SAMPLING AND ANALYSIS PLAN

INCLUDING THE FIELD SAMPLING PLAN
AND QUALITY ASSURANCE PROJECT PLAN

FOR

THE KENMARK TEXTILES SITE
FARMINGDALE, NEW YORK

FOR

COMPLIANCE WITH USEPA ADMINISTRATIVE
ORDER ON CONSENT
RI/FS INDEX NO. II CERCLA-10204

PREPARED FOR

SJ&J SERVICE STATIONS, INC.

JULY, 1992

fanning, phillips & molnar
ENGINEERS
RONKONKOMA NEW YORK

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SECTION 1.0
FIELD SAMPLING PLAN

1.1 Introduction

In accordance with United States Environmental Protection Agency (EPA) Order on Consent #10204, this Field Sampling Plan (FSP) has been prepared for the Kenmark Textiles Corporation Site (the "Site"). The FSP, along with the Quality Assurance Project Plan (QAPP), constitute the Sampling and Analysis Plan (SAP).

The objective of the FSP is to present detailed procedures for field investigations including sampling, monitoring, and instrument calibration for the implementation of the EPA approved Remedial Investigation/Feasibility Study (RI/FS) Workplan. The FSP will present the site background and setting, sampling objectives, locations, and procedures as well as procedures for the field investigations.

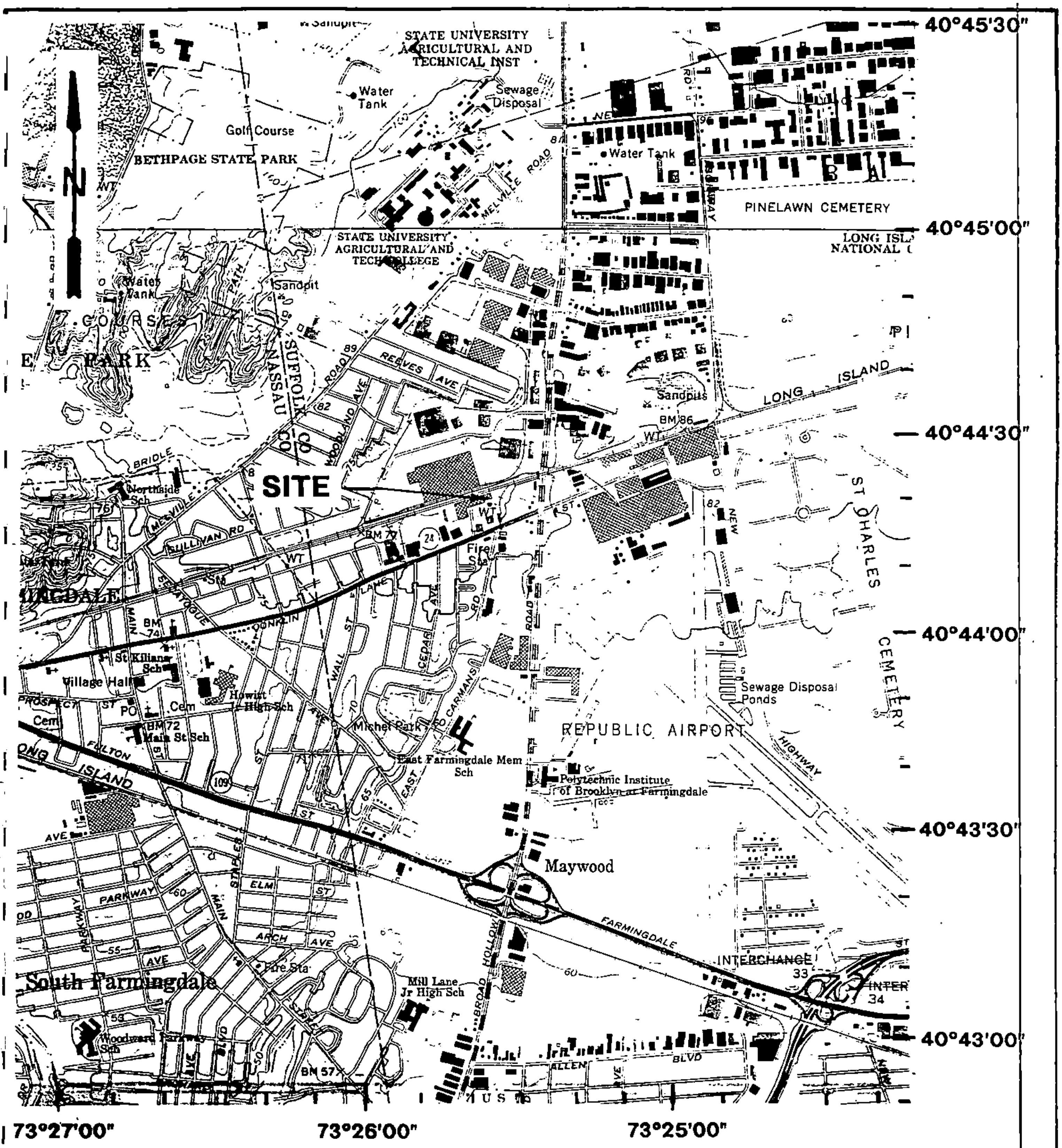
A Health and Safety Plan (HSP) has been prepared to be executed in conjunction with the FSP. The HSP has been bound under a separate cover to facilitate its use in the field.

Upon approval by the EPA, this SAP and the HSP will be deemed incorporated into the consent order by reference.

1.2 Site Background and Setting

1.2.1 Site Location

The Site is situated in a light industrial area and consists of an industrial facility located at 921 Conklin Street in the Town of Babylon, New York (see Figure 1.2.1.1 for Site location). The area north and east of the Site is also characterized by light industry. Residential developments are located to the south and west, with approximately 10,000 residents living within a one-mile radius of the



SOURCE: U.S. GEOLOGICAL SURVEY 7.5 MINUTE TOPOGRAPHIC MAPS (HUNTINGTON, 1979 AND AMITYVILLE, 1979 QUADRANGLES)

SCALE 1:24 000

1 ½ 0 1 MILE

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FIGURE 1.2.1.1 – SITE LOCATION

Site. The other notable feature evident on Figure 1.2.1.1 is the recharge basin located 0.2 miles south of the Site. This recharge basin was once used for industrial discharge and is the subject of a separate New York State Department of Environmental Conservation (NYSDEC) Superfund investigation.

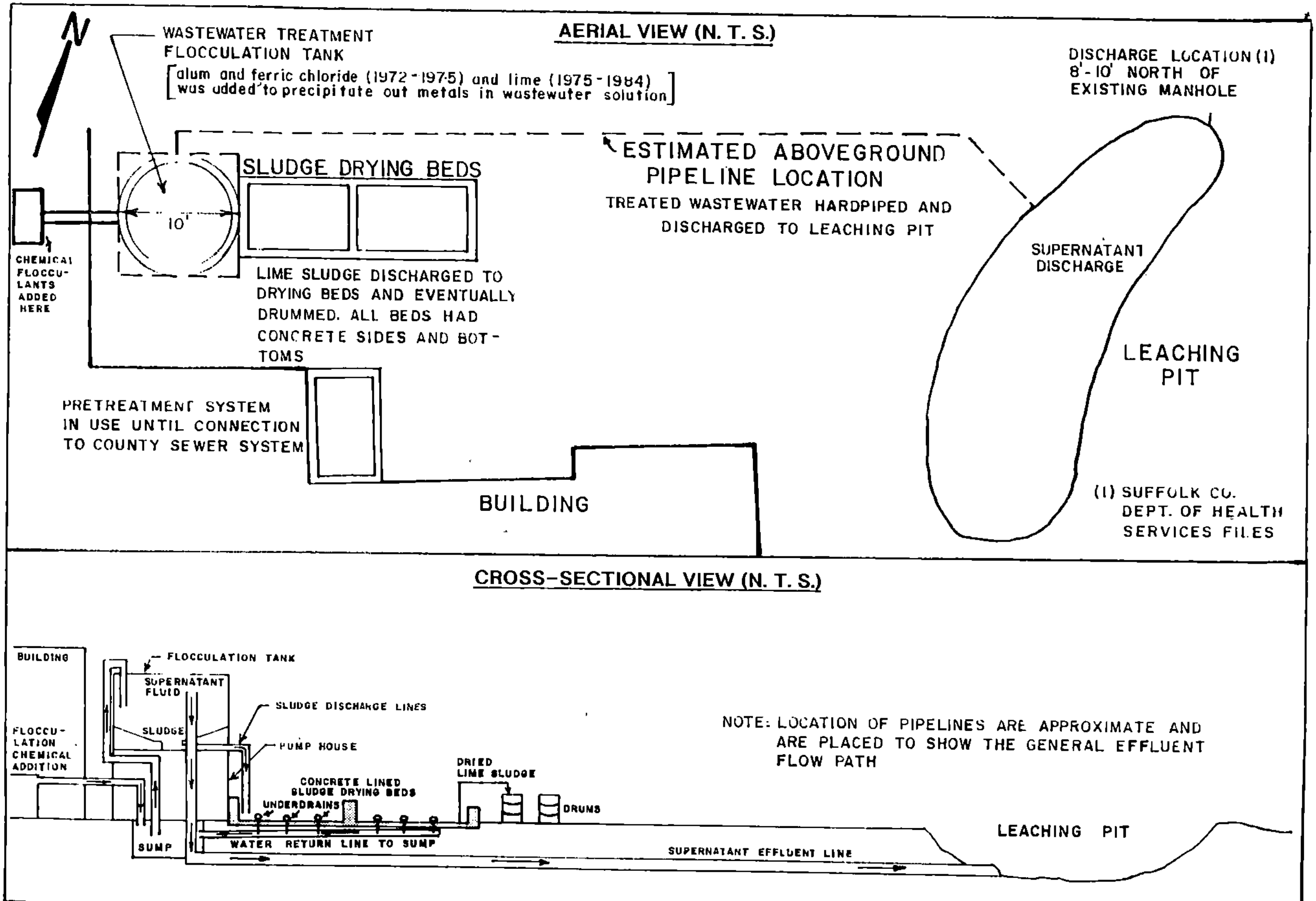
1.2.2 Site History

The Site has been the location of several textile screening and dyeing operations since at least 1917. The Independent Silk Dyeing Company, Inc., later the Independent Textile Dyeing Company, Inc. (Independent Textile), conducted silk and textile screening operations at the Site from 1917 until the company's dissolution in 1958. During the period that Independent Textile conducted operations at the Site, the company allegedly discharged wastewater into a leaching pit which was located at the Site.

In 1958, Independent Textile sold the Site property to B.G.M. Products, Inc., which in turn sold two parcels of Site property to Joseph Picone in September, 1972. The remainder of the Site property had been sold by B.G.M. Products, Inc. to three individuals in 1964, and following a series of transactions, was purchased by Irwin Schoffman and Brent Associates, Inc. in 1968.

Following the dissolution of Independent Textile in 1958, textile screening and dyeing operations at the Site ceased until approximately 1972, at which time the Jayne Textile Printing Corporation (Jayne Textile) began conducting screen and textile printing operations at the Site. Figure 1.2.2.1 depicts the level of treatment that the effluent stream received and the general flow path of each component.

Wastewater generated during the course of Jayne Textile's



[alum and ferric chloride (1972-1975) and lime (1975-1984) was added to precipitate out metals in wastewater solution]

TREATED WASTEWATER HARDPIPED AND DISCHARGED TO LEACHING PIT

LIME SLUDGE DISCHARGED TO DRYING BEDS AND EVENTUALLY DRUMMED. ALL BEDS HAD CONCRETE SIDES AND BOTTOMS

PRETREATMENT SYSTEM IN USE UNTIL CONNECTION TO COUNTY SEWER SYSTEM

(1) SUFFOLK CO. DEPT. OF HEALTH SERVICES FILES

NOTE: LOCATION OF PIPELINES ARE APPROXIMATE AND ARE PLACED TO SHOW THE GENERAL EFFLUENT FLOW PATH

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FIGURE 1.2.2.1 – SCHEMATIC OF WASTEWATER TREATMENT DESIGN AND LAYOUT AT JAYNE TEXTILE

operations was pumped from a pretreatment tank where chemical flocculants were added inside the building into a wet well (sump) located outside the main building. This sump was housed in a small building (pump house) still present at the Site. A flocculation (settling) tank was present on top of the building. Wastewater from the sump was pumped upwards into the settling tank. Alum and ferric chloride were added to the wastewater resulting in solids precipitating out of the wastewater which collected at the tank bottom. The supernatant liquid at the top of the tank was discharged through an underground pipe into a leaching pit 80 feet east of this tank. The sludge was discharged into sludge drying beds that were concrete lined on the bottoms and sides. The sludge drying beds had an underdrain system of porous pipe to draw off excess water from the sludge and discharge it back into the sump.

As early as 1972, Jayne Textile used the on-Site sludge drying beds and leaching pits as depositories for sludge and wastewater generated during its industrial processes. The residual sludge from the settling tank, that was placed in sludge drying beds for final dewatering was periodically removed from the drying beds and placed in drums. These drums were stored on the Site, south of the main building (see Figure 1.2.2.2 for Site layout). The drums were subsequently removed from the Site.

The supernatant liquid flowed from the flocculation tank to the on-Site leaching pit (shown east of the building in Figure 1.2.2.2) through an underground pipe reported to be metallic (as depicted in Figure 1.2.2.1). A PVC pipe was uncovered in the vicinity of the suspected metal pipe during the Fanning, Phillips and Molnar 1990 RI.

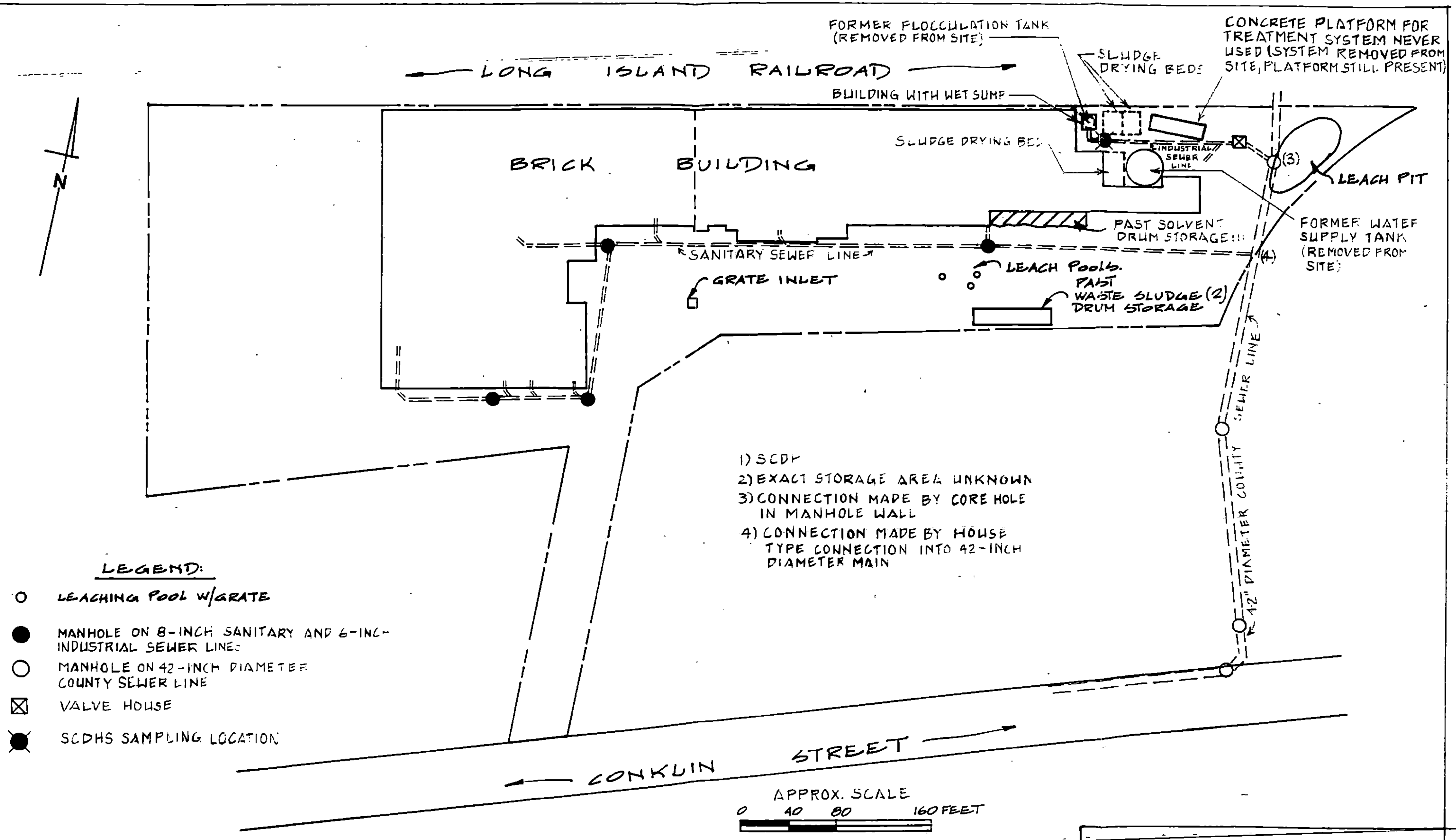

FIGURE 1.2.2.2

SITE LAYOUT

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This pipe was found exposed in the leaching pit wall. The pit was enlarged to approximately its present size in 1972 from a previously-existing smaller pit. The 1972 and 1976 aerial photographs in the EPA Historical Site Analysis show that this pit may have had a dividing wall in it, resulting in two separate pits.

A recent interview with an employee at the Site indicated that the only effluent line that he had knowledge of was of PVC construction. This employee has been at the Site since the mid-1970's. The EPA personnel present also questioned this employee on an issue regarding the outside area where the wastewater treatment occurs that was discussed in a DEC memorandum dated June 24, 1987. One issue was a 1972 Suffolk County Industrial Waste Inspection report that claimed that condensate from the steam cooker discharged to the ground surface in the area behind the building. The employee stated that the condensate, to his knowledge, always went into the wash process tanks and that the reference to the discharge to the outside area may refer to the steam relief valve discharge line on the boiler system (clean steam).

According to a 1974 SPDES permit application filed by Jayne Textile with the DEC, wastewater generated by Jayne Textile at the Site "may contain" cyanide, cadmium, chromium, copper, lead, and phenols.

In September, 1974, Jayne Textile was notified by DEC that the company was in violation of the New York State Environmental Conservation Law for discharging industrial wastewater into the groundwater without a permit.

On November 1, 1974, Jayne Textile entered into an Order on

Consent with DEC which established a time schedule for the implementation of a wastewater treatment system. This Order on Consent was binding on any new corporations which would assume the facility's operations at the Site. Jayne Textile ceased operations at the Site before the Order on Consent was fully complied with.

In 1975, Jayne Textile reorganized into the Kenmark Textile Printing Corporation (Kenmark Textile). The wastewater treatment procedures used by Kenmark at the Site were essentially the same as those used by Jayne Textile, except that Kenmark used lime rather than alum and ferric chloride to treat wastewater generated at the facility. Kenmark also allegedly discharged the supernatant liquid to leaching pits located in the northeast corner of the Site in the same manner as described for the period of time (1972-1975) during which Jayne Textile operated the facility. The leaching pit used at the Site was unlined, thereby permitting alleged wastewater discharges to seep into the surrounding soil. The 1972 photo shows this area to be the only pit present within the vicinity of the Site.

Sampling conducted between January, 1974 and May, 1984, by the Suffolk County Department of Health Services (SCDHS) and Lakeland Engineering, a contractor hired by Kenmark Textile, revealed that the wastewater discharged into the on-Site leaching pits contained hexavalent chromium, copper, iron, lead, silver, and phenols in violation of New York State GA groundwater effluent standards (see Table 1.2.2.1).

In 1975, DEC's Mobile Analytical Laboratory obtained soil samples from various locations around the Kenmark Textile facility. Soil samples taken from the facility's pump house basin (sump), leaching

TABLE 1.2.2.1
SUMMARY OF CHRONOLOGICAL WASTEWATER DISCHARGE ANALYSIS
BY S.C.D.H. (1) AND LAKELAND ENGINEERING (2)
KENMARK TEXTILES SITE - FARMINGDALE, NEW YORK

Point of Sampling	Metal Parameters with One or More Readings over State GA Effluent Standards	Other Parameters with One or More Reading over State GA Effluent Standards
Supernatant Discharge to Leaching Pit	Chromium (Hexavalent) (5/20) Copper (2/10) Iron (17/24) Lead (2/13) Silver (1/10)	Phenol (2/2) pH (26/31) C.O.D. (22/22) MBAS (11/20) (3/5) Dissolved Solids (21/23) Suspended Solids (1/14) Chloride

Note: (2/12) equals number of readings over GA State Standards/per total number of readings.

(1) Analysis over period from January, 1974 - May, 1984

(2) Analysis over period from September, 1979 - September, 1981

pits, and sludge drying beds allegedly contained elevated levels of copper, chromium, lead, zinc, silver, and arsenic. No volatiles, pesticides, PCBs, base/neutral or acid extractables were detected in this Phase II DEC sampling event.

Kenmark Textile allegedly stored approximately fifty drums of sludge at the Site for a period of at least five years. Analyses performed on the stored sludge by Lakeland Engineering, a contractor hired by Kenmark, revealed the presence of non-hazardous levels of silver.

Kenmark was notified on numerous occasions by DEC, SCDHS and the Suffolk County Department of Environmental Control (SCDEC) that the company was allegedly in violation of several state and county laws regulating the discharge and storage of hazardous substances and industrial wastes. Several consent decrees and modified consent decrees entered into with DEC, and various effluent limitations and compliance schedules which had been established in a draft SPDES permit were issued to Kenmark Textile by the State of New York.

In 1980, Joseph Picone sold his property at the Site to SJ&J Service Stations, Inc. (SJ&J), of which he is president.

In May, 1983, Irwin Schoffman and Brent Associates, Inc. sold two parcels of the Site property to 937-941 Conklin Street Associates. In 1985, these two parcels were sold by 937-941 Conklin Street Associates to Charles Selig who, in 1989 or 1990, resold this property to 937-941 Conklin Street Associates.

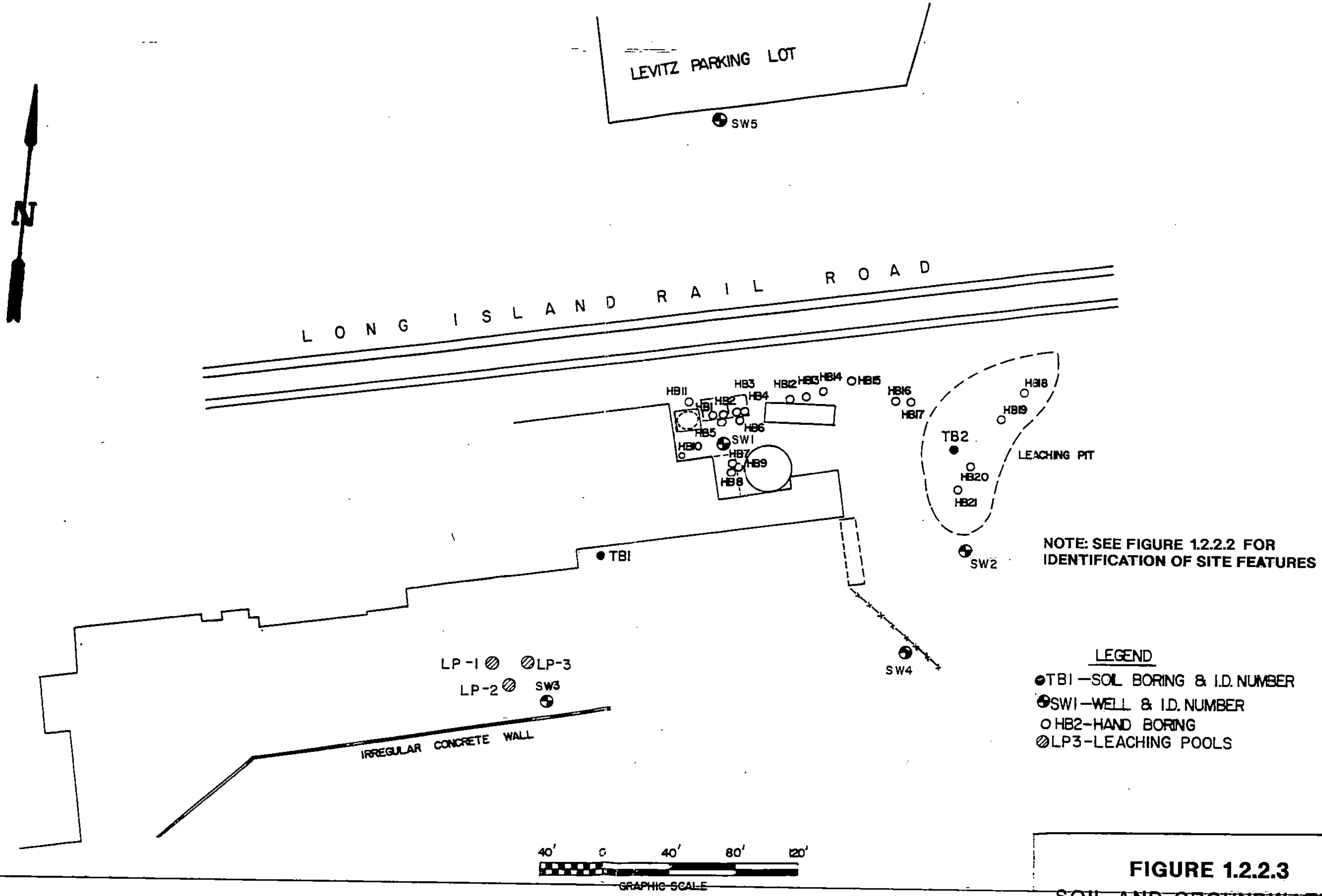
In January, 1984, Irwin Schoffman and Brent Associates, Inc. sold one lot of property at the Site to Brent Conklin, a co-partnership of Brent Associates, Inc., Irwin Schoffman, and Jacob and Ruth Kogel.

In November, 1984, Kenmark Textile was connected to the Suffolk County Southwest Sewer District enabling it to discharge its wastewater directly into the sewer system.

In January, 1985, Kenmark sold its business to its employees, who changed the company's name to the Susquehanna Textile Company, Ltd. (Susquehanna Textile).

In May, 1986, DEC drafted consent orders for Susquehanna Textile and SJ&J which provided for, inter alia, investigation of the "existing, current and/or potential releases or migration" of hazardous wastes from the Site and the development of a remedial program designed to address this contamination. The Site was defined as the property upon which the Susquehanna Textile facility is located, and SJ&J entered into the Consent Order with the State. Pursuant to the Consent Order, SJ&J hired Fanning, Phillips and Molnar to prepare an RI/FS Sampling Plan and Sampling Report for the Site.

The Fanning, Phillips and Molnar RI Sampling Report was completed for the Susquehanna Textile facility in June, 1990. The sampling results revealed concentrations of copper, zinc, chromium, silver, arsenic, lead, and volatile organic compounds (VOCs) in the soils. VOCs, including chloromethane and tetrachloroethene, were detected in the groundwater at the Site above Federal and State groundwater standards. However, chloromethane was also detected in the trip blank (see Figure 1.2.2.3 for sampling locations). According to the RI Sampling Report, groundwater samples collected from monitoring wells at the Site revealed lead and VOC contamination in excess of New York State and Federal groundwater standards.



NOTE: SEE FIGURE 1.2.2.2 FOR IDENTIFICATION OF SITE FEATURES

LEGEND
● TB1 – SOIL BORING & I.D. NUMBER
⊕ SW1 – WELL & I.D. NUMBER
○ HB2 – HAND BORING
▨ LP3 – LEACHING POOLS

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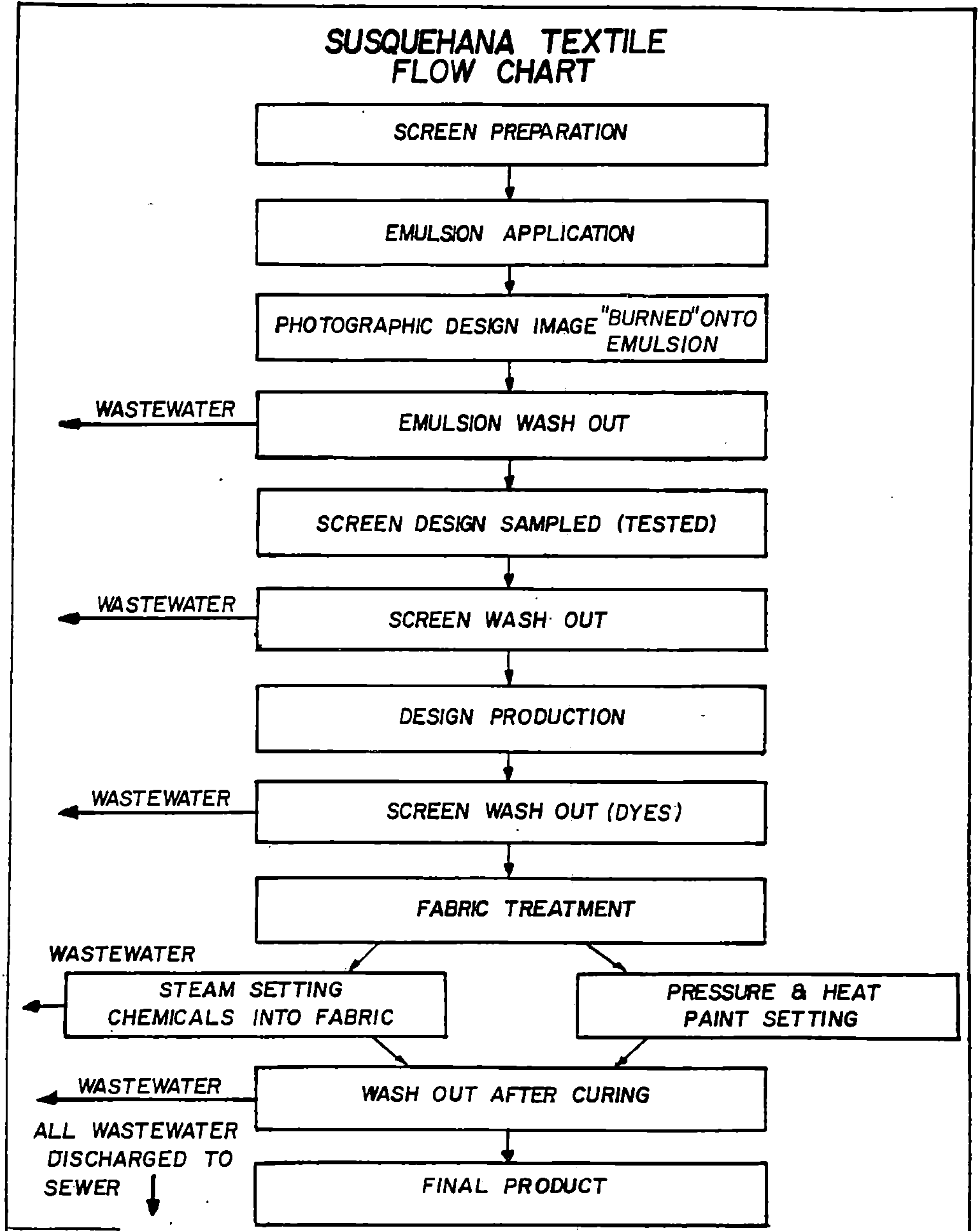
FIGURE 1.2.2.3
SOIL AND GROUNDWATER
SAMPLING LOCATIONS

1.2.3 Current Conditions

The basic processing operation for the Site's present tenants is shown in a flow diagram in Figure 1.2.3.1. A screen is first coated with a light-sensitive emulsion. The design is then transferred photographically to the emulsion-coated screen, after which the light-softened emulsion is washed away, leaving the design behind represented as open screen (positive). The emulsion not subjected to the light then hardens and becomes opaque. The screen design is then tested on a fabric. If the design checks out, production begins with a different screen used for each color. The dyes used at the present time and in the past are water-based dyes. Screen washout occurs after color application. The dye is then set into the fabric by a pressure and heat process or steam. Minor amounts of wastewater are produced from the steaming process as condensate. The fabric is then finally washed and the final product is then produced. Wastewater is produced by the final rinse out. Presently, all wastewater is disposed of into the Suffolk County sewer in accordance with Suffolk County Regulations for the South West Sewer District. The waste stream has been investigated and monitored frequently and no treatment has been required by SCDHS. This sewer disposal has been in effect since November, 1984.

The chemicals used in the process have included the Immarcol direct photo emulsion and the water soluble dyes used to color the fabrics. Occasionally solvents are used within the shop to remove adhesives from the tables that are used for wallpaper processes. The solvents are used on rags used to wipe down the process tables. These rags are collected by a linen supply and service company. All



FP&M FIGURE 1.2.3.1 – INDUSTRIAL PROCESS FLOW CHART wastewater produced on Site is presently discharged to the sanitary sewer.

1.2.4 Environmental Setting

1.2.4.1 Topography and Drainage

Topography

The elevation of the Site is approximately 80 feet above mean sea level (AMSL) with the surface drainage predominantly in a south-southeast direction, as controlled by the Site topography. The grade at the Site is generally flat except for the base of the LIRR tracks, which has been raised in elevation (see Figure 1.2.1.1). The regional topographic gradient was obtained from the USGS 7½ minute topographic quadrangle map for Amityville. The topographic gradient in the vicinity of the Site slopes gently to the south-southeast at an average rate of approximately 15 feet per mile (0.28 percent).

Drainage

The USGS reports that the soils of the Site area are highly permeable and runoff is estimated to be two percent of the total rainfall for storms of two to three inches in magnitude and five to six percent for storms of approximately ten inches. Therefore, runoff from the Site is likely to be very limited due to the low topographic gradient and the highly permeable soils.

There are no natural surface water bodies (streams, rivers, lakes) within one-half mile downgradient of the Site to receive surface runoff. There is one artificial surface water body located approximately 0.2 miles south of the Site (see Figure 1.2.1.1) that does not have an outlet. This area was originally a sand and gravel mining operation. After mining operations ceased, the basin was utilized as a recharge basin for wastewater discharge until approximately 1985. The basin may accept runoff from the impervious surrounding area. The basin is the subject of a State Superfund investigation. It is unknown if the level of water in this basin reflects the groundwater table or if it is the result of clogging of the basin floor.

1.2.4.2 Soils

To assess the soil types at the Site, the soil survey for Suffolk County, New York was obtained from the Soil Conservation Service. The Site was determined to contain "Urban Lands" soil which are described as consisting of more than 80 percent buildings and pavements. No more specific description of the soils is presented in this source. However, in the vicinity of the Site, the predominant soil type is "Cut and Fill Lands, Gently Sloping". This indicates much of this light industrial area is constructed upon fill.

1.2.4.3 Geology

Surficial Geology

The surficial geology of the Site consists of outwash plain deposits of the Wisconsinan glaciation. These deposits consist of stratified medium to coarse sand and gravel. The nearest change in surficial geology is approximately 2.0 miles to the north of the Site. It is an area mapped as the Manneto Gravel, which rises in elevation to approximately 125 feet AMSL.

Regional Geology

The generalized geology of the Site area features a base of Precambrian crystalline bedrock predominantly composed of schist and gneiss overlain by the Lloyd Sand Member of the Raritan Formation

(Cretaceous age). The clay member of the Raritan Formation overlies the Lloyd Sand Member, and thereby acts as a confining unit. It is referred to as the Raritan Clay. The Lloyd Sand Member is predominantly composed of light-colored sand and gravel and lenses of clay and silty clay. The Raritan Clay is composed of multicolored clay, silt, and some very fine to fine sand.

Overlying the Raritan Formation is the Magothy Formation, also of Cretaceous age, which consists of nonfossiliferous beds and lenses of gray and white fine quartz sand, clayey and silty sand, and clay. At the Site area, upper Pleistocene deposits (glacial outwash) directly overlie the Magothy Formation. These deposits are composed of stratified medium-coarse sand and gravel.

Site Geology

As presented in the Fanning, Phillips and Molnar 1990 RI/FS report, two test borings and five groundwater monitoring wells were drilled. Based upon the previous RI report, soils at depths ranging from 0-37 feet are described as brown to light-brown, medium to coarse, well-sorted sand, some gravel (rounded), and limited clay (mixed with silt) lenses.

1.2.4.4 Hydrogeology

Regional

There are two aquifers of potential concern beneath the Site. The shallower aquifer is the Upper Glacial (water table) Aquifer which is estimated to have a saturated thickness of 60 to 80 feet. It is associated with the upper Pleistocene deposits. The second aquifer is the Magothy Aquifer, which underlies the Upper Glacial Aquifer. It is estimated to be over 500 feet thick and is associated with the Magothy

Formation. Beneath the Magothy, the Raritan Clay represents a confining layer and the lower limit of the Magothy aquifer. Neither the Gardiners Clay, the 20-foot Clay, nor any other confining unit is reported to exist beneath the Site from the ground surface down to the Raritan Clay.

The water table elevation and regional flow direction in the vicinity of the Site has been obtained from the SCDHS Groundwater Elevation Contour Map (March, 1990) and is presented in Figure 1.2.4.4.1. This figure shows that the groundwater elevation at the Site is approximately 55 feet AMSL.

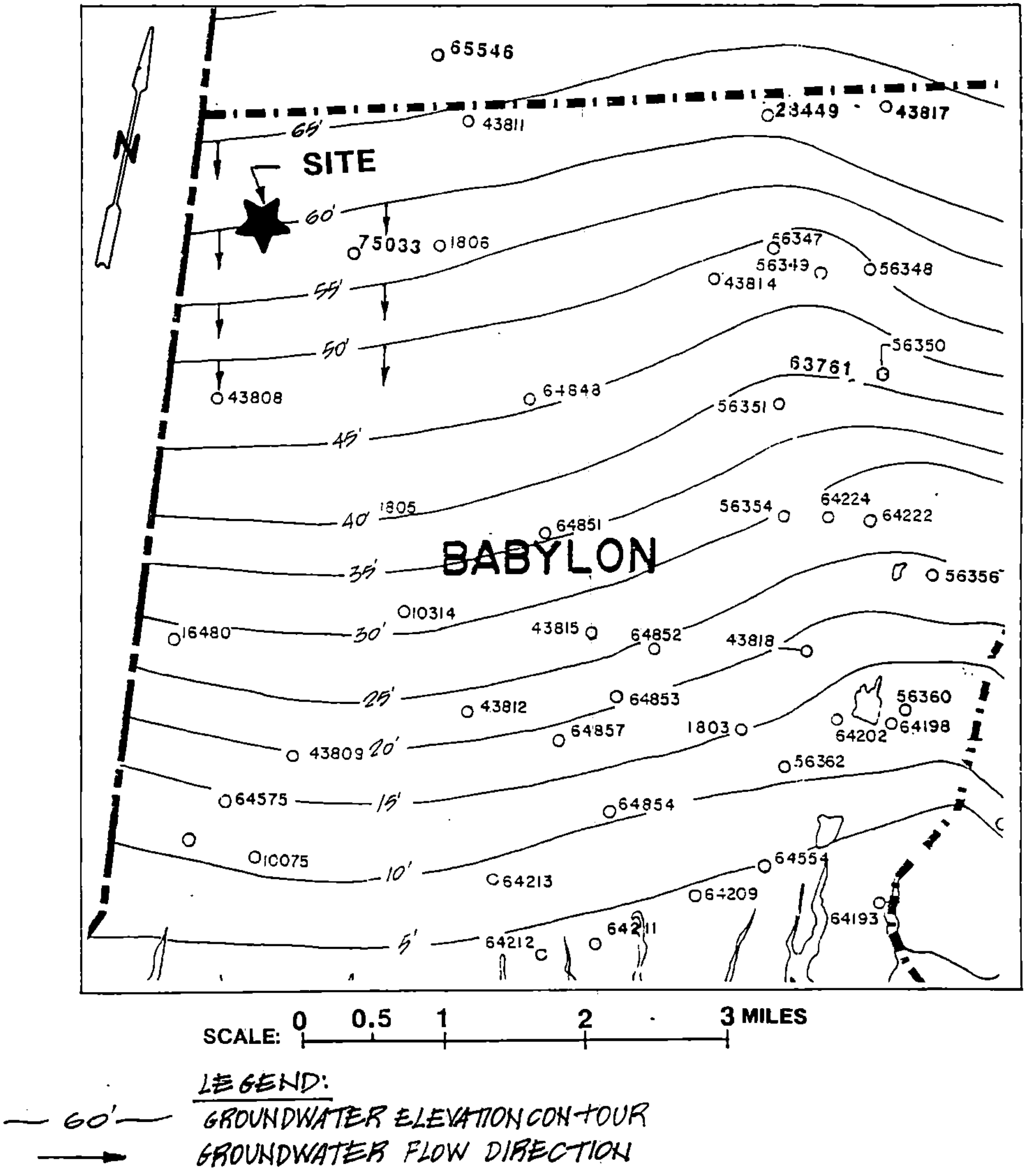
Based upon a surface elevation of approximately 80 feet and a groundwater elevation of approximately 55 feet, the depth to groundwater on the Site area is approximately 25 to 30 feet. The generalized horizontal groundwater flow direction in the Site area is south-southeast.

An estimate of the average hydraulic conductivity and transmissivity for the Site area is given in the USGS Paper 627-E "Water Transmitting Properties of Aquifers on Long Island, New York". The estimated average hydraulic conductivity given for the approximate Site area is 2,000 gallons per day per square foot (gal/d/f^2). The estimated transmissivity for the Site area is 150,000 gallons per day per foot (gal/d/f).

Site Hydrogeology

The Site hydrogeology was obtained from data presented in the Fanning, Phillips and Molnar 1990 RI Report. Table 1.2.4.4.1 presents a summary of well installation and development information.

Soil samples were obtained from the saturated zone within the



SOURCE: BASE MAP FROM THE SCDHS, MARCH, 1990

FIGURE 1.2.4.4.1 – REGIONAL WATER TABLE CONTOUR MAP AND GROUNDWATER FLOW DIRECTION

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TABLE 1.2.4.4.1
SUMMARY OF WELL INSTALLATION AND DEVELOPMENT AT THE KEMARK TEXTILES SITE
FARMINGDALE, NEW YORK

Well ID#	Date Installed	Depth of Well 11/91 Measurements	Screen Length	Screen Slot Size	Depth to Water 7/21/88 Measurements	Date of Final Development	Total Gallons Purged
SW-1	06/01/88	36.20	10'	0.010"	29.82	07/14/88	48
SW-2	06/11/88	33.81	10'	0.010"	27.00	07/13/88	35
SW-3	05-28-88	36.32	10'	0.010"	28.35	07/14/88	34
SW-4	06/01/88	30.40	10'	0.010"	26.90	07/14/88	41
SW-5*	06/24/88	24.25	10'	0.010"	16.45	07/14/88	95

* SW-5 was not installed on the site. This well was selected to represent upgradient groundwater conditions.

borings of SW-1, SW-3, SW-4 and SW-5 to determine the average hydraulic conductivity of the water table aquifer by using the Moretrench American Corporation Method. The results of the calculations showed the average hydraulic conductivity to be approximately 1,640 gal/d/f^2.

Water level measurements were taken at each of the wells (measurements were taken in 1988). The elevation and location of each well point, and measuring point of each well, were surveyed by a New York State-licensed surveyor. From the survey and water level measurements, Figure 1.2.4.4.2 was constructed to show a groundwater contour map of the water table. The contour map shows the groundwater flow direction beneath the Site to be south-southeast. This result is consistent with the regional flow direction.

The average groundwater flow gradient was calculated to be 0.00086. Through calculations of the average hydraulic conductivity and the average groundwater gradient, the pore velocity was calculated to be approximately 0.53 ft/day in a south-southeast direction.

1.2.4.5 Climate

The Site is located in Suffolk County, New York. Climate information was obtained from the Suffolk County Planning Department "Data Book, 1983." The Suffolk County climate is characterized as coastal being influenced by the adjacent water masses. The prevailing wind directions are northeast and south, reflecting the dominance of the cold Arctic air masses in the winter and cooling ocean breezes in the summer. The annual average wind speed is approximately 9 miles per hour. The average relative humidity varies from approximately 70 percent in the winter to 78 percent in the summer. Rainfall occurs an

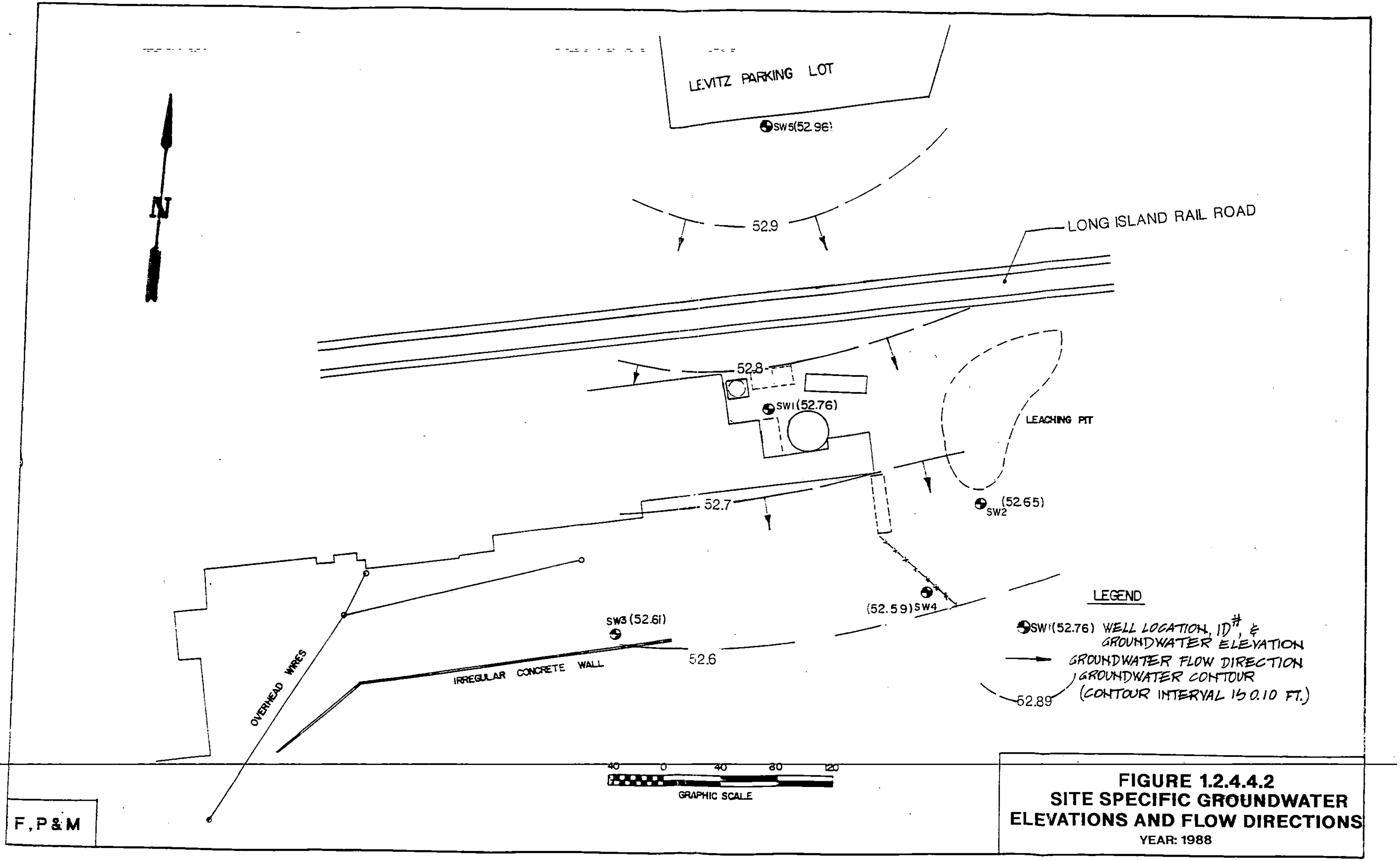


FIGURE 1.2.4.4.2
SITE SPECIFIC GROUNDWATER ELEVATIONS AND FLOW DIRECTIONS
YEAR: 1988

average of 125 days per year.

The USGS water supply paper 1768 "Hydrology of the Babylon-Islip Area, Suffolk County, Long Island, New York" lists the approximate annual precipitation rate within the Site area as 46 inches per year. Water losses, due to evapotranspiration and direct run off, are listed as a total loss of 22 inches, yielding a recharge rate to the groundwater reservoir as 24 inches per year. This recharge rate predominantly occurs during late fall, and early spring.

1.2.4.6 Population and Environmental Resources

Approximately 10,000 residents live within a one-mile radius of the Site. This population is generally centered in the residential areas south and west of the Site, and a small residential area northwest of the Site. The remaining areas surrounding the Site have non-permanent work force populations present, primarily during daytime. These areas are Fairchild Republic, Pinelawn, and Saint Charles Cemeteries southeast and east of the Site and the industrial area north of the Site.

Environmental resources within a 1.0-mile radial area of the Site include groundwater and the Bethpage State Park. No wetlands are known to exist within one mile of the Site. There are no national forests, national recreation areas or natural surface water bodies within this area. One artificial recharge basin is present south of the Site.

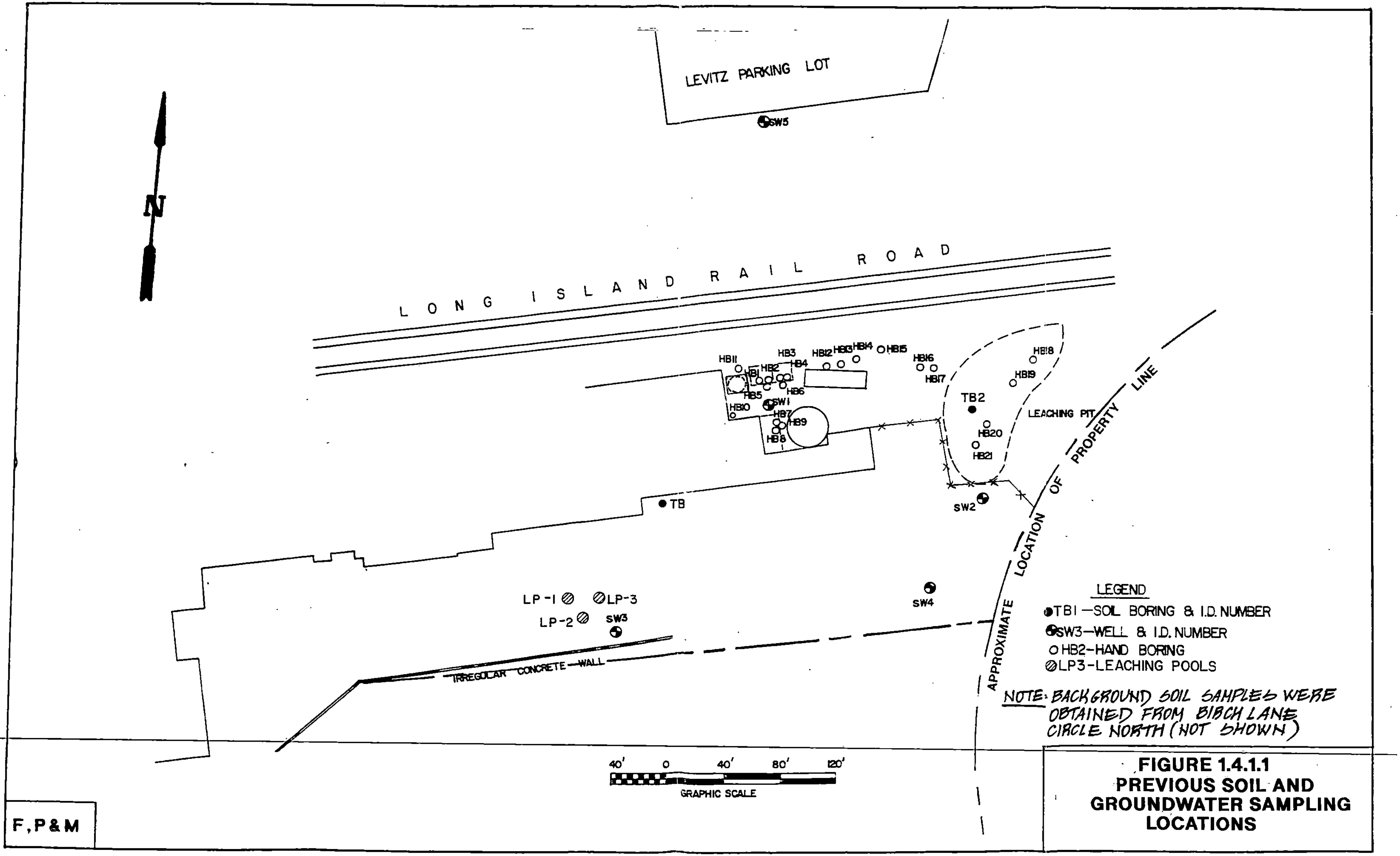
- **Leaching Pools** - Obtain sediment samples from the leaching sediment surfaces of the leaching pools down to the water table in order to obtain a chemical profile of the vadose zone.
- **Groundwater** - Obtain upgradient, Site, and downgradient water quality data. Also, deep water quality will be obtained downgradient of the leaching pit.
- **Air** - Obtain air samples to determine if airborne metals are present at the Site.

1.4 Sample Locations and Field Investigation

This subsection will present the previous sample locations and a summary of the samples obtained during the 1988 sampling round by Fanning, Phillips and Molnar. The proposed sample locations will then be presented (with sample depths and parameters to be analyzed for by the laboratory). In addition, field investigations will be performed including a physical characteristics survey, a meteorological investigation, a human population and land use investigation, and an ecological investigation.

1.4.1 Previous Sample Locations

During the sampling round performed by Fanning, Phillips and Molnar in 1988, 57 soil samples were obtained at the Site. An additional two samples were obtained off-Site as background soil samples. Also, groundwater samples were obtained from each of the five groundwater monitoring wells, four of which are on the Site. The fifth well is north of the Site in a hydraulically upgradient position to ascertain background groundwater conditions. Figure 1.4.1.1 shows the locations of all soil and groundwater samples obtained during the



NOTE: BACKGROUND SOIL SAMPLES WERE OBTAINED FROM BIRCH LANE CIRCLE NORTH (NOT SHOWN)

FIGURE 1.4.1.1
PREVIOUS SOIL AND GROUNDWATER SAMPLING LOCATIONS

1988 sampling round with the exception of the background soil sampling location (which is presented in Figure 1.4.1.2). The descriptions and sample intervals for each soil sample obtained, along with the laboratory parameters tested, are presented in Table 1.4.1.1. The descriptions of the groundwater samples obtained, along with the laboratory parameters tested, are presented in Table 1.4.1.2.

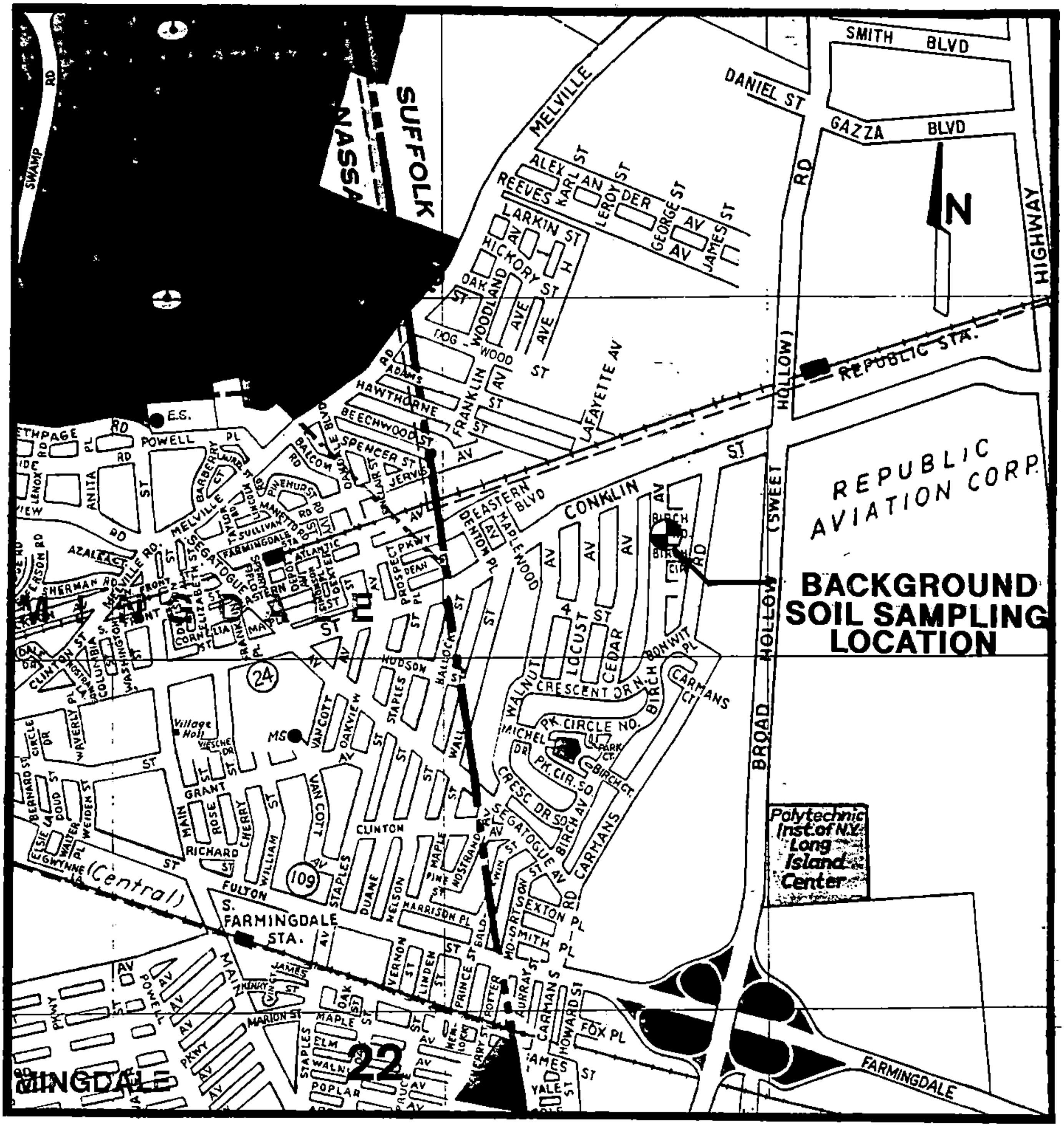
In addition to the soil and groundwater samples, two liquid samples were obtained from areas identified as "old industrial wastewater tank" and "broken pipe". The wastewater tank is located outdoors between the building and the north sludge drying beds (beneath the formerly-existing flocculation tank). The broken pipe was located where monitoring well SW-1 presently exists. The results of all sampling were presented and discussed in the Fanning, Phillips and Molnar RI/FS Work Plan (January, 1992). Data validation was performed on all samples and the results are presented in Table 1.4.1.3.

1.4.2 Proposed Sampling Locations

The proposed sampling for the Site consists of groundwater, soil, sediment, and air sampling. The groundwater, soil, and sediment sample locations are presented in Figure 1.4.2.1. Figure 1.4.2.2 shows additional soil sampling locations east and south of the site. Tables 1.4.2.1 and 1.4.2.2 present a summary of the groundwater, soil, and sediment sampling.

1.4.2.1 Groundwater Sampling

The five existing and five proposed groundwater monitoring wells will be sampled for Target Compound List (TCL), Volatile Organic Compounds (VOCs), TCL Semivolatile Organic Compounds (SVOC's), and



SCALE: 1" = 0.5 MILES

F,P&M FIGURE 1.4.1.2 – BACKGROUND SOIL SAMPLING LOCATION FROM 1988 SAMPLING ROUND

TABLE 1.4.1.1*
SUMMARY OF PREVIOUS SOIL SAMPLING AT THE KENMARK TEXTILES SITE
FARMINGDALE, NY

Sample Location and ID#	Date of Sampling	Sample Depth Interval	Date Sample was Submitted to lab	Physical Description of Sample	Parameters Tested
TEST BORING IN FORMER SOLVENT DRUM STORAGE AREA					
TB-1	05/26/88	4'-6'	05/26/88	Gravelly sand with some clay.	VOCs(1)
TB-1	05/26/88	8'-10'	05/26/88	Sand-gravel with some fine sand.	VOCs
TB-1	05/26/88	18'-20'	05/26/88	Medium-course sand with rounded fine gravel.	VOCs
TB-1	05/26/88	22'-24'	05/26/88	Medium-course sand with rounded fine gravel.	VOCs
ALONG PIPELINE					
HB-11	06/03/88	0"-6"	06/06/88	Gray silty sludge and brown silt.	Metals(2)
HB-12	06/03/88	6"-12"	06/06/88	Brown sand with silt and gravel.	Metals
HB-13	06/03/88	6"-12"	06/06/88	Fine brown sand with silt.	Metals
HB-14	06/03/88	6"-12"	06/06/88	Fine brown sand with silt.	Metals
HB-15	06/03/88	0"-6"	06/06/88	Brown silty sand with some gravel.	Metals
HB-16	06/03/88	6"-12"	06/06/88	Brown silt with some fine sand and clay.	Metals
HB-17	06/03/88	6"-12"	06/06/88	Brown silty clay.	Metals
TEST BORING IN LEACH PIT					
TB-2	07/12/88	10'-12'	07/13/88	Brown-orange fill with discolored gray sand.	Metals
TB-2	07/12/88	12'-14'	07/13/88	Medium-course sand slightly discolored.	Metals
TB-2	07/12/88	14'-16'	07/13/88	Medium-course sand with gravel. Streaks of blackish substance.	Metals
TB-2	07/12/88	16'-18'	07/13/88	Medium-course sand with some gravel. Streaks of blackish substance.	Full PP scan
TB-2	07/12/88	18'-20'	07/13/88	Medium-course sand with some gravel. Some moist silt.	Metals
TB-2	07/12/88	20'-22'	07/13/88	Medium-course black and brown sand with some gravel.	Metals
TB-2	07/12/88	22'-24'	07/13/88	Brown (slightly gray) medium-course sand with some blackish color.	Metals(3)

* All samples composited from indicated depths, except VOCs.
(1) Volatile Organic Compounds by U.S.E.P.A. Method 624 as per results of OVA screening.
(2) Metals are: As, Cd, Cr, Cu, Pb, Hg, Ni, Ag, and Zn (Also, Cr^{+6} for sample TB-2)
(3) Sample split between NYTest and H_2M Labs.
(4) Not composited due to obstruction in soil.

TABLE 1.4.1.1* (continued)

Sample Location and ID#	Date of Sampling	Sample Depth Interval	Date Sample was Submitted to lab	Physical Description of Sample	Parameters Tested
TB-2	07/12/88	24'-26'	07/13/88	Medium-course sand (brown) with gravel. Some discoloration.	VOCs(1) Metals(2)
TB-2	07/12/88	26'-28'	07/13/88	Black stained medium-course sand with some gravel.	Metals
HAND BORING IN LEACHING PIT					
HB-18	06/03/88	0"-6"	06/06/88	Stained dark gray medium-course sand and gravel.	Metals
HB-18	06/03/88	2.5'-3'	06/06/88	Gray-stained medium-course sand and gravel.	VOCs Metals
HB-18	06/03/88	4'-4.5'	06/06/88	Medium-course sand with gravel. Slight gray staining.	VOCs Metals
HB-19	06/03/88	0"-6"	06/06/88	Medium-course sand with some gravel.	Metals
HB-19	06/03/88	2.5'-3'	06/06/88	Medium-course sand with some gravel.	VOCs Metals
HB-19	06/03/88	4.5'-5'	06/06/88	Medium-course sand with some gravel.	VOCs Metals
HB-20	06/06/88	0"-6"	06/06/88	Brown, medium-course sand with gravel.	VOCs Metals
HB-20	06/06/88	2.5'-3'	06/06/88	Tan, medium-course sand with gravel.	Metals
HB-20	06/06/88	5'-5.5'	06/06/88	Tan, medium-course sand with gravel, pebbles.	VOCs Metals
HB-21	06/06/88	0"-6"	06/06/88	Brown, medium-course sand with silt and gravel.	Metals
HB-21	06/06/88	2.5'-3'	06/06/88	Tan, medium-course sand with gravel	VOCs Metals
HB-21	06/06/88	5'-5.5'	06/06/88	Medium-course sand with gravel.	Metals
BACKGROUND SAMPLES					
BLCN	06/06/88	0'-2'	06/06/88	Medium-course sand with some gravel.	VOC Metals
BLCN	06/06/88	0'-2'	06/06/88	Medium-course sand with some gravel.	VOCs Metals

* All samples composited from indicated depths, except VOCs.

(1) Volatile Organic Compounds by U.S.E.P.A. Method 624 as per results of OVA screening.

(2) Metals are: As, Cd, Cr, Cu, Pb, Hg, Ni, Ag, and Zn (Also, Cr^{+6} for sample TB-2)

(3) Sample split between NYTest and H$_2$M Labs.

(4) Not composited due to obstruction in soil.

TABLE 1.4.1.1* (continued)

Sample Location and ID#	Date of Sampling	Sample Depth Interval	Date Sample was Submitted to lab	Physical Description of Sample	Parameters Tested
OUTSIDE SLUDGE DRYING BEDS					
HB-5	06/02/88	0"-6"	06/02/88	Medium course sand with some gravel.	Metals(2)
HB-5	06/02/88	2'-2.5'	06/02/88	Medium course sand with some gravel.	Metals
HB-6	06/02/88	0"-6"	06/02/88	Medium course sand with some gravel.	Metals
HB-6	06/02/88	2'-2.5'	06/02/88	Medium course sand with some gravel.	Metals
HB-9	06/02/88	3'-3.5'	06/02/88	Medium course sand with some gravel.	Metals
STEAM COOKER AREA					
HB-10	06/02/88	6"-12"	06/02/88	Medium course sand with some gravel.	Metals
HB-10	06/02/88	At 18"(4)	06/02/88	Medium course sand with some gravel.	Metals
SLUDGE DRYING BEDS					
HB-1	06/02/88	0"-6"	06/02/88	Medium course sand with some gravel.	VOCs(1) Metals
HB-1	06/02/88	6"-12"	06/02/88	Medium course sand with some gravel.	Metals
HB-2	06/02/88	0"-6"	06/02/88	Medium course sand with some gravel.	Metals
HB-2	06/02/88	6"-12"	06/02/88	Medium course sand with some gravel.	Metals
HB-3	06/02/88	0"-6"	06/02/88	Medium course sand with some gravel.	Metals
HB-3	06/02/88	6"-12"	06/02/88	Medium course sand with some gravel.	Metals Full Priority Pollutant Scan
HB-4	06/02/88	0"-6"	06/02/88	Medium course sand with some gravel.	Metals
HB-4	06/02/88	6"-12"	06/02/88	Medium course sand with some gravel.	VOCs Metals
HB-7	06/02/88	0"-6"	06/02/88	Medium course sand with some gravel.	VOCs Metals
HB-7	06/02/88	2.5'-3'	06/02/88	Medium course sand with some gravel.	Metals
HB-8	06/02/88	0"-6"	06/02/88	Medium course sand with some gravel.	VOCs Metals
HB-8	06/02/88	2.5'-3'	06/02/88	Medium course sand with some gravel.	Metals

* All samples composited from indicated depths, except VOCs.

(1) Volatile Organic Compounds by U.S.E.P.A. Method 624 as per results of OVA screening.

(2) Metals are: As, Cd, Cr, Cu, Pb, Hg, Ni, Ag, and Zn (Also, Cr^{+6} for sample TB-2)

(3) Sample split between NYTest and H_2M Labs.

(4) Not composited due to obstruction in soil.

TABLE 1.4.1.1* (continued)

Sample Location and ID#	Date of Sampling	Sample Depth Interval	Date Sample was Submitted to lab	Physical Description of Sample	Parameters Tested
WELL BORINGS					
SW-1	05/31/88	20'-22'	05/31/88	Medium-course sand with fine gravel.	VOCs(1)
SW-3	05/27/88	25'-27'	05/31/88	Medium-course sand lens of fine gravel	VOCs
SW-4	05/31/88	15'-17'	05/31/88	Medium-course sand	VOCs
LEACHING POOLS					
LP-1	05/27/88, 05/31/88	0"-6"	05/31/88, 06/02/88	Dark, fine silt with slight odor.	VOCs Metals(2)
LP-2	05/27/88, 05/31/88	0"-6"	05/31/88, 06/02/88	Black, moist clay with some gravel	VOCs Metals
LP-3	05/27/88, 05/31/88	0"-6"	05/31/88, 06/02/88	Dark clay with sand. Slight odor.	VOCs Metals
FIELD AND TRIP BLANKS					
TRIP BLANK	05/25/88	Aqueous Trip Blank	05/26/88	Aqueous	VOCs
TRIP BLANK	05/25/88	Aqueous Trip Blank	05/31/88, 06/02/88	Aqueous	VOCs
FIELD BLANK	05/31/88	Aqueous Field Blank	05/31/88, 06/31/88	Aqueous	VOCs
TRIP BLANK	05/31/88	Aqueous Trip Blank	06/02/88	Aqueous	VOCs
FIELD BLANK	05/31/88	Aqueous Field Blank	06/02/88	Aqueous	VOCs Metals
TRIP BLANK	06/01/88	Aqueous Trip Blank	06/02/88	Aqueous	VOCs Metals
FIELD BLANK	06/01/88	Aqueous Field Blank	06/02/88	Aqueous	VOCs Metals
TRIP BLANK	06/06/88	Aqueous Trip Blank	06/06/88	Aqueous	VOC Metals
FIELD BLANK	06/06/88	Aqueous Field Blank	06/06/88	Aqueous	VOC Metals
TRIP BLANK	06/06/88	Aqueous Trip Blank	06/06/88	Aqueous	VOC Metals
FIELD BLANK	06/06/88	Aqueous Field Blank	06/06/88	Aqueous	VOC Metals
TRIP BLANK	07/12/88	Aqueous Trip Blank	07/13/88	Aqueous	Full PP scan
FIELD BLANK	07/12/88	Aqueous Trip Blank	07/13/88	Aqueous	Full PP scan

* All samples composited from indicated depths, except VOCs.
(1) Volatile Organic Compounds by U.S.E.P.A. Method 624 as per results of OVA screening.
(2) Metals are: As, Cd, Cr, Cu, Pb, Hg, Ni, Ag, and Zn (Also, Cr^{+6} for sample TB-2)
(3) Sample split between NYTest and H_2M Labs.
(4) Not composited due to obstruction in soil.

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TABLE 1.4.1.2
SUMMARY OF PREVIOUS GROUNDWATER SAMPLING AT THE KENMARK TEXTILE SITE FARMINGDALE, NEW YORK

Well ID#	Depth of Screened Interval (Feet Below Grade)	Depth to Water (Feet)	Parameters Tested
SW-1	26 to 36	29.82	Metals
SW-2	24 to 34	27.00	Metals, VOCs, BNAEs
SW-3	26 to 36	28.35	Metals, VOCs, BNAEs
SW-4	20 to 30	26.90	Metals, VOCs, BNAEs
SW-5	14 to 24	16.45	Metals, VOCs, BNAEs

Note: All metals analyses were performed for filtered and unfiltered samples.

TABLE 1.4.1.3
VALID AND/OR USABLE DATA
KENMARK TEXTILES SITE
FARMINGDALE, NEW YORK

Sample ID# and Depth	Comments	Level of Data Quality Objectives (parameter)
Background Samples		
BLCN (0-6") (24"-30")	Valid and usable (all depths)	IV (metals)(1)
Former Solvent Drum Storage Area		
TB-1 (4'-6') (8'-10') (18'-20') (22'-24')	Resample for VOCs or obtain QR* from H2M	IV (pending H2M QR)
Along Pipeline		
HB-11 (0-6") HB-12 (6"12") HB-13 (6"-12") HB-14 (6"-12") HB-15 (0-6") HB-16 (6"-12") HB-17 (6"-12")	Valid and usable (all depths)	IV (metals)
Test Boring in Leaching Pit		
TB-2 (10'-12') (12'-14') (14'-16') (16'-18') (18'-20') (20'-22') (22'-24') (24'-26') (26'-28')	Valid and usable (all depths)	IV (metals for all depths; Full PP list for 16'-18'; and VOCs(2) for 24'-26')
Leaching Pit		
HB-18 (0-6") (30"-36") HB-19 (0-6") (30"-36") (54"-60") HB-20 (0-6") (2.5'-3') (60'-66') HB-21 (0-6") (30-36") (5'-5.5')	Valid and usable (all depths)	IV (metals)
Outside Sludge Drying Beds		
HB-5 (0-6") (2'-2.5') HB-6 (0-6") (2'-2.5') HB-9 (3'-3.5')	Valid and usable (all depths)	IV (metals)
Steam Cooker Area		
HB-10 (6"-12") (at 18")	Valid and usable (both depths)	IV (metals)
Beneath Sludge Drying Beds		
HB-1 (0-6") (6"-12") HB-2 (0-6") (6"-12") HB-3 (0-6") (6"-12") HB-4 (0-6") (6"-12") HB-7 (0-6") (2.5'-3') HB-8 (0-6") (2.5'-3')	Valid and usable (all depths)	IV (metals for all samples and depths; VOCs for HB-1 (0-6"); Full PP list except VOCs for HB-3 (6"-12"); VOCs for HB-4 (6"-12"); VOCs for HB-7 (0-6"); and VOCs for HB-8 (0-6").
Well Borings		
SW-1 (20'-22') SW-4 (15'-17')	Valid and usable (both samples)	IV (VOCs)
Leaching Pools		
LP-1 (0-6") LP-2 (0-6") LP-3 (0-6")	Valid and usable metals for all three, need VOCs	IV (metals)
Groundwater Monitoring Wells		
MW-1 Aqueous MW-2 Aqueous MW-3 Aqueous MW-4 Aqueous MW-5 Aqueous	Valid and usable aqueous metals for all five wells, need VOCs	IV (metals)

* QR indicates Quantification Report
(1) Metals indicate: As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn
(2) VOCs indicate: Priority Pollutant Volatile Organic Compounds

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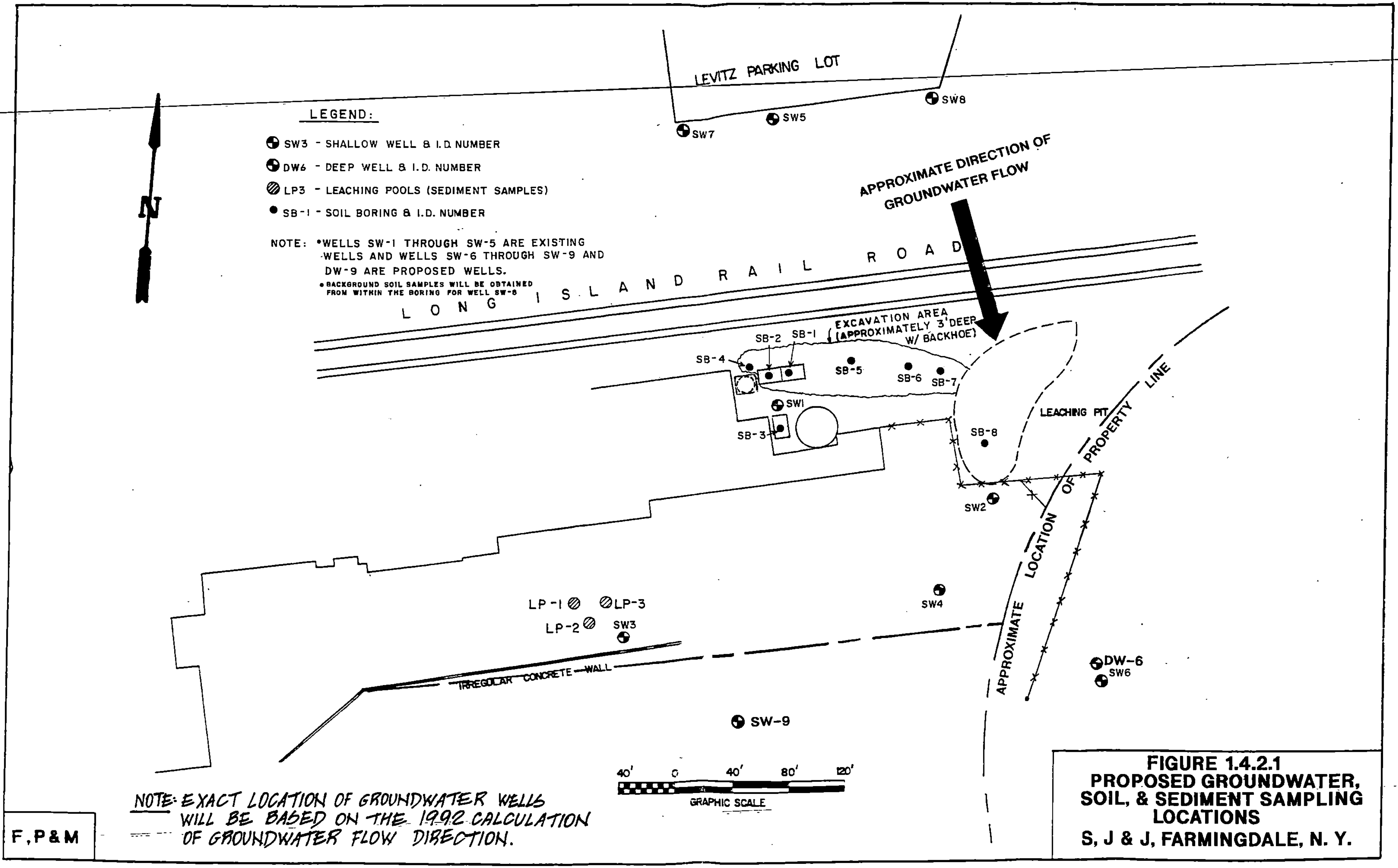


LEGEND:

⊕ SW3 - SHALLOW WELL & I.D. NUMBER

⊕ DW6 - DEEP WELL & I.D. NUMBER

▨ LP3 - LEACHING POOLS (SEDIMENT SAMPLES)

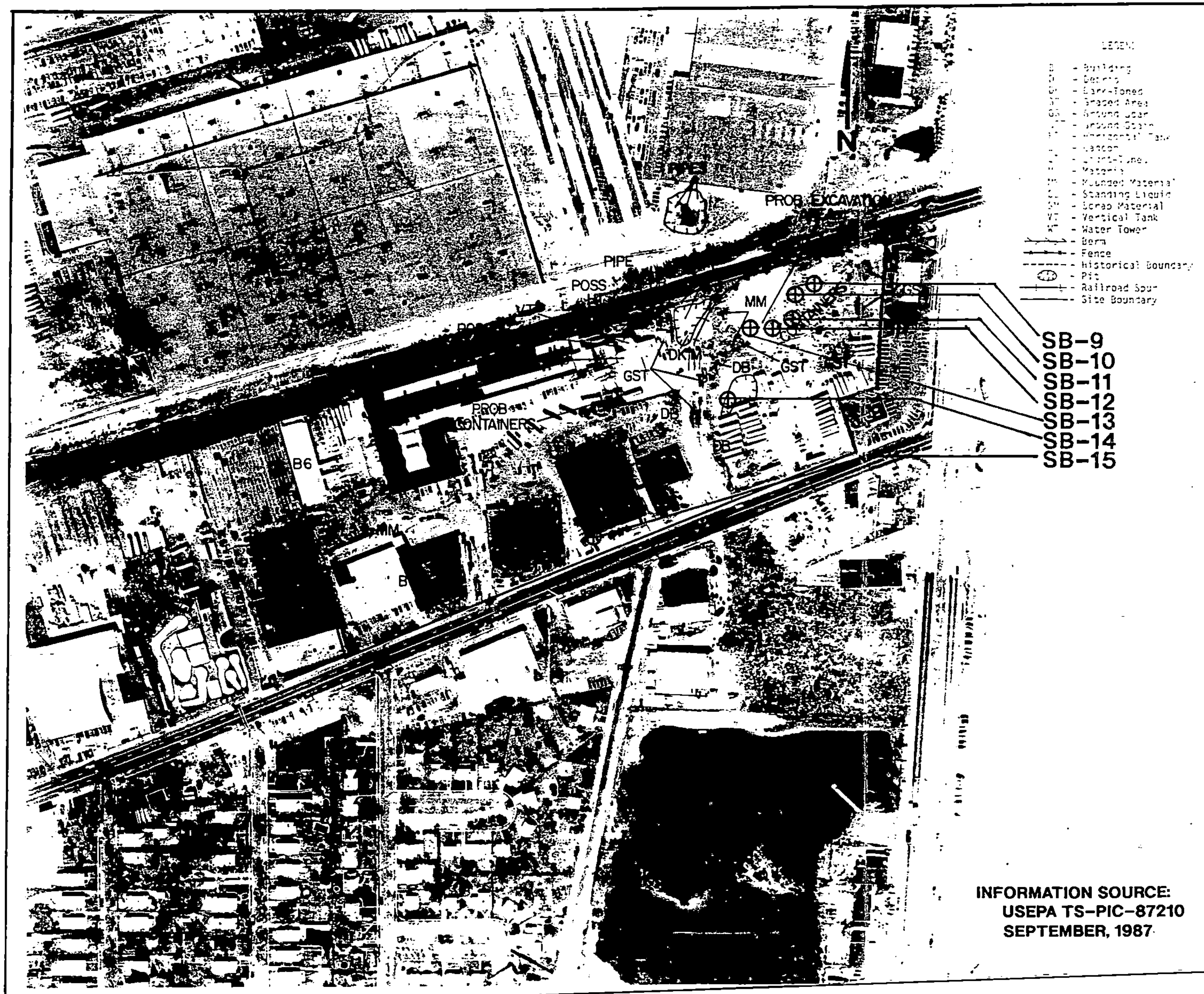
● SB-1 - SOIL BORING & I.D. NUMBER

NOTE: *WELLS SW-1 THROUGH SW-5 ARE EXISTING WELLS AND WELLS SW-6 THROUGH SW-9 AND DW-9 ARE PROPOSED WELLS.

* BACKGROUND SOIL SAMPLES WILL BE OBTAINED FROM WITHIN THE BORING FOR WELL SW-8

NOTE: EXACT LOCATION OF GROUNDWATER WELLS WILL BE BASED ON THE 1992 CALCULATION OF GROUNDWATER FLOW DIRECTION.

FIGURE 1.4.2.1
PROPOSED GROUNDWATER, SOIL, & SEDIMENT SAMPLING LOCATIONS
S, J & J, FARMINGDALE, N. Y.



INFORMATION SOURCE:
USEPA TS-PIC-87210
SEPTEMBER, 1987

FIGURE 7
KENMARK TEXTILES APRIL 7, 1980 APPROX SCALE 1:2,860

EXPLANATION:

⊕ **SB-10** - PROPOSED SOIL BORING. LOCATION

F, P & M

FIGURE 1.4.2.2
PROPOSED SOIL SAMPLING LOCATIONS IN EASTERN AREA SHOWN ON 1980 AERIAL PHOTO
S, J & J, FARMINGDALE, N. Y.

TABLE 1.4.2.1*
SUMMARY OF PROPOSED FIELD INVESTIGATION
KENMARK TEXTILE SITE
FARMINGDALE, NEW YORK

Monitoring Wells, Samples, or Borings	Estimated Depth	Purpose
Monitoring Wells		
SW-6	35'	Downgradient of site & additional water level measurement.
SW-7	35'	Upgradient water quality & additional level measurement.
SW-8	35'	Upgradient water quality & additional level measurement.
SW-9	35'	Downgradient of site & additional water level measurement.
DW-6	85'	Determine vertical gradient and deep water quality.
Groundwater Samples		
SW-1	25'-35'	Obtain groundwater quality downgradient of drying beds.
SW-2	25'-35'	Obtain groundwater quality downgradient of leaching pit.
SW-3	25'-35'	Obtain groundwater quality downgradient of leaching pools.
SW-4	25'-35'	Obtain groundwater quality downgradient of flocculation tank, sludge drying beds and underground pipeline. gradient of flocculation tank,
SW-5	25'-35'	Upgradient groundwater quality.
SW-6	25'-35'	Downgradient groundwater quality.
SW-7	25'-35'	Upgradient groundwater quality.
SW-8	25'-35'	Upgradient groundwater quality.
SW-9	25'-35'	Downgradient groundwater quality.
DW-6	75'-85'	Deep water quality downgradient of leaching pit.
Soil Borings/Samples		
Beneath Sludge Drying Beds		
SB-1	2'-2.5', 4'-5'	Obtain shallow soil data for chemical profile.
SB-2	2'-2.5', 4'-5'	Obtain shallow soil data for chemical profile.
SB-3	4'-5',8'-10' 4'-5'	Obtain shallow soil data for chemical profile.
Along Pipeline		
SB-4	IBP 3'-5'BP	Obtain soil data for shallow chemical profile. Obtain soil data for shallow chemical profile.
SB-5	IBP, 3'-5'BP	Obtain soil data for shallow chemical profile.
SB-6	IBP, 3'-5'BP	Obtain soil data for shallow chemical profile.
SB-7	IBP, 3'-5'BP	Obtain soil data for shallow chemical profile.
Leaching Pit		
SB-8	6"-12", 1'-3' 3'-5' etc	Obtain soil data for deep chemical profile.
East of Property		
SB-9	1'-2', 3',4', 5'-7'	Obtain soil data for shallow soils near suspect lagoon area
SB-10	1'-2', 3'-4', 5'-7'	Obtain soil data for shallow soils near suspect lagoon area
SB-11	1'-2', 3'-4', 5'-7'	Obtain soil data for shallow soils near suspect lagoon area
SB-12	1'-2', 3'-4', 5'-7'	Obtain soil data for shallow soils near suspect lagoon area
SB-13	1'-2', 3'-4', 5'-7'	Obtain soil data for shallow soils near suspect lagoon area
SB-14	1'-2', 3'-4', 5'-7'	Obtain soil data for shallow soils near pallet storage area
South of Property		
SB-15	5-7 10-12	Obtain soil data for soils near pit identified in 1966 and 1969 aerial photos (Reference 18)
Background		
BG-1	1'-2', 3'-5'	Obtain background soil data
Sediment		
Leaching Pools		
LP-1	1'-2', 2'-4' 4'-6'etc	Obtain sediment data for chemical profile in vadose zone.
LP-2	1'-2', 2'-4' 4'-6'	Obtain sediment data for chemical profile in vadose zone.
LP-3	1'-2', 2'-4' 4'-6'	Obtain sediment data for chemical profile in vadose zone.

* See Figure 1.4.2.1 for sampling locations, Table 1.4.2.2 for summary of sampling, and Table 1.6.1 for sample numbering system.

NOTE: IBP = Immediately beneath pipe
BP = Beneath Pipe

TABLE 1.4.2.2*
SUMMARY OF SAMPLING
KENMARK TEXTILE SITE
FARMINGDALE, NEW YORK

Groundwater Samples

Sample ID#*	Number of Samples	Type of Samples	Depth	Analytical Parameters For First Round of Sampling	FID/PID[1] Analysis
SW-1	2	Groundwater	25'-35'	TCL VOCs/SVOCs, TAL/Cr^{+6}	No
SW-2	2	Groundwater	25'-35'	TCL VOCs/SVOCs, TAL/Cr^{+6}	No
SW-3	2	Groundwater	25'-35'	TCL VOCs/SVOCs, TAL/Cr^{+6}	No
SW-4	2	Groundwater	25'-35'	TCL VOCs/SVOCs, TAL/Cr^{+6}	No
SW-5	2	Groundwater	25'-35'	TCL VOCs/SVOCs, TAL/Cr^{+6}	No
SW-6	2	Groundwater	25'-35'	TCL VOCs/SVOCs, TAL/Cr^{+6}	No
SW-7	2	Groundwater	25'-35'	TCL VOCs/SVOCs, TAL/Cr^{+6}	No
SW-8	2	Groundwater	25'-35'	TCL VOCs/SVOCs, TAL/Cr^{+6}	No
SW-9	2	Groundwater	25'-35'	TCL VOCs/SVOCs, TAL/Cr^{+6}	No
DW-6	2	Groundwater	85'-95'	TCL VOCs/SVOCs, TAL/Cr^{+6}	No

Note: Analysis parameters may be reduced for the second round of sampling. TAL metals will be submitted for filtered and unfiltered samples.

Soil Samples

Beneath Sludge Drying Beds

SB-1	2	Soil	2'-2.5', 4'-5'	TAL/Cr^{+6}	Yes
SB-2	2	Soil	2'-2.5', 4'-5'	TAL/Cr^{+6}	Yes
SB-3	2	Soil	4'-5', 8'-10'	TAL/Cr^{+6}	Yes

Note: Sample SB-1 (2'-2.5') will also be sampled for TCL VOCs/SVOCs. Also, of the six sludge drying bed samples, the sample with the highest FID/PID reading will be retained for TCL VOCs/SVOCs. If no readings are obtained on FID/PID then only SB-1 (2'-2.5') will be analyzed for TCL VOCs/SVOCs.

Along Pipeline

SB-4	2	Soil	IBP, 3'-5' BP	TAL/Cr^{+6}	Yes
SB-5	2	Soil	IBP, 3'-5' BP	TAL/Cr^{+6}	Yes
SB-6	2	Soil	IBP, 3'-5' BP	TAL/Cr^{+6}	Yes
SB-7	2	Soil	IBP, 3'-5' BP	TAL/Cr^{+6}	Yes

NOTE: The sample with the highest PID reading (of the eight samples) will also be sampled for TCL VOCs and SVOC's
IBP: Immediately beneath pipe, BP: Beneath Pipe If the pipe is not located samples will be obtained at 2 to 4' below ground surface. Samples will be obtained at breaks, joints or discoloration of pipe, if none exist, samples will be obtained as listed in Figure 1.4.2.1

Leaching Pit

SB-8	3	Soil	6"-12", 1'-3', 3'-5', etc.,	TAL,TCL VOCs/SVOCs, Cr^{+6} PCBs	Yes

NOTE: Depth for sample is feet below leaching pit surface. Continuous split spoons will be obtained to the water table. The three samples showing the highest FID/PID readings will be retained for lab analysis. If no FID/PID readings are obtained, samples will be retained at 1'- 3', 3'-5', and 9'-11'.

East Property

SB-9	1	Soil	1'-2', 3'-4', 5'-7'	TCL VOCs/SVOCs, TAL/Cr^{+6}	Yes
SB-10	1	Soil	1'-2', 3'-4', 5'-7'	TCL VOCs, and TAL/Cr^{+6}	Yes
SB-11	1	Soil	1'-2', 3'-4', 5'-7'	TCL VOCs, and TAL/Cr^{+6}	Yes
SB-12	1	Soil	1'-2', 3'-4', 5'-7'	TCL VOCs, and TAL/Cr^{+6}	Yes
SB-13	1	Soil	1'-2', 3'-4', 5'-7'	TCL VOCs/SVOCs, TAL/Cr^{+6}	Yes
SB-14	1	Soil	1'-2', 3'-4', 5'-7'	TCL VOCs/SVOCs, TAL/Cr^{+6}	Yes

Note: The sample showing the highest PID reading will be retained for analysis. If no PID readings are obtained, at least half the samples will be obtained at a depth of 1'-2' and the remaining samples obtained at a depth of 3'-4'.

South Property

SB-15	1	Soil	5'-7', 10'-12'	TCL VOCs/SVOCs, TAL/Cr^{+6} for highest PID reading	Yes

NOTE: The sample will be taken from within the former lagoon. If no PID/FID readings are obtained, a composite of the 5-7' and 10-12' samples will be submitted for SVOCs, TAL/Cr^{+6}. VOCs will be obtained from the 10-12' depth.

Background

BG-1	2	Soil	1'-2', 3'-5'	TCL VOCs/SVOCs, TAL/Cr^{+6}	No

NOTE: BG-1 will be obtained from within boring SW-8. The sample from 3'-5' will also be analyzed for PCBs.

Sediment Samples

Leaching Pools

LP-1	3	Sediment	1'-2', 2'-4', 4'-6' etc.,	TCL VOCs/SVOCs, TAL/Cr^{+6}	Yes
LP-2	3	Sediment	1'-2', 2'-4', 4'-6' etc.,	TCL VOCs/SVOCs, TAL/Cr^{+6}	Yes
LP-3	3	Sediment	1'-2', 2'-4', 4'-6' etc.,	TCL VOCs/SVOCs, TAL/Cr^{+6}	Yes

NOTE: The leaching pools will be sampled continuously to the water table and three samples with the highest FID/PID reading will be retained for analysis. For LP-1 and LP-3, only the sample with the highest FID/PID reading will be analyzed for SVOCs. For LP-2 , the two samples with the Highest FID/PID will be analyzed for SVOCs. If the depths cannot be selected based on FID/PID analysis, then the depths for analysis of TCL VOCs and TAL/Cr^{+6} will be 1'-2', 4'-5', and 10'-12' below the surface of the leaching pool sediments. The sampling depth for TCL SVOCs will be 4'-5' for LP-1 and LP-3, and 1'-2' and 4'-5' for LP-2.

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* See Table 1.6.1 for sample numbering system.
1 FID/PID - Flame Ionization Detector or Photoionization Detector.
2 TCL VOCs: Target Compound List, Volatile Organic Compounds, SVOCs: Semi-Volatile Organic Compounds, TAL: Target Analyte List, Cr^{+6}: Hexavalent Chromium

Target Analyte List parameters and hexavalent chromium (TAL/Cr^{+6}). The groundwater sampling procedures will be presented in Subsection 1.4.7.

1.4.2.2 Soil Sampling

Based upon the previous 1990 RI report and meetings with EPA regarding this project, Fanning, Phillips and Molnar will address five specific areas of concern in the soils (potential sources of contamination). This sampling program is intended to provide the information necessary to determine the nature and extent of soil contamination in those areas that have been identified as areas of concern.

The five areas of concern are identified as: (1) beneath the sludge drying beds; (2) along the buried pipe; (3) within the leaching pit; (4) east of the leaching pit (and railroad spur); and (5) soils south of the facility, specifically the formerly-existing pit present in the 1966 and 1969 aerial photos. In addition to the five areas of concern, soil background conditions will also be investigated on Site in an area that has no known history of contamination.

Beneath the Sludge Drying Beds

Soil samples from beneath the Sludge Drying Beds will be obtained at three locations (see Figures 1.4.2.1 and 1.4.2.2 for all soil and sediment sampling locations). A total of two samples will be obtained from each of these locations. The depth intervals for all soil and sediment sampling are presented in Table 1.4.2.2. Analysis for these samples will be for TAL parameters and hexavalent chromium. In addition, sample SB-1 (2 to 2.5 feet) will be sampled for TCL VOCs/SVOCs. Also, of the six sludge drying bed samples, the sample with the highest organic vapor reading will be retained for TCL VOCs/SVOCs. If no vapor readings are noted, then only SB-1 (2 to 2.5 feet) will be analyzed for TCL VOCs/SVOCs. Organic vapors will be monitored utilizing either an organic vapor analyzer/flamionization detector (FID) or a MicroTIP/photoionization detector (PID).

Along the Buried Pipe Line

Prior to obtaining any soil samples along the pipeline (as previously performed), a backhoe (and operator) or a worker utilizing a shovel will be used to excavate the pipe in order to investigate the pipe existence and location. A 3-foot-deep trench will be excavated at this location. The soils within the trench will then be inspected and four locations will be identified for soil sampling. Each location will be sampled at two depths: immediately beneath the pipe and 3 to 5 feet beneath the pipe. Sample locations that will be chosen will be at any evident breaks or joints in the pipe. If no breaks, discoloration, or joints are evident, the locations chosen will be at the previous sampling locations (HB-11, HB-13, HB-16, and HB-17). These locations were detected with concentrations of metals in the previous investigation. After sampling, soils will be replaced into the trench.

Soil samples will be tested for TAL parameters and hexavalent chromium. In addition, one sample will be analyzed for TCL VOCs and TCL SVOCs based on the highest FID/PID reading. In the event that the pipe is not located, the EPA will be notified and one depth interval (2 to 4 feet below the surface) will be sampled at each location (for the same parameters as discussed above).

Leaching Pit

One deep soil boring is proposed within the leaching pit. Based upon the previous RI 1990 report, samples obtained within the leaching pit indicated slightly elevated concentrations of select metals. This location will be utilized for soil boring and soil sampling. The depth intervals for soil sampling will be 6 to 12 inches, 1 to 3 feet, 3 to 5 feet, etc. to the water table (continuous split spoon samples). As a portion of the leaching pit has been infilled previously to allow access for a drill rig, the sample intervals will begin at the datum obtained from a new survey of the leaching pit base elevation (prior to the infilling). The boring, SB-8, will occur in the south half of the leaching pit. From all soil samples obtained, FID/PID analysis will be performed and the three samples with the highest FID/PID readings will be retained for analysis for TAL parameters plus hexavalent chromium, TCL VOCs, TCL SVOCs, and TCL PCBs. If no readings are obtained for the FID/PID then samples will be retained at 1 to 3 feet, 3 to 5 feet, and 9 to 11 feet.

East of the Property

A total of six soil borings will be performed to the east side of the leaching pit (samples SB-9 through SB-14). Figure 1.4.2.2 shows the locations of these borings. Samples will be obtained at depth intervals from 1 to 2 feet, 3 to 4 feet, and 5 to 7 feet. Soil samples obtained within each of the borings will be screened with a FID/PID to determine which sample will receive laboratory analysis. One sample from each boring with the highest total organic vapor reading will be retained for laboratory analysis. In the event that no FID/PID readings are recorded, at least half the samples will be taken at a depth of 1 to 2 feet and the remaining samples will be taken at a depth of 3 to 4 feet. The sample will be analyzed for TAL parameters plus hexavalent chromium analysis and TCL SVOCs, and a discrete sample at the 3-foot depth. The samples will be analyzed for TCL VOCs. TCL SVOCs will be analyzed only at SB-9, SB-13, and SB-14.

South Side 1960's Pit Area

One soil boring will be performed to the south of the Site in a formerly-existing possible leaching pit. Figure 1.4.2.2 shows the location of this soil boring which is identified as SB-15. The majority of the previous pit area is covered by a building. The boring location chosen is the portion of the previous pit area not covered by the building.

Two samples will be obtained within the boring at 5 to 7 feet and 10 and 12 feet. These samples will be screened with an organic vapor analyzer to determine which one sample will receive laboratory analysis. The sample recorded with the highest FID/PID reading will be retained for laboratory analysis for TAL/hexavalent chromium, TCL VOCs, and TCL SVOCs. In the event that no FID/PID readings are recorded, a composite soil sample of the 5 to 7-foot depth and 10 to 12-foot depth samples will be submitted for TAL/Cr^{+6}, TCL SVOC analysis and a discrete sample of the 10 to 12-foot sample will be submitted for VOC analysis.

Background Soil Samples

A total of two background soil samples will be obtained at depths of 1 to 2 feet and 3 to 5 feet from within the boring for well SW-8. These soil samples will be tested for TAL/Cr^{+6}, TCL VOCs/SVOCs. In addition, the sample from 3 to 5 feet will also be analyzed for PCBs.

All sampling locations will be clearly marked and a NYS-Licensed Surveyor will survey the location for placement on a base map. Soil sampling procedures will be presented in Subsections 1.4.8 and 1.4.9.

1.4.2.3 Sediment Sampling

Continuous split-spoon samples will be obtained from the surface of the sediment (at the base of each leaching pool) down to the water table. Each soil sample (within each leaching pool) will be screened for organic vapors with a FID/PID and the three soil samples recorded with the highest readings will be retained for TCL VOC, TAL and hexavalent chromium analysis. For LP-1 and LP-3, the sample with the highest FID/PID reading will also be analyzed for TCL SVOCs. For LP-2, the two samples with the highest FID/PID readings will be analyzed for TCL SVOCs.

If the depths cannot be selected based on FID/PID analysis, then the depths for TAL/Cr^{+6} and TCL VOCs analysis will be 1 to 2 feet, 4 to 5 feet, and 10 to 12 feet below the surface of the leaching pool sediment. The sampling depth of TCL SVOCs will be 4 to 5 feet for LP-1 and LP-3, and 1 to 2 feet and 4 to 5 feet for LP-2.

Sediment sampling procedures will be presented in Subsection 1.4.8.

1.4.2.4 Air Sampling

The purpose of the air sampling is to determine both the background air quality and the air quality as it pertains to potential sources of contamination at the Site. As the potential contaminants at the Site have been determined to be primarily metals, air sampling will be performed only for metal analysis.

Four (4) air sampling locations will be chosen as presented in Subsection 1.4.10.

1.4.3 Monitoring Well Installation and Geophysical Investigation

1.4.3.1 Monitoring Well Installation

A total of five (5) groundwater monitoring wells will be installed at the Site to augment the five existing groundwater monitoring wells. The drilling contractor to perform this work (as well as soil borings) will be Tyree Environmental Services, Inc. The proposed wells will consist of two upgradient wells, which will be installed off Site (on the Levitz Furniture Corporation property), and three downgradient wells. Of the three downgradient wells, two wells will be shallow wells and one well will be a deep well. The deep well will be installed alongside a shallow well to function together as a paired piezometer (Figure 1.4.2.1 shows the location of existing and proposed groundwater monitoring wells). The position of the downgradient wells is based on the groundwater flow direction, which was calculated to be in a south-southeast direction during the 1988 study by Fanning, Phillips and Molnar. The groundwater flow direction will be re-investigated prior to installation of the proposed wells. If the groundwater flow direction does not concur with the 1988 calculated direction, the EPA will be notified prior to installation of any new wells and the locations of the proposed downgradient wells may be adjusted accordingly.

The purpose of the upgradient wells is to evaluate water quality entering the Site and to provide additional data for water table elevation measurements.

The purpose of the downgradient wells is to assist in determinin the nature and extent of potential contamination emanating from the Site. The paired piezometers (SW-6 and DW-6) will be positioned downgradient of the leaching pit. The shallow well, SW-9 will be downgradient of both the leaching pools and Well SW-3.

All wells will be drilled by using the hollow-stem auger method (approximately 12-inch outside diameter auger flight). For the deep well, if hollow-stem drilling is not possible, an alternative method of drilling will be proposed and implemented upon EPA approval.

The four shallow wells will be constructed of four-inch inner diameter (ID), Schedule 40 PVC. The shallow wells will be installed to a depth of approximately 10 feet below the water table. A 15-foot well screen will be placed 10 feet below, and 5 feet above, the water table. The well screen slot size will be 0.020 inches (based on the grain size analyses performed during the previous well installation). Sand pack (#2 Morie gravel) will be placed opposite the screen in the borehole annulus to a depth of 2 feet above the top of the screen. Bentonite tablets will be placed above the sand pack. The bentonite layer will be approximately two feet thick. The wells will then be grouted to grade with an appropriate cement/bentonite mixture. All sand packs, bentonite, and grout will be tremie-piped into the borehole to reduce the potential for bridging (and gradational sand packing). The wells will be completed with flush-to-grade, cemented castings and frames.

The deep well will be constructed similar to the shallow wells with the exception that the well screen length will be 10 feet. Also, during drilling of the deep well, potable water may be introduced into the augers to equalize head in the augers with respect to head in the surrounding aquifer. This will reduce or prevent heaving of the formation up into the auger flights. The amount of water introduced into the well will be recorded in a field notebook. If potable water is introduced to the borehole, a sample of the introduced water will be obtained and analyzed (for the same parameters that will be analyzed for the groundwater) to ensure that contaminants are not being introduced into the borehole. The sample laboratory results will be obtained prior to introduction of potable water into the borehole. The well will be developed as soon as possible following a 24 hour waiting period for the bentonite seal to set and a minimum of three times the water introduced into the well will be exhausted during development. The bottom of the deep well will be approximately 60 feet below the water table (total depth of approximately 85 feet). This well will be screened in the lower portion of the Upper Glacial Aquifer. The deep well will be completed with a flush-to-grade casting and frame. Figure 1.4.3.1 shows a typical groundwater monitoring well construction diagram. A summary of well installation is presented as follows:

- Casing and Well Screen - 4-inch I.D. threaded Schedule 40 PVC. No solvent or glue will be used to assemble the well screen and riser casing.
- Screen Slot Size - 0.020-inch machine slotted.
- Storage of Casing and Screen - The PVC casing and screen lengths will not be stored on the ground. The well string will be stored on racks or on a clean tarp spread over level ground.
- Cleaning of Casing and Screen - Casing and screen will be

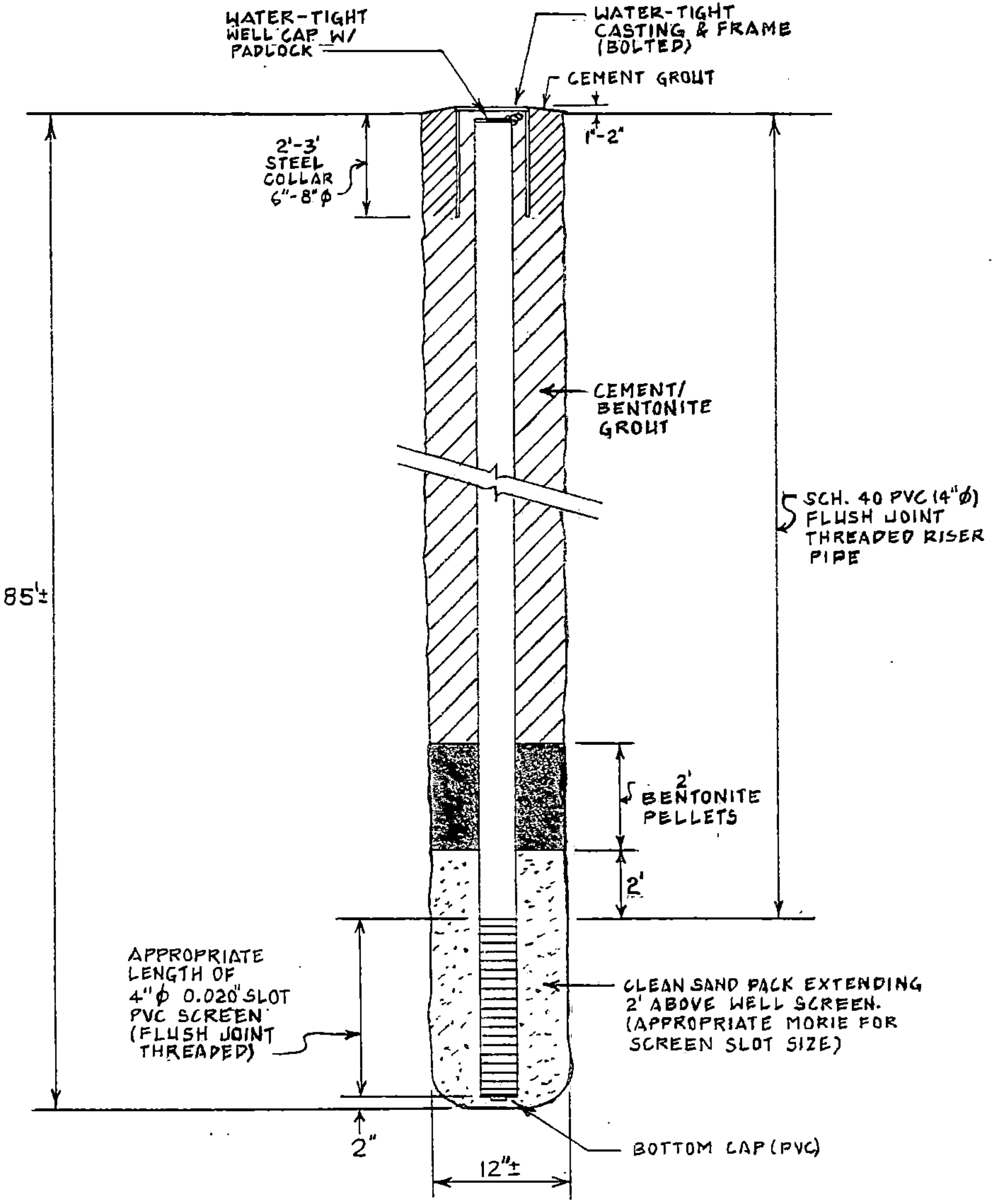

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FIGURE 1.4.3.1 – TYPICAL GROUNDWATER MONITORING WELL CONSTRUCTION

steam-cleaned before the are installed in the boring.

- Bottom Cap - A bottom cap will be installed below the well screen in all monitoring wells.
- Decontamination - All downhole equipment will be steam-cleaned. This procedure will be repeated between drilling each well.
- Sand Pack - By weight, 90 percent of the sand pack material will be larger than the screen slot size (i.e., #2 Morie).
- Placement of the Sand Pack - The sand pack will extend to a minimum of 2 feet above the top of the well screen. This extension will be confirmed by measuring down the annular space with a weighted tape. The sand pack will be tremie-piped into the annular space.
- Bentonite Seal - A 2-foot bentonite seal will be placed in the annular space above the sand pack in each well by tremie-piping bentonite pellets into the annular space.
- Grouting Annular Space - A bentonite-cement grout about 5 percent bentonite, with greater than one bag of Portland cement per 10 gallons of potable water, will be pumped into the annular space to fill the space from the top of the bentonite seal to the ground surface. The grout will be tremie-piped into the annular space. Care will be taken not to disrupt the bentonite seal.
- Surveying - A survey will be performed in which the elevation of the top of the PVC well casing and the surrounding steel protective casing of each well will be determined to ±0.01-foot, and the reference point marked.

The horizontal coordinates of each well will be tied into the Site map. In addition, all existing wells will be surveyed in the same manner.

Split-Spoon Sampling

During the installation of all wells at the Site, a geologic log will be prepared by obtaining split-spoon soil samples at 5-foot intervals (beginning at a depth of 5 feet) throughout each borehole column. A 2-foot length split spoon and a 140-pound drive hammer will be used to obtain the sample. Split-spoon blow counts will be recorded for each six-inch interval that the spoon is driven (in the event that future geotechnical analysis is required). Upon retrieval of the split spoon, the length of sample recovery will be recorded, the geologic description including grain size (using the Unified Soil Classification System (USCS) grain size classes), color, and roundness. The sample will then be placed in eight-ounce glass jars and marked with the date, location, and depth interval. At the paired piezometers (SW-6, DW-6), only the deep well will required split spoon sampling. In addition (for the deep well), a split-spoon sample will be obtained after completion of the borehole drilling to assure that the Magothy Aquifer has not been penetrated. In the event that the Magothy Aquifer is penetrated, the borehole will be grouted (and allowed sufficient time to set) to a minimum of 5 feet above the Upper Glacial-Magothy interface before well construction begins.

Well Development

All newly-installed and previously-installed wells will be developed prior to sampling. The new wells, which are 4-inch ID, will be developed with a submersible pump. All wells will be developed until a turbidity reading of 50 nephelometric turbidity units (NTUs) or less is attained and specific conductivity, pH, and temperature have stabilized (variance of less than 10 percent over the removal of two successive volumes). For low recovery wells, a minimum of 3 borehole volumes will be removed.

For the previously-existing wells, which are 2-inch ID, development will be performed with hand bailers or, if feasible a centrifugal or submersible pump may be used.

If a submersible pump is used for the development, the pump will be constructed of stainless steel and the evacuation tubing will be made of polyethylene or teflon. If a centrifugal pump is used, the intake pipe entering the borehole will be stainless steel and polyethylene or teflon hose will be used.

All tubing and evacuation equipment which enter the borehole will be rinsed with a low phosphate detergent and potable water, then potable water, then rinse with demonstrated analyte-free water prior to use. All tubing will be dedicated to individual wells.

Drill Cuttings and Development Water

During hollow-stem auger well drilling on Site, soil cuttings will be visually inspected for discoloration and screened with a FID or PID. Discoloration will be defined as any notable changes in the "natural" soils that would indicate "unnatural" conditions. Drill cuttings that exhibit FID/PID readings greater than 5 parts per million (ppm) or show discoloration, will be drummed. Drill cuttings that exhibit readings of less than 5 ppm will be used for grading and fill material on the Site.

Drummed drill cuttings will be sampled and analyzed for TCL

VOCs/SVOCs, and TAL/Cr^{+6}. During well drilling on Site, cuttings will be segregated into temporary piles of either < 5 ppm or > 5 ppm (and/or discolored) in order to reduce potential waste generated.

It should be noted that cuttings generated during well drilling on Site are not expected to be contaminated. This is because the wells are not located within areas of concern, but rather in areas to detect groundwater contamination from areas of concern (with the exception of SW-9).

Cuttings generated during well drilling upgradient (at Levitz) will be distributed in the area surrounding each well (SW-7 and SW-8).

Cuttings generated during soil boring and soil sampling (where wells are not constructed) will be used as backfill for each boring. Cuttings will be placed back into each boring such that the last cuttings will be backfilled first and the first cuttings backfilled last.

During well development and purging (prior to sampling), the exhausted water will be discharged onto the ground in the vicinity of the well (in an area that will allow the water to infiltrate back into the ground). No discharge water will be permitted to enter leaching pools or leave the property from which it is generated. As discussed previously, the soils at the Site are highly permeable and the water will be allowed to infiltrate back to the groundwater.

1.4.3.2 Monitoring Well Geophysical Investigation

A geophysical investigation will be performed on deep well DW-6. This investigation will consist of natural gamma logging to correlate stratigraphic information with well boring and split-spoon data. The primary use of the natural gamma logging will be to identify clay layers and identify areas of relatively higher clay content since fine-grained detrital material that contain abundant clay are usually more radioactive than quartz sand. Fanning, Phillips and Molnar has contracted a geophysical firm (Aqua-Terra Geophysical) to perform this work. The logging will take place after the well has been completed.

1.4.4 Meteorologic Investigation

Atmospheric conditions will be monitored at the Site on a daily basis. Prior to commencement of field work each day, barometric pressure, relative humidity, wind velocity and direction, temperature, and organic vapors will be recorded.

The location for the atmospheric measurements will be in the vicinity of monitoring well SW-4 (see Figure 1.4.2.1 for well location) as this is a relatively open area.

Measurements of barometric pressure, relative humidity, wind velocity, and temperature will be obtained with a Solomat 500E. Wind direction will be measured with a wind-directional tell tale. Organic vapors will be measured by a Century 128 Organic Vapor Analyzer (FID) or a Photovac MicroTip (PID). Calibration of these instruments will be checked daily in the field and exposed to a canister of hydrocarbon free air for "zeroing" prior to ascertaining background concentrations of organic vapors.

All data will be recorded in the Site field notebook.

1.4.5 Human Populations and Land Use Investigations

The purpose of the human populations and land use investigations is to determine population and demographics. Much of this information has been presented in Section 3.0 of the RI/FS work plan. However, Fanning, Phillips and Molnar will obtain the most current census data from the Long Island Regional Planning Board which recently completed a study for the "Comprehensive Groundwater Management Plan". In addition, local Town Planning and Zoning Boards will also be contacted for information regarding land use and potentially sensitive populations.

A field survey will be performed, where possible, to confirm file information. All data obtained from this investigation will be further evaluated to determine the drinking water suppliers, wells, water intakes, and water distribution. The previous well survey will be updated during this RI to include locating downgradient domestic and industrial wells within one-half mile of the Site. As part of this survey, information will be obtained from the SCDHS and, if necessary, a physical survey will be conducted.

1.4.6 Ecological Investigation

The purpose of the ecological investigation is to determine if the terrestrial, aquatic or other ecosystems in the Site area could potentially be impacted from a potential release. Fanning, Phillips and Molnar will investigate the ecological setting and potential for impacts in this RI. The investigation will be performed to determine: potential human exposure through agricultural land use (hunting and fishing not applicable); ecosystem components and characteristics; critical habitats; and biocontamination. This investigation will be performed by use of aerial photograph analysis, water resource reports, records of area plants, animal surveys, and existing records of the Site environment. Contacts will be made with the USGS, DEC, SCDHS, and local agencies. A cover type map will be developed for the Site and area within 0.5 miles from the perimeter of the Site. The cover type map will be generated in accordance with guidelines presented in "Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites (NYSDEC, June, 1991)." In the event that a sensitive environment is identified as a potential receptor of contamination from the Site, a qualified ecologist will perform an investigation as appropriate.

1.4.7 Groundwater Sampling Procedures

Groundwater samples will be obtained at each of the 10 wells (5 wells are previously-existing and 5 wells are to be installed). Seven of the 10 wells are on the Site and 3 wells are upgradient of the Site (on the Levitz Furniture Corporation property). The 5 previously-existing wells are 2-inch ID wells and the new wells are to be 4-inch ID (Figure 1.4.2.1 for groundwater well locations).

Two rounds of groundwater sampling of the 10 wells at the Site will be performed: the first round will occur a minimum of 2 weeks after all wells have been developed and the second round will occur a minimum of 1 month after the first round of sampling. The parameters analyzed for the first round of groundwater sampling will include TCL VOCs/SVOCs, TAL parameters (which include metals and cyanide) to include filtered and unfiltered samples, and hexavalent chromium. These parameters may be reduced for the second round of sampling based on the results of the first round of sampling (and approval of the EPA). The laboratory selected to perform all sample analyses is H2M Labs, Inc. in Melville, New York.

The groundwater wells will be sampled after development to a turbidity value of 50 NTUs or less (or a minimum of 3 to 5 well volumes have been purged in the case of slow recovering wells) and a minimum of 2 weeks after development. The procedures for groundwater sampling are as follows:

1. The depth to the static water level and depth of the well will be measured with an electric water level indicator. Measurements will be recorded to the nearest 0.01 feet.
2. The length of the column of water will be calculated and the volume of the well will be derived by multiplying 0.16 gallons/foot for the two inch wells, and 0.65 gallons/foot for the four-inch wells.
3. A stainless steel submersible or centrifugal pump with a stainless steel intake pipe with polyethylene or teflon hose, or a teflon bailer will be used to purge a minimum of three well volumes of water from each well. All tubing and evacuation equipment which enter the borehole will be rinsed with a low-phosphate detergent and potable water, then potable water, then rinsed with demonstrated analyte-free water prior to use (by filling two un-used 55-gallon drums with detergent/water and water and placing the submersible pump with attached hose in the detergent/water drum and pumping the liquid through the equipment and then pumping the potable water through the equipment. Finally, demonstrated analyte-free deionized water will be poured over the pump/hose prior to installment in the well). All tubing will be dedicated to individual wells.
4. Three to five volumes will be purged from the well. Following the removal of each volume of water, stability parameters will be field monitored including pH, specific

conductivity, and temperature. Stability will be achieved when all stability parameter values vary less than 10 percent over the removal of two successive volumes after three volumes are purged. If stability is not achieved after three volumes are purged, an additional volume will be purged and the fourth volume values will be compared to the third volume values. In addition, turbidity will be measured to assure that groundwater turbidity is 50 NTUs or less prior to sampling. In wells with very low recoveries, the well will be evacuated to near dryness once and allowed to recover sufficiently for samples to be taken. EPA will be notified prior to sampling very low recovery wells.

5. Upon achievement of stability, sampling will commence. All samples will be obtained as soon as possible after purging and within three hours of purging. Sample water will be withdrawn from the well only by use of a bottom-loading teflon bailer. A dedicated polypropylene line will be attached to the bailer. At all wells, the sample bottles for VOC analysis (two 40 mil. vials) will be filled (to zero headspace) prior to filling any other sample vials. Samples for VOCs will be preserved with 1:1 hydrochloric acid to a pH of less than 2.

6. Each sample container will be labeled with the job name (job name will be "SJ&J"), sample identification number, date, sampler's firm ("FP&M"), and analysis to be performed.

7. The labeled sample containers will be placed in a laboratory-supplied cooler with ice or chemical ice packs to

depress the temperature to 4° C. The coolers will be sealed with nylon strapping tape and custody seals will be placed across the cooler openings in a manner to reveal if the cooler was opened during transit.

8. The sample coolers will be delivered by a Fanning, Phillips and Molnar Site worker directly to the laboratory.

All groundwater samples obtained during each day of sampling are anticipated to be delivered to the laboratory the same day. In the event that samples are obtained too late for delivery to the laboratory, the samples will be kept in the custody of Fanning, Phillips and Molnar and delivered to the laboratory the following morning.

Upon delivery of the samples to the laboratory, Fanning, Phillips and Molnar will obtain a copy of the chain of custody.

1.4.8 Drill Rig-Assisted Soil Boring Sampling Procedures

Hollow-stem drill rig augering (with 8-inch outside diameter auger flights) will be utilized to obtain split-spoon samples at the following locations:

Beneath Sludge Drying Beds

SB-3 (4' to 5', 8' to 10')

Leaching Pit

SB-8 (6" to 12", 1' to 3', 3' to 5', etc. (continuous split spoons to the water table)

East Property

SB-9 (1' to 2', 3' to 4' , 5' to 7')
SB-10 (1' to 2', 3' to 4', 5' to 7')
SB-11 (1' to 2', 3' to 4', 5' to 7')
SB-12 (1' to 2', 3' to 4', 5' to 7')
SB-13 (1' to 2', 3' to 4', 5' to 7')
SB-14 (1' to 2', 3' to 4', 5' to 7')

South Property

SB-15 (5' to 7', 10' to 12')

Background

BG-1 (1' to 2', 3' to 5')

Leaching Pools

LP-1 (1' to 2', 2' to 4', 4' to 6', etc. (continuous split spoons to water table)

LP-2 (1' to 2', 2' to 4', 4' to 6', etc. (continuous split spoons to water table)

LP-3 (1' to 2', 2' to 4', 4' to 6', etc. (continuous split spoons to water table)

For leaching pit boring, an elevation survey will be performed by Fanning, Phillips and Molnar to estimate the elevation of the former leaching pit bottom surface. The original survey diagram is presented in Appendix A. This diagram shows that the former drilling location (and surface of the leaching pit) exists at a location of 25.52 feet N 82° E of the center of the manhole at the edge of the leaching pit. The surface of the leaching pit is 6.82 feet below the elevation of the manhole. If the "nail in tree"(which still exists as of January, 1992) is used as a reference, the previous boring is located 46.32' N77°E of the nail in tree. The elevation of the surface is 14.29 feet below the nail. The growth of the tree is 3-4 years is not expected to be significant for the accuracy of this survey.

All soil and sediment samples will be obtained by use of a split-spoon sampler. Upon opening the split spoon, sample containers for VOC analysis will be filled as quickly as possible (if VOCs are to be analyzed) using a decontaminated stainless steel spoon and then FID or PID readings will be obtained on the remaining soil in the split spoon. If the VOC sample is not selected for analysis, the sample will be discarded. The balance of soil in the split spoon will then be homogenized. Homogenization will be used to mix individual grab samples to minimize bias of sample representiveness due to natural stratification or constituents within the sample.

Samples of a soil/sediment matrix will be homogenized by first removing rocks, twigs, leaves, and other debris not considered part of the sample. The soil/sediment will be placed in a stainless steel pan and thoroughly mixed using a stainless steel spoon. The sample will then be quartered and moved to the four corners of the pan. Each quarter of the pan will be mixed individually, and then rolled to the center of the pan and the entire sample will be mixed again.

These samples will represent composites over the depth interval that the split spoon has penetrated.

1.4.9 Hand Auger Soil Sampling Procedures

The shallow soil samples will be obtained with a hand auger with a 3.5 inch ID bucket. The samples, which will be obtained with a hand auger, are as follows:

Beneath Sludge Drying Beds

SB-1 (2' to 2.5', 4' to 5')

SB-2 (2' to 2.5', 4' to 5')

Along Pipeline

SB-4 (Immediately beneath the pipe, 3' to 5' beneath the pipe)

SB-5 (Immediately beneath the pipe, 3' to 5' beneath the pipe)

SB-6 (Immediately beneath the pipe, 3' to 5' beneath the pipe)

SB-7 (Immediately beneath the pipe, 3' to 5' beneath the pipe)

Sample containers to be filled and analyzed for VOCs will be filled prior to other containers and the samples will be obtained directly from the top of the auger bucket. Soil vapor may be monitored at select locations for determinations of laboratory analysis. A FID or PID will be used to screen samples as presented in Section 1.4.8. The balance of the soil in the auger bucket will then be placed in a stainless steel mixing bowl for homogenization and the other sample containers will be filled. These samples will represent composites over the depth interval for which the auger bucket collected the sample.

Prior to obtaining hand auger samples for the area designated as "Along Pipeline", a backhoe may be utilized to excavate a three-foot-deep trench in the vicinity of the suspected location of pipeline. Hand shovels may also be used to assist in the pipe location investigation.

In the event that hand augering is unsuccessful at any locations due to excessive depth or obstruction, a drill rig may be utilized and samples will be obtained following the procedures outlined in Section 1.4.8.

1.4.10 Air Sampling Procedures

Four (4) air samples will be obtained to determine if airborne soil particulates contain adsorbed metals and present a potential health threat.

To collect particulates, a standard industrial hygiene pump and assembly will be used. The pumping rate will be five liters per minute. The sample duration will be 30 minutes (to achieve a total sample volume of 150 liters). A membrane filter with a pore size of 0.8 micrometers will be used to capture the particulates. The sample will then be analyzed for TAL (metals only).

The 4 samples will be collected as follows: The first sample (which will be designated as AS-1), will be collected from within the leaching pit at the topographically lowest point. All samples will be obtained at a height of approximately 4 feet above the grade of the sampling location. Sample AS-2 will be obtained 10 feet beyond the rim of the leaching pit in the down wind direction. Sample AS-3 will be obtained in the vicinity of monitoring well SW-1. Sample AS-4 will be a background sample, which will be obtained at the property border in the direction equal to the wind direction. For example, if the wind direction is north at the time of sampling, the background sample will be taken along the north border.

Meteorological data, as outlined in Subsection 1.4.4, will be obtained for each air sampling location prior to commencement of sampling. Sampling will take place during the afternoon when winds are typically strongest. Attempts will be made to sample during periods when wind velocity is greater than approximately 4 miles per hour (352 feet/minute).

An air pathway analysis will be performed as part of the RI. Using surface soil concentrations of metals and semiviolatiles and soil gas or soil bulk concentrations of volatile emissions, emission rates will be estimated for each of the contaminants from each of the areas at the site. These emission rates will be used to predict maximum fenceline ambient concentrations of each of the contaminants. The predicted lead concentration will be compared to the National Ambient Air Quality Standard for lead. For the contaminants for which risk numbers are available, the predicted ambient concentrations will be used by EPA in the baseline risk assessment.

1.4.11 Quality Assurance/Quality Control

Quality Assurance/Quality Control (QA/QC) samples will be obtained during the groundwater, soil and sediment sampling. A summary of QA/QC samples to be obtained is presented in Table 1.4.11.1.

During groundwater sampling, one field blank per day will be prepared by pouring the laboratory-supplied, demonstrated analyte-free deionized water through the decontaminated teflon bailer and into the sample containers. The field blank will be tested for the same parameters as the groundwater sampled. If more than one decontamination event occurs per day, the same person will perform the decontamination to maintain uniformity in the procedure. In addition, one field blank will be obtained for the filter and filter apparatus for the groundwater samples which are to be analyzed for metals. The field blank results will be interpreted for the determination of either laboratory or field contamination and will attest to the quality of the decontamination procedures.

A trip blank will be prepared in the field using demonstrated analyte-free deionized water on the same day as the associated groundwater samples. The trip blanks will be preserved in the same manner as the groundwater samples. Trip blanks will be prepared at a minimum frequency of one per day and will be prepared only when aqueous samples for VOCs are obtained. The deionized water will be demonstrated analyte-free. The criteria for demonstrated analyte-free water is as follows: The assigned values for the Contract Required Detection Limits (CRDLs) and Contract Required Quantitation Limits (CRQLs) are listed in the CLP SOWs. These criteria apply to <u>all</u> blank

TABLE 1.4.11.1
SUMMARY OF QA/QC SAMPLES

	Number of Samples	Analytical Parameters
Groundwater Samples		
Field Blank	1 per day	TCL VOCs/SVOCs, TAL/Cr^{+6}(1)
Trip Blank	1 per day	TCL VOCs
Matrix Spike	1*	TCL VOCs/SVOCs
Matrix Spike Duplicate	1*	TCL VOCs/SVOCs
Duplicate Sample	1 per every 20 samples obtained.	TCL VOCs/SVOCs, TAL/Cr^{+6}
Soil and Sediment Samples		
Field Blank	1 per day	TCL VOCs/SVOCs, TAL/Cr^{+6}, PCBs
Duplicate Sample	1 per every 20 samples obtained.	TCL VOCs/SVOCs, TAL/Cr^{+6}

* 1 per every 20 samples obtained or every 14 calendar days, whichever comes first.

(1) TCL VOCs/SVOCs = Target Compound List Volatile Organic Compounds/Semi-Volatile Compounds, TAL = Target Analyte List, Cr^{+6} = Hexavalent Chromium, PCBs = Polychlorinated biphenyls.

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water used for superfund-lead as well as PRP projects whether or not EPA CLP analytical methods are employed. If the levels of detection needed on a specific site are lower than the CLP CRDLs/CRQLs, then those levels are used to define the criteria for analyte-free water:

purgeable organics	<10 ppb
semi-volatile organics	<CRQL
pesticides	<CRQL
PCBs	<CRQL
inorganics	<CRQL

However, specifically for common laboratory contaminants listed below, the allowable limits are three times the respective CRQLs:

methylene chloride
acetone
toluene
2-butanone
phthalates

Trip blanks will be analyzed for TCL VOCs only. The purpose of the trip blanks are to ensure that no cross-contamination of TCL VOCs occurs in the laboratory sample cooler due to breakage and to attest to laboratory water quality.

A matrix spike and matrix spike duplicate will be submitted to the laboratory by obtaining extra volume of selected aqueous samples which are to be analyzed for VOCs and SVOCs. The frequency of matrix spikes and matrix spike duplicates will be one per twenty aqueous samples or one each fourteen calendar day period, which ever comes first.

To check the precision of the laboratory, blind duplicate samples for each matrix will be obtained at a frequency of at least five percent of the total number of samples obtained.

For the soil and sediment sampling, one field blank per day will be prepared for each equipment-type decontamination event. The same aliquot of water may be used for all equipment associated with a particular sample matrix for analysis of semi-volatile organics, PCBs, and inorganics.

1.4.12 Slug Testing Procedures

Slug testing will be performed on all wells to derive estimates of hydraulic conductivity. The slug testing will be performed by the following procedures:

1. The depth to the static water level will be measured to the nearest 0.01 foot.
2. A Druck^{TM} transducer will be lowered into the well approximately seven feet below the static water surface.
3. A decontaminated slug consisting of a capped PVC pipe that is water-filled will be submerged between the transducer and the water surface. The slug will be sufficient volume to effect a minimum of two feet of displacement in the well.
4. The depth to the static water level will be re-measured and compared with the results of Step #1 to assure recovery to static condition.
5. The slug will be removed from the water and the rising head recovery rate will be recorded (change in head vs. time) with a Telog 2109 data logger with one-second data interval capability.
6. The slug test will be complete when the well recovers to static conditions.
7. The results of the slug testing will be stored on a floppy disk in the field. Hydraulic conductivity estimates will later be derived using the Bouwer-Rice method.

1.4.13 Decontamination Procedures

All downhole equipment used during the drilling of the monitoring wells will be steam cleaned prior to use at each location to prevent cross contamination. This equipment includes, but is not limited to, the hollow-stem auger flights, the split spoons, and the PVC pipe.

The backhoe or shovels used for the pipe excavation will be decontaminated by steam cleaning.

All sampling equipment will be decontaminated. The sampling equipment includes, but is not limited to, teflon bailers, hand augers, and mixing bowls. The decontamination procedure is as follows:

1. Equipment will be scrubbed in a bath of potable water and low-phosphate detergent;
2. Potable water rinse;
3. Equipment will be sprayed with a 10 percent nitric acid solution;
4. Potable water rinse;
5. Equipment will be sprayed by methanol followed by hexane;
6. Deionized water (demonstrated analyte-free) rinse; and
7. Equipment will be allowed to air dry. For storage or transport, equipment will be wrapped in aluminum foil (shiny side out).

1.4.14 Surveying

Upon completion of all monitoring wells and soil sampling locations, a New York State licensed surveyor will be contracted to survey the wells and sampling locations and elevations. The elevations will be measured relative to sea level by incorporating

Coast and Geodetic markers into the survey.

Each soil sample location will be marked in the field labeled after completion of sampling for the surveyor to easily identify for measurements and for location on a Site base map.

1.5 Field Monitoring Instruments

Field monitoring instruments will be calibrated prior to use as per the manufacturer's specifications. The instruments will generally be calibrated daily prior to commencement of Site work. The function of each instrument is presented as follows:

- Photovac MicroTIP - this instrument is a photoionization detector (PID) that measures the concentration of airborne ionizable gases and vapors. The MicroTIP does not distinguish between individual compounds and will not read methane. The calibration will be performed with a cylinder of "zero gas" (hydrocarbon free air) to "zero" the instrument and a 100 ppm cylinder of isobutylene to calibrate the span.
- Century Model OVA - 128 Portable Organic Vapor Analyzer (OVA) - this instrument is a flame ionization detector (FID) that measures the concentration of airborne ionizable gases and vapors. The OVA does not distinguish between individual compounds in the survey mode and the OVA will detect methane. The calibration will be performed with "zero gas" to "zero" the instrument. The span gas will be a 50 ppm concentration of methane. Background atmospheric concentrations of methane are generally two to four ppm, therefore, background concentrations of organic vapors at

the Site will generally be obtained with the MicroTIP (which does not detect methane).

- Solomat 500e - this is a multifunctional environmental instrument that measures air temperature, relative humidity, barometric pressure, and wind velocity.
- Omega PHH-80 - this instrument will be used to measure pH and specific conductivity of groundwater. The pH and specific conductivity of this instrument will be calibrated with Omega pH and specific conductivity solutions (within the appropriate calibration range of the groundwater at the Site).

1.6 Sample Handling and Analysis

1.6.1 Sample Designation

All samples will be identified as outlined in Table 1.6.1.1.

1.6.2 Sample Packaging and Shipment

All samples will be placed in a laboratory-supplied cooler and packed with ice or chemical ice packs to depress the temperature to 4°C. The shipping coolers will be secured with nylon strapping tape and custody seals will be placed along cooler openings in a manner to reveal if the cooler was opened during transit. The sample containers will be picked up by Fanning, Phillips and Molnar personnel at the laboratory. At the end of each day of sampling, the samples will be delivered to the laboratory by Fanning, Phillips and Molnar personnel. In the event that samples cannot be delivered to the laboratory the same day, the samples will remain in the custody of Fanning, Phillips and Molnar personnel overnight and the samples will be delivered to the laboratory the following morning.

TABLE 1.6.1.1
SAMPLE NUMBERING SYSTEM
KENMARK TEXTILES CORP. SITE
FARMINGDALE, NEW YORK

Matrix	Matrix/Location Code	Example
o <u>Soil</u>		
Soil Boring (Split-Spoon and hand auger Samples)	SB-	SB-1 (depth)
o <u>Groundwater</u>		
Shallow Well	SW-	SW-2
Deep Well	DW-	DW-2
o <u>Sediment</u>		
Leaching Pool	LP-	LP-1 (depth)
o <u>Background</u>	BG-	BG-1 (depth)
o <u>Air</u>	AS-	AS-1
o <u>Field Blanks</u>	FB-	FB-1
o <u>Trip Blanks</u>	TB-	TB-1
o <u>Matrix Spike</u>	MS-	MS-1 (may include depth if soil)
o <u>Matrix Spike Duplicate</u>	MSD-	MSD-1 (may include depth if soil)

Note:

- Duplicate samples will be assigned a sequential prefix and number in the shallow well groundwater category. For example, the first duplicate obtained will be assigned the number SW-10 (as there are 9 shallow wells).
- Each sample designation will be recorded in the field notebook along with the location, depth interval, matrix, and other pertinent information.

1.6.3 Chain-of-Custody Procedures

For each day of sampling, a chain-of-custody sheet will be completed and submitted to the laboratory (a copy of the chain of custody will be retained by Fanning, Phillips and Molnar). The chain-of-custody sheet will include the project name and Fanning, Phillips and Molnar's project number (126-91-03), the sampler's signature and the locations, intervals, and analysis parameters requested. Appendix B presents a sample chain-of-custody sheet. No samples are anticipated to be in the custody of any party other than Fanning, Phillips and Molnar or H2M Laboratories. A sample will be considered under custody if one or more of the following criteria are met:

- The sample is in the sampler's possession.
- The sample is in the sampler's view after being in possession.
- The sample was in the sampler's possession and was then locked up to prevent tampering.
- The sample is in a designated secure area.

1.6.4 Sample Containers, Preservation, Holding Times, and Analysis Methods

Sample containers, preservation, holding times, and analysis methods, are presented in Tables 1.6.4.1 (groundwater samples), 1.6.4.2 (soil and sediment samples), and 1.6.4.3 (air samples).

TABLE 1.6.4.1
GROUNDWATER SAMPLE CONTAINERS, PRESERVATION, HOLDING TIMES, AND ANALYSIS METHODS

Parameter	Containerization Size	Containerization Type	Preservation	Holding Time	EPA Analysis Method
TCL VOCs	2 x 40 ml Teflon Septum	Glass Vial	4°C (zero headspace) 1:1 hydrochloric acid	14 days	EPA 524.2
TCLs VOCs	2 x 1 liter	2.5 liter jug	4°C	7 days extraction and 40 days to analysis	625
TAL Metals (except Hg)	1 liter	Heavy Duty Polyethlyene Bottles	HNO_3 to pH<2 4°C	6 months	200 series
Hg	250 ml	Heavy Duty Polyethlyene Bottles	HNO_3 to pH<2	28 days	245.1
CN (total)	1 liter	Heavy Duty Polyethlyene Bottles	4°C (see note at bottom of page for additional preservation procedures)	14 days	335.2
Cr^{+6}	250 ml	Heavy Duty Polyethlyene Bottles	4°C	24 hours	218.4
PCBs	4 X 1 liter	Amber Glass		5 days extraction 40 days to analyze	608

Notes: Holding times begin on the date of sample collection. Triple volume will be collected for MS/MSD samples for aqueous organic samples. For the cyanide aliquot preservation, the following guidelines will be followed:

1) Test a drop of sample with potassium-starch paper (KI-starch paper): a blue color indicates the presence of oxidizing agents and the need for treatment. Add asorbic acid, a few crystals at a time, until a drop of sample produces no color on the indicator paper. Then add an additional 0.6 of ascorbic acid for each liter of sample volume. 2) Test a drop of sample on lead acetate paper previously moistened with acid buffer solution. Darkening of the paper indicates the presence of S^{2-}. If S^{2-} is present, add powdered cadmium carbonate until a drop of the treated solution does not darken the lead acetate test paper and then filter the solution before raising the pH for stabilization. 3) Preserve samples with 2 ml of 10 N sodium hydroxide per lite of sample (pH>12).

TABLE 1.6.4.2
SOIL AND SEDIMENT SAMPLE CONTAINERS, PRESERVATION, HOLDING TIMES, AND ANALYSIS METHODS

Parameter	Containerization Size	Containerization Type	Preservation	Holding Time	EPA Analysis Method
TCL VOCs	2 x 40 ml	Glass Vial	4°C	10 days	8240
TCL VOCs	16 oz	Clear Glass Wide Mouth Jar	4°C	7 days extraction and 40 days to analysis	8250
TAL Metals (except Hg)	8 oz	Clear Glass Wide Mouth Jar	4°C	6 months	7000 Series
Hg	8 oz	Clear Glass Wide Mouth Jar	4°C	28 days	7471
Cr^{+6}	8 oz	Clear Glass Wide Mouth Jar	4°C	24 hours	7196
PCBs	8 oz	Clear Glass Wide Mouth Jar with Teflon Lines	4°C	10 days extraction 40 days to analyze	608

Note: Holding times begin on the date of sample collection.

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TABLE 1.6.4.3
AIR SAMPLE CONTAINERS, PRESERVATIONS, HOLDING TIMES, AND ANALYSIS METHODS

Preseration	Containerization	Preservation	Holding Time	EPA Analysis Method
TAL Metals	Filter Cartridges 0.8 um pore space	None	None (Hg - 7 days)	7300 Pb-7105 Hg-6009

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SECTION 2.0
QUALITY ASSURANCE PROJECT PLAN

1.1 Introduction

This Quality Assurance Project Plan (QAPP) is presented with the Field Sampling Plan (FSP) and together comprise the Sampling and Analysis Plan for the remedial investigation/feasibility study (RI/FS) for the Kenmark Textiles site (the "Site").

The purpose of this QAPP is to describe the following:

- Project Description
- Project Organization and Responsibilities
- Quality Assurance Objectives for Measurement
- Sampling Procedures
- Sample Custody
- Calibration Procedures
- Analytical Procedures
- Data Reduction, Validation and Reporting
- Internal Quality Control
- Performance and System Audits
- Preventive Maintenance
- Data Assessments Procedures
- Corrective Action
- Quality Assurance Reports

The QAPP was prepared in accordance with the EPA publication, "Test Methods for Evaluating Solid Waste (SW-846), November, 1986", and the EPA document entitled, "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, USEPA QAMS-005/80", and "Guidelines for Preparation of Combined Work/Quality Assurance Project Plans for Environmental Monitoring (USEPA, Office of Water Regulations and Standards, May, 1984".

2.2 Project Description

2.2.1 Objective and Scope

The objective of the RI work plan is to determine the areal and vertical extent of soil and groundwater contamination at the Site.

Based upon the findings of the RI, remedial alternatives will be presented and the most feasible alternative(s) of remediation will be utilized. Mitigation and elimination of any present or potential threat to human health or the environment as per the requirements of the consent order for the RI/FS will be completed.

The scope of the work for the RI will include groundwater monitoring well installations, groundwater sampling, soil/sediment sampling, air sampling, geophysical testing (gamma logging), slug testing, and a meteorological investigation. Specific protocols for each activity have been presented previously in Subsection 1.4.

2.2.2 Data Usage

The intended use of the data collected is to determine the nature and extent of contamination, provide data for the risk assessment, assist in the selection of remedies which will protect human health and the environment, and identify Federal potentially applicable or relevant and appropriate requirements (ARARs) as a result of remediation.

2.2.3 Schedule

The estimated schedule for the field activities at the Site are presented in Table 2.2.3.1.

2.3 Project Organization and Approach

The project organization is presented on Figure 2.3.1. The resumes of key personnel are presented in Appendix C. The Project

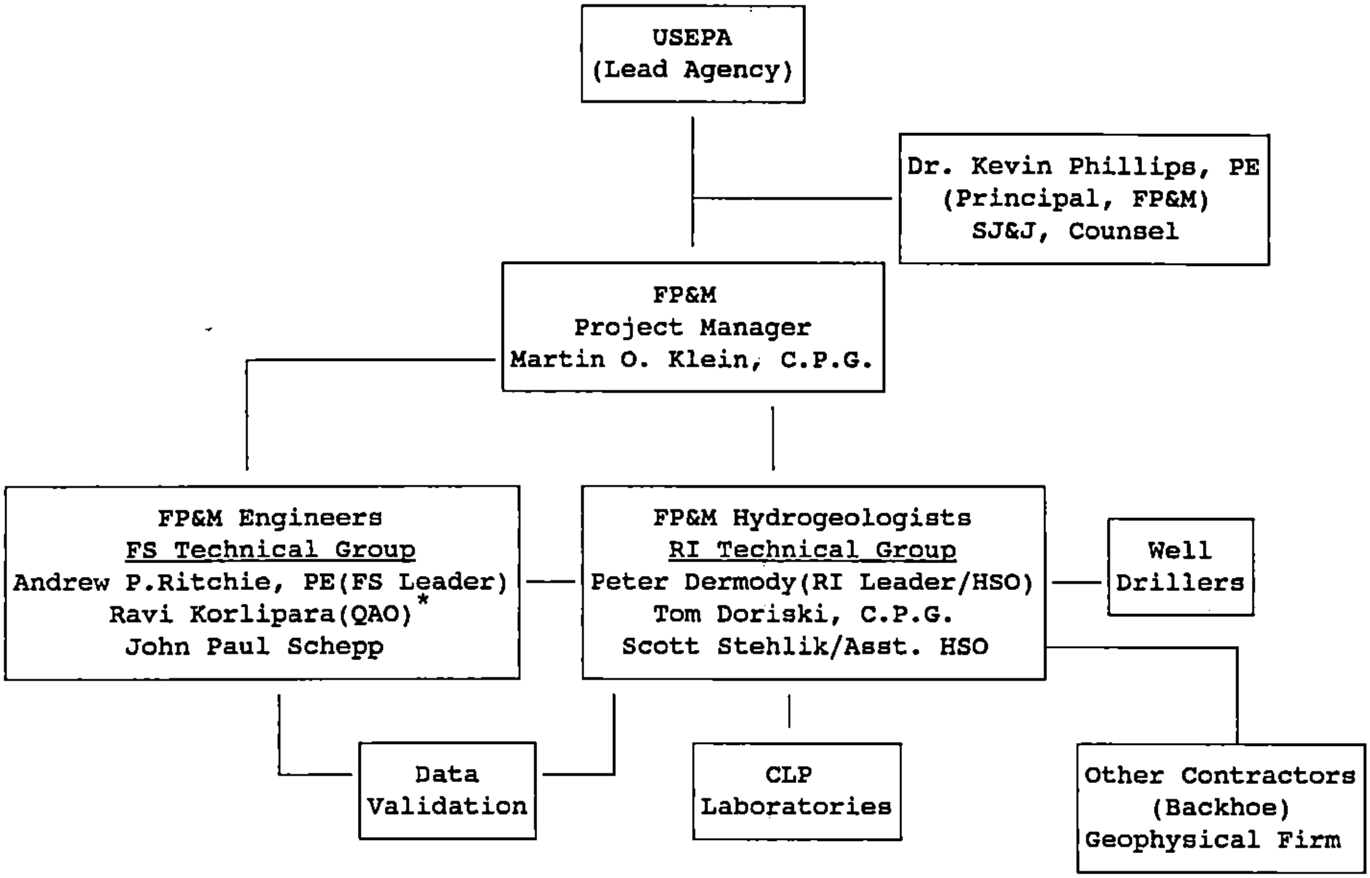
TABLE 2.2.3.1

ESTIMATED SCHEDULE FOR FIELD INVESTIGATION*
KENMARK TEXTILES SITE
FARMINGDALE, NEW YORK

```
 >===>Critical  >--->Non-Critical  >...>Free Float  >+++>Completed  *Milestone
--------------------------------------------------------------------------------
                                              1992 MAY                      JUN
          Description                              01   08   15   22   29   05
----------------------------------------------------------------------------------
          INSTALL MONITORING WELLS                 >========>.    .    .    .
          GEOPHYSICAL TESTING                      |    .    =    .    .    .
          DEVELOP MONITORING WELLS                 |    .    >=>  .    .    .
          SOIL AND SEDIMENT BORING SAMPLING        |    .    .  >=========> .
          HAND AUGER SOIL SAMPLING                 |    .    .  =>.    .    .
          SURVEYING OF WELLS AND SAMPLE LOCATION   |    .    .    .    .   =.
          ALLOW WELLS TO STABILIZE                 |    .    .  >=========> .
          GROUNDWATER SAMPLING                     |    .    .    .    .   =.
          SLUG TESTING                             |    .    .    .    .    =>
          DEMOBILIZATION                           |    .    .    .    .    .  *
```

* Start date is estimated to be May 1, 1992, however, this date may change.

FIGURE 2.3.1
PROJECT MANAGEMENT CHART FOR RI/FS
KENMARK TEXTILES



* QAO - Quality Assurance Officer

Manager (PM) has primary responsibility for plan development and implementation of the RI/FS, including coordination among the RI and FS leaders and support staff, development of bid packages, acquisition of engineering or specialized technical support, and all other aspects of the day-to-day activities associated with the project. The PM identifies staff requirements, directs and monitors Site progress, ensures implementation of quality procedures and adherence to applicable codes and regulations, and is responsible for performance within the established budget and schedule.

The Quality Assurance Officer (QAO) is responsible for overall project quality, including development of the generic program and project QA/QC plans, review of specific task QA/QC procedures, review of laboratory, vendor, and subcontractor plans and procedures, and auditing of specific tasks at established intervals. The QAO reports directly to Fanning, Phillips and Molnar's Principal and is independent of the PM's reporting structure.

The RI leader reports to and will work directly with the PM to develop the SAP and will be responsible for the implementation of the field investigation, the analysis, interpretation and presentation of data acquired relative to the Site, and preparation of the RI report.

The FS leader will work closely with the RI leader to ensure that the field investigation generates the proper usable type and quantity of data for the initial screening of candidate technologies, detailed evaluation of remedial alternatives, development of requirements for an evaluation of treatability study/pilot testing, and if required, an associated cost analysis. The FS report will be developed by the FS technical group.

The RI leader is responsible for on-Site management for the duration of all Site RI operations, including the activities conducted by Fanning, Phillips and Molnar such as sampling, and inspecting the work performed by other contractors, such as well drillers and surveyors. The RI leader will provide consultation to the PM and EPA and decide on factors relating to sampling activities and changes to the field sampling program.

The RI leader and PM will ensure that the analytical laboratory will perform analyses as described in the SAP. The QAO will be responsible for assuring that proper collection, packaging, preservation, and shipping of samples is performed in accordance with EPA guidelines. The QAO will consult frequently with the RI Leader.

The Health and Safety Officer will be responsible for implementing the Health and Safety Plan.

Project progress meetings will be held, as needed, to evaluate project status, and review major deliverables.

2.4 Quality Assurance Objectives for Measurement

The overall QC objectives for field activities, data analyses, and laboratory analyses is to produce data at the highest quality level to provide direct support for the feasibility study. All sampling activities used directly to support the RI/FS will use Level IV Data Qualities Objectives. These activities include two rounds of groundwater sampling and one round of soil/sediment sampling and air sampling.

Specifically, all data will be gathered or developed using procedures appropriate for the intended use. Standard procedures are used so that known and acceptable levels of accuracy, precision, representativeness, completeness, and comparability are maintained for each data set. Descriptions of these criteria are presented in the following subsections.

2.4.1 Accuracy

Accuracy is the degree of agreement of a measurement, X, with an accepted reference or true value, T, usually expressed as the difference between the two values, X-T, or the difference as a percentage of the reference or true value, 100(X-T)/T, and sometimes expressed as a ratio X/T. Accuracy is a measure of the bias in a system.

The accuracy of data collected using field instruments is difficult to quantify. It can be qualitatively maximized, however, by strict adherence to standard protocols and, where applicable, manufacturer's operating and calibration procedures. This will ensure that the data are accurate and within the manufacturer's reported accuracy limits.

Analytical accuracy is expressed as the percent recovery of an analyte (or a surrogate in the case of organic analytes) that has been added to the sample or standard matrix (e.g., a blank) at a known concentration before analysis and is expressed by the following formula:

$$\text{Accuracy} = \text{percent recovery} = \frac{A_T\ A_O}{A_F} \text{ X } 100 \text{ percent}$$

where:

A_T = Total amount found in fortified sample

A_O = Amount found in unfortified sample

A_F = Amount added to sample

The QA objectives for accuracy will have the following minimum requirements:

- Spiked samples to assess the accuracy of non-detects and positive sample results.
- Field and trip blanks to determine if sample contamination has occurred.

2.4.2 Precision

Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is best expressed in terms of the standard deviation.

Analytical precision is calculated by expressing as a percentage, the difference between results of analyses of duplicate samples for a given analyte. Precision can be expressed by the formula:

$$RPD = \frac{C_1 \quad C_2}{(C_1 + C_2)/2} \text{ X 100 percent}$$

where:

RPD = Relative percentage difference

C_1 = Concentration of analyte in sample

C_2 = Concentration of analyte in duplicate

The QA objectives for precision will have the following minimum requirements:

- Confidence level of 80%.
- One set of duplicates for both the groundwater and soil/sediment samples.
- Measurement error (using duplicate samples results) within ± 20% using the RPD formula.

2.4.3 Completeness

Completeness is a measure of the relative number of data points that meet all the acceptance criteria including accuracy, precision, and any other required by the specific analytical method used. It is usually a comparison of actual numbers of valid data points and expected numbers of valid data points expressed as a percentage.

Access to various areas and/or media along with unanticipated difficulties with sample collection affect field data completeness. For example, poor sample recovery in a split-spoon sample reduces the number of soil samples that can be collected and, therefore, affects the completeness.

Difficulties encountered while handling samples in the laboratory, as well as unforeseen complications regarding analytical methods, may affect completeness during sample analysis. For example, the proposed analytical methods (particularly for the organics analyses) are intended to anlayze "environmental samples" (low and medium-level concentrations). The applicability of these methods to unknown or hazardous-level samples may results in poor performance and, therefore, have an adverse effect on achieving the data completeness goal. No specific completeness goals will be established for Kenmark Textiles RI. If a sample is deemed unobtainable (within reasonable effort) by the RI leader, or a location requires resampling, the RI leader will report the circumstances to the PM who will contact the EPA to determine if this sample is "critical" and what methods will be employed to obtain valid results.

There are certain data points that are considered critical to the investigation. Critical data points are sampling locations for which valid data must be obtained for the sampling event to be considered complete and/or that can be expressed by a percentage of samples taken in a medium. An example of a critical data point may be an upgradient well or any other data point considered vital to the decision-making process. Critical data points for the Kenmark Textiles RI will be determined by the EPA, the PM, and the RI Leader.

2.4.4 Comparability

Comparability expresses the confidence with which one data set can be compared with another. The comparability of the data, a relative measure, is influenced by sampling and analytical procedures. By providing specific protocols to be used for obtaining and analyzing samples, data sets should be comparable regardless of who obtains the sample or performs the analysis.

2.5 Sampling Procedures

Field sampling procedures are provided in Subsection 1.4. A list of the number of samples, their types, matrix, and parameters is presented in Tables 1.4.2.1 and 1.4.2.2. Sample containerization preservation, holding times, and analysis methods have been presented in Subsection 1.6.4.

2.5.1 Sample Custody

Chain-of-custody procedures have been presented in Subsection 1.6.3.

2.5.2 Field Logs

All data collection activities performed at the Site will be documented either in a weatherproof, bound notebook or on appropriate forms. Entries will be as detailed and descriptive as possible so that a particular situation can be recalled without reliance on the collector's memory. All field log entries will be dated. Field notebooks will be assigned to individual field personnel for the duration of their stay in the field. All field log forms will be kept in ring binders assigned to individual field personnel.

The cover of each notebook or ring binder will contain the following information:

- o Person to whom the book is assigned
- o Project name
- o Start Date
- o End Date

All measurements, observations, and samples collected will be recorded. If an incorrect entry is made, the data will be crossed out with a single strike mark and the mark initialed. All entries to notebooks will be made with black indelible ink.

Any revision to field notes will be made on the field log and will be dated and initialed by the person revising the log. There will no erasures or deletions from the field logs.

2.5.3 Photographs

To the extent practicable, sampling locations will be photographed to provide a visual record of the conditions of the sampling area. All rolls of film will be numbered with roll number and picture number and recorded in the field notebook. Pictures of the sampling locations will be taken with 35-mm slide or print film.

2.5.4 Calibration Procedure and Frequencies

This section will present the calibration procedures and frequencies for all field monitoring instrument (the use of each instrument has been presented in Subsection 1.5.

Photovac MicroTIP (Photoionization Detector)

Isobutylene at 100 ppm in air will be used as Span Gas. A commercial zero grade gas will be used as the zero gas. To calibrate the instrument, use the Calibration Kit (Photovac Part No. 390033) as follows:

1. Connect the supplied regulator to the Span Gas cylinder. Hand tighten the fittings.
2. Open the valve on the gas bag by turning the valve stem fully counter clockwise.
3. Attach the gas bag adapter nut to the regulator. Hand tighten the fittings.
4. Turn the regulator knob counter clockwise about half turn to start the flow of gas.
5. Fill the gas bag about half full and then close the regulator fully clockwise to turn off the flow of gas.
6. Disconnect the bag from the adapter and empty it. Flush the bag a few times with the Span Gas and then fill it.
7. Close the gas bag by turning the valve clockwise.
8. Press SETUP and select the desired Cal Memory with arrow keys and press ENTER. Press EXIT to leave Setup.
9. Press CAL and expose MicroTIP to Zero Gas. Press ENTER and MicroTIP sets its zero point.
10. MicroTIP then asks for the Span Gas concentration. Enter the Known Span Gas concentration and then connect the Span Gas bag adapter to the inlet.
11. Press ENTER and MicroTIP sets its sensitivity.

12. When MicroTIP's display reverts to normal, MicroTIP is calibrated and ready for use. Remove the Span Gas bag from the inlet.

The instrument will be calibrated prior to the commencement of each day's work.

<u>Century Model OVA-128 Portable Organic Vapor Analyzer (OVA)</u>

Calibration will be accomplished using a sample of a known concentration of methane in air as follows:

1. Place instrument in normal operation with CALIBRATE Switch set to X10 and GAS SELECT dial set to 300, and allow 20 minutes for warm up and stabilization.
2. Use the CALIBRATE ADJUST (zero) knob to adjust the meter reading to zero.
3. Introduce a methane sample of a known concentration and adjust trimpot R32 so the meter reading corresponds to the know sample.
4. Extinguish the flame by blocking the exhaust ports.
5. Leave CALIBRATE Switch on X10 position and use CALIBRATE ADJUST (zero) knob to adjust Readout meter reading to 4 ppm.
6. Move the CALIBRATE Switch to the X1 position and using trimpot R31, adjust Readout meter reading to 4 ppm.
7. Move CALIBRATE Switch to X10 position again. Use CALIBRATE ADJUST (zero) knob to adjust Readout meter to 40 ppm.
8. Move CALIBRATE Switch to X100 position and use trimpot R33 to adjust Readout meter to 40 ppm.
9. Move CALIBRATE Switch back to X10 scale. Rezero Readout

meter to 0 ppm; reignite instrument.

10. Unit is now balanced over the full range, calibrated to methane, and ready to be placed in normal service.

OVA calibration will be performed prior to entering the Site. On a daily basis, the calibration span will be checked by exposing the OVA to a known concentration of methane. If the reading deviates by greater than ten percent, the calibration procedure (shown above) will be performed.

Solomat 500E

The Solomat 500E multifunctional environmental instrument measures temperature, relative humidity, wind velocity, and barometric pressure. The calibration procedures for temperature and relative humidity are presented in Appendix C. The temperature and relative humidity probes will be calibrated prior to initiation of Site work. The barometric pressure and wind velocity probes are factory calibrated and will be returned to Solomat for calibration checks prior to Site work.

Omega PHH-80

Calibrate pH with a buffer that is within 3pH units of the test sample.

1. Rinse the pH probe in distilled water.
2. Insert in a fresh pH7 buffer solution.
3. Slide back the battery compartment cover to the first stop, exposing the adjustment pots.
4. Adjust the CAL pot until the display reads 7.00.
5. Remove probes, rinse and insert in a pH4 or pH10 buffer solution.

6. Adjust the SLOPE pot until the display reads the correct value.

Conductivity Mode

1. Rinse probes thoroughly by agitating pure water.
2. Wipe off conductivity probe and allow it to dry.
3. When dry, conductivity should read 0 in air.
4. Adjust ZERO pot if reading is incorrect. If the conductivity probe does not zero, it may indicate dried solids on the sensor. Clean with a mild detergent solution.
5. Immerse sensor in known conductivity solution. Choose a conductivity calibration solution that is near the samples to be measured. Adjust SPAN pot to desired conductivity value.
6. Only a single-point calibration in the 2K range is required to standardize. However, if the instrument is to be used primarily in higher ranges, it is recommended that the single-point calibration be performed near point of use for best resolution.
7. Rinse probe and return to storage compartment.

The Omega PHH-80 meter will be calibrated daily prior to use.

2.5.5 Analytical Procedures

2.5.5.1 Field Testing and Screening

As part of the analytical protocol for all samples, several parameters will be tested in the field. Groundwater will be tested for temperature, pH, and specific conductance during well purging prior to sampling. At each sampling location, a sample will be collected in a clean 8-ounce jar for the purpose of field testing. This portion of the QAPP will describe the procedures for analysis of field parameters.

pH Measurement

The pH of all liquid samples will be measured using a portable pH meter. Before analyzing a sample, the pH meter will be calibrated. The probe is then rinsed with distilled water and placed in the sample to be tested. The reading will be allowed to stabilize and then recorded in the field notebook. After the reading is taken, the probe will be rinsed with distilled water.

Specific Conductance and Temperature Measurement

The specific conductance and temperature of all liquid samples will be taken. When not in use, the probe will be placed in distilled water. Prior to placing the probe in the sample, the probe will be rinsed with distilled water. The temperature will be taken. Time will be allowed for the reading to stabilize prior to recording the measurement in the field notebook.

Meteorological Measurements

The procedures for meteorological measurement have been presented in Subsection 1.4.4.

2.5.5.2 Laboratory Methods

Laboratory analytical methods for use in this project to analyze soil, sediment, air and water samples were presented in Subsection 1.6.4. The limits of detection for the analytical procedures will be in accordance with the CLP-SOW (ILM01.0) and (OLM01.6). The Practical Quantification Limit (PQL) convention will be used for reporting of organic analytical data as recommended for specific methods and matrices in "Test Methods for Evaluating Solid Waste" (SW-846, November 1986, Third Edition). Values below the stated PQLs will be qualified with a "J" to indicate the presence of a compound that meets the identification criteria but for which the concentration is less than the sample PQL and is therefore, estimated rather than accurately quantified.

2.6 Data Reduction, Validation, and Reporting

2.6.1 Field and Technical Data Reduction and Recording

As described in Subsection 2.5.2, all field data will be recorded by field personnel in weatherproof, bound field notebooks and in ring binders on the appropriate field forms. For example, during drilling activities, the field team member supervising a rig will keep a chronologic log of drilling activities, a vertical descriptive log of lithologies encountered (following the Unified Soil Classification System), other pertinent drilling information (staining, odors, field screening, atmospheric measurements, water levels, geotechnical data), and a labor and materials accounting in the notebook.

After checking the data in the field notebooks and forms, the data will be reduced to tabular form, wherever possible, by entering it in data files. Data may be set up in spreadsheet-type tabular files (e.g., water level data) or as two-dimensional arrays. Soil boring and well log diagrams will be completed and filed for incorporation into the RI report.

The slug test data will be stored on floppy discs in the field for later data reduction. Graphs of head changes vs. time will be printed out and the Bouwer-Rice Slug Test calculations will be applied to the data.

2.6.2 Field and Technical Data Validation

Validation of objective field and technical data will be performed at two different levels. On the first level, data will be validated at the time of collection by following standard procedures and QC checks. At the second level, after data reduction into table or arrays, the data will be reviewed for anomalous values. If possible, by seeking clarification from the field personnel responsible for collecting the data.

Field data will be validated by the review of field reports for reasonableness and completeness. In addition, random checks of sampling and field conditions will be made to check recorded data at that time to confirm the recorded observations. Whenever possible, peer review also will be incorporated into the data validation process, particularly for subjective data, in order to maximize consistency among field personnel.

2.6.3 Laboratory Data Reporting

The laboratory data report will conform to a full USEPA CLP report. The laboratory reports will include sample analytical results, methods of analysis, surrogate recoveries, reportable field and laboratory QA/QC sample analytical results, method limits of detection, and sample practical quantification limits (PQLs).

When SW-846 Third Edition methods are used, the generic QC procedures listed in Chapter One, and the specific QC procedures listed in Section Eight of each method will be followed. For the analysis of TCL analytes, the lab may use the CLP criteria for surrogates, internal standards, pesticide linearity and retention time shift shown on the Chapter One QC forms, or the lab may propose their own QC criteria based on SW-846 protocol. When non-TCL analytes are analyzed by SW-846 methods, the lab must propose all QC criteria

For groundwater samples, EPA 524.2 will be used for VOC analysis. The following criteria will be met.

1. The parameter list for this site is the TCL. All method requirements must be followed for these compounds.
2. All samples are to be analyzed within holding times:

   7 days if sample is not preserved.

   14 days if sample is preserved.
3. Sample batch is 20 samples maximum.
4. Detection limit determination must be performed for all analytes prior to start of sample collection. The lab must use the MDL determination procedures stated in Section 10.3 of M524.2. All results must be provided to EPA. Include (for each analyte): concentration spiked into blank water, concentrations obtained for each of <u>7 or more</u> replicates, standard deviation, mean conc. of replicates, and the student t valued used in the calculation. This information must be provided to enable the reviewer to regenerate the lab's calculations of the detection limit. (See Appendix E for H2M Laboratories MDL Study.
5. At a minimum, a five point initial calibration must be performed. It has been shown that the five concentrations following often yield results which meet the required QC criteria: 4, 10, 20, 30, and 40 ug/l. The lab may use these or may extend their calibration range, however, <u>all</u> QC criteria must be adhered to for each analyte.
6. The continuing calibration standard must be analyzed prior to sample analysis and once per 12 hours in order to verify a valid

initial calibration. Use the % difference criteria specified in Method 524.2 Section 9.3.5, which is ±30% difference. If this criteria is exceeded, a new initial calibration must be run.

7. A laboratory fortified blank at a concentration of 1 ug/1 for each analyte must be analyzed immediately following each continuing calibration. The accuracy for this standard must be between 80% - 120% recovery. If this accuracy cannot be achieved, the problem must be located and corrected, then the instrument must be recalibrated prior to sample analysis.
8. The MS tune must be verified at the beginning of each 12 hour period of analysis and all samples must be run within this 12 hour period.
9. A lab reagent blank must be analyzed prior to the samples and shown to the free of contamination. Failure to obtain method blank values less than 1 ug/l requires that all samples prepared with the method blank be reprepared and reanalyzed for the affected parameters.
10. All samples, blanks, duplicates, and calibration standards <u>must</u> be spiked with the surrogates and internal standards specified in the OLM01 CLP SOW for Organics. A re-analysis is required if one or more % recoveries as stated in the OLM01 CLP SOW are exceeded.
11. The primary and secondary ions listed in the OLM01 CLP SOW for organics must be used for identification of the TCL parameters not listed in Method 524.2.
12. A laboratory generated mass spectrum must be provided for all compounds detected above and below the detection limit for all samples and laboratory fortified blanks.

13. All calibration and analytical procedures given in Method 524.2 whether presented as optional or required, <u>must</u> be followed.

14. Up to ten volatile compounds (not on the TCL) of greatest apparent concentration shall be tentatively identified via a forward search of the NBS mass spectral library as described in the OLM01 CLP SOW for organics. Only tentatively identified compounds (TICs) with a peak ares >40% of the nearest internal standard are to be reported.

15. If the EPA RPM wishes MMB to audit a certain percentage of the data validation effort of the PRP contractor, an EPA-CLP type deliverables package must be made available. This will also include a detailed example calculation that clearly demonstrates the manner in which the final results were derived. Where applicable, each component of the calculation must be explained (eg. if the calculation includes a dilution factor, it must be clear how and why each dilution occurred). The laboratory must supply any and all information required to reproduce, during an EPA data validation, all results reported.

2.6.4 Laboratory Data Reduction

Upon receiving data results from the laboratory, the data reduction will consist of tabularizing positive detections. Results with parameters that are undetected will also contain the detection limits. Qualifiers will be reported in the tables alongside the data result. Qualifiers will be reported for results with detection below mean quantification limits, detection with field, trip or method blank contamination, etc,. After tables are complete, a person other than the individual who initially generated the tables will double check the results tables.

2.6.5 Laboratory Data Validation

Data validation is a systematic procedure of reviewing a body of data against established criteria to provide a specified level of assurance of its validity prior to its intended use.

The criteria includes duplicate sample analysis, spiked addition recoveries, instrument calibrations, detection limits, tests for normality, tests for outliners, and data base entry checks.

Data Validation Services, North Creek, New York has been selected to perform the data validations (contact: Judy Harry, phone (518) 251-4429). Laboratory data validation will be performed as per the USEPA Region II Data Validation SOPs as per USEPA letter of June 11, 1992. The laboratory will prepare a full CLP deliverables package or the SW-846 equivalent to enable data validation according to USEPA Region II SOPs.

2.6.6 Data Management

Laboratory data will be compiled in accordance with the Contract Laboratory Program Statement of Work (CLP-SOW) for Inorganics (ILMO1.0) and organics (OLMO1.6). In addition, a copy of all laboratory results will be kept on file in Fanning, Phillips and Molnar's permanent project files for a minimum of 10 years. Field notes, technical reports, and original diagrams are also maintained in the permanent project files. EPA will be given 90 days notice prior to destroying any documents after 10 years.

Data generated by the CLP laboratories will be validated according to the USEPA Region II Data Validation SOPs.

2.7 Internal Quality Control Checks

Internal Quality Control Checks-(Field)

The quality assurance effort for the field investigation program is developed to ensure that field protocols themselves do not introduce error into the data collection process. To achieve this goal, sampling procedures have been developed, as described in the FSP, which will be followed by all field personnel. Any deviation from SOPs necessitated by unanticipated field conditions will be fully documented as they occur. Sample containers will be cleaned and prepared in accordance with OSWER Directive #9240.0-05 "specifications and guidance for obtaining contaminant-free sample containers".

Field quality control checks have been introduced into the sample collection procedures to minimize the potential for interference or introduction of extraneous contaminants during sample collection, storage, transport, and/or equipment decontamination. These checks are provided through collection of field quality control samples. The following types of quality control samples will be included in the sampling quality assurance program:

- A minimum of one trip blank per day will be prepared to accompany groundwater samples tested for VOCs. Trip blanks will be prepared in the field and receive the same preservation as the VOC samples.
- One field blank per day will be prepared for each equipment-type decontamination event. The same aliquout of water may be used for all equipment associated with a particular sample matrix for analysis of semi-volatile organics, PCBs, and inorganics.

- Field duplicate samples will be obtained for each matrix at a frequency of at least five percent of the total number of samples obtained. A duplicate is defined as: two samples collected independently at a sampling location during a single act of sampling. A field duplicate is collected as a separate sample immediately after the collection of field sample. Collection procedures for field duplicates are identical to those for the original samples. Duplicate groundwater samples will be collected from the same bailerful of groundwater extracted from the same well after pumping. Soil samples, except those for VOC analysis will be homogenized in a stainless steel mixing bowl.
- Sufficient volume of aqueous samples which are to be analyzed for VOCs and SVOCs will be collected will be provided to the laboratory for matrix spike and matrix spike duplicate analysis.
- Records will be obtained from the laboratory to demonstrate that the water used for field blanks, trip blanks, etc. is demonstrated analyte-free. This requires that the analytical results are below the contract required detection limits that are listed in the CLP SOWs.
- Sample bottles will also be prepared in accordance with this guidance document and analytical proof of cleanliness of the containers will be obtained from the lab.

Internal Quality Control Checks-Laboratory

The quality of analytical data generated daily in a CLP laboratory is controlled by the CLP-SOW. As specified, types and frequencies of internal quality control checks have been developed for each analysis type. In general, internal laboratory QC checks will consist of the following:

- <u>Method-Blanks</u> - Method blanks will consist of Certified analyte-free water and treated in the same manner as the sample (i.e., digested, extracted, distilled, etc.) that is then analyzed and reported as a standard sample would be.
- <u>Method Blank Spike</u> - A method blank spike is a sample of laboratory reagent-grade water fortified (spiked) with the analyte of interest that is prepared and analyzed with the associated sample batch. Method blank spikes are not included with VOCs analyses since the same function is served by the calibration standard analysis.
- <u>Matrix Spikes</u>- A matrix spike is an aliquot of a field sample that is fortified (spiked) with analytes of interest and analyzed with an associated sample batch to monitor the effects of the field sample matrix (matrix effects) on the analytical method. For each sample round, matrix spikes will be prepared once every 20 samples per matrix.
- <u>Laboratory Duplicate Samples</u> - Duplicate samples are obtained by splitting a field sample into two separate aliquots and performing two separate analyses on the aliquots. The analysis of laboratory duplicates monitors sample precision; however, it may be affected by sample inhomogeneity, particularly in the case of nonaqueous samples. Laboratory duplicates will be run and reported for specific analyses only. For each sample round, a laboratory

duplicate will be run with every 20 field samples.

In addition to the quality control samples described above, the following three additional types of independent quality control checks (not associated with field sample batches) are routinely analyzed in the laboratory:

- Laboratory Control Standard for Inorganics- This is a standard solution with a certified concentration that is analyzed as a sample and is used to monitor analytical accuracy.
- Blind Performance Sample-This is a QC sample of known concentration obtained from the USEPA, the National Bureau of Standards (NBS), or a commercial source. The blind performance sample is not recognizable to the analyst as a performance sample and is used to monitor analytical accuracy.
- Known Performance Sample - A known performance sample is the same as a blind performance samples, but is identified to the analyst so that he/she may use it to check the accuracy of an analytical procedure. It is particularly applicable when a minor revision or adjustment has been made to an analytical procedure or instrument.

2.7.1 Performance and Systems Audits

Audits may consist of two types: system audits, and performance audits. The purpose of a system audit is to determine whether appropriate corporate, division, and project systems are in place. A performance audit is used to indicate whether those systems are functioning properly.

Project System Audits

The project system audits will be performed as scheduled in the CLP-SOW. The Quality Assurance Officer may periodically, on an unannounced basis, call for a system audit. The Laboratory Manager must respond by submitting the QAPP, and the auditor will then determine whether the QAPP is in place. The auditor also will determine whether the review called for the QAPP have been and are being conducted. On a scheduled basis, certain projects are identified by the Quality Assurance Officer for a more formal audit. These audits evaluate in depth the implementation of the QA Program for the project as they apply to field and data analysis and reduction procedures.

Technical Performance Audits

Technical performance audits will be performed on an ongoing basis during the project as field data are generated, reduced, and analyzed. All numerical analyses, including manual calculations, mapping, and computer modeling, will be documented and will be the subject of performance audits in the form of quality control review, numerical analysis, and peer review. All records of numerical analyses will be legible, reproduction quality, and complete enough to permit logical reconstruction by a qualified individual other than the originator.

Field Performance Audits

Periodic in-field performance audits will be conducted by the appropriate technical QA Officers for the particular discipline of field activities (e.g., hydrogeologist to audit well drilling activities). The purpose of the field audits will be to ensure that the methods and protocols detailed in the QAPP are being consistently adhered to in the field.

Prior to the audit, the auditing QA Officer will prepare a checklist to ensure completeness of the review and to document the results of the audit. Items to be examined may include, as appropriate, the implementation of approved work procedures; calibration and operation of equipment; packaging, storage, and shipping of samples obtained; and documentation procedures.

The records of field operations will be reviewed to verify that field-related activities were performed in accordance with appropriate project procedures. Items reviewed may include, but are not limited to, the calibration records of field equipment, daily field activity logs, chain-of-custody documentation, and field logs. Audits of field activities will occur at least once during the RI field activities.

During an audit and upon its completion, the auditors will discuss the findings with the individuals audited and cite any corrective actions to be initiated.

Minor administrative findings that can be resolved to the satisfaction of the auditors during an audit are not required to be cited as items requiring corrective action. Findings that are not resolved during the course of the audit and findings affecting the overall quality of the project, regardless of when they are resolved, will be noted on the audit checklist and the results provided to the Project Manager, who will ensure that the corrective actions have been implemented.

Laboratory System Audits

CLP laboratories participate in several external system audits sponsored by USEPA. The type of audit, auditing agency, and frequency of these audits for the CLP laboratories can be found in the CLP-SOW.

Laboratory Performance Audits

Each CLP laboratory participates in several external performance audits sponsored by numerous agencies. These performance audits in the form of blind performance samples submitted by the auditing agency.

2.7.2 Preventive Maintenance

As discussed in Subsection 2.5.4, the field equipment will be properly calibrated, charged, and in good general working condition prior to the beginning of each working day.

All field instruments will be properly protected against inclement weather conditions during the field investigation. Each instrument is specially designed to maintain its operating integrity during variable temperature ranges that are representative of ranges that are expected to be encountered during cold-weather working conditions. At the end of each working day, all field equipment will be placed in a cool dry room for overnight storage.

All subcontractor equipment (e.g., drill rigs, water trucks, etc.) will arrive at the Site each day in proper working condition. All lubrication, hydraulic, and motor oils will be checked by the subcontractors prior to the start of each work day to ensure there are no leaks.

2.7.3 Data Assessment Procedures

2.7.3.1 Field Data

Precision

Groundwater purged prior to sampling will be tested for temperature, pH, and specific conductance. Stability of the groundwater will be established by comparison of temperature, pH, and specific conductance of successive measurement.

Accuracy

To ensure accuracy of measurements of field parameters, calibration of the field instruments will be checked and adjusted (if necessary) daily.

Completeness

The RI Leader is responsible for ensuring that all equipment is functioning and calibrated properly so that all field measurements made meet the requirements for accuracy and precision. The RI Leader will review field data as they are complied to ensure completeness.

2.7.3.2 Laboratory Data

This subsection discusses the routine procedures used for the assessment of precision, accuracy, and completeness.

Precision

The precision of analyses of replicate sample will be calculated. The precision requirements for organic analyses are given in Subsection 2.4.2. All analytical data are reviewed relative to those criteria.

Accuracy

The calculation of analytical accuracy for organic compounds was presented in Subsection 2.4.1.

For metals, analytical accuracy is measured from analysis of laboratory control standards and a sample fortified with the element of interest.

Completeness

Completeness has been defined in Subsection 2.4.3 as a measure of the amount of analytical data of acceptable quality (i.e., data meeting all accuracy and precision criteria) generated by an analytical method or system. No minimum goals for completeness have been established.

2.7.4 Corrective Action

2.7.4.1 Field Corrective Action

The initial responsibility for monitoring the quality of field measurements and observations lies with the field personnel. The RI Leader is responsible for verifying that all quality control procedures are followed. This requires that the RI Leader assess the correctness of field methods and the ability to meet quality assurance objectives. If a problem arises that might jeopardize the integrity of the project, the RI Leader will notify the Project Manager and the appropriate technical QA Officer. An appropriate corrective action will then be decided upon and implemented. The RI Field Team Leader will document the problem, the corrective action, and the results. Copies of the documentation form will be provided to the Project Manager and the appropriate technical QA Officer.

2.7.4.2 Laboratory Corrective Action

The initial responsibility to monitor the quality of an analytical system lies with the analyst. The analyst will verify that all quality control procedures are followed and results of analysis of quality control samples are within acceptance criteria. This requires that the analyst assess the correctness of all of the following items, as appropriate:

- Sample Preparation Procedure;
- Initial Calibration;
- Calibration Verification;
- Method Blank Results; and
- Laboratory Control Standard.

If the assessment reveals that any of the QC acceptance criteria are not met, the analyst must immediately assess the analytical system to correct the problem. The analyst notifies the Laboratory Manager and QA Coordinator of the problem and, if possible, identifies potential causes and corrective action.

2.7.5 Quality Assurance Reports

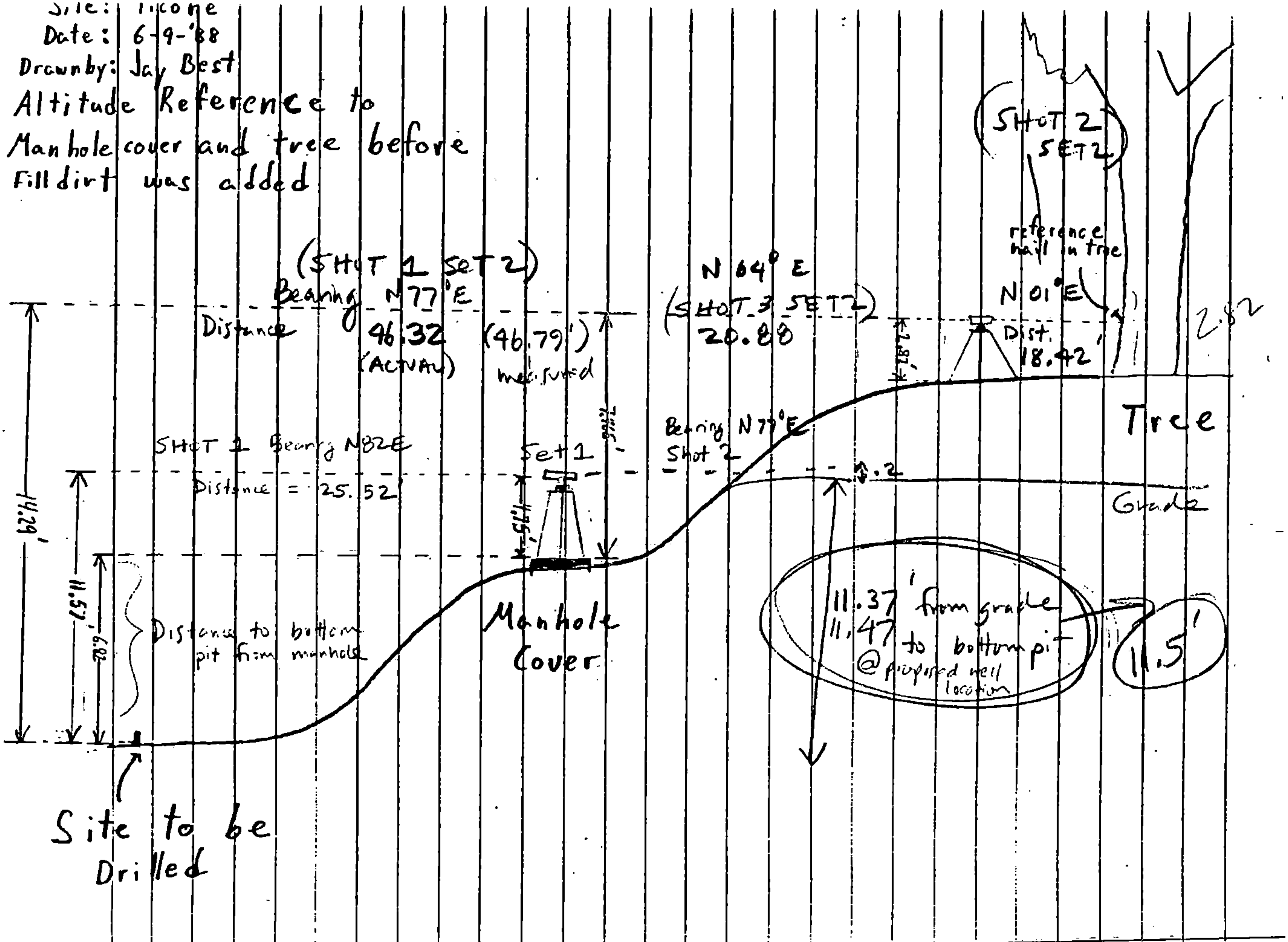
The RI Leader will provide the Project Manager with daily field progress reports and compiled field data sets at weekly or other intervals, as appropriate. In addition, the QA/QC Officer will be copied for all corrective action documentation. The QA/QC Officer will perform unannounced field QA audits. On the basis of this information, the QC/QC Officer will provide quarterly QA update memos for this project to the Project Manager. The Quality Assurance Officer will be notified immediately of field QA situations requiring corrective action.

APPENDIX A

1988 SURVEY OF THE LEACHING PIT SURFACE

Site: Ticone
Date: 6-9-'88
Drawnby: Jay Best

Altitude Reference to
Manhole cover and tree before
Fill dirt was added



APPENDIX B

SAMPLE CHAIN-OF-CUSTODY SHEET

fanning, phillips & molnar
ENGINEERS
RONKONKOMA NEW YORK

PROJ. NO.	PROJECT NAME
SAMPLERS: (Signature)	

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	TOTAL NO. OF CONTAINERS										REMARKS

Relinquished by: (Signature)	Date	time	Received by: (Signature)	Relinquished by: (Signature)	Date	time	Received by: (Signature)
Relinquished by: (Signature)	Date	time	Received by: (Signature)	Relinquished by: (Signature)	Date	time	Received by: (Signature)
Relinquished by: (Signature)	Date	time	Received for Laboratory by: (Signature)	Date	time	Remarks	

APPENDIX C

RESUMES OF KEY PERSONNEL

KEVIN J. PHILLIPS, P.E., Ph.D.
Principal

Registration
Dr. Phillips is registered as a licensed professional engineer in New York, New Jersey, Connecticut, Massachusetts, Alabama, and Georgia.

Experience Summary
Dr. Phillips has over 21 years of experience in geohydrology and environmental engineering, involving such activities as RCRA Hazardous Waste Audits, design & treatment, ground and surface water quality analysis, water quality modeling, environmental impact assessment, 201 facilities planning, 208 areawide wastewater management, 303e basin planning, industrial waste surveys, industrial waste treatment and teaching four graduate courses at Polytechnic Institute of New York and two courses at SUNY at Stonybrook.

Education

B.C.E.	Civil Engineering	City College of NY	1970
M.S.	Hydrodynamics	Massachusetts Institute of Technology	1972
E.E.	Water Quality	Massachusetts Institute of Technology	1973
Ph.D.	Environmental Engineering	Polytechnic Institute of New York	1978

Technical Seminars
Water Well Hydraulics; Dewatering Technology; Groundwater Pollution Modeling Course; Water Quantity Management for Long Island: Today and Tomorrow; Corrective Action for Containing and Controlling Groundwater Contamination; Eleventh Annual Research Symposium on Land Disposal; Second Annual Environmental Expo for Business and Industry; Hazardous Waste Disposal Management; Underground Storage Tank Management; Tunnel/Underground Construction; Aquifer Remediation Using In Situ Bioreclamation; Introduction to Groundwater Geochemistry; Region II Environmental Regulation Conference; Sixth Annual Summer Institute in Risk Management in Environmental Health and Protection; ECRA Triggers and Transactions; ECRA Process; Sampling and Cleanup Plans; Haz Mat International '88; HELP's Modeling Workshop; Pollution Insurance Coverage and Environmental Claims Management; Industrial Hygiene Practice Course; Haz Mat International '90; Municipal Solid Waste Landfills: Design, Operation and Management; Aquifer Reclamation and Source Control; Asbestos Inspector; MODFLOW for Simulation of Ground Water Flow and Advective Transport; Implementing the 1990 Clean Air Act: EPA Speaks; Defense Cleanup Contracting Opportunities; Avoiding the Most Common Mistakes Under RCRA and RCRA Land Disposal Restrictions—Step-By-Step Compliance.

Associations
Tau Beta Pi National Engineering Honor Society
Sigma Xi National Scientific Honor Society
American Society of Civil Engineers
Water Pollution Control Federation
National Society of Professional Engineers
National Water Well Association
American Water Work Association

Employment History

1982-Present	Fanning, Phillips and Molnar
1978-Present	Professor - PINY
1980-Present	Professor - SUNY at Stony Brook
1980-1982	Fanning, Phillips and Associates
1979-1980	Environmental Management and Engineering
1973-1979	Weston Environmental Consultants and Designers
1970-1973	Massachusetts Institute of Technology
1970	Vollmer Associates

Key Projects - Geohydrology Studies
Physical Modeling, Groundwater Contaminant Transport, LI
Mathematical Modeling Groundwater, LI
Nassau/Suffolk Areawide Wastewater Management "208" study
Consultant Hydrologist #1, NYCTA -- Water Supply Study, NYCMTA
Groundwater Investigation of Landfill Impacts of Groundwater Quality
Jamaica Yard Stabilization Project, NYCTA
NYCTA - Two Year Consultant Hydrologist
GW Investigation of the Oceanside & Merrick Landfills, NY
Army Corps of Engineers (NE Water Supply Study)
Upzoning the Payson Whitney Estate
MEK Spill/Aquifer Restoration, Hicksville, NY
TCE and DCE, Aquifer Investigation, Metex Corporation
Environmental Audit and Site Evaluation, Metex Corporation
ECRA Parts 1 and 2 Submission, Metex Corporation
Legal Defense of Upzoning, Village of Lake Success
Geohydrological Investigation for Sports Complex in Flushing, UDC
Geohydrologic Investigation, Hub Truck Rental, Farmingdale
Geohydrology, Jerry Spiegel Associates
Geohydrology, Air National Guard
Geohydrologic Investigation, ACI
Consultant Hydrologist #3 NYCTA
T.V. City, The Trump Organization
Water Resource Impact, Central Islip, Parr Development
RCRA Tank (UST), Shorewood Packaging Corporation, Farmingdale
Site Contamination Investigation, Anorad, Hauppauge
Environmental Investigation and Proposed Cleanup Plan, Shorewood
Water Supply Survey, Metex Corporation
360 Permit Closure/Inactive Hazardous Waste Site Investigation,
  Phase II, Montauk Landfill, Town of East Hampton
Uniondale Private Landfill Phase II, Uniondale Realty Assoc., NY
Phase II Soil and Groundwater Screening Investigation, NYCTA
Phase I and II Site Contamination Investigation, Anorad, Hauppauge
Phase I and II Geohydrologic Investigation, ACI, Hauppauge

Hazardous Wastes/RCRA Audits
Hazardous Waste Recycling Center
Genzale Plating Company -- Petroleum Tank Cleaners
Irwin Measuring Tool Company
Metex Corporation, 206 Talmadge Road, NJ
Westbury Refining Corporation
Mill-Max Manufacturing Corporation
Metex Corporation, 970 New Durham, NJ
Air, Water & RCRA Audit, L.T. Heat Treating, Inc.
Hazardous Materials & Wastes Analysis & Design of Hazardous
  Storage Building, LORAL
Waste Stream Evaluation, Shorewood Packaging Corporation, NY
RCRA Seminar, Shorewood Packaging Corporation, NY
Industrial Waste Underground Storage Tank Abandonment, NY
Isopropyl Alcohol Underground Storage Tank Removal, Shorewood NY
Facility Compliance Audit, Shorewood Transport, VA
Rag Recycling Center, Shorewood Packaging Corporation, NY
RCRA Audit Shorewood Packaging Corporation, GA
Lyons Ventures, Inc., Herzog Law Firm, NY
Hazardous Survey Nardy Pontiac Honda
Investigate 30 UST & 4 Aboveground Tanks, Remove & Design
  Replacement - Air National Guard
Dorne & Morgolin -- Amsterdam Color Works, NY
L.T. Heat Treatment, NY -- Hemingway Printing Co., CN
TSD Closure Plan, Shorewood Packaging Corp., GA
TSD Closure Plan, Irwin Measuring Tool Corp., NY

Environmental Audits
Riverhead Shopping Center, Realco -- American Cancer Society
Metex Corporation -- Westbury Refining Corporation
Environmental Audit, Mill-Max Manufacturing Corporation
Environmental Site Audit, Mill-Max Manufacturing Corporation
Panel Realty/Philips International -- Realco, Uniondale
Hub Truck Rental, Farmingdale -- Realco, Long Beach
Realco, Merrick -- Realco, Riverhead -- Realco, Columbus, GA
Pierpoint-on-the-Hudson -- Delta Realty, Haverstraw, NY
Realco, Lafayette, IN -- Parr Development, Tech Park Site
Parr Development, 58.2 Acre Parcel for Residential Development
Asbestos Survey at Buildings Located at Central Islip Parr Development
N. Racanelli Associates, Holtsville -- Trump Organization
Goldstein & Rubinton -- Gus Schad -- Polimeni Enterprises, Bohemia
Neil Buick Corporation, Port Jefferson Station
N. Racanelli Associates, Smithtown -- Phase I, Webster & Sheffield
Phase I, Parr Development Company, Yaphank -- Rosenman & Colin
Crosstown Syndicate, TGI Friday's, Huntington, NY
Cibro Group, Phase I and II, Environmental Site Assessment
Cibro Group, Environmental Assessment

Environmental Impact Statements
R&D Plaza, Brookhaven -- Yaphank Industrial Park
Heartland Business Center -- Sheridan Industrial Oil Corporation
NYCTA, Jamaica Yard Expansion -- Grucci Fireworks Company
NYCTA, Coney Island Train Yard -- NYCTA-SIRTOA, Staten Island
Urban Development Corporation -- T.V. City, Trump Organization
New Convention Center, Southaven -- East Hampton Water Main
Schlitz Brewery -- Township of Mahwah & Town of Mahwah
DEIS Uniondale Shopping Center -- Gus Schad, Sills Industrial Park
DEIS Webcor Office Developments Watermill
DiStefano, Flower Hill Condominiums
General Foods Corporate Headquarters Rye, NY

Industrial Waste Surveys
USEPA Effluent Guidelines - Explosive Industry
USEPA Effluent Guidelines - Photo Processing Industry
USEPA Effluent Guidelines - Hospitals
Nassau - Suffolk 208 - L.I. Regional Planning Board
Major Waste Oil Reprocessing Plant Brookhaven

Industrial Wastewater Treatment Design

Geometric Circuits, Inc. -- NTU Circuits, Inc.
Heartland Industrial Park -- Sixty Minute Photo
Mill-Max Manufacturing Company -- Irwin Measuring Tool Company
Shorewood Wastewater Treatment Plant

Landfills

Town of East Hampton - Montauk Landfill
Town of East Hampton - Springs-Fireplace Road Landfill
Town of Mamakating -- The Trump Organization
Envirofil, Inc., Macomb, IL -- Parr Development Company
Parsons/Wittermore, Oceanside Landfill
Long Island Ashfill Study -- Uniondale Realty Associates
Parsons/Wittermore, Merrick Landfill
Nassau County Department of Health, Denton Avenue
Nassau County Department of Health, Syosset
Town of Babylon, Babylon Landfill
Envirofil, Inc., Harland, Michigan
Envirofil, Inc., Kelly Run Sanitation, Inc., Elizabeth, PA

Superfund

Remedial Investigation and Feasibility Study for SJ&J
Remedial Investigation for Grucci Site
Syosset Landfill - Soil and Groundwater Sampling, Syosset
Sheridan Industrial Waste Oil - Construction of Gas Strippers
Investigation of Groundwater Quality, NTU Circuits
Management Services for Genzale Plating
Denton Ave. Landfill - Sampling & Analysis of Septage Lagoons
Montauk Landfill, Geohydrologic Investigation, Town of East Hampton
Town of Mamakating, Town Landfill, Geohydrologic Investigation
Garvies Point Landfill, Old Stone Development Corporation
Environmental Engineering/Geohydrology, Genzale Printing,
  Franklin Square, NY
Phase II Environmental, Strober Realty, Brooklyn, NY
Remedial Investigation/Feasibility Study, SJ&J, Farmingdale, NY
Phase II Study, Uniondale Shopping Center

Publications

Dr. Phillips has published over 15 articles in professional journals ranging from *"Least Cost Optimization in Areawide Wastewater Management Using Mixed Interger Programming"* to *"Design Factors for a Septage Treatment Facility."*

ANDREW P. RITCHIE, P.E.

Department Manager Environmental Engineering

Experience Summary

Mr. Ritchie has experience in environmental and civil engineering: EIS; RI/FS; regulations and compliance; waste minimization and recycling; groundwater, sludge and soil sampling; assessment and remediation; methane recovery systems; water balance studies; water shed analysis; air quality analysis; waste treatment design; water, drainage and sewer design; concrete and repaving design. Mr. Ritchie has managed in excess of 100 environmental projects.

Education

B.S.	Civil Engineering	Bringham Young University	1986
M.B.A.	Management	Hofstra University	1991

Seminars Attended

Remedial Alternatives of Petroleum Contaminated Soils, University of MA
Risk Mgmt. in Environmental Health and Protection, NY University
Risk Assessment for the Groundwater Scientist, NWWA
Industrial Biological Wastewater Treatment Systems, CPA
Industrial Water Pollution Control Technology, CPA

Associations/Certifications

40 hour OSHA Safety at Hazardous Material Sites	September, 1990
Professional Engineer, NY	April, 1991

Employment History

1988-Present	Fanning, Phillips and Molnar
1986-1988	Dvirka and Bartilucci Consulting Engineers
1986	US PHS, Indian Health Service, MI
1985	US PHS, Indian Health Service, AZ

Key Projects

Testified as an expert witness involving engineering aspects of hydraulics and hydrology. Nassau Supreme Court, Beldock Industries Corp. v. W. Hempstead-Hempstead Gardens Water District (Index #13585-90), Hon. Alfred S. Robins.

Performed a RCRA investigation, sampling and cleanup of an illegal 200 drum storage facility in Schenectady, NY.

Construction project management of a soil flushing and influent treatment ECRA remediation project. Management included overseeing time schedules, budgets and proper construction methods.

Inspected & prepared an Action Plan for identification, labeling, sampling, characterization, removal & documentation of a paint mfgr. in Bronx, NY. The facility stored 2,000 drums illegally & is subject to criminal & civil penalties.

Prepared & managed pneumatic pump test, of a methane recovery system, Town of East Hampton, NY.

Vapor recovery design review and air permit preparation for Hertz Car Rental, NY, NY. Pneumatic calculations for a 300 foot recovery line (30 floors).

Industrial wastewater treatment investigation including Pretreatment Standard identification, waste stream evaluation, sampling, hydraulic calculations, batch and continuous flow evaluations and presentation to the City of LaGrange, GA.

Reviewed and commented on a proposed conceptual remediation design for a USEPA Superfund site. Project remediation included soil vapor stripping, water removal and treatment (air stripping) and in-situ bioremediation.

Performed a RCRA, CWA, CAA, SARA Title III and TSCA compliance inspection of a packaging facility in Andalusia, AL.

Prepared a Cleanup Action Plan including technologies, methods and costs for 10 year illegal dumping activities, Andalusia, AL.

Planned, executed and evaluated RCRA TCLP waste stream characterization for 3 printing facilities in NY, GA and AL.

Prepared a RCRA Closure Plan for an illegal discharge of hazardous waste, in accordance with USEPA current RCRA regulations, LaGrange, GA.

Prepare specifications, selected contractors and supervised construction management for the removal and/or abandonment of 6 USTs, Smithtown, NY.

Supervised construction management activities regarding a soil flushing and water recovery/treatment system, Edison, NJ.

Managed and reviewed the preparation of and filing of a NJDPES permit in conjunction with a deep aquifer cleanup of chlorinated solvents, Edison, NJ.

Conducted a RCRA, CWA, CAA and SARA compliance for 200,000 square feet printing operation in Waterbury. CT.

Prepared plans and specifications for the removal of an isopropyl alcohol UST and installation of a new flammable liquid storage room in Farmingdale, NY.

Managed a stream study in conjunction with a NJPDES application for an ECRA cleanup project. The stream study consisted of 12 weeks of sampling nontital stream flow analysis and impact of the calculated air stripper effluent.

Acted as an expert witness to the Nassau County Tax Assessors Office on 6 separate environmental discharge cases. One facility is a USEPA and NYS Superfund site and three are NYS Inactive Hazardous Waste sites.

Managed the identification, analysis and design of a vadose zone soil stripping project as part of an industrial waste tank abandonment, Farmingdale, NY.

Prepared engineering reports, permits and managed the preparation of plans and specifications for an ECRA cleanup in Edison, NJ.

Managed a multi-harbor stormwater management study for the Town of Huntington, NY.

Managed dewatering & pumping well design projects for the NYCTA.

Conducted a RCRA compliance audit with the GA EPD to review a printing facility's operations and minimize violations in LaGrange, GA.

Performed a RCRA, CWA, and CAA compliance study for a major trucking transport facility in Roanoke, VA.

Managed a waste recycling study for a printing manufacturer. The study is aimed at cost savings in excess of $100,000/yr.

Performed in-house RCRA seminars for large quantity generator clients.

Managed an air permit compliance investigation for a lithographic printing operation with an excess of 90 stacks, Farmingdale, NY.

Preparation of an EIS for a shopping center in Uniondale, NY. Presented the EIS's findings at the Town of Hempstead public meetings.

EIS Preparation for an office building in Mitchel Field, NY.

Preparation and supervision of PCB sampling and remediation plans for a contaminated transformer and soils, New Britain, CT.

Investigation of RCRA, CWA, and CAA compliance status for a metal heat treating plant in Brooklyn, NY.

Determined hazardous waste compliance and remedial alternatives for metal tape measure manufacturing plant, Suffolk County, NY.

Designed a methane recovery system for shopping center to be built over a landfill in Uniondale, NY.

Determined air quality impacts for traffic flows associated with 5 separate proposed developments by utilizing the NYS DOT Hot Spot Screening Analysis.

Groundwater sampling, analysis, and remedial design of groundwater contamination from a tank abandonment in Suffolk County, NY.

Preparation of Environmental Site Assessment Review of a 14.1 acre oil terminal site, Bronx, NY.

Research, review & prepare a report discussing state Standards & EPA Records of Decision to determine soil cleanup levels for the Trump Organization.

Investigation of the watershed effects on the Winston Estate Wetlands caused by development, Scarsdale, NY.

Feasibility Study for the conversion of an 11 acre bulk storage petroleum facility to be converted into condominium development, Island Park, NY.

Water distribution design, plans, and specifications of various developments for the Shoreham Water Authority, Shoreham, NY.

Sewer main design, plans & specs for Grumman Aerospace Corp, Bethpage NY.

Preparation of expansion possibilities, the Walt Whitman Mall, Huntington, NY.

Repaving design, plans specs & inspection of the Roosevelt Field Mall loopway.

Handicapped sidewalk and road improvement designs, plans and specifications, East Williston, NY.

Drainage design of failing system for the Town of Hempstead.

Foundation design and Article XI compliance for chemical storage buildings at various plants, Grumman Aerospace Corporation, Bethpage, NY.

Waste treatment design, Kincheloe, MI.

Surveyed and designed a water line extension, White River, AZ.

MARTIN O. KLEIN, C.P.G.
Department Manager, Geohydrology

Experience Summary

Mr. Klein is a certified professional geologist with experience in managing projects in environmental science relating to geohydrology, land planning, ground and surface water quality analysis, groundwater flow and contaminant transport modeling, soils and soil gas analysis, geophysics and Environmental Impact Assessment. In addition, Mr. Klein has provided expert testimony as a rebuttal witness for a wetlands project on Long Island.

Education

B.S.	Geology	State University of NY at Cortland	1984
M.S.	Hydrogeology	Adelphi University	1988

Additional Course Work

Organic Chemistry
Climatology
Land-use Planning
Geomorphology
Coastal Processes
Environmental Engineering
Glacial and Quaternary Geology
Zoology
Botany

Seminars Attended

Introduction to Groundwater Geochemistry - NWWA
Safety at Hazardous Materials Sites (40 hours) - NWWA
Risk Assessment for the Groundwater Scientist - NWWA
Managing Environmental Risks in Real Estate Transactions - New York University
NJ Environmental Laws and Regulations - Government Institutes, Inc.
Chemistry II - Hazmat International
Geostatistical and Sampling Analysis - Hazmat International
analysis and Design of Aquifer Test - NWWA
Mgmt. of Contaminated Groundwater & Aquifer Restoration - NWWA
PRP Course: Proven Strategies for Responding to Superfund Liability - Government Institutes
Natural Resource Damages Claims and Litigation - Executive Enterprises, Inc.

Associations/Certifications

40 Hour OSHA Training (29 CFR Part 1910.120)
American Institute of Professional Geologists (CPG) 8188
Geological Society of America
National Water Well Association
New York Water Pollution Control Federation
American Association of Petroleum Geologists

Employment History

1985-Present	Fanning, Phillips and Molnar
1985	R&L Well Drilling
1984-1985	William Floyd School District

Key Projects

N.Y.C. Transit Authority: Projects performed since 1985 include pumping tests, dewatering system inspections, environmental investigations, groundwater modeling, and well design for bus terminals and subway systems in Brooklyn, Queens, Staten Island, and Manhattan, NY.

The Trump Organization: Performed and supervised Phase I and II investigations (including environmental setting for environmental impact statement), Trump City site (Penn Yards site) on 70 acre parcel in New York City, NY.

Parr Organization: Performed and supervised numerous Phase I and II investigations for sites on Long Island, NY. Performed Phase I and II investigation and environmental setting for EIS (SEQRA) for 900 acre Central Islip, NY, site.

Shorewood Packaging Corporation: Performed and supervised Phase I and II, and RCRA investigations (including OVA/GC and magnetometer investigations) for the following sites: Farmingdale, NY; Waterbury, CT; LaGrange, GA; and Andalusia, AL.

City of Elizabeth: Environmental evaluation of proposed widening of the NJ Turnpike, Elizabeth, NY.

Town of East Hampton: Preparation and directed implementation of NYSDEC 6 NYCRR Part 360 Closure Plans (environmental investigation and mon-itoring) for the Town of East Hampton landfills: 1) Springs-Fireplace Road landfill, 2) Montauk landfill; Phase II investigation and HRS scoring for Springs-Fireplace Road Landfill; Town Hydrogeologist.

Urban Development Corporation: Geohydrologic investigation for site of proposed domed stadium in Flushing, Queens, NY. Included the installation of over 20 monitoring wells, groundwater mapping and sampling, and pump test analysis for aquifer characterization.

Nassau County Tax Assessor's Office: Coordinated and supervised extensive file searches for environmental compliance for numerous sites in Nassau County, NY.

Metex Corporation: Performed and supervised extensive bedrock groundwater investigation (including pump tests), rock core analysis, and geophysical survey for ECRA compliance in Edison, NJ.

Envirofil: Supervised environmental compliance investigations and assessments of potential liability for numerous landfill acquisitions at landfill sites in IL, PA, MI.

Village of Lake Success: Performed investigation and evaluation of the effects of proposed down zoning on quantity and quality of groundwater. Applied and developed site-specific groundwater-nitrogen budget models for present and proposed landuse in Village of Lake Success, NY.

Irwin Measuring Tool Company: Well design, installation, and monitoring of groundwater monitoring wells at site in Patchogue, NY. Files review and evaluation of major treatment, storage and disposal facility (TSDF) on Long Island for compliance with NYSDEC hazardous waste regulations for potential liability.

SJ&J Service Stations: Project Manager of RI/FS for this Class 2 federal and state Superfund site, Farmingdale, NY.

Mill-Max: Investigation and evaluation of soils and soil gas to determine condition of underground storage tanks and leak detection system for RCRA compliance, Oyster Bay, NY.

Grucci Pyrotechnic: Supervised Phase I investigation for this Class 2a state Superfund site after explosion at Bellport, NY, facility.

Town of Huntington: Delineation of watershed areas for design of a drainage system, Huntington, NY.

Town of Mamakating: Preparation and supervision of NYSDEC 6 NYCRR Part 360 Closure Plan (environmental investigation and monitoring) for the Town of Mamakating Landfill, NY; Town Hydrogeologist.

City of Glen Cove: Supervised geohydrologic investigation of groundwater system and contaminants for litigation against Superfund site (Photo Circuits), due to contamination of water supply wells.

New York Institute of Technology: Coordinated and supervised phase II investigation at facility in Westbury, NY, involving extensive soil sampling for determination of a release of hazardous waste.

Cibro Southshore Terminal: Performed Phase I and II investigations for major oil storage facility in Island Park, NY.

Automatic Connector, Inc.: Coordinated and supervised a remedial investigation including a magnetometer survey and pumping tests to determine the nature and extent of contaminants at Hauppauge, NY, facility.

Anorad Corporation: Supervised and performed remedial investigation through OVA/GC survey on soil vapor and soil and groundwater sampling at facility in Hauppauge, NY.

HUB Truck Rental: Phase I and II site investigations for the following sites: Garden City, NY; Lynbrook, NY; and Holbrook, NY.

Town of Islip: Coordinated and supervised extensive Phase I investigation on condemned site in Brentwood, NY.

Southaven Properties: Preparation of environmental impact statement for site in Southaven, NY. Applied and developed site-specific groundwater-nitrogen budget models for present and proposed landuse.

Performed and/or supervised Phase I and II Investigations (including PRP work in part) for:
N. Racanelli Associates; Polemini Enterprises; Philips International; Realco Management; Gika Construction; Nardy Pontiac Honda; Dorne & Margolin; Garden City Shopping Associates; Twomey, Latham, Shea & Kelley; Rosenman & Colin; D'Amato, Forchelli, Libert, Schwartz, Mineo & Carlino; Whiteman & Osterman; Goldstein & Rubinto, P.C.; Sidley & Austin; Webster & Scheffield; Alston & Bird

RAVI K. KORLIPARA, Ph.D.
Environmentalist I

Experience Summary

Dr. Korlipara had considerable experience in theoretical and mathematical modeling of dynamic systems. Experimental experience in electrodeposition and protection and strength enhancement of off-shore structures. Currently involved in applying this experience and academic and research background to environmental science.

Dr. Korlipara also has three years of experience in the environmental field, a major portion of which is involved with groundwater flow and solute transport, hydrologic, hydrogeologic, and air dispersion modeling. He conducted theoretical research in Statistical Mechanics for his Ph.D. dissertation work. As such, Dr. Korlipara possesses a rigorous and fundamental understanding of transport properties of porous media and a flow dynamic and thermodynamic principles. He has indepth analytical, numerical, and computational abilities. He has experience with mainframe (IBM3080, UNIVAC1100), miniframe (VAX 11/780), and personal computers and with VMS and DOS operating systems. He has written extensive computer codes in Fortran during his Ph.D., including those for numerically solving boundary and initial value problems.

Education

B.Tech.	Chemical Engineering Regional Engineering College, Warangal, India	1980
M.S.	Materials Science and Engineering SUNY at Stony Brook	1983
Ph.D.	Mechanical Engineering SUNY at Stony Brook	1988

Associations/Certifications

Engineer-In-Training 1991
American Society of Mechanical Engineers
National Water Well Association
American Geophysical Union
Association of Groundwater Scientists and Engineers
40 Hour OSHA Course - Safety of Hazardous Materials Sites

Employment History

August 1988 - Present: Fanning, Phillips and Molnar

Key Projects

Remedial Investigation analysis of a hazardous waste site in Queens Plaza, NY.

Remedial Investigation of Federal and State superfund site on Long Island, NY.

Analysis and recommendations for the organization of hazardous, incompatible materials' storage inside storage room at LORAL facilities, NY.

SARA III Calculations for Shorewood, Farmingdale, NY.

Environmental site audit and investigation of potential sources of contamination at a manufacturing plant on Long Island, NY.

Data Usability Analysis for groundwater sampling results at Phillips International site in Uniondale, NY.

Chlorine dispersion modeling under the New Jersey Toxic Catastrophe Prevention Act Program for Parsippany/Troy Sewage Treatment Plant, NJ.

Measurement and calculation of VOC emission rates and filing for Air Permits for Shorewood Packaging Corporation, Farmingdale, NY.

Facility - Wide Emission Reduction Plan reports for Irwin Measuring Tool Company, Patchogue, NY.

Feasibility report for air pollution treatment of a solvent emission process for Irwin Measuring Tool Company, Patchogue, NY.

Odor investigation for Irwin Measuring Tool Company, Patchogue, NY.

Estimation of amounts of volatile contaminants in soil, removal rates through vapor extraction remediation technique, and remediation duration for a site on Long Island, NY.

Estimation of permeability, radius of influence, and flow patterns for methane migration, based on pneumatic tests at a Landfill on Long Island, NY.

Investigation (modeling, analysis and recommendations) of the New York City Transit Authority - Nostrand Avenue dewatering projects.

Pump test analysis for the New York City Transit Authority - Lenox Avenue project.

Water balance study to determine the impact of a proposed Tech Park development in Islip on adjoining Champlin Creek for Parr Organization, NY.

Long-term projections for groundwater levels in South Fork of Long Island using a Finite Element Regional Groundwater Flow model for East Hampton Township, NY.

A study of the cumulative impact of development of the Long Island Pine Barrens (groundwater quantity and quality) for the Brookhaven Town Center, NY.

Publications

Dr. Korlipara has published two scientific papers, with five more in preparation, discussing electrodeposition, diffusion, polydispersity, percolation, and composite media.

THOMAS P. DORISKI, C.P.G.
Senior Geohydrologist

Experience Summary

Mr. Doriski has experience in hydrogeologic investigation and environmental engineering. This experience includes soil and groundwater investigations/remediations at manufacturing firms and chemical plants; environmental impact statements for property developments; design of replacement domestic well systems in contaminated areas; aquifer sensitivity studies for agricultural chemicals and hydrocarbons; soil and groundwater investigations of leaking underground storage tanks and pilot venting studies.

Education

B.S.	Geology	Southampton College	1977
M.S.	Environmental Engineering	SUNY at Stony Brook	1984

Certification

OSHA-approved 40 hour Health and Safety Training Course for Hazardous Waste Operations with annual 8 hour update courses and annual physicals.

Professional Affiliations

American Institute of Professional Geologists CPG-7906
Geological Society of America
National Water Well Association

Employment History

1990-Present	Fanning, Phillips and Molnar
1985-1990	Roux Associates
1977-1985	U.S. Geological Survey

Key Projects

Participated in several surface water-groundwater investigations at a 245 acre Superfund site in MA. Site work included well installation, test pits, thermistor installation for assessment for frost line depth, selection of and data gathering at surface water flow measurement sites, construction of a stream gaging site designed to continuously monitor stream stage, surface water temperature and groundwater levels in two stream bank wells.

Investigated off-site migration of volatile organic compounds from a poly vinyl chloride manufacturing plant at a 450 acre Superfund site in DE. Groundwater sampling utilizing domestic and monitoring wells and aquifer pumping tests were conducted. Designed and supervised the installation of domestic replacement wells in an area of contaminated shallow aquifer, with associated pumping tests and sampling analysis to determine quantity and quality of the deeper aquifer.

Participated in a surface water-groundwater investigation at an 800 acre Superfund site in TN that included surface water flow measurements and continuous monitoring of flow. Designed and constructed four stream gauging stations. Monitoring wells were constructed to evaluate aquifer and aquiclude properties beneath the site. Slug tests, step tests, and pumping tests were performed and evaluated.

Prepared a hydrogeologic report for a Draft Environmental Impact Statement for a major development in a sole source aquifer area.

Conducted an ECRA investigation of a New Jersey agricultural pesticides plant, encompassing on-site source investigation and remediation, surfical sampling along drainage ditches and marsh area, off-site migration in groundwater and operation of a groundwater interceptor system.

Assisted in soil and groundwater investigations of leaking underground storage tanks at manufacturing firms, schools, municipalities-several cases reached closure with respect to regulatory agency involvement.

Conducted a groundwater investigation at a former coal gasification facility, involving delineation and impact assessment of numerous polycyclic aromatic hydrocarbon source areas.

Participated in a flow augmentation needs study that studied the effects of maintaining flow in an intermittent to dry stream bed. Work included measurement of stream flow, groundwater level measurements and soil moisture readings with neutron logging equipment.

Conducted a hydrogeologic investigation in accordance with N.Y. State Department of Environmental Conservation Part 360 regulations for a closed landfill in a complex hydrogeologic framework on a small peninsula where heavy pumpage for water supply occurs.

Conducted a remedial investigation of a former landfill in accordance with N.Y. State Department of Environmental Conservation - Hazardous Waste Division regulations. A detailed hydrogeologic report including a Hazardous Ranking System (HRS) evaluation was prepared to assist the regulatory agency in decisions regarding the site.

Conducted a hydrogeologic investigation in accordance with N.Y. State Department of Environmental Conservation Part 360 regulations for a proposed landfill. Monitoring well clusters were installed, pumping tests were evaluated and sampling was conducted.

Supervised hydrogeologic investigations at several manufacturing firms involved in regulatory actions.

Performed detailed pre-acquisition environmental studies of several landfills for a waste management company. Work included soil, groundwater, and surface water sampling and assessment of compliance with Federal and State solid and hazardous waste regulations.

Performed Phase II investigations for the N.Y.S. Department of Environmental Conservation at former landfill sites on Long Island, NY.

Conducted an aquifer sensitivity to hydrocarbon contamination study for a major enhanced bioremediation company involving five key areas nationwide.

Performed an assessment and subsequently assumed management of a hydrocarbon remediation project in a bedrock aquifer. Remediation had been conducted using groundwater pumping and air stripping followed by reinjection into the aquifer with nutrients in an effort to stimulate enhanced biodegradation. Tasks included definition of flow patterns, determination of receptors, assessment and recommendations regarding numerous domestic well water treatment systems and reassessment of all water quality data.

Performed technical reviews of previous and on-going hydrogeologic work conducted at service stations and terminals for a major petroleum company. This work was conducted after the acquisition and operation of the properties by another major petroleum company. This involved working with both companies on issues of responsibility for each property's contamination.

Performed pilot venting studies for hydrocarbon remediation of groundwater and the soil zone at several underground petroleum storage facilities. Design of remedial venting systems for these sites was performed.

Developed a soil gas survey/vacuum head measurement protocol to be used during pilot and full-scale venting studies to assess extent of contamination.

Developed a sampling and shipping protocol for groundwater samples and product samples at service stations with underground storage tanks.

Participated in a nationwide domestic well sampling program for agricultural chemicals for a major manufacturer, involving 13 counties in 9 states.

Conducted a groundwater, surface water and soil investigation at a pesticides bulk storage station. Delineation of groundwater flow patterns and chemical migration in bedrock aquifer was performed by utilization of existing domestic supply wells.

Publications

Author of 4 publications on geology and groundwater of Long Island.

PETER DERMODY
Hydrologist

Experience Summary

Mr. Dermody has experience in groundwater contamination studies, pump tests, slug tests, specific capacity tests, stepped-drawdown tests, vadose zone vapor studies, landfill studies, RI/FS, surface-water hydrology studies, ecological assessments, photogram metric aerial analysis of panchromatic and infrared imagery, and groundwater modeling.

Education

A.S.	Biology	Nassau Community College	1985
B.S.	Geology	Hofstra University	1987
M.S.	Earth Science	Adelphi University	1991

Associations

National Water Well Association

Certification

OSHA-approved 40 hour Health and Safety Training Course for Hazardous Waste Operations

Employment History

1988-Present	Fanning, Phillips and Molnar

Key Projects

Well installation, sampling, slug testing, vertical flow component analysis, and characterization of the nature and extent of leachate plumes for the East Hampton and Montauk Landfills.

Vadose Zone well installation, combustible gas monitoring, and analysis of meteorological conditions on methane migration for the East Hampton and Montauk Landfills.

RI/FS study including soil gas, soil, and groundwater analysis, development of RI/FS workplan, sampling and analysis plan, and health and safety plan for a federal Superfund site in Farmingdale, NY.

Delineation and analysis of water shed area for Orowoc Creek, Islip, NY.

Waterfowl inventory and speciation for the Town of Huntington, NY.

Environmental Impact Statement on ecological and hydrological effects of supplying fire-fighting water to the East Hampton airport.

Infrared imagery analysis for vegetational damage due to methane migration for the Town of East Hampton, NY.

Investigation and analysis of transport, dispersion, and degradation of a service station gasoline leak, Merrick, NY.

Pump test and aquifer analysis for a dewatering system for the N.Y.C. Transit Authority.

Soil, soil gas, and industrial waste sampling and analysis for Shorewood Packaging at LaGrange, GA; Roanoke, VA; Farmingdale, NY; and Waterbury, CT locations.

Bedrock well installation and geophysical analysis of groundwater system for Metex Corporation, Edison, NJ.

Environmental assessment and land use investigation and evaluation for property transfers.

Well installation and hydrogeological investigation for Irwin Measuring Tool, Patchogue, NY.

PCB investigation of leaking transformer for Salomon and Gruber, New Britain, CT.

Final Environmental Impact Statement for housing development in Southaven, NY.

Assessment of the feasibility of obtaining groundwater for use at the N.Y.C. Transit Authority.

Assessment of water supply for the U.S. Coast Guard, Springs, NY.

Underground storage tank leak investigation and floating product monitoring and sampling for Racanelli Associates at a site in Old Bethpage, NY.

Interpretation and analysis of geohydrological data for the New York City Transit Authority.

Sampling analysis and investigation of groundwater flow for M & M Rolloff, Holtsville, NY.

Tetrachloroethylene spill analysis for the Vadose Zone and groundwater from a site in Hauppauge. NY.

Vadose Zone organic vapor analysis and computer generation and interpretation for a site in Farmingdale, NY.

Well installation, well plumbness calculations and sampling and analysis for Automatic Connectors, Inc., Hauppauge, NY.

JOHN PAUL SCHEPP
Assistant Engineer

Experience Summary

Mr. Schepp has diverse experience in the construction, inspection and design of civil and environmental engineering projects. His last year of school stressed environmental engineering topics including: water and wastewater treatment, groundwater, contaminant transport, geology and hydrology. His education has emphasized computer modeling of groundwater, biological treatment, hydraulic and storm drainage systems.

Responsible for the inspection and testing of the HDPE liner and leachate collection systems at the Chemical Waste Management, Inc. Model City hazardous waste landfill.

Installed and removed underground fuel storage tanks, pumps, piping and dispensers.

Involved in the construction inspection of watermain, sewer and septic tank installations.

Education

B.S.	Civil Engineering SUNY at Buffalo	1991
A.A.S.	Civil Technology/Environmental Control Monroe Community College	1986

Certifications/Memberships

Engineer-In-Training(NY)	1991
40-Hour OSHA Health and Safety Training for Hazardous Waste Operations	1991

Employment History

1991-Present	Fanning, Phillips and Molnar
1990 (Summer)	Environmental Construction Services, Duluth, GA
1989 (Summer)	Villager Construction Co., Inc., Fairport, NY
1988 (Summer)	City Pump and Tank Service, Inc., Rochester, NY
1986-1987	Larsen Engineers/Architects, Rochester, NY

Key Projects

Shorewood Packaging Corporation Vadose Zone Cleanup

Managed the construction and operation of a vapor extraction/activated carbon filtration system for contaminated soils.
Prepared the operation and maintenance plans for the system. Including sampling and testing of air for organic vapors at various stages of treatment.

Shorewood Packaging Corporation Rag Recycling/ Industrial Waste Treatment Feasibility Study

Reviewed the feasibility of various industrial waste treatment alternatives and outlined the most cost effective methods.

Shorewood Packaging Corporation

Prepared Air Permits for an Ultraviolet-Cured Printing System; in keeping with ambient and short term guideline concentrations of contaminants.

Town of Huntington Stormwater Management Plan

Evaluated and designed conceptual methods for the mitigation of stormwater and fecal coliform introduction to estuarine waters.

New York City Transit Authority

Performed hydraulic calculations for 90 year old combined sewer tunnels and an inverted siphon system.

Confidential Client

Prepared a staging and sampling plan for a facility illegally storing over 2000 hazardous waste drums.

Nassau County

Reviewed the geology, hydrogeology, contamination and remedial measures for a petroleum contaminated groundwater site under litigation.

SCOTT STEHLIK
Geohydrologist

Experience Summary

Mr. Stehlik has experience in environmental geology involving geohydrology, soils and soil gas analyses, environmental site audits, ground and surface water quality analysis, groundwater flow modeling and state and federal Superfund site remedial investigations.

Education

B.S.	Geology/Environmental Concentration	SUNY at Cortland	1985
Graduate Courses:	Environmental Law; Long Island Geology; and Long Island Water Resources	SUNY at Stony Brook	1990-Present

Certification

OSHA - Approved 40 hour Health and Safety Training Course for Hazardous Waste Operations.

Associations

National Water Well Association

Employment History

1990-Present	Fanning, Phillips and Molnar
1986-1987	Henderson and Bodwell Consulting Engineers

Key Projects

Supervision of groundwater and methane monitoring well construction.

Hydrogeologic Phase II Investigation, groundwater and methane monitoring at Springs-Fireplace Road Landfill and Montauk Landfill.

USEPA Hazard Ranking System (HRS) Score for Springs-Fireplace Road Landfill.

Hazardous material analysis and drum disposal for Shorewood Packaging Corporation, Virginia.

Soil sampling and analysis through foundation of building at Heminway Corporation, Waterbury, CT, for Shorewood Packaging Corporation.

Investigation of industrial waste underground storage tank for Shorewood Packaging Corporation, Farmingdale, NY. Remediation by installation of vapor extraction system.

Organic vapor analysis for the detection of groundwater and soils contamination with volatile organic compounds in New York and Connecticut.

Environmental Site Review and Geohydrologic Investigation for Automatic Connector, Inc., Commack, NY.

Phase I and II Environmental Site Audits throughout New York.

Phase I Typical Tasks

History of Land Use of Site and Vicinity - chain of title, past spill activity, aerial photos, survey to identify past and existing dumping, structures, areas of stressed vegetation, and hazardous material storage.

Site Inspection - identify existing above and below ground tank or drum storage, areas of past spillage, investigate groundwater quality data, test drainage pools for presence of organic vapors and petroleum hydrocarbons, vapor phase testing in the unsaturated zone with an on-site OVA/GC.

Phase II Typical Tasks

Follow-up Soil Vapor Survey
Magnetometer Survey
Characterize Materials in Drums and Tanks
Soil Sampling and Lab Analysis
Groundwater Sampling if Applicable

Groundwater sampling and analysis at Landfills, Superfund sites, and for compliance with consent orders as well as Potentially Responsible Party delineation throughout New York.

Remedial Investigation/Feasibility Study for SJ&J Picone, Farmingdale, NY (federal and state Superfund site).

Regulatory compliance and environmental status report of the Nassau County Attorney's Office regarding the New Cassel industrial area, NY.

Advective Groundwater Flow Investigation and Analysis for Nassau and Suffolk Counties.

Fresh and Saltwater Wetlands Investigation for Eastern Long Island.

Groundwater investigation for compliance with consent Order at Nardy Pontiac Honda, St. James, NY.

Deep soil boring installation/soil and groundwater contamination investigation at anorad Corporation, Hauppauge, NY.

Well installation and soil vapor testing using photoionization detector (PID), flame ionization detector (FID) and OVA/GC.

Aquifer examination implementing slug and pump tests.

Aerial photo study pertaining to past and present land use.

Vadose Zone and Groundwater Investigation by headspace analysis of soil vapor for the New York City Transit Authority.

APPENDIX D

SOLOMAT 500E CALIBRATION PROCEDURES FOR TEMPERATURE AND HUMIDITY PROBES

5 TEMPERATURE

The 500e can measure temperature using the two most popular methods; the type K thermocouple and the Pt100 Platinum RTD. The first two sections describe first thermocouple temperature measurements, then Pt100 temperature measurements. Section 5.3 gives advice about measuring temperature.

5.1 TYPE K THERMOCOUPLE

The **K T/C** rotary switch position selects temperature using Type K thermocouples. Plug a thermocouple probe into the yellow subminiature thermocouple socket, select either °C or °F calibration with the SYMBOL switch and read the temperature. A full description of thermocouple probes is available in the 500e catalog. Refer to the Specifications section of this manual to determine accuracy.

Thermocouples are temperature sensors and a type K thermocouple temperature probe uses Chromel Alumel thermocouple wire as the temperature sensor. You can use any Chromel Alumel temperature probe from any manufacturer, so long as it uses a subminiature type polarized Chromel Alumel (Type K) plug.

While any two different metals can be connected together to make a thermocouple, the Chromel Alumel thermocouple is the most popluar thermocouple in use today. The thermocouple can be used to 1270°C and is reasonably stable at high temperatures. These thermocouple probes cannot go to low temperatures and are not as accurate as the platinum probes, but can operate to higher temperatures and quickly respond to temperature changes.

When using Chromel Alumel thermocouple probes, do remember:

1. Check that the accuracy of type K thermocouple is adequate for your application.
2. Use only type K compensation or extension cable for extending the probe-to-instrument distance.
3. Use only proper thermocouple plugs to avoid error at the plug junction (all Solomat probes are fitted with industry-standard subminiature thermocouple plugs).
4. Periodically recalibrate the 500e (using the 500e 'thermocouple zero' adjust) if your thermocouple has been used at high temperatures or in reducing atmospheres.
5. Avoid using portable K thermocouple probes above 1100°C. The thermocouple wire is too thin to remain stable at high temperatures.
6. Check that the sheath material (either stainless steel or nickel alloy) will not corrode in your measuring environment; sulfurous atmospheres are especially troublesome.
7. Avoid cable temperatures greater than 80°C with the standard cable. Should you need high temperature or special armoured cable, contact Solomat; the 203AH and 201IH are supplied with armored cable that can withstand 400°C.
8. For easiest use, we suggest that you store your 500e and your thermocouple probes at the same temperature. If you plug a cold thermocouple probe into a warm socket, then it may take up to three minutes for the display to settle as the cold junction readjusts to the new temperature.

SAFETY

1. The MPM 500e displays flashing **'oooo'** for an open circuit (broken) thermocouple.
2. Follow the warnings in this manual and the 500e manual about possible dangerous conductive electrical paths when using grounded thermocouples and AC adaptors at the same time.

WARNING

Mineral insulated thermocouple probes (e.g. 201IH) may lose their electrical isolation if used or stored in high humidity environments. This could create an electrical path from the sheath through the instrument to the AC adaptor. It is the user's responsbility to ensure that mineral insulated probes are correctly used and stored.

Recalibration: It is easy to check the accuracy of your thermocouple probe at room temperature. Simply plug a platinum Pt100 temperature probe into the left-hand 9-pin socket and a thermocouple probe into the thermocouple socket above it. Place both probes next to each other, and allow stabilization for 15 minutes. Also allow the thermocouple plug and socket to thermally equilibrate (the 'cold junction' must be at the same temperature as the thermocouple plug). Now switch between Pt100 and K type. The platinum (Pt100) is very accurate, so if the thermocouple reading is within ±2.2°C (4°F) of the Pt100, then it is within specification. Only 0.3°C (or 0.1°C if sensor is ½ DIN) of this allowed error is due to the Pt100. The rest of the error is the A.N.S.I. allowed error for K type thermocouples. If the difference between K type and Pt100 is more than ±2.2°C (4°F) or if you want to calibrate the 500e for a specific thermocouple probe, then refer to the 'Recalibration' section of this manual for recalibration instructions. You can easily trim the thermocouple to 0.1°C accuracy.

5.2 Pt100 RTD

You can also measure temperature using platinum Pt100 RTD probes. The 500e will accept any Solomat Pt100 or Pt100/%RH probe. Plug a probe into the right-hand 9-pin socket, select **Pt100** on the rotary switch and choose either °C or °F calibration with the SYMBOL switch. A full description of Pt100 probes is available in the 500e catalog. To determine accuracy, refer to the Specifications section of this manual.

NOTE: Although the temperature range of the MPM 500e is 800°C for Pt100 probes, the maximum temperature depends on the temperature probe. For example, the 355RH thermohygrometer probe can only measure temperature up to 70°C.

Platinum as a Temperature Sensor: The RTD (Resistance Temperature Detector) is a popular alternative to thermocouples for measuring temperature. The most widely accepted RTD is platinum, termed Pt100 in industrial applications.

A platinum RTD uses the change in the electrical resistance of platinum to measure temperature. Platinum has become the industrial and laboratory temperature calibration standard from −270° to +800°C. Easily refined to a high purity (99.999%), mechanically and electrically stable, and resistant to contamination and oxidation, no other temperature detector can approach the superior interchangeability of platinum RTDs.

Whereas ageing in thermocouples and thermistors will lead to long term drift, platinum RTDs have excellent long-term stability up to 800°C. Recalibration is unnecessary.

The absence of special compensation leads and cold junction errors along with the high output of platinum RTDs means more accurate instrumentation than for thermocouples.

Certain chemicals will give a high %RH reading:

- Ammonia
- Alcohol
- Formaldehyde

The above information is only a guideline, and if you are concerned about your chemical environment, contact Solomat or your distributor, specifying the temperature and approximate humidity, along with the concentrations and types of chemicals that are present. This is the safest way of ensuring reliable measurements.

3. MECHANICAL SHOCK: Avoid mechanical shock to the humidity and Pt100 sensors.
4. HIGH HUMIDITY: Your humidity probe can measure from 0 to 100% RH, but if you are going to continuously monitor humidity above 75%, then the sensor should be recalibrated by Solomat or by using the recalibration kit.

   Alternatively, make your spot checks with the same time delay: typically 90 seconds delay at high humidities will bring you into the 'window of accuracy' at room temperatures. Allow longer times at lower temperatures. The sensor will recover from condensation (100% RH), but please maintain the probe in a vertical position to prevent collection of condensate on the sensor itself.

   A third option is to order the new special high humidity high temperature sensor. DO NOT use this sensor to measure dewpoint.

6.2 SPECIAL HUMIDITY PROBES

These three probes are electronically the same as the 355RH but are built with sheaths which are designed for specifc applications. The **356RH** probe is a sword probe specifically designed for measuring ERH (equilibrium relative humidity) of paper stacks. The **357RH** is designed for measuring ERH in grains and other store material and, with its extended shaft, relative humidity in difficult to reach areas. Both of these sensors can temporarily measure humidity at ambient temperatures of up to 100°C. DO NOT expose the electronics in the handle to these temperatures. The **358RH** isolates the humidity and temperature sensors from the electronics for high temperature and remote semi-permanent measurements.

The **356RH** has a sensor exposed to the air through the small holes at the top of the flat edge of the sword. DO NOT allow dust, etc, to collect around this area. Store the tip in a clean place when not in use.

The **357RH** is provided with a 0.1 micron PTFE/glass filter which can be esily replaced. DO NOT attempt to clean this filter; it is meant to be a replaceable filter (order part no. HT6). A sintered bronze (cleanable) filter can be also supplied (part no. HT7), but this filter will greatly slow the sensor response time.

To change the 357RH filter:

1. Remove the two screws which retain the black acetal nose.
2. Remove the black nose and slide the filter off the sheath.
3. Inspect the sensor for any damage or contamination.
4. Slide the new filter onto the steel sheath.
5. Replace the nose and the two retaining screws.

The **358RH** separates the Pt100 and humidity sensors from the electronics to minimize the sensor housing size and to allow high temperature sensor use where the electronics would otherwise be damaged. The sensor head is made from glass filled nylon and acetal, with epoxy filling connecting the PTFE cable to the acetal adaptor. A ¼" BSP lock nut and washer are included with the sensor head for panel mounting.

The cable between the electronics (in the black acetal body) and the sensors is a screene PTFE cable. Standard cable length is 2 meters, but up to 50 meters can be accomodated contact Solomat. The metal connector from the cable to the electronics pushes into the socket when the two red alignment dots are in register.

The electronics are calibrated to each humidity sensor so sensor housings are not interchangeable with the electronics. The electronics and sensor are shipped as a matched pair

6.3 HUMIDITY CALIBRATION

Periodic checking of the calibration of your humidity sensor will increase your self-confider in making reliable humidity measurements (the instrument does not change calibration; on the sensor can change calibration with time). These are several situations that require checking calibration.

1. The sensor has been cleaned either to remove dust (using a clean airstream), to remov ionic deposits (using distilled water) or to remove oils or cigarette tar (using perchloroethyler
2. The probe was calibrated for use in high humidities and you need recalibration to ambient humidities.
3. The probe will be used continuously in high humidities (>75%RH).
4. The standard 12, 18 or 24 month calibration check is due, according to your maintenance schedule. Good instrument practice for monitoring humidity includes a maintenance schedu
5. The sensor has been badly damaged. If the sensor has been chemically or mechanicall damaged, please return the probe to Solomat or your distributor for checking, and if necessary, fitting of a new sensor.

If you wish to check the humidity calibration of your probe yourself, allow enough time to it correctly: 1 hour to initially set up the humidity references and 24 hours to stabilize the salt reference when first preparing the salt jar, plus another 2 hours to check the probe. Accurate humidity calibration requires patience.

HC1 Calibration Kit: NOTE: Leave bottles in the packing case. This packing case supports the bottles and minimizes sudden temperature changes.

The humidity calibration kit includes the following items:

- Saturated salt reference jar
- Zero % RH reference jar
- Two packages of 75% reference salt (high purity sodium chloride)

Your calibration kit allows you to accurately check your probe zero calibration at 0%RH using a material (molecular sieve dessicant) which literally holds onto any water in the air, producing a very dry atmosphere (0% to 0.5%RH) at any temperature. This zero reference is very simple and reliable.

The high humidity reference (for checking the span calibration) is a saturated salt solution. The water concentration of air in a closed system that is in (PVT and chemical) equilibrium wit saturated solution is dependent only on the type of salt being used, and to a lesser degre the local temperature and pressure. By using different salts the value of the salt reference can vary from 11% and 97% RH. The accuracy of the salt reference depends on the specific s and is typically between 0.5% and 2%, but if the salt is improperly prepared the error can as much as 20%.

ZERO Calibration: The molecular sieve dessicant in the zero reference jar will maintain a 0%/0.5% RH humidity, so long as the jar is well sealed. The dessicant can absorb up to 5% of its weight in water before losing its effectiveness, and a quick drying will rejuvinate the dessican giving the reference a typical lifetime of 3 years or more.

Remove the rubber stopper and press the black acetal probe body into the jar. For 356RH, 357RH and 358RH use the grey silicone rubber adaptor (supplied with probe) to seal the probe into the salt jar.

Allow at least 1 hour for stabilization of the probe and dessicant.

If the zero is out by more than ±2%, then carefully adjust the zero trim in the base of the probe, following the instructions overleaf.

If you suspect that the molecular sieve dessicant is no longer capable of maintaining 0% RH (for instance if you know that the lid has been left off), then you can rejuvenate the dessicant by drying it at 250° to 300°C (480° to 570°F) for 3 to 4 hours on a drying shelf, then transferring the hot dessicant immediately into the reference jar and sealing, allowing the dessicant to cool in the jar.

SPAN Calibration: Your calibration kit is supplied with two packages of sodium chloride salt. This salt allows you to calibrate the span of your probe at (nominally) 75%. However, if you are almost always measuring humidity at another relative humidity then you can use another (high purity) salt which is closer to your humidity application (as shown in Table 7). Prepare the saturated salt solution as follows: empty one of the salt packages into the salt reference jar. Add 22ml of distilled water to the salt using the enclosed syringe. Stir with a glass or plastic rod. You can use cold water, but water that is about 5° to 10°C warmer than the ambient temperature will speed stabilization of the salt solution. Add the water slowly, stirring until there is only 1 to 2mm of saturated water on top of the salt slush after settling (see Figure 4). Replace the lid and cover and allow the solution to stabilize for 24 hours before attempting to calibrate the span of your probe. There is no need to remove the bottle from the packing case.

NOTE: Lithium chloride, when mixed with water is exothermic. Add water slowly to avoid overheating. The LiCl solution temperature should not go below 18°C (64°F), or the salt will need replacing.

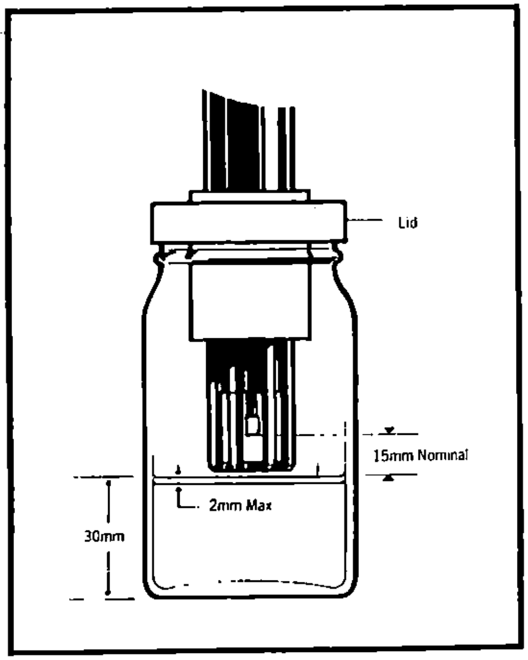


Figure 4
CORRECT SALT JAR SETUP FOR SODIUM CHLORIDE (NaCl) KIT SUPPLIED WITH HC1. OTHER SALTS WILL NOT ATTAIN THE 30mm HEIGHT.

SALT	TEMPERATURE							
	10°C 50°F	15°C 59°F	20°C 68°F	25°C 77°F	30°C 86°F	35°C 95°F	40°C 104°F	45°C 113°F
LITHIUM CHLORIDE MONOHYDRATE	—	—	11.3	11.3	11.3	11.3	11.2	11.1
MAGNESIUM CHLORIDE HEXAHYDRATE	33.5	33.3	33.1	32.8	32.4	32.1	31.6	31.1
MAGNESIUM NITRATE HEXAHYDRATE	57.4	55.9	54.4	52.9	51.4	49.9	48.4	46.9
SODIUM CHLORIDE	75.7	75.6	75.5	75.3	75.1	74.9	74.7	74.5
POTASSIUM CHLORIDE	86.9	85.9	85.1	84.3	83.6	83.0	82.3	81.7
POTASSIUM SULFATE	98.2	97.9	97.6	97.3	97.0	96.7	96.4	96.1
POTASSIUM NITRATE	96.0	95.4	94.6	93.6	92.3	90.8	89.0	87.0
POTASSIUM CHROMATE	—	—	98.2	98.0	97.8	96.9	96.2	95.5

Table 7. RELATIVE HUMIDITY OF SATURATED BINARY SALTS AT DIFFERENT TEMPERATURES.

After the solution has stabilized, insert the humidity probe into the jar, and allow 30 minutes for the probe to equilibrate. If the instrument display is more than ±2% from the value listed in Table 8 for your ambient temperature then adjust the span trim in the base of the probe as described below. DO NOT leave the probe in the salt reference for longer than 2 hours.

Certain precautions should be followed to ensure an accurate salt reference solution:

1. Ideally, the salt solution should be kept at a constant temperature (±0.5°C) during stabilization and calibration. Avoid drafts, direct sunlight, and changes in temperature greater than 1°C/hour. Any large increases in temperature will unsaturate the solution, and stirring followed by restabilization is necessary. Once the salt solution is prepared, keep at a constant temperature; you are then always ready for recalibration (the 24 hour stabilization period can be ignored). Use the foam packing case to minimize the effect of drafts on the salt reference jar temperature.
2. Excessive temperature cycling of the salt solution will form crystals and the solution may not remain saturated. If excessive temperature cycling occurs, prepare a new solution.
3. The top of the salt solution should be about 10 to 15mm from the sensor.

Recalibration: If the zero and/or the span of your humidity probe is out of calibration, then you can easily recalibrate.

1. CAREFULLY prise off the cable cap from the probe using a large blade screwdriver.
2. CAREFULLY pull the probe cable cap away from the probe body, as shown in the figure overleaf. The two exposed trimmers are the zero and the span adjustments. These two trimmers do not interact with each other, so if you adjust only the span, you should not need to recheck the zero again.
3. Adjust using a small screwdriver.
4. CAREFULLY press the probe cable cap back into the body.

If you are using the probe continuously at humidities above 75%, then recalibration is desirable for best accuracy. Prepare a saturated salt solution of either potassium chloride (for about 85%RH use) or potassium sulfate (for about 95% RH use) as described earlier. Let the salt solution settle for 24 hours. Allow at least 7 hours for probe stabilization, then retrim the span. The 7 hours stabilization is at 25°C (77°F) ambient temperature; this time is reduced to about 1 hour at 45°C (113°F).

Contact Solomat for special high temperature or fixed point calibrations.

APPENDIX E

MDL STUDY FROM H2M LABORATORIES

H2M LABS, INC.

VOLATILE ORGANICS
METHOD DETECTION LIMIT STUDY

Instrument ID: 5996A Column ID: RTX502.2 Analysis Date: 2/26/92

Method No.: 524.2 Matrix: Water Amount Spiked: 1 PPB

File I.D. No.:	V3565	V3566	V3567	V3568	V3571	V3575	V3576				
COMPOUND	MDL 1	MDL 2	MDL 3	MDL 4	MDL 5	MDL 6	MDL 7	AVG.	S	MDL	ASP CRQL
Dichlorofluoromethane	0.797	0.725	0.647	0.775	0.728	0.647	0.546	0.695	0.087	0.273	
Chloromethane	1.02	0.921	0.913	1.16	0.914	0.907	0.826	0.952	0.108	0.338	
Bromomethane	1.21	0.968	1.10	1.03	1.02	1.02	1.09	1.00	0.791	0.248	
Vinyl Chloride	1.05	0.917	0.947	0.998	1.02	0.904	0.995	0.976	0.054	0.171	
Chloroethane	1.23	0.949	1.03	1.02	1.01	0.930	1.00	1.02	0.098	0.308	
Trichlorofluoromethane	1.07	0.875	0.899	0.991	1.10	0.943	1.01	0.977	0.077	0.243	
Methylene Chloride	1.43	1.30	1.43	1.40	1.33	0.985	1.44	1.34	0.162	0.511	
1,1-Dichloroethene	1.15	0.999	1.08	1.10	1.23	1.06	1.18	1.11	0.078	0.245	
1,1-Dichloroethane	1.19	1.08	1.16	1.16	1.16	1.05	1.07	1.13	0.045	0.149	
Trans-1,2-Dichloroethene	1.15	1.04	1.12	1.09	1.14	0.978	1.09	1.09	0.062	0.195	
Cis-1,2-Dichloroethene	1.21	1.10	1.21	1.17	1.20	1.07	1.18	1.16	0.056	0.175	
2,2-Dichloropropane	1.09	0.737	0.792	0.633	0.704	0.581	0.724	0.782	0.178	0.559	
Chloroform	1.38	1.32	1.43	1.40	1.43	1.36	1.49	1.40	0.055	0.173	
Bromochloromethane	1.19	1.12	1.26	1.24	1.23	1.11	1.26	1.20	0.064	0.200	
1,2-Dichloroethane	1.28	1.19	1.32	1.32	1.30	1.19	1.30	1.27	0.057	0.180	
1,1,1-Trichloroethane	1.20	1.10	1.17	1.15	1.19	1.13	1.25	1.17	0.049	0.155	
1,1-Dichloropropene	1.12	1.02	1.07	1.05	1.15	0.973	1.07	1.06	0.059	0.186	
Carbon Tetrachloride	1.06	0.958	1.01	1.00	0.997	0.967	1.10	1.01	0.051	0.159	
Trans-1,3-Dichloropropene	1.05	1.12	1.22	[illegible]	1.11	0.571	1.12	1.08	0.107	0.336	
Trichloroethene	1.24	1.14	1.25	1.24	1.38	1.23	1.31	1.26	0.074	0.233	
1,2-Dichloropropane	1.43	1.40	1.52	1.51	1.53	1.50	1.65	1.51	0.080	0.252	
Dibromomethane	1.27	1.14	1.28	1.27	1.24	1.13	1.17	1.21	0.066	0.206	
Bromodichloromethane	1.09	1.08	1.20	1.14	1.13	1.06	1.18	1.13	0.052	0.164	
1,1,2-Trichloroethane	1.32	1.21	1.38	1.32	1.29	1.17	1.27	1.28	0.071	0.223	
Benzene	1.19	1.08	1.17	1.15	1.17	1.08	1.17	1.14	0.045	0.143	
Cis-1,3-Dichloropropene	1.11	1.10	1.21	1.11	1.11	0.998	1.09	1.10	0.061	0.193	
1,3-Dichloropropane	1.25	1.20	1.37	1.31	1.30	1.16	1.28	1.27	0.071	0.222	
Dibromochloromethane	1.04	1.07	1.21	1.19	1.16	1.08	1.17	1.13	0.067	0.209	
Tetrachloroethane	1.26	1.15	1.18	1.37*	1.27	1.15	1.33	1.24	0.088	0.275	
1,2-Dibromoethane	1.19	1.23	1.39	1.37	1.32	1.14	1.31	1.28	0.094	0.295	
Toluene	1.24	1.12	1.22	1.20	1.23	1.14	1.28	1.20	0.057	0.177	
Chlorobenzene	1.26	1.14	1.25	1.20	1.27	1.15	1.32	1.22	0.066	0.208	
1,1,1,2-Tetrachloroethane	1.15	1.13	1.29	1.21	1.22	1.12	1.21	1.18	0.050	0.158	

* Analysis from V3570

H2M LABS, INC.

VOLATILE ORGANICS
METHOD DETECTION LIMIT STUDY

Instrument ID: 5996A Column ID: RTX502.2 Analysis Date: 2/26/92

Method No.: 524.2 Matrix: Water Amount Spiked: 1 PPB

File I.D. No.:	V3565	V3566	V3567	V3568	V3571	V3575	V3576				
COMPOUND	MDL 1	MDL 2	MDL 3	MDL 4	MDL 5	MDL 6	MDL 7	AVG.	S	MDL	ASP CRQL
Ethylbenzene	1.23	1.10	1.20	1.21	1.25	1.10	1.33	1.20	0.082	0.257	
M/P-Xylene	2.53	2.27	2.41	2.50	2.51	2.23	2.66	2.44	0.152	0.478	
O-Xylene	1.23	1.10	1.21	1.20	1.24	1.10	1.35	1.20	0.087	0.272	
Bromoform	1.06	1.09	1.29	1.21	1.19	1.14	1.18	1.17	0.079	0.242	
1,1,2,2-Tetrachloroethene	1.30	1.23	1.40	1.22	1.17	1.03	1.10	1.21	0.123	0.386	
1,2,3-Trichloropropane	1.05	1.12	1.22	1.10	1.11	0.871	1.12	1.08	0.107	0.336	
Isopropylbenzene	1.24	1.09	1.17	1.15	1.22	1.06	1.12	1.15	0.066	0.207	
Bromobenzene	1.23	1.20	1.30	1.25	1.30	1.16	1.23	1.26	0.072	0.226	
4/ 2-Chlorotoluene	2.60	2.33	2.50	2.42	2.62	2.29	2.39	2.45	0.128	0.402	
N-Propylbenzene	1.28	1.12	1.19	1.17	1.25	1.09	1.15	1.18	0.068	0.213	
4-Chlorotoluene											
1,3,5-Trimethylbenzene	1.32	1.17	1.23	1.27	1.31	1.15	1.20	1.24	0.067	0.210	
T-Butylbenzene	1.37	1.16	1.22	1.23	1.30	1.08	1.17	1.22	0.095	0.300	
1,2,4-Trimethylbenzene	1.32	1.17	1.24	1.27	1.30	1.15	1.21	1.24	0.064	0.202	
Sec-Butylbenzene	1.36	1.16	1.21	1.19	1.29	1.11	1.17	1.21	0.085	0.267	
P-Isopropylbenzene	1.40	1.19	1.25	1.24	1.32	1.14	1.18	1.25	0.0894	0.281	
1,3-Dichlorobenzene	1.41	1.26	1.35	1.30	1.40	1.24	1.28	1.32	0.0676	0.212	
1,4-Dichlorobenzene	1.45	1.26	1.38	1.31	1.43	1.25	1.30	1.34	0.0804	0.253	
1,2-Dichlorobenzene	1.48	1.30	1.42	1.35	1.47	1.25	1.32	1.37	0.088	0.277	
Styrene	1.25	1.14	1.29	1.20	1.27	1.10	1.25	1.21	0.065	0.205	
N-Butylbenzene	1.49	1.23	1.30	1.27	1.34	1.18	1.22	1.30	0.153	0.480	
1,2-Dibromo-3-Chloropropane	1.41	1.17	1.47	1.38	1.16	1.12	1.31	1.29	0.139	0.436	
1,2,4-Trichlorobenzene	*2.40	2.48	2.57	2.25	2.52	2.07	2.13	2.33	0.187	0.587	
Napthalene	*1.9	2.15	1.99	2.00	2.03	1.66	1.66	1.91	0.188	0.590	
Hexachlorobutandiene	*1.58	1.53	1.53	1.45	1.62	1.30	1.34	1.48	0.112	0.352	
1,2,3-Trichlorobenzene	*1.91	2.20	2.02	1.49	2.06	1.66	1.64	1.92	0.212	0.667	

* Processed from V 3570