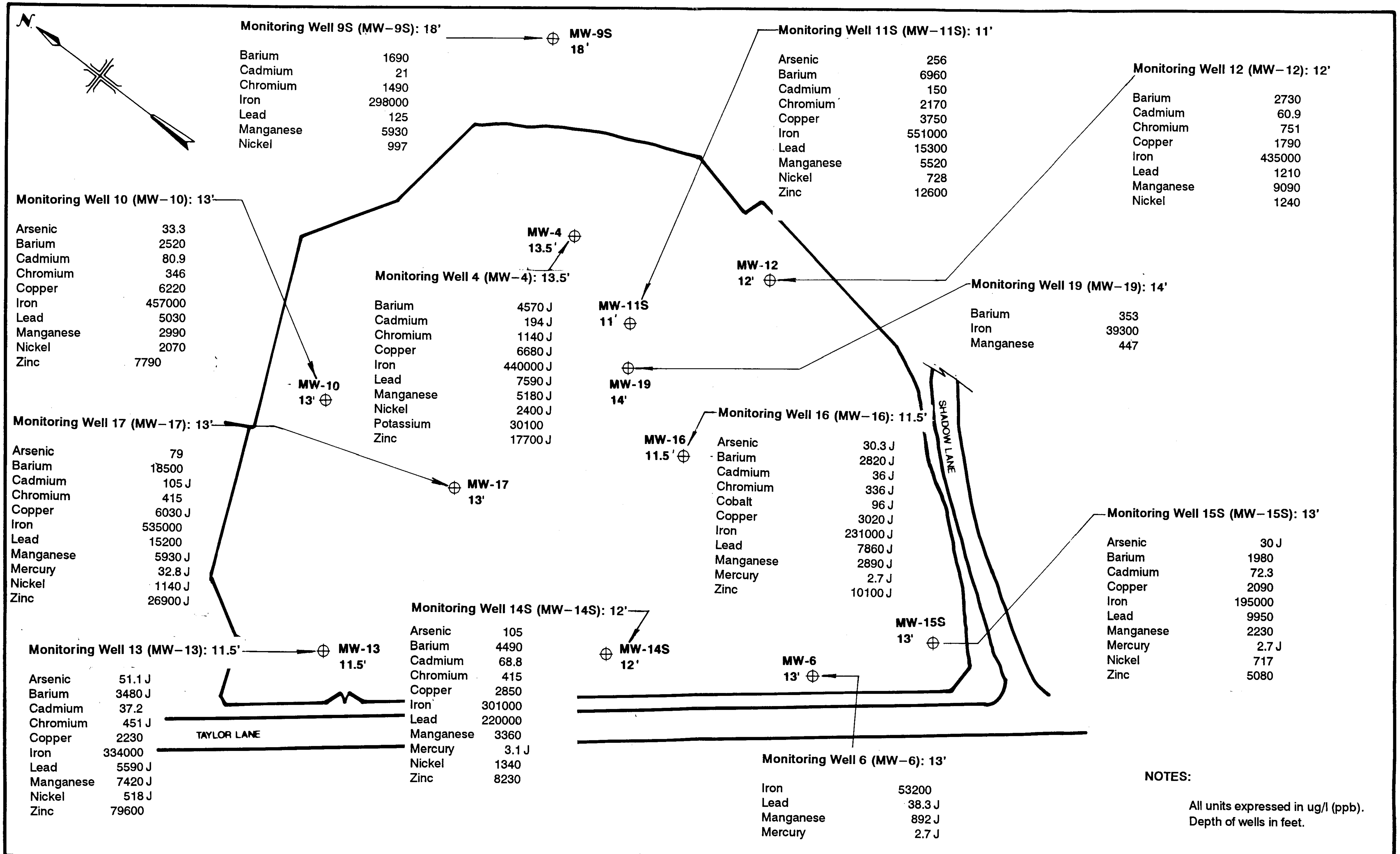
Inorganic Compounds

TAL inorganic parameters are present in the leachate randomly throughout the site, and the maximum detected levels are shown in Figure 1-12. As previously indicated in the RI (Volume 1), the total maximum metal concentrations were detected in the central portion of the site. Individual inorganic concentrations also have elevated levels located randomly throughout the site.

Arsenic was detected in 9 of the 12 shallow monitoring wells on the site. During round one sampling, the concentrations ranged from 2.8 ppb in MW-9S, to a maximum of 204 ppb in MW-11S. In seven of the wells, arsenic exceeded the NYSDEC drinking water standards. In both sampling rounds, MW-11S had the maximum detected concentrations found on-site. In MW-19, located 13 feet downgradient of MW-11S, arsenic was not detected. Well MW-17 had the second highest detected value of 79.3 ppb.

Barium was detected in 11 of the 12 wells sampled. The maximum concentration detected on-site was in MW-17 at a level of 18,500 ppb. Cadmium was detected in 10 of the 12 monitoring wells screened in the fill. Concentrations ranged in MW-15S from 3.1 ppb to a maximum of 194 ppb in MW-4 in the first round, and a minimum of 21 ppb in MW-9S to a maximum of 150 ppb in MW-11S during the second round. Copper was detected in 8 of the 12 wells screened in the fill layer. The maximum detected concentration was found in MW-4 at a level of 6,680 ppb.

Total chromium concentrations generally decreased significantly from the first round of sampling to the second round of sampling. The most notable decrease occurred in MW-4 which had a concentration of 1,140 ppb in round one, to non detect (ND) in round two. Four other wells that experienced similar trends were MW-11, MW-13, MW-16 and MW-17. On the other hand, there were two wells (MW-9S, MW-15S) which showed a significant



Monitoring Well 9S (MW–9S): 18'

Barium	1690
Cadmium	21
Chromium	1490
Iron	298000
Lead	125
Manganese	5930
Nickel	997

Monitoring Well 11S (MW–11S): 11'

Arsenic	256
Barium	6960
Cadmium	150
Chromium	2170
Copper	3750
Iron	551000
Lead	15300
Manganese	5520
Nickel	728
Zinc	12600

Monitoring Well 12 (MW–12): 12'

Barium	2730
Cadmium	60.9
Chromium	751
Copper	1790
Iron	435000
Lead	1210
Manganese	9090
Nickel	1240

Monitoring Well 10 (MW–10): 13'

Arsenic	33.3
Barium	2520
Cadmium	80.9
Chromium	346
Copper	6220
Iron	457000
Lead	5030
Manganese	2990
Nickel	2070
Zinc	7790

Monitoring Well 4 (MW–4): 13.5'

Barium	4570 J
Cadmium	194 J
Chromium	1140 J
Copper	6680 J
Iron	440000 J
Lead	7590 J
Manganese	5180 J
Nickel	2400 J
Potassium	30100
Zinc	17700 J

Monitoring Well 19 (MW–19): 14'

Barium	353
Iron	39300
Manganese	447

Monitoring Well 17 (MW–17): 13'

Arsenic	79
Barium	18500
Cadmium	105 J
Chromium	415
Copper	6030 J
Iron	535000
Lead	15200
Manganese	5930 J
Mercury	32.8 J
Nickel	1140 J
Zinc	26900 J

Monitoring Well 16 (MW–16): 11.5'

Arsenic	30.3 J
Barium	2820 J
Cadmium	36 J
Chromium	336 J
Cobalt	96 J
Copper	3020 J
Iron	231000 J
Lead	7860 J
Manganese	2890 J
Mercury	2.7 J
Zinc	10100 J

Monitoring Well 15S (MW–15S): 13'

Arsenic	30 J
Barium	1980
Cadmium	72.3
Copper	2090
Iron	195000
Lead	9950
Manganese	2230
Mercury	2.7 J
Nickel	717
Zinc	5080

Monitoring Well 13 (MW–13): 11.5'

Arsenic	51.1 J
Barium	3480 J
Cadmium	37.2
Chromium	451 J
Copper	2230
Iron	334000
Lead	5590 J
Manganese	7420 J
Nickel	518 J
Zinc	79600

Monitoring Well 14S (MW–14S): 12'

Arsenic	105
Barium	4490
Cadmium	68.8
Chromium	415
Copper	2850
Iron	301000
Lead	220000
Manganese	3360
Mercury	3.1 J
Nickel	1340
Zinc	8230

Monitoring Well 6 (MW–6): 13'

Iron	53200
Lead	38.3 J
Manganese	892 J
Mercury	2.7 J

NOTES:

All units expressed in ug/l (ppb).
Depth of wells in feet.

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MAMARONECK TAYLOR LEAF COMPOST SITE
INORGANIC COMPOUND CONCENTRATIONS (ug/L) IN LEACHATE SAMPLES (WELLS SCREENED IN THE FILL)

MALCOLM PIRNIE, INC.

FIGURE 1-12

increase between rounds one and two. MW-9S had a chromium concentration of 432 ppb in round one, and increased to 1,490 ppb in round two. Similarly, the levels in MW-15S rose from 10.9 ppb in round one to 328 ppb during round two.

Total lead was detected in 11 out of 12 monitoring wells on the site. The maximum detected concentration was found in MW-14S, at a level of 220,000 ppb. The next highest level of lead was detected in samples from MW-11S and MW-17 at concentrations of 15,300 ppb and 15,200 ppb, respectively. Manganese was detected in all 12 wells that were sampled. The maximum concentration detected was found in MW-12 at a level of 9,090 ppb. The minimum concentration detected, 447 ppb, was found in MW-19.

Total mercury was detected in a total of 9 out of 12 wells sampled. The maximum level detected during the first round of sampling was in MW-17 with a value of 32.8 ppb. The minimum concentration was found in MW-4, at a level of 0.22 ppb. The levels of mercury detected throughout the remainder of the site decreased significantly during the second round of sampling. The most notable decrease occurred in MW-17 with a decrease to 3.8 ppb.

Nickel was detected in 10 of the 12 well sampled. Since there is no NYSDEC drinking water standard, the USEPA MCL was used, which has a proposed value of 100 ppb. Using this value as a criteria, 9 of the 10 wells were in exceedence of this value. The maximum detected concentration was found in MW-4, at a level of 2,400 ppb. Zinc was detected in 8 of the 12 monitoring wells sampled. The maximum concentration was found in MW-13, at a level of 79,600 ppb. Cyanide was detected in three of the 12 wells (MW-11S, MW-14S, MW-19) that were sampled during the field investigation.

1.5.5 Comparison of Contaminant Levels in Ground Water to ARARs

In those cases where no NYSDEC drinking water standard or USEPA MCL were available, the contaminants were classified as unspecified organic contaminants and defaulted to a standard of 50 ppb. The first criteria used in evaluating the ground water concentration in the sand layer, was the NYSDEC Class GA Ground Water standards (6 NYCRR Part 703.5). This criterion was considered on the basis that ground water would be treated and reinjected on-site to the lower aquifer. This standard applies to the site only for the ground water contained in the lower aquifer, which potentially could be used as a future source of potable water. Figures 1-13 and 1-14 list only those concentrations detected above the Class GA Standards for wells screened in the sand layer.

Volatile Organic Compounds

The only VOCs detected in the ground water within the sand unit were found in MW-14M. Vinyl chloride was detected in both rounds of sampling; 70 ppb in round one and 95 ppb in round two. 1,2-dichlorethene was also detected consistently in both rounds, with the maximum concentration occurring in MW-14M at a value of 100 ppb. No SVOCs were detected in any wells at concentrations greater than the NYSDEC standard.

Pesticides were detected in two monitoring wells at concentrations greater than the NYSDEC drinking water standard. Alpha-BHC, beta-BHC and gamma-BHC were detected in MW-14M at concentrations of 0.0390 ppb, 0.0260 ppb, and 0.0140 ppb, respectively. Monitoring well M11-M contained alpha-BHC at a level of 0.054 ppb, beta-BHC at value of 0.270 ppb, and dieldrin at 0.0587 ppb. No PCBs were detected in any of the wells at levels exceeding the NYSDEC drinking water standard.

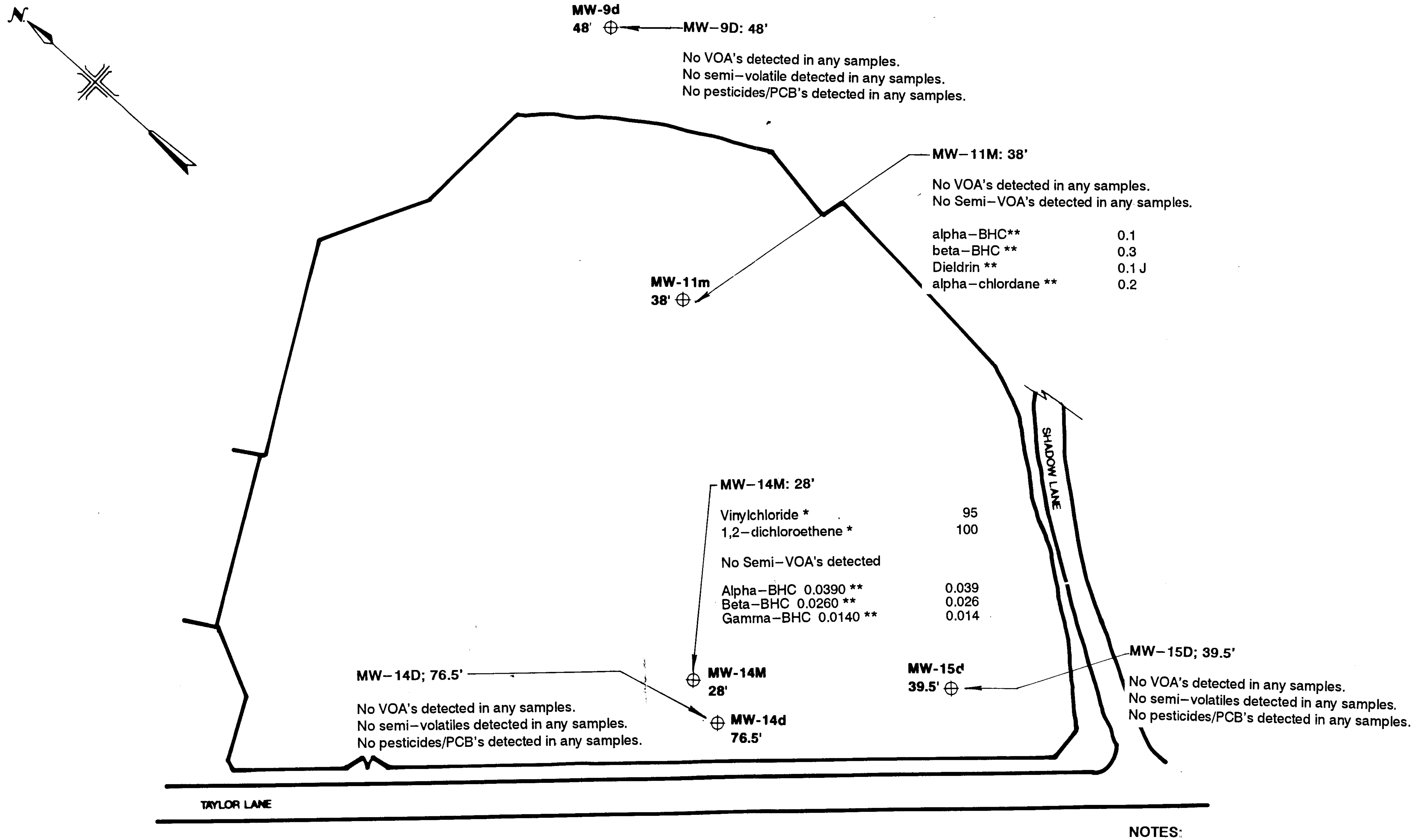
Inorganic Compounds

Contained on Figure 1-14 are the inorganic contaminants and associated concentrations which exceeded the Class GA drinking water standards. However, for purposes of discussing the nature and extent of contamination, only the following constituents were evaluated: chromium, iron, lead, manganese, nickel, magnesium nickel, and cyanide.

Arsenic, cadmium, copper, mercury and zinc were not detected in excess of the NYSDEC drinking water standards in any of the wells screened within the sand unit, and therefore not further considered contaminants of concern.

Total chromium was detected in four (MW-9D, MW-11M, MW-14D, MW-15D) of the five wells sampled during field investigations at levels exceeding the NYSDEC drinking water standard. The maximum detected concentration was found on-site was in MW-9D at a concentration of 1,210 ppb.

Iron was detected in all five wells screened in the lower sand unit. The maximum concentration occurred in MW-9D, at a value of 50,500 ppb above the Class GA standard of 800 ppb.



MW-9D: 48'

No VOA's detected in any samples.
No semi-volatile detected in any samples.
No pesticides/PCB's detected in any samples.

MW-11M: 38'

No VOA's detected in any samples.
No Semi-VOA's detected in any samples.

alpha-BHC**	0.1
beta-BHC **	0.3
Dieldrin **	0.1 J
alpha-chlordane **	0.2

MW-14M: 28'

Vinylchloride *	95
1,2-dichloroethene *	100

No Semi-VOA's detected

Alpha-BHC 0.0390 **	0.039
Beta-BHC 0.0260 **	0.026
Gamma-BHC 0.0140 **	0.014

MW-14D; 76.5'

No VOA's detected in any samples.
No semi-volatiles detected in any samples.
No pesticides/PCB's detected in any samples.

MW-15D; 39.5'

No VOA's detected in any samples.
No semi-volatiles detected in any samples.
No pesticides/PCB's detected in any samples.

NOTES:

	All units expressed in ug/L (ppb)
J	Indicates estimated value
*	Indicates volatile organic compounds.
**	Indicates pesticides.
***	Indicates PCB's.

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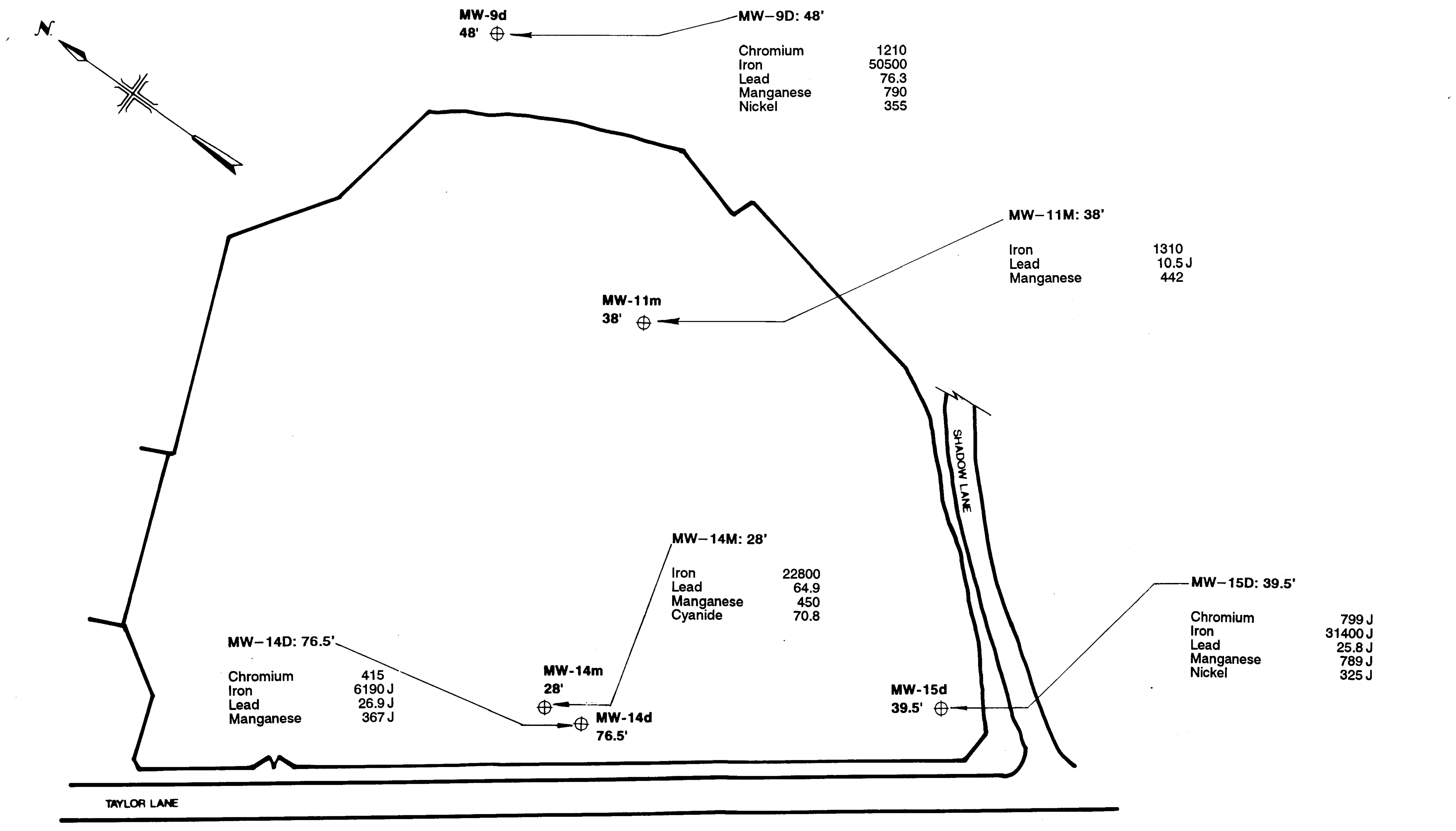
MAMARONECK TAYLOR LEAF COMPOST SITE
VOLATILE ORGANIC COMPOUNDS, SEMI-VOLATILE COMPOUNDS, PESTICIDES AND PCB CONCENTRATIONS (ug/L)
DETECTED IN GROUND WATER (EXCEEDING NY STATE GROUND WATER STANDARDS)

MALCOLM PIRNIE, INC.

FIGURE 1-13



NOTES:

All concentrations expressed in ug/L (ppb).
Depth of wells expressed in feet.
J indicates estimated value

MALCOLM PIRNIE

MAMARONECK TAYLOR LEAF COMPOST SITE
INORGANIC COMPOUND CONCENTRATIONS (ug/L) DETECTED IN GROUND WATER
(EXCEEDING NY STATE GROUND WATER STANDARDS)

MALCOLM PIRNIE, INC.

FIGURE 1-14

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Total lead was detected in all of the five wells screened within the sand unit. The maximum concentration detected was in MW-9D, at level of 76.0 ppb. The next highest concentration was in MW-14M at a value of MW-14M. The NYSDEC drinking water standard is 25 ppb, and was exceeded in 4 of the 5 monitoring wells.

Manganese was detected in all five monitoring wells sampled at the Mamaroneck site. The most elevated concentration was detected in MW-9D at a level of 790 ppb. Nickel was detected in three (MW-9D, MW-11M, MW-15D) of the five wells screened in the sands. The highest detected concentration was found in MW-9D, at a value of 355 ppb in MW-9D.

1.6 GENERAL RESPONSE OBJECTIVES AND ACTIONS

As required under the 6 NYCRR Part 375 for inactive hazardous waste sites, remedial alternatives for the Mamaroneck Site were developed with the objective of being protective of human health and the environment. The remedial action objective will be achieved by controlling the source of contamination and eliminating the potential exposure pathway where possible. As indicated in Table 1-1, the primary constituents of concern at the site are volatile and semi-volatile organic compounds, pesticides, PCBs, and metals. The principal media of concern are the isolated "hot spots" along the eastern border of the site, contaminated fill, leachate, and ground water beneath the fill. Presently, there is a low probability of organic chemicals in the soil and ground water volatilizing into the air. However, under excavation conditions, this situation would require constant monitoring.

1.6.1 Remedial Action Objectives for Fill/Isolated "Hot Spots"

Fill contamination exists at various locations on-site, including isolated "hot spots" and is primarily the result of disposal of miscellaneous wastes at the site over the course of many years. Contamination exists throughout the disposal areas at the site and consists of volatile organic compounds, semivolatile organic compounds, pesticides, PCBs, and metals. Because of the low permeability of the fill, the high cation exchange capacities, and high organic content, the contaminants have not historically been highly mobile. However, low levels of contaminants have migrated into the sand aquifer below. The contaminants at the site represent a potential risk to human health and the environment due to the potential for heavy metals and PAHs to continue to migrate from the leachate into the ground water beneath the site, which could lead to potential off-site migration. The fill contaminants also represent a potential health hazard due to the potential for exposure to contaminants via surface soils (dermal exposure) or ingestion.

The preliminary objective of the remedial action for the fill and isolated "hot spots" is to reduce or eliminate the potential for exposure to contaminants via dermal contact or ingestion, and to control the source of migration from the leachate and into the ground water.

1.6.2 Remedial Action Objectives for Leachate/Ground Water

Minimal ground water contamination at the site has resulted from migration of contaminants in the leachate to the sands. However, much lower levels of the more mobile contaminants have migrated from the upper fill layers downward into the ground water within the sand layer beneath the fill.

The VOC leachate concentrations detected throughout the site were totalled and compared with the Westchester County Sewer Influent limit of 2,100 ppb of total VOCs (which include VOCs, SVOCs, pesticides and PCBs). Based on the average concentrations detected from all sampling events, it is estimated that pre-treatment of the leachate may be required for volatiles and metals prior to discharge into the POTW (Refer to Appendix A - Treatability Study). However, the degree of pre-treatment for volatiles and metals is dependent upon the ultimate concentrations, and flow of leachate generated from the remedial action, and approval for the discharge of the leachate into the WCDEF POTW.

The remedial action objective for ground water is to decrease, to the extent feasible, further generation of leachate (source control), and to control the migration of contaminants that are already in the sands from farther migrating off-site.

2.0 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES

2.1 REMEDIAL TECHNOLOGY SCREENING CRITERIA

This section identifies general remedial technologies which may be applicable to fill, leachate, and ground water at the Mamaroneck Taylor Lane site. In addition, each alternative also applies to the isolated "hot spots" located on the eastern perimeter of the site. Each technology is qualitatively evaluated considering three primary screening criteria to screen out and eliminate those alternatives that are not effective, implementable, or reasonable in cost. A broader description of each of the screening criteria follows.

2.1.1 Effectiveness Evaluation

A key aspect of the screening evaluation of each general remedial alternative is its effectiveness in protecting human health and the environment. Each alternative is evaluated based on its effectiveness in providing a reduction of contamination toxicity, mobility, or volume. Both short and long-term components of effectiveness are evaluated. Short-term effects are those possible during the construction and implementation period; and conversely, long-term effects refer to the period of time after the remedial action is completed.

2.1.2 Implementability Evaluation

Implementability is a measure of both the technical and administrative feasibility of constructing, operating, and maintaining a remedial action alternative. It is used during screening to evaluate a combination of process options with respect to conditions at a specific site. Technical feasibility refers to the ability to construct, reliably operate, and meet technology-specific regulations for process options until a remedial action is completed. It also includes operation, maintenance, replacement, and monitoring of technical components of an alternative, if required, into the future after the remedial action is complete. Administrative feasibility refers to the ability to obtain approvals from other offices and agencies, the availability of treatment, storage, and disposal services and capacity, and the requirements for, and availability of, specific equipment and technical specialists.

2.1.3 Cost Evaluation

Typically, technologies have been defined well enough prior to screening that some estimate of cost is available for a comparison to be made among technologies. However, because uncertainties associated with the definition of technologies often remain, it may not be practical to define the cost of technologies with the accuracy desired for the detailed analysis. At this stage in the evaluation, a cost analysis is made primarily on the basis of engineering judgement. The cost associated with each process option are compared with costs of other process options within the same technology type, usually on a per-unit basis.

2.2 REMEDIAL TECHNOLOGIES FOR SOIL/FILL

The available technologies for meeting the remedial objectives for soil/fill at the Mamaroneck Taylor Lane site can be divided into four categories: containment; in-situ treatment; excavation with on-site treatment and placement of soils back on-site; and excavation with off-site treatment and disposal. In the following sections, remedial technologies within each of these categories are identified and evaluated.

2.2.1 Containment

Containment may involve various capping/covering technologies. Capping is a containment process by which the ground surface is sufficiently covered to prevent surface water infiltration, control erosion, and isolate and contain contaminated wastes. A variety of impermeable cover materials and sealing techniques are currently available. Fine-grained soils such as clays and silty clays have low permeabilities and are suited for capping because they resist infiltration and percolation of water. Flexible synthetic membranes including materials made of polyvinyl chloride (PVC), high or low density polyethylene (HDPE/LDPE) and synthetic rubbers are also available for use as cover materials.

Capping is an effective method for preventing percolation of precipitation through the contaminated soils at the site. Moreover, capping can be easily implemented and has a relatively low capital and operation and maintenance (O&M) cost. Several capping options are further described as follows:

Gravel Cover

A gravel cover is typically utilized for the purpose of preventing erosion and mitigating contact with contaminated materials. However, on it's own, it is not effective in preventing infiltration of precipitation or surface water through the gravel to the subgrade, and therefore eliminated from further evaluation. Following grading to prevent pooling or ponding of precipitation, a geotextile filter fabric layer followed by an approximate six-inch layer of crushed gravel may be placed over the contaminated soils.

Topsoil Cover

A topsoil cover is typically used only for the purpose of preventing erosion and contact with contaminated materials. It is only partially effective in reducing infiltration of precipitation or surface water through the soil by promoting evapotranspiration and runoff by improved vegetation cover. An approximate six-inch thick layer of topsoil may be placed over the contaminated soils and seeded to promote vegetative growth for erosion control and evapotranspiration. This alternative is not effective in reducing the overall amount of infiltration through the cap, and therefore is not retained as an individual capping alternative.

Asphalt Cover

An asphalt cover is effective in mitigating erosion and contact with contaminated materials at a hazardous waste site, and will limit infiltration of surface water to various degrees depending upon its thickness and composition. In consideration of future use of the site, the most applicable asphalt cover would be constructed in accordance with road or parking area design specifications to support vehicles. This type of asphalt cover will include a layer of stone, followed by a base asphalt course and a final top course. The asphalt layers are smoothed and compacted following placement. This alternative is not effective in reducing the overall amount of infiltration through the cap, and is not retained as a capping alternative.

6 NYCRR Part 360 Soil Cap

The 6 NYCRR Part 360 cap is most commonly used in the closing of non-hazardous landfills. The cap is placed in layers following grading of the site to facilitate surface water run-off. The initial layer consists of synthetic filter fabric covered by crushed stone or sand for venting methane gas (which is typically generated by decomposition of municipal solid waste in landfills). The gas vent layer is then covered by another layer of filter fabric, followed by an 18-inch barrier layer of recompacted low permeability clay, or geosynthetic membrane. A 24-inch layer of barrier soil serves as a protection to either the barrier layer or geosynthetic membrane, from root penetration, desiccation and freezing. A final six-inches of topsoil is then placed and seeded to promote vegetative growth for erosion control purposes. Both of these alternatives options, clay or geosynthetic membrane cap, have been retained for further development.

6 NYCRR Part 373 (RCRA) Cap

The multi-media RCRA cap is generally implemented at hazardous waste sites. This type of cap is especially useful at sites where the ground water has not been impacted, but the potential for ground water contamination exists. The initial layer (placed following site grading to facilitate surface water run-off) consists of 24-inches of low permeability, recompacted soil followed by six-inches of sand, a synthetic membrane liner, a 12-inch sand drainage layer, a layer of synthetic filter fabric, and a 24-inch barrier protection layer. The final layer is six-inches of topsoil seeded to promote vegetative growth for erosion control purposes.

Based on the low permeability of the fill material and concentrations of the contaminants at the Mamaroneck site, the RCRA cap was not considered a cost effective remedial alternative and therefore, screened from further development.

2.2.2 In-Situ Treatment Technologies

Soil Vapor Extraction

Soil vapor extraction (SVE) is designed to physically remove volatile compounds, generally from the vadose or unsaturated zone. It is an in-situ process employing vapor extraction wells alone or in combination with air injection wells. Vacuum blowers supply the motive force, inducing air flow through the soil matrix. The air strips the VOCs from the soil and carries them to the screened extraction wells. Air emissions from the systems are typically controlled by adsorption onto activated carbon, thermal destruction or condensation by refrigeration. SVE is effective for removing VOCs, but is not effective for removing semivolatile organic compounds or pesticides. Since both of these types of organic constituents exist in the soil on the site, SVE will not effectively reduce all soil contamination on-site.

A number of soil characteristics influence the overall effectiveness and implementability of SVE at a site. The primary factors influencing SVE effectiveness are the soil heterogenicity and permeability. The more heterogeneous the soil, the more difficult it is to remediate with SVE. Since the soils/fill layer at the Mamaroneck site are highly heterogeneous, this would be a limiting factor in the treatment of the soils with SVE. The soils also demonstrate a low air permeability which is not suitable for in-situ SVE. Additional factors influencing the effectiveness of SVE are the total organic carbon content and sorptive capacity, both of which are high in the soils at the Mamaroneck site and not conducive to implementing SVE. The aforementioned site soil characteristics as well as the fact that SVE will remove only VOCs demonstrate the limited applicability of SVE for use at the Mamaroneck site, and therefore, will not be further evaluated as a treatment technology.

Soil Flushing (In-situ)

An in-situ soil flushing system consists of flooding a contaminated site with a washing solution which is percolated vertically downward through the soil column. Flushing solutions include water, acids, bases and surfactants. The selection of a particular solution is dependant on the type of contaminant to be removed from the soil. The washing solution is introduced either through injection or infiltration, and solubilizes, emulsifies or chemically reacts with the contaminants in the soil, and effectively flushes the contaminants from the soil. The flushing solution and entrained contaminants, termed elutriate, are then collected in drains or a well network and returned to the surface, where the contaminants are recovered, treated or disposed. The best results for soil flushing are obtained in highly permeable, low organic content soils.

The major advantages of soil flushing are that it is relatively cost effective and easy to implement. However, the soils must exhibit a high permeability for flushing to be effective. As previously indicated, the soils at the site are composed primarily of low permeable clays and silts, thus preventing a complete and intimate contact of the flushing solution. Additional disadvantages of soil flushing include: the introduction of potentially toxic substances; i.e., the flushing solution; incomplete removal of contaminants due to impermeable or heterogeneous soil; and difficulty in total and successful collection of the elutriate.

To date, in-situ soil flushing has not been demonstrated on a large scale remediation project involving low permeability soils. In addition, this technology would have a limited applicability at the Mamaroneck site due to the range of contaminants present in the fill material. For these reasons, soil flushing is not implementable or effective for use at the Mamaroneck site, and thus is eliminated from further consideration during the FS.

Vitrification (In-situ)

In-situ vitrification (ISV) utilizes electrical power to heat and melt contaminated soils, to form a stable glass and crystalline structure with very low leaching characteristics. ISV uses a square array of four electrodes inserted into the ground to establish a current in the soil, and heat the soil to a range of 2900°F to 3600°F, well above a typical soil's melting point. As the melt is generated downwards from the surface, organic constituents are destroyed by pyrolysis and the pyrolized products migrate to the surfaces of the vitrified zone where they are combusted in the presence of oxygen. Non-volatile inorganic contaminants are incorporated into the melt. The resultant product is devoid of residual organics compounds. In-situ vitrification was originally used to stabilize radioactive wastes, and it has only been recently considered for the treatment of hazardous material.

This technology may be applied to most soil types. However, the limiting factors in implementing vitrification, include: the need for a low soil moisture content and the absence of glass-forming materials such as silicon and aluminum oxides. If a significant quantity of soil below the water table needs to be treated, dewatering must be performed prior to vitrification, thereby increasing the overall costs significantly.

ISV also requires off-gas collection, treatment and disposal of spent activated carbon, scrubber water, and other waste materials from the air pollution control equipment which may be hazardous. Also, backfilling with clean soil may be required since the volume of soil can decrease 20% to 40% during the process.

Vitrification will not be retained for further detailed analysis during the FS due to the prohibitive costs associated with the process on a large scale basis. Dewatering of the fill, in combination with the excessive power requirements, and off-gas collection and treatment system, creates an economically impractical solution.

Solidification/Stabilization (In-situ)

In-situ soil mixing stabilization/solidification combines the use of a cement-based proprietary additive with an in-situ deep soil mixing system. The mixing system involves a vertical drive auger with a series of cutting and mixing blades. As the auger is advanced into the contaminated material, the additive slurry is injected through ports in the auger head and mixed with the medium to be stabilized. Typically, three foot diameter columns are positioned with the necessary overlap to cover the entire area to be stabilized. Based on results of the laboratory bench-scale treatability testing, the additive mixture can be tailored to provide optimum fixation of the target contaminants and physical strength/durability of the solidified mass.

In-situ soil mixing has been successfully used to immobilize organic and inorganic wastes. However, the most significant challenge in applying solidification/stabilization treatment in-situ is achieving complete and uniform mixing of the solidifying/stabilizing agent with the soils. Implementing in-situ solidification/stabilization would be very difficult at the Mamaroneck Taylor Lane site based on the low permeability of the soils, and the inability to guarantee complete contact of the solidification agent with the contaminated soils. Therefore, this technology has been eliminated from any further development during the FS.

Bioremediation (In-situ)

Bioremediation promotes and accelerates the natural biodegradation process in the undisturbed soil. Generally, it consists of the recirculation of ground water, which has been conditioned with nutrients and an oxygen source, through infiltration galleries or injection wells in an effort to stimulate and sustain microbial degradation of the soil contaminants by indigenous bacteria. A common system design consists of central withdrawal of ground water and reinfiltration through infiltration galleries or wells at several locations around the outer border of the treated area. In general, soil saturation is required. Since the treatment process is aerobic, oxygen and soluble forms of mineral nutrients must be introduced throughout the saturated zone. Oxygen is usually the limiting factor, however, nitrate is being researched as an alternate electron receptor. The end products of aerobic biodegradation are carbon dioxide, water and bacterial biomass.

This technology would be difficult to implement at the site due to the highly impermeable fill material present. Also, bioremediation would not be an effective technology for reducing the concentrations of certain contaminants found on-site, namely, heavy metals and PCBs. In addition, the heavy metals present in the soil at the site may be toxic to microbial degradation. Therefore, in-situ bioremediation is eliminated as a feasible technology for soil remediation at the Mamaroneck site.

2.2.3 Excavation and On-site Treatment and Disposal

The technolgies evaluated under this alternative assume excavation would occur after dewatering of the fill has been completed. In addition, it is assumed that the fill will be treated on-site, and disposed of back on-site.

Incineration

Incineration uses high temperatures ranging from 1600 to 2200°F to volatilize and combust organic constituents in hazardous wastes. The three most common incinerator designs are rotary kilns, infrared furnaces and circulating fluidized bed incinerators. The destruction and removal efficiency (DRE) for properly operated incinerators often exceeds the 99.99 percent requirement for hazardous waste.

Rotary kilns are slightly inclined, refractory lined cylinders used for the controlled combustion of organic wastes under net oxidizing conditions. Wastes and auxiliary fuel are injected into the high end of the kiln and passed through the combustion zone as the kiln slowly rotates. Retention time can vary from a few minutes to an hour or more. Ash is removed from the lower end of the kiln. Flue gases are passed through a secondary combustion zone and then through air pollution control units. Residuals generated from this process include: ash, stack gases, and brine solution from the ash quench and wet scrubber.

Infrared thermal units use silicon carbide elements to generate thermal radiation beyond the red end of the visible spectrum. Materials to be treated pass through the unit on a conveyor belt. Residuals from this process are the same as those from a rotary kiln.

Fluidized beds consist of a refractory lined vessel filled with an inert, granular material. Combustion air is forced upward through the bed thereby suspending the material. Fluidized beds can be operated at lower temperatures than other incinerators because of the high mixing energies aiding combustion. Fluidized beds also use limestone to capture acid-gases, thus eliminating the need for wet scrubbers and one of the residual streams from the process.

Some general limitations regarding all incinerator types are the following: relatively high costs, public resistance, and complications due to the presence of metals including lead and arsenic. Heavy metals can react with other elements in the feed stream such as chlorine or sulfur, forming more volatile and toxic compounds than the original species. In addition, fine particle size of soil feed such as clays and silts will result in high particulate loading in flue gases. For these reasons, this technology would not be appropriate for use as an on-site treatment alternative, and is eliminated from further consideration. In addition, several waste disposal firms have indicated that, based on the cadmium and arsenic levels in the fill/soils, the materials would not be accepted for incineration. Therefore, this alternative has been eliminated as a potential remediation option.

Enhanced Volatilization

Enhanced volatilization, also known as low temperature thermal desorption, is a physical process that uses heat to vaporize organic contaminants from soil at temperatures as high as 600°C. A rotary kiln is typically used with air, combustion gas, or inert gas is used as the transfer medium for the vaporized components. Since the contaminants are not destroyed in the desorber unit, off-gases from the desorber must be treated to remove organic contaminants and particulates. This can be achieved through carbon beds, thermal oxidizers or condenser systems.

Enhanced volatilization has been proven effective for the removal of VOCs and many SVOCs such as dichlorobenzene, bis-(2-ethylhexyl)-phthalate and PCBs. Factors affecting the performance of thermal desorption are the desorber operating temperature, residence time, moisture content of the soil and the type of soil to be treated.

To date; thermal desorption has been the selected remedy for 14 Federal Superfund sites. However, enhanced volatilization would not be applicable for use the Mamaroneck site since this technology does not effectively remove heavy metals from soils. This would, therefore, require the use of an additional technology in concert with thermal desorption, and significantly increase the overall capital and O&M costs. This process option is not retained for further consideration as a remedial alternative for use at the Mamaroneck site.

Soil Washing (Ex-situ)

Soil washing is an aqueous based technology that is effective in treating various organic and inorganic waste groups. It was designed for the separation/segregation and volumetric reduction of hazardous materials in soils. The process involves high energy contacting and mixing of excavated contaminated soils with aqueous-based washing solution in a series of mobile washing units. The selection of the washing fluid is based on the contaminants that are to be removed.

Advantages of soil washing include a closed treatment system, potential significant volume reduction of the contaminant mass, wide application to a variety of waste groups, and the mobility of technology and relatively low costs compared to other multi-contaminant treatment technologies.

Soil washing relies on the fact that contaminants have a tendency to adhere to the organic carbon and fine-grained soil fraction as opposed to the coarse grained mineral fraction. Hence, the process is relatively ineffective on soils with high silt and clay content.

Soil washing is therefore not considered for further development as an effective remedial technology for use at the Mamaroneck site due to the soil characteristics.

Biological Treatment (Ex-situ)

Bioremediation technologies involve enhancing the biodegradation of contaminants through the stimulation of indigenous soil and ground water microbial populations or the addition of proprietary, natural microbial species. Two types of ex-situ processes to be considered under biological treatment are slurry phase and land treatment.

Slurry-phase biological treatment involves mixing the excavated soil with water to create a slurry that is mechanically agitated in an environment with the appropriate ambient conditions of nutrients, oxygen, pH and temperature. Microorganisms may be seeded initially or added continuously throughout an appropriate residence time. Upon completion of the process, the slurry is dewatered and the treated soil is disposed.

In land treatment, soil is placed in a prepared, lined soil treatment bed. Manure or nutrients are added as supplements to the soil and periodically cultivated. The use of standard construction equipment allows management of a large area of treatment.

These bioremediation processes have fairly broad applicability for organic wastes and are usually cost effective. Performance, however, is highly dependent on site conditions and can be inhibited by complex waste mixtures. At the Mamaroneck site, bioremediation is not further considered a viable remediation alternative because of the levels of heavy metals contained within the fill, which could have an inhibiting effect on the treatment process.

Solidification/Stabilization

As previously described, solidification/stabilization is a process whereby a cement based proprietary additive is mixed with the contaminated medium to form a stabilized material. Based on results of laboratory bench-scale treatability testing, the additive mixture can be tailored to provide optimum fixation of target contaminant and physical strength of the solidified mass. This process can either be performed in-situ as was described previously, or excavated and treated on-site.

The solidification/stabilization technology can be implemented as an on-site treatment alternative with relative ease. However, the long-term stability of the generated material would require extensive pilot testing prior to evaluating its overall effectiveness. This alternative is retained for further analysis and development.

Chemical Dehalogenation

The Alkaline Metal Hydroxide/Polyethylene Glycol (APEG) dehalogenation technology uses a glycolate reagent to remove halogens from halogenated aromatic organic compounds in a batch reactor. KPEG (potassium hydroxide/polyethylene glycol) is the most commonly used type of APEG reagent. APEG processes involve heating and physical mixing of contaminated soils, sludges and liquids with chemical reagents. During the reaction, water vapor and volatile organics are removed and condensed. Carbon filers are used to trap VOCs that are not condensed in the vapor. The treated residue is rinsed to remove reactor by-products and reagent and then dewatered prior to disposal. APEG processes have been proven effective for aromatic halides such as dioxins, furans and PCBs, but may not be effective for the suite of contaminants at this site, and is screened from further consideration.

Base Catalyzed Dechlorination (BCD) is another technology for removing chlorine molecules from contaminants such as PCBs, dioxins and pentachlorophenols. Like the APEG process, BCD requires the addition of a reagent to the contaminated media and heating of the material for reaction. But, because the reagent is not a glycol reagent, it is significantly less expensive than the KPEG reagent. BCD is an emerging technology and engineering research is being conducted for process optimization and scale-up. Based on this, chemical dehalogenation has been eliminated from further consideration due to its uncertain effectiveness on a full scale.

2.2.4 Excavation and Off-Site Treatment and Disposal

Off-Site Treatment and Disposal

Soil could also be excavated at the site after dewatering and treated at an off-site facility via solidification/stabilization and disposed of at a permitted landfill facility. The overall effectiveness of solidification/stabilization generally increases when performed ex-situ and off-site. The primary reason for the increase in effectiveness is the application of the technology; namely, that it occurs under controlled conditions. However, the limiting factors detailed previously for solidification/stabilization remain the same, with the added cost of transportation.

Solidification/stabilization is an implementable technology, but has not been demonstrated on a large scale application confirming the reduction of leachate generation. This technology will be retained for further development, under the assumption that pilot scale testing be conducted prior to implementing at the site.

2.2.5 No Action/Institutional Controls

Measures have already been taken by the Village of Mamaroneck to restrict access to the site, including the installation of a security fence around the site. The no action alternative would include additional institutional measures such as deed restrictions, adding new fencing to restrict Village personnel, additional signs (eg., "warning" and "no trespassing" signs), re-routing of the bicycle path, and potentially hiring a security service to patrol the site perimeter.

2.3 REMEDIAL TECHNOLOGIES FOR LEACHATE/GROUND WATER

Technologies to be considered for implementation of a leachate/ground water remedy at the Taylor Lane site consist of containment of the leachate and sands aquifer contaminants, recovery of leachate and ground water, treatment of recovered ground water, and if necessary, disposal. Specific technologies for each of these is discussed in the following sections.

2.3.1 Containment

Slurry Walls

Slurry walls are artificial hydraulic barriers installed to prevent water from flowing onto or off of the site. The typical slurry wall is constructed by pumping slurry into a trench as it is being excavated. The slurry walls may be made of cement-bentonite or concrete, but generally a soil-bentonite mix is used. The maximum depth of the wall is limited by the excavation equipment, often simply a backhoe. Walls up to 80 feet deep may be installed with a modified backhoe, or deeper using clam shell or dragline equipment. The slurry helps to maintain the integrity of the trench and forces bentonite into the soil matrix which reduces the permeability of the soil. "Keyed" slurry walls are connected to an aquiclude or competent geological member, while "hanging" slurry walls penetrate the water table but are not keyed into an aquitard. The primary function of a hanging slurry wall is to trap floating hydrocarbons and migrating gases.

Slurry walls may be placed upgradient of contaminated areas so that ground water will flow around the area, downgradient to catch ground water after it has flowed through a contaminated area, or circumferential to wastes so that contaminated ground water will be trapped while uncontaminated waters migrate around and outside the slurry walls. This option can be combined with a cap to prevent infiltration. Hydraulic cement has generally been used for grouting. This type of cement will readily harden and maintain its integrity in water. The addition of a clay or polymer will sometimes improve the effectiveness of the cement.

Certain types of clays (e.g., bentonite) that swell and form a gel in the presence of water are also used alone and in combination with a chemical additive. Clay grouts are relatively inexpensive and effective in coarse sands or small rock fissures. They have low gel strengths, however, so cannot support structures. This technology is retained for further development.

Grouting

Grouting is a process whereby one of a variety of fluids (eg., cement, clay, bentonite, silicates, polymers and so forth) is injected into a rock or soil mass to reduce ground water flow and strengthen the formation. Grout curtains are used in unconsolidated materials. Boreholes are drilled and grout is injected under pressure to form columns of interconnecting grout "pods". Some testing has indicated that grout curtains may not be capable of attaining low permeabilities due to non-coalescence of grout pods in adjacent holes and shrinkage of the grout during curing. Grouting, however, is more suited for rock formations than unconsolidated formations and will not be evaluated as means for ground water control at the site.

Sheet Piling

Sheet piling can be used as a ground water barrier in the same manner as a slurry wall. Sheet piles can be made of wood, precast concrete, or steel. Since wood is an ineffective water barrier and pre-cast concrete is only used when great strength is required, only steel sheet piling will be discussed. Steel sheet piles are driven into the ground through unconsolidated material using a drop hammer. However, fill materials or rocky soil may prevent advancement of the sheet pile or deflect the driven pile rendering any such wall ineffective as a ground water barrier. An alternative method is the excavation of trench followed by placement of the sheet pile and backfill material to stabilize the sheet pile walls. This alternative method would require dewatering of the excavation prior to installation. Again, sheet pile walls are typically keyed into a confining unit to prevent the downward migration of contamination following containment. Due to the presence of a significant amount of fill material and debris in the on-site soils, this type of technology will not be evaluated further as means for ground water control at the site.

2.3.2 Recovery

Trenches

Trenches can be installed to create a continuous zone of ground water influence. Equipment components include drain pipes or gravel beds to convey water, filters and envelopes to prevent system clogging and improve flow characteristics, and manholes or wet wells to collect water so that it can be pumped to the surface for treatment and/or disposal. Trenches will be retained for further evaluation as a leachate/ground water containment alternative.

Horizontal Wells

Horizontal wells may be utilized to extract ground water at depths up to about 65 feet. Horizontal wells, as used in the oil industry, are installed by drilling horizontally through the media, without the need to excavate the media in which the horizontal wells are installed. Typical installations use 393 to 820 feet of 32 to 65 feet diameter perforated recovery pipe (heavy polyethylene tubing) normally installed with double polyester filter. A key to the installation is the attachment of a pumping riser which extends from the recovery pipe to the surface. This pump riser is normally either 50 or 82 feet PVC pipe, depending on well capacity. The end of the well opposite the pumping header is brought to the surface with non-perforated tubing. This cleanout end is normally capped, but can be used for pumping also.

Although the technology for horizontal wells is feasible, the cost associated with installation, and operation and maintenance (O&M) are prohibitive. Therefore, horizontal wells have not been retained for further evaluation.

Well Points

Well points are effective at dewatering shallow water bearing zones and are therefore considered for dewatering the fill. Well points are generally installed at spacings of 10 to 20 feet, all around the area to be dewatered. During operation, a central pump lifts water from each well by producing a partial vacuum in the header pipes. Well points are generally driven into the water bearing zone because the large number of points makes drilling cost prohibitive. Driving of well points is not easily implementable at the Mamaroneck site because of the unknown location of construction debris in the fill. Also, because of the low permeability of the fill, a large number of well points would be required to completely dewater the entire site, making the installation cost extremely prohibitive. This technology will not be evaluated further as a means of ground water control at the site.

Containment Wells

Vertical containment wells are frequently used to recover contaminated ground water for treatment and to control the migration of contaminant plumes through hydraulic influence of the well. Although aquifer testing conducted as part of the RI indicated that the use of collection wells is not practical in the fill, the greater transmissivity of the underlying sand makes it a viable alternative for controlling off-site migration of metals in the sand, and is retained for further development.

2.3.3 Leachate/Ground Water Treatment

The following technologies have been identified as being potentially applicable to treating contaminated leachate/ground water at the site. The screening evaluation in this section is based on the results of the Treatability Study performed by Malcolm Pirnie as well as other applicable treatment technolgies. The results of the Treatability Study are contained in Appendix A.

Air Stripping

Air stripping is a proven technology for removing volatile compounds from ground water. This technology is generally effective for the removal of compounds for which the Henry's constant is greater than 0.003 (dimensionless). Air stripping is particularly effective for the removal of low-molecular weight chlorinated hydrocarbons such as vinyl chloride, TCE and dichloroethylene. In the most common stripping process design, extracted water is introduced at the top of a tower filled with high-surface area packing material. Influent ground water is sprayed downward over the packing material while air is blown upward through the column. Volatile compounds are transferred to the vapor phase and either vented to the atmosphere or transported to an air pollution control system such as activated carbon.

Air stripping efficiency depends on temperature, the chemical and physical characteristics of the contaminants and the process design criteria for the air stripper. Process design criteria include packing height, liquid loading, air-to-water ratio and type of packing material. Air stripping equipment is relatively simple, and start-up and shutdown can be accomplished fairly quickly. The capital and O&M costs are moderate compared to other physical and chemical treatment process options.

Air stripping was investigated in the treatability study for this site and found to be an effective method of removing volatile compounds. This technology will be retained for further development.

Carbon Adsorption

Using carbon adsorption technology, contaminated ground water is passed through reactors packed with granulated activated carbon. Upon contact with the solid, contaminants are adsorbed onto the solid phase. The extent to which a particular compound is adsorbed by the carbon can be estimated using experimentally determined partition coefficients. This treatment is particularly effective in the removal of volatile organic compounds (VOCs) and semi-volatile compounds, and may also be used to remove pesticides and PCBs.

Monitoring the effluent for VOC breakthrough is necessary to determine when the carbon has been saturated. Regeneration of spent carbon can either be carried out on-site or off-site. On-site regeneration of the carbon increases capital investment as well as operation and maintenance (O&M) costs. If off-site regeneration is selected, the vendor is responsible for collecting and disposing of the spent carbon and providing reactivated carbon.

Continuous treatment can be performed if two absorbers are connected in series. Ground water is passed through the first absorber until VOC breakthrough is observed. The ground water is then diverted to the second absorber while the carbon in the first reactor is regenerated. Carbon adsorption has been demonstrated to be effective and implementable at hazardous waste sites. Capital costs are moderate. O&M costs can be high due to the need for carbon regeneration.

Data obtained for carbon adsorption during the treatability study on leachate indicated that carbon was capable of removing pesticides, as well as VOCs which were difficult to remove by air stripping; however, high levels of organic constituents (COD and TOC) were measured in the leachate collected for the treatability study, thereby introducing significant competitive adsorption. Pre-treatment, such as settling prior to carbon adsorption, may reduce the influent organics to this process. Also, the wide-spread use of carbon for wastewater treatment and extensive literature indicates that this technology would be an effective process for the removal of organics from the ground water. This technology will be retained for further development.

Biological Treatment

In the conventional activated sludge biological treatment process, aqueous waste flows into an aeration basin where it is aerated for several hours. During this time, a suspended microbial population aerobically degrades organic matter in the stream and generates new cells. In the post-treatment clarifier, sludge is settled out of the effluent and can be recycled back into the reactor to maintain the microbial population. Clarified water flows to disposal or further processing such as carbon polishing.

Modifications of this aerobic biodegradation are fixed-film systems that could include trickling filters or bio-disks system in which the biomass is attached to an inert medium such as PVC. Contaminated water is sprayed over the medium and organics are degraded after contacting the biological "slime" layer on the surfaces. Air is supplied countercurrent to the water flow to maintain sufficient aerobic conditions.

Data obtained during the treatability study indicated that biological treatment was marginally capable of degrading organics in the ground water studies (See Appendix A). During the treatability study the biomass was sustained which indicated that no components in the ground water were toxic to the biological system during this study. However, due to the hydrogeological characteristics at the site, a low flow would be recovered from the fill material. Biological treatment is an appropriate candidate process to degrade the general organic contamination present in the contaminated leachate within the fill. The bench-scale SBR data indicate that the contaminated leachate did not cause any significant toxic effects or inhibition of the biomass. However, the treatability data also indicate that it is unlikely that a viable biological treatment process will be able to be maintained on-site, due to the low concentration, low mass of organics present, and limited degradability of the organic contamination present. Significant difficulty in maintaining a viable activated sludge process was observed during bench-scale tests. Therefore. on-site biological treatment is not recommended for this site.

UV/H_2O_2 Oxidation

Advanced oxidation processes (AOPs) such as ultra violet (UV) light and hydrogen peroxide (H_2O_2), involve the generation of hydroxyl radicals to destroy organic compounds.

AOPs can be used to remove a variety of chlorinated hydrocarbons such as benzene, toluene, TCE and chloroform, as well as pesticides.

Although UV light alone can oxidize some organics, it is generally used in conjunction with H_2O_2 and/or ozone to facilitate oxidation. During the UV/H_2O_2 oxidation process, hydrogen peroxide is used to oxidize contaminants with UV light as a catalyst. The UV light converts hydrogen peroxide into hydroxyl radicals which are strong oxidants. These radicals convert volatile organic chemicals to carbon dioxide, water and chlorine (for chlorinated VOCs). Process variables include UV energy dose, hydrogen peroxide dose, pH, temperature, and mixing efficiency. Bench-scale studies must be conducted to estimate these variables and the size of the reactor. UV/H_2O_2 oxidation was not studied during the treatability study for this project.

In this process, ground water is pumped through a heat exchanger which regulates inlet temperature. Hydrogen peroxide is added to the feed as it proceeds to the reactor, which is equipped with UV lamps. Following mixing, the treated ground water is then discharged from the reactor. An emission control system may be necessary since the agitation in the reactor volatilizes organic compounds in the ground water.

The operational costs associated with a UV/peroxide system are high due to the great amount of energy required to operate the system. Based on the organic levels at the Taylor Lane site, the UV/peroxide system would be prohibitively expensive, without yielding greater treatment benefits. Also, this alternative involves an innovative technology, and its ability to achieve the desired effectiveness on a full scale is not certain. For these reasons, this alternative has been screened from further consideration.

Chemical Precipitation

Chemical precipitation is a process in which acid or base is added to a solution to reach a desired pH where the constituents have their lowest solubility. Metals can be precipitated from solutions in the forms of hydroxides, sulfides, carbonates or other insoluble salts. Hydroxide precipitation with lime is most common; however, sodium sulfide is sometimes used to achieve lower concentrations of metals in the treatment effluent. The residuals from this process are metal-containing sludge and the treatment effluent, which have an elevated or lowered pH or, in the case of sulfide precipitation, excess sulfides.

In a typical chemical precipitation process, precipitation/flocculation is used. Generally, a chemical such as lime or sodium sulfate is added to the water in a rapid mixing tank along with flocculating agents. Rapid mixing is performed for a short period of time, and then the water flows to a flocculation chamber in which longer mixing a proper retention time is provided for the agglomeration of precipitated particles. Agglomerated particles are separated from the liquid phase by settling in a sedimentation chamber, and/or by other physical processes such as filtration.

This process was not studied during the treatability study for this site since metals were not present in the raw leachate used for the treatability study collected during an onsite ground water pumping test. However, chemical precipitation is a proven, reliable technology which has been used extensively in municipal water treatment plants. Based on the maximum concentrations detected in the ground water at the Taylor Lane site, chemical precipitation would likely be effective for the removal of the metals, and is therfore retained for further development.

Filtration

Filtration is a physical process whereby suspended solids are removed from solution by passing the fluid through a porous medium. Granular media filtration is typically used for treating aqueous waste streams, such as ground water. The filter media consists of a bed of granular particles (typically sand or sand with anthracite). The bed is contained within a basin and is supported by an underdrain system which allows the filtered liquid to be drawn off while retaining the filter media in place. As ground water laden with suspended solids passes through the bed of filter medium, the particles become trapped on top of and within the bed. This either reduces the filtration rate at a constant pressure or increases the amount of pressure needed to force the ground water through the filter. In order to prevent plugging, the filter is backwashed at high velocity to dislodge the particles. The backwash water contains high concentrations of solids and requires further treatment. Typically, multiple units are employed so that a continuous process may be run.

Filtration is a reliable and effective means of removing low levels of solids from ground water provided the solids content is less than 50 to 100 mg/L. Filtration by itself will not adequately remove the soluble metals from the ground water at the Taylor Lane site. To achieve soluble metals removal, additional steps such as chemical precipitation would have to be employed. Hence, filtration will not be retained for further evalution.

Reverse Osmosis

Pressure driven membrane processes such as reverse osmosis and nano-filtration are based on a phenomena known as osmosis. Osmosis is the natural flow of a solvent such as water through semi-permeable membrane which separates two solutions of different concentrations of salts, or a solution from its pure solvent. Reverse osmosis is the reversal of natural osmosis by application of a pressure exceeding the osmotic pressure on the more concentrated side of the two solutions separated by a semi-permeable membrane. The remaining concentrated solution is called the concentrate and the dilute side is called the permeate.

Membrane processes can be used to remove a wide variety of materials from water ranging from suspended particles to metal ions. Reverse Osmosis (RO) membranes were developed to remove salts from seawater and brackish water supplies. These membranes have the smallest pore sizes and typically remove particle sizes in the range of 0.0001 to 0.01 microns. Of the pressure-driven membrane processes, RO has the highest pressure (200-2000 psi), lowest flux rate (3-20 gpd), and is the most expensive to build and operate. RO concentrates dissolved inorganics; therefore, increases in osmotic pressure and scaling from inorganic precipitation in the concentrate stream may impose recovery limitations. For this reason, the effectiveness of RO systems is dependent on several water quality parameters and is very site specific.

Small system RO processes are typically set up in two-stage configurations to increase product recovery. The reject stream from the first stage is used to feed the second stage, which has one-half as many membranes. No additional pumping is required between the stages because of the high pressure of the first-stage concentrate stream. RO membranes are cleaned periodically by pumping cleaning solutions through the membranes. The solution composition depends on the type of membrane used and the type of membrane fouling that is occurring. Types of membrane fouling include scaling and precipitation of colloidal, organic, and biological matter.

Some RO applications may require pre- or post-treatment of water. Pretreatment processes may be required to remove turbidity, color, iron and manganese in order to maintain membrane capacity.

RO has historically been used for desalination of sea or brackish water in regions which did not have other available water supplies. More recent applications for RO have been used for the removal of the following metals: barium, cadmium, chromium, mercury, and selenium. The ground water at the Taylor Lane site contains other metals in addition to the metals listed here. Therefore, it is not certain whether RO would remove the metals of concern at the site. RO was not studied during the treatability study.

In addition, significant concentrations of suspended solids iron in the ground water at the Taylor Lane site have been detected, which would likely cause fouling problems with this technology. However, RO could be used in concert with other technologies if discharge requirements were very stringent (such as discharge to ground water). Based on the high pressures, the operating costs for this alternative are very high. This is an emerging technology, and the feasibility for this alternative to remove the metals in the ground water on a large scale has not been demonstrated. For these reasons, this alternative has been eliminated from further consideration.

Ion Exchange

Ion exchange is a chemical process by which soluble ions are transferred from a liquid to a solid phase or vice versa. Ion exchange is classified as a sorption process. In the process, ions are removed from the aqueous phase by electrostatic exchange with ions that are held by ion exchange resins. In an ion exchange treatment scenario, contaminated ground water is passed through a filter resin. Charged ions in the ground water are exchanged for ions of similar charge on the resin surface.

Once the resin becomes saturated with contaminant ions it must be regenerated. During regeneration a highly concentrated solution of the ion associated with the exchanger is passed through the unit. The contaminant ions which had attached to the resin during the operational phase are now removed and replaced by the original resin ions. The displaced contaminant ions are then disposed.

In a cation exchange process, the ions most often displaced are the sodium ions. Cation exchange can be used to remove calcium, magnesium, iron, and manganese. In an anion exchange process, the ions most often displaced from the resin are chloride ions. Anion exchange can be used to remove nitrate, arsenic, chloride, hexavalent chromium, selenium, and sulfate. Based on the metals contaminants at the Taylor Lane site, the selection of one of these ion exchange processes would not adequately remove all of the contaminants. Specifically, elevated levels of zinc, a contaminant detected consistently at the Taylor Lane site, would not be removed by either ion exchange process. Also, organic species frequently interact with the ion exchangers, causing either high regenerant concentrations, or interference with the removal of the desired metals. Based on the aformentioned reasons, this technology has been eliminated from further consideration.

2.3.4 Leachate/Ground Water Disposal

Recovered leachate/ground water can be disposed of through several options, namely: (1) Publicly Owned Treatment Works (POTW), (2) off-site surface water body (Magid Pond) or (3) reinjection to the lower sand aquifer. The most suitable location is a function of the discharge requirements, appropriate treatment technology, and physical parameters, such as distance from the site and physical characteristics. The following section summarizes the discharge locations that were considered for disposal of recovered ground water from the Taylor Lane site.

Discharge to POTW

Under this alternative, leachate/ground water would be discharged into the sanitary sewer for ultimate treatment at the publicly owned treatment works (POTW). A sewer use ordinance, the Westchester County Environmental Facilities Sewer Act, would regulate this discharge. The sewer act contains permissible discharge limits for several metals and total organic compounds. Based on these limits, the leachate samples collected during the pump test met the sewer act guidelines. However, ground water and leachate collected under static conditions (RI - Volumes 1 and 2) exceeded POTW standards for heavy metals. Therefore, for purposes of the FS, it is assumed that metals pre-treatment will be necessary. This would need to be confirmed during design.

Ground water would be discharged into the sanitary sewer located along the southwest border of the site. This alternative is technically feasible and potentially implementable using standard construction practices. Approval would be required from the Westchester County Department of Environmental Facilities (DEF) and NYSDEC, prior to discharging the treated leachate. This discharge option is being retained for further consideration during the development of the remedial alternatives.

Discharge to Surface Water

The Taylor Lane site lies within the Otter Creek watershed, which drains directly into the Long Island Sound. The closest body of water to the site is Magid Pond, which drains into Otter Creek, and is located west of the site. Magid Pond is a freshwater wetlands which is regulated under Article 24 of the New York State Environmental Conservation Law, Freshwater Wetlands Act. Magid Pond is classified as a Class D surface water body according to the New York State Surface Water Quality Standards.

Under this scenario, following pre-treatment, leachate would be discharged into Magid Pond. Due to the close proximity of Magid Pond to the site, this alternative is technically feasible and implementable using standard construction practices.

In terms of administrative feasibility, this alternative may be more difficult than other ground water discharge options to implement. A New York State Pollutant Discharge Elimination System (SPDES) permit for the surface water discharge would be required. In addition, since Magid Pond is a freshwater wetlands, a New York State wetlands permit may also be required.

Prior to discharge, leachate would have to be pre-treated to comply with surface water standards for organics and inorganics, as applicable to Class D waters. Therefore, this alternative is more costly than the POTW discharge option which requires only metals removal. Based on the institutional and technical issues regarding implementation, the surface water discharge alternative has been eliminated from further development. If during design it was determined that no other available discharge location existed, this alternative would be reevaluated and further developed.

Discharge to Ground Water

This alternative would involve discharging treated leachate/ground water to the lower aquifer, through the use of injection wells. Under this alternative, ground water ARARs would include drinking water standards, which would require the removal of metals and organic parameters. A New York State discharge to ground water permit would be required for this discharge. This alternative would be technically difficult to implement, since the permeability of the soils is very low. Additionally, since the water table is shallow, discharging to ground water using injection wells is difficult. Therefore, due to the hydrogeological and administrative constraints, as well as being more costly, this alternative has been eliminated from further evaluation.

2.4 SUMMARY OF SCREENING

A summary of the screening technologies applicable for fill, leachate and ground water contamination are presented in Tables 2-1 and 2-2. The technologies identified in Tables 2-1 and 2-2 will be further evaluated and developed in Chapter 3.0.

TABLE 2-1
Mamaroneck Taylor Lane Leaf Compost Site
SCREENING OF SOIL/FILL TECHNOLOGIES

Technology	EFFECTIVENESS	IMPLEMENTABILITY	COST	ELIMINATED/ SCREENED
CONTAINMENT:				
Capping	+	+	+	NO
IN-SITU TECHNOLOGIES:				
Soil Vapor Extraction	-	0	0	YES
Soil Flushing	-	0	+	YES
Vitrification	-	0	-	YES
Solidification/stabilization	-	0	0	YES
Bioremediation	-	0	0	YES
EXCAVATION AND ON-SITE TREATEMENT:				
Incineration	-	0	-	YES
Enhanced Volatilization	-	0	-	YES
Soil Washing	-	0	0	YES
Biological Treatment	-	0	0	YES
Solidification/stabilization	+	+	0	NO
Chemical Dehalogenation	-	-	0	YES
EXCAVATION AND OFF-SITE TREATMENT AND DISPOSAL:				
Incineration	-	0	0	YES
Thermal Desorption	-	0	0	YES
Biological Treatment	-	0	0	YES
Solidification/stabilization	+	+	+	NO

KEY:
- Lowest degree of compliance with criteria
0 Moderate degree of compliance with criteria
\+ Highest degree of compliance with criteria

TABLE 2-2
Mamaroneck Taylor Lane Leaf Compost Site
SCREENING OF LEACHATE/GROUND WATER TECHNOLOGIES

Technology	EFFECTIVENESS	IMPLEMENTABILITY	COST	ELIMINATED/ SCREENED
CONTAINMENT:				
Slurry Walls	+	0	0	NO
Grouting	-	0	0	YES
Sheet Piling	-	0	0	YES
RECOVERY:				
Trenches	+	0	0	NO
Well Points	-	0	+	YES
Containment Wells	+	+	0	NO
TREATMENT:				
Air Stripping	+	+	+	NO
Carbon Adsorption	+	+	0	NO
Biological Treatment	-	-	0	YES
UV/Peroxide Oxidation	0	0	-	YES
Chemical Softening	+	+	0	NO
Filtration	+	+	+	NO
Reverse Osmosis	0	-	-	YES
Ion Exchange	-	-	0	YES
DISPOSAL:				
Discharge to POTW	+	+	+	NO
Discharge to Surface Water	+	0	-	YES
Discharge to Ground Water	-	-	0	YES

3.0 DEVELOPMENT OF REMEDIAL ALTERNATIVES

This section of the Feasibility Study groups selected remedial technologies into proposed remedial alternatives which meet one or more of the general response objectives outlined in Chapter 1.0. Remedial technologies were screened in Chapter 2.0 based on their ability to remediate individual media. The focus of this section is to combine retained technologies into alternatives which will remediate media of concern. The following alternatives have been further evaluated in Chapter 3.0:

Alternative 1 No-action with Continued Monitoring and Institutional Controls.

Alternative 2 Installation of 6 NYCRR Part 360 Cap over entire site area, with the following modifications.

- 2A No hydrological control or containment of leachate/ground water.
- 2B With hydrologic control of the leachate/ground water via slurry walls and two containment wells. On-site pretreatment of leachate/ground water and disposal at POTW.
- 2C With hydrologic control of the leachate/ground water via trenches with two containment wells. On-site treatment of leachate/ground water and disposal at POTW.

Alternative 3 Excavation of Fill with On-Site Solidification/Stabilization with the following modifications.

- 3A Dewatering of excavation area via trenches with temporary pretreatment and discharge to POTW.
- 3B Dewatering of excavation area via trenches and containment of ground water via containment wells. On-site treatment of leachate/ground water and disposal at POTW.

Alternative 4 Excavation of Fill with Off-Site Solidification with the following modifications.

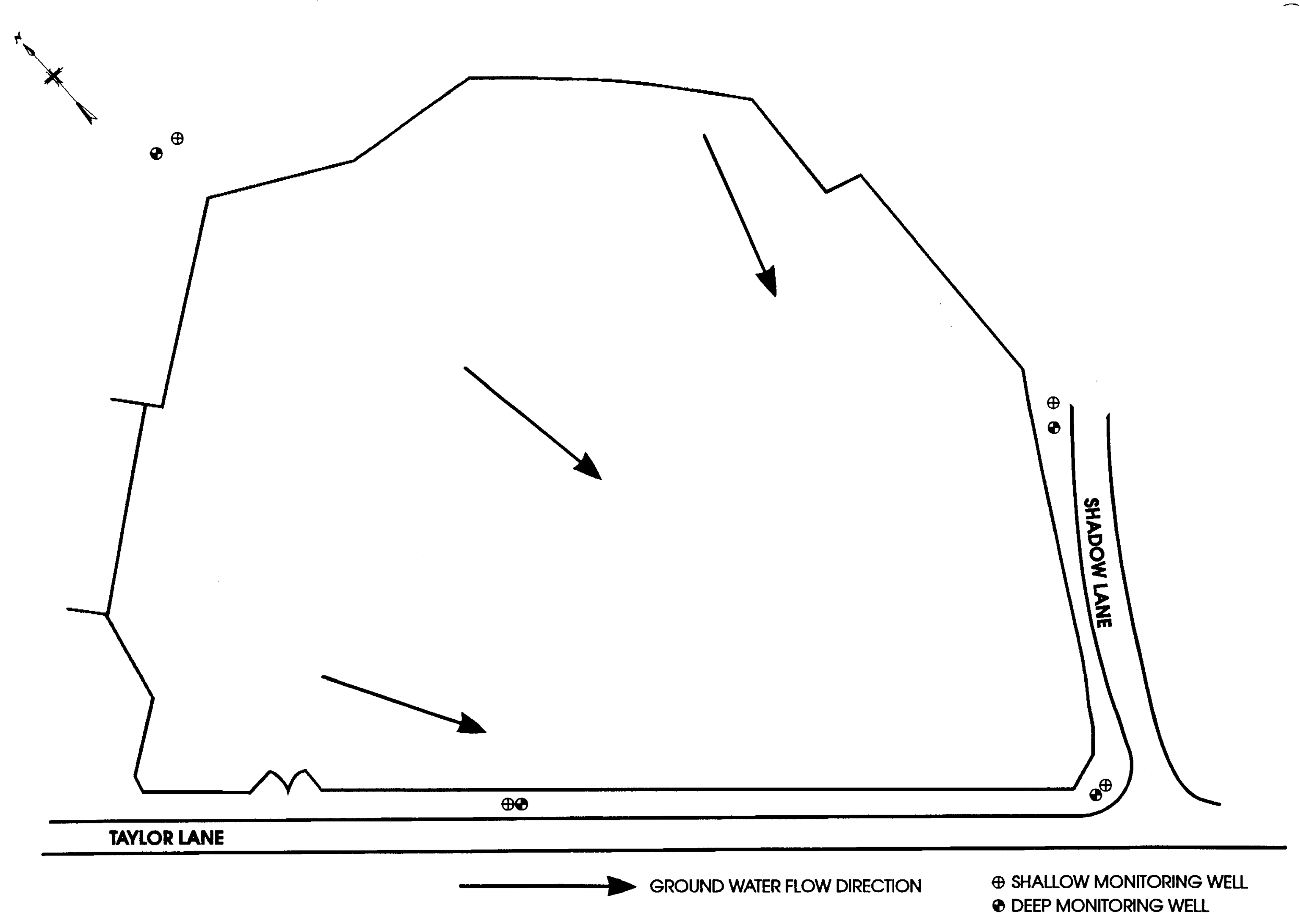
- 4A Dewatering of excavation area via trenches with temporary pretreatment and discharge to POTW.
- 4B Dewatering of excavation area via trenches and containment of ground water via containment wells. On-site treatment of leachate/ground water and disposal at POTW.

3.1 ALTERNATIVE 1 - NO-ACTION WITH CONTINUED MONITORING AND INSTITUTIONAL CONTROLS

No-action with continued monitoring provides a base upon which other alternatives may be developed and compared to. Monitoring would be accomplished by installing 4 monitoring well couplets around the perimeter of the site for collecting ground water samples and water level measurements on a periodic basis. Alternative 1 also represents the minimum amount of effort needed to restrict exposure to contaminants at the Mamaroneck Taylor Lane site. During the RI (Volumes 1 and 2), field investigations of ground water flow indicated that the ground water recharge was occurring in the northern, topographically higher section of the site. This was demonstrated by a downward vertical gradient in well couplets in this area. The studies also indicated that ground water moves from this area towards the southern topographically lower portion of the site. In the southern portion of the site, ground water discharge is occurring, as demonstrated by the upward gradient observed in monitoring well couplets in this area. This is supported by surface waters that have ponded in the southern portion of the site. The chemical analysis of surface water samples taken from the southern portion of the site indicate that the discharging water does not contain constituents of concern. However, previous field investigations have not clearly identified the final discharge location of ground water migrating from the site.

The aforementioned monitoring system would include collecting ground water samples and measuring the ground water elevations in these wells on a quarterly basis for the first two years of the project and annually for the duration (28 years). The ground water samples would be analyzed for full TAL and TCL parameters. Results of these analyses would serve as a warning system if contaminated ground water is beginning to migrate off-site, or if an upgradient source begins to migrate on-site. A review of the ground water elevations may indicate that changes to the hydrologic dynamics of site are occurring, which may potentially cause contaminated ground water to migrate from the site. Continued intermittent monitoring of the ground water at the site is an important process which will be needed for each remedial alternative.

Figure 3-1 shows the locations of the monitoring wells required for the no-action scenario. Each couplet would consist of a two-inch diameter monitoring well screened in the fill and a two-inch diameter monitoring well screened in the underlying sand. The fill



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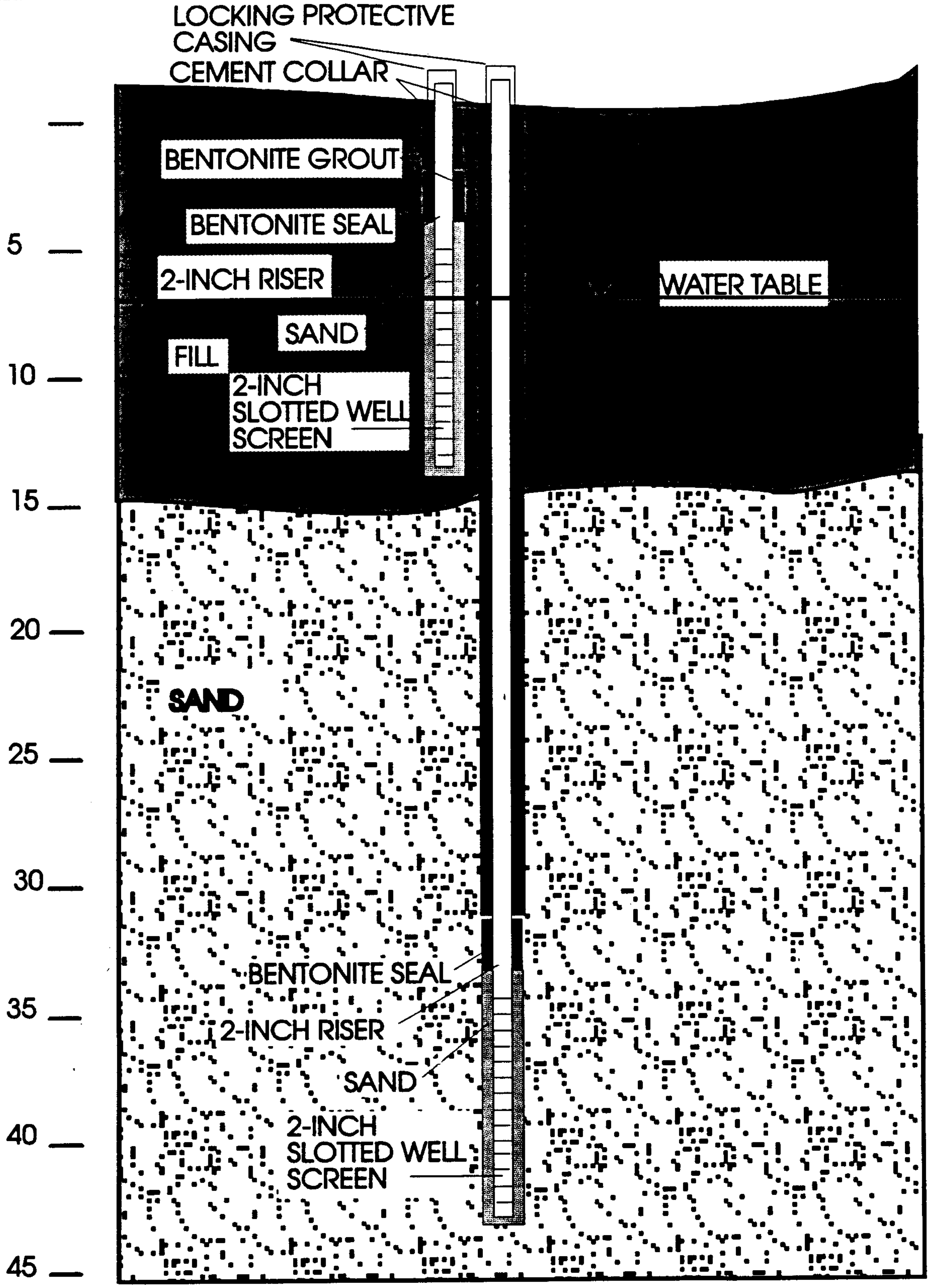
MAMARONECK TAYLOR LANE LEAF COMPOST SITE
ALTERNATIVE 1 - NO ACTION WITH INSTITUTIONAL CONTROLS

FIGURE 3-1



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MAMARONECK TAYLOR LANE LEAF COMPOSTING SITE
TYPICAL 2 INCH DIAMETER WELL COUPLET

FIGURE 3-2

TABLE 3–1
Mamaroneck Taylor Lane Leaf Compost Site
Detailed Cost Analysis for
ALTERNATIVE 1 – NO ACTION WITH INSTITUTIONAL CONTROLS

	Capital	O&M	Assumptions
Continued Monitoring			
Monitoring Well Installation	$16,000		$4000/couplet, 4 well couplets
Well Development	$2,760		2 People; 2 Days; 4 well couplets
Annual Sampling		$2,800	Quarterly for first two years (15 wells); Annually for remainder of 8 wells
Quarterly Sampling	$11,200		
Analyses	$55,120	$4,240	$530/sample, TCL/TAL, (8 wells annually)
Fencing	$12,310	$1,000	$12.30 per ft x 1000ft, 6 ft chain link
Subtotal	$97,390	$8,040	
ALLOWANCES			
Contingency (20%)	$19,478	$1,608	
ECONOMIC ANALYSIS			See Economic Parameters below
Totals	$116,868	$9,648	
Present Worth of O&M	$163,456		
Total Present Worth	$280,000		

ECONOMIC PARAMETERS

j = 0.040 (inflation)
i = 0.080 (interest)
n = 30.000 (project life)
Present Worth Multiplier = 16.942

monitoring wells would be approximately 15 to 20 feet in depth, screening across the water table. The sand monitoring wells would be approximately 30 to 40 feet in depth. Figure 3-2 shows the typical design of a monitoring well couplet.

The second portion of the no-action alternative involves regrading the site boundary to include the southeastern berm soils. Existing fencing would be reinforced and expanded, thereby preventing public access to any areas where soil contaminants are found. Institutional controls, such as postings to reflect health hazards associated with entering the fenced area, would be issued.

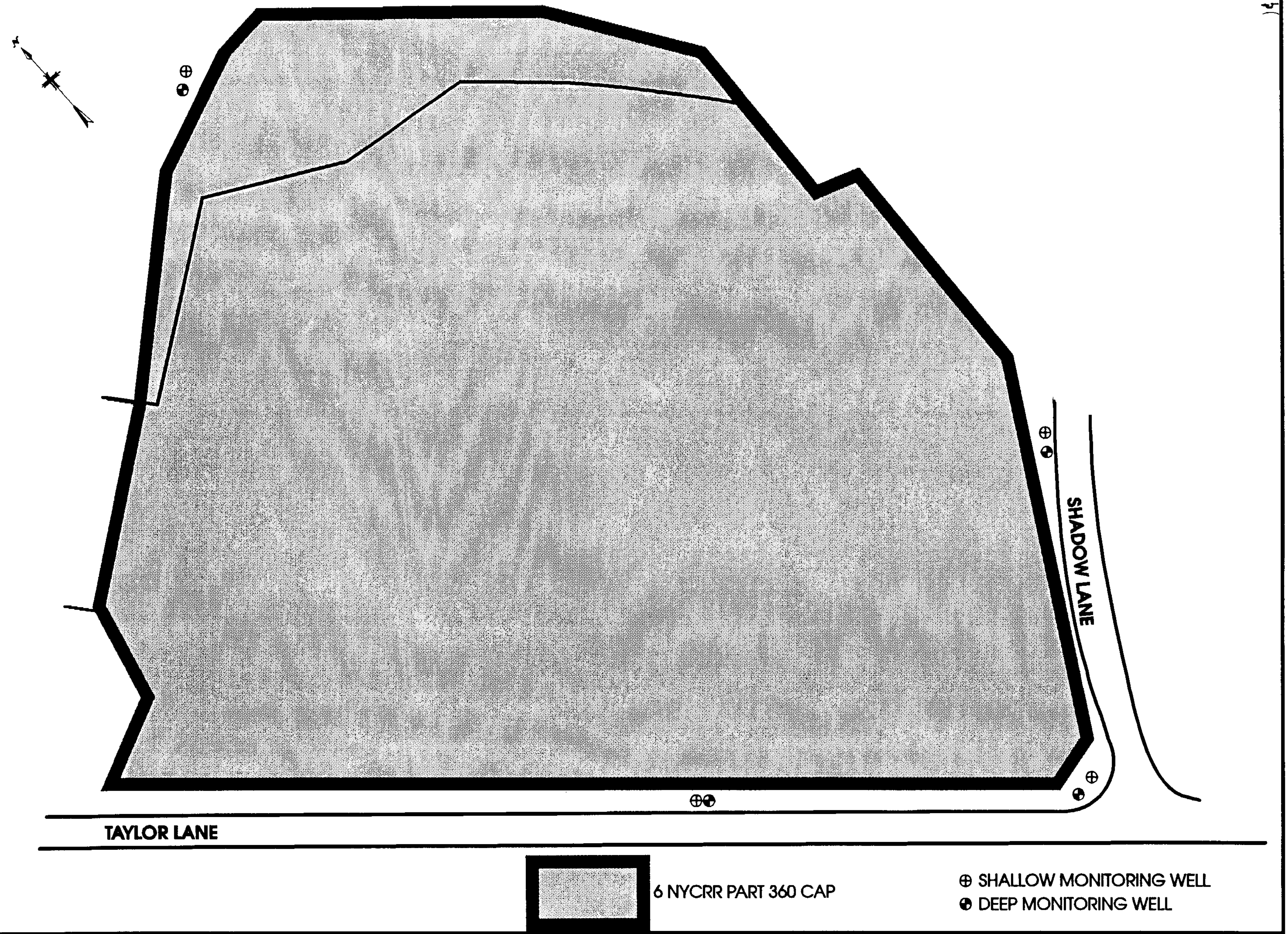
This alternative will not prevent significant quantities of precipitate infiltration. Moreover, leachate will continue to be generated, and the remedial action objectives will not be met. The estimated cost associated with the no-action alternative is $116,868 and a detailed analysis can be found in Table 3-1.

3.2 ALTERNATIVE 2 - INSTALLATION OF 6 NYCRR PART 360 CAP

The containment technologies developed under Alternative 2 minimize infiltration of precipitation into the fill material and reduce the quantity of leachate generated at the Mamaroneck site. Alternative 2 includes the consolidation of contaminated fill/soils on-site, upgrading the site fencing, and installing a NYCRR Part 360 Cap. Within Alternative 2, three sub-alternatives are presented, each with variations on the amount and type of control for the leachate/ground water. Initially, development of the cap technology is discussed, which is followed by a more detailed discussion of the leachate/ground water containment options.

For each of the alternatives, prior to installing the cap, the southeastern soil berm areas would be consolidated, and the soils moved from outside the fenced area to within the site boundary line. The total volume of soils to be excavated from the berm and moved onto the site was estimated at 250 cubic yards. The area which will be capped encompasses approximately 300,000 ft^2, and includes the section of the site near the MW-9 cluster, which extends slightly beyond the boundary of the Taylor Lane site. (See Figure 3-3)

The specific details governing the design of the cap are described in Volume 6 of the NYCRR Part 360. A Part 360 cap would be fully protective of human health and the environment and complies with several remedial objectives. The Part 360 cap consists of use of either a clay layer or geosynthetic membrane liner, overlain by a vegetative cover.



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MAMARONECK TAYLOR LANE LEAF COMPOST SITE
ALTERNATIVE 2A - PART 360 CAP (NO GROUND WATER CONTAINMENT)

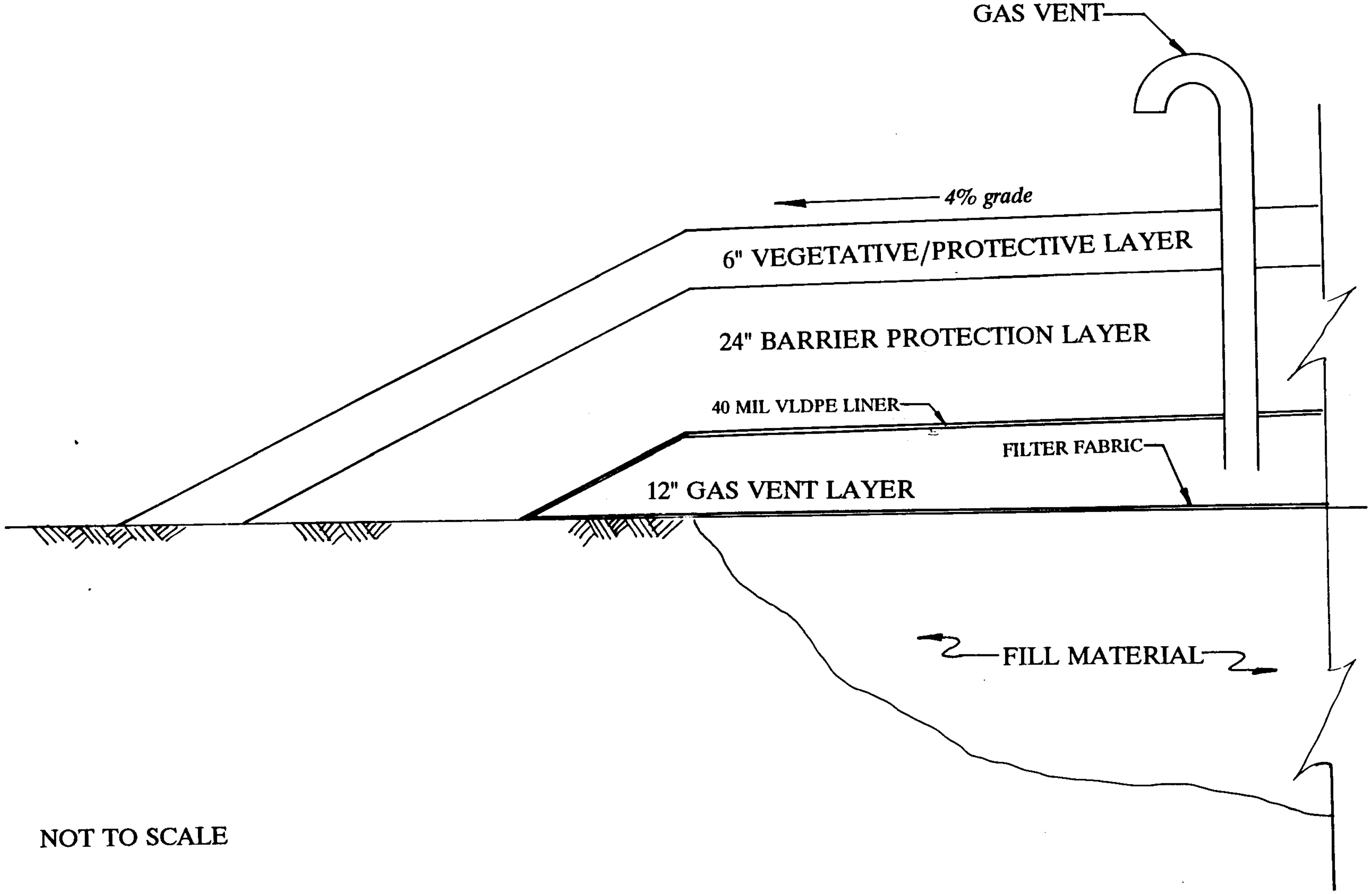
FIGURE 3-3

In addition, a gas ventilation system would be installed in conjunction with the capping materials to provide a venting of the subsurface gases.

A description of each cap layer function, beginning with the fill material and working upwards, follows: (1) the gas venting layer located directly above the waste material, and below the filter fabric layer, is designed and constructed to effectively remove gases generated as a result of decomposition within the cap; (2) the filter fabric is designed to prevent migration of fine soil particles into the gas venting system, thereby inducing clogging; (3) a low permeability soil cover (bentomat) is constructed to minimize precipitation through the fill material, and must be placed at a slope of no less than four percent to promote positive drainage; or (4) a geomembrane cover very low density polyethylene (VLDPE) as an alternate to the low permeability soil cover, is also used to minimize drainage through the fill material; (5) a layer of barrier cover soil to prevent disturbances to the capping media; and (6) a final topsoil cover to maintain vegetative growth. (See Figure 3-4)

The cap efficiencies used in the FS are estimated values, and are based on published values from vendor and manufacturer literature. The first alternative, a bentomat clay covering, has an estimated efficiency in the range of 90-92%. One major factor determining the overall cap efficiency is the permeability of the substance. The average measured hydraulic conductivity of the fill was 3.2 ft/day, which is equivalent to a permeability of 10^{-8}. Based on this, it is critical that the material chosen for use at the site be considerably less permeable than the material it is capping. However, the maximum permeability range for bentomat is 10^{-7} to 10^{-9}, which may not adequately assure protection against infiltration. In addition, the cost associated with obtaining and installing bentomat is significantly higher than the VLDPE liner. Based on the lower cap efficiency and higher capital cost, the bentomat is screened from further consideration for use as a feasible alternative.

Utilizing a geosynthetic membrane increases the cap efficiency, to a range of 93-96%. A variey of geosynethetic membranes are commercially available, however, a VLDPE liner will be retained for used for at this site. Compared to a high density polyethylene liner, VLDPE exhibits superior elongation and chemical resistant properties. In addition, unlike polyvinylchloride (PVC) liners, which uses a plasticizer to bond the sheeting and can become brittle over time, a VLDPE liner is heat welded and withstands the effects of time much better.



NOT TO SCALE

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MAMARONECK TAYLOR LANE LEAF COMPOST SITE
6 NYCRR PART 360 CAP PROFILE

MALCOLM PIRNIE, INC.

FIGURE 3-4

Capping of the site area complies with several of the remedial action objectives. In addition, capping provides a protective layer over the contaminated site surface soils, thus eliminating future exposure to on-site workers and residents within the site vicinity. While capping technologies are relatively easy to implement, the overall efficiency and cost effectiveness for each alternative are highly dependent upon the individual cap used. In addition, each capping technology will have future land use restrictions at the site. During the remedial design, the capping alternatives discussed in the FS should be further evaluated in regards to constructability, long-term integrity, and cost for construction and maintenance.

Precipitation which infiltrates the site is dependent on the climatic conditions and type of capping system. One important factor when considering different capping options is the rate of leachability, which can be calculated using the Hydrologic Evaluation of Landfill Performance (HELP) model. The model requires input of site climatologic data and performs an analysis of runoff, evapotranspiration, and percolation through the cap. The HELP model was performed at this site to correlate the cap efficiencies for the 40 mil VLDPE liner and the no action alternative. The results of the HELP model are contained in Appendix G.

Under Alternative 2, three sub-alternatives relating to the control of ground water are discussed. Alternative 2A does not include hydrogeologic control, Alternative 2B utilizes a slurry wall and containment wells to maintain hydrological control, and Alternative 2C controls the ground water via trenches and containment wells.

3.2.1 Alternative 2A - Part 360 Cap

This alternative is hydrogeologically similar to the no-action alternative with the main difference being that recharge on site has been diverted because of the placement of the cap. Due to this recharge diversion, a lowering of the water table can be expected on site, thus reducing the amount of ground water exposed to contaminants in the soil and stopping contaminant migration via precipitation infiltration through the vadose zone. The ground water monitoring required under this alternative (4 well couplets placed around the site perimeter) would be the same as the no-action alternative. The estimated cost for this alternative is $862,187 the details of which are contained in Table 3-2.

TABLE 3-2
Mamaroneck Taylor Lane Leaf Compost Site
Detailed Cost Analysis for
ALTERNATIVE 2A – 6 NYCRR PART 360 CAP (No Ground Water containment)

	Capital	O&M	Assumptions
Cap Materials			
Regrading of Berm	$5,000		250 cy @ $20/cy (excavation cost)
Fill/Gas vent Layer	$33,333		12" thick @ 3.00/cy (11,111cy sand/gravel installed)
Gas Vents	$5,600		7 vents – 1 per acre ($800 each vent installed)
Filter Fabric	$90,000		$0.30/sf installed over 300,000sf (6–10oz. filter fabric)
40 mil VLDPE	$210,000		300,000sf coverage @ $0.70/sf
Barrier Soil Layer	$88,889		24" thick @ $4.00/cy (22,222cy soil installed)
Top Soil	$44,444		1/2" thick @ $8.00/cy (5,555cy soil installed)
Final Regrading/Seeding	$14,000		$2,000/acre over 7 acres
Cap Maintenance		$33,333	300,000sf @ $1/sy
Subtotal (S1)	$491,267	$33,333	
Continued Monitoring			
Monitoring Well Installation	$16,000		$4000/couplet, 4 well couplets
Well Development	$2,760		2 People; 2 Days; 4 well couplets
Annual Sampling		$2,800	Quarterly for first two years (15 wells); Annually for
Quarterly Sampling	$11,200		remainder of wells (8 wells)
Analyses	$55,120	$4,240	$530/sample, TCL/TAL, (8 wells annually)
Fencing	$12,310	$1,000	$12.30 per ft x 1000ft, 6 ft chain link
Subtotal (S2)	$97,390	$8,040	
ALLOWANCES			
Further site delineation (S3)	$50,000		
Subtotal (S1+S2+S3)	$638,657	$41,373	
Engineering (15%)	$95,799		
Contingency (20%)	$127,731	$8,275	
ECONOMIC ANALYSIS			See Economic Parameters below
Totals	**$862,187**	**$49,648**	
Present Worth	$841,136		
Total Present Worth	$1,703,000		

ECONOMIC PARAMETERS

j = 0.040 (inflation)

i = 0.080 (interest)

n = 30.000 (project life)

Present Worth Multiplier = 16.942

3.2.2 Alternative 2B - 6 NYCRR Part 360 Cap with Slurry Wall and Two Containment Wells

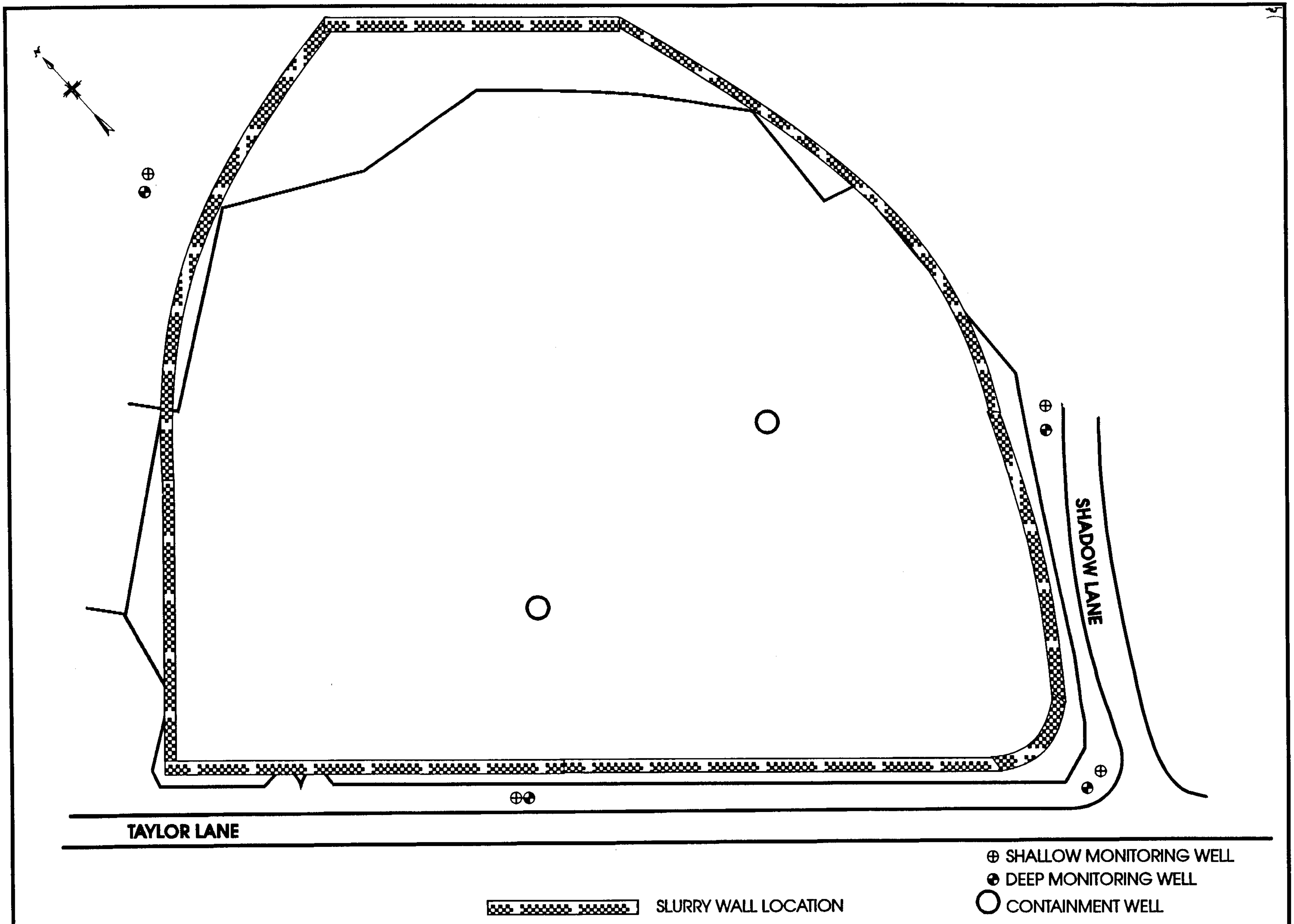
This alternative is similar to the capping alternative 2A described under Section 3.2.1, with the addition of a slurry wall and two ground water containment wells. Although this containment system does not directly impact the function of the cap, it does contribute to the overall efficiency for the alternative by providing recovery of the leachate and containment of the ground water.

Under Alternative 2B, the perimeter will be surrounded with a slurry wall to prevent the contaminated ground water from migrating from the site. The slurry wall will be keyed into the bedrock, at a depth ranging from about 15 feet below grade at the upgradient boundary of the site to 80 feet below grade at the downgradient boundary of the site. The slurry wall is to be placed around the perimeter of the site and would be approximately 2200 feet long. The slurry wall around the site would effectively keep contaminants from migrating off-site. However, the ground water within the slurry wall would need to be controlled, and would be accomplished through the installation of two containment wells installed within the confines of the slurry wall.

Containment wells are 8-inch diameter stainless steel wells installed in the sand underlying the fill. The wells would screen approximately 30 feet of the sand and would pump intermittently at a rate of about 20 gallons per minute (gpm) each (total of 40 gpm). This pumping rate would be sufficient to keep an inward gradient along the perimeter of the site. However, the average pumping rate over time should be less than the peak discharge rate from the wells of 40 gpm because the flow rate will decrease over time.

During the remedial action, the effectiveness of the slurry wall would also need to be monitored. This would be accomplished by the basic monitoring program described in the no-action alternative with the modification of having six monitoring wells installed inside the slurry wall to monitor the effectiveness of the containment wells. The inside monitoring wells would be used to gather ground water elevation data. This data would be used to determine if an inward gradient across the slurry wall is maintained. Figure 3-5 shows the locations of the slurry wall, the containment wells and the monitoring wells.

For purposes of the FS, it assumed that the leachate/ground water will be pretreated for metals removal and discharged to the POTW. The organic compounds at the Taylor Lane site (volatiles, semi-volatiles, pesticides, and PCBs) are regulated as a total level, with



MALCOLM PIRNIE

ALTERNATIVE 2B - PART 360 CAP WITH GROUND WATER CONTAINMENT VIA SLURRY WALLS AND TWO CONTAINMENT WELLS

FIGURE 3-5

the limit being 2,100 ug/L. Since these organic contaminants currently meet this total level, it is assumed that only metals removal will be required prior to discharge to the POTW. Under this alternative, the ground water would be treated by chemical precipitation. A flow diagram showing the ground water treatment for this scenario is presented in Figure 3-6. For the purposes of the FS, the preliminary estimate of cost for pretreatment and sludge disposal have been incorporated. The overall cost for implementing this alternative was calculated to be $3,176,883, as indicated in Table 3-3.

3.2.3 Alternative 2C - 6 NYCRR Part 360 Cap with Trench and Containment Wells

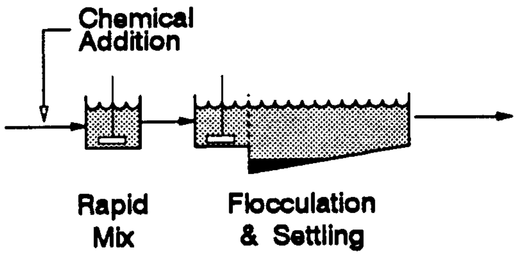
The design of the cap for Alternative 2C is the same as that described for Alternative 2A with the addition of one trench and two containment wells. Similar to the advantages in Alternative 2B, Alternative 2C also provides for collection of the leachate and containment of the ground water.

This option consists of a trench oriented across the leachate flow along the downgradient edges of the site and two containment wells used to control ground water in the sand below the fill. The trench would be constructed to a depth just below the fill and would be approximately 700 feet long by approximately 20 feet deep. Figure 3-7 shows the locations of the trench and the containment wells as well as monitoring well locations. Using the Verma and Brutsaert calculation (1971,1972) for flow to an excavated face,(Freeze and Cherry, 1979) a trench of this construction will produce approximately 200 gallons per day per linear foot of well. The hydraulic conductivity used in the calculation is based on slug test data collected during the RI which is an order of magnitude estimation only. Using the trench dimensions and assumptions described above, the initial flow rate from the trench was calculated to be approximately 100 gpm.

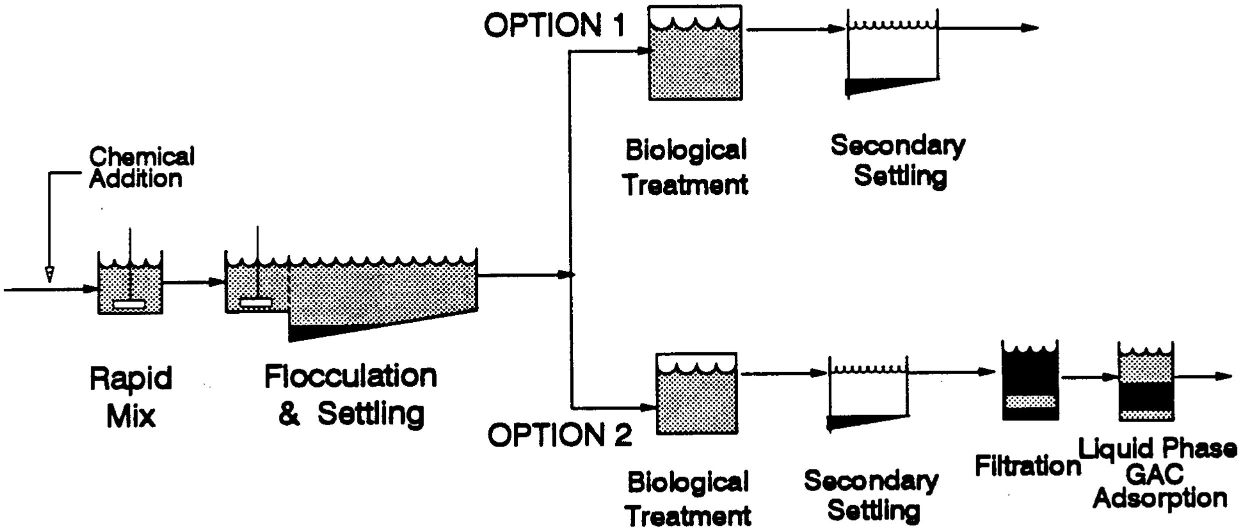
The trench would be used in conjunction with two 8-inch containment wells which would control ground water movement in the sand below the fill. These two wells are the same as the two wells described in Section 3.2.2, and would pump at a continuous rate of 20 gpm each, for a total of 40 gpm. The total amount of water produced from this ground water control system is estimated to be 140 gpm. Because of the decreased recharge associated with the placement of the Part 360 Cap, the amount of discharge from the system would decrease with time. The steady level cannot be estimated based on the existing data

FIGURE 3-6
POTENTIAL PROCESS TRAINS FOR CONTAMINATED GROUND WATER TREATMENT
MAMARONECK TAYLOR LANE FEASIBLITY STUDY

Discharge to POTW with Pretreatment



Discharge to Surface Water



Note: Biological treatment and secondary settling may drop from the surface water alternative

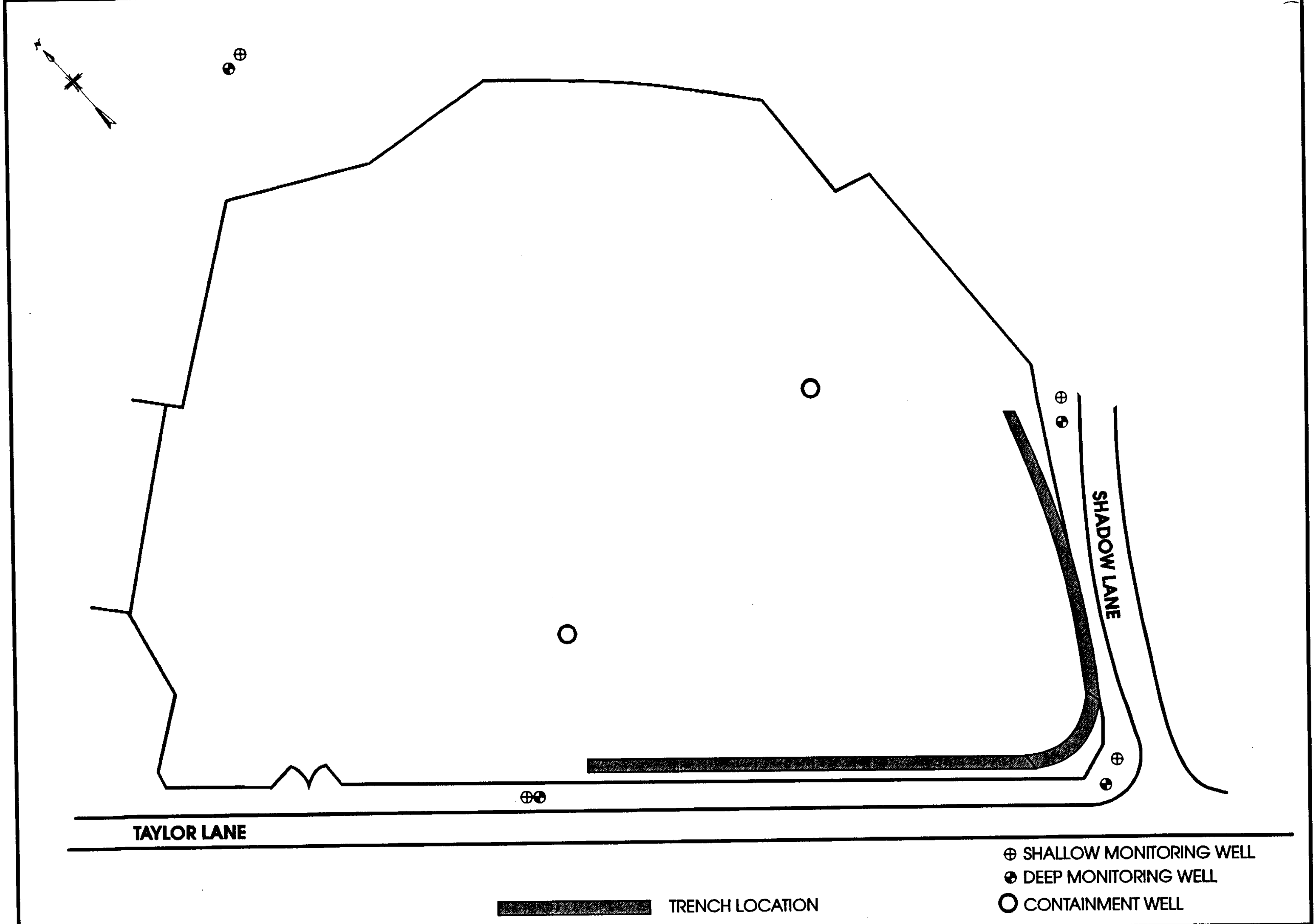
TABLE 3–3
Mamaroneck Taylor Lane Leaf Compost Site
Detailed Cost Analysis for
Alternative 2B – 6 NYCRR Part 360 Cap with Ground Water Containment via Slurry Walls And Two Containment Wells

	Capital	O&M	Assumptions
Part 360 Cap (S1)	$862,187	$49,648	See Table 3–2; 6 NYCRR Part 360 Cap only
GROUND WATER CONTROL			
Slurry Walls	$965,000		$15/sf (depth 30ft – perimeter 2100ft)
Containment Wells			2 collection wells
– Well Installation	$36,300		$18,150 each well (2 wells)
– Step–Drawdown Test	$2,760		2 people; 2 days
– Pumps	$3,000		$1,500 each pump
Subtotal (S2)	$1,007,060		
PRE–TREATMENT			
Equalization Tank	$50,000		Allowance
Feed Pumps	$6,000		4 @ $1,500 each
Lime Softening	$288,000	$48,000	50 gpm two–stage package plant
Sludge Dewatering	$140,000	$2,000	Alfa–Laval PM–38000
Subtotal (S3)	$484,000	$50,000	
DISPOSAL			
Discharge to POTW			
– Conveyance to POTW	(1)	(1)	
– POTW fees	(1)	(1)	
– Monitoring	(1)	(1)	
Sludge Disposal		$220,000	Generating 900 tons/yr; 20% solids sludge
Subtotal (S4)	(1)	$220,000	
ALLOWANCES			
(S1+S2+S3+S4)	$2,353,247	$319,648	
Engineering (15%)	$352,987		
Contingency (20%)	$470,649	$63,930	
ECONOMIC ANALYSIS			See Economic Parameters below.
Totals	**$3,176,883**	**$383,578**	
Present Worth	$6,498,570		
Total Present Worth	$9,675,000		

(1) Costs not available from Westchester County DEF as of 10/92; but would be included during remedial design.

ECONOMIC PARAMETERS

j = 0.040 (inflation)
i = 0.080 (interest)
n = 30.000 (project life)
Present Worth Multiplier = 16.942



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ALTERNATIVE 2C - PART 360 CAP WITH GROUND WATER CONTAINMENT VIA TRENCH AND TWO CONTAINMENT WELLS

FIGURE 3-7

and would required additional testing during design. Design-phase testing would be required to provide a more accurate flow rate and dimensions for the trench.

Monitoring of the system for effectiveness would start with the basic monitoring program described in Section 3.1 for the no-action alternative. Additional information on the effectiveness of the extraction system would be gained through seven well couplets placed strategically across the site. These well couplets would be used for measuring ground water elevation only. The capital cost associated with Alternative 2C is $2,009,808, and the details of the calculation are contained in Table 3-4.

3.3 ALTERNATIVE 3 - EXCAVATION OF FILL MATERIAL WITH ON-SITE SOLIDIFICATION

Prior to excavating the fill material, dewatering would be required. Dewatering of the fill could be accomplished through the use of four temporary trenches, three of which are placed perpendicular to the flow direction of the ground water. These trenches would be of similar design to the one trench described in Section 3.2.3. Flow to the system would be four times greater than flow to the trench described above (approximately 400 gpm for the total of four trenches). However, the flow to the trenches would diminish over time and the fill should be effectively dewatered. It is assumed that the leachate collected during the dewatered process would be pre-treated for metals removal prior to discharge to the POTW. In the event that the POTW could not accommodate a flow of the quantity, the dewatering process could happen more slowly.

Once the fill has been sufficiently dewatered, excavation of the soils can begin. The total volume of soil to be excavated has been estimated at 170,000 cubic yards, which assumes excavation to a depth of 15-feet. This also includes the berm of the site, and a distance beyond MW-9 cluster. Excavation would be accomplished through the use of the following equipment: hydraulic backhoes and loaders, vacuum loaders and a variety of miscellaneous hand excavation tools. Upon removal, the soil would be solidified on-site through the use of a pozzolanic material, such as: Portland cement, quick lime, hydrated lime, fly ash, gypsum, cement-kiln dust, or lime-kiln dust. Material mixing can be accomplished in transit mix trucks. The equipment is self-contained and requires minimal set-up time. Once the materials (water, fill and pozzolanic material) are added to the mixer, they are thoroughly blended by a circular rotation of the blades and end-to-end tilting.

TABLE 3–4
Mamaroneck Taylor Lane Leaf Compost Site
Detailed Cost Analysis for
Alternative 2C – 6 NYCRR Part 360 Cap with Ground Water Containment via Trench And Two Containment Wells

	Capital	O&M	Assumptions
Part 360 Cap (S1)	$862,187	$49,648	See Table 3–2; 6 NYCRR Part 360 Cap only
GROUND WATER CONTROL			
– Trench (One)	$51,000	$1,000	$30,000 mobilization, $300 per foot; 700ft x 15ft
– Pump	$1,500		$1500 each
Containment Wells			
– Monitoring Well Installation	$36,300		$18,150 each well; 2 wells; 8" diameters
– Step–Drawdown Test	$2,760		2 people; 2 days
– Pumps	$3,000		$1,500 each pump; 2 pumps
Subtotal (S2)	$94,560	$1,000	
TREATMENT			
Equalization Tank	$50,000		Allowance
Feed Pumps	$6,000		4 @ $1,500
Chemical Precipitation	$336,000	$56,000	90 gpm two–stage package plant
Sludge Dewatering	$140,000	$2,000	Alfa–Laval PM–38000
Subtotal (S3)	$532,000	$58,000	
DISPOSAL			
Discharge to POTW			
– Conveyance to POTW	(1)	(1)	
– POTW fees	(1)	(1)	
– Monitoring	(1)	(1)	
Sludge Disposal		$394,000	Based on 1600 tons/yr; 20% solids sludge
Subtotal (S4)	(1)	$394,000	
ALLOWANCES			
Subtotal (S1+S2+S3+S4)	$1,488,747	$502,648	
Engineering (15%)	$223,312		
Contingency (20%)	$297,749	$100,530	
ECONOMIC ANALYSIS			See Economic Parameters below.
Totals	**$2,009,808**	**$603,178**	
Present Worth	$10,219,032		
Total Present Worth	$12,229,000		

(1) Costs not available from Westchester County DEF as of 10/92; but would be included during remedial design.

ECONOMIC PARAMETERS

j = 0.040 (inflation)
i = 0.080 (interest)
n = 30.000 (project life)
Present Worth Multiplier = 16.942

Immediately after treatment, the treated materials are discharged to prevent hardening inside the mixer. Residual solids and liquids from treatment and decontamination can be placed in a basin, or roll-off boxed for transport.

Within Alternative 3, two scenarios for ground water control have been developed. Alternative 3A consists of on-site stabilization only, while Alternative 3B consists of on-site solidification with continuing containment of the ground water in the sands (as leachate will no longer be present).

3.3.1 Alternative 3A - Excavation of Fill With On-Site Solidification

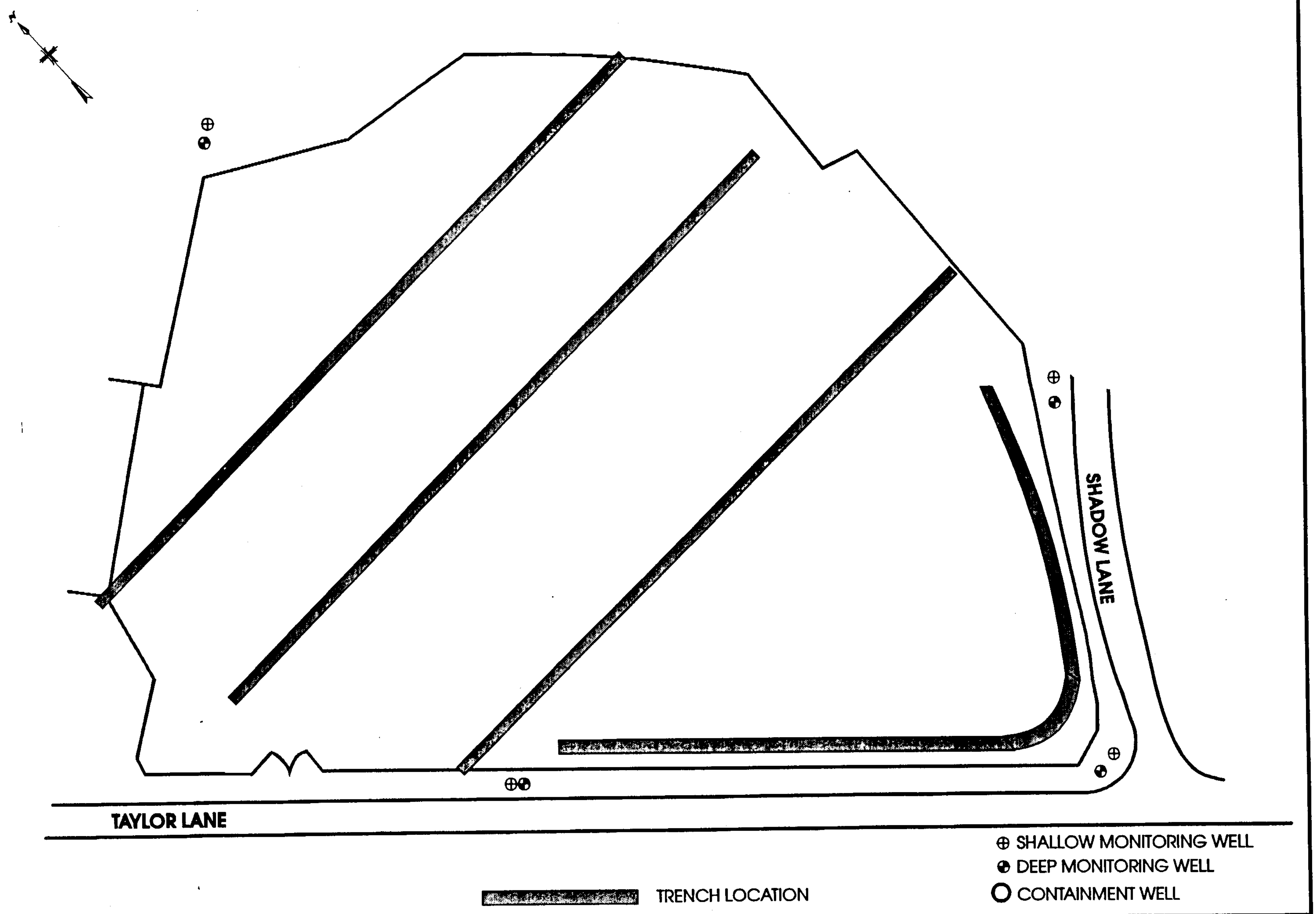
The aforementioned description details the unit processes required for stabilizing the fill material. Under Alternative 3A, there is no control of the ground water beyond dewatering the fill. (See Figure 3-8) Therefore, the hydrogeology is similar to Alternative 1 - no action. Monitoring for this alternative is the same as that for the no-action alternative described in Section 3.1. The estimated capital cost for Alternative 3A is $13,362,017, and the details of the calculation are in Table 3-5.

3.3.2 Alternative 3B - Excavation of Fill with On-Site Solidification and Containment

Excavation of the fill material, followed by on-site solidification would occur in the same manner as previously described. However, this alternative also includes control of ground water through the use of two containment wells. (See Figure 3-9) These wells would be designed in the same manner as those described in section 3.2.2. Monitoring would be the same as the no-action alternative. The estimated cost for Alternative 3B is $14,135,931, and the details of the calculations are presented in Table 3-6.

3.4 ALTERNATIVE 4 - EXCAVATION OF FILL WITH OFF-SITE SOLIDIFICATION

Under this alternative, dewatering of the fill and ground water monitoring would be accomplished in the same manner as described for Alternative 3. Once the soil has been excavated, the waste will be placed into roll-offs, or other temporary containers, and transferred to an off-site facility for solidifying/stabilizing and final disposal. The unit processes described for on-site solidification are similar to those for off-site



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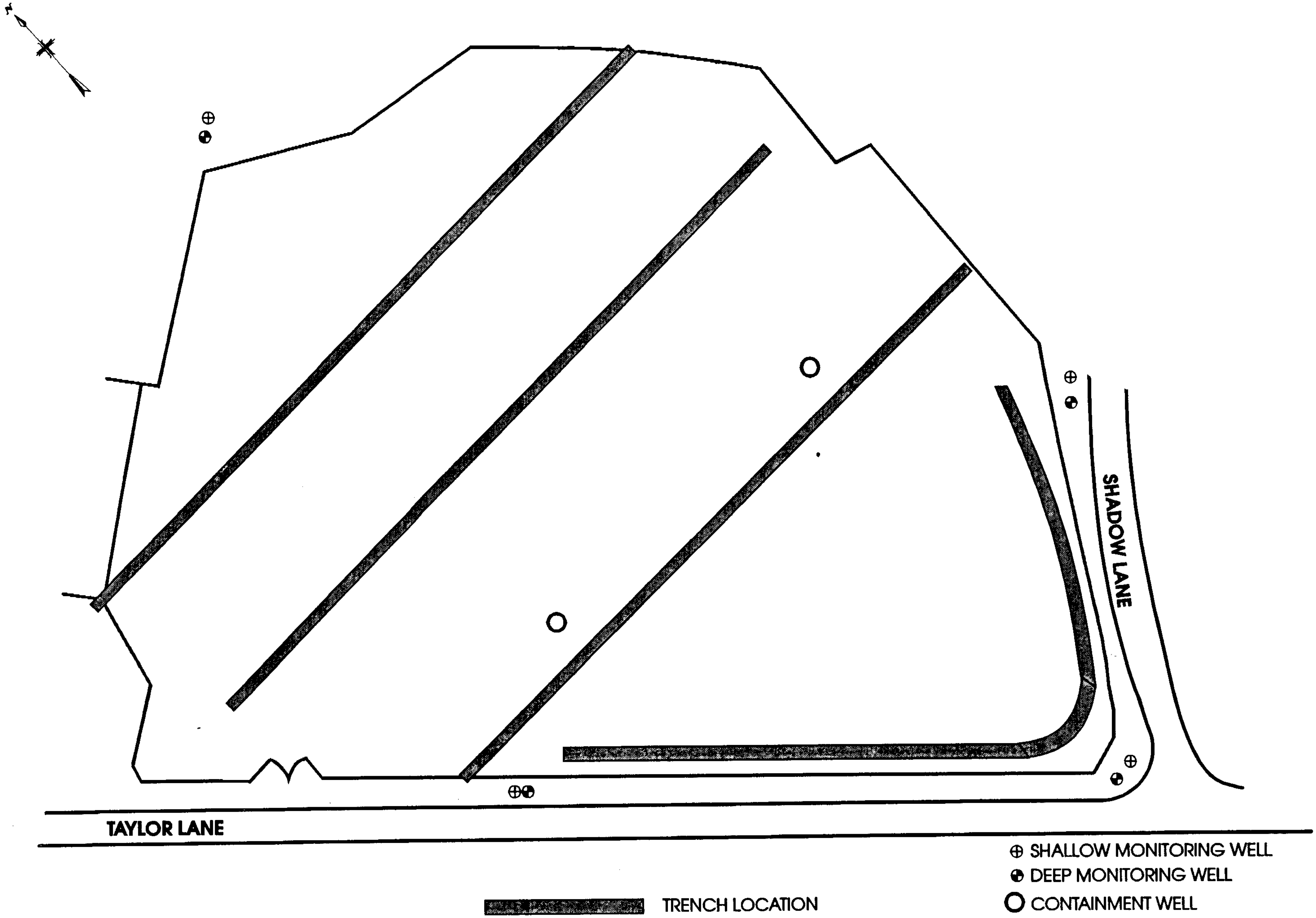
ALTERNATIVE 3A - EXCAVATION OF FILL WITH ON-SITE SOLIDIFICATION/STABILIZATION (S/S) - NO GROUND WATER CONTROL

FIGURE 3-8



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ALTERNATIVE 3B - EXCAVATION OF FILL WITH ON-SITE
S/S - CONTAINMENT OF GROUND WATER VIA TWO CONTAINMENT WELLS

FIGURE 3-9

TABLE 3-5
Mamaroneck Taylor Lane Leaf Compost Site
Detailed Cost Analysis for
ALTERNATIVE 3A – On-Site Solidification with no Ground Water Control

	Capital	O&M	Assumptions
DEWATERING			Dewatering of Fill via 4 Trenches
Trenches (Four)	$114,000		$30,000 mobilization, $300 per foot
Pumping	$6,000		$1,500 each; 4 pumps
Subtotal (S1)	$120,000		
FILL MATERIAL			
Excavation	$3,475,000		170,000 cy @ $20 per cy; 300,000sf – depth 15ft
On-site Solidification	$5,100,000		170,000cy @ $30/cy; 300,000sf – depth 15ft
Subtotal (S2)	$8,575,000		
CONTINUED MONITORING			
– Well Installation	$16,000		$4000/couplet, 4 well couplets
– Well Development	$2,760		2 People; 2 Days; 4 well couplets
– Annual Sampling		$2,800	Quarterly for first two years (15 wells); Annually for
– Quarterly Sampling	$11,200		remainder of wells (8 wells)
– Analyses	$55,120	$4,240	$530/sample, TCL/TAL (8 wells annually)
– Fencing	$12,310	$1,000	$12.30 per ft x 1000ft, 6 ft chain link
Subtotal (S3)	$97,390	$8,040	
PRE-TREATMENT			
Equalization Tank	$100,000		Allowance
Feed Pumps	$6,000		Redundant pumps (4), $1500 each
Chemical Precipitation	$448,000	$53,500	200 gpm two stage package plant
Sludge Dewatering	$240,000	$4,000	Alfa-Laval PM-35000
Subtotal (S4)	$794,000	$57,500	
DISPOSAL			
POTW fees	(1)	(1)	400 gpm
TCLP Samples	$21,400		20 samples @ $1070 each
Sludge Disposal	$290,000	$220,000	
Subtotal (S5)	$311,400	$220,000	
ALLOWANCES			
Subtotal (S1+S2+S3+S4+S5)	**$9,897,790**	**$285,540**	
Engineering (15%)	$1,484,669		
Contingency (20%)	$1,979,558	$57,108	
ECONOMIC ANALYSIS			See Economic Parameters below.
Totals	**$13,362,017**	**$342,648**	
Present Worth	$5,805,141		
Total Present Worth	$19,167,000		

(1) Costs not available from Westchester County DEF as of 10/92; but would be included during remedial design.

ECONOMIC PARAMETERS

j = 0.040 (inflation)
i = 0.080 (interest)
n = 30.000 (project life)
Present Worth Multiplier = 16.942

TABLE 3-6
Mamaroneck Taylor Lane Leaf Compost Site
Detailed Cost Analysis for
ALTERNATIVE 3B – On-Site Solidification with Ground Water Control via 2 Containment Wells

	Capital	O&M	Comments
DEWATERING/CONTROL			Dewatering of Fill via 4 trenches
Trenches (Four)	$114,000		$30,000 mobilization, $300 per foot
Pumping	$6,000		$1,500 each; 6 pumps
Containment Wells			
– Well Installation	$36,300		$18,150 each well; 2 wells; 8" diameters
– Step-Drawdown Test	$2,760		2 people; 2 days
– Pumps	$3,000		$1,500 each pump; 2 pumps
Subtotal (S1)	$162,060		
CONTINUED MONITORING			
Monitoring Well Installation	$16,000		$4000/couplet, 4 well couplets
Well Development	$2,760		2 People; 2 Days; 4 well couplets
Annual Sampling		$2,800	Quarterly for first two years (15 wells); Annually for
Quarterly Sampling	$11,200		remainder of wells (8 wells)
Analyses	$55,120	$4,240	$530/sample, TCL/TAL (8 wells annually)
Fencing	$12,310	$1,000	$12.30 per ft x 1000ft, 6 ft chain link
Subtotal (S2)	$97,390	$8,040	
FILL MATERIAL			
Excavation	$3,475,000		170,000 cy, $20 per cy
On-site Solidification	$5,100,000		170,000 cy, $30 per cy
Fencing	$12,310		$12.30 per ft x 1000ft, 6 ft chain link
Subtotal (S3)	$9,106,210		
PRE-TREATMENT			
Equalization Tank	$100,000		Allowance
Feed Pumps	$6,000		Redundant pumps (4), $1500 each
Lime Softening	$448,000	$59,000	400 gpm two stage package plant
Sludge Dewatering	$240,000	$4,000	Alfa-Laval PM-35000
Subtotal (s4)	$794,000	$63,000	
DISPOSAL			
POTW fees	(1)	(1)	400 gpm
TCLP Samples	$21,400		20 @ $1070 each
Sludge Disposal	$290,000	$220,000	
Subtotal (S5)	$311,400	$220,000	
ALLOWANCES			
Subtotal (S1+S2+S3+S4+S5)	$10,471,060	$291,040	
Engineering (15%)	$1,570,659		
Contingency (20%)	$2,094,212	$58,208	
ECONOMIC ANALYSIS			Economic Parameters same as Table 3-5.
Totals	**$14,135,931**	**$349,248**	
Present Worth	$5,916,958		
Total Present Worth	$20,053,000		

(1) Costs not available from Westchester County DEF as of 10/92; but would be included during remedial design.

solidification/stabilization; however, the volume of soil which can be treated per batch is greatly increased. The final disposal facility will be a licensed and approved landfill.

3.4.1 Alternative 4A - Excavation of Fill with Off-Site Solidification

This process option is similar to the other excavation alternatives previously described. Under this alternative there is no control of the ground water beyond dewatering the fill. The hydrogeology and monitoring program is therefore similar to that of the no action alternative. The estimated capital cost associated with this alternative is $63,349,290, and the detailed analysis is presented in Table 3-7.

3.4.2 Alternative 4B - Excavation of Fill with Off-Site Solidification and Containment Wells in the Sand

Under this alternative, dewatering of the fill, control of the ground water and monitoring would be accomplished in the same manner as described for Alternative 3B. The estimated capital cost for this alternative is $63,392,571, and the details are presented in Table 3-8.

TABLE 3–7
Mamaroneck Taylor Lane Leaf Compost Site
Detailed Cost Analysis for
ALTERNATIVE 4A – Off–Site Solidification/Stabilization and Disposal

	Capital	O&M	Assumptions
DEWATERING			Dewatering of FIll via 4 Trenches
Trenches (4)	$114,000		$30,000 mobilization, $300 per foot; 4 trenches
Pumps	$6,000		$1,500 each; 4 pumps
Subtotal (S1)	$120,000		
FILL MATERIAL			
Excavation	$3,400,000		170,000cy @ $20/cy
Backfill of site	$1,500,000		150,000cy @ $10/cy
Transportation & Disposal	$40,800,000		$170,000cy @ $240/cy
Subtotal (S2)	$45,700,000		
PRE–TREATMENT			
Equalization Tank	$100,000		Allowance
Feed Pumps	$6,000		Redundant pumps (4), $1500 each
Lime Softening	$448,000	$53,500	200 gpm two stage package plant
Sludge Dewatering	$240,000	$4,000	Alfa–Laval PM–35000
Subtotal (S3)	$794,000	$57,500	
DISPOSAL			
POTW fees	(1)	(1)	400 gpm
Sludge Disposal	$290,000	$220,000	Dispose with soil
TCLP samples	$21,400		Assume 10 samples @ $1070/sample
Subtotal (S4)	$311,400	$220,000	
ALLOWANCES			
Subtotal (S1+S2+S3+S4)	**$46,925,400**	**$277,500**	
Engineering (15%)	$7,038,810		
Contingency (20%)	$9,385,080	$55,500	
ECONOMIC ANALYSIS			Economic Parameters same as Table 3–5.
Totals	**$63,349,290**	**$333,000**	
Present Worth	$5,641,684		
Total Present Worth	$68,991,000		

(1) Costs not available from Westchester County DEF as of 10/92; but would be included during remedial design.

TABLE 3–8
Mamaroneck Taylor Lane Leaf Compost Site
Detailed Cost Analysis for
ALTERNATIVE 4B – Off–Site Solidification and Disposal with Ground Water Control

	Capital	O&M	Comments
DEWATERING/CONTROL			Dewatering of Fill via 4 Trenches
Trenches (Four)	$114,000		$30,000 mobilization, $300 per foot
Pumping	$6,000		$1,500 each; 6 pumps
Containment Wells			
– Well Installation	$26,300		$13,150 each well; 2 wells; 8" diameters
– Step–Drawdown Test	$2,760		2 people; 2 days
– Pumps	$3,000		$1,500 each pump; 2 pumps
Subtotal (S1)	$152,060		
FILL MATERIAL			
Soil Excavation	$3,400,000		170,000cy @ $20 per cy
Backfill of site	$1,500,000		150,000 cy @ $10/cy
Transportation & Disposal	$40,800,000		170,000cy @ $240/cy
Subtotal (S2)	$45,700,000		
PRE–TREATMENT			
Equalization Tank	$100,000		Allowance
Feed Pumps	$6,000		Redundant pumps (4), $1500 each
Lime Softening	$448,000	$59,000	400 gpm two stage package plant
Sludge Dewatering	$240,000	$4,000	Alfa–Laval PM–35000
Subtotal (S3)	$794,000	$63,000	
DISPOSAL			
POTW fees	(1)	(1)	400 gpm
TCLP Samples	$21,400		20 @ $1070 each
Sludge Disposal	$290,000	$220,000	
Subtotal (S4)	$311,400	$220,000	
ALLOWANCES			
Subtotal (S1+S2+S3+S4)	$46,957,460	$283,000	
Engineering (15%)	$7,043,619		
Contingency (20%)	$9,391,492	$56,600	
ECONOMIC ANALYSIS			Economic Parameters same as Table 3–5.
Totals	**$63,392,571**	**$339,600**	
Present Worth	$5,753,502		
Total Present Worth	$69,146,000		

(1) Costs not available from Westchester County DEF as of 10/92; but would be included during remedial design.

4.0 DETAILED ANALYSIS OF ALTERNATIVES

4.1 NCP CRITERIA

In this chapter, these alternatives will be evaluated with respect to the following nine criteria, as stipulated in the 6 NYCRR Part 376 (Inactive Hazardous Waste sites):

- Overall Protection of Human Health and the Environment
- Compliance with Applicable, Relevant, and Appropriate Requirements (ARARs)
- Long-term Effectiveness and Permanence
- Reduction of Toxicity Mobility, or Volume through Treatment
- Short-term Effectiveness
- Implementability
- Cost
- Community Acceptance
- State Acceptance

A brief summary of each criterion follows:

4.1.1 Overall Protection of Human Health and the Environment

This criterion relates to whether the alternative provides adequate protection to human health and the environment and describes how risks posed through each potential exposure pathway are eliminated. The criterion evaluates long-term benefits to public health and the environment in contrast to short-term or long-term risks posed by implementation of the alternative. Considerations include construction impacts and impacts of the remedy to human health and the environment.

4.1.2 Compliance with Applicable, Relevant and Appropriate Requirements (ARARs)

The remedial alternatives will be evaluated to determine whether they attain ARARs and other requirements that are "to be considered" (TBCs).

4.1.3 Long-Term Effectiveness and Permanence

Alternatives will be evaluated for the long-term effectiveness and permanence they afford, along with the degree of certainty that the alternative will prove successful. The magnitude of residual risk remaining from untreated waste or treatment residuals will be considered. The characteristics of the residuals will be considered to the degree that they remain hazardous, taking into account their volume, toxicity, mobility, and propensity to bioaccumulate. The adequacy and reliability of controls necessary to manage treatment residuals and untreated waste will also be considered. This factor addresses in particular the uncertainties associated with land disposal for providing long-term protection from residuals; the assessment of the potential need to replace technical components of the alternative; and the potential exposure pathways and risks posed should the remedial action need replacement. In addition to those items listed above, an assessment of the possible future uses of land will be discussed under each alternative.

4.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

The degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume will be assessed. The treatment or recycling processes employed by the alternatives will be assessed as to the amount of hazardous substances or contaminants destroyed, treated, or recycled; the degree of expected reduction in toxicity, mobility, or volume of the waste; the degree to which the treatment is irreversible; the type and quantity of residuals that will remain following treatment; and the degree to which treatment reduces the inherent hazards posed by the principal threats at the facility.

4.1.5 Short-Term Effectiveness

The short-term effectiveness of alternatives will be assessed. The short-term risks that may be posed to the community during implementation of the alternative will be considered. The potential impacts on workers and the environment during remedial action, as well as the effectiveness and reliability of the protective measures, will be assessed. The time until remedial action objectives are achieved is also evaluated.

4.1.6 Implementability

Each alternative will be assessed for its ease or difficulty of implementation. This assessment includes the consideration of the following: technical feasibility, administrative feasibility, reliability, the ability to monitor the effectiveness of the remedy, the availability of services and materials necessary to implement the alternative, ability to construct and operate, ease of undertaking additional measures, if necessary, ability to obtain approvals from other agencies, availability of necessary equipment and specialists, and timing of new technology under consideration.

4.1.7 Cost

The cost analysis includes an estimate of the capital and operation and maintenance (O&M) costs for each alternative. In developing this cost estimate, the following steps were used:

- Estimate capital costs and estimate operation and maintenance cost. Capital costs include the following components:
    - Construction costs, including materials, labor, contractor overhead and profit;
    - Equipment costs;
    - Engineering expenses including costs of administration, design, drafting, construction supervision, reporting and sampling performed during remediation; and
    - Legal fees and permitting costs.
- Operation and maintenance costs include the following components:
    - Operation labor costs, including wages, training, overhead and benefits associated with the labor needed for post-construction operations;
    - Maintenance costs, including costs for labor, parts, and other resources required for routine maintenance; and
    - Materials and energy including costs of items such as electricity required for operation of the remedial equipment.

Final cost comparison of alternatives is conducted via a present worth analysis.

4.1.8 State Acceptance

The state acceptance criterion relates to the State perception of the selected remedy and its acceptability as the method of restricting ground water migration at the site. State acceptance will be assessed in the NYSDEC Record of Decision (ROD) following a review of the State comments received on the FS report and the Proposed Plan.

4.1.9 Community Acceptance

The community acceptance criterion relates to the public perception of the selected remedy and its acceptability as the method of restricting ground water migration at the site. Community acceptance will be assessed in the Record of Decision (ROD) following a review of the public comments received on the FS report and the Proposed Plan.

4.2 ALTERNATIVE 1 - NO-ACTION WITH CONTINUED MONITORING AND INSTITUTIONAL CONTROLS

NYSDEC regulations require that the no-action alternative be evaluated at every site to establish a baseline for comparison. Under this alternative, no-action would be taken at the site to contain farther migration of contaminants. Minimal activity would be conducted to eliminate the potential for dermal or ingestive exposure to contaminants for the soils, including moving the berm to the east of the site and upgrading the site fence. Institutional controls, such as site postings, would also be implemented under the no action alternative. The no-action alternative also includes periodic monitoring of ground water as described in Section 3. Monitoring includes ground water sampling of perimeter wells to track the potential for off-site migration of contaminants into the sands.

4.2.1 Overall Protection of Human Health and Environment

Presently, precipitation is percolating into the fill material and generating leachate. This leachate is contaminated with a variety of organic and inorganic compounds. Although the highly organic nature and high cation exchange capacity of the fill significantly retards the movement of contaminants from the leachate, the compounds may come into contact with ground water in the sands beneath the fill, such that ground water in contact with leachate may become increasingly contaminated. At this point, it cannot be determined to what extent the contaminated ground water has or will continue to migrate off-site. However, under the no-action alternative, it is likely that some contaminants may continue to migrate off-site. The most significant risk from the site under the no-action alternative is from the potential for dermal contact with or ingestion of the soils, particularly if the composting or other activities resumed at the site. The no-action alternative does offer some protection of human health and the environment because the potential impacts to the community and workers during the construction of remedial alternatives would not be incurred. This would include potential air exposure, additional generation of leachate or surface runoff due to dewatering or construction activities, and associated risks of transporting hazardous substances.

4.2.2 Compliance with Applicable or Relevant and Appropriate Requirements

The no-action alternative would not comply with ARARs because the ground water in the sand does not presently comply with drinking water standards. It is also unlikely that the ground water would comply with ARARs in the future because leachate would continue to be generated and would continue to be in contact with the ground water. Additionally, continued exposure to soils which are above guidance levels would be possible.

4.2.3 Long-Term Effectiveness and Permanence

This alternative would not be effective in the long term because leachate would continue to be generated, thus potentially continuing to contaminate ground water. It cannot be determined whether and to what extent the contaminated ground water would migrate off-site. However, the monitoring described under the no-action alternative could be used to evaluate the potential for off-site migration.

4.2.4 Reduction in Toxicity, Mobility or Volume through Treatment

Because the no-action alternative does not include source control or treatment, it would not reduce toxicity, mobility, or volume of contaminants.

4.2.5 Short-term Effectiveness

The no-action alternative is not effective in the short term since it does not remove the probability of off-site migration of contaminants. It is estimated that the no-action alternative could be implemented within two months from initiation, and monitoring would be continued for 30 years.

4.2.6 Implementability

The no-action alternative would be easily implementable. Preexisting monitoring wells could be augmented with additional wells. The removal of soils from the site boundaries exceeding cleanup criteria are a small quantity and could be moved quickly. No additional construction would be required.

4.2.7 Cost

Costs for this alternative would be chiefly comprised of monitoring and ground water analysis costs. The Capital, Annual Operation and Maintenance (O&M) and Present Worth costs for this alternative are detailed in Section 3 and are as follows:

Capital Cost:	$ 116,868
Annual O&M Cost:	$ 9,648
Present Worth:	$ 280,000

4.3 ALTERNATIVE 2 - PART 360 CAP

Alternatives 2A, 2B, 2C, include the installation of a Part 360 Cap over the entire site, including incorporating fill from the site perimeter and continued monitoring for the generation of leachate and potential for off-site migration of contaminants in the ground water. Within Alternative 2 are the following three sub-alternatives:

Alternative 2A - Part 360 Cap (no ground water containment)
Alternative 2B - Part 360 Cap, Slurry Wall and 2 Containment Wells
Alternative 2C - Part 360 Cap, Trench, and 2 Containment Wells

For ease in comparing alternatives, the seven criteria for each of the three sub-alternatives are discussed collectively.

4.3.1 Overall Protection of Human Health and Environment

As discussed in the no-action alternative, precipitation is percolating into the site fill material and causing the generation of leachate. This leachate is contaminated with a variety of organic and inorganic compounds. The installation of a Part 360 Cap would effectively reduce the generation of leachate, which would reduce the potential for contamination contaminant to come into contact with ground water in the sands layer beneath the fill. However, under Alternative 2A, ground water movement is not controlled and contamination in the lower reaches of the fill and in the sand may migrate off-site. However, this alternative includes perimeter monitoring wells that could be used to track whether contaminants are moving off-site. Therefore, this alternative is not fully protective of human health and the environment.

Alternative 2B, which consists of the Part 360 Cap, a slurry wall, and two containment wells is protective of human health and the environment because the installation of the slurry wall would significantly reduce the movement of ground water from the site. Additional monitoring would have to be conducted to determine the impact to ground water movement on the outside of the slurry wall.

Alternative 2C, which consists of the Part 360 Cap, a trench, and two containment wells around the site perimeter is protective of human health and the environment because the trench and containment wells would restrict the movement of leachate and ground water.

Alternatives 2A, 2B, and 2C offer additional protection of human health and the environment because the potential impacts to the community and workers during excavation or transport off-site would not be incurred. This would include potential air exposure, additional generation of leachate or surface runoff due to dewatering or construction activities, and associated risks of transporting hazardous substances.

4.3.2 Compliance with Applicable or Relevant and Appropriate Requirements

For all three alternatives, the Part 360 Cap will be constructed and maintained in accordance with Part 360 requirements and will thus meet ARARs. Similarly, construction activities will be conducted such that ambient air standards will not be violated. In terms of meeting the drinking water criteria in the ground water in the sands, Alternatives 2B and 2C will comply with drinking water criteria ARARs because contamination in the sands will be contained and it is unlikely that contaminants above the drinking water criteria will migrate off-site. Alternatives 2A, 2B, and 2C also reduce the potential for dermal exposure or ingestion.

4.3.3 Long-Term Effectiveness and Permanence

Alternatives 2A, 2B, and 2C would be effective in the long-term because the source of contaminants at the site would be controlled, thereby significantly reducing the continued contamination of ground water. In addition, these alternatives provides some flexibility for future land use possibilities, as discussed in Section 5.0.

4.3.4 Reduction in Toxicity, Mobility or Volume through Treatment

Alternatives 2A, 2B, and 2C would reduce toxicity, mobility and volume of contaminants because they all will provide source control. In these alternatives, less leachate would be generated which would impact the extent to which ground water beneath the fill continues to be contaminated. Alternatives 2B and 2C would further reduce the mobility of contaminant by recovery of the ground water through the use of two containment wells.

4.3.5 Short-term Effectiveness

Alternatives 2A, 2B, and 2C would all be effective in the short term because they would provide source control, in a relatively short period of time as indicated in the schedule below:

Alternative 2A	6 months; Continued monitoring for 30 years
Alternative 2B	8 months; Continued monitoring for 30 years
Alternative 2C	8 months; Continued monitoring for 30 years

4.3.6 Implementability

The technologies for Alternatives 2A, 2B, and 2C are proven and would be easily implemented. However, the design and construction of Alternatives 2B and 2C would be more timely. Also, both of these alternatives involve discharge to the POTW, which would have to be further evaluated during design.

4.3.7 Cost

Costs for these three alternatives include construction of the Part 360 Cap and, in the case of Alternatives 2A and 2B, construction of the slurry wall and trench, respectively, and construction and permitting for the ground water treatment system. Detailed summaries of the costs were presented in Section 3. The Capital, Annual Operation and Maintenance (O&M) and Present Worth costs for this alternative are detailed in Table 3-2, and are as follows:

ALTERNATIVE	CAPITAL COST	ANNUAL O&M	PRESENT WORTH
2A - Part 360 Cap	$862,187	$49,648	$1,703,000
2B - Part 360 Cap; Slurry Wall and Two Containment Wells	$3,176,883	$383,578	$9,765,000
2C - Part 360 Cap; Trench and Two Containment Wells	$2,009,808	$603,178	$12,229,000

4.4 ALTERNATIVE 3 - EXCAVATION OF FILL WITH ON-SITE SOLIDIFICATION

Alternative 3 includes excavation of the site fill with on-site solidification as detailed in Section 3. Within Alternative 3 are the following two subalternatives:

Alternative 3A - Excavation of fill via trenches and on-site solidification/stabilization

Alternative 3B - Excavation of fill via trenches and on-site solidification/stabilization. Containment of ground water via two containment wells

For ease in comparing alternatives, the seven criteria for each of the sub-alternatives are discussed collectively.

4.4.1 Overall Protection of Human Health and Environment

As discussed in the no-action alternative, precipitation is percolating into the site fill material and causing the generation of leachate. This leachate is fairly contaminated with a variety of organic and inorganic compounds. The excavation of the fill, solidification, and backfill on-site would effectively provide source control and remove the ability of the fill to generate leachate and would eliminate the mobility of contaminants that had been bound in the fill. A significant volume of leachate would be generated during dewatering that would require treatment prior to discharge. Alternative 3A includes perimeter monitoring wells to track whether contaminants are moving off-site. Therefore, this alternative is protective of human health and the environment. Alternative 3B, which includes two on-site containment wells, would prevent future migration of ground water from the site. Therefore, both Alternatives 3A and 3B are protective of human health and the environment.

Alternatives 3A and 3B would present some risk to workers on-site and to the community during excavation and treatment. However, this risk would be minimized through the use of ambient air monitoring.

4.4.2 Compliance with Applicable or Relevant and Appropriate Requirements

For both alternatives, the excavation and treatment would be conducted in accordance with applicable requirements (specifically relating to pretreatment of the ground water and discharge to the POTW).

4.4.3 Long-Term Effectiveness and Permanence

Alternatives 3A and 3B would be effective in the long term because the source of contaminants at the site would be removed, thereby eliminating the potential for contamination to reach the ground water. In addition, off-site migration of contaminants would be significantly reduced. Future land use possibilities under this alternative are discussed in Section 5.0.

4.4.4 Reduction in Toxicity, Mobility or Volume through Treatment

Alternatives 3A and 3B would reduce toxicity, mobility and volume of contaminants due to the fact that the source of contamination has been removed and eliminated.

4.4.5 Short-term Effectiveness

Alternatives 3A and 3B would be effective in the short term due to the removal of the source of contamination. Satisfactory long-term fixation of target contaminants of the solidified mass can be expected. It is estimated that the two alternatives could be implemented within the following time schedule:

Alternative 3A	15 months; Continued monitoring for 30 years
Alternative 3B	15 months; Continued monitoring for 30 years

4.4.6 Implementability

The technologies for Alternatives 3A and 3B are proven and could be implemented. A treatability study may have to be conducted on the stabilization process to determine design parameters. The design and construction of Alternatives 3A and 3B would be more complex due to the area that would be required (presumably on-site) for treatment/stabilization of the soils. Also, Alternatives 3B involves discharge to the POTW. As described earlier, issues surrounding the capacity and willingness of the POTW would have to be resolved during design, and could significantly affect implementability.

4.4.7 Cost

Costs for these two alternatives include excavation, treatment, and backfill of the fill/soils, dewatering of the fill area and pretreatment prior to discharge to the POTW, and, in the case of 3B, installation of two containment wells on-site in the sands (discharge would also be through the treatment system prior to discharge to the POTW. Detailed summaries of the costs were presented in Section 4. The Capital, Annual Operation and Maintenance (O&M) and Present Worth costs for this alternative are detailed in Section 4 and are as follows:

ALTERNATIVE	CAPITAL COST	ANNUAL O&M	PRESENT WORTH
3A - Excavation and On-Site Solidification	$13,362,017	$342,648	$19,167,000
4B - Excavation and On-Site Solidification with Containment Wells in the Sands	$14,135,931	$349,248	$20,053,000

4.5 ALTERNATIVE 4 - EXCAVATION OF FILL WITH OFF-SITE SOLIDIFICATION

Alternative 4 includes excavation of the site fill with off-site solidification as detailed in Section 3. The alternative would include dewatering, excavation and off-site treatment of soil parcels from the site perimeter which would be backfilled with clean soil. The site would be backfilled with clean fill. Monitoring of the ground water would continue to evaluate the potential for off-site migration of contaminants that are already in the ground water.

Within Alternative 4 are the following two sub-alternatives:

Alternative 4A - Excavation of Fill via Trenches and Off-Site Solidification of Fill

Alternative 4B - Excavation of Fill via Trenches and Off-Site Solidification. Containment of the ground water via two containment wells

For ease in comparing alternatives, the seven criteria for each of the two sub-alternatives are discussed collectively.

4.5.1 Overall Protection of Human Health and Environment

As discussed in the no-action alternative, precipitation is percolating into the site fill material and causing the generation of leachate. Excavation of the fill, solidification, and backfill on-site would effectively provide source control and remove the ability of the fill to generate leachate. A significant volume of leachate would be generated during dewatering that would require treatment prior to discharge. Alternative 4A includes perimeter monitoring wells to track whether contaminants are moving off-site. Therefore, this alternative may be protective of human health and the environment, but the extent to which it is would have to be verified during the remedial action. Alternative 4B, which includes two on-site containment wells, would prohibit the future migration of ground water from the site and would provide a certainty that contaminants are not leaving the site. Therefore, both Alternatives 4A and 4B are highly protective of human health and the environment. Alternative 4B provides a higher certainty that contaminated ground water is not leaving the site.

Alternatives 4A and 4B would present some risk to workers on-site and to the community during excavation and treatment. However, this risk could be mitigated with the use of ambient air monitoring. This include potential air exposure, additional generation of leachate or surface runoff due to dewatering or construction activities, and associated risks of excavating hazardous substances.

4.5.2 Compliance with Applicable or Relevant and Appropriate Requirements

For both alternatives, the excavation and treatment would be conducted in accordance with applicable requirements (specifically relating to pretreatment of the ground water and discharge to the POTW). Similarly, construction activities will be conducted such that ambient air standards will not be violated. In terms of meeting the drinking water criteria in the ground water in the sands, Alternatives 4B would comply with drinking water criteria ARARs because contamination in the sands will be contained and it is unlikely that contaminants above the drinking water criteria will migrate off-site. Alternative 4A may also comply with ARARs. However, the extent to which ground water contaminants may migrate off-site would have to be verified during the remedial action.

Alternatives 4A and 4B comply with soil standards in that all soils and fill areas currently above the cleanup standards would be covered and the potential for exposure via dermal or ingestion would be significantly reduced or eliminated.

4.5.3 Long-Term Effectiveness and Permanence

Alternatives 4A and 4B would be effective in the long term because the source of contaminants at the site would be controlled, thereby significantly reducing the continued contamination of ground water. In addition, this alternative provides some flexibility for future land use possibilities. Land uses that have been identified as compatible with the existence of soil stabilization are discussed in Section 5.0.

4.5.4 Reduction in Toxicity, Mobility or Volume through Treatment

Alternatives 4A and 4B would reduce toxicity, mobility and volume of contaminants through treatment because they provide source control. In these alternatives, the generation of leachate would be reduced to none which would impact the extent to which ground water beneath the fill continues to be contaminated. Alternative 4B would further reduce the mobility and volume of contaminants because contaminants in the ground water would be further contained from migrating off-site and recovered ground water would be treated prior to discharge at the POTW.

4.5.5 Short-term Effectiveness

Alternatives 4A and 4B would be effective in the short term because they would provide source control as soon as they are constructed. Alternative 4A would be slightly more effective in the short term because the construction time would be less. Alternative 4B would required more time for dewatering and construction of a ground water pretreatment system. In addition, discussions would have to be held with the POTW on the maximum flow rate that can be accommodated. The time to implementation for alternative 4B is a direct function of the flow rate that can be used during dewatering. It is estimated that the two alternatives could be implemented within the following:

Alternative 4A	8 months; no continued monitoring.
Alternative 4B	12 months; no continued monitoring.

4.5.6 Implementability

The technologies for Alternatives 4A and 4B are proven and could be implemented. A treatability study may have to be conducted on the stabilization parameters to determine design parameters. Also, Alternatives 4B involves discharge to the POTW. As described earlier, issues surrounding the capacity and willingness of the POTW would have to be resolved during design, and could significantly affect implementability.

4.5.7 Cost

Costs for these two alternatives include excavation, treatment, and backfill of the fill/soils, dewatering of the fill area and pretreatment prior to discharge to the POTW, and, in the case of 4B, installation of two containment wells on-site in the sands (discharge would also be through the treatment system prior to discharge to the POTW. Detailed summaries of the costs were presented in Section 3. The Capital, Annual Operation and Maintenance (O&M) and Present Worth costs for this alternative are detailed in Section 3 and are as follows:

ALTERNATIVE	CAPITAL COST	ANNUAL O&M	PRESENT WORTH
4A - Excavation and On-Site Solidification	$63,349,290	$333,000	$68,991,000
4B - Excavation and On-Site Solidification with Containment Wells in the Sands On-Site	$63,392,571	$339,600	$69,146,000

4.6 SUMMARY OF FINDINGS OF DETAILED ANALYSIS

The summary of the findings for the detailed analysis for each alternative according to the seven criteria specified in the NCP are provided in Table 4-1.

TABLE 4-1 - DEVELOPMENT AND DETAILED ANALYSIS OF ALTERNATIVES

ALT #	SOILS	LEACHATE/SANDS	TREATMENT/DISCHARGE	Overall Protection of Health and Environment	Compliance with ARARs	Long Term Effectiveness	Reduction of Toxicity Mobility or Volume	Short Term Effectiveness	Implementability	Cost ($) Capital/ (O&M) (Thousands)
1	NO ACTION W/CONTINUED MONITORING AND FENCING.			0	–	–	–	0	+	116 (9.6)
2	INSTALLATION OF PART 360 CAP OVER ENTIRE SITE AFTER CONSOLIDATION OF ISOLATED BERM 'HOT SPOTS'									
2A	Consolidation of contaminated fill/soils for on-site disposal, and capping of site.	None	None	0/+(1)	0/+(1)	0	0/+	+	+	862 (49.6)
2B	Same as 2A.	Containment of leachate via slurry wall around site perimeter; containment of ground water via extraction wells on-site.	Pretreatment for metals removal and discharge to POTW.	+	+	0	0/+	+	+	3,176 (383)
2C	Same as 2A.	Containment of leachate via horizontal well; containment of GW via extraction wells on-site.	Same as 2B.	+	+	0	0/+	+	+	2,009 (603
3	ALTERNATIVE 3 - EXCAVATION OF FILL WITH ON-SITE SOLIDIFICATION/STABILIZATION (S/S)									
3A	Excavation of Contaminated areas; on-site S/S and backfill on-site.	Dewatering of area to be excavated via horizontal wells.	Short term discharge to POTW.	0/+	+	+	+	0/+	–	13,362 (342)
3B	Same as 3A.	Dewatering of excavated area via horizontal wells; GW containment via extraction wells.	Short Term Discharge to POTW and long term pretreatment for metals removal and discharge to POTW.	+	+	+	+	0/+	–	14,135 (349)
4	EXCAVATION OF FILL WITH OFF-SITE SOLIDIFICATION/STABILIZATION (S/S)									
4A	Excavation with Off-Site Treatment via S/S	Same as 3A.	Same as 3A.	0	+	+	+	0/+	–	63,349 (333)
4B	Same as 4A.	Same as 3B.	Same as 3B.	0	+	+	+	0/+	–	63,392 (339)

(1) Would be confirmed via monitoring during the remedial action.

5.0 POTENTIAL LAND USE CONSIDERATIONS

In this chapter, the four alternatives developed in Chapter 4 will be evaluated with respect to potential future land use. The types of improvements considered for future use must provide an adequate degree of protection to human health, and meet the criteria stipulated in the 6 NYCRR Part 375 - Inactive Hazardous Waste Sites.

The focus of this section is not on developing and evaluating future land use improvements for the site, but, rather, to conceptually compare options of certain land characteristics and uses that may be applicable to the alternatives discussed in Chapter 4. The land use characteristics that may both directly or indirectly impact the future use of the site are the following:

- Physical Characteristics
- Institutional Controls
- Public Access and Usage
- Economic Desirability of the Neighborhood and Community
- Revenue Return
- Future Liability

A comparison of each of the above mentioned land characterisitics, as they apply to the alternatives selected for use at the site, are presented in Table 5-1.

TABLE 5-1
Mamaroneck Taylor Lane Leaf Compost Site
Potential Land Use

ALTERNATIVES	PHYSICAL CHARACTERISTICS	INSTITUTIONAL CONTROLS	PUBLIC ACCESS AND USAGE	ECONOMIC DESIRABILITY	REVENUE RETURN/ EXPEDITURES	FUTURE LIABILITY
Alternative 1 NO ACTION	· No changes instituted to contours or physical characteristics of land.	· Continued monitoring of ground water. · Continued surveillance of hazardous waste site. · Continued maintenance of fencing.	· No public access. · Site remains vacant. · Authorized personnel only permitted on-site.	· Neighboring properties detracted by proximity to adjoining hazardous waste site.	· Site would be classified an inactive hazardous waste site, must be maintained over long term; capital & operating expenses to village & community.	· Authorized personnel only on-site. · Future liability from potential dermal contact/ ingestion of fill. · Leachate generated; continued ground water contamination. · Village potentially receive fines for failure to remediate site.
Alternative 2 (2A, 2B, 2C) CAPPING	· Land contours revised to accommodate cap.	· Continued monitoring of ground water. · Site converted to non-hazardous site, with restricted public use.	· Limited public access and usage. · Depending on site improvements, site could be used for park area, playground, tennis, basketball courts, jogging.	· Neighboring properties improved. · Improvement of site by capping. Site improvements such as park lands would create economic desirably for neighbors property and community.	· Limited monitoring costs; may decrease over time. · Site used for recreational facility, could generate income for village; pay for monitoring costs, revenue producing.	· No future liability from public contact with fill material. · Alternatives 2B, 2C comply with ARARs for ground water; leachate contained.
Alternatives 3 & 4 (3A, 3B, 4A, 4B) SITE REMEDIATION	· Land contours modified. · Fill material removed; chemically stabilized. · Alternatives 3A and 3B include replacement with backfill. · Alternatives 4A and 4B; complete replacement of fill with clean fill.	· No institutional controls; above typically applied planning and zoning laws.	· Unlimited public access and usage depending on land improvements. · Land could be sold; used for residential, commercial, or other usages, based on zoning or village ordinances.	· Once remediated, site improvements such as residential & commercial improvements could be made; increased value of neighborhood & community.	· Site approved for construction of residential/commercial buildings, could be sold, resulting in income and long term revenue. · Land could be leased; used by village for income producing improvements.	· Remediation of site complete. · Eliminate potential dermal contact or ingestion. · Protection of ground water.

APPENDIX A
TREATABILITY STUDY

MAMARONECK TAYLOR LANE TREATABILITY STUDY

1.0 Introduction

The Taylor Lane Leaf Compost Site (Site), located in the Village of Mamaroneck in Westchester County, New York, is an eight acre plot that from the 1950's to the early 1970's was a municipal fill. Between July 1987 and 1988, Malcolm Pirnie and the NYSDEC conducted initial field activities at the Site. Based on the results of this initial investigation, the Site was classified by the NYSDEC as a Class 2 hazardous waste site and placed on the New York State Superfund Registry List. On August 14, 1989, the Village entered into an Administrative Order on Consent with the NYSDEC, which directed the Village to perform a four stage remedial program consisting of the following components: Remedial Investigation, Feasibility Study (RI/FS), Remedial Design and Implementation.

Phase I of the remedial program was initiated in April 1990, and the results were compiled by Malcolm Pirnie, Inc. and presented in the "Mamaroneck Taylor Lane Leaf Compost Site Final Remedial Investigation Report (Volume I)", submitted to the NYSDEC in June 1992. As detailed in this report, leachatecontamination was found predominantly in the fill material, which is composed primarily of silt and fine sands, ash, and miscellaneous debris.

Between January and April 1992, Malcolm Pirnie, Inc. conducted additional field activities to provide a more definitive assessment of the nature, depth, and extent of contamination in areas identified as having elevated contamination concentrations during the RI. On April 28, 1992 Malcolm Pirnie and the NYSDEC jointly conducted a pumping test on MW-19 as a supplemental task of the Remedial Investigation (RI). The pumping well, MW-19, is a relatively new well that is screened from two to twelve feet (2'-12') below grade and penetrates the contaminated fill that overlies the Site. Water levels were monitored in the pumping well and various observation wells and piezometers. The pumping test was conducted for 24-hours at a rate of 1 gpm.

Additionally, during the April 1992 pumping test a representative sample of the leachate that was pumped from MW-19 was collected to conduct a treatability study. The data generated during the Treatability Study forms the basis of this report, and will be used to help evaluate treatment alternatives, processes, implementability, and costs for treatment and discharge of the leachate which may be generated from the implementation of various remedial alternatives for the Site.

2.0 Treatability Study Overview

The objective of the treatability study was to determine potential applicability and efficiency of various treatment processes for leachate contaminant removal. Based on the results of the RI and supplemental RI, leachate quality within the fill material has been shown to be somewhat variable. The majority of samples have shown limited contamination; however, certain samples have shown elevated concentrations of the contaminants of concern. Of specific concern was a sample collected in March 1991 from MW-11 which was found to contain elevated levels of metals, semivolatiles, and volatiles.

The supplemental RI pumping test of MW-19 was conducted, in part, to generate a larger sample of leachate from active pumping of a well located in the fill material, which would potentially be more representative of the quality of the leachate to be expected during active remedial measures for the site.

Based on historical leachate quality information from the RI and supplemental RI, the following treatment objectives and associated unit processes were identified as conceptually applicable for Site leachate treatment:

- Oil & grease removal: oil/water separation
- Metals removal: precipitation, settling, filtration
- Volatile Organic Compound, pesticide, and general organic removal: activated carbon adsorption, air stripping, biological treatment

During the treatability study, each treatment process was investigated individually, and evaluated on the basis of implementability, cost, and effectiveness. Conceptual process trains that were initially considered for treating contaminated leachate are presented in Figure 1. These conceptual process trains illustrate the maximum number and type of processes which might be necessary. The level or extent of leachate treatment that will be ultimately necessary will be directly dependent on the quantity and quality of the leachate generated during remedial actions, and the ultimate point of discharge selected for leachate disposal.

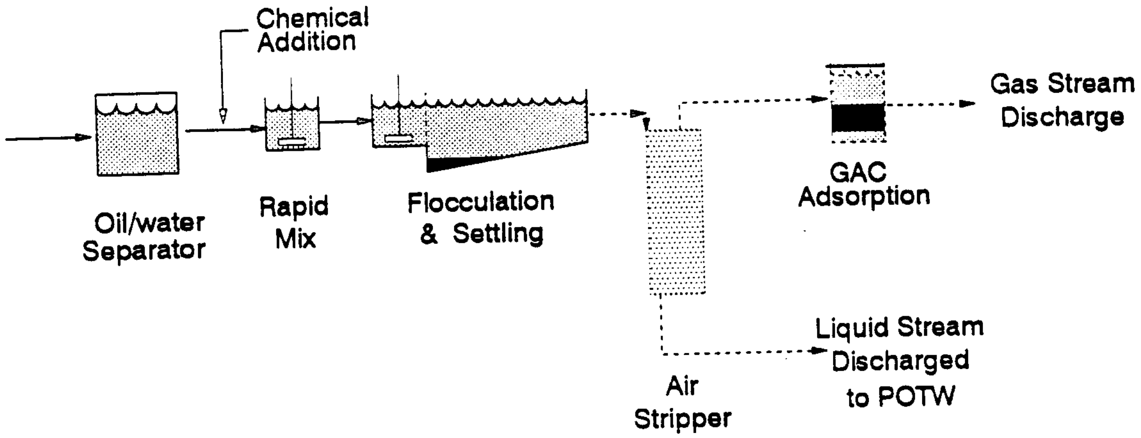
For this site in particular, there are many alternatives for the ultimate disposal point for the leachate, including:

Direct discharge to a POTW, without pretreatment
On-site pretreatment, with discharge to a POTW
On-site treatment and discharge to surface water
On-site treatment and discharge to class GA ground water

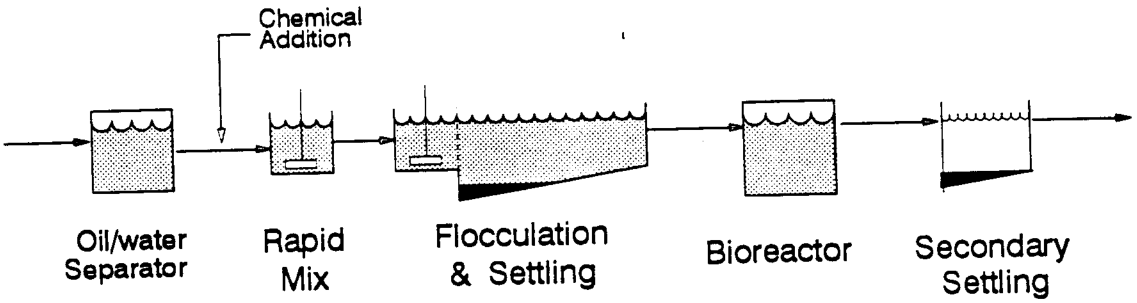
The treatment alternative selected for the leachate must be capable of achieving the applicable discharge standards for these different disposal points, as summarized in Table 1.

In addition, the treatability study necessarily focused on the appropriate processes for treating the quality of leachateactually collected during the pumping test. Based on this leachate characterization data, inappropriate processes were necessarily eliminated from this study.

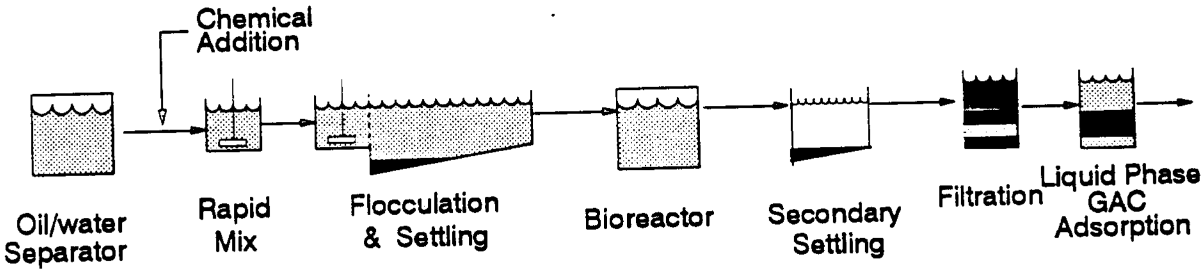
Pretreatment for Discharge to POTW



Discharge to Surface Water



Discharge to Ground Water



MALCOLM PIRNIE

POTENTIAL PROCESS TRAINS FOR CONTAMINATED GROUND WATER TREATMENT
MAMARONECK TAYLOR LANE
MAMARONECK, N.Y.

MALCOLM PIRNIE, INC.

FIGURE 1

TABLE 1
MAMARONECK TAYLOR LANE
GROUND WATER ARARs/SCGs

PARAMETER	Frequency of Detection	Range of Detected Concentrations (ug/L)	GROUNDWATER				POTW	SURFACE WATER CLASS D
			USEPA MCLs (ug/L)	NYCRR GW STDS (ug/L)	NYCRR MCLs (ug/L) [1],[2]	POC	(ug/L)	(ug/L)
VOLATILES								
Acetone	1/5 [5]	7100			50		[3]	
Benzene	2/28	11–19	5	0.7	5	*	[3]	
Bromomethane	1/28	1			5	*	[3]	
Carbon Disulfide	1/5 [5]	10			50		[3]	
Chloroethane	2/28	2			5	*	[3]	
Chloroform	1/28	1	100 [4]	7			[3]	
Chloromethane	1/28	3			5	*	[3]	
1,1-Dichloroethene	1/28	1			5	*	[3]	
1,2-DCE (total)	2/5 [5]	100			50		[3]	
Ethylbenzene	2/28	5–53	700		5	*	[3]	
4-Methyl-2-Pentanone	1/28	280			5		[3]	
Toluene	5/28	1–28,000	1000		5	*	[3]	
1,1,1-TCA	4/28	1–6	200		5		[3]	
Vinyl Chloride	2/5 [5]	95	2	2			[3]	
Xylenes	2/28	10–280	10,000		5	*	[3]	
SEMI-VOLATILES								
Acenaphthylene	1/28	2			50			
Anthracene	1/28	5		50	50		[3]	
Benzo (a) Anthracene	3/28	3 – 10	0.1 (pMCL)		50	x	[3]	
Benzo (b) Fluoranthene	2/28	3 – 9	0.2 (pMCL)		50	x	[3]	
Benzo (k) Fluoranthene	1/28	7	0.2 (pMCL)		50	x	[3]	
Benzo (a) Pyrene	3/28	3 – 11	0.2 (pMCL)		ND	x	[3]	
Benzoic Acid	1/28	2			50		[3]	
Benzo (g,h,i) Perylene	1/28	8			ND		[3]	
Benzyl Alcohol	1/28	28			50		[3]	
Bis (2-Ethylhexyl) Phthalate	13/28	2 – 30		50	50		[3]	
Chrysene	3/28	3 – 11	0.2		50	x	[3]	
Di-n-Butylphthalate	1/28	4			50		[3]	
Dibenzofuran	2/28	5 – 12			50		[3]	
Diethyl Phthalate	1/28	5			50		[3]	
2,6-Dinitrotoluene	1/5 [5]	2			50		[3]	
Fluoranthene	6/28	3 – 23			50		[3]	
Fluorene	4/28	2 – 28			50		[3]	
Indeno (1,2,3-cd) Pyrene	1/28	8	0.4		ND	x	[3]	
2-Methyl Naphthalene	2/28	220 – 400			50		[3]	
4-Methylphenol	1/28	52			50		[3]	5
Naphthalene	3/28	2 – 130			50		[3]	
Phenanthrene	9/28	2 – 57			50		[3]	
Pyrene	6/28	2 – 21			50		[3]	
PESTICIDES/PCBs								
Aldrin	2/28	0.050 – 0.240		ND			[3]	0.001
alpha-BHC	2/28	0.038 – 0.950		ND			[3]	
beta-BHC	2/28	0.073 – 1.10		ND			[3]	
delta-BHC	2/28	0.025 – 0.070		ND			[3]	
alpha-Chlordane	4/28	0.032 – 0.250					[3]	
gamma-Chlordane	2/28	0.073 – 0.086					[3]	
4,4'-DDD	9/28	0.120 – 870		ND			[3]	0.001
4,4'-DDE	1/28	0.710		ND			[3]	0.001
4,4'-DDT	2/28	0.030 – 0.570		ND			[3]	0.001
Dieldrin	2/28	0.075 0.084		ND			[3]	0.001
Endosulfan I	2/28	0.078 – 0.50					[3]	0.22
Heptachlor Epoxide	1/28	0.036	0.2	ND			[3]	0.001
Aroclor 1254	4/28	0.750 – 22.0		0.1			[3]	0.001
INORGANICS								
Aluminum	28/28	177 – 331,000		2000	100 (aquatic)			
Antimony	14/28	40.4 – 175						
Arsenic	21/28	2.5 – 258	50	25			200	
Barium	28/28	19 – 18,900	1000	1000			2000	
Beryllium	18/28	1.0 – 7.9	1(pMCL)	1100 [*]				
Cadmium	20/28	3.1 – 221	5	10			700	
Calcium	28/28	5,220 – 886,000		10				
Chromium	28/28	10.9 – 2,170	50	50			3000	
Cobalt	19/28	15.6 – 388		5 (aquatic)	5 (aquatic)			
Copper	21/28	49.9 – 10,500	1300	200			2800	
Iron	28/28	1,010 – 1,102,000	300(sMCL)	300				300
Lead	24/28	10.5 – 31,300	15	25			400	1045 +
Magnesium	28/28	1,200 – 191,000						
Manganese	28/28	31.1 – 12,100	50(sMCL)	300				
Mercury	22/28	0.21 – 14.3	2	2			200	
Nickel	25/28	15.3 – 2,400	100(pMCL)				2800	4044 +
Potassium	28/28	515 – 203,000						
Selenium	2/28	20 – 5,980	50	10			200	
Silver	13/28	4.7 – 203	50	50			800	213+
Sodium	28/28	3,180 – 78,500		20000				
Thallium	7/28	2.8 – 8.2						20
Vanadium	25/28	6.5 – 4,830						190
Zinc	28/28	18.5 – 78,800	5000(sMCL)	300			1800	2172+

[1] POCs must not exceed 5 ppb; UOCs must not exceed 50ppb
[2] Total POCs and UOCs must not exceed 100 ppb
[3] Total VOC, SVOCs, Pesticides and PCBs must not exceed 2100 ug/L
[4] As Total Trihalomethanes
[5] Compound was only detected in the Supplemental RI

* denotes Principal Organic Contaminant
x denotes carcinogenic PAH
ND = Non Detectable
MCL = Maximum Contaminant Level
pMCL = Proposed Maximum Contaminant Level
sMCL = Secondary Maximum Contaminant Level
\+ = Derived from equation with hardness = 1000 mg/L

Frequency and ranges from Risk Assessment Report
USEPA MCLs from 40 CFR 141
NY Ground water quality criteria from 6NYCRR 703.5
NY MCLs from NY Water Supply Rules section 5-1.51

3.0 Sampling

During the pumping test conducted on April 28, 1992, both discreet and time-weighted composite samples from MW-19 were collected for characterization and subsequent treatability testing.

The duration of the pumping test was 24 hours. Hourly composite samples were taken each hour for the entire pumping test, to be composited later in the lab for treatability testing. Conductivity, pH, temperature, and headspace volatile organic via an HNu photoionization detector (PID) of the leachate were measured in the field prior to collecting each hourly composite sample as a gross indication of contamination spikes (Table 2); however, no significant variability was detected. Additionally, 2-40ml glass vials were filled each hour for volatile organic (VOC) analysis. These vials were temporally composited in the laboratory by the GC/MS analyst immediately prior to analysis.

The twenty-four (24) aliquots were subsequently transported to the Malcolm Pirnie Tarrytown Lab Facility and composited into one treatability sample in a 55-gallon drum. This drum was placed in an overpack that was iced daily for sample preservation, and to reduce the potential for volatilization. A Masterflex pump was used to transfer samples from the drum to appropriate process containers, to minimize loss of VOCs from the sample. Treatability sample aliquots were also flash mixed prior to being transferred to process containers. The treatability sample was handled in this way in an attempt to assure sample homogeneity.

Table 2
MAMARONECK TAYLOR LANE
GROUND WATER SCREENING DATA

SAMPLE DATE	SAMPLE TIME	PARAMETER			
		Conductivity (mv/cm)	pH	Temperature (C)	Headspace HNu Reading (mg/L)
27-Apr-92	12:15	1700	7.0	12.9	3.2
	13:30	1500	6.9	12.3	3.4
	14:00	1500	7.0	13.6	3.6
	15:45	1400	6.7	11.8	3.0
	16:50	1400	6.8	11.7	2.8
	17:45	1400	7.0	11.4	3.4
	18:45	1300	6.8	10.8	2.2 *
	19:45	1300	6.8	9.6	0.2 *
	20:45	1300	6.8	9.9	0 *
	21:45	1300	6.7	9.7	NA
	22:45	1300	6.8	9.7	NA
	23:45	1300	6.8	9.7	NA
28-Apr-92	00:45	1300	6.7	9.2	NA
	01:45	1300	6.8	9.1	NA
	02:45	1300	6.8	9.5	NA
	03:45	1300	6.8	9.7	NA
	04:45	1300	6.8	9.5	NA
	05:45	1300	6.8	9.5	NA
	06:45	1300	6.8	9.6	NA
	07:45	1300	6.9	9.9	NA
	08:45	1300	7.0	9.9	NA
	09:45	800	7.2	13.1	NA

Notes: * – Indicates that the field personnel noted that HNu was giving erratic readings possibly due to moisture.

NA – Not measured

4.0 Characterization

To provide baseline data on the characteristics of the raw water and to select appropriate treatment processes to be evaluated during the treatability study, the composite leachate sample was analyzed for the following parameters, utilizing the listed analytical methods:

PARAMETER	METHOD
GENERAL PARAMETERS	
pH	EPA 150.1
Temperature	NA
Conductivity	EPA 120.1
HNu Readings of Headspace	NA
Biochemical Oxygen Demand (BOD_5)	EPA 405.1
Chemical Oxygen Demand (COD)	EPA 410.3
Total Organic Carbon (TOC)	EPA 415.1
Total Suspended Solids (TSS)	EPA 160.2
Total Dissolved Solids (TDS)	EPA 160.1
Alkalinity	EPA 310.1
Hardness	EPA 6010
Ammonia-Nitrogen	EPA 350.1
Sulfate	EPA 375.4
Phenolics	EPA 420.2
Odor	EPA 140.1
Color	EPA 110.2
Surfactants (MBAS)	EPA 425.1
SPECIFIC PARAMETERS	
Volatile Organic (VOCs)	EPA 624
SemiVolatile Organic	EPA 625
Pesticides/PCBs	EPA 608
Metals	ICP 200

The characterization profile of the pumped leachate that was used for the treatability study is provided in Table 3, and is discussed below.

General Parameters - pH, temperature, conductivity, and HNu values reported on Table 3 are the range and calculated average of the individual hourly samples taken in the field prior to being temporally composited at the lab. After the individual hourly samples were composited, on April 28, a sample was taken directly from the 55-gallon drum containing the composite sample and analyzed for the other parameters listed in Table 3.

General Organics - Total organic carbon (TOC), biochemical oxygen demand (BOD_5), and chemical oxygen demand (COD) measurements were all taken to assess the level and relative degradability of the general organic contamination present in the leachate in the overlying fill material. TOC is a measure of the total organic carbon present in the sample. The BOD_5 test measures the amount of oxygen consumed during the microbially-induced oxidation (degradation) of the biodegradable portion of the organic carbon present in the contaminated leachate . Alternatively, the COD test measures the total amount of oxygen that would be consumed if all material in the leachate were oxidized using a strong oxidant; reduced substances such as sulfides, sulfites, and ferrous iron will be oxidized and reported as COD. When evaluated together, TOC, BOD_5 and COD measurements give an indication of the total amount of general organic contamination, and its associated biodegradability.

Comparison of the BOD_5 and COD measurements for the leachate obtained during the pumping test indicates that less than 33% of the measured oxygen demand is exerted in the BOD_5 test, which indicates the contaminated leachate does not contain as much degradable material as domestic wastewater. In addition, the measured value of approximately 50 mg/l for the BOD_5 test indicates that the leachate in the fill is approximately 1/4 as strong as domestic wastewater. However, there were no signs of inhibition in the BOD^5 test.

Total Suspended and Dissolved Solids - TSS and TDS measurements indicate that there is a moderate level of both suspended and dissolved solids in the treatability study sample, and that the solids content of the leachate is predominantly dissolved.

Metals - Both total and soluble metals concentrations were evaluated for the pumped leachate , to give an indication of both the total amount of metals present, and the amount of the metals contamination which could be attributed to the solids present in the leachate . Generally, concentrations of detected metals in the leachate were very low, with the exception of iron, magnesium, manganese, potassium, and sodium. Total vs. soluble metals measurements indicate that majority of the iron is in the particulate form; this iron represents approximately 50% of the total suspended solids measured. It is likely that the iron is also responsible for a portion of the COD measured. The alkali metals concentrations (magnesium, potassium, and sodium) measured are typical of certain leachate s, and are virtually all in dissolved form. Based on the analytical data indicating low concentrations of heavy metals present in the leachate sample, metals removal process testing for this sample of leachate was not conducted.

Volatile Organics - VOCs were detected in the treatability sample from MW-19 at significantly lower levels than had been previously measured, with the exception of acetone. Seven volatile organic compounds were detected in this sample of leachate ; however, acetone was the only VOC detected at a level of concern. This was also evident in the levels of contamination measured in MW-11 (March 1991) and MW-19 (February 1992). These findings, when viewed in conjunction with the body of volatile organic data taken over the course of the RI, indicate that the leachate is not homogeneously contaminated. Given the observed variability in the composition of the fill overlying the Site, the variability in the levels of contamination measured in the leachate at different locations on the Site is not surprising. However, since these volatile organic measurements were obtained from a well which is believed to be in one of the worst areas of contamination, the low levels measured are encouraging indications of what might be attained during any long term pumping.

Semi-Volatile Organics - Five semi-volatile organics were detected at levels below the specified detection limits; therefore, approximate concentrations are reported in Table 3.

Pesticides/PCBs - Low levels of alpha, beta, and gamma-BHC were detected in the leachate sample. No measurable levels of PCBs were detected.

Table 3
MAMARONECK TAYLOR LANE CHARACTERIZATION DATA

GENERAL PARAMETERS	RESULTS		
	Range	Average	Units
pH	6.7 – 7.2	6.9	standard units
Temperature	9.1 – 13.6	10.6	(C)
Conductivity	800 – 1700	1310	(mv/cm)
HNu Headspace Readings	2.8 – 3.6	3.2	ppm
BOD5	51.3		mg/L
COD	177		mg/L
TOC	275		mg/L
TSS	55		mg/L
TDS	1028		mg/L
Alkalinity	770		mg/L CaCO3
Hardness	511		mg/L CaCO3
NH3–N	9.26		mg/L
Sulfate	82.3		mg/L
Phenolics, recoverable	0.02		mg/L
Odor	20		TON
Color	175		Units
Surfactants, methylene blue	0.209		mg/L

Table 3 (cont)
MAMARONECK TAYLOR LANE
CHARACTERIZATION DATA

ANALYSIS	RESULTS	
VOLATILES	COMPOUND	COMPOSITE GROUND WATER CONCENTRATION (ug/L)
	CHLOROMETHANE	<5.00
	VINYL CHLORIDE	<5.00
	BROMOMETHANE	<5.00
	CHLOROETHANE	<5.00
	TRICHLOROFLUOROMETHANE	<5.00
	1,1-DICHLOROETHENE	<5.00
	ACROLEIN	<5.00
	METHYLENE CHLORIDE	3.18J
	ACRYLONITRILE	<5.00
	1,2-DICHLOROETHENE	<5.00
	1,1-DICHLOROETHANE	<5.00
	TRANS-1,2-DICHLOROETHENE	<5.00
	CHLOROFORM	<5.00
	1,1,1-TRICHLOROETHANE	<5.00
	CARBON TETRACHLORIDE	<5.00
	BENZENE	2.19
	1,2-DICHLOROETHANE	<5.00
	TRICHLOROETHENE	<10.00
	1,2-DICHLOROPROPANE	<5.00
	CIS-1,3-DICHLOROPROPANE	<5.00
	BROMODICHLOROMETHANE	<5.00
	2-CHLOROETHYLVINYL ETHER	<5.00
	TRANS-1,3-DICHLOROPROPENE	<5.00
	TOLUENE	1.93J
	1,1,2-TRICHLOROETHANE	<5.00
	TETRACHLOROETHENE	<5.00
	DIBROMOCHLOROMETHANE	<5.00
	CHLOROBENZENE	<5.00
	ETHYL BENZENE	<5.00
	m,p-XYLENE	1.88J
	o- XYLENE	<5.00
	BROMOFORM	<5.00
	1,1,2,2-TETRACHLOROETHANE	<5.00
	CARBON DISULFIDE	<5.00
	2-BUTANONE	<10.00
	VINYL/ACETATE	<5.00
	2-HEXANONE	<5.00
	4-METHYL-2-PENTANONE	9.66
	STYRENE	<5.00
	DICHLORODIFLUOROMETHANE	<5.00
	METHYL-TERT BUTYL ETHER	<5.00
	1,2,4-TRIMETHYLBENZENE	46.78
	1,3-DICHLOROBENZENE	<5.00
	1,4-DICHLOROBENZENE	<5.00
	1,2-DICHLOROBENZENE	<5.00
	ACETONE	1802

NOTES:

J = Mass spectral data indicates the presence of a compound that meets the identification criteria. The result is less than the specified detection limit but greater than zero. The concentration given is an approximate value.

Table 3 (cont)
MAMARONECK TAYLOR LANE
CHARACTERIZATION DATA

ANALYSIS	RESULTS		
		COMPOSITE GROUND WATER CONCENTRATION (mg/L)	
METALS	METAL	TOTAL	SOLUBLE
	ALUMINUM	<0.1	<0.1
	ANTIMONY	<0.06	<0.06
	ARSENIC *	<0.01	<0.01
	BARIUM	0.291	0.182
	BERYLLIUM	<0.003	<0.003
	CADMIUM	<0.003	<0.003
	CHROMIUM	<0.01	<0.01
	COBALT	<0.02	<0.02
	COPPER	<0.01	<0.01
	IRON	22.2	0.073
	LEAD	<0.1	<0.1
	MAGNESIUM	45.0	46.3
	MANGANESE	0.286	0.281
	MERCURY *	<0.0005	<0.0005
	NICKEL	0.02	0.02
	POTASSIUM	39.0	39.6
	SELENIUM	<0.01	<0.01
	SILVER	<0.01	<0.01
	SODIUM	46.6	50.4
	THALLIUM	<0.01	0.0203
	VANADIUM	<0.02	<0.02
	ZINC	0.063	0.030

NOTES: Meters were analyzed via ICAP unless indicated otherwise.
* – Indicates analyzed via furnace.

Table 3 (cont)
MAMARONECK TAYLOR LANE CHARACTERIZATION DATA

ANALYSIS	RESULTS	
SEMIVOLATILES	COMPOUND	COMPOSITE GROUND WATER CONCENTRATION (ug/L)
	ACENAPTHENE	<10.8
	ACENAPTHYLENE	<10.8
	ANTHRACENE	<10.8
	BENZO(a)ANTHRACENE	<10.8
	BENZO(b)FLUORANTHENE	<10.8
	BENZO(k)FLUORANTHENE	<10.8
	BENZO(a)PYRENE	<10.8
	BENZO(g,h,i)PERYLENE	<10.8
	BUTYLBENZYLPHTHALATE	<10.8
	bis(2-Chloroethyl) ETHER	<10.8
	bis(2-Chloroisopropyl) ETHER	<10.8
	bis(2-ETYLHEXYL)PHTHALATE	3.37J
	4-BROMOPHENYL-PHENYLETHER	<10.8
	2-CHLORONAPHTHALENE	<10.8
	4-CHLOROPHENYL-PHENYLETHER	<10.8
	CHRYSENE	<10.8
	DIBENZO(a,h)ANTHRACENE	<10.8
	DI-n-BUTYLPHTHALATE	<10.8
	1,2-DICHLOROBENZENE	<10.8
	1,3-DICHLOROBENZENE	<10.8
	1,4-DICHLOROBENZENE	<10.8
	3,3'DICHLOROBENZIDINE	<10.8
	DIETHYLPHTHALATE	<10.8
	DIMETHYLPHTHALATE	<10.8
	2,4-DINITROTOLUENE	<10.8
	2,6-DINITROTOLUENE	<10.8
	DI-N-OCTYLPHTHALATE	<10.8
	FLUORANTHENE	<10.8
	FLUORENE	<10.8
	HEXACHLOROBENZENE	<10.8
	HEXACHLOROBUTADIENE	<10.8
	HEXACHLOROETHANE	<10.8
	INDENO(1,2,3-cd)PYRENE	<10.8
	ISOPHORONE	<10.8
	NAPHTHALENE	1.23J
	NITROBENZENE	<10.8
	N-NITROSO-di-n-PROPYLAMINE	<10.8
	PHENANTHRENE	<10.8
	PYRENE	<10.8
	1,2,4-TRICHLOROBENZENE	<10.8
	4-CHLORO-3-METHYLPHENOL	<10.8
	2-CHLOROPHENOL	<10.8
	2,4-DIMETHYLPHENOL	<10.8
	2,4-DINITROPHENOL	<27.0
	4,6-DINITRO-2-METHYLPHENOL	<27.0
	2-NITROPHENOL	<10.8
	4-NITROPHENOL	<27.0
	PENTACHLOROPHENOL	<27.0
	PHENOL	<10.8
	2,4,6-TRICHLOROPHENOL	<10.8
	2,4,5-TRICHLOROPHENOL	<27.0
	BENZYL ALCOHOL	<10.8
	2-METHYLPHENOL	<10.8
	4-METHYLPHENOL	5.10J
	BENZOIC ACID	1.39J
	BIS(2-Chloroethoxy)METHANE	<10.8
	2,4-DICHLOROPHENOL	<10.8
	2-METHYLNAPHTHALENE	<10.8
	4-CHLOROANILINE	<10.8
	HEXACHLOROCYLCLOPENTADIENE	<10.8
	2-NITROANAILINE	<27.0
	3-NITROANAILINE	<27.0
	DIBENZOFURAN	<10.8
	4-NITROANAILINE	<27.0
	N-NITROSODIPHENYLAMINE	1.85J
	ANAILINE	<10.8
	PYRIDINE	<10.8
	AZOBENZENE	<10.8

NOTES:

J - Mass spectral data indicates the presence of a compound that meets the identification criteria. The result is less than the specified detection limit but greater than zero. The concentration given is an approximate value.

Table 3 (cont)
MAMARONECK TAYLOR LANE CHARACTERIZATION DATA

ANALYSIS	RESULTS	
	COMPOUND	COMPOSITE GROUND WATER CONCENTRATION (ug/L)
PESTICIDES and PCBs	ALPHA-BHC	0.306
	BETA-BHC	0.433
	DELTA-BHC	0.149
	GAMMA-BHC	<0.053
	HEPTACHLOR	<0.053
	ALDRIN	<0.053
	HEPTACHLOR EPOXIDE	<0.053
	ENDOSULFAN	<0.053
	DIELDRIN	<0.105
	4,4'-DDE	<0.105
	ENDRIN	<0.105
	ENDOSULFAN II	<0.105
	4,4'-DDD	<0.105
	ENDOSULFAN SULFATE	<0.105
	4,4'-DDT	<0.105
	METHOXYCHLOR	<0.526
	CHLORDANE	<0.053
	TOXAPHENE	<5.26
	AROCLOR-1016	<1.05
	AROCLOR-1221	<2.11
	AROCLOR-1232	<0.105
	AROCLOR-1242	<0.105
	AROCLOR-1248	<0.105
	AROCLOR-1254	<0.105
	AROCLOR-1260	<0.105
	ENDRIN ALDEHYDE	<0.105

Table 3 (cont)
MAMARONECK TAYLOR LANE CHARACTERIZATION DATA

ANALYSIS	RESULTS	
	COMPOUND	COMPOSITE GROUND WATER CONCENTRATION (ug/L)
TRIP BLANK VOLATILES	CHLOROMETHANE	<10.00
	VINYL CHLORIDE	<5.00
	BROMOMETHANE	<5.00
	CHLOROETHANE	<5.00
	TRICHLOROFLUOROMETHANE	<5.00
	1,1-DICHLOROETHENE	<5.00
	ACROLEIN	<5.00
	METHYLENE CHLORIDE	<5.00
	ACRYLONITRILE	<5.00
	1,2-DICHLOROETHENE	<5.00
	1,1-DICHLOROETHANE	<5.00
	TRANS-1,2-DICHLOROETHENE	<5.00
	CHLOROFORM	<5.00
	1,1,1-TRICHLOROETHANE	<5.00
	CARBON TETRACHLORIDE	<5.00
	BENZENE	<5.00
	1,2-DICHLOROETHANE	<5.00
	TRICHLOROETHENE	<10.00
	1,2-DICHLOROPROPANE	<5.00
	CIS-1,3-DICHLOROPROPANE	<5.00
	BROMODICHLOROMETHANE	<5.00
	2-CHLOROETHYLVINYL ETHER	<5.00
	TRANS-1,3-DICHLOROPROPENE	<5.00
	TOLUENE	<5.00
	1,1,2-TRICHLOROETHANE	<5.00
	TETRACHLOROETHENE	<5.00
	DIBROMOCHLOROMETHANE	<5.00
	CHLOROBENZENE	<5.00
	ETHYL BENZENE	<5.00
	m,p-XYLENE	<5.00
	o- XYLENE	<5.00
	BROMOFORM	<5.00
	1,1,2,2-TETRACHLOROETHANE	<5.00
	CARBON DISULFIDE	<5.00
	2-BUTANONE	<10.00
	VINYL/ACETATE	<5.00
	2-HEXANONE	<5.00
	4-METHYL-2-PENTANONE	<5.00
	STYRENE	2.8J
	DICHLORODIFLUOROMETHANE	<5.00
	METHYL-TERT BUTYL ETHER	<5.00
	1,2,4-TRIMETHYLBENZENE	<10.00
	1,3-DICHLOROBENZENE	<5.00
	1,4-DICHLOROBENZENE	<5.00
	1,2-DICHLOROBENZENE	<5.00
	ACETONE	<10.00

NOTES:

J = Mass spectral data indicates the presence of a compound that meets the identification criteria. The result is less than the specified detection limit but greater than zero. The concentration given is an approximate value.

5.0 Unit Treatment Processes - Methodologies, Results, and Discussion

Oil/Water Separation

A preliminary evaluation of the level of oil/water separation that could be achieved was made by allowing a 2 liter beaker of the leachate to stand undisturbed. Visual observations of this sample were made after 20, 40, 60 minutes, and 24 hours. No oil layer was visually apparent after 20, 40, and 60 minutes; however, after 24 hours a sheen and clear film was observed at the surface of the sample.

Since oil and grease was not visually apparent, BTEX (benzene, toluene, ethylbenzene, and xylene) was used as a surrogate parameter. The BTEX concentration detected in the raw leachate sample was 6.0 ug/l.

Air Stripping

Since VOCs were detected in the leachate (Table 3), a bench-scale air stripping experiment was conducted to evaluate removal efficiencies. Approximately 25% of the VOCs measured in the characterization sample (Table 3) volatilized during handling and compositing; therefore, another treatability sample was collected and analyzed for VOCs immediately prior to air stripping investigations (Table 4, raw).

The efficiency of transfer of contaminants from the liquid to air depends on the mass transfer coefficient and the Henry's law constant. A high Henry's law constant indicates a very strippable compound; toluene, xylene, and benzene are strippable contaminants.

During this treatability study, an aeration tank type air stripping process was evaluated. A constant volume (Q = ft^3 water) of sample was injected with incremented air volumes (V = ft^3 air); therefore, the G/Q was a ratio of volumes rather than flow rates. In this way variable loading rates (G/Q) could be evaluated as presented in Table 2.

A 2 liter sample was injected with diffused air via a fine pore stone diffuser located at the bottom of a 3 liter glass container. A rotameter was used to maintain a constant air flow rate of 500 cc/min and the G/Q was a function of increased air injection times. 40 mL of stripped sample were removed from the stripping basin every 30 minutes and were analyzed for VOCs. The initial VOC concentration in the stripping basin prior to injection of air was also analyzed for VOCs and is labelled RAW on Table 4.

Air stripping data are provided in Table 4. At an operating G/Q of 62.5, 2-Hexanone, 4-methyl-2-Pentanone, and 1,2,4-Tri-methylbenzene were stripped. Acetone was detected in the initial sample at a concentration of 1998 ug/L. A 55% removal efficiency of acetone (Table 5) was achieved at the standard operating G/Q of 62.5.

As previously discussed, the treatability sample contained lower VOC levels than had been historically measured in the leachate at other locations on the Site. In fact, levels are very

Table 4
MAMARONECK TAYLOR LANE
AIR STRIPPING RESULTS

PARAMETER	G/Q Ratio									
	RAW	7.50	15	22.5	30	37.5	45	52.5	57.5	62.5
Benzene, µg/l	1.63 J	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	< 50.0	< 50.0	< 50.0	< 10.0
Methylene chloride, µg/l	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	12.97 B , J	13.52 B , J	12.07 B , J	5.18 J
Toluene, µg/l	< 10.0	7.39 J	8.26 J	8.50 J	8.05 J	9.47 J	< 50.0	8.61 J	< 50.0	7.83 J
Acetone, µg/l	1998	1907	1593	1596	1093	1018	1104	1224	1160	900
2-Butanone, µg/l	6.56 J	7.51 J	< 10.0	< 10.0	< 10.0	< 10.0	< 50.0	< 50.0	< 50.0	< 10.0
2- Hexanone, µg/l	94.49	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	< 50.0	< 50.0	< 50.0	< 10.0
4-Methyl-2-Pentanone, µg/l	8.96	8.43 J	5.39 J	2.70 J	2.40 J	2.19 J	< 50.0	< 50.0	< 50.0	< 10.0
M,P-Xylene, µg/l	1.42 J	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	< 50.0	< 50.0	< 50.0	< 10.0
O-Xylene, µg/l	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	1.88 J	< 50.0	< 50.0	< 50.0	< 10.0
Methyl-Tert Butyl Ether, µg/l	3.94 J	2.52 J	1.59 J	1.04 J	< 10.0	< 10.0	< 50.0	< 50.0	< 50.0	< 10.0
1,2,4-Trimethylbenzene, µg/l	33.37	6.08 J	1.77 J	< 10.0	< 10.0	4.06 J	< 50.0	< 50.0	< 50.0	< 10.0

J - Indicates an Estimated Value.

B - Analyte found in Blank as well as Sample.

TABLE 5

MAMARONECK TAYLOR LANE
CALCULATED REMOVAL EFFICIENCIES

PARAMETERS	REMOVAL EFFICIENCY (G/Q = 62.5)
Benzene	100%
Methylene Chloride	-
Toluene	-
Acetone	55%
2-Butanone	100%
2-Hexanone	100%
4-Methyl-2-Pentanone	100%
M,P-Xylene	100%
O-Xylene	100%
Methyl-Tert Butyl Ether	100%
1,2,4-Trimethylbenzene	100%

Notes:

-	Indicates an estimated value for parameter was reported in the stripped sample; however, this parameter was not detected in the raw ground water sample.

low, with most only slightly above detection limits. As a result, the concentration of many of the volatiles present in the treatability sample have been reported as estimated values (Table 4) indicating that their concentration was below the minimum detection limit.

Sand Filtration

Sand filtration of the sample was performed with a 1-liter downflow filter mechanism. The target hydraulic loading rate used for filtration was 4 gpm/ft2 (418 ml/min). A Masterflex pump was used to pump the sample through the filter. One background sample was taken prior to treatment of the raw sample to determine any possible contaminants in the filter mechanism or sand. This was done by pumping analyte-free water through the filter. In addition to the treated and background samples, a raw sample was submitted for analysis as a control. Running the filter on the sample showed no plugging or decrease in flow rate during operation. All samples were analyzed for pesticides.

Activated Carbon Adsorption

To determine the effectiveness and estimate the cost for using activated carbon for removal of pesticides and organic, jar tests were conducted. Six 1 liter samples of the leachate were dosed with 0, 1, 3, 6, 10, and 15 g/L PAC (powder activated carbon) as indicated in Table 6.

TABLE 6

MAMARONECK TAYLOR LANE
PAC JAR TEST EXPERIMENTAL DESIGN

Beaker No.	Leachate Volume (ml)	PAC Weight (g)
1	1,000	0
2	1,000	1
3	1,000	3
4	1,000	6
5	1,000	10
6	1,000	15

After 15 minutes of mixing at 150 rpm with a Phipp's Bird Stirring Apparatus, the contents of each beaker were allowed to settle for 5 minutes and filtered. All samples , except for beaker No. 4, were analyzed for TOC and COD. Beaker No. 4 was not analyzed for TOC and COD due to laboratory loss of sample; however, beaker No. 4 was analyzed for pesticides and VOCs.

The removal efficiency for activated carbon is affected by many factors and is different for each water source; therefore, site-specific isotherm data using the actual water source were conducted to assess activated carbon treatment efficiency. Isotherm data for the Mamaroneck leachate were generated and used to estimate activated carbon adsorption capacities and organic removal efficiency based on the isotherm parameters. High levels of organic constituents were measured in the influent to this process (Table 3) thereby introducing significant competitive adsorption.

Carbon isotherm data are shown in Table 7. COD and TOC data were used to estimate the Freundlich isotherm parameters k and 1/n, which represent the best fit of the jar test data to the Freundlich isotherm adsorption model. This Fruendlich isotherm may then be used to determine the PAC usage rate that is capable of removing specific pesticides thereby achieving a desired effluent pesticide concentration. The TOC and COD data were used to generate the Freundlich isotherm.

The PAC adsorption estimate using the Freundlich isotherm is presented in Table 8. The estimated PAC partition coefficients (1/n) corresponding to the slope of the COD and TOC isotherms are 3.4 and 1.6; the respective y-intercept values (k) are 3.0 E -4 ug COD/mg PAC and 8.0 ug TOC/mg PAC. As previously stated the Freundlich isotherm may be used to evaluate the adsorption data such that estimated regression coefficients may be used to predict the desired PAC dosage capable of obtaining a targeted removal. However, the r squared values, which indicate the degree of scatter exhibited by the data, for these two regression analyses are 0.68 and 0.74. Therefore, the validity of these correlations are limited.

Pesticide levels detected in the treatability sample (Table 3 and Table 7-Beaker 1) were below NY MCLs; however, if the remedy for this site requires achieving the leachate NYCRR GW Standards, pesticide removal to levels below the appropriate analytical quantification limits will be requisite. The leachate used in the treatability carbon adsorption jar test was not pre-treated to remove the bulk of the organic; therefore, the COD and TOC competes with the pesticides and higher doses of carbon is required to remove the pesticides. Pesticide data for the 6g/L PAC dosed sample indicated that this PAC dosage was capable of removing the pesticides, as well as the less strippable volatile organic (Table 4). Consequently, if carbon adsorption is implemented in a full-scale pesticide remedy, it is likely that GAC (granular activated carbon) will be a polishing step subsequent to bulk removal of organic. Isotherm parameters indicated above may be used in the FS process investigations to aid in the design of a carbon adsorption process.

Table 7
MAMAROCNECK TAYLOR LANE
ISOTHERM DATA

	PAC Concentrations					
PARAMETERS	**CONTROL**	**1 g/l**	**3 g/l**	**6 g/l**	**10 g/l**	**15 g/l**
VOA's						
Methylene Chloride, (μg/l)	2.04 J	NA	NA	2.02 J	NA	NA
Acetone, (μg/l)	1216	NA	NA	470	NA	NA
Toluene, (μg/l)	1.17 J	NA	NA	< 10.0	NA	NA
Methyl-Tert Butyl Ether (μg/l)	2.36 J	NA	NA	< 10.0	NA	NA
1,2,4-Trimethylbenzene (μg/l)	11.40	NA	NA	< 10.0	NA	NA
PESTICIDES						
alpha-BHC, (μg/l)	0.140	NA	NA	< 0.081	NA	NA
beta-BHC, (μg/l)	0.111	NA	NA	< 0.081	NA	NA
delta-BHC, (μg/l)	0.192	NA	NA	< 0.081	NA	NA
gamma-BHC (Lindane) (μg/l)	0.102	NA	NA	< 0.081	NA	NA
Dieldrin, (μg/l)	0.0679	NA	NA	< 0.161	NA	NA
OTHER PARAMETERS						
COD, (mg/l)	197	52.2	30.08	NA	27.8	30.8
TOC, (mg/l)	275	9.5	2.8	NA	3.2	2.1

J - Indicates an Estimated Value.
B - Analyte found in Blank as well as Sample.

Table 8
Mamaroneck Taylor Lane
PAC Adsorption Estimate
Freundlich Isotherm

Ci		PAC	Ce		log Ce		Qe		log Qe	
COD (mg/L)	TOC (mg/L)	Dosage (mg/L)	COD (mg/L)	TOC (mg/L)	COD	TOC	COD	TOC	COD	TOC
197	275	1000	52.2	9.5	1.7	1.0	0.1448	0.2655	−0.8	−0.6
197	275	3000	30.8	2.8	1.5	0.4	0.0554	0.090733	−1.3	−1.0
197	275	10000	27.8	3.2	1.4	0.5	0.01692	0.02718	−1.8	−1.6
197	275	15000	30.8	2.1	1.5	0.3	0.01108	0.018193	−2.0	−1.7

Biological Treatment (Sequencing Batch Reactor - SBR)

Biological treatment experimentation was conducted to assess the biodegradability of the general organic contamination present in the leachate. In addition, for scenarios where the leachate would be discharged to a POTW, these tests give an indication of whether or not the leachate discharge would present an adverse impact on the biological processes employed in a POTW system. A sequencing batch reactor (SBR) was operated to assess the toxicity and treatability of the compounds present in the leachate. The SBR process was designed to include four operating cycles as indicated in Table 9.

TABLE 9

MAMARONECK TAYLOR LANE
SBR CYCLE SCHEDULE

Cycle	Time (minutes)	Operating Conditions
Feed/React	0 - 30	System is being fed @ 30 mr/min with Mamaroneck leachate
Aeration/React	30 - 180	System is aerated
Settling	180 - 210	SBR air is turned off and solids are allowed to settle
Decant	210 - 240	Supernatant is decanted @ 60 ml/min

Two bench-scale SBR's were set-up on May 11, 1992. Reactor 1 contained activated sludge from the Stamford, CT wastewater treatment plant (WWTP) (MLSS = 2500 - 3000 mg/L) to assess the biological treatability of the leachate. Reactor 2 contained activated sludge from the Stamford WWTP that was instantaneously dosed with 1,000 mg/L PAC at startup. The purpose of setting up this second SBR was to evaluate whether the PAC adsorption process could be operated in conjunction with the biological treatment process, and whether or not the addition of PAC to the activated sludge process would enhance the performance. The PAC has several potential process advantages, such as removal of nondegradable organic and improvement of sludge settleability.

A limited startup and acclimation phase (5/11 - 5/13/92) was conducted to establish reactor operating cycles as presented in Table 9. During this startup phase the influent to the reactors was Stamford, CT primary clarifier effluent (COD = 320 mg/L).

On May 13, 1992 the primary clarifier effluent feed to the SBRs was replaced with the Mamaroneck leachate. The reactors were run continuously through May 19, 1992. Reactor operation was assessed by monitoring the following parameters daily:

- Influent COD_{total}
- Influent $COD_{soluble}$
- MLSS
- Reactor dissolved oxygen (DO)
- Reactor temperature
- Reactor pH
- Effluent COD_{total}
- Effluent $COD_{soluble}$

The dissolved oxygen uptake rates of the biomass were measured daily and were used as an indication of reactor viability and inhibition due to influent contaminated leachate. The target SBR operating conditions were:

- HRT = 3 hours
- F/M = 0.3

The biomass DO uptake rates are presented in Figures 2, 3, and 4. The decreasing DO uptake rates indicate a reduction in biomass viability over the course of the reactor operation. This was likely due to the relatively weak feed strength of the leachate. No significant toxicity of the leachate to the activated sludge biomass was observed. However, over the course of reactor operation, the COD of the influent to the bioreactor decreased markedly. This was likely attributable to either oxidation or degradation of the influent leachate during storage. This weakening of the feed to the reactor exacerbated operational difficulties with maintaining a viable, active biomass.

Table 10 summarizes the SBR data. Reactor operating parameters (MLSS, F/M) are presented, as well as influent and effluent total and soluble COD concentrations; these are also illustrated on Figures 5 and 6. On May 18, effluent soluble COD values in both reactors reached the levels of the influent even though oxygen uptake rates indicated removals of organics were occurring. When we evaluate the oxygen uptake rates, it appears that only 15 to 20 mg/L of BOD_5 and COD were being removed by the biological treatment system. Hence, the systems appeared to have reached a steady state by May 18.

The influent to the SBR process was the contaminated leachate which was a low level energy or food source and had a relatively low degradability. Additionally, the pumping test data indicate that the fill pumping rate is not likely to be sustainable above a rate of 1 GPM. Consequently, this flow rate and levels of organics present in the contaminated leachate may not be sufficient to support a viable biological system.

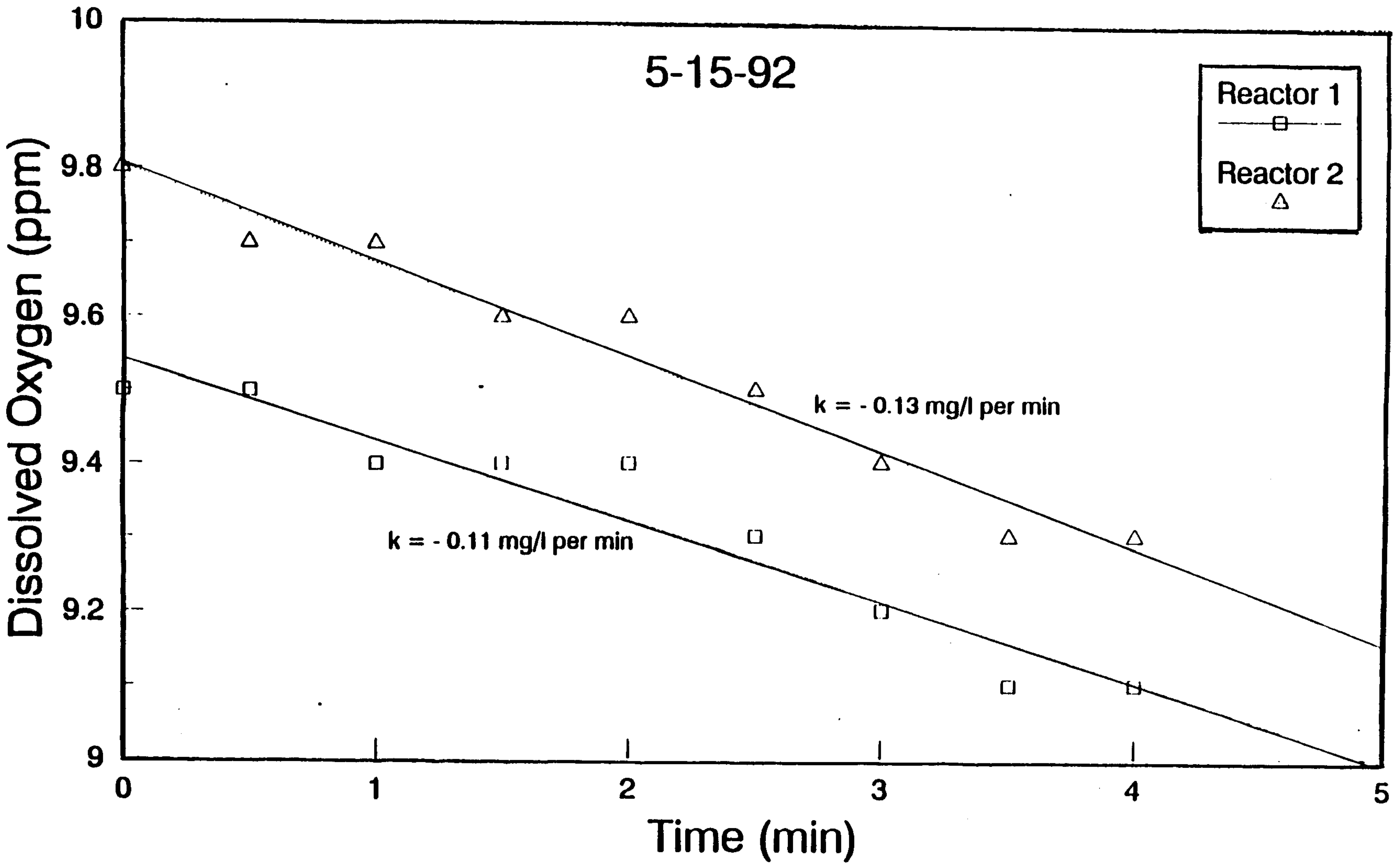
TABLE 10
MAMAROCNECK TAYLOR LANE
BIOREACTOR DATA

REACTOR 1

DATE	PARAMETERS								
	INFLUENT		MLSS	F/M	D.O.	pH	TEMPERATURE	EFFLUENT	
	Total COD (mg/L)	Sol COD (mg/L)	(mg/L)	Sol Inf COD/MLSS	(mg/L)		(C)	Total COD (mg/L)	Sol COD (mg/L)
13-May-92	420	249	640	0.39	6.8	6.6	23	223	120
14-May-92	336	188	650	0.29	7.6	8.0	18	201	146
15-May-92	197	123	550	0.22	8.5	8.3	20	175	75
18-May-92	213	204	620	0.33	7.5	8.2	23	204	204

REACTOR 2

DATE	PARAMETERS								
	INFLUENT		MLSS	F/M	D.O.	pH	TEMPERATURE	EFFLUENT	
	Total COD (mg/L)	Sol COD (mg/L)	(mg/L)	Sol Inf COD/MLSS	(mg/L)		(C)	Total COD (mg/L)	Sol COD (mg/L)
13-May-92	420	249	940	0.26	6.3	7.1	23	165	114
14-May-92	336	188	870	0.22	7.6	8.2	17.5	181	162
15-May-92	197	123	820	.15	8.2	8.3	20	143	101
18-May-92	213	204	1360	0.15	7.7	8.4	22	230	242



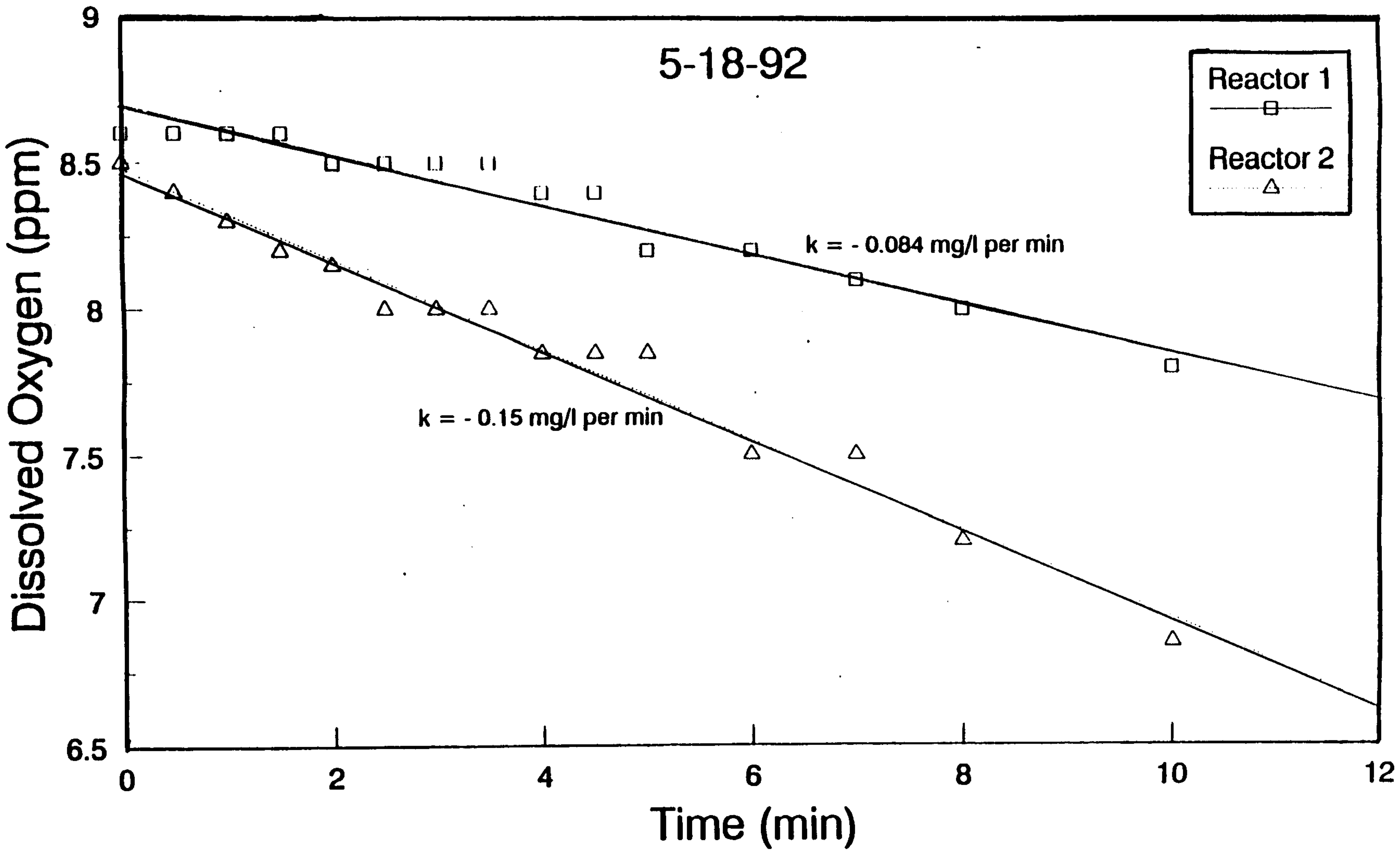
MALCOLM PIRNIE

D.O. UPTAKE - BIOLOGICAL REACTORS # 1 & 2

MAMARONECK TAYLOR LANE
MAMARONECK, N.Y.

MALCOLM PIRNIE, INC.

FIGURE 2



MALCOLM PIRNIE

D.O. UPTAKE - BIOLOGICAL REACTORS # 1 & 2
MAMARONECK TAYLOR LANE
MAMARONECK, N.Y.

MALCOLM PIRNIE, INC.

FIGURE 3

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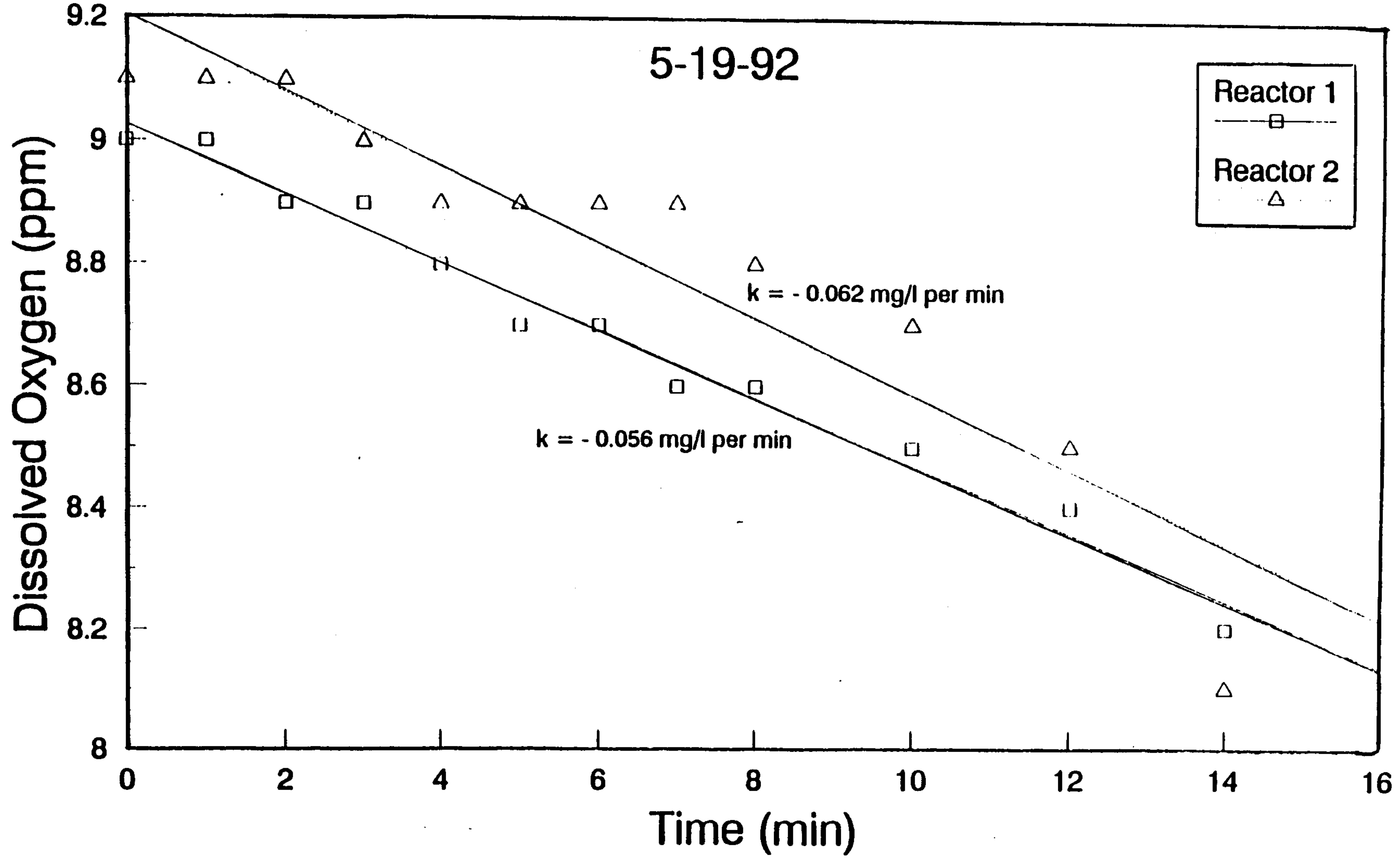
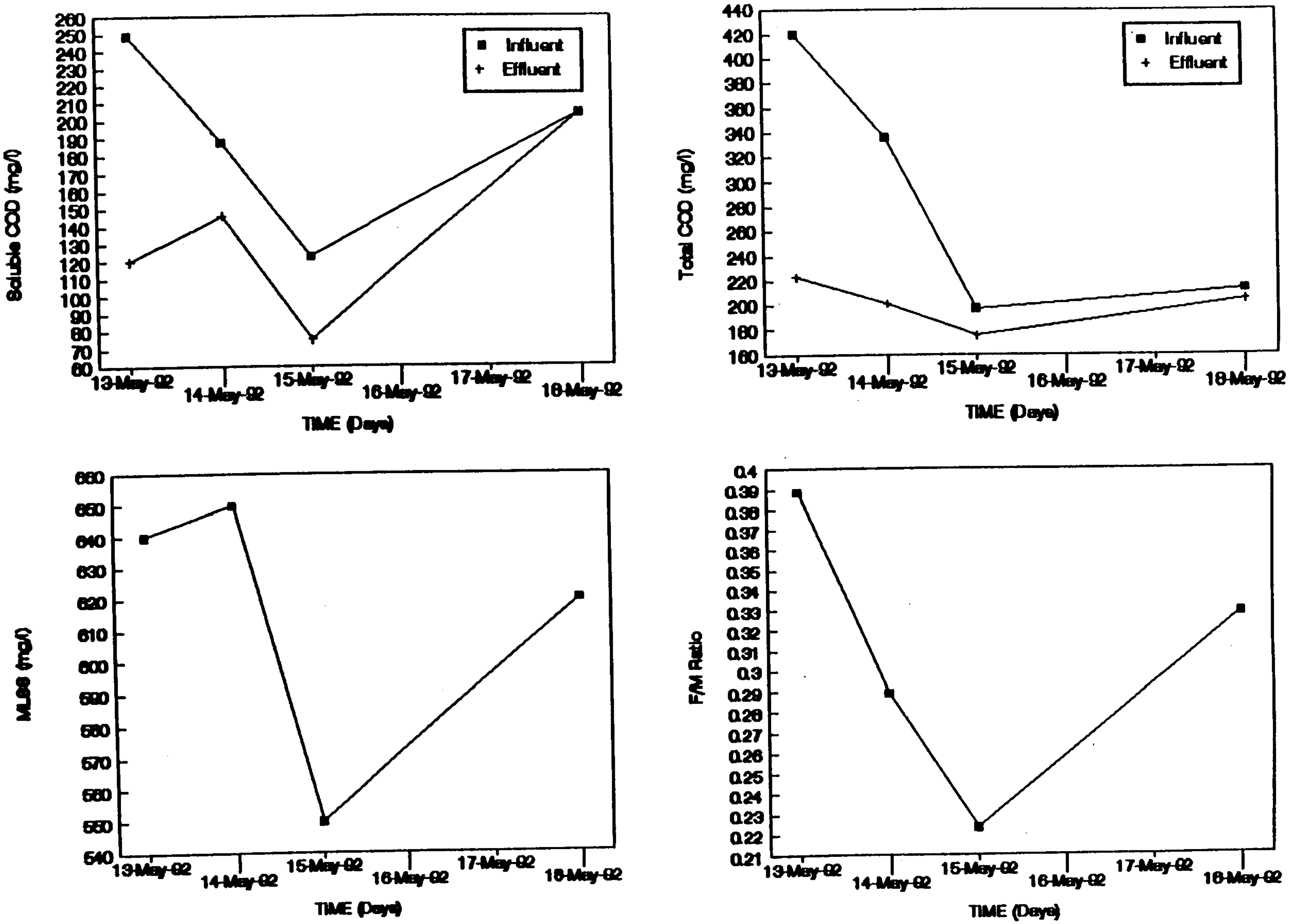


MALCOLM PIRNIE

D.O. UPTAKE - BIOLOGICAL REACTORS # 1 & 2
MAMARONECK TAYLOR LANE
MAMARONECK, N.Y.

MALCOLM PIRNIE, INC.

FIGURE 4



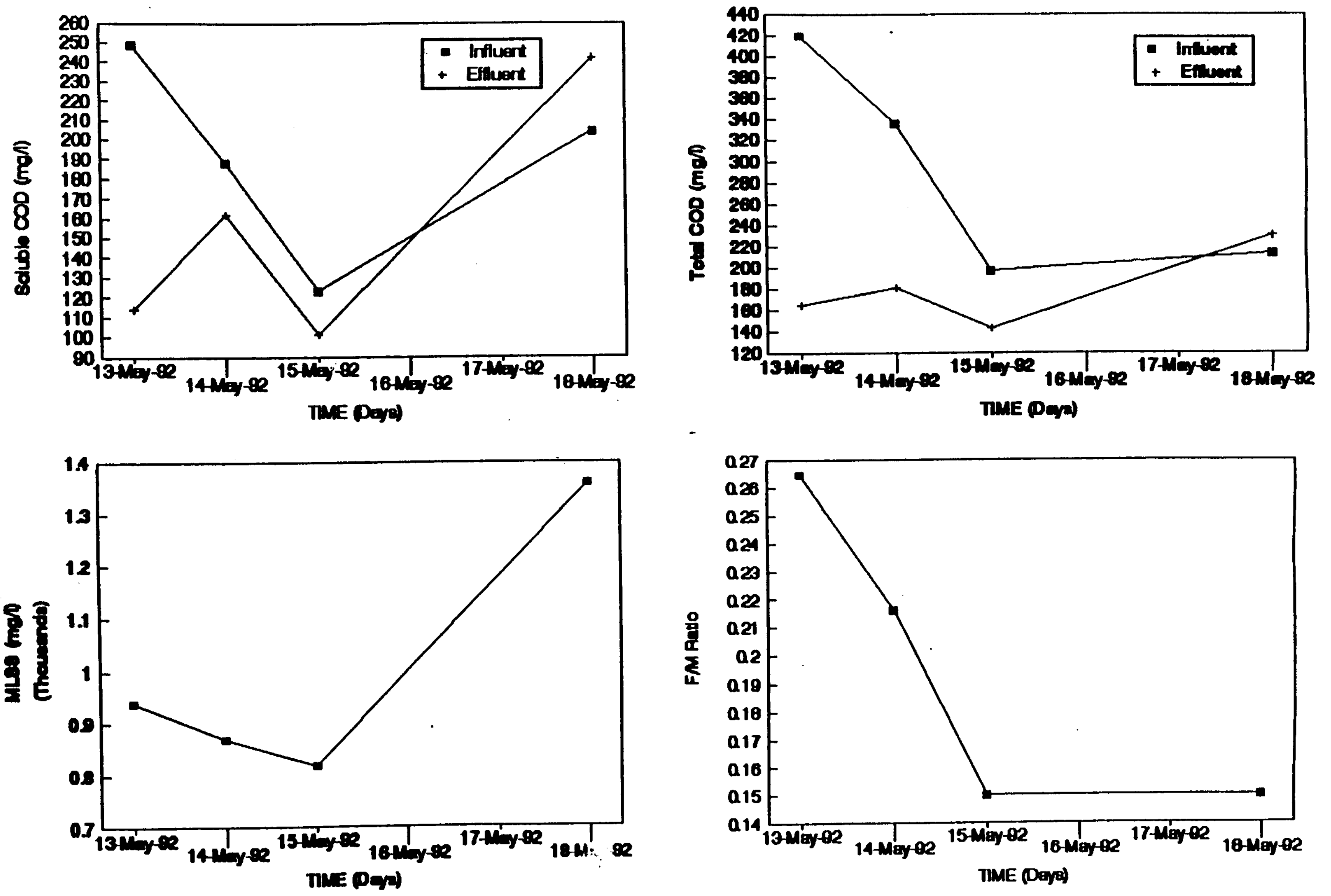
MALCOLM PIRNIE

REACTOR 1 - SBR DATA
MAMARONECK TAYLOR LANE
MAMARONECK, N.Y.

MALCOLM PIRNIE, INC.

FIGURE 5

4945



MALCOLM PIRNIE

REACTOR 2 - SBR DATA
MAMARONECK TAYLOR LANE
MAMARONECK, N.Y.

MALCOLM PIRNIE, INC.

FIGURE 6

6.0 Conclusions and Recommendations

Given the composition and concentration of the leachate on the Site, site-specific treatability data were necessary to aid in the evaluation of the potential remedial scenarios. Possible leachate contamination determined from previous analyses of on-site leachate included volatiles, semi-volatiles, pesticides, and metals.

Figure 1 presents a schematic of the potential process trains that may be considered on the Site to treat the contaminated leachate prior to discharge or disposal. Selection of the ultimate disposal point for the leachate determines the level/extent of treatment necessary to achieve applicable discharge standards (Table 1).

The levels of contamination of the composited leachate collected during the April 28, 1992, pumping test were significantly lower than the levels that had been previously measured. Results for volatiles, semi-volatiles, and pesticides showed very low contaminant concentrations. Aside from commonly occurring metals found in leachate (e.g, iron, magnesium and sodium), all metal concentrations fell below GA drinking water standards.

Even for the low concentrations measured, air stripping was observed to be an effective process for the removal of volatiles from the groundwater. The pumped leachate used for the treatability studies contained approximately 1900 ug/L volatiles (VOCs), semivolatiles (SVOCs), pesticides, and PCBs. The maximum allowable total concentration of VOCs, SVOCs, pesticides, and PCBs that is allowed to be discharged to any POTW regulated by the Westchester County Department of Environmental Facilities is 2100 ug/L. Therefore, no pre-treatment for volatiles, semi-volatiles, or pesticides would be required assuming this leachate is representative of the leachate to be discharged to the POTW. Additionally, no VOC removal would be required if the leachate was discharged to surface water. VOC removal would be required if the leachate was discharged to the lower aquifer ground water.

Due to the low level of metals contamination measured in the treatability sample, metals removal processes were not assessable during this treatability study. However, based on the historical metals contamination measured in other samples of leachate generated on the site, and the actual flow rate and concentration of metals in leachate generated during remedial actions, metals pretreatment prior to discharge to a Westchester County POTW may or may not be required.

Biological treatment is an appropriate candidate process to degrade the general organic contamination present in the contaminated leachate within the fill. The bench-scale SBR data indicate that the contaminated leachate did not cause any significant toxic effects or inhibition of the biomass. However, the treatability data also indicate that it is unlikely that a viable biological treatment process will be able to be maintained on-site, due to the low concentration, low mass of organics present, and limited degradability of the organic contamination present. Significant difficulty in maintaining a viable activated sludge process was observed during bench-scale tests. Therefore, on-site biological treatment is not recommended for this site.

When the above results are viewed in aggregate, the recommended ultimate discharge point for the contaminated leachate generated from remedial actions on the site should be to a POTW, via the Westchester County sewer system. The degree of pretreatment for metals and volatile organic removal, if any, is dependent upon the ultimate concentrations and flow of the leachate generated from remedial actions, and the outcome of negotiations with the NYSDEC and the WCDEF, which both regulate discharge of waters to the POTW's in Westchester County. The most favorable option would be to discharge leachate without pretreatment to the Westchester County sewer system. This would simplify the implementation of any remedial measure for the Site (excluding the no-action alternative), as well as substantially reduce the cost for the ultimate remedy by eliminating the capital cost, and greatly reducing the operating and maintenance costs for the leachate element of the remedial system.

APPENDIX B
TREATABILITY STUDY - CHARACTERIZATION DATA

IENT RESULTS SUMMARY REPORT
vision Notes: COMPLETE ORIGINAL

MARONECK

ontact: ANNMARIE SORENA, NNJ X 210
PI Project Manager:

Group: ORGANICS

roject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
547-021-T52	92-01433-N	MAMARONECK	04/29/92	04/29/92	PR	VOA-W	Benzene	2.19J	ug/L
				04/29/92	PR		Bromodichloromethane	<5.00	ug/L
				04/29/92	PR		Bromoform	<5.00	ug/L
				04/29/92	PR		Bromomethane	<5.00	ug/L
				04/29/92	PR		Carbon tetrachloride	<5.00	ug/L
				04/29/92	PR		Chlorobenzene	<5.00	ug/L
				04/29/92	PR		Chloroethane	<5.00	ug/L
				04/29/92	PR		2-Chloroethylvinyl ether	<5.00	ug/L
				04/29/92	PR		Chloroform	<5.00	ug/L
				04/29/92	PR		Chloromethane	<10.0	ug/L
				04/29/92	PR		Dibromochloromethane	<5.00	ug/L
				04/29/92	PR		1,2-Dichlorobenzene	<5.00	ug/L
				04/29/92	PR		1,3-Dichlorobenzene	<5.00	ug/L
				04/29/92	PR		1,4-Dichlorobenzene	<5.00	ug/L
				04/29/92	PR		1,1-Dichloroethane	<5.00	ug/L
				04/29/92	PR		1,2-Dichloroethane	<5.00	ug/L
				04/29/92	PR		1,1-Dichloroethene	<5.00	ug/L
				04/29/92	PR		Trans-1,2-Dichloroethene	<5.00	ug/L
				04/29/92	PR		1,2-Dichloropropane	<5.00	ug/L
				04/29/92	PR		Cis-1,3-Dichloropropene	<5.00	ug/L
				04/29/92	PR		Trans-1,3-Dichloropropene	<5.00	ug/L
				04/29/92	PR		Ethylbenzene	<5.00	ug/L
				04/29/92	PR		Methylene chloride	3.18J	ug/L
				/29/92	PR		1,1,2,2-Tetrachloroethane	<5.00	ug/L
				04/29/92	PR		Tetrachloroethene	<5.00	ug/L

IENT RESULTS SUMMARY REPORT
vision Notes: COMPLETE ORIGINAL

MARONECK

ontact: ANNMARIE SORENA, NNJ X 210
PI Project Manager:

Group: ORGANICS

roject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
547-021-T52	92-01433-N	MAMARONECK	04/29/92	04/29/92	PR	VOA-W	Toluene	1.93J	ug/L
				04/29/92	PR		1,1,1-Trichloroethane	<5.00	ug/L
				04/29/92	PR		1,1,2-Trichloroethane	<5.00	ug/L
				04/29/92	PR		Trichloroethene	<10.0	ug/L
				04/29/92	PR		Trichlorofluoromethane	<5.00	ug/L
				04/29/92	PR		Vinyl chloride	<5.00	ug/L
				04/30/92	PR		Acetone	1801.96	ug/L
				04/29/92	PR		Carbon Disulfide	<5.00	ug/L
				04/29/92	PR		2-Butanone	<10.0	ug/L
				04/29/92	PR		Vinyl Acetate	<5.00	ug/L
				04/29/92	PR		2-Hexanone	<5.00	ug/L
				04/29/92	PR		4-Methyl-2-Pentanone	9.66	ug/L
				04/29/92	PR		Styrene	<5.00	ug/L
				04/29/92	PR		M,P-Xylene	1.88J	ug/L
				04/29/92	PR		O-Xylene	<5.00	ug/L
				04/29/92	PR		Dichlorodifluoromethane	<5.00	ug/L
				04/29/92	PR		Methyl-Tert Butyl Ether	<5.00	ug/L
				04/29/92	PR		1,2,4-Trimethylbenzene	46.78	ug/L
				04/29/92	PR		Cis-1,2-Dichloroethene	<5.00	ug/L
				04/29/92	PR		Ethyl Methacrylate	<5.00	ug/L
				04/29/92	PR		1,2,3-Trichloropropane	<5.00	ug/L
				04/29/92	PR		1,4-Dichloro-2-butene	<5.00	ug/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/14/92	SN	BNA-W	Acenaphthene	<10.8	ug/L
				05/14/92	SN		Acenaphthylene	<10.8	ug/L
				05/14/92	SN		Anthracene	<10.8	ug/L

IENT RESULTS SUMMARY REPORT
vision Notes: COMPLETE ORIGINAL

MARONECK

ntact: ANNMARIE SORENA, MNJ X 210
I Project Manager:

Group: ORGANICS

oject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/14/92	SN	BNA-W	Benzo(a)anthracene	<10.8	ug/L
				05/14/92	SN		Benzo(b)fluoranthene	<10.8	ug/L
				05/14/92	SN		Benzo(k)fluoranthene	<10.8	ug/L
				05/14/92	SN		Benzo(a)pyrene	<10.8	ug/L
				05/14/92	SN		Benzo(ghi)perylene	<10.8	ug/L
				05/14/92	SN		Benzyl butyl phthalate	<10.8	ug/L
				05/14/92	SN		Bis(2-chloroethyl)ether	<10.8	ug/L
				05/14/92	SN		Bis(2-chloroisopropyl)ether	<10.8	ug/L
				05/14/92	SN		Bis(2-ethylhexyl)phthalate	3.37J	ug/L
				05/14/92	SN		4-Bromophenyl phenyl ether	<10.8	ug/L
				05/14/92	SN		2-Chloronaphthalene	<10.8	ug/L
				05/14/92	SN		4-Chlorophenyl phenyl ether	<10.8	ug/L
				05/14/92	SN		Chrysene	<10.8	ug/L
				05/14/92	SN		Dibenzo(a,h)anthracene	<10.8	ug/L
				05/14/92	SN		Di-n-butyl phthalate	<10.8	ug/L
				05/14/92	SN		1,2-Dichlorobenzene	<10.8	ug/L
				05/14/92	SN		1,3-Dichlorobenzene	<10.8	ug/L
				05/14/92	SN		1,4-Dichlorobenzene	<10.8	ug/L
				05/14/92	SN		3,3'-Dichlorobenzidine	<10.8	ug/L
				05/14/92	SN		Diethyl phthalate	<10.8	ug/L
				05/14/92	SN		Dimethyl phthalate	<10.8	ug/L
				05/14/92	SN		2,4-Dinitrotoluene	<10.8	ug/L
				05/14/92	SN		2,6-Dinitrotoluene	<10.8	ug/L
				05/14/92	SN		Di-n-octyl phthalate	<10.8	ug/L
				05/14/92	SN		Fluoranthene	<10.8	ug/L

.IENT RESULTS SUMMARY REPORT
ivision Notes: COMPLETE ORIGINAL

AMARONECK

ontact: ANNMARIE SORENA, NNJ X 210
PI Project Manager:

Group: ORGANICS

roject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/14/92	SN	BNA-W	Fluorene	<10.8	ug/L
				05/14/92	SN		Hexachlorobenzene	<10.8	ug/L
				05/14/92	SN		Hexachlorobutadiene	<10.8	ug/L
				05/14/92	SN		Hexachloroethane	<10.8	ug/L
				05/14/92	SN		Indeno(1,2,3-cd)pyrene	<10.8	ug/L
				05/14/92	SN		Isophorone	<10.8	ug/L
				05/14/92	SN		Naphthalene	1.23J	ug/L
				05/14/92	SN		Nitrobenzene	<10.8	ug/L
				05/14/92	SN		N-Nitroso-di-n-propylamine	<10.8	ug/L
				05/14/92	SN		Phenanthrene	<10.8	ug/L
				05/14/92	SN		Pyrene	<10.8	ug/L
				05/14/92	SN		1,2,4-Trichlorobenzene	<10.8	ug/L
				05/14/92	SN		4-Chloro-3-methylphenol	<10.8	ug/L
				05/14/92	SN		2-Chlorophenol	<10.8	ug/L
				05/14/92	SN		2,4-Dimethylphenol	<10.8	ug/L
				05/14/92	SN		2,4-Dinitrophenol	<27.0	ug/L
				05/14/92	SN		4,6-Dintro-2-methylphenol	<27.0	ug/L
				05/14/92	SN		2-Nitrophenol	<10.8	ug/L
				05/14/92	SN		4-Nitrophenol	<27.0	ug/L
				05/14/92	SN		Pentachlorophenol	<27.0	ug/L
				05/14/92	SN		Phenol	<10.8	ug/L
				05/14/92	SN		2,4,6-Trichlorophenol	<10.8	ug/L
				05/14/92	SN		2,4,5-Trichlorophenol	<27.0	ug/L
				05/14/92	SN		Benzyl Alcohol	<10.8	ug/L
				05/14/92	SN		2-Methylphenol	<10.8	ug/L

IENT RESULTS SUMMARY REPORT
vision Notes: COMPLETE ORIGINAL

MARONECK

ntact: ANNMARIE SORENA, NNJ X 210
'I Project Manager:

Group: ORGANICS

roject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/14/92	SN	BNA-W	4-Methylphenol	5.10J	ug/L
				05/14/92	SN		Benzoic Acid	1.39J	ug/L
				05/14/92	SN		Bis(2-Chloroethoxy)methane	<10.8	ug/L
				05/14/92	SN		2,4-Dichlorophenol	<10.8	ug/L
				05/14/92	SN		2-Methylnaphthalene	<10.8	ug/L
				05/14/92	SN		4-Chloroaniline	<10.8	ug/L
				05/14/92	SN		Hexachlorocyclopentadiene	<10.8	ug/L
				05/14/92	SN		2-Nitroaniline	<27.0	ug/L
				05/14/92	SN		3-Nitroaniline	<27.0	ug/L
				05/14/92	SN		Dibenzofuran	<10.8	ug/L
				05/14/92	SN		4-Nitroaniline	<27.0	ug/L
				05/14/92	SN		N-Nitrosodiphenylamine	1.85J	ug/L
				05/14/92	SN		Aniline	<10.8	ug/L
				05/14/92	SN		Pyridine	<10.8	ug/L
				05/14/92	SN		Azobenzene	<10.8	ug/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/10/92	EA	PEST-W	alpha-BHC	.306	ug/L
				05/10/92	EA		beta-BHC	.443	ug/L
				05/10/92	EA		delta-BHC	.149	ug/L
				05/10/92	EA		gamma-BHC (Lindane)	<.053	ug/L
				05/10/92	EA		Heptachlor	<.053	ug/L
				05/10/92	EA		Aldrin	<.053	ug/L
				05/10/92	EA		Heptachlor epoxide	<.053	ug/L
				05/10/92	EA		Endosulfan I	<.053	ug/L
				05/10/92	EA		Dieldrin	<.105	ug/L
				05/10/92	EA		4,4'-DDE	<.105	ug/L

ENT RESULTS SUMMARY REPORT
ision Notes: COMPLETE ORIGINAL

ARONECK

ntact: ANNMARIE SORENA, NNJ X 210
I Project Manager:

Group: ORGANICS

oject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/10/92	EA	PEST-W	Endrin	<.105	ug/L
				05/10/92	EA		Endosulfan II	<.105	ug/L
				05/10/92	EA		4,4'-DDD	<.105	ug/L
				05/10/92	EA		Endosulfan sulfate	<.105	ug/L
				05/10/92	EA		4,4'-DDT	<.105	ug/L
				05/10/92	EA		Methoxychlor	<.526	ug/L
				05/10/92	EA		Chlordane	<.053	ug/L
				05/10/92	EA		Toxaphene	<5.26	ug/L
				05/10/92	EA		Aroclor-1016	<1.05	ug/L
				05/10/92	EA		Aroclor-1221	<2.11	ug/L
				05/10/92	EA		Aroclor-1232	<1.05	ug/L
				05/10/92	EA		Aroclor-1242	<1.05	ug/L
				05/10/92	EA		Aroclor-1248	<1.05	ug/L
				05/10/92	EA		Aroclor-1254	<1.05	ug/L
				05/10/92	EA		Aroclor-1260	<1.05	ug/L
				05/10/92	EA		Endrin Aldehyde	<.105	ug/L
1547-021-T52	92-01434-N	TRIP BLANK	04/29/92	05/03/92	PR	VOA-W	Benzene	<5.00	ug/L
				05/03/92	PR		Bromodichloromethane	<5.00	ug/L
				05/03/92	PR		Bromoform	<5.00	ug/L
				05/03/92	PR		Bromomethane	<5.00	ug/L
				05/03/92	PR		Carbon tetrachloride	<5.00	ug/L
				05/03/92	PR		Chlorobenzene	<5.00	ug/L
				05/03/92	PR		Chloroethane	<5.00	ug/L

CLIENT RESULTS SUMMARY REPORT
Revision Notes: COMPLETE ORIGINAL

MAMARONECK

Contact: ANNMARIE SORENA, NNJ X 210
MPI Project Manager:

Group: ORGANICS

Project #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result Units
1547-021-T52	92-01434-N	TRIP BLANK	04/29/92	05/03/92	PR	VOA-W	2-Chloroethylvinyl ether	<5.00 ug/L
				05/03/92	PR		Chloroform	<5.00 ug/L
				05/03/92	PR		Chloromethane	<10.0 ug/L
				05/03/92	PR		Dibromochloromethane	<5.00 ug/L
				05/03/92	PR		1,2-Dichlorobenzene	<5.00 ug/L
				05/03/92	PR		1,3-Dichlorobenzene	<5.00 ug/L
				05/03/92	PR		1,4-Dichlorobenzene	<5.00 ug/L
				05/03/92	PR		1,1-Dichloroethane	<5.00 ug/L
				05/03/92	PR		1,2-Dichloroethane	<5.00 ug/L
				05/03/92	PR		1,1-Dichloroethene	<5.00 ug/L
				05/03/92	PR		Trans-1,2-Dichloroethene	<5.00 ug/L
				05/03/92	PR		1,2-Dichloropropane	<5.00 ug/L
				05/03/92	PR		Cis-1,3-Dichloropropene	<5.00 ug/L
				05/03/92	PR		Trans-1,3-Dichloropropene	<5.00 ug/L
				05/03/92	PR		Ethylbenzene	<5.00 ug/L
				05/03/92	PR		Methylene chloride	<5.00 ug/L
				05/03/92	PR		1,1,2,2-Tetrachloroethane	<5.00 ug/L
				05/03/92	PR		Tetrachloroethene	<5.00 ug/L
				05/03/92	PR		Toluene	<5.00 ug/L
				05/03/92	PR		1,1,1-Trichloroethane	<5.00 ug/L
				05/03/92	PR		1,1,2-Trichloroethane	<5.00 ug/L
				05/03/92	PR		Trichloroethene	<10.0 ug/L
				05/03/92	PR		Trichlorofluoromethane	<5.00 ug/L
				05/03/92	PR		Vinyl chloride	<5.00 ug/L
				05/03/92	PR		Acetone	<10.0 ug/L

IENT RESULTS SUMMARY REPORT
·vision Notes: COMPLETE ORIGINAL

MARONECK

ontact: ANNMARIE SORENA, MNJ X 210
PI Project Manager:

Group: ORGANICS

roject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
547-021-T52	92-01434-N	TRIP BLANK	04/29/92	05/03/92	PR	VOA-W	Carbon Disulfide	<5.00	ug/L
				05/03/92	PR		2-Butanone	<10.0	ug/L
				05/03/92	PR		Vinyl Acetate	<5.00	ug/L
				05/03/92	PR		2-Hexanone	<5.00	ug/L
				05/03/92	PR		4-Methyl-2-Pentanone	<5.00	ug/L
				05/03/92	PR		Styrene	2.80J	ug/L
				05/03/92	PR		M,P-Xylene	<5.00	ug/L
				05/03/92	PR		O-Xylene	<5.00	ug/L
				05/03/92	PR		Dichlorodifluoromethane	<5.00	ug/L
				05/03/92	PR		Methyl-Tert Butyl Ether	<5.00	ug/L
				05/03/92	PR		1,2,4-Trimethylbenzene	<10.0	ug/L
				05/03/92	PR		Cis-1,2-Dichloroethene	<5.00	ug/L
				05/03/92	PR		Ethyl Methacrylate	<5.00	ug/L
				05/03/92	PR		1,2,3-Trichloropropene	<5.00	ug/L
				05/03/92	PR		1,4-Dichloro-2-butene	<5.00	ug/L

IENT RESULTS SUMMARY REPORT
vision Notes: COMPLETE ORIGINAL

MARONECK

ntact: ANNMARIE SORENA, NNJ X 210
I Project Manager:

Group: METALS

oject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result Units
547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	AL ICAP	Aluminum by ICAP	<.100 mg/L
547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	SB ICAP	Antimony by ICAP	<.060 mg/L
547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/02/92	ML	AS-FURN	Arsenic (Furnace)	<0.010 mg/L
547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	BA ICAP	Barium by ICAP	.291 mg/L
547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	BE ICAP	Beryllium by ICAP	<.003 mg/L
547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	CD ICAP	Cadmium by ICAP	<.003 mg/L
547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	CR ICAP	Chromium by ICAP	<.010 mg/L
547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	CO ICAP	Cobalt by ICAP	<.020 mg/L
547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	CU ICAP	Copper by ICAP	<.010 mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	FE ICAP	Iron by ICAP	22.2 mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	PB ICAP	Lead by ICAP	<.100 mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	MG ICAP	Magnesium by ICAP	45.0 mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	MN ICAP	Manganese by ICAP	.286 mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/05/92	ML	HG	Mercury	<0.0005 mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	NI ICAP	Nickel by ICAP	<.020 mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	K ICAP	Potassium by ICAP	39.0 mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	ML	SE-FURN	Selenium (Furnace)	<0.010 mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	AG ICAP	Silver by ICAP	<.010 mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	NA ICAP	Sodium by ICAP	46.6 mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	ML	TL-FURN	Thallium (Furnace)	<0.010 mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	V ICAP	Vanadium by ICAP	<.020 mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	ZN ICAP	Zinc by ICAP	.063 mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	AL ICAP F	Lead ICAP FILT	<.100 mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	SB ICAP F	Antimony ICAP FILT	<.060 mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/02/92	ML	AS-FILT	Arsenic-filtered	<0.010 mg/L

IENT RESULTS SUMMARY REPORT
vision Notes: COMPLETE ORIGINAL

MARONECK

ontact: ANNMARIE SORENA, NNJ X 210
PI Project Manager:

Group: METALS

roject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	BA ICAP F	Barium ICAP FILT	.182	mg/L
547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	BE ICAP F	Beryllium ICAP FILT	<.003	mg/L
547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	CD ICAP F	Cadmium ICAP FILT	<.003	mg/L
547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	CA ICAP F	Calcium ICAP FILT	133	mg/L
547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	CR ICAP F	Chromium ICAP FILT	<.010	mg/L
547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	CO ICAP F	Cobalt ICAP FILT	<.020	mg/L
547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	CU ICAP F	Copper ICAP FILT	<.010	mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	FE ICAP F	Iron ICAP FILT	.073	mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	PB ICAP F	Lead ICAP FILT	<.100	mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	MG ICAP F	Magnesium ICAP FILT	46.3	mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	MN ICAP F	Manganese ICAP FILT	.281	mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/05/92	ML	HG-FILT	Mercury (filt)	<0.0005	mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	NI ICAP F	Nickel ICAP FILT	<.020	mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	K ICAP F	Potassium ICAP FILT	39.6	mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	ML	SE-FILT	Selenium (filt)	<0.010	mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	AG ICAP F	Silver ICAP FILT	<0.010	mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	NA ICAP F	Sodium ICAP FILT	50.4	mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	ML	TL-FILT	Thallium (Dissolved)	0.0203	mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	V ICAP F	Vanadium ICAP FILT	<0.020	mg/L
1547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	DMP	ZN ICAP F	Zinc ICAP FILT	.030	mg/L

ENT RESULTS SUMMARY REPORT
ision Notes: COMPLETE ORIGINAL

ARONECK

ntact: ANNMARIE SORENA, NNJ X 210
I Project Manager:

Group: INORGANICS

oject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
47-021-T52	92-01433-N	MAMARONECK	04/29/92	05/04/92	MR	ALK	Alkalinity	770	mg/lCaCO3
47-021-T52	92-01433-N	MAMARONECK	04/29/92	05/06/92	TM	BOD5	Biochem O2 Demand 5	51.3	mg/L
47-021-T52	92-01433-N	MAMARONECK	04/29/92	05/21/92	ND	COD	Chemical Ox. Demand	177	mg/l
47-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	ML	COLOR	Color	175	Units
47-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	ML	HARD	Hardness	511	mg/l CaCO3
47-021-T52	92-01433-N	MAMARONECK	04/29/92	04/30/92	ML	MBAS	Surfactants-methyl blue	0.209	mg/L
47-021-T52	92-01433-N	MAMARONECK	04/29/92	05/27/92	TM	NH3-N	Ammonia-Nitrogen	9.26	mg/L
47-021-T52	92-01433-N	MAMARONECK	04/29/92	05/01/92	ML	ODOR	Odor	20.0	TON
47-021-T52	92-01433-N	MAMARONECK	04/29/92	05/26/92	DS	PHN.3	Phenolics, recoverable	0.020	mg/L
47-021-T52	92-01433-N	MAMARONECK	04/29/92	04/30/92	MR	SO4	Sulfate	82.3	mg/L
547-021-T52	92-01433-N	MAMARONECK	04/29/92	04/29/92	ND	TDS	Total Dissolved SOLIDS	1028	mg/L
547-021-T52	92-01433-N	MAMARONECK	04/29/92	06/24/92	TM	TKN-N	Total Kjeldal Nitrogen	2.06	mg/L
547-021-T52	92-01433-N	MAMARONECK	04/29/92	05/04/92	TM	TOC	Total Organic Carbon	275	mg/L
547-021-T52	92-01433-N	MAMARONECK	04/29/92	04/29/92	ND	TSS	Total Suspended Solids	55.0	mg/L

MALCOLM, PIRNIE, INC.
ENVIRONMENTAL LABORATORY
707 OLD SAW MILL RIVER ROAD
TARRYTOWN, NY 10591
TEL. 914-345-8230
FAX. 914-345-8741

CHAIN OF CUSTODY RECORD

Page 1 of 1

NAME OF CLIENT MAMARONECK
PROJECT NUMBER 1547-02-1T52
ADDRESS —
CITY — STATE — ZIPCODE —
CONTACT NAME A. SORENA TEL# NNJ - X 210 / WHI - X 2978

FOR LAB USE ONLY
C.C.R. #
QUOTE #
REPORT #

SAMPLE RECEIVE ☐
SAMPLE LOGGING ☐
SAMPLE DISTRIB. ☐

PROJECT DESCRIPTION: GROUNDWATER TREAT. STUDY

SAMPLER SIGNATURE: Ann Marie Sorena DATE: 4/29/92

IF SAMPLE(S) REQUIRE SPECIAL QA/QC, CHECK HERE ☐ AND DESCRIBE :

PRESERVATIVE TYPE CHECK(S)
1. HNO3 ☐
2. H2SO4 ☐
3. H3PO4 ☐
4. HCl ☐
5. NaOH ☐
6. Na2SO3 ☐
7. None ☐
8. Other(s): ☐

NO. OF CONTAINERS

SAMPLE ID	DESCRIPTION	DATE	TIME	MATRIX	PRESERVATION	Volatiles Organic Compounds	Acid extractable compounds	Base/Neutral Extractable Compounds	Pesticides	PCB's	Herbicides	Cyanide	EP Toxicity - Organics	EP Toxicity - Inorganics	Phenols	Metals	Others	REMARKS
						24 COM		1	1 ONE CONTAINER FOR BOTH						1	2 1 FILTERED 1 TOTAL		
92-1433	MW-19					X		X	X	X					X	X		
	~~MW-19~~																~~X~~	~~SULFATE~~
	MW-19																X	SO4 [illegible] TDS / TSS.
	MW-19																X	BOD
	MW-19																X	[illegible] /[illegible]
	MW-19																X	[illegible]/TKN
	MW-19																X	TOC.
																	X	HARD
92-1434	TRIP BLANK																	VOA

Relinquished by (Signature)	Date	Time	Received by (Signature):	Date	Time	Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time
Ann Marie Sorena	4/29/92	11:50									

Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time

REMARKS Metals: Al Sb As Ba Be Cd Ca Cr Co Cu Fe Pb Mg Mn Hg Ni K Se Ag Na Tl V Zn

FORM MP-# 302 1/90

ALCOLM PIRNIE, INC.
NVIRONMENTAL LABORATORY
07 OLD SAW MILL RIVER ROAD
ARRYTOWN, NY 10591
EL. 914-345-8230
AX. 914-345-8741

CHAIN OF CUSTODY RECORD

Page 1 of 1

NAME OF CLIENT MAMARONECK
PROJECT NUMBER 1547-02-1T52
ADDRESS —
CITY — STATE — ZIPCODE —
CONTACT NAME A. SORENA TEL# NNJ-X 210 WHI-X 2978

FOR LAB USE ONLY
C.C.R. #
QUOTE #
REPORT #

ROJECT DESCRIPTION: GROUNDWATER TREAT. STUDY

SAMPLER SIGNATURE: DATE: 4/29/92

IF SAMPLE(S) REQUIRE SPECIAL QA/QC, CHECK HERE ☐ AND DESCRIBE :

PRESERVATIVE TYPE CHECK(S)
1. HNO3 ☐
2. H2SO4 ☐
3. H3PO4 ☐
4. HCl ☐
5. NaOH ☐
6. Na2SO3 ☐
7. None ☐
8. Other(s): ☐

SAMPLE RECEIVE ☐
SAMPLE LOGGING ☐
SAMPLE DISTRIB. ☐

NO. OF CONTAINERS

SAMPLE ID	DESCRIPTION	DATE	TIME	MATRIX	PRESERVATION	Volatiles Organic Compounds	Acid extractable compounds	Base/Neutral Extractable Compounds	Pesticides	PCB's	Herbicides	Cyanide	E.P. Toxicity - Organics	E.P. Toxicity - Inorganics	Phenols	Metals	Others	REMARKS
						24 COM		1	1 ONE CONTAINER FOR BOTH						1	2 1 FILTERED 1 TOTAL		
92-1433	MW-19					X		X	X	X					X	X		
	~~MW-19~~																~~X~~	~~SULFATE~~
	MW-19																X	SO4 TDS / MBAS TSS.
	MW-19																\	BOD
	MW-19																X	COLOR/ODOR
	MW-19																X	NO3/TKN
	MW-19																X	TOC.
																	X	HARD
92-1434	TRIP BLANK																	VOA

Relinquished by (Signature)	Date	Time	Received by (Signature):	Date	Time	Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time
Ann Marie Sorena	4/29/92	4:50									

Relinquished by (Signature)	Date	Time	Received by (Signature):	Date	Time

REMARKS Metals: Al Sb As Ba Be Cd Ca Cr Co Cu Fe Pb Mg Mn Hg Ni K Se Ag Na Tl V Zn

APPENDIX C
TREATABILITY STUDY - AIR STRIPPING DATA

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
ENVIRONMENTAL LABORATORY
707 OLD SAWMILL RIVER ROAD
TARRYTOWN, NY 10591
(914) 345-5930

CLIENT RESULTS SUMMARY REPORT
DUPLICATE ORIGINAL

MAMARONECK

ANNMARIE SORENA, NNJ X 210
MPI Project Manager:

Project #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
1547-021-T52	92-01460-N	RAW	04/29/92	05/03/92	PR	VOA-W	Benzene	1.63J	ug/L
				05/03/92	PR		Bromodichloromethane	<10.0	ug/L
				05/03/92	PR		Bromoform	<10.0	ug/L
				05/03/92	PR		Bromomethane	<10.0	ug/L
				05/03/92	PR		Carbon tetrachloride	<10.0	ug/L
				05/03/92	PR		Chlorobenzene	<10.0	ug/L
				05/03/92	PR		Chloroethane	<10.0	ug/L
				05/03/92	PR		2-Chloroethylvinyl ether	<10.0	ug/L
				05/03/92	PR		Chloroform	<10.0	ug/L
				05/03/92	PR		Chloromethane	<10.0	ug/L
				05/03/92	PR		Dibromochloromethane	<10.0	ug/L
				05/03/92	PR		1,2-Dichlorobenzene	<10.0	ug/L
				05/03/92	PR		1,3-Dichlorobenzene	<10.0	ug/L
				05/03/92	PR		1,4-Dichlorobenzene	<10.0	ug/L
				05/03/92	PR		1,1-Dichloroethane	<10.0	ug/L
				05/03/92	PR		1,2-Dichloroethane	<10.0	ug/L
				05/03/92	PR		1,1-Dichloroethene	<10.0	ug/L
				05/03/92	PR		Trans-1,2-Dichloroethene	<10.0	ug/L
				05/03/92	PR		1,2-Dichloropropane	<10.0	ug/L
				05/03/92	PR		Cis-1,3-Dichloropropene	<10.0	ug/L
				05/03/92	PR		Trans-1,3-Dichloropropene	<10.0	ug/L
				05/03/92	PR		Ethylbenzene	<10.0	ug/L

APPROVED BY: ____________ DATE: 6/17/92

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ENVIRONMENTAL LABORATORY
707 OLD SAWMILL RIVER ROAD
TARRYTOWN, NY 10591
(914) 345-5930

LIENT RESULTS SUMMARY REPORT
UPLICATE ORIGINAL

AMARONECK

\NNMARIE SORENA, NNJ X 210
\PI Project Manager:

roject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
1547-021-T52	92-01460-N	RAW	04/29/92	05/03/92	PR	VOA-W	Methylene chloride	<10.0	ug/L
				05/03/92	PR		1,1,2,2-Tetrachloroethane	<10.0	ug/L
				05/03/92	PR		Tetrachloroethene	<10.0	ug/L
				05/03/92	PR		Toluene	<10.0	ug/L
				05/03/92	PR		1,1,1-Trichloroethane	<10.0	ug/L
				05/03/92	PR		1,1,2-Trichloroethane	<10.0	ug/L
				05/03/92	PR		Trichloroethene	<10.0	ug/L
				05/03/92	PR		Trichlorofluoromethane	<10.0	ug/L
				05/03/92	PR		Vinyl chloride	<10.0	ug/L
				05/04/92	PR		Acetone	1998.01B	ug/L
				05/03/92	PR		Carbon Disulfide	<10.0	ug/L
				05/03/92	PR		2-Butanone	6.56J	ug/L
				05/03/92	PR		Vinyl Acetate	<10.0	ug/L
				05/03/92	PR		2-Hexanone	94.49	ug/L
				05/03/92	PR		4-Methyl-2-Pentanone	8.96	ug/L
				05/03/92	PR		Styrene	<10.0	ug/L
				05/03/92	PR		M,P-Xylene	1.42J	ug/L
				05/03/92	PR		O-Xylene	<10.0	ug/L
				05/03/92	PR		Dichlorodifluoromethane	<10.0	ug/L
				05/03/92	PR		Methyl-Tert Butyl Ether	3.94J	ug/L
				05/03/92	PR		1,2,4-Trimethylbenzene	33.37	ug/L
				05/03/92	PR		Cis-1,2-Dichloroethene	<10.0	ug/L

APPROVED BY: ______________ DATE: ________

IENT RESULTS SUMMARY REPORT
PLICATE ORIGINAL

MARONECK

NNMARIE SORENA, NNJ X 210
PI Project Manager:

roject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
547-021-T52	92-01460-W	RAW	04/29/92	05/03/92	PR	VOA-W	Ethyl Methacrylate	<10.0	ug/L
				05/03/92	PR		1,2,3-Trichloropropane	<10.0	ug/L
				05/03/92	PR		1,4-Dichloro-2-butene	<10.0	ug/L
547-021-T52	92-01461-W	S1	04/29/92	05/03/92	PR	VOA-W	Benzene	<10.0	ug/L
				05/03/92	PR		Bromodichloromethane	<10.0	ug/L
				05/03/92	PR		Bromoform	<10.0	ug/L
				05/03/92	PR		Bromomethane	<10.0	ug/L
				05/03/92	PR		Carbon tetrachloride	<10.0	ug/L
				05/03/92	PR		Chlorobenzene	<10.0	ug/L
				05/03/92	PR		Chloroethane	<10.0	ug/L
				05/03/92	PR		2-Chloroethylvinyl ether	<10.0	ug/L
				05/03/92	PR		Chloroform	<10.0	ug/L
				05/03/92	PR		Chloromethane	<10.0	ug/L
				05/03/92	PR		Dibromochloromethane	<10.0	ug/L
				05/03/92	PR		1,2-Dichlorobenzene	<10.0	ug/L
				05/03/92	PR		1,3-Dichlorobenzene	<10.0	ug/L
				05/03/92	PR		1,4-Dichlorobenzene	<10.0	ug/L
				05/03/92	PR		1,1-Dichloroethane	<10.0	ug/L
				05/03/92	PR		1,2-Dichloroethane	<10.0	ug/L
				05/03/92	PR		1,1-Dichloroethene	<10.0	ug/L

APPROVED BY: ____________ DATE: ________

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TARRYTOWN, NY 10591
(914) 345-5930

IENT RESULTS SUMMARY REPORT
PLICATE ORIGINAL

MARONECK

NMARIE SORENA, NNJ X 210
PI Project Manager:

roject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
547-021-T52	92-01461-N	S1	04/29/92	05/03/92	PR	VOA-W	Trans-1,2-Dichloroethene	<10.0	ug/L
				05/03/92	PR		1,2-Dichloropropene	<10.0	ug/L
				05/03/92	PR		Cis-1,3-Dichloropropene	<10.0	ug/L
				05/03/92	PR		Trans-1,3-Dichloropropene	<10.0	ug/L
				05/03/92	PR		Ethylbenzene	<10.0	ug/L
				05/03/92	PR		Methylene chloride	<10.0	ug/L
				05/03/92	PR		1,1,2,2-Tetrachloroethane	<10.0	ug/L
				05/03/92	PR		Tetrachloroethene	<10.0	ug/L
				05/03/92	PR		Toluene	7.39J	ug/L
				05/03/92	PR		1,1,1-Trichloroethane	<10.0	ug/L
				05/03/92	PR		1,1,2-Trichloroethane	<10.0	ug/L
				05/03/92	PR		Trichloroethene	<10.0	ug/L
				05/03/92	PR		Trichlorofluoromethane	<10.0	ug/L
				05/03/92	PR		Vinyl chloride	<10.0	ug/L
				05/04/92	PR		Acetone	1906.888	ug/L
				05/03/92	PR		Carbon Disulfide	<10.0	ug/L
				05/03/92	PR		2-Butanone	7.51J	ug/L
				05/03/92	PR		Vinyl Acetate	<10.0	ug/L
				05/03/92	PR		2-Hexanone	<10.0	ug/L
				05/03/92	PR		4-Methyl-2-Pentanone	8.43J	ug/L
				05/03/92	PR		Styrene	<10.0	ug/L
				05/03/92	PR		M,P-Xylene	<10.0	ug/L

APPROVED BY: ______________ DATE: __________

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707 OLD SAWMILL RIVER ROAD
TARRYTOWN, NY 10591
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IENT RESULTS SUMMARY REPORT
PLICATE ORIGINAL

MARONECK

NNMARIE SORENA, NNJ X 210
PI Project Manager:

roject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
547-021-T52	92-01461-N	S1	04/29/92	05/03/92	PR	VOA-W	O-Xylene	<10.0	ug/L
				05/03/92	PR		Dichlorodifluoromethane	<10.0	ug/L
				05/03/92	PR		Methyl-Tert Butyl Ether	2.52J	ug/L
				05/03/92	PR		1,2,4-Trimethylbenzene	6.08J	ug/L
				05/03/92	PR		Cis-1,2-Dichloroethene	<10.0	ug/L
				05/03/92	PR		Ethyl Methacrylate	<10.0	ug/L
				05/03/92	PR		1,2,3-Trichloropropane	<10.0	ug/L
				05/03/92	PR		1,4-Dichloro-2-butene	<10.0	ug/L
1547-021-T52	92-01462-N	S2	04/29/92	05/03/92	PR	VOA-W	Benzene	<10.0	ug/L
				05/03/92	PR		Bromodichloromethane	<10.0	ug/L
				05/03/92	PR		Bromoform	<10.0	ug/L
				05/03/92	PR		Bromomethane	<10.0	ug/L
				05/03/92	PR		Carbon tetrachloride	<10.0	ug/L
				05/03/92	PR		Chlorobenzene	<10.0	ug/L
				05/03/92	PR		Chloroethane	<10.0	ug/L
				05/03/92	PR		2-Chloroethylvinyl ether	<10.0	ug/L
				05/03/92	PR		Chloroform	<10.0	ug/L
				05/03/92	PR		Chloromethane	<10.0	ug/L
				05/03/92	PR		Dibromochloromethane	<10.0	ug/L
				05/03/92	PR		1,2-Dichlorobenzene	<10.0	ug/L

APPROVED BY: ________________ DATE: ________

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707 OLD SAWMILL RIVER ROAD
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IENT RESULTS SUMMARY REPORT
PLICATE ORIGINAL

MARONECK

NNMARIE SORENA, NNJ X 210
PI Project Manager:

roject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
547-021-T52	92-01462-N	S2	04/29/92	05/03/92	PR	VOA-W	1,3-Dichlorobenzene	<10.0	ug/L
				05/03/92	PR		1,4-Dichlorobenzene	<10.0	ug/L
				05/03/92	PR		1,1-Dichloroethane	<10.0	ug/L
				05/03/92	PR		1,2-Dichloroethane	<10.0	ug/L
				05/03/92	PR		1,1-Dichloroethene	<10.0	ug/L
				05/03/92	PR		Trans-1,2-Dichloroethene	<10.0	ug/L
				05/03/92	PR		1,2-Dichloropropane	<10.0	ug/L
				05/03/92	PR		Cis-1,3-Dichloropropene	<10.0	ug/L
				05/03/92	PR		Trans-1,3-Dichloropropene	<10.0	ug/L
				05/03/92	PR		Ethylbenzene	<10.0	ug/L
				05/03/92	PR		Methylene chloride	<10.0	ug/L
				05/03/92	PR		1,1,2,2-Tetrachloroethane	<10.0	ug/L
				05/03/92	PR		Tetrachloroethene	<10.0	ug/L
				05/03/92	PR		Toluene	8.26J	ug/L
				05/03/92	PR		1,1,1-Trichloroethane	<10.0	ug/L
				05/03/92	PR		1,1,2-Trichloroethane	<10.0	ug/L
				05/03/92	PR		Trichloroethene	<10.0	ug/L
				05/03/92	PR		Trichlorofluoromethane	<10.0	ug/L
				05/03/92	PR		Vinyl chloride	<10.0	ug/L
				05/04/92	PR		Acetone	1592.73B	ug/L
				05/03/92	PR		Carbon Disulfide	<10.0	ug/L
				05/03/92	PR		2-Butanone	<10.0	ug/L

APPROVED BY: ____________ DATE: ________

MALCOLM PIRNIE

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ENVIRONMENTAL LABORATORY
707 OLD SAWMILL RIVER ROAD
TARRYTOWN, NY 10591
(914) 345-5930

ENT RESULTS SUMMARY REPORT
LICATE ORIGINAL

ARONECK

NMARIE SORENA, NNJ X 210
I Project Manager:

oject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
547-021-T52	92-01462-N	S2	04/29/92	05/03/92	PR	VOA-W	Vinyl Acetate	<10.0	ug/L
				05/03/92	PR		2-Hexanone	<10.0	ug/L
				05/03/92	PR		4-Methyl-2-Pentanone	5.39J	ug/L
				05/03/92	PR		Styrene	<10.0	ug/L
				05/03/92	PR		M,P-Xylene	<10.0	ug/L
				05/03/92	PR		O-Xylene	<10.0	ug/L
				05/03/92	PR		Dichlorodifluoromethane	<10.0	ug/L
				05/03/92	PR		Methyl-Tert Butyl Ether	1.59J	ug/L
				05/03/92	PR		1,2,4-Trimethylbenzene	1.77J	ug/L
				05/03/92	PR		Cis-1,2-Dichloroethene	<10.0	ug/L
				05/03/92	PR		Ethyl Methacrylate	<10.0	ug/L
				05/03/92	PR		1,2,3-Trichloropropane	<10.0	ug/L
				05/03/92	PR		1,4-Dichloro-2-butene	<10.0	ug/L
1547-021-T52	92-01463-N	S3	04/29/92	05/03/92	PR	VOA-W	Benzene	<10.0	ug/L
				05/03/92	PR		Bromodichloromethane	<10.0	ug/L
				05/03/92	PR		Bromoform	<10.0	ug/L
				05/03/92	PR		Bromomethane	<10.0	ug/L
				05/03/92	PR		Carbon tetrachloride	<10.0	ug/L
				05/03/92	PR		Chlorobenzene	<10.0	ug/L
				05/03/92	PR		Chloroethane	<10.0	ug/L

APPROVED BY: ____________ DATE: ________

MALCOLM PIRNIE, INC.
ENVIRONMENTAL LABORATORY
707 OLD SAWMILL RIVER ROAD
TARRYTOWN, NY 10591
(914) 345-5930

IENT RESULTS SUMMARY REPORT
PLICATE ORIGINAL

MARONECK

NNMARIE SORENA, NNJ X 210
PI Project Manager:

roject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
1547-021-T52	92-01463-N	S3	04/29/92	05/03/92	PR	VOA-W	2-Chloroethylvinyl ether	<10.0	ug/L
				05/03/92	PR		Chloroform	<10.0	ug/L
				05/03/92	PR		Chloromethane	<10.0	ug/L
				05/03/92	PR		Dibromochloromethane	<10.0	ug/L
				05/03/92	PR		1,2-Dichlorobenzene	<10.0	ug/L
				05/03/92	PR		1,3-Dichlorobenzene	<10.0	ug/L
				05/03/92	PR		1,4-Dichlorobenzene	<10.0	ug/L
				05/03/92	PR		1,1-Dichloroethane	<10.0	ug/L
				05/03/92	PR		1,2-Dichloroethane	<10.0	ug/L
				05/03/92	PR		1,1-Dichloroethene	<10.0	ug/L
				05/03/92	PR		Trans-1,2-Dichloroethene	<10.0	ug/L
				05/03/92	PR		1,2-Dichloropropane	<10.0	ug/L
				05/03/92	PR		Cis-1,3-Dichloropropene	<10.0	ug/L
				05/03/92	PR		Trans-1,3-Dichloropropene	<10.0	ug/L
				05/03/92	PR		Ethylbenzene	<10.0	ug/L
				05/03/92	PR		Methylene chloride	<10.0	ug/L
				05/03/92	PR		1,1,2,2-Tetrachloroethane	<10.0	ug/L
				05/03/92	PR		Tetrachloroethene	<10.0	ug/L
				05/03/92	PR		Toluene	8.50J	ug/L
				05/03/92	PR		1,1,1-Trichloroethane	<10.0	ug/L
				05/03/92	PR		1,1,2-Trichloroethane	<10.0	ug/L
				05/03/92	PR		Trichloroethene	<10.0	ug/L

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LIENT RESULTS SUMMARY REPORT
UPLICATE ORIGINAL

AMARONECK

NNMARIE SORENA, NNJ X 210
PI Project Manager:

Project #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
1547-021-T52	92-01463-N	S3	04/29/92	05/03/92	PR	VOA-W	Trichlorofluoromethane	<10.0	ug/L
				05/03/92	PR		Vinyl chloride	<10.0	ug/L
				05/04/92	PR		Acetone	1595.888	ug/L
				05/03/92	PR		Carbon Disulfide	<10.0	ug/L
				05/03/92	PR		2-Butanone	<10.0	ug/L
				05/03/92	PR		Vinyl Acetate	<10.0	ug/L
				05/03/92	PR		2-Hexanone	<10.0	ug/L
				05/03/92	PR		4-Methyl-2-Pentanone	2.70J	ug/L
				05/03/92	PR		Styrene	<10.0	ug/L
				05/03/92	PR		M,P-Xylene	<10.0	ug/L
				05/03/92	PR		O-Xylene	<10.0	ug/L
				05/03/92	PR		Dichlorodifluoromethane	<10.0	ug/L
				05/03/92	PR		Methyl-Tert Butyl Ether	1.04J	ug/L
				05/03/92	PR		1,2,4-Trimethylbenzene	<10.0	ug/L
				05/03/92	PR		Cis-1,2-Dichloroethene	<10.0	ug/L
				05/03/92	PR		Ethyl Methacrylate	<10.0	ug/L
				05/03/92	PR		1,2,3-Trichloropropene	<10.0	ug/L
				05/03/92	PR		1,4-Dichloro-2-butene	<10.0	ug/L

1547-021-T52	92-01464-N	S4	04/29/92	05/03/92	PR	VOA-W	Benzene	<10.0	ug/L
				05/03/92	PR		Bromodichloromethane	<10.0	ug/L

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LIENT RESULTS SUMMARY REPORT
UPLICATE ORIGINAL

AMARONECK

NNMARIE SORENA, NNJ X 210
PI Project Manager:

Project #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
1547-021-T52	92-01464-N	S4	04/29/92	05/03/92	PR	VOA-W	Bromoform	<10.0	ug/L
				05/03/92	PR		Bromomethane	<10.0	ug/L
				05/03/92	PR		Carbon tetrachloride	<10.0	ug/L
				05/03/92	PR		Chlorobenzene	<10.0	ug/L
				05/03/92	PR		Chloroethane	<10.0	ug/L
				05/03/92	PR		2-Chloroethylvinyl ether	<10.0	ug/L
				05/03/92	PR		Chloroform	<10.0	ug/L
				05/03/92	PR		Chloromethane	<10.0	ug/L
				05/03/92	PR		Dibromochloromethane	<10.0	ug/L
				05/03/92	PR		1,2-Dichlorobenzene	<10.0	ug/L
				05/03/92	PR		1,3-Dichlorobenzene	<10.0	ug/L
				05/03/92	PR		1,4-Dichlorobenzene	<10.0	ug/L
				05/03/92	PR		1,1-Dichloroethane	<10.0	ug/L
				05/03/92	PR		1,2-Dichloroethane	<10.0	ug/L
				05/03/92	PR		1,1-Dichloroethene	<10.0	ug/L
				05/03/92	PR		Trans-1,2-Dichloroethene	<10.0	ug/L
				05/03/92	PR		1,2-Dichloropropane	<10.0	ug/L
				05/03/92	PR		Cis-1,3-Dichloropropene	<10.0	ug/L
				05/03/92	PR		Trans-1,3-Dichloropropene	<10.0	ug/L
				05/03/92	PR		Ethylbenzene	<10.0	ug/L
				05/03/92	PR		Methylene chloride	<10.0	ug/L
				05/03/92	PR		1,1,2,2-Tetrachloroethane	<10.0	ug/L

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LIENT RESULTS SUMMARY REPORT
UPLICATE ORIGINAL

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ANNMARIE SORENA, NNJ X 210
MPI Project Manager:

Project #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
1547-021-T52	92-01464-N	S4	04/29/92	05/03/92	PR	VOA-W	Tetrachloroethene	<10.0	ug/L
				05/03/92	PR		Toluene	8.05J	ug/L
				05/03/92	PR		1,1,1-Trichloroethane	<10.0	ug/L
				05/03/92	PR		1,1,2-Trichloroethane	<10.0	ug/L
				05/03/92	PR		Trichloroethene	<10.0	ug/L
				05/03/92	PR		Trichlorofluoromethane	<10.0	ug/L
				05/03/92	PR		Vinyl chloride	<10.0	ug/L
				05/07/92	PR		Acetone	1093.13B	ug/L
				05/03/92	PR		Carbon Disulfide	<10.0	ug/L
				05/03/92	PR		2-Butanone	<10.0	ug/L
				05/03/92	PR		Vinyl Acetate	<10.0	ug/L
				05/03/92	PR		2-Hexanone	<10.0	ug/L
				05/03/92	PR		4-Methyl-2-Pentanone	2.40J	ug/L
				05/03/92	PR		Styrene	<10.0	ug/L
				05/03/92	PR		M,P-Xylene	<10.0	ug/L
				05/03/92	PR		O-Xylene	<10.0	ug/L
				05/03/92	PR		Dichlorodifluoromethane	<10.0	ug/L
				05/03/92	PR		Methyl-Tert Butyl Ether	<10.0	ug/L
				05/03/92	PR		1,2,4-Trimethylbenzene	<10.0	ug/L
				05/03/92	PR		Cis-1,2-Dichloroethene	<10.0	ug/L
				05/03/92	PR		Ethyl Methacrylate	<10.0	ug/L
				05/03/92	PR		1,2,3-Trichloropropane	<10.0	ug/L

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.IENT RESULTS SUMMARY REPORT
JPLICATE ORIGINAL

AMARONECK

NNMARIE SORENA, MMJ X 210
PI Project Manager:

Project #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
1547-021-T52	92-01464-N	S4	04/29/92	05/03/92	PR	VOA-W	1,4-Dichloro-2-butene	<10.0	ug/L
1547-021-T52	92-01465-N	S5	04/29/92	05/03/92	PR	VOA-W	Benzene	<10.0	ug/L
				05/03/92	PR		Bromodichloromethane	<10.0	ug/L
				05/03/92	PR		Bromoform	<10.0	ug/L
				05/03/92	PR		Bromomethane	<10.0	ug/L
				05/03/92	PR		Carbon tetrachloride	<10.0	ug/L
				05/03/92	PR		Chlorobenzene	<10.0	ug/L
				05/03/92	PR		Chloroethane	<10.0	ug/L
				05/03/92	PR		2-Chloroethylvinyl ether	<10.0	ug/L
				05/03/92	PR		Chloroform	<10.0	ug/L
				05/03/92	PR		Chloromethane	<10.0	ug/L
				05/03/92	PR		Dibromochloromethane	<10.0	ug/L
				05/03/92	PR		1,2-Dichlorobenzene	<10.0	ug/L
				05/03/92	PR		1,3-Dichlorobenzene	<10.0	ug/L
				05/03/92	PR		1,4-Dichlorobenzene	<10.0	ug/L
				05/03/92	PR		1,1-Dichloroethane	<10.0	ug/L
				05/03/92	PR		1,2-Dichloroethane	<10.0	ug/L
				05/03/92	PR		1,1-Dichloroethene	<10.0	ug/L
				05/03/92	PR		Trans-1,2-Dichloroethene	<10.0	ug/L
				05/03/92	PR		1,2-Dichloropropane	<10.0	ug/L

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ENT RESULTS SUMMARY REPORT
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NMARIE SORENA, NNJ X 210
'1 Project Manager:

roject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
547-021-T52	92-01465-W	S5	04/29/92	05/03/92	PR	VOA-W	Cis-1,3-Dichloropropene	<10.0	ug/L
				05/03/92	PR		Trans-1,3-Dichloropropene	<10.0	ug/L
				05/03/92	PR		Ethylbenzene	<10.0	ug/L
				05/03/92	PR		Methylene chloride	<10.0	ug/L
				05/03/92	PR		1,1,2,2-Tetrachloroethane	<10.0	ug/L
				05/03/92	PR		Tetrachloroethene	<10.0	ug/L
				05/03/92	PR		Toluene	9.47J	ug/L
				05/03/92	PR		1,1,1-Trichloroethane	<10.0	ug/L
				05/03/92	PR		1,1,2-Trichloroethane	<10.0	ug/L
				05/03/92	PR		Trichloroethene	<10.0	ug/L
				05/03/92	PR		Trichlorofluoromethane	<10.0	ug/L
				05/03/92	PR		Vinyl chloride	<10.0	ug/L
				05/04/92	PR		Acetone	1018.25B	ug/L
				05/03/92	PR		Carbon Disulfide	<10.0	ug/L
				05/03/92	PR		2-Butanone	<10.0	ug/L
				05/03/92	PR		Vinyl Acetate	<10.0	ug/L
				05/03/92	PR		2-Hexanone	<10.0	ug/L
				05/03/92	PR		4-Methyl-2-Pentanone	2.19J	ug/L
				05/03/92	PR		Styrene	<10.0	ug/L
				05/03/92	PR		M,P-Xylene	<10.0	ug/L
				05/03/92	PR		O-Xylene	1.88J	ug/L
				05/03/92	PR		Dichlorodifluoromethane	<10.0	ug/L

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LIENT RESULTS SUMMARY REPORT
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NNMARIE SORENA, MMJ X 210
PI Project Manager:

Project #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
1547-021-T52	92-01465-N	S5	04/29/92	05/03/92	PR	VOA-W	Methyl-Tert Butyl Ether	<10.0	ug/L
				05/03/92	PR		1,2,4-Trimethylbenzene	4.06J	ug/L
				05/03/92	PR		Cis-1,2-Dichloroethene	<10.0	ug/L
				05/03/92	PR		Ethyl Methacrylate	<10.0	ug/L
				05/03/92	PR		1,2,3-Trichloropropane	<10.0	ug/L
				05/03/92	PR		1,4-Dichloro-2-butene	<10.0	ug/L
1547-021-T52	92-01466-N	S6	04/29/92	05/04/92	SN	VOA-W	Benzene	<50.0	ug/L
				05/04/92	SN		Bromodichloromethane	<50.0	ug/L
				05/04/92	SN		Bromoform	<50.0	ug/L
				05/04/92	SN		Bromomethane	<50.0	ug/L
				05/04/92	SN		Carbon tetrachloride	<50.0	ug/L
				05/04/92	SN		Chlorobenzene	<50.0	ug/L
				05/04/92	SN		Chloroethane	<50.0	ug/L
				05/04/92	SN		2-Chloroethylvinyl ether	<50.0	ug/L
				05/04/92	SN		Chloroform	<50.0	ug/L
				05/04/92	SN		Chloromethane	<50.0	ug/L
				05/04/92	SN		Dibromochloromethane	<50.0	ug/L
				05/04/92	SN		1,2-Dichlorobenzene	<50.0	ug/L
				05/04/92	SN		1,3-Dichlorobenzene	<50.0	ug/L
				05/04/92	SN		1,4-Dichlorobenzene	<50.0	ug/L

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IENT RESULTS SUMMARY REPORT
PLICATE ORIGINAL

MARONECK

INMARIE SORENA, NNJ X 210
PI Project Manager:

roject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
547-021-T52	92-01466-N	S6	04/29/92	05/04/92	SN	VOA-W	1,1-Dichloroethane	<50.0	ug/L
				05/04/92	SN		1,2-Dichloroethane	<50.0	ug/L
				05/04/92	SN		1,1-Dichloroethene	<50.0	ug/L
				05/04/92	SN		Trans-1,2-Dichloroethene	<50.0	ug/L
				05/04/92	SN		1,2-Dichloropropane	<50.0	ug/L
				05/04/92	SN		Cis-1,3-Dichloropropene	<50.0	ug/L
				05/04/92	SN		Trans-1,3-Dichloropropene	<50.0	ug/L
				05/04/92	SN		Ethylbenzene	<50.0	ug/L
				05/04/92	SN		Methylene chloride	12.97BJ	ug/L
				05/04/92	SN		1,1,2,2-Tetrachloroethane	<50.0	ug/L
				05/04/92	SN		Tetrachloroethene	<50.0	ug/L
				05/04/92	SN		Toluene	<50.0	ug/L
				05/04/92	SN		1,1,1-Trichloroethane	<50.0	ug/L
				05/04/92	SN		1,1,2-Trichloroethane	<50.0	ug/L
				05/04/92	SN		Trichloroethene	<50.0	ug/L
				05/04/92	SN		Trichlorofluoromethane	<50.0	ug/L
				05/04/92	SN		Vinyl chloride	<50.0	ug/L
				05/04/92	SN		Acetone	1104.06B	ug/L
				05/04/92	SN		Carbon Disulfide	<50.0	ug/L
				05/04/92	SN		2-Butanone	<50.0	ug/L
				05/04/92	SN		Vinyl Acetate	<50.0	ug/L
				05/04/92	SN		2-Hexanone	<50.0	ug/L

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ENT RESULTS SUMMARY REPORT
LICATE ORIGINAL

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MARIE SORENA, MNJ X 210
I Project Manager:

oject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
47-021-T52	92-01466-N	S6	04/29/92	05/04/92	SN	VOA-W	4-Methyl-2-Pentanone	<50.0	ug/L
				05/04/92	SN		Styrene	<50.0	ug/L
				05/04/92	SN		M,P-Xylene	<50.0	ug/L
				05/04/92	SN		O-Xylene	<50.0	ug/L
				05/04/92	SN		Dichlorodifluoromethane	<50.0	ug/L
				05/04/92	SN		Methyl-Tert Butyl Ether	<50.0	ug/L
				05/04/92	SN		1,2,4-Trimethylbenzene	<50.0	ug/L
				05/04/92	SN		Cis-1,2-Dichloroethene	<50.0	ug/L
				05/04/92	SN		Ethyl Methacrylate	<50.0	ug/L
				05/04/92	SN		1,2,3-Trichloropropane	<50.0	ug/L
				05/04/92	SN		1,4-Dichloro-2-butene	<50.0	ug/L

547-021-T52	92-01467-N	S7	04/29/92	05/04/92	SN	VOA-W	Benzene	<50.0	ug/L
				05/04/92	SN		Bromodichloromethane	<50.0	ug/L
				05/04/92	SN		Bromoform	<50.0	ug/L
				05/04/92	SN		Bromomethane	<50.0	ug/L
				05/04/92	SN		Carbon tetrachloride	<50.0	ug/L
				05/04/92	SN		Chlorobenzene	<50.0	ug/L
				05/04/92	SN		Chloroethane	<50.0	ug/L
				05/04/92	SN		2-Chloroethylvinyl ether	<50.0	ug/L
				05/04/92	SN		Chloroform	<50.0	ug/L

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IENT RESULTS SUMMARY REPORT
LICATE ORIGINAL

MARONECK

NMARIE SORENA, NNJ X 210
I Project Manager:

oject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
547-021-T52	92-01467-N	S7	04/29/92	05/04/92	SN	VOA-W	Chloromethane	<50.0	ug/L
				05/04/92	SN		Dibromochloromethane	<50.0	ug/L
				05/04/92	SN		1,2-Dichlorobenzene	<50.0	ug/L
				05/04/92	SN		1,3-Dichlorobenzene	<50.0	ug/L
				05/04/92	SN		1,4-Dichlorobenzene	<50.0	ug/L
				05/04/92	SN		1,1-Dichloroethane	<50.0	ug/L
				05/04/92	SN		1,2-Dichloroethane	<50.0	ug/L
				05/04/92	SN		1,1-Dichloroethene	<50.0	ug/L
				05/04/92	SN		Trans-1,2-Dichloroethene	<50.0	ug/L
				05/04/92	SN		1,2-Dichloropropane	<50.0	ug/L
				05/04/92	SN		Cis-1,3-Dichloropropene	<50.0	ug/L
				05/04/92	SN		Trans-1,3-Dichloropropene	<50.0	ug/L
				05/04/92	SN		Ethylbenzene	<50.0	ug/L
				05/04/92	SN		Methylene chloride	13.52BJ	ug/L
				05/04/92	SN		1,1,2,2-Tetrachloroethane	<50.0	ug/L
				05/04/92	SN		Tetrachloroethene	<50.0	ug/L
				05/04/92	SN		Toluene	8.61J	ug/L
				05/04/92	SN		1,1,1-Trichloroethane	<50.0	ug/L
				05/04/92	SN		1,1,2-Trichloroethane	<50.0	ug/L
				05/04/92	SN		Trichloroethene	<50.0	ug/L
				05/04/92	SN		Trichlorofluoromethane	<50.0	ug/L
				05/04/92	SN		Vinyl chloride	<50.0	ug/L

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ENT RESULTS SUMMARY REPORT
LICATE ORIGINAL

ARONECK

MARIE SORENA, MNJ X 210
I Project Manager:

oject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
47-021-T52	92-01467-N	S7	04/29/92	05/04/92	SN	VOA-W	Acetone	1223.588	ug/L
				05/04/92	SN		Carbon Disulfide	<50.0	ug/L
				05/04/92	SN		2-Butanone	<50.0	ug/L
				05/04/92	SN		Vinyl Acetate	<50.0	ug/L
				05/04/92	SN		2-Hexanone	<50.0	ug/L
				05/04/92	SN		4-Methyl-2-Pentanone	<50.0	ug/L
				05/04/92	SN		Styrene	<50.0	ug/L
				05/04/92	SN		M,P-Xylene	<50.0	ug/L
				05/04/92	SN		O-Xylene	<50.0	ug/L
				05/04/92	SN		Dichlorodifluoromethane	<50.0	ug/L
				05/04/92	SN		Methyl-Tert Butyl Ether	<50.0	ug/L
				05/04/92	SN		1,2,4-Trimethylbenzene	<50.0	ug/L
				05/04/92	SN		Cis-1,2-Dichloroethene	<50.0	ug/L
				05/04/92	SN		Ethyl Methacrylate	<50.0	ug/L
				05/04/92	SN		1,2,3-Trichloropropane	<50.0	ug/L
				05/04/92	SN		1,4-Dichloro-2-butene	<50.0	ug/L
1547-021-T52	92-01468-N	S8	04/29/92	05/04/92	SN	VOA-W	Benzene	<50.0	ug/L
				05/04/92	SN		Bromodichloromethane	<50.0	ug/L
				05/04/92	SN		Bromoform	<50.0	ug/L
				05/04/92	SN		Bromomethane	<50.0	ug/L

APPROVED BY: ____________ DATE: ________

ENT RESULTS SUMMARY REPORT
LICATE ORIGINAL

ARONECK

NMARIE SORENA, NNJ X 210
I Project Manager:

oject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
547-021-T52	92-01468-N	S8	04/29/92	05/04/92	SN	VOA-W	Carbon tetrachloride	<50.0	ug/L
				05/04/92	SN		Chlorobenzene	<50.0	ug/L
				05/04/92	SN		Chloroethane	<50.0	ug/L
				05/04/92	SN		2-Chloroethylvinyl ether	<50.0	ug/L
				05/04/92	SN		Chloroform	<50.0	ug/L
				05/04/92	SN		Chloromethane	<50.0	ug/L
				05/04/92	SN		Dibromochloromethane	<50.0	ug/L
				05/04/92	SN		1,2-Dichlorobenzene	<50.0	ug/L
				05/04/92	SN		1,3-Dichlorobenzene	<50.0	ug/L
				05/04/92	SN		1,4-Dichlorobenzene	<50.0	ug/L
				05/04/92	SN		1,1-Dichloroethane	<50.0	ug/L
				05/04/92	SN		1,2-Dichloroethane	<50.0	ug/L
				05/04/92	SN		1,1-Dichloroethene	<50.0	ug/L
				05/04/92	SN		Trans-1,2-Dichloroethene	<50.0	ug/L
				05/04/92	SN		1,2-Dichloropropane	<50.0	ug/L
				05/04/92	SN		Cis-1,3-Dichloropropene	<50.0	ug/L
				05/04/92	SN		Trans-1,3-Dichloropropene	<50.0	ug/L
				05/04/92	SN		Ethylbenzene	<50.0	ug/L
				05/04/92	SN		Methylene chloride	12.07BJ	ug/L
				05/04/92	SN		1,1,2,2-Tetrachloroethane	<50.0	ug/L
				05/04/92	SN		Tetrachloroethene	<50.0	ug/L
				05/04/92	SN		Toluene	<50.0	ug/L

APPROVED BY: ____________ DATE: ________

MALCOLM PIRNIE, INC.
ENVIRONMENTAL LABORATORY
707 OLD SAWMILL RIVER ROAD
TARRYTOWN, NY 10591
(914) 345-5930

NT RESULTS SUMMARY REPORT
ICATE ORIGINAL

RONECK

MARIE SORENA, NNJ X 210
Project Manager:

ject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
7-021-152	92-01468-N	S8	04/29/92	05/04/92	SN	VOA-W	1,1,1-Trichloroethane	<50.0	ug/L
				05/04/92	SN		1,1,2-Trichloroethane	<50.0	ug/L
				05/04/92	SN		Trichloroethene	<50.0	ug/L
				05/04/92	SN		Trichlorofluoromethane	<50.0	ug/L
				05/04/92	SN		Vinyl chloride	<50.0	ug/L
				05/04/92	SN		Acetone	1159.038	ug/L
				05/04/92	SN		Carbon Disulfide	<50.0	ug/L
				05/04/92	SN		2-Butanone	<50.0	ug/L
				05/04/92	SN		Vinyl Acetate	<50.0	ug/L
				05/04/92	SN		2-Hexanone	<50.0	ug/L
				05/04/92	SN		4-Methyl-2-Pentanone	<50.0	ug/L
				05/04/92	SN		Styrene	<50.0	ug/L
				05/04/92	SN		M,P-Xylene	<50.0	ug/L
				05/04/92	SN		O-Xylene	<50.0	ug/L
				05/04/92	SN		Dichlorodifluoromethane	<50.0	ug/L
				05/04/92	SN		Methyl-Tert Butyl Ether	<50.0	ug/L
				05/04/92	SN		1,2,4-Trimethylbenzene	<50.0	ug/L
				05/04/92	SN		Cis-1,2-Dichloroethene	<50.0	ug/L
				05/04/92	SN		Ethyl Methacrylate	<50.0	ug/L
				05/04/92	SN		1,2,3-Trichloropropane	<50.0	ug/L
				05/04/92	SN		1,4-Dichloro-2-butene	<50.0	ug/L

PROVED BY: ________________ DATE: __________

ENT RESULTS SUMMARY REPORT
LICATE ORIGINAL

ARONECK

MARIE SORENA, NNJ X 210
Project Manager:

ject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
47-021-T52	92-01469-N	S9	04/29/92	05/06/92	PR	VOA-W	Benzene	<10.0	ug/L
				05/06/92	PR		Bromodichloromethane	<10.0	ug/L
				05/06/92	PR		Bromoform	<10.0	ug/L
				05/06/92	PR		Bromomethane	<10.0	ug/L
				05/06/92	PR		Carbon tetrachloride	<10.0	ug/L
				05/06/92	PR		Chlorobenzene	<10.0	ug/L
				05/06/92	PR		Chloroethane	<10.0	ug/L
				05/06/92	PR		2-Chloroethylvinyl ether	<10.0	ug/L
				05/06/92	PR		Chloroform	<10.0	ug/L
				05/06/92	PR		Chloromethane	<10.0	ug/L
				05/06/92	PR		Dibromochloromethane	<10.0	ug/L
				05/06/92	PR		1,2-Dichlorobenzene	<10.0	ug/L
				05/06/92	PR		1,3-Dichlorobenzene	<10.0	ug/L
				05/06/92	PR		1,4-Dichlorobenzene	<10.0	ug/L
				05/06/92	PR		1,1-Dichloroethane	<10.0	ug/L
				05/06/92	PR		1,2-Dichloroethane	<10.0	ug/L
				05/06/92	PR		1,1-Dichloroethene	<10.0	ug/L
				05/06/92	PR		Trans-1,2-Dichloroethene	<10.0	ug/L
				05/06/92	PR		1,2-Dichloropropane	<10.0	ug/L
				05/06/92	PR		Cis-1,3-Dichloropropene	<10.0	ug/L
				05/06/92	PR		Trans-1,3-Dichloropropene	<10.0	ug/L

PPROVED BY: ____________ DATE: ________

MALCOLM PIRNIE

ENT RESULTS SUMMARY REPORT
LICATE ORIGINAL

ARONECK

MARIE SORENA, MMJ X 210
I Project Manager:

oject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
47-021-T52	92-01469-N	S9	04/29/92	05/06/92	PR	VOA-W	Ethylbenzene	<10.0	ug/L
				05/06/92	PR		Methylene chloride	5.18J	ug/L
				05/06/92	PR		1,1,2,2-Tetrachloroethane	<10.0	ug/L
				05/06/92	PR		Tetrachloroethene	<10.0	ug/L
				05/06/92	PR		Toluene	7.83J	ug/L
				05/06/92	PR		1,1,1-Trichloroethane	<10.0	ug/L
				05/06/92	PR		1,1,2-Trichloroethane	<10.0	ug/L
				05/06/92	PR		Trichloroethene	<10.0	ug/L
				05/06/92	PR		Trichlorofluoromethane	<10.0	ug/L
				05/06/92	PR		Vinyl chloride	<10.0	ug/L
				05/07/92	PR		Acetone	899.98B	ug/L
				05/06/92	PR		Carbon Disulfide	<10.0	ug/L
				05/06/92	PR		2-Butanone	<10.0	ug/L
				05/06/92	PR		Vinyl Acetate	<10.0	ug/L
				05/06/92	PR		2-Hexanone	<10.0	ug/L
				05/06/92	PR		4-Methyl-2-Pentanone	<10.0	ug/L
				05/06/92	PR		Styrene	<10.0	ug/L
				05/06/92	PR		M,P-Xylene	<10.0	ug/L
				05/06/92	PR		O-Xylene	<10.0	ug/L
				05/06/92	PR		Dichlorodifluoromethane	<10.0	ug/L
				05/06/92	PR		Methyl-Tert Butyl Ether	<10.0	ug/L
				05/06/92	PR		1,2,4-Trimethylbenzene	<10.0	ug/L

APPROVED BY: ______________ DATE: ________

MALCOLM PIRNIE, INC.
ENVIRONMENTAL LABORATORY
707 OLD SAWMILL RIVER ROAD
TARRYTOWN, NY 10591
(914) 345-5930

NT RESULTS SUMMARY REPORT
ICATE ORIGINAL

ARONECK

MARIE SORENA, NNJ X 210
Project Manager:

oject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
7-021-T52	92-01469-W	S9	04/29/92	05/06/92	PR	VOA-W	Cis-1,2-Dichloroethene	<10.0	ug/L
				05/06/92	PR		Ethyl Methacrylate	<10.0	ug/L
				05/06/92	PR		1,2,3-Trichloropropane	<10.0	ug/L
				05/06/92	PR		1,4-Dichloro-2-butene	<10.0	ug/L

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0 Records Processed

APPROVED BY: ________________ DATE: _________

```
                                      QUANT REPORT                          Page  1

                                      Quant Rev: 7     Quant Time:   920504 16:20
Operator ID: SHARON                                   Injected at:   920504 14:43
Output File: >X3250::QC                           Dilution Factor:        1.00000
Data File:   >X3250::D4                             Instrument ID:   #2 VOA
Name: BLANK
Misc:

ID File: IDW824::SS
Title: Daily Calibration via Single Point at 50 ug/L .
                                                   Last Qcal Time: 920504 13:22
Last Calibration: 920416 08:19

                                      R.T. Q ion    Area      Conc     Units    q
            Compound                  ----- -----  --------  --------  ------- ---
      ------------------------------
  1) *Bromochloromethane               7.84 128.0     32714     50.00  ug/L     74
 10)  Methylene Chloride               5.28  84.0      1705      2.32J ug/L     41
 11)  Acetone                          4.63  43.0      3411     22.63  ug/L     90
 20)  1,2-Dichloroethane-d4(surr.)     8.85  65.0     49833     49.20  ug/L     96
 21) *1,4-Difluorobenzene              9.70 114.0    124723     50.00  ug/L     89
 38) *Chlorobenzene-d5                15.28 117.0     99139     50.00  ug/L     85
 51)  Bromofluorobenzene(surr.)       17.83  95.0     82581     49.77  ug/L     87
 52)  Toluene-d8(surr.)               12.41  98.0    100846     50.45  ug/L     99

* Compound is ISTD
```

This blank pertains to
aqueous volatile samples
analyzed on 5/4/92

```
                                   QUANT REPORT                          Page  1

                                   Quant Rev: 7    Quant Time:  920503 11:08
Operator ID: PHTSY                                 Injected at:  920503 10:36
Output File: ^X3230::QC                        Dilution Factor:     1.00000
Data File:   >X3230::04                          Instrument ID:  #2 VOA
Name: BLANK
Misc:

ID File: IDW824::SS
Title: Daily Calibration via Single Point at 50 ug/L .
Last Calibration: 920416 08:19               Last Qcal Time: 920503 09:59


                Compound                R.T.  Q ion    Area      Conc    Units    q
       ------------------------------  ----- -----  --------  --------  -------  ---
  1) *Bromochloromethane                7.84 128.0     30925     50.00  ug/L
 10)  Methylene Chloride                5.28  84.0      1497      2.12J ug/L
 11)  Acetone                           4.58  43.0      1141      8.60  ug/L
 20)  1,2-Dichloroethane-d4(surr.)      8.84  65.0     46079     48.63  ug/L
 21) *1,4-Difluorobenzene               9.66 114.0    122277     50.00  ug/L
 38) *Chlorobenzene-d5                 15.27 117.0     95323     50.00  ug/L
 51)  Bromofluorobenzene(surr.)        17.83  95.0     78208     50.16  ug/L
 52)  Toluene-d8(surr.)                12.41  98.0     97751     51.19  ug/L

 * Compound is ISTD
```

This blank pertains to
aqueous samples analyzed
on 5/3/92.

```
                                  QUANT REPORT                          Page  1

rator ID: PATSY                   Quant Rev: 7     Quant Time:  920506 10:11
tput File  >X3283::D4                              Injected at:  920506 09 39
e File:    >X3283::D3                          Dilution Factor:       1 00000
e: BLANK                                         Instrument ID:  #2 VOA
sc:

File: ICM824::S3
le: Daily Calibration via Single Point at 50 ug/L
st Calibration: 920416 08:19                  Last Qcal Time: 920506 09:02


             Compound                 R T.  Q ion    Area      Conc     Units    q
    ------------------------------- ----- ----- -------- -------- ------- ---
 1) *Bromochloromethane              7 98  128 0    34142    50.00   ug/L     47
 1)  Acetone                         4 67   43.0     1650    11.27   ug/L     89
     1,2-Dichloroethane-d4(surr )    8 93   65 0    51515    49 03   ug/L     93
 )  *1,4-Difluorobenzene             9.74  114.0   134538    50.00   ug/L     83
 )  *Chlorobenzene-d5               15.36  117.0   106547    50 00   ug/L     85
     Bromofluorobenzene(surr.)      17.92   95.0    86680    51.30   ug/L     85
     Toluene-d8(surr.)              12 49   98 0   107699    52 12   ug/L     98

Compound is ISTD
```

This blank pertains to VOA samples analyzed on ~~5/4/92~~. 5/6/92.

KEY TO REPORT

B--THIS FLAG IS USED WHEN THE ANALYTE IS FOUND IN THE BLANK AS WELL AS THE SAMPLE. IT INDICATES POSSIBLE/PROBABLE CONTAMINATION, AND WARNS THE USER TO TAKE APPROPRIATE ACTION.

J--INDICATES AN ESTIMATED VALUE. THE RESULT IS LESS THAN THE SAMPLE QUANTITATION LIMIT BUT GREATER THAN ZERO.

NES--NOT ENOUGH SAMPLE.

LE--LABORATORY ERROR.

NA--NOT APPLICABLE.

ND--NOT DETECTED

BR--BROKEN UPON RECEIPT

ALCOLM PIRNIE, INC.
NVIRONMENTAL LABORATORY
07 OLD SAW MILL RIVER ROAD
ARRYTOWN, NY 10591
EL. 914-345-8230
AX. 914-345-8741

CHAIN OF CUSTODY RECORD

Page 1 of 1

NAME OF CLIENT MAMARONECK
PROJECT NUMBER 1517021 T52
ADDRESS -
CITY - STATE ZIPCODE
CONTACT NAME A. SORENO TEL#

FOR LAB USE ONLY
C.C.R.#
QUOTE #
REPORT #

SAMPLE RECEIVE ☐
SAMPLE LOGGING ☐
SAMPLE DISTRIB. ☐

ROJECT DESCRIPTION: GROUNDWATER TREATABILITY

SAMPLER SIGNATURE: Ann Marie Sorena DATE: 4/29/92

IF SAMPLE(S) REQUIRE SPECIAL QA/QC, CHECK HERE ☐ AND DESCRIBE :

PRESERVATIVE TYPE CHECK(S)
1. HNO3 ☐
2. H2SO4 ☐
3. H3PO4 ☐
4. HCl ☐
5. NaOH ☐
6. Na2SO3 ☐
7. None ☐
8. Other(s): ☐

						NO. OF CONTAINERS												
SAMPLE ID	DESCRIPTION	DATE	TIME	MATRIX	PRESERVATION	Volatiles Organic Compounds	Acid extractable compounds	Base/Neutral Extractable Compounds	Pesticides	PCB's	Herbicides	Cyanide	E.P. Toxicity - Organics	E.P. Toxicity - Inorganics	Phenols	Metals	Others	REMARKS
RAW	92-1460	4/29/92	12:30	LIQ	HCl	X												GIVE VERBAL
S1	92-1461		1:00			X												RESULTS
S2	92-1462		1:30			X												ASAP TO
S3	92-1463		2:00			X												A. SORENA OR
S4	92-1464		2:30			X												J. GOLLISZ IN
S5	92-1465		3:00			X												TREATABILITY
S6	92-1466		3:30			X												
S7	92-1467		4:00			X												
S8	92-1468		4:30			X												
S9	92-1469		5:00			X												

Relinquished by (Signature)	Date	Time	Received by (Signature):	Date	Time	Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time
Ann Marie Sorena	4/29/92	5:05	D. Podolak	4/29/92	5 PM						

Relinquished by (Signature)	Date	Time	Received by (Signature):	Date	Time	REMARKS
						2 week TAT

APPENDIX D
TREATABILITY STUDY - SAND FILTRATION DATA

MALCOLM PIRNIE, INC.
ENVIRONMENTAL LABORATORY
707 OLD SAWMILL RIVER ROAD
TARRYTOWN, NY 10591
(914) 345-5930

IENT RESULTS SUMMARY REPORT
MPLETE ORIGINAL

MARONECK

INMARIE SORENA, NNJ X 210
›I Project Manager:

roject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
547-021-T52	92-01758-N	P1	05/11/92	06/16/92	EA	PEST-W	alpha-BHC	<.052	ug/L
				06/16/92	EA		beta-BHC	<.052	ug/L
				06/16/92	EA		delta-BHC	<.052	ug/L
				06/16/92	EA		gamma-BHC (Lindane)	<.052	ug/L
				06/16/92	EA		Heptachlor	<.052	ug/L
				06/16/92	EA		Aldrin	<.052	ug/L
				06/16/92	EA		Heptachlor epoxide	.008	ug/L
				06/16/92	EA		Endosulfan I	<.052	ug/L
				06/16/92	EA		Dieldrin	.026	ug/L
				06/16/92	EA		4,4'-DDE	<.104	ug/L
				06/16/92	EA		Endrin	<.104	ug/L
				06/16/92	EA		Endosulfan II	<.104	ug/L
				06/16/92	EA		4,4'-DDD	<.104	ug/L
				06/16/92	EA		Endosulfan sulfate	<.104	ug/L
				06/16/92	EA		4,4'-DDT	<.104	ug/L
				06/16/92	EA		Methoxychlor	<.521	ug/L
				06/16/92	EA		Chlordane	<.052	ug/L
				06/16/92	EA		Toxaphene	<5.21	ug/L
				06/16/92	EA		Aroclor-1016	<1.04	ug/L
				06/16/92	EA		Aroclor-1221	<2.08	ug/L
				06/16/92	EA		Aroclor-1232	<1.04	ug/L
				06/16/92	EA		Aroclor-1242	<1.04	ug/L

APPROVED BY: DATE: 6/18/92

MALCOLM PIRNIE, INC.
ENVIRONMENTAL LABORATORY
707 OLD SAWMILL RIVER ROAD
TARRYTOWN, NY 10591
(914) 345-5930

LIENT RESULTS SUMMARY REPORT
OMPLETE ORIGINAL

AMARONECK

NNMARIE SORENA, NNJ X 210
PI Project Manager:

roject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
1547-021-T52	92-01758-W	P1	05/11/92	06/16/92	EA	PEST-W	Aroclor-1248	<1.04	ug/L
				06/16/92	EA		Aroclor-1254	<1.04	ug/L
				06/16/92	EA		Aroclor-1260	<1.04	ug/L
				06/16/92	EA		Endrin Aldehyde	<.104	ug/L
1547-021-T52	92-01759-W	P2	05/11/92	06/16/92	EA	PEST-W	alpha-BHC	.067	ug/L
				06/16/92	EA		beta-BHC	.140	ug/L
				06/16/92	EA		delta-BHC	.064	ug/L
				06/16/92	EA		gamma-BHC (Lindane)	<.052	ug/L
				06/16/92	EA		Heptachlor	<.052	ug/L
				06/16/92	EA		Aldrin	<.052	ug/L
				06/16/92	EA		Heptachlor epoxide	<.052	ug/L
				06/16/92	EA		Endosulfan I	<.052	ug/L
				06/16/92	EA		Dieldrin	.009	ug/L
				06/16/92	EA		4,4'-DDE	<.104	ug/L
				06/16/92	EA		Endrin	<.104	ug/L
				06/16/92	EA		Endosulfan II	<.104	ug/L
				06/16/92	EA		4,4'-DDD	<.104	ug/L
				06/16/92	EA		Endosulfan sulfate	<.104	ug/L
				06/16/92	EA		4,4'-DDT	<.104	ug/L
				06/16/92	EA		Methoxychlor	<.521	ug/L

APPROVED BY: ____________ DATE: ________

MALCOLM PIRNIE, INC.
ENVIRONMENTAL LABORATORY
707 OLD SAWMILL RIVER ROAD
TARRYTOWN, NY 10591
(914) 345-5930

ENT RESULTS SUMMARY REPORT
IPLETE ORIGINAL

ARONECK

NMARIE SORENA, NNJ X 210
I Project Manager:

oject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
547-021-T52	92-01759-N	P2	05/11/92	06/16/92	EA	PEST-W	Chlordane	<.052	ug/L
				06/16/92	EA		Toxaphene	<5.21	ug/L
				06/16/92	EA		Aroclor-1016	<1.04	ug/L
				06/16/92	EA		Aroclor-1221	<2.08	ug/L
				06/16/92	EA		Aroclor-1232	<1.04	ug/L
				06/16/92	EA		Aroclor-1242	<1.04	ug/L
				06/16/92	EA		Aroclor-1248	<1.04	ug/L
				06/16/92	EA		Aroclor-1254	<1.04	ug/L
				06/16/92	EA		Aroclor-1260	<1.04	ug/L
				06/16/92	EA		Endrin Aldehyde	<.104	ug/L
1547-021-T52	92-01760-N	P3	05/11/92	06/16/92	EA	PEST-W	alpha-BHC	.115	ug/L
				06/16/92	EA		beta-BHC	.165	ug/L
				06/16/92	EA		delta-BHC	.055	ug/L
				06/16/92	EA		gamma-BHC (Lindane)	<.052	ug/L
				06/16/92	EA		Heptachlor	<.052	ug/L
				06/16/92	EA		Aldrin	<.052	ug/L
				06/16/92	EA		Heptachlor epoxide	<.052	ug/L
				06/16/92	EA		Endosulfan I	<.052	ug/L
				06/16/92	EA		Dieldrin	.009	ug/L
				06/16/92	EA		4,4'-DDE	<.103	ug/L

APPROVED BY: ______________ DATE: ________

NT RESULTS SUMMARY REPORT
LETE ORIGINAL

ARONECK

MARIE SORENA, NNJ X 210
Project Manager:

oject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
7-021-T52	92-01760-N	P3	05/11/92	06/16/92	EA	PEST-W	Endrin	<.103	ug/L
				06/16/92	EA		Endosulfan II	<.103	ug/L
				06/16/92	EA		4,4'-DDD	<.103	ug/L
				06/16/92	EA		Endosulfan sulfate	<.103	ug/L
				06/16/92	EA		4,4'-DDT	<.103	ug/L
				06/16/92	EA		Methoxychlor	<.515	ug/L
				06/16/92	EA		Chlordane	<.052	ug/L
				06/16/92	EA		Toxaphene	<5.15	ug/L
				06/16/92	EA		Aroclor-1016	<1.03	ug/L
				06/16/92	EA		Aroclor-1221	<2.06	ug/L
				06/16/92	EA		Aroclor-1232	<1.03	ug/L
				06/16/92	EA		Aroclor-1242	<1.03	ug/L
				06/16/92	EA		Aroclor-1248	<1.03	ug/L
				06/16/92	EA		Aroclor-1254	<1.03	ug/L
				06/16/92	EA		Aroclor-1260	<1.03	ug/L
				06/16/92	EA		Endrin Aldehyde	<.103	ug/L

**

PPROVED BY: ________________ DATE: ________

ALCOLM PIRNIE, INC.
WIRONMENTAL LABORATORY
)7 OLD SAW MILL RIVER ROAD
ARRYTOWN, NY 10591
EL. 914-345-8230
AX. 914-345-8741

CHAIN OF CUSTODY RECORD

Page 1 of 1

NAME OF CLIENT · MAMARONECK
PROJECT NUMBER 1547 021 T52
ADDRESS -
CITY - STATE ZIPCODE
CONTACT NAME WARREN PYZNICHOK TEL# WHI

FOR LAB USE ONLY
C.C.R. #
QUOTE #
REPORT #

SAMPLE RECEIVE ☐
SAMPLE LOGGING ☐
SAMPLE DISTRIB. ☐

ROJECT DESCRIPTION: TREATABILITY STUDY
PESTICIDE REMOVAL W/ SAND FILTRATION

SAMPLER SIGNATURE : Ann Marie Sorena DATE: 5/11/92

IF SAMPLE(S) REQUIRE SPECIAL QA/QC, CHECK HERE ☐ AND DESCRIBE :

PRESERVATIVE TYPE CHECK(S)
1. HNO3 ☐
2. H2SO4 ☐
3. H3PO4 ☐
4. HCl ☐
5. NaOH ☐
6. Na2SO3 ☐
7. None ☐
8. Other(s): ☐

NO. OF CONTAINERS

SAMPLE ID	DESCRIPTION	DATE	TIME	MATRIX	PRESERVATION	Volatiles Organic Compounds	Acid extractable compounds	Base/Neutral Extractable Compounds	Pesticides	PCB's	Herbicides	Cyanide	E.P. Toxicity - Organics	E.P. Toxicity - Inorganics	Phenols	Metals	Others	REMARKS
P1	BACKGROUND	5/11/92	10:00	LIQ	7				1	1								92-1758
P2	RAW	/	10:30	LIQ	7				1	1								1759
P3	FINAL	/	10:45	LIQ	7				1	1								1760

Relinquished by (Signature)	Date	Time	Received by (Signature):	Date	Time	Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time
Ann Marie Sorena	5/11/92	11:00	N. Podolak	5/11/92	2pm						
Relinquished by (Signature)	Date	Time	Received by (Signature):	Date	Time	REMARKS					

FORM-APL # 002 1/90

APPENDIX E
TREATABILITY STUDY - BIOLOGICAL DATA

NT RESULTS SUMMARY REPORT
sion Notes: COMPLETE ORIGINAL

\RONECK

tact: ANNMARIE SORENA, NNJ X 210
Project Manager:

Group: INORGANICS

ject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
7-021-T52	92-01894-N	INFLUENT	05/19/92	05/24/92	TM	BOD5	Biochem O2 Demand 5	80.5	mg/L
7-021-T52	92-01894-N	INFLUENT	05/19/92	06/25/92	TM	PTOT	Phosphorous, total	<0.04	mg/l
7-021-T52	92-01894-N	INFLUENT	05/19/92	06/29/92	SUB	TOC	Total Organic Carbon	34	mg/L
47-021-T52	92-01895-N	RCTR1-EFFL	05/19/92	05/24/92	TM	BOD5	Biochem O2 Demand 5	<2.00	mg/L
47-021-T52	92-01895-N	RCTR1-EFFL	05/19/92	06/25/92	TM	PTOT	Phosphorous, total	<0.04	mg/l
47-021-T52	92-01895-N	RCTR1-EFFL	05/19/92	06/29/92	SUB	TOC	Total Organic Carbon	29	mg/L
47-021-T52	92-01896-N	TCTR2-EFFL	05/19/92	05/24/92	TM	BOD5	Biochem O2 Demand 5	89.5	mg/L
47-021-T52	92-01896-N	TCTR2-EFFL	05/19/92	06/25/92	TM	PTOT	Phosphorous, total	<0.04	mg/l
47-021-T52	92-01896-N	TCTR2-EFFL	05/19/92	06/29/92	SUB	TOC	Total Organic Carbon	29	mg/L

IALCOLM PIRNIE, INC.
NVIRONMENTAL LABORATORY
07 OLD SAW MILL RIVER ROAD
ARRYTOWN, NY 10591
EL. 914-345-8230
AX. 914-345-8741

CHAIN OF CUSTODY RECORD

Page 1 of 1

NAME OF CLIENT MAMARONECK
PROJECT NUMBER 1547-021-TS2
ADDRESS –
CITY – STATE – ZIPCODE –
CONTACT NAME T. Gullist TEL# (WD) x 2778
A. Sorrena (WWT) x 210

FOR LAB USE ONLY
C.C.R. #
QUOTE #
REPORT #
SAMPLE RECEIVE ☐
SAMPLE LOGGING ☐
SAMPLE DISTRIB. ☐

'ROJECT DESCRIPTION: Oxid Treatability
Study

SAMPLER SIGNATURE: DATE: 5/19/92

IF SAMPLE(S) REQUIRE SPECIAL QA/QC, CHECK HERE ☐ AND DESCRIBE :

PRESERVATIVE TYPE CHECK(S)
1. HNO3 ☐
2. H2SO4 ☐
3. H3PO4 ☐
4. HCl ☐
5. NaOH ☐
6. Na2SO3 ☐
7. None ☐
8. Other(s): ☐

NO. OF CONTAINERS

SAMPLE ID	DESCRIPTION	DATE	TIME	MATRIX	PRESERVATION	Volatiles Organic Compounds	Acid extractable compounds	Base/Neutral Extractable Compounds	Pesticides	PCB's	Herbicides	Cyanide	E.P. Toxicity - Organics	E.P. Toxicity - Inorganics	Phenols	Metals	Others: BOD / TP & TOC	REMARKS
12-1894	INFLUENT	5/19/92	–	L	H2SO4 for TP & TOC												2	BOD, TOTAL PHOS, TOC
12-1895	RCTR1 EFFL	5/19/92		L													2	
12-1896	RCTR2 EFFL	5/19/92	–	L													2	

Relinquished by (Signature)	Date	Time	Received by (Signature):	Date	Time	Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time
	5/19/92	11:30 AM							W. Podulah	5/19/92	MON
Relinquished by (Signature)	Date	Time	Received by (Signature):	Date	Time	**REMARKS** FOR EACH SAMPLE # --> 2 BOTTLES					

1 BOTTLE FOR BOD, 1 BOTTLE FOR TOT PHOS & TOC.
TOT PHOS & TOC SAMPLES MUST

APPENDIX F
TREATABILITY STUDY - ISOTHERM DATA

ENT RESULTS SUMMARY REPORT
ision Notes:

ARONECK

ntact: ANNMARIE SORENA, NNJ X 210
(Project Manager:

Group: ORGANICS

oject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
47-021-T52	92-01887-N	150THRM-9G1L	05/15/92	05/28/92	PR	VOA-W	Benzene	<10.0	ug/L
				05/28/92	PR		Bromodichloromethane	<10.0	ug/L
				05/28/92	PR		Bromoform	<10.0	ug/L
				05/28/92	PR		Bromomethane	<10.0	ug/L
				05/28/92	PR		Carbon tetrachloride	<10.0	ug/L
				05/28/92	PR		Chlorobenzene	<10.0	ug/L
				05/28/92	PR		Chloroethane	<10.0	ug/L
				05/28/92	PR		2-Chloroethylvinyl ether	<10.0	ug/L
				05/28/92	PR		Chloroform	<10.0	ug/L
				05/28/92	PR		Chloromethane	<10.0	ug/L
				05/28/92	PR		Dibromochloromethane	<10.0	ug/L
				05/28/92	PR		1,2-Dichlorobenzene	<10.0	ug/L
				05/28/92	PR		1,3-Dichlorobenzene	<10.0	ug/L
				05/28/92	PR		1,4-Dichlorobenzene	<10.0	ug/L
				05/28/92	PR		1,1-Dichloroethane	<10.0	ug/L
				05/28/92	PR		1,2-Dichloroethane	<10.0	ug/L
				05/28/92	PR		1,1-Dichloroethene	<10.0	ug/L
				05/28/92	PR		Trans-1,2-Dichloroethene	<10.0	ug/L
				05/28/92	PR		1,2-Dichloropropane	<10.0	ug/L
				05/28/92	PR		Cis-1,3-Dichloropropene	<10.0	ug/L
				05/28/92	PR		Trans-1,3-Dichloropropene	<10.0	ug/L
				05/28/92	PR		Ethylbenzene	<10.0	ug/L
				05/28/92	PR		Methylene chloride	2.02J	ug/L
				05/28/92	PR		1,1,2,2-Tetrachloroethane	<10.0	ug/L
				05/28/92	PR		Tetrachloroethene	<10.0	ug/L

6g/l

ENT RESULTS SUMMARY REPORT
ision Notes:

ARONECK

tact: ANNMARIE SORENA, NNJ X 210
Project Manager:

Group: ORGANICS

ject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
7-021-T52	92-01887-N	150THRM-9G1L	05/15/92	05/28/92	PR	VOA-W	Toluene	<10.0	ug/L
				05/28/92	PR		1,1,1-Trichloroethane	<10.0	ug/L
				05/28/92	PR		1,1,2-Trichloroethane	<10.0	ug/L
				05/28/92	PR		Trichloroethene	<10.0	ug/L
				05/28/92	PR		Trichlorofluoromethane	<10.0	ug/L
				05/28/92	PR		Vinyl chloride	<10.0	ug/L
				05/28/92	PR		Acetone	470.35B	ug/L
				05/28/92	PR		Carbon Disulfide	<10.0	ug/L
				05/28/92	PR		2-Butanone	<10.0	ug/L
				05/28/92	PR		Vinyl Acetate	<10.0	ug/L
				05/28/92	PR		2-Hexanone	<10.0	ug/L
				05/28/92	PR		4-Methyl-2-Pentanone	<10.0	ug/L
				05/28/92	PR		Styrene	<10.0	ug/L
				05/28/92	PR		M,P-Xylene	<10.0	ug/L
				05/28/92	PR		O-Xylene	<10.0	ug/L
				05/28/92	PR		Dichlorodifluoromethane	<10.0	ug/L
				05/28/92	PR		Methyl-Tert Butyl Ether	<10.0	ug/L
				05/28/92	PR		1,2,4-Trimethylbenzene	<10.0	ug/L
				05/28/92	PR		Cis-1,2-Dichloroethene	<10.0	ug/L
				05/28/92	PR		Ethyl Methacrylate	<10.0	ug/L
				05/28/92	PR		1,2,3-Trichloropropane	<10.0	ug/L
				05/28/92	PR		1,4-Dichloro-2-butene	<10.0	ug/L
47-021-T52	92-01887-N	150THRM-9G1L	05/15/92	07/05/92	EA	PEST-W	alpha-BHC	<.081	ug/L
				07/05/92	EA		beta-BHC	<.081	ug/L
				07/05/92	EA		delta-BHC	<.081	ug/L

NT RESULTS SUMMARY REPORT
ision Notes:

ARONECK

tact: ANNMARIE SORENA, NNJ X 210
Project Manager:

Group: ORGANICS

ject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result Units
7-021-T52	92-01887-N	150THRM-9G1L	05/15/92	07/05/92	EA	PEST-W	gamma-BHC (Lindane)	<.081 ug/L
				07/05/92	EA		Heptachlor	<.081 ug/L
				07/05/92	EA		Aldrin	<.081 ug/L
				07/05/92	EA		Heptachlor epoxide	<.081 ug/L
				07/05/92	EA		Endosulfan I	<.081 ug/L
				07/05/92	EA		Dieldrin	<.161 ug/L
				07/05/92	EA		4,4'-DDE	<.161 ug/L
				07/05/92	EA		Endrin	<.161 ug/L
				07/05/92	EA		Endosulfan II	<.161 ug/L
				07/05/92	EA		4,4'-DDD	<.161 ug/L
				07/05/92	EA		Endosulfan sulfate	<.161 ug/L
				07/05/92	EA		4,4'-DDT	<.161 ug/L
				07/05/92	EA		Methoxychlor	<.810 ug/L
				07/05/92	EA		Chlordane	<.081 ug/L
				07/05/92	EA		Toxaphene	<8.10 ug/L
				07/05/92	EA		Aroclor-1016	<1.61 ug/L
				07/05/92	EA		Aroclor-1221	<3.23 ug/L
				07/05/92	EA		Aroclor-1232	<1.61 ug/L
				07/05/92	EA		Aroclor-1242	<1.61 ug/L
				07/05/92	EA		Aroclor-1248	<1.61 ug/L
				07/05/92	EA		Aroclor-1254	<1.61 ug/L
				07/05/92	EA		Aroclor-1260	<1.61 ug/L
				07/05/92	EA		Endrin Aldehyde	<.161 ug/L

ENT RESULTS SUMMARY REPORT
ision Notes:

ARONECK

ntact: ANNMARIE SORENA, NNJ X 210
Project Manager:

Group: ORGANICS

ject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
7-021-T52	92-01888-N	I5OTHRM-CONTROL	05/15/92	05/28/92	PR	VOA-W	Benzene	<10.0	ug/L
				05/28/92	PR		Bromodichloromethane	<10.0	ug/L
				05/28/92	PR		Bromoform	<10.0	ug/L
				05/28/92	PR		Bromomethane	<10.0	ug/L
				05/28/92	PR		Carbon tetrachloride	<10.0	ug/L
				05/28/92	PR		Chlorobenzene	<10.0	ug/L
				05/28/92	PR		Chloroethane	<10.0	ug/L
				05/28/92	PR		2-Chloroethylvinyl ether	<10.0	ug/L
				05/28/92	PR		Chloroform	<10.0	ug/L
				05/28/92	PR		Chloromethane	<10.0	ug/L
				05/28/92	PR		Dibromochloromethane	<10.0	ug/L
				05/28/92	PR		1,2-Dichlorobenzene	<10.0	ug/L
				05/28/92	PR		1,3-Dichlorobenzene	<10.0	ug/L
				05/28/92	PR		1,4-Dichlorobenzene	<10.0	ug/L
				05/28/92	PR		1,1-Dichloroethane	<10.0	ug/L
				05/28/92	PR		1,2-Dichloroethane	<10.0	ug/L
				05/28/92	PR		1,1-Dichloroethene	<10.0	ug/L
				05/28/92	PR		Trans-1,2-Dichloroethene	<10.0	ug/L
				05/28/92	PR		1,2-Dichloropropane	<10.0	ug/L
				05/28/92	PR		Cis-1,3-Dichloropropene	<10.0	ug/L
				05/28/92	PR		Trans-1,3-Dichloropropene	<10.0	ug/L
				05/28/92	PR		Ethylbenzene	<10.0	ug/L
				05/28/92	PR		Methylene chloride	2.04J	ug/L
				05/28/92	PR		1,1,2,2-Tetrachloroethane	<10.0	ug/L
				05/28/92	PR		Tetrachloroethene	<10.0	ug/L

ENT RESULTS SUMMARY REPORT
ision Notes:

ARONECK

tact: ANNMARIE SORENA, NNJ X 210
Project Manager:

Group: ORGANICS

ject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result Units
7-021-T52	92-01888-N	ISOTHRM-CONTROL	05/15/92	05/28/92	PR	VOA-W	Toluene	1.17J ug/L
				05/28/92	PR		1,1,1-Trichloroethane	<10.0 ug/L
				05/28/92	PR		1,1,2-Trichloroethane	<10.0 ug/L
				05/28/92	PR		Trichloroethene	<10.0 ug/L
				05/28/92	PR		Trichlorofluoromethane	<10.0 ug/L
				05/28/92	PR		Vinyl chloride	<10.0 ug/L
				05/28/92	SN		Acetone	1216.39B ug/L
				05/28/92	PR		Carbon Disulfide	<10.0 ug/L
				05/28/92	PR		2-Butanone	<10.0 ug/L
				05/28/92	PR		Vinyl Acetate	<10.0 ug/L
				05/28/92	PR		2-Hexanone	<10.0 ug/L
				05/28/92	PR		4-Methyl-2-Pentanone	<10.0 ug/L
				05/28/92	PR		Styrene	<10.0 ug/L
				05/28/92	PR		M,P-Xylene	<10.0 ug/L
				05/28/92	PR		O-Xylene	<10.0 ug/L
				05/28/92	PR		Dichlorodifluoromethane	<10.0 ug/L
				05/28/92	PR		Acrylonitrile	<10.0 ug/L
				05/28/92	PR		Methyl-Tert Butyl Ether	2.36J ug/L
				05/28/92	PR		1,2,4-Trimethylbenzene	11.40 ug/L
				05/28/92	PR		Cis-1,2-Dichloroethene	<10.0 ug/L
				05/28/92	PR		Ethyl Methacrylate	<10.0 ug/L
				05/28/92	PR		1,2,3-Trichloropropane	<10.0 ug/L
				05/28/92	PR		1,4-Dichloro-2-butene	<10.0 ug/L
				05/28/92	PR		Acrolein	<10.0 ug/L
				05/28/92	PR		1,4-Dioxane	<10.0 ug/L

ENT RESULTS SUMMARY REPORT
/ision Notes:

IARONECK

ntact: ANNMARIE SORENA, NNJ X 210
l Project Manager:

Group: ORGANICS

oject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
47-021-T52	92-01888-N	ISOTHRM-CONTROL	05/15/92	07/11/92	EA	PEST-W	alpha-BHC	.140	ug/L
				07/11/92	EA		beta-BHC	.111	ug/L
				07/11/92	EA		delta-BHC	.192	ug/L
				07/11/92	EA		gamma-BHC (Lindane)	.102	ug/L
				07/11/92	EA		Heptachlor	<.069	ug/L
				07/11/92	EA		Aldrin	<.069	ug/L
				07/11/92	EA		Heptachlor epoxide	<.069	ug/L
				07/11/92	EA		Endosulfan I	<.069	ug/L
				07/11/92	EA		Dieldrin	.0679	ug/L
				07/11/92	EA		4,4'-DDE	<.139	ug/L
				07/11/92	EA		Endrin	<.139	ug/L
				07/11/92	EA		Endosulfan II	<.139	ug/L
				07/11/92	EA		4,4'-DDD	<.139	ug/L
				07/11/92	EA		Endosulfan sulfate	<.139	ug/L
				07/11/92	EA		4,4'-DDT	<.139	ug/L
				07/11/92	EA		Methoxychlor	<.694	ug/L
				07/11/92	EA		Chlordane	<.069	ug/L
				07/11/92	EA		Toxaphene	<6.94	ug/L
				07/11/92	EA		Aroclor-1016	<1.39	ug/L
				07/11/92	EA		Aroclor-1221	<2.78	ug/L
				07/11/92	EA		Aroclor-1232	<1.39	ug/L
				07/11/92	EA		Aroclor-1242	<1.39	ug/L
				07/11/92	EA		Aroclor-1248	<1.39	ug/L
				07/11/92	EA		Aroclor-1254	<1.39	ug/L
				07/11/92	EA		Aroclor-1260	<1.39	ug/L

ENT RESULTS SUMMARY REPORT
ision Notes:

ARONECK

tact: ANNMARIE SORENA, NNJ X 210
Project Manager:

Group: ORGANICS

ject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result	Units
7-021-T52	92-01888-N	150THRM-CONTROL	05/15/92	07/11/92	EA	PEST-W	Endrin Aldehyde	<.139	ug/L

ENT RESULTS SUMMARY REPORT
ision Notes:

ARONECK

tact: ANNMARIE SORENA, NNJ X 210
Project Manager:

Group: INORGANICS

ject #	Lab Id	Client Id	Date Sampled	Date Analyzed	By	Analysis	Parameter	Result Units
47-021-T52	92-01883-N	150THRM-1G1L	05/15/92	06/03/92	ND	COD	Chemical Ox. Demand	52.2 mg/l
47-021-T52	92-01883-N	150THRM-1G1L	05/15/92	06/29/92	SUB	TOC	Total Organic Carbon	9.5 mg/L

47-021-T52	92-01884-N	150THRM-3G1L	05/15/92	06/03/92	ND	COD	Chemical Ox. Demand	30.08 mg/l
47-021-T52	92-01884-N	150THRM-3G1L	05/15/92	06/29/92	SUB	TOC	Total Organic Carbon	2.8 mg/L

47-021-T52	92-01885-N	150THRM-10G1L	05/15/92	06/03/92	ND	COD	Chemical Ox. Demand	27.8 mg/l
47-021-T52	92-01885-N	150THRM-10G1L	05/15/92	06/29/92	SUB	TOC	Total Organic Carbon	3.2 mg/L

47-021-T52	92-01886-N	150THRM-15H1L	05/15/92	06/03/92	ND	COD	Chemical Ox. Demand	30.8 mg/l
47-021-T52	92-01886-N	150THRM-15H1L	05/15/92	06/29/92	SUB	TOC	Total Organic Carbon	2.1 mg/L

```
                              QUANT REPORT                       Page  1

 ator ID: PATSY               Quant Rev: 7    Quant Time: 920528 08:55
tput File: >X2255::SS                         Injected at: 920528 07:20
 a File:   >X2255::D4                      Dilution Factor:    1.00000
ame: BLANK                                   Instrument ID:  # 06
 sc:

 File: I
itle: Daily Calibration via Single Point at 50 ug/L
st Calibration: 920521 14:53                 Last Qual Time: 920520 07:4

            Compound                  R.T.  Q ion    Area      Conc    Units    %
 ---------------------------------- ----- ----- -------- -------- -------- ---
 1) *Bromochloromethane               7.80 128.0    28953    50.00  ug/L     86
 1) Acetone                           4.52  43.0     1320     6.37  ug/L     9
  )  1,2-Dichloroethane-d4(surr.)     8.90  65.0    64578    52.19  ug/L     97
  ) *1,4-Difluorobenzene              9.66 114.0   157735    50.00  ug/L     9
38) *Chlorobenzene-d5                15.23 117.0   130593    50.00  ug/L     86
~~ )  1,2,3-Trichloropropane         16.26  75.0     2255     1.46  ug/L     9~~
 1)  Bromofluorobenzene(surr.)       17.79  95.0   121605    49.16  ug/L     97
52)  Toluene-d8(surr.)               12.37  98.0   150404    49.45  ug/L     9

* Compound is ISTD
```

This blank pertains to volatile aqueous samples analyzed on 5/28/92

MALCOLM PIRNIE, INC.
ENVIRONMENTAL LABORATORY
707 OLD SAW MILL RIVER ROAD
TARRYTOWN, NY 10591
TEL. 914-345-8230
FAX. 914-345-8741

CHAIN OF CUSTODY RECORD

Page 1 of 1

NAME OF CLIENT MAMARONECK
PROJECT NUMBER 1547-02-1TS2
ADDRESS –
CITY – STATE – ZIPCODE –
CONTACT NAME J. GOLLISZ (WP) TEL# X2978
A. SORFNA (NNJ) X 210

FOR LAB USE ONLY
C.C.R #
QUOTE #
REPORT #
SAMPLE RECEIVE ☐
SAMPLE LOGGING ☐
SAMPLE DISTRIB. ☐

PROJECT DESCRIPTION: GW TREATABILITY STUDY

SAMPLER SIGNATURE : DATE: 5/15/92

IF SAMPLE(S) REQUIRE SPECIAL QA/QC, CHECK HERE ☐ AND DESCRIBE :

PRESERVATIVE TYPE CHECK(S)
1. HNO3 ☐
2. H2SO4 ☐
3. H3PO4 ☐
4. HCl ☐
5. NaOH ☐
6. Na2SO3 ☐
7. None ☐
8. Other(s): ☐

						NO. OF CONTAINERS												
SAMPLE ID	DESCRIPTION	DATE	TIME	MATRIX	PRESERVATION	Volatiles Organic Compounds	Acid extractable compounds	Base/Neutral Extractable Compounds	Pesticides	PCB's	Herbicides	Cyanide	E.P. Toxicity - Organics	E.P. Toxicity - Inorganics	Phenols	Metals	Others:	REMARKS
92-1883	ISOTHRM-15/l	5/15/92	–	L	H_2SO_4 (for COD,TOC)													COD, TOC
1884	ISOTHRM-35/l	↓	↓	↓	↓													↓
1885	ISOTHRM-105/l																	
1886	ISOTHRM-155/l																	
1887	ISOTHRM-605/l					X			X									
1888	ISOTHRM-CONT					X			X									

Relinquished by (Signature)	Date	Time	Received by (Signature):	Date	Time	Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time
	5/15/92	3:30 PM	Podolak	5/15/92	4 pm						

Relinquished by (Signature)	Date	Time	Received by (Signature):	Date	Time

REMARKS
VOC'S & PEST ONLY FOR LAST 2 Samples. ALL COD/TOC Samples

ALL SAMPLES IN REFRIG.

FORM-MPL # 002 1/90

APPENDIX G
HELP MODEL RESULTS

MAMARONECK HELP MODEL ANALYSES

In order to determine the potential percolation rates through the proposed cap for the above referenced site, a Hydrologic Evaluation of Landfill Performance (HELP) model, version 2.05, was utilized. The HELP model performs a sequential daily analysis of runoff, evapotransiration, infiltration and lateral drainage within the capping system. The model requires input of site Climatological data, soil characteristics, and proposed capping design parameters.

The model was run for a flexible membrane liner (FML) cap and for a no-action alternative. The capping design consisted of the following (from the top down):

- 6-inch layer of soil capable of supporting vegetative growth, permeability = 5.2×10^{-4} cm/sec, poor grass cover.
- 24-inch compacted protective cover layer, permeability = 1.2×10^{-4}.
- 40 mil VLDPE FML.
- 12-inch non-compacted gravel layer, permeability = 1×10^{-3}.

In addition, the model was run for the 6-inch layer only to analyze the no-action alternative.

Input data for the model included the following:

- Climatological data was generated by the model using default rainfall data for New York, New York. Five years of precipitation data (1974-1978) were available.
- Average monthly temperatures and solar radiation data were synthetically generated through a subroutine within the HELP Model. Average monthly temperatures for the site were inputted to the subroutine.
- The contaminated soil layer was assumed to have a permeability of 1×10^{-8} cm/sec.
- The slope of the cap was assumed to be 4%.
- The leakage fraction (that portion of the liner which is assumed to have failed) used was 0.0001. This fraction is based on typical values recommended by the USEPA for use in the HELP model, and is equivalent to 0.01 percent of the FML being susceptible to leakage.

Specific model input values are reported on the Default Soil and Design Data Input sheet attached.

```
MARMARONECK: JOB NO. 1547-021-P53
FML CAPPING OPTION - FILE: MARM1.FML
SEPTEMBER 24, 1992

                    POOR GRASS

                     LAYER  1
                     --------

              VERTICAL PERCOLATION LAYER
 THICKNESS                        =     6.00 INCHES
 POROSITY                         =     0.4730 VOL/VOL
 FIELD CAPACITY                     =     0.2217 VOL/VOL
 WILTING POINT                     =     0.1043 VOL/VOL
 INITIAL SOIL WATER CONTENT         =     0.2217 VOL/VOL
 SATURATED HYDRAULIC CONDUCTIVITY    =     0.000935999968 CM/SEC

                     LAYER  2
                     --------

               LATERAL DRAINAGE LAYER
 THICKNESS                        =     24.00 INCHES
 POROSITY                         =     0.3325 VOL/VOL
 FIELD CAPACITY                     =     0.2173 VOL/VOL
 WILTING POINT                     =     0.1361 VOL/VOL
 INITIAL SOIL WATER CONTENT         =     0.2173 VOL/VOL
 SATURATED HYDRAULIC CONDUCTIVITY    =     0.000006000000 CM/SEC
 SLOPE                           =     4.00 PERCENT
 DRAINAGE LENGTH                    =     360.0 FEET

                     LAYER  3
                     --------

    BARRIER SOIL LINER WITH FLEXIBLE MEMBRANE LINER
 THICKNESS                        =     1.00 INCHES
 POROSITY                         =     0.3325 VOL/VOL
 FIELD CAPACITY                     =     0.2173 VOL/VOL
 WILTING POINT                     =     0.1361 VOL/VOL
 INITIAL SOIL WATER CONTENT         =     0.3325 VOL/VOL
 SATURATED HYDRAULIC CONDUCTIVITY    =     0.000006000000 CM/SEC
 LINER LEAKAGE FRACTION             =     0.00010000
```

```
                    LAYER  4
                    --------

               VERTICAL PERCOLATION LAYER
THICKNESS                      =    12.00 INCHES
POROSITY                       =     0.4570 VOL/VOL
FIELD CAPACITY                   =     0.1309 VOL/VOL
WILTING POINT                    =    0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT            =     0.1158 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY    =      0.001000000047 CM/SEC

                    LAYER  5
                    --------

               VERTICAL PERCOLATION LAYER
THICKNESS                      =   180.00 INCHES
POROSITY                       =     0.4000 VOL/VOL
FIELD CAPACITY                   =     0.3560 VOL/VOL
WILTING POINT                    =    0.2899 VOL/VOL
INITIAL SOIL WATER CONTENT            =     0.3560 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY    =      0.000000010000 CM/SEC

                GENERAL SIMULATION DATA
                -----------------------

SCS RUNOFF CURVE NUMBER             =      82.80
TOTAL AREA OF COVER              =  348480. SQ FT
EVAPORATIVE ZONE DEPTH             =      14.00 INCHES
UPPER LIMIT VEG. STORAGE          =      5.4980 INCHES
INITIAL VEG. STORAGE           =      5.2928 INCHES
INITIAL SNOW WATER CONTENT          =       0.0000 INCHES
INITIAL TOTAL WATER STORAGE IN
  SOIL AND WASTE LAYERS           =      72.3473 INCHES

            SOIL WATER CONTENT INITIALIZED BY PROGRAM.

                 CLIMATOLOGICAL DATA
                 -------------------

DEFAULT RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND
SOLAR RADIATION FOR      NEW YORK CITY      NEW YORK

MAXIMUM LEAF AREA INDEX               = 1.00
START OF GROWING SEASON (JULIAN DATE)  =  118
END OF GROWING SEASON (JULIAN DATE)    =  298
```

```
       NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT
JAN/JUL    FEB/AUG    MAR/SEP    APR/OCT    MAY/NOV    JUN/DEC
-------    -------    -------    -------    -------    -------
 29.60      31.70      39.50      50.50      60.30      69.00
 74.10      72.70      65.50      54.80      44.50      33.80


   AVERAGE MONTHLY VALUES IN INCHES FOR YEARS   74 THROUGH   78
-----------------------------------------------------------------

                   JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                   ------- ------- ------- ------- ------- -------
PRECIPITATION
-------------
 TOTALS              4.59    2.46    3.50    2.69    3.68    3.60
                     3.60    4.95    5.63    3.12    2.68    4.30
 STD. DEVIATIONS     2.10    0.91    1.16    0.66    1.58    2.17
                     2.52    1.94    2.87    1.17    2.42    1.70
RUNOFF
------
 TOTALS             2.997   1.602   1.177   0.577   0.278   0.386
                    0.631   0.847   1.290   0.455   1.278   2.272
 STD. DEVIATIONS    2.543   1.718   1.099   0.580   0.541   0.512
                    0.919   1.748   2.043   0.686   1.901   1.609
EVAPOTRANSPIRATION
------------------
 TOTALS             0.870   1.346   2.535   2.900   3.554   2.989
                    4.423   4.274   3.128   2.214   1.433   0.873
 STD. DEVIATIONS    0.172   0.234   0.102   0.340   0.953   1.588
                    1.152   0.804   0.868   0.391   0.444   0.167
LATERAL DRAINAGE FROM LAYER  2
------------------------------
 TOTALS            0.0461  0.0417  0.0377  0.0233  0.0184  0.0110
                   0.0106  0.0024  0.0044  0.0169  0.0186  0.0350
 STD. DEVIATIONS   0.0142  0.0049  0.0076  0.0077  0.0063  0.0076
                   0.0097  0.0029  0.0068  0.0175  0.0223  0.0204
PERCOLATION FROM LAYER  3
-------------------------
 TOTALS            0.0187  0.0173  0.0185  0.0169  0.0170  0.0158
                   0.0150  0.0121  0.0115  0.0148  0.0147  0.0170
 STD. DEVIATIONS   0.0019  0.0005  0.0005  0.0006  0.0005  0.0007
                   0.0020  0.0016  0.0021  0.0038  0.0038  0.0035
PERCOLATION FROM LAYER  5
-------------------------
 TOTALS            0.0001  0.0001  0.0001  0.0001  0.0001  0.0001
                   0.0001  0.0001  0.0001  0.0001  0.0001  0.0001
 STD. DEVIATIONS   0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
                   0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
```

```
AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 74
                        THROUGH 78
          ----------------------------------------------------
                              (INCHES)        (CU. FT.)   PERCENT
                           ---------------   ----------   -------
    PRECIPITATION             44.79   ( 8.110)   1300818.    100.00

     RUNOFF                 13.788  ( 5.245)    400411.     30.78

   EVAPOTRANSPIRATION         30.540  ( 2.581)    886884.     68.18

  LATERAL DRAINAGE FROM       0.2661 ( 0.0641)      7726.       0.59
                           LAYER  2

  PERCOLATION FROM LAYER  3   0.1892 ( 0.0107)      5493.       0.42

  PERCOLATION FROM LAYER  5   0.0015 ( 0.0002)        44.       0.00

  CHANGE IN WATER STORAGE     0.198  ( 1.297)       5752.       0.44


          PEAK DAILY VALUES FOR YEARS   74 THROUGH   78
          -----------------------------------------------
                                      (INCHES)   (CU. FT.)
                                       -------   --------
          PRECIPITATION                   3.77      109480.8

           RUNOFF                        2.814      81706.7

      LATERAL DRAINAGE FROM LAYER  2      0.0017        50.6

        PERCOLATION FROM LAYER  3        0.0006        18.5

              HEAD ON LAYER  3            30.5

        PERCOLATION FROM LAYER  5        0.0000         0.1

          SNOW WATER                      3.96      115056.7

        MAXIMUM VEG. SOIL WATER (VOL/VOL)        0.3927

        MINIMUM VEG. SOIL WATER (VOL/VOL)        0.1224
```

```
FINAL WATER STORAGE AT END OF YEAR   78
--------------------------------------------------------------
        LAYER       (INCHES)      (VOL/VOL)
         -----      --------      ---------
          1           2.68          0.4470

          2           8.06          0.3358

          3           0.33          0.3325

          4           1.97          0.1639

          5          64.60          0.3589

        SNOW WATER                  0.00
```

APPENDIX H
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REFERENCES

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