RICHARD D. GALLI, P.E., P.C.
52 BROADWAY, GREENLAWN, N.Y. 11740
(516) 754-0396
FAX: (516) 754-7408

ASTRO ELECTROPLATING, INC.

NYSDEC SITE CODE: 1-52-036

PHASE II REPORT

Prepared by:

Richard D. Galli, P.E., P.C.

August, 1989

TPF:pmsS2

89-001-04

TABLE OF CONTENTS

LIST OF TABLES

TABLE

LIST OF FIGURES

Figures

APPENDICES

A. Boring Logs

B. P.I.D. Data Sheets

C. Chain of Custody Sheets

D. Monitoring Well Construction Reports

E. References

F. Soils Analysis Data (Bound Separately)

G. Groundwater Analysis Data (Bound Separately)

1.0 EXECUTIVE SUMMARY

Pursuant to a Consent Order signed by the New York State Department of Environmental Conservation (NYSDEC), **Richard D. Galli, P.E., P.C. (RDG)** has performed a soils and groundwater investigation at 170 Central Avenue, Farmingdale, Suffolk County, New York (site #1-52-036). The site is operated by Astro Electroplating, Inc. (AEI) owned by Finch Realty, Inc. The president of AEI is Mr. Neil Weinstein.

AEI is a small plating facility which has been at 170 Central Avenue for approximately twenty years. At one time, AEI discharged treated plating wastes to a permitted SPDES discharge pool until 1986, at which time treated wastewater was rerouted to the Southwest Sewer District. In 1986, four in-line leaching pools located on the northeast side of 170 Central Avenue were unearthed, soil and sludge containing inorganic contamination was removed from the four leaching pools and the pools were backfilled with clean fill. All remedial operations were under the supervision of the Suffolk County Department of Health Services (SCDHS).

During the actual field investigation, representatives of the NYSDEC, Division of Environmental Enforcement, White Plains, New York, were present. Specific procedures, such as well installation, sample preparation, decontamination of equipment, etc. were followed in accordance with the NYSDEC approved workplan.

Two exploratory borings and boring/installation and development of five water table monitoring wells were completed on May 17, 1989 by Marine Pollution Control, Inc. A total of 16 soil samples were collected during the field investigation and delivered to NYTest Environmental Laboratories, Inc. on a daily basis due to sample holding time limitations. The complete data package for the laboratory analysis of the soil samples was available to **RDG** by July 13, 1989. On May 30, 1989 the five monitoring wells were sampled, and samples delivered to NYTest Environmental, Inc., Inc. The data package for the laboratory analysis of the groundwater samples was available to **RDG** on July 27, 1989.

The subsurface exploration determined that the Upper Glacial Aquifer underlies the site and consists primarily of mixtures of sand and gravel having a porosity of 38% and permeability of approximately 82.2 ft/day. Through continued research into technical literature, **RDG** has determined that the Gardiner's Clay or the "20 foot" clay does not underlie the subject site. The total thickness of glacial sediments below the AEI facility is approximately 125 feet. The referenced clay layers "pinch out" or become discontinuous approximately one mile south of the subject site. Installation of the five monitoring wells determined that depth to groundwater varied from 38.5 to 39.00 feet at the subject site during the month of April, 1989, therefore the saturated thickness of the Upper Glacial Aquifer is approximately 90 feet. Above average rainfall since the installation of the monitoring wells has increased the elevation of the local water table approximately two feet.

Potentiometric data collected from the AEI monitoring well network indicates groundwater flows south-southeast through the property at 0.32 ft/day, horizontal flow, within the upper Glacial Aquifer. Localized mounding of the water table was observed in several monitoring wells located adjacent to storm drains one to two days after moderate to severe rainstorms. The direction of groundwater flow through the AEI site is consistent with regional groundwater flow, although localized mounding was observed in several wells.

Although the vertical component of groundwater flow generally is limited within the aquifers of Long Island due to the anistropic nature of the sediment, recharge of underlying aquifers occurs within the Farmingdale area. The subject site is within Zone II according to Suffolk County Sanitary Code Article 7, designated as an area of deep recharge to underlying aquifers.

The area in which the AEI site is located has been industrialized since the 1960's. There are at least six facilities within a 1.5 mile radius of the subject site that have been cited for disposal of hazardous materials to soils and groundwater and are currently listed on the NYSDEC Inactive Hazardous Waste Disposal Sites in New York State, 1989. Regulatory agency files and regional groundwater studies indicate a potential for contribution from off-site sources of contamination to groundwater resources within the subject site by facilities upgradient of the AEI site.

Several industrial facilities upgradient of the AEI site have been cited by the SCDHS for discharges which have exceeded organic and inorganic groundwater effluent stands. A sample from a SPDES pool utilized by Tronic Plating, Inc. located on

168 Central Avenue, contained inorganic contaminants in excess of SCDHS standards such as chromium, zinc, cadmium, copper, lead, nickel, and silver. According to official records, waste waters containing unacceptable amounts of copper, lead, cadmium, and zinc were released by IW Industries located on 35 Melville Park Road. Additionally, two manufacturers of printed circuit boards, P&V Circuits, Inc. and Diversified Manufacturers, Inc., located directly north of the AEI facility are suspected of having discharged wastes containing copper to the local sanitary sewer.

Site topography is essentially flat, having a slope of less than 3 percent. No naturally occurring surface water bodies exist within the site area. Site soils consist of the Urban Land (Ur) series. The subject site is almost entirely paved. The site consistently floods during and immediately after periods of heavy precipitation.

Laboratory analysis of the selected soil samples indicates that the presence of soil contamination is limited to subsurface soils within the immediate area of the SPDES pool in which plating wastes were legally discharged and within the area of the four leaching pools. Levels of total chromium and copper greater than 200 ppm were detected within samples collected at depths less than twenty feet.

Soil samples collected at MW-3, from an interval of 9-11 feet, exhibited concentrations of 2,070 ppm hexavalent chromium and 191 ppm copper; samples collected at B-2, from an interval of 13-15 feet, contained concentrations of 435 ppm total chromium and 195 ppm copper. Portions of a gray/green sludge were observed in both of these samples.

A correlation of discoloration of soil and levels of copper and chromium was observed within other samples collected from the general area of waste water discharge, all of which were within a depth range of 10-17 feet below grade. Though the greatest concentrations of total chromium and copper were identified at depths less than 20 feet, levels of these metals were also present within the soil samples collected from groundwater interface. Hexavalent chromium was at trace or low concentrations within all soil samples collected from the area of wastewater discharge.

Complex chemical reactions affecting the concentrations and proportions of chemical species are suspected of occurring in the soil and groundwater matrix. Examples of these reactions are:

-Reduction of hexavalent to trivalent chromium in soil.

-Oxidation of trivalent to hexavalent chromium in groundwater.

-Adsorption of trivalent chromium to iron oxide coatings on soil grains, reducing its mobility.

-Production of chromic oxides and hydroxides from interaction of plume and groundwater chemistry.

The overall effect of these reactions is to increase the concentration of trivalent chromium in soil while increasing the concentration of hexavalent chromium in groundwater.

The soil samples collected from MW-1 were typical of glacial outwash plain deposits with no unnatural discolorization. The soil samples selected for laboratory analysis from monitoring well MW-1 contained detectible concentrations of chromium, copper, and zinc. The upgradient soil samples can be considered typical of ambient or natural background soil quality.

Soil samples collected from downgradient monitoring wells MW-4 and MW-5 exhibited soil quality typical of ambient quality identified within upgradient samples with few exceptions. Copper and zinc were identified within soil sample MW-4, 45-47 feet, having concentrations of 36.8 ppm and 72.3 ppm respectively.

Volatile organic compounds were not identified within the selected soil samples with the exception of acetone and methylene chloride detected at trace concentrations within several soil samples.

Concentrations of several inorganic contaminants, including copper, nickel, total chromium, and hexavalent chromium were present within groundwater samples collected from monitoring wells MW-2 and MW-3, located within the immediate area of past waste water discharges. The duplicate sample collected from monitoring well MW-3 indicated highly to moderately variable results for chromium, copper, and zinc. Hexavalent chromium concentration within samples collected from monitoring wells MW-2 and MW-3 were highly variable, with indicated concentrations of 6.0 and 140.0 ug/l respectively.

Concentrations of inorganic contamination were identified in downgradient monitoring well MW-4 including total chromium 2,350 ug/l, hexavalent chromium at 2,400 ug/l, copper 32,400 ug/l, and nickel 6,320 ug/l. All of the indicated concentrations are in excess of NYSDEC Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance Values, April, 1987. Downgradient monitoring well MW-5 contained only slightly elevated concentrations of chromium and copper with the remaining parameters consistent with water quality identified in upgradient monitoring well MW-1.

Volatile organic compounds including 1.1.1-trichloroethane, trichloroethene, 1,1-dichloroethene and tetrachloroethene, were detected throughout the AEI monitoring well network.

2.0 PURPOSE OF INVESTIGATION

The investigation was conducted to assess the vertical and areal extent of soil and groundwater contamination at the site resulting from improper disposal of hazardous material by AEI. The specific hazardous materials and relative concentrations of such materials within soils and groundwater distributed throughout the subject site was determined. The information obtained by this investigation is intended to enable NYSDEC to assign the subject site its proper Hazardous Site Classification.

3.0 SCOPE OF WORK

The activities described in Sections 3.1 - 3.13 below were performed during the Phase II Investigation at Astro Electroplating Inc. site.

3.1 Collection and Review of Background Information

Published literature of Long Island geology, hydrology, soils and climate were collected, reviewed, and any useful or pertinent information regarding the investigation was incorporated into this report.

Additionally, regulatory agencies files on surrounding properties, such as Tronic Plating, Inc., were reviewed to determine the likelihood of off-site contamination migration into the AEI site. Water Quality data for local observation, monitoring, and water supply wells provided by the Suffolk County Department of Health Services were reviewed to determine local water quality and the potential of AEI contributing to the degradation of local groundwater quality (see Appendix E - List of References).

3.2 Exploratory Borings

A total of two exploratory borings were placed through two of four abandoned leaching pools (see Section 4.0). During the Spring and Summer of 1986, supervised by Suffolk County Department of Health Services (SCDHS) personnel, the abandoned leaching pools were unearthed and subjected to contaminated soil and sludge removal followed by backfilling. Exploratory Boring B-1 was placed through leaching pool Number 1; B-2 was placed through leaching pool Number 3. The exploratory borings were completed to a total depth of 40 feet with split spoon soil samples continuously recovered at two feet intervals. The approved workplan called for the exploratory borings to be placed a total of 30 feet below grade, but was increased to 40 feet by NYSDEC officials during the field operations. A total of three soil samples from each exploratory boring were selected for laboratory analysis.

After the completion of each boring, the bore hole was filled with cement grout to surface level. All soil cuttings produced during the completion of the borings were placed in drums.

3.3 Monitoring Well Installation

The installation of the five monitoring wells was completed from April 21, to May 1, 1989 with few technical problems encountered. On several occasions, there were delays in drilling that resulted from the uncertainty in the location of underground drainage systems and abandoned utilities in spite of having the utilities marked out. This problem was overcome and resulted in a delay of approximately 2.0 working days. All well installations and construction techniques performed reflect the specifications presented in the approved Phase II Workplan. All soil cuttings generated during the installation of monitoring wells MW-2 and MW-3 were drummed due to the wells' proximity to wastewater discharge points and discolorization of several soil samples collected from the well borings. Soil cuttings generated during the installation of the remaining monitoring wells appeared to be free of contamination and therefore were not required to be drummed.

The number, depth and location of the monitoring wells were altered from the original monitoring well network as given in the approved Phase II Workplan. The actual location, number and depth of the installed monitoring wells was in accordance with NYSDEC alterations outlined in an official letter and attached monitoring well location sketch, dated March 13, 1989.

Depth to groundwater at the subject site ranged between 38.5 and 39.0 feet at the time of well installation (see Appendix D, Monitoring Well Construction Report). All wells were installed to a depth of approximately 47 feet. Standing water within each well ranged between 8.5 and 9.0 feet at the time of installation. It must be noted that standing water levels will seasonally fluctuate.

Continuous split spoon soil samples were recovered during the boring of the monitoring well MW-3 to determine if there were any significant stratigraphic changes within the subject site, such as an impermeable clay strata. No significant strata changes were encountered (see Figure 6.1 Geologic Cross Section). At the remaining five wells, split spoon samples were recovered every five feet.

Two split spoon samples from each monitoring well boring were selected for laboratory analysis based on criteria outlined in Section 3.4.

3.4 Soil Sample Collection, Preparation, Description, P.I.D. Screening

A total of 104 split spoon soil samples were recovered, placed in sample containers and screened for total volatile organic concentrations using a Photo Ionization Detector (P.I.D.), (HNU, Model PI-101). Of the entire 104 samples, 16 were delivered to the laboratory for analysis.

All split spoon samples recovered during the installation of the five monitoring wells and completion of the two exploratory borings were prepared as if all were to be sent to the laborabory for CLP analysis. This included the use of disposable surgical gloves, decontaminated stainless steel spatula/spoons and the use of three different types of sample containers, 40 ml vials, 350 ml amber jar, and 350 ml wide mouth jar (all with teflon cap seals).

After all split spoon soil samples were recovered during the course of each day, the number of soil samples selected for laboratory analysis was determined by the following criteria:

- Approved workplan, Sec. 4.1, 4.2, 4.3
- Recorded HNU reading (highest reading was selected)
- Depth and location (most samples collected at the groundwater interface were selected)
- Physical appearance of sample which may indicate contamination such as discoloration
- Agreement of NYSDEC representative and Hydrogeologist from **RDG**

3.5 Monitoring Well Development

Development of the five monitoring wells was completed within two days using a Hydrolift Pump, an inertial pumping system manufactured by WaTerra Pumps, Ltd. All groundwater pumped during the development process was drummed in accordance with NYSDEC requirements, a total of 825 gallons. The turbidity of the monitoring wells ranged from 46 to 17 NTU.

3.6 Groundwater Sample Collection

Groundwater samples were collected from the five monitoring wells on May 30, 1989. Samples were collected using dedicated teflon bailers. The monitoring wells were purged using the dedicated teflon bailers; a minimum of 5 volumes of standing water was removed before sampling.

Before purging and sampling of the monitoring wells, the bailers had been decontaminated in the following manner: All hand bailers were washed with alconox laboratory grade detergent, thoroughly rinsed with potable water, given an acetone wash, followed by a hexane wash, and air-dried. After being air-dried, the bailers were given a final rinse of distilled water.

The NYSDEC representative present during the groundwater sampling operation "split" groundwater samples from monitoring wells MW-2 and MW-3. A total of five samples, one duplicate sample and one field blank were collected. Chain of Custody forms were written out for the samples. The samples were hand delivered the same day of collection to NYTest Environmental Inc. for analysis.

3.7 Monitoring Well Survey

A licensed land surveyor, Jerome D'Amaro, P.E., completed a survey of the five monitoring wells and two exploratory borings. The elevations of the monitoring well locking cap and manhole cover were measured to the nearest one-hundredth (0.01) of a foot and based on Suffolk County datum. The locations of all monitoring wells and exploratory borings were plotted on Figure 1.1 in relation to the building housing the AEI facility, 170 Central Avenue (see Plot Plan, Figure 1.1).

3.8 Groundwater Elevation Monitoring

Static water levels were measured at the five monitoring wells on a monthly basis for a total of four months. The measurements were recorded using a sonic well depth indicator to the nearest one hundredth (0.01) foot. Depth to water measurements are given in Table 6.2. Using these measurements, along with the survey data, accurate water table elevations were calculated in relation to mean sea level (MSL) (see Table 6.3).

3.9 Laboratory Analysis of Selected Samples

NYTest Environmental, Inc. performed analysis on 6 groundwater and 16 soil samples according to given EPA methods and within given CLP guideline. Data sheets for soils analysis are given in Appendix F, groundwater in Appendix G. Summary tables are given in Section 6.0. Discussion of the laboratory analysis is presented in Sections 6.4 (soil) and 6.6 (water).

The data package for the soil analysis was available to RDG on July 13, 1989. The data package for the groundwater samples was available on July 27, 1989.

3.10 Development of Sedimentary Cross-Section for the Subject Site

Using the boring logs produced during the boring operations at the subject site, a cross sectional diagram was produced (see Figure 6.1). Total depth of cross section was dependent on depth of borings during the monitoring well installation, approximately 47 feet.

3.11 Development of Groundwater Contour Map

Two groundwater contour maps were produced using the groundwater elevation data (see Figures 6.2 and 6.3). From the contour maps, hydraulic gradients were graphically derived and used to calculate horizontal groundwater flow rates through the AEI property.

3.12 Geotechnical Evaluation of Sediment Sample

A soil sample collected from the screened interval of monitoring well MW-3 was mailed to Geotechniques Associates on 7/19/89 to accurately determine hydrologic parameters such as porosity and permeability of the sample.

3.13 Survey of Adjacent Properties/Local Water Quality

To determine the potential of off-site contribution to groundwater, and soil contamination at the subject site, site inspections of surrounding properties and research into various regulatory agencies' files was completed.

4.0 SITE HISTORY

Astro Electroplating, Inc. is a small privately owned plating facility employing approximately forty people as a normal work force. The plating facility operates from a leased multi-tenant building, presently owned by Finch Realty Corporation, at 170 Central Avenue, Farmingdale, Town of Babylon. AEI has occupied 9,700 square feet, within the northern most section of the one-story brick industrial building, for approximately twenty years. AEI incorporated in 1968. The facility has always been a tenant of 170 Central Avenue with Finch Realty as the owner. According to historical records, prior to the industrial building's construction, the property was used for agricultural purposes.

AEI specializes in plating nickel, chromium and copper to premolded plastic components. The manufacturing process generates a waste water volume of approximately 10,000 gallons per day which was discharged to a permitted industrial leaching pool until 1986.

Four (4) leaching pools were unearthed beneath the parking lot area located on the northeast side of 170 Central Avenue during the month of June, 1986. Liquid and sludge samples recovered from the unearthed leaching pools (October, 1966) were acidic and indicated the presence of several heavy metals. After the discovery of the leaching pools, AEI stopped all discharges to the one permitted SPDES pool, (See Figure 1.1 - Plot Plan for location of SPDES pool and the four pools). By the month of October, 1986 the removal of contaminated liquid sludge and soils from the leaching pools was completed by a licensed waste hauler, Chemical Management, Inc. under supervision by personnel from the SCDHS. According to SCDHS records, leaching pools numbers 1 and 2 had the pre-cast leaching rings completely removed, leaching pools numbers 3 and 4 were powerwashed and the precast leaching rings left in place. All leaching pools were backfilled with clean fill after removal of contaminated material was completed, to the satisfaction of SCDHS personnel, and at a later date paved over.

By August, 1987, AEI was treating its wastewater using a Met-Pro, Inc. Physical/Chemical Treatment System and discharging the treated wastes to the Southwest Sewer District. The treatment system is presently able to properly treat up to 35 gallons per minute (gpm), actual wastewater generation is typically less than 20 gpm.

The treatment system removes suspended particulates and heavy metals from wastewater solutions to meet effluent discharge standards specified by the Suffolk County Department of Public Works (SCDPW). The removed contaminants are concentrated into a hydroxide sludge by a filter press and sludge dryer. The sludge is periodically removed from the facility by a licensed waste hauler and shipped to a licensed TSD facility.

The plating process at AEI consists of thirty-four (34) separate tanks. The operational process involved in the production of a finished product is as follows:

> The molded plastic products are taken from the warehouse (storage) portion of the building and attached to a dip bar with racks with contain approximately 100 plastic pieces. The dip bar is attached to an overhead conveyor which is electrically controlled with a manual override. The average production is five cycles per hour, or six hundred (600) pieces per day. Currently, AEI plates 10,000 square feet per day. The pieces then move through the thirty-four tanks, all equipped with drip shields, of which all but one are used in the process. The capacity of the tanks varies from 600 gallons (31 tanks) to 1,200 gallons (3 tanks). Chemicals stored in the tanks include chromic acid, sodium hydroxide, palladium chloride, hydrochloric acid, nickel, copper sulfate, sodium bicarbonate, and nickel sulfate.

5.0 REGIONAL ASSESSMENT

5.1 Climate

Although greatly modified by the Atlantic Ocean, the climate of Suffolk County is dominated by continental influences because air masses and weather systems affecting Long Island have their origin principally over the land area of North America, but are mediated by the effect of topography, elevation, and the Atlantic Ocean. The climate can be characterized as moderate. The annual average maximum temperature is 61°F; average minimum is 44°F (see Table 5.1). Precipitation is generally evenly distributed throughout the year. The average annual precipitation is 43.4 inches and the mean annual lake evaporation is 31 inches (Soil Survey of Suffolk County, New York, 1983). Thus, net precipitation is 12.4 inches. The one-year 24-hour rainfall is approximately 2.75 inches.

5.2 Site Geology

Limiting the study area to a 3-mile radius of the AEI site, the area may be subdivided into a small northern region of irregular hills, the Ronkonkoma moraine, and a large southern region of a broad gently sloping outwash plain which slopes southward at about 20 feet per minute. These topographic features are primarily glacial depositional in origin and are only slightly modified by stream erosion. The AEI site would be considered within the outwash plain physiographic province.

The AEI site is underlain by unconsolidated Pleistocene and Cretaceous deposits. The unconsolidated deposits are deposited over Precambrian bedrock consisting of gneisses and schists.

Within the study area, depth to bedrock is approximately 1,350 feet below sea level. The bedrock has a low hydraulic conductivity and is considered to be the bottom hydrologic boundary of the groundwater flow system.

5.3 Sedimentary Stratigraphgy

Cretaceous Deposits

The Upper Cretaceous sediments include mostly continental material deposited uncomformably over bedrock, in thickening wedges toward the southeast. These deposits include the Raritan Formation and the undifferentiated Magothy Formation. The Cretaceous deposits were covered by continental and marine sediments during the Pleistocene. The Pleistocene deposits, including the Jameco Gravel, Gardiners Clay, and Upper Glacial Deposits, consists of both deltaic and lagoonal marine sediments of interbedded sand, silt, and clay. The following paragraphs address stratigraphic formation in more detail (See Table 5.3 Suffolk County Stratigraphy and Hydrologic Units).

° **Raritan Formation**

The Lloyd Sand member, the earliest Cretaceous deposit within the study area, lies uncomformably on bedrock and consists mainly of deltaic deposits of fine to coarse sand interbedded with small to large gravel. Interbeds of silt and clay and silty and clayey sand are common throughout the unit. The Lloyd aquifer is overlain and generally overlapped by a clay member of the Raritan Formation.

The Lloyd aquifer has moderate horizontal hydraulic conductivity, estimated to be 40 ft/day (1.4 X 10^{-2} cm/sec). However, individual sandy and gravelly beds within the aquifer may have much higher values. High capacity wells tapping the Lloyd aquifer have generally been pumped at rates less than 1,000 gal/min, but pumpage rates as high as 1,600 gal/min from a single well have been reported (Soren, 1971). Specific capacities (gal/min pumped per foot of drawdown in the well) of wells in the Lloyd aquifer have ranged from 4 to about 40 gal/min/ft (Soren, 1971). Water in the Lloyd aquifer is highly confined between the bedrock and the Raritan clay unit and is approximately 250 feet in thickness within the East Farmingdale area.

The Raritan unit consists mainly of deltaic clay and silty clay beds and some interbedded sand. It is approximately 200 feet in thickness within the study area. The unit is characterized as having a low vertical hydraulic conductivity, (approximately 10^{-2} ft/day or 3 X 10^{-6} cm/sec), thereby acting as a confining layer between the Lloyd sand member and the overlying Magothy Aquifer.

° **Magothy Formation and Matawan Group (Undifferentiated)**

The Magothy Formation and Matawan Group comprise the uppermost remaining deposits of the Creaceous Period in the study area. This unit was severely eroded from Late Cretaceous to the time of deposition of the Jameco Gravel.

The deposits of the Magothy Formation and Matawan Group, like the earlier Crataceous deposits, are of continental origin and are mostly deltaic sand and silty sand with lesser amounts of interbedded clay and silt. The unit commonly has a coarse sand and in many places a gravel basal zone 25 to 50 feet thick. The Magothy Formation is the thickest stratagraphic unit below the AEI facility in East Farmingdale with an approximate thickness of 600 feet.

The Magothy Aquifer has been estimated to have an average horizontal conductivity of 50 ft/d (1.7 X 10^{-2} cm/sec), but as in the Lloyd aquifer, individual sandy and gravelly beds may have values four to five times higher.

° **Pleistocene Deposits**

The Cretaceous deposits were covered by continental and marine sediments during the Pleistocene. The Pleistocene deposits, including the Jameco Gravel, Gardiners Clay and Upper Pleistocene Deposits, consist of both deltaic and lagoonal marine sediments of interbedded sand, silt, and clay (see Table 5.3 - Suffolk County Stratigraphy and Hydrologic Units).

° **Jameco Gravel**

The Jameco Gravel is the earliest Pleistocene deposit in the study area. It is considered a channel filling deposit (Buxton 1981 : Soren, 1978). The Jameco Gravel is <u>not</u> present within the East Farmingdale area.

° **Gardiners Clay**

The Gardiners Clay is a marine deposit along the south shore of Long Island, in southern Nassau County and southwestern Suffolk County. Based on several U.S.G.S. investigations and hydrologic mapping programs which attempted to map the areal extent and stratagraphic thickness of the Gardiners Clay, it can be inferred that the Gardiners Clay does <u>not</u> underlie the AEI site. According to Figure 5.2 taken from the U.S.G.S. Water Resources Investigations Report 82-4056, the Gardiners Clay "pinches out" or becomes discontinuous within the general area of Republic Airfield, approximately two miles south of the subject site. Similar to the Raritan Clay member, the Gardiners Clay is characterized by a low vertical hydraulic conductivity, on the order of 10^{-3} ft/d (3.5×10^{-7} cm/sec). Therefore, where it is present, it restricts vertical flow between the upper Glacial and the deeper aquifers. Where the confining unit is absent, such as in the East Farmingdale area, groundwater flow between aquifers is unrestricted.

° **Upper Pleistocene Deposits**

The Upper Pleistocene deposits are Wisconsinian in age and of glacial origin. The deposits unconformably overlie all underlying units are are found throughout Long Island's surface. Upper Pleistocene deposits are approximately 100-125 feet in thickness below the AEI site.

The terminal moraine is an unsorted and unstratified mixture of clay, sand, gravel, and boulders that were accumulated at the front of the continental glacier. The ground moraine is similar in character to the terminal-moraine deposits, but was formed at the base of the ice sheet by ablation. Meltwater from the ice front flowed southward and carried sand and gravel in broad coalescing sheets to form an outwash plain that extends from the terminal moraine south to the coast forming the south shore of Long Island. The Upper Pleistocene deposits within the AEI site are primarily outwash plain deposits.

° **20 Foot Clay"**

The "20 Foot Clay" is a marine deposit within the upper Pleistocene deposits near the south shore of Long Island. The 20 Foot Clay layer is <u>not</u> located within the site area and is generally limited to the barrier island area within Suffolk County (U.S.G.S. Hydrologic Atlas 501).

5.4 Upper Glacial Aquifer/Hydrologic Properties

The Upper Glacial Aquifer includes all of the saturated glacial drift. Sand beds and sand-and-gravel beds in the outwash plain south of the terminal moraine are moderately to highly porous, with porosities of 30 to 40 percent, (Veatch, et al 1906) and are highly permeable, capable of yielding large quantities of water to wells. Horizontal hydraulic conductivity of glacial outwash has been estimated to be 270 ft/d (9.5 X 10^{-2} cm/sec).

Public-water supply and other high capacity wells tapping outwash deposits have commonly yielded as much as 1,500 gal/min, with specific capacities ranging from 50 to 60 gal/min/ft (Soren, 1971). Terminal and ground-moraine deposits generally have much lower conductivity than outwash deposits because they include clay and silt and are not well sorted. Coarse sand and gravel lenses within the moraine deposits may yield significant amounts of water, but locations of such lenses are scattered and unpredictable. The hydraulic gradient of the Upper Glacial Aquifer is defined as the slope of the water table. Values of 0.0021 to 0.0016 ft/ft are typical for South Shore locations, outwash deposits (Kimm and Braids, U.S.G.S. Professional Paper 1085). The Upper Glacial Aquifer is of primary interest during the soils and groundwater investigation since it is in direct contact with past waste water discharges by AEI.

5.5 Hydraulic Interconnection of Aquifers

The aquifers of Long Island are hydraulically interconnected. Layers of clay and silt within an aquifer or clayey and silty units between aquifers, confine the ground water; but these units do not completely prevent the vertical movement of water through them.

On the average, the vertical hydraulic conductivity and rates of vertical flow through the Upper Glacial Aquifer are greater than those of all other hydrogeologic units in Suffolk County. The vertical movement of water through the Magothy Aquifer is impeded by intercalated lenses and beds of clay and silt; but, locally, vertical movement through the aquifer is facilitated by the lateral discontinuity of clay and silt beds. Vertical movements of water through clay and silt beds of the Magothy Aquifer is very slow. The Raritan clay effectively confines water in the underlying Lloyd aquifer because the Raritan clay is thick and is of very low hydraulic conductivity. Movement through the bedrock is negligible (Jensen and Soren, 1974).

(Getzen, 1977) estimated that the ratio of vertical hydraulic conductivity to horizontal conductivity in the Upper Glacial Aquifer ranges from 1:10 to 1:24 and that in the Magothy Aquifer, the ratio ranges from 1:30 to 1:60.

The contact between the upper glacial and the Magothy Aquifers is not a smooth plane. Glacial deposits filled buried valleys that were cut in the Magothy Aquifer, and these deposits are in lateral contact with truncated beds in the Magothy Aquifer. In the buried valleys, water enters the Magothy Aquifer at depths of hundreds of feet directly from the Upper Glacial Aquifer.

Near Huntington, approximately three miles north of the AEI site, a buried valley cuts completely through the Magothy Aquifer and extends into the Raritan clay. In the Ronkonkoma basin, the Magothy Aquifer seems to be nearly completely cut through; and along the north shore, where locally all the pre-Pleistocene deposits were completely eroded, the glacial Aquifer is in contact with the full thickness of the Magothy Aquifer (Jenson and Soren, 1974).

Where the Upper Glacial Aquifer lies directly on sandy beds on the Magothy Aquifer, good vertical hydraulic continuity exists between the two aquifers. Head losses between the water table in the Upper Glacial Aquifer and the base of the Magothy Aquifer in the area of the main groundwater divide in western Suffolk County (a vertical distance of as much as 900 feet) in 1968 generally were less than 2 feet. Furthermore, in areas of Long Island where groundwater withdrawals from both the upper glacial and the Magothy Aquifers are large, the cones of depression in their water-level surfaces caused by pumping are similar in areal extent and configuration. These observations confirm the high degree of hydraulic continuity between the two aquifers in many parts of the country (Jensen and Soren).

In the south shore area, the Gardiners Clay and the Monmouth greensand effectively confine water in the Magothy Aquifer; and the high degree of confinement helps to prevent the downward movement of salty groundwater into the Magothy Aquifer. Wells that tap the Magothy Aquifer on the barrier bars yield fresh water and commonly flow at land surface.

Recharge of underlying aquifers primarily takes place at the center of Long Island, an area commonly referred to as the deep recharge zone consistent with the regional groundwater divide, through vertical movement of groundwater through the Upper Glacial Aquifer. Recharge to the Lloyd aquifer results from downward movement of water from the Magothy Aquifer and from the Upper Glacial Aquifer through the Raritan clay.

Suffolk County Sanitary Code, Article 7, has divided Suffolk County up into Management Zones in an effort to protect the recharge zone areas mentioned previously. According to these regulations, the Melville-East Farmingdale area is within Zone II and is considered an area of deep recharge to underlying aquifers.

The main recharge area of the Lloyd aquifer seems to be in the Ronkonkoma area. Head losses across a thickness of 150 to 180 feet of Raritan clay in the county generally ranged from 6 to 42 feet in 1968 (Jenson and Soren, 1974).

5.6 Groundwater Flow

Generally, groundwater within Long Island aquifers flows in a Southerly direction south of the regional groundwater divide, and in a northerly direction north of the divide (see Figure 5.3). As explained in Section 5.5, horizontal movement of groundwater is from 10 to 60 times greater than the vertical movement of groundwater for the Upper Glacial and Magothy Aquifers. Table 5.4 gives estimated hydraulic conductivities for Long Island aquifers, vertical and horizontal. Groundwater is recharged by natural means through precipitation which infiltrates through

Holocene and Pleistocene sediments eventually being intercepted by the Upper Glacial Aquifer. Groundwater within the Upper Glacial Aquifer primarily flows horizontally through the aquifer eventually discharging into surface streams and/or one of several salt water bodies surrounding Long Island. Recharge of underlying aquifers primarily occurs within the deep recharge zones of Long Island as discussed in Section 5.5 along the regional groundwater divide through vertical movement of groundwater from the Upper Glacial Aquifer (see Figure 5.4).

Horizontal component of groundwater flow through the southwest region of Suffolk County is primarily in a south, southeast direction. The SCDHS has conducted an extensive groundwater flow investigation throughout Suffolk County during the years 1987 and 1988 and has developed detailed water table and potentiometric contour maps for the Upper Glacial and Magothy Aquifers. Figure 5.5 is taken directly from the SCDHS Water Table Contour Map, March 1988. The contour map clearly identifies a south to southeast groundwater flow through the Melville-East Farmingdale area. Other groundwater studies conducted by **RDG**, Geraghty and Miller, Inc., and others within the region have observed similar flow patterns within the Upper Glacial Aquifer.

5.7 Groundwater Wells/Groundwater Quality

Several public supply monitoring wells and observation wells are located in the Farmingdale area. The SCDHS, NYSDEC at Stony Brook, and the U.S.G.S. were contacted to obtain groundwater quality data pertaining to the area (see Figure 5.6).

Three upgradient wells OW66132, OW42680, and OW43811 were identified. Observation wells 66132 and 42680 screened in the

Magothy and Upper Glacial regions are approximately 3/4 miles north of the site. OW43811 screened in the Upper Glacial region is approximately 1/4 mile directly east of the site. Four down-gradient monitoring and public supply wells were identified within the immediate vicinity. Observation well 1806, screened in the Upper Glacial region, is approximately 1 mile south of the site, public supply wells 75033 and 75034, screened in the Upper Glacial region, are approximately 1 mile southwest of the site. Public supply well 39709, screened in the Magothy, is approximately 1 mile southwwest of the site.

Unfortunately although an extensive effort was made a significant amount of data could not be obtained from either the SCDHS, NYSDEC, or the U.S.G.S.

Upgradient Wells

Observation wells 66132 and 42680 were buried in 1982 by road construction. Sampling by the SCDHS on 8/5/82 of 66132 indicated that a concentration less than .10 mg/l of copper was detected. The sample was not tested for chromium. Less than .1 mg/l of iron, less than .08 mg/l of manganese, and less than .4 mg/l of zinc were found. Indicator parameters such as sodium were less than 7.3 mg/l. Chloride was 15 mg/l, and sulfates were 6.9 mg/l. Three volatile organic compounds were tested: 1.2-dichloropropane was 2 ppb; 1,1,2-trichloroethylene levels were less than 5 ppb; tetrachloroethylene levels were less than 2 ppb. No organic or inorganic data was available for 42680.

Analysis of OW43811 was conducted in 4/2/86, 9/11/86, and 6/3/87. Volatile organic levels were all less than 5 ppb. Only a limited amount of indicator parameters and inorganic elements were tested. Indicator parameters such as chloride ranged from 26 to 30 mg/l; sulfate ranged from 94-110 mg/l; nitrate ranged from 21-24 mg/l; metallic elements such as iron ranged from .1-.2 mg/l; magnesium from 15-16 mg/l; manganese from .06-.14 mg/l; ions such as calcium ranged from 48-52 mg/l; sodium from 15-16 mg/l; and potassium from 2.6-3.5 mg/l.

Downgradient Wells

Public Supply Well 39709 was tested on 1/17/86, 4/14/86, and on 4/15/87 by the SCDHS. Indicator parameters such as chloride, ranged from 4-5 mg/l; sulfate from less than 4 to less than 5 mg/l. Nitrates and nitrites were consistently less than .2 mg/l. Iron ranged from .06 to .10 g/l; manganese less than .02 to less than .05 mg/l; copper less than .02 to less than .10 mg/l. Levels of chromium ranged from less than .02 to less than .10 mg/l. Silver and lead were consistently less than 10 mg/l. Cadmium and selenium were consistently less than 2 mg/l. Less than 20 mg/l of arsenic was detected.

A water quality analysis of samples was completed from both 75033 and 75034 on 11/13/83, 8/22/84, 1/14/85, and 9/10/86. Values reported for various volatile organic compounds were consistently less than 5 ug/l at 75034. Values reported for VOC's within well 75033 were less than 5 ug/l except for 5 ug/l of 1,1,1-trichloroethane and 14.0 ug/l for trichloroethylene. Indicator parameters for ions such as chloride ranged from 4 ug/l to 17 ug/l for 75033. Chloride concentration at 75034 increased from 4.7 to 12 ug/l from 1983 to 1985. Sulfate concentrations ranged from 2.9 to 5 ug/l at 75034 and ranged from 20 to 31 ug/l at 75033. Iron concentrations decreased from

200 to 50 mg/l from 1983 to 1985 at 75033, and increased from 1100 to 1300 from 1983 to 1984 at 75034. Manganese concentrations ranged from 430 to 610 ug/l at 75033 and from 80 to 130 ug/l at 75044. Copper was reported at 100 ug/l in 1984 at 75033 and 75034. No completion report was available for Well 1806; the most recent analysis of this well was completed in March, 1978.

5.8 Industrial Survey of Local Industries

Several known local industrial sites, as of the April, 1989, NYSDEC Phase II Inactive Hazardous Waste Sites listing, also exist in the East Farmingdale area. Several of the companies listed above are also included in this category such as: Tronic Plating of Farmingdale, McGovern Sod Farm of Melville, Target Rock Corp. of Farmingdale, IW Industries of Melville, and Cantor Brothers, Inc. of Farmingdale.

There is direct correlation between specific upgradient discharges of inorganic contaminants, the direction of groundwater flow through the East Farmingdale area, and the identified contamination within the AEI site. Therefore, there may be some degree of contribution to groundwater contamination within the AEI site by inorganics from off-site sources.

The area surrounding 170 Central Avenue has been industrialized for the past 15-20 years with small to medium sized manufacturing facilities. Previously, the East Farmingdale area was utilized extensively by the aircraft industry but presently consists of a diversified assortment of small industrial facilities.

An industrial survey of the extent and type of discharge violations which occurred upgradient of the AEI site was compiled with information from the NYSDEC and SCDHS SPDES violation and inspection records. A summary of our findings continues below:

Several industrial facilities in the East Farmingdale area have been cited by the SCDHS Industrial Survey permitted and unpermitted effluent discharges which exceeded groundwater effluent standards of the NYSDEC ECL and/or the Suffolk County Sanitary Code. Industrial concerns have or are suspected of having discharged excessive amounts of solvents and/or organic compounds are Cantor Brothers, Inc. of Farmingdale; Sedco, a Raytheon Company in Farmingdale; IW Industries in Melville; and Venus Scientific of East Farmingdale. Facilities which were cited as having discharged inorganic wastes include Tronic Plating of Farmingdale located in the industrial building directly west of 170 Central Avenue, as well as AEI.

According to SCDHS records, Tronic Plating, located at 168 Central Avenue, discharged plating wastes to site SPDES pools in excess of SPDES discharge limits on several occasions. SCDHS sampling, completed on 11/28/73, identified concentrations of copper and chromium in excess of SPEDES effluent discharge limits at levels of 3.8 and 7 mg/l, respectively. On 3/17/82, 19.0 mg/l of copper were discharged in violation of their SPDES permit according to monitoring reports. The most recent monitoring of waste waters sampled by SCDHS personnel on 8/31/83, indicated 9.0 mg/l of copper.

IW Industries, Inc. located at 35 Melville Park Road, was cited on 5/9/83 for unpermitted discharges from an ultrafiltration system of 10 mg/l of zinc and 16.4 mg/l of lead. After obtaining a SPDES permit, a permitted waste stream discharge on 7/10/84 was cited as containing 2.4 mg/l of copper and 29.0 mg/l of lead which prompted a Notice of Violation from the SCDHS.

Located within 176 Central Avenue, the industrial building directly north of 170 Central Avenue, are small printed circuit board manufacturers, such as Diversified Manufacturing, Inc. Diversified Manufacturing, Inc. was cited for discharging plating wastes to the local sanitary sewer in 1985. Copper is the primary contaminant within printed circuit board plating works.

6.0 SITE ASSESSMENT

6.1 Site Soils

A soil survey of Suffolk County published by the United States Department of Agriculture indicates that the soil type at AEI can be considered urban land, bordered by The Haven Series. Urban land consists of areas that are covered by parking lots and buildings, such as the lightly developed industrial area in which the subject site is located.

The Nassau County Soil Survey provides a comprehensive definition of urban soil which is also found in Suffolk County:

-Surface layer (surface to 11 inches), black silt loam

-Subsurface layer (11-15 inches), dark brown silt loam

-Sub Soil (15-29 inches), yellow brown silt loam

(29-33 inches), strong brown, very gravelly, loamy sand

-Substratum (33-60 inches), very pale brown standard gravel

The area is bordered by the Haven loam, which may be considered the original soil type. This can be found to the south in Pinelawn Cemetary and to the east at Long Island National Cemetary. The Haven Series consists of deep, well-drained, medium textured soils that formed in a loamy or silty mantle over stratified coarse sand and gravel. This soil is generally found on outwash plains between the two terminal moraines (Harbor Hill and Ronkonkoma), and is utilized extensively for agricultural purposes in Suffolk County.

Various concentrations of elements such as cadmium, chromium, copper, lead, manganese, and zinc are reported naturally occurring in Long Island soils by the U.S.G.S. Water Resources Investigation 85-4088 (Effect of Urban Storm-Water Runoff on Ground Water Recharge Basins on Long Island, NY). This report indicates that Long Island soils typically contain iron, aluminum, manganese, and zinc, and that their pH ranges from 4.5 to 6.8.

6.2 Site Topography

The South Farmingdale area has a subdued topography, typical of the glacial outwash plain region of Long Island. In general, the area slopes gently to the south with few natural relief features. The Babylon Landfill, located approximately two miles southeast of the subject site, is the most prominent topographic feature within the general area.

The industrial park at 170 Central Avenue which houses the AEI facility is almost entirely covered by manmade structures and construction materials such as asphalt and concrete. The slope of the site is less than 2%. Evidence of the shallow slope and low relief can be seen during frequent flooding of the parking lot surrounding the building at 170 Central Avenue.

6.3 Site Stratigraphy

The geological cross section represented in Figure 6.1 was constructed from field descriptions of more than 100 samples taken over the course of the Phase II investigation at AEI. The site is located south of the Ronkonkoma recessional moraine within glacial outwash deposits.

The majority of samples recovered are very characteristic of outwash plain deposits. Most of the soil types encountered were medium to coarse grained sand, brown to tan in color, and were slightly to well-sorted with respect to grain size distribution. Many samples contained varying amounts of gravel. An increase in grain size with a decrease in sorting occurred at and below the water table. Small scale alternations from fine to coarse sands were also noted in the boring logs.

A light gray clay and silt layer approximately 6 inches thick was identified during the installation of monitoring well MW-5 at an approximate depth of 10½ feet. The aerial extent of this shallow clay lense is unknown. The clay-rich material has a low hydraulic conductivity indicated by the high moisture content of the sediment. This was the only naturally occurring clay layer encountered during the field investigation.

Fill material consisting of fine grained silt-rich brown sand containing gravel and an assortment of man-made debris was recovered at shallow to moderate depths at B-1, B-2, MW-2, and MW-3, the former area of wastewater discharge. Fill material was recovered at a maximum depth of 17 feet within exploratory boring B-1, placed through leaching pool #1. Several soil samples recovered from the installation of MW-3 and the completion of B-2 contained a gray-green sludge material.

A soil sample from MW-3, collected at a depth of 43-45 feet, within the screened interval, was sent to Geo-Tech Associates for geotechnical analysis. This soil sample is representative of the medium to coarse grained soils encountered throughout the saturated zone during the field investigation at the AEI site. All monitoring wells are screened within this material. The field description of soil sample MW-3, 43-45 feet, is as follows:

Coarse grained quartz sands, loose, moist, little gravel, fairly sorted (grain size distribution). Blow Counts, every 6 inches : 5-7-8-8.

The geotechnical information was made available to **RDG** on September 5, 1989. The hydraulic conductivity and sediment porosity were determined using a constant head permeameter after the sediment had been prepared according to prevailing field conditions. Grain size distribution of the sample was also taken into consideration.

The following information was obtained:

- Porosity : 38%
- Permeability at 20°C : 2.9 X 10-2 cm/sec or 82.2 feet/day

A porosity of 38% is typical for medium to coarse grained sands with gravel. The laboratory result for permeability or hydraulic conductivity of 82.2 feet/day is significantly less than the estimated horizontal hydraulic conductivity of 270 feet/day given by McClymonds and Franke (1970).

The difference in the laboratory calculated value and the above estimated horizontal hydraulic conductivity is the result of very different methods used to calculate this hydraulic parameter. The McClymonds and Franke 1970 report calculated hydraulic conductivities using pump test data primarily from large high capacity wells with partial penetrating and fully penetrating well screens using the Theis nonequilibrium formula. This method of calculation has significant limitations which the authors make light of in their report. It is common to have highly variable hydraulic conductivity and transmissivity values using pump test data from wells screened in the same aquifer and aquifer material.

In many cases, particularly with clean medium to coarse sands and gravels, laboratory calculated hydraulic parameters will accurately represent the true characteristics of aquifer materials. This generality does not hold true for fine grained aquifer sediments since the effective porosity (Nef) typically decreases with decrease in grain size.

6.4 Soil Quality

In order to determine the extent and concentration of contaminants, two exploratory borings and five monitoring wells were completed from which a total of 16 soil samples were selected for analysis.

Soil sampling was concentrated at three locations within the AEI site, upgradient from the point of known wastewater discharge, within the immediate area of discharge, and downgradient from the point of discharge.

A brief description of each location and corresponding site plan identification is as follows:

Upgradient Location: Monitoring Well Number 1, located on the north side of AEI facility. The two soil samples selected for laboratory analysis from this location can be considered background soil quality and would be representative of uncontaminated soil within the study area.

Discharge Location: Two exploratory borings, B-1 and B-2, and two monitoring well locations, MW-2 and MW-3, were installed/completed through and/or directly adjacent to the four leaching pools and SPDES discharge pool on the east side of the AEI facility (see Plot Plan, Figure 1.1). Exploratory boring B-2 directly intercepts leaching pool number 3. Monitoring well MW-2 was placed between exploratory borings B-1 and B-2, approximately seven feet to the east of the alignment of B-1 and B-2. Exploratory boring B-1 is approximately 42 feet south of exploratory boring B-2 and directly intercepts leaching pool number 1. Montoring well MW-3 is approximately five feet south of the inactive SPDES discharge pool. Three samples were selected for laboratory analysis from each boring while two samples were selected from each monitoring well.

Downgradient Location: MW-5 is located approximately 300 feet south-southwest of the point of immediate discharge (B-2) and is situated on the front lawn of 170 Central Avenue. Monitoring well MW-4 is approximately 215 feet south of the point of discharge (B-2) and is situated in the parking lot/driveway of 170 Central Avenue. Both of these monitoring wells are located downgradient of all leaching pools and the SPDES discharge pool.

All soil samples selected for laboratory analysis were analyzed for the following parameters:

- TCL metals & Cyanide
- Hexavalent Chromium
- TCL Volatile Organics
- Phenol

A field blank was collected from a decontaminated, steam cleaned, split spoon sampler and analyzed for TCL metals and cyanide, hexavalent chromium, and TCL volatile organics. A trip blank was continuously transported with soil samples in a cooler and was analyzed for TCL volatile organics. A tap water sample was collected from the steam generator used to decontaminate all "down-hole" drilling equipment. The steam generator was connected to a potable water source inside the AEI building. The tap water sample was analyzed for TCL metals and Cyanide, Hexavalent Chromium, and TCL volatile organics.

Results of the laboratory analysis of the sixteen (16) selected soil samples are summarized in Table 6.1. Volatile organics were not detected within any collected soil samples with the exception of acetone and methylene chloride and therefore no summary table is given. The laboratory analysis indicates that soil contamination is limited to the subsurface soil in close proximity to the the plating waste discharge area. Upgradient sampling points are free of any elevated levels of identified soil contaminants. The downgradient locations of MW-4 and MW-5 exhibit little, if any, elevated levels of contaminants. Analysis of samples from the immediate area near the wastewater discharge locations indicated concentrations of total chromium (2,070-17 ppm), copper (195-36.8 ppm) and zinc (687-6.5 ppm) as well as detectible concentrations of hexavalent chromium (19.5-.75 ppm), and nickel (60.9-3.6 ppm) existed. Tap water samples and the Field Blank contained trace amounts of copper and zinc, which may have been introduced by the plumbing at the facility.

Soil samples recovered from the installation of monitoring well MW-1 exhibited characteristics typical of outwash plain deposits found in the East Farmingdale area. The boring log indicates sequences of fine to coarse grained, brown to tan sand, variably sorted with some gravel. No discolorations were noted. Total chromium was less than 10 ppm; hexavalent chromium and cyanide were less than 1 ppm. Nickel ranged from 2.4 to 2.6 ppm, copper was less than 5 ppm. Zinc was slightly elevated at 16.3 ppm (20-22') and 11.1 ppm (35-37') which is typical of Long Island soils. TCL volatile organics were all below detection limits within all soil samples selected for laboratory analysis although trace amounts of acetone and methylene chloride were detected in selected samples, including the field and trip blanks.

Levels of total chromium and copper were detected within samples at depths less than 20 feet. The shallow subsurface soils recovered at the exploratory borings and monitoring wells within this area were characteristic of fill materials and varied in color, grain size, and type. Below a depth of 15 feet, soil is similar to outwash plain deposits described at monitoring well MW-1.

The indicated concentration of total chromium and copper were identified within a recovered sample from monitoring well MW-3 at a depth of 10-12 feet. This sample, described as brown silt-clay with gray-green sludge, contained 2,070 ppm of total chromium and 191 ppm of copper. The second highest indicated concentrations were encountered at exploratory boring B-2 at a depth of 13-15 feet, which also contained materials described as a layer of gray-green sludge and contained concentrations of 435 ppm of total chromium and 195 ppm of copper. A correlation between soil discoloration and chromium and copper concentrations was present within several other soil samples, all of which were recovered at depths less than 20 feet.

The indicated concentrations of zinc within soil samples collected from the area of the four leaching pools do not have a direct correlation with sample depth or discoloration. Zinc concentrations greater than 200 ppm were identified within soil samples collected within the area of the local water table, approximately 40 feet below grade. The referenced soil samples were not discolored and were characteristic of other samples collected at the water table. Nickel concentrations within discharge area tended not to follow any apparent pattern. Highest nickel concentration was identified at 66.4 ppm within soil sample exploratory boring B-2 at 37-39 feet.

Though potential soil contamination was limited to shallow subsurface soils, concentrations of total chromium and copper were indicated present within soil samples recovered from the water table within the area of past wastewater discharge.

There is no consistent relationship between observed elevated concentrations of total chromium and observed concentrations of hexavalent chromium in soil samples collected from the area of wastewater discharge. Highest identified concentrations of 14.5 and 8.5 ppm hexavalent chromium were detected in soil samples from B-2 at 13-15 feet and 15-17 feet and are assoicated with 435 and 171 ppm total chromium concentrations. However, soil sampled at MW-3, 7-11 feet, which contained indicated concentrations of total chromium at 2,070 ppm, contained only

0.75 ppm hexavalent chromium. The proportion of hexavalent chromium to total chromium in soil samples recovered from exploratory borings and monitoring wells appears to be lower than the corresponding proportion observed in groundwater samples. This may be due to a greater incidence of hexavalent chromium reduction in a soil matrix than a groundwater matrix. Additionally, as noted by James Dragun in The Fate of Hazardous Materials in Soil (1989), the contained concentration of trivalent and therefore total chromium is controlled by the presence of chromic oxides or hydroxides created by the interaction of groundwater and metallic components in soil, these being stable and of very low solubility. The interaction may produce an increase in trivalent chromium concentration. The observed increase may be further enhanced by adsorption of trivalent chromium (Dragun) which becomes immobilized unlike hexavalent chromium. Therefore, hexavalent chromium has a greater potential to be transported by groundwater. However, a study conducted by the U.S.G.S on a similar plating waste plume noted the interaction of iron (of which analysis indicated concentrations within all AEI soil samples) and heavy metals such as chromium; a dynamic equilibrium, between the sorption of heavy metals by iron oxide coating and co-precipitation of heavy metals with iron hydroxides from the plating waste plume, was observed.

The soil samples collected from MW-1 were typical of glacial outwash plain deposits with no unnatural discolorization. The soil samples selected for laboratory analysis from monitoring well MW-1 concentrations of chromium, copper and zinc. The upgradient soil samples can be considered typical of ambient or natural background soil quality.

Soil samples collected from downgradient monitoring wells MW-4 and MW-5 exhibited soil quality typical of ambient quality identified within upgradient samples with few exceptions. Copper and zinc was identified within soil sample MW-4, 45-47 feet, having an indicated concentration of 36.8 ppm and 72.3 ppm respectively.

6.5 Site Hydrology

Located south of the regional groundwater divide of Long Island, groundwater flows in a southerly direction within the underlying aquifers of the AEI site. Pleistocene deposits, consisting of the Upper Glacial Aquifer, are 100 to 125 feet in thickness below the subject site (see Figure 5.1). Depth to groundwater is approximately 38 feet below grade, making the saturated thickness of the Upper Glacial Aquifer at the subject site 62 to 87 feet. The actual contact between Pleistocene and Upper Cretaceous deposits, comprising sediments of the Magothy Aquifer, is poorly defined within southwestern Suffolk County (T.P. Dorski, F. Wilde-Katz, 1982).

Occasionally, a thin sedimentary layer containing organic matter such as deposits of peat associated with pyrite lignite crystals would be encountered at the erosional surface or unconformity separating the two stratigraphic units. Additionally, the mineral assemblages of the Upper Glacial deposits and Upper Cretaceous deposits are not exactly the same with the Upper Cretaceous deposits having a greater percentage of mafic, magnesium and ferric rich minerals.

As discussed in Section 5.1.4, all confining units separating the Upper Glacial and Magothy Aquifers, primarily the Gardiners

Clay and the "20 Foot Clay", "pinch-out" or are discontinuous within Southwestern Suffolk County. The two aquifers are in direct contact, but hydraulic communication between the aquifers is limited due to anistropic character, or horizontal stratification of both Pleistocene and Cretaceous sediments. This stratification is the condition of greater horizontal movement of groundwater than vertical in both aquifers and explains the small difference in pressure head from one aquifer to the next.

The subject site is within Groundwater Management Zone II (Sanitary Code Article 7, Water Pollution Control) which is identified as a deep recharge area of Suffolk County, contributing recharge water to a deep groundwater flow system. Therefore, in spite of the anisotropic nature of the aquifers, recharge to underlying aquifers such as the Magothy and Lloyd Aquifers occurs within the East Farmingdale area of Suffolk County.

Well Measurements

Depth to groundwater measurements were recorded on a monthly basis within the five monitoring wells located on the property at 170 Central Avenue. Well measurements were recorded to the nearest one-hundredth of a foot using a Sonic Well Depth Indicator, Model DR-759, manufactured by Soil Test Inc. All measurements are from the top of each well casing/riser pipe at a designated point. Each designated measuring point was surveyed to Suffolk County Datum, and elevations are given in Figure 1.1. Table 6.2 includes all depth-to-water measurements recorded since May, 1989. Above average precipitation in the months of May and June, 1989, can be seen as a decreasing trend in depth-to-water measurements taken from May to July, indicating a rise of the local water table during these months.

Groundwater Flow Through the AEI Site, Glacial Aquifer

Two groundwater contour maps of the Upper Glacial Aquifer were developed for the subject site using water table elevation values calculated from the recorded depth-to-water measurements at the five site monitoring wells, Table 6.2, Figure 6.2, 5/30/89 Groundwater Contour Map, Figure 6.3, 7/28/89, Groundwater Contour Map.

Within an unconfined aquifer, water table contour lines also represent the potentiometric (potential energy head) surface of the represented aquifer. Direction of groundwater flow is perpendicular to the water table contour lines/potentiometric surface contour lines. Using the developed groundwater contour maps, horizontal direction of groundwater flow within the Upper Glacial Aquifer is determined to be in a south to southeast direction through the AEI site. Direction of flow was calculated at 170° from magnetic north using both groundwater contour maps.

A south to south-east direction of groundwater flow is consistent with regional groundwater flows for the Upper Glacial Aquifer within the Melville-East Farmingdale area as represented by Figure 5.5. Additionally, **RDG** has completed several groundwater studies with the general area and have determined similar ground water flow directions.

There is an obvious influence on the static water levels within monitoring wells MW-3 and MW-4 which are both located directly adjacent or within the vicinity of several stormdrains and stormdrain overflows within the AEI parking lot. The localized mounding of the water table is an occurrence which has been documented by several technical investigations and by other groundwater investigations and is commonly associated with storm drains, septic systems, recharge basins and injection wells. A Phase II investigation conducted by Geraghty and Miller, Inc., completed at the Fairchild Republic Co. property, located approximately one mile from the AEI site, has identified several localized water table mounds as the result of a recharge basin and several storm drains. The Geraghty and Miller, Inc. Fairchild Republic Co. Phase II has identified a south-southeast groundwater flow through the property.

The effects of the localized water table mounding is clearly illustrated in Figure 6.2, the groundwater contour map using potentiometric data collected on 5/30/89. Several severe rainstorms occurred the week prior to 5/30/89, including one storm which was unconfirmingly classified as a 70-year storm for Long Island.

Using the groundwater contour maps for the subject site, it is possible to calculate the hydraulic gradient of the Upper Glacial aquifer. Given the hydraulic gradients, hydraulic conductivity and sediment porosity given in Section 6.2 and a modified form of the Darcy equation for groundwater flow velocity, an accurate value for groundwater velocity for the Upper Glacial Aquifer can be calculated through the subject site.

RDG has calculated the groundwater flow velocity within the Upper Glacial Aquifer at 0.32 ft/day for the AEI site. Vertical movement of groundwater within the Upper Glacial Aquifer has been estimated to be at rates of 1/10 to 1/24 of the horizontal component of groundwater flow as discussed in Section 5.5. According to the estimated ratios and the calculated horizontal flow rates, vertical flow rates of groundwater can be as much as 0.032 ft/day or as little as 0.014 ft/day within the Upper Glacial Aquifer.

6.6 Groundwater Quality

Seven groundwater samples were collected from the five installed monitoring wells in order to determine ambient water quality and potential groundwater contamination as a result of past wastewater discharge by AEI, as well as to define potential movement of such contaminants.

Groundwater samples were collected from the five monitoring wells on May 30, 1989. Samples were collected using dedicated teflon bailers. The monitoring wells were purged of a minimum of 5 volumes of standing water.

All hand bailers were washed with alconox laboratory grade detergent, thoroughly rinsed with potable water, given an acetone wash, followed by a hexane wash, and air-dried. After being dried, the bailers were given a final rinse of distilled water.

A total of five samples, one duplicate sample, and one field blank were collected. The NYSDEC representative present during the groundwater sampling operation "split" groundwater samples from monitoring wells MW-2 and MW-3. Chain of Custody forms were written out for the samples. The samples were hand delivered the same day of collection to NYTest Environmental Inc. for analysis.

Laboratory analysis of the site groundwater included:

-TCL Metals
-TCL Volatile Organics
-Hexavalent Chromium
-Cyanide
-Phenols
-Indicator Parameter

The field blank sample was analyzed for all the above parameters except for the indicator parameters. The trip blank was analyzed for volatile organics. Temperature and pH of groundwater was tested in the field immediately after collection of samples.

The data package of organic and inorganic analysis was made available to RDG on July 27, 1989. A summary of groundwater analysis is provided in Table 6.4 - Metals Analysis, Table 6.5 - Volatile Organic Analysis, and Table 6.6 - Indicator Parameters.

Inorganic contamination was identified directly downgradient of the area of immediate wastewater discharge. Various volatile organic compounds were identified within all monitoring wells at low concentrations. According to NYS groundwater quality standards, parameter concentrations such as flouride, nitrate, sulfate, and chloride concentrations indicate that water quality is acceptable, in regard to such standards.

The measured pH values of the collected groundwater samples were inconsistent from one groundwater sample to the next. The temperature of the samples was consistent at 60°F.

Metallic constituents such as chromium and hexavalent chromium were detected in upgradient samples from MW-1 at 7.8 and 8.0 ppb respectively. Concentrations of 27.9 ppb of copper, 20.0 ppb of nickel, and 43.5 ppb of zinc were also detected. Low levels of 1,1,1-trichloroethane and trichlorethene were indicated in upgradient samples.

Concentrations of chromium, hexavalent chromium, copper, nickel, and zinc were characterized as highly variable within groundwater samples collected from the area of immediate discharge, which includes MW-2, MW-3, and its duplicate. Selected concentrations at these wells were as follows: total chromium -427 ppb; hexavalent chromium - 140 ppb; copper - 292 ppb; nickel - 272 ppb; zinc - 99.3 ppb. Trichloroethene was detected in samples from immediate discharged locations (MW-2 and MW-3).

Heavy metal concentrations identified within downgradient water samples, MW-4 and MW-5, were highly divergent. Samples collected from monitoring well MW-4 exhibited high concentrations of the same heavy metal species identified in samples collected from the immediate discharge location (MW-2 and MW-3). Levels of the same heavy metals identified at MW-5 could be categorized as background concentrations. Levels of total chromium, hexavalent chromium and copper increased marginally from MW-1 to MW-5 (upgradient to down gradient sampling points); nickel and zinc did not change significantly. The levels of total chromium, hexavalent chromium, copper, and nickel identified at monitoring well MW-4 were found to exhibit the maximum concentations found in groundwater samples at the AEI site. Levels of zinc were also found. Significant changes in a downgradient direction from MW-1 to MW-4 were indicated. 1,1,1-Trichloroethane and trichloroethene were detected in samples from downgradient locations.

Concentrations of hexavalent chromium and total chromium are highly variable in groundwater as in soil, but there seems to be a greater proportion of hexavalent chromium to total chromium in groundwater than in soil. As described in Section 6.4, Soil Quality, several factors may account for this. Examples of these factors are:

Greater incidence of hexavalent chromium reduction in groundwater, an increased mobility of hexavalent chromium in groundwater, and adsorption of trivalent chromium by iron oxide coatings on soil grains as well as increase in trivalent chromium solubility with plume chemistry interaction.

The field measurements of pH completed on the collected groundwater samples indicated significant differences in pH within the collected samples. Monitoring wells MW-1 and MW-2 indicated pH values typical of natural Long Island groundwater quality. The sample collected from monitoring well MW-3 and the duplicate sample had a pH value of 8.37, considered slightly alkaline. Samples collected from down gradient monitroing wells MW-4 and MW-5 indicated slightly acidic pH values, compared to natural conditions, at 4.20 and 4.97 respectively. The temperature of the collected samples, measured immediately upon recovery of each sample, was consistent at 60°F, typical of Long Island natural conditions.

A comparison of NYSDEC Ambient Water Quality Standards Guidance Values (TOG 1.1.1, April, 1987) and groundwater effluent limits regarding concentration of organic and inorganic contaminants indicates that certain standards have been exceeded (see Table 6.7 for comparison). Concentrations of 1,1,1-trichloroethane exceeded the 50 ppb standards; concentrations of trichloroethene exceeded the 10 ppb standard; concentrations of 1,1-dichloroethene, and 1,2-dichloroethane may have exceeded effluent limits although no standards were given in the 1987 TOGS revision. Standards for total chromium were exceeded at three wells : MW-2, MW-3, and MW-4. Standards for hexavalent chromium and nickel were exceeded at MW-3 and MW-4. The standard for copper was exceeded at MW-4.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The AEI property is underlain by glacial outwash deposits consisting of sands and gravels having a porosity of 38% and a permeability (hydraulic conductivity) of approximately 82.2 ft/day. Depth to groundwater at the subject site is approximately 35 feet. Groundwater flows in a south to southeast direction within an area of the AEI site at 0.32 ft/day, horizontal flow. Direction and velocity of groundwater observed at the subject site is consistent with regional groundwater flow.

The subject site is situated in an area of East Farmingdale, New York which has been industrialized since the 1960's. Regulatory agency files and regional groundwater studies indicate a potential for contribution from off-site sources of contamination to groundwater resources within the subject site by facilities upgradient of the AEI site.

The completed field investigation and laboratory analysis of samples collected from the AEI site indicate soil contamination is limited to subsurface soils within the immediate area in which plating wastes were legally discharged, SPDES pool, and within the area of the four (4) leaching pools. Levels of total chromium and copper greater than 200 ppm were detected within samples collected at depths less than twenty (20) feet. Several soil samples which contained significant concentrations of total chromium and copper exhibited a discolorization.

Complex chemical reactions effecting the concentrations and proportions of chemical species are suspected of occurring in the soil matrix. The overall effect of these reactions is to increase the concentrations of trivalent chromium in soil while increasing the concentration of hexavalent chromium in groundwater.

Concentrations of several inorganic contaminants, including copper, nickel, total chromium, and hexavalent chromium were present within groundwater samples collected from monitoring wells MW-2 and MW-3, located within the immediate area of past wastewater discharges. The duplicate sample collected from monitoring well MW-3 indicated highly to moderately variable results from chromium, copper, and zinc. Hexavalent chromium concentration within samples collected from monitoring wells MW-2 and MW-3 were highly variable, with indicated concentrations of 6.0 and 140.0 ug/l respectively.

Concentrations of inorganic contamination were identified in downgradient monitoring well MW-4 including total chromium 2,350 ug/l, hexavalent chromium at 2,400 ug/l, copper 32,400 ug/l, and nickel 6,320 ug/l. All of the indicated concentrations are in excess of NYSDEC Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance Values, April, 1987. Downgradient monitoring well MW-5 contained only slightly elevated concentrations of chromium and copper with the remaining parameters consistent with water quality identified in upgradient monitoring well MW-1.

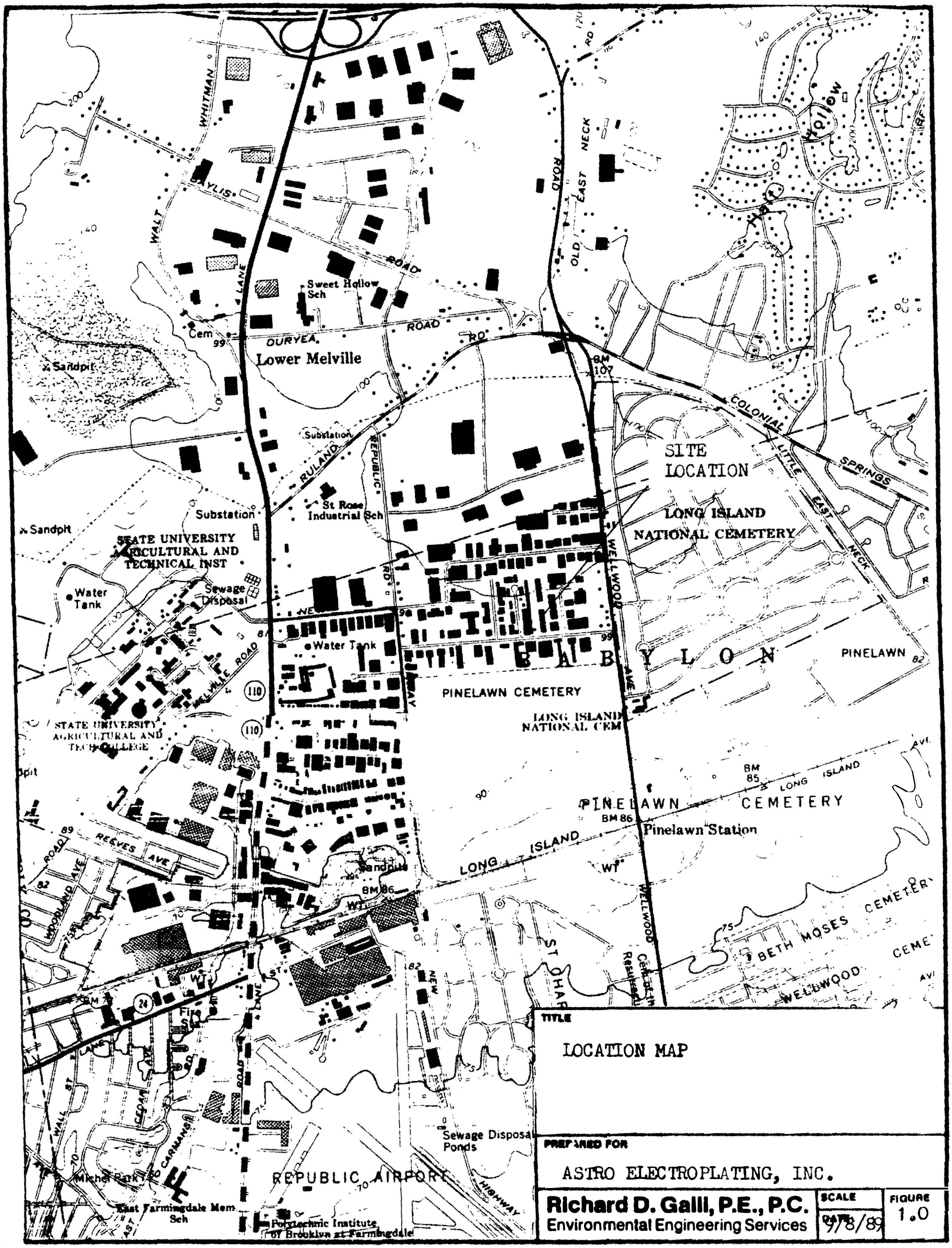
Volatile organic compounds, including 1.1.1-trichloroethane, trichloroethene, 1,1-dichloroethene and tetrachloroethene, were detected throughout the AEI monitoring well network.

Indicator parameters such as flouride, nitrate, sulfate, chloride, and temperature were within typical concentrations, or temperature range, for Long Island quality within a developed area. Field measured pH values were inconsistent with typical water quality for present-day Long Island.

The fact that the highest concentration of groundwater contamination was identified in down gradient monitoring well MW-4 and not within monitoring wells MW-2 and MW-3, both installed within the immediate area of wastewater discharge, may indicate a "non-active" source of contamination. The observed pattern of groundwater contamination may be the result of a groundwater contaminant plume moving off-site with contaminant concentrations observed in monitoring wells MW-2 and MW-3 being the result of residual soil contamination within the area of past waste water discharges. Another possibility is that a "slug" of contaminated groundwater, the origin being from an off-site source, has moved through the subject site and the observed contaminant concentrations within MW-4 identify the location of the "slug" at the time of sampling. Given the mobility of the observed contaminants within groundwater, the second scenario is not beyond the realm of possibility.

RDG would recommend that a second round of groundwater samples be collected from the AEI monitoring well network. The additional data generated from a second round of sampling, and analysis, would be useful in determining the persistance and mobility of previously identified groundwater contamination.

RDG would have the collected groundwater samples analyzed by a CLP laboratory for the several observed contaminants of most concern including chromium (total), hexavalent chromium, copper, nickel, and zinc. Conductivity and pH of the collected samples would be completed in the field in addition to the laboratory analysis.



TITLE

LOCATION MAP

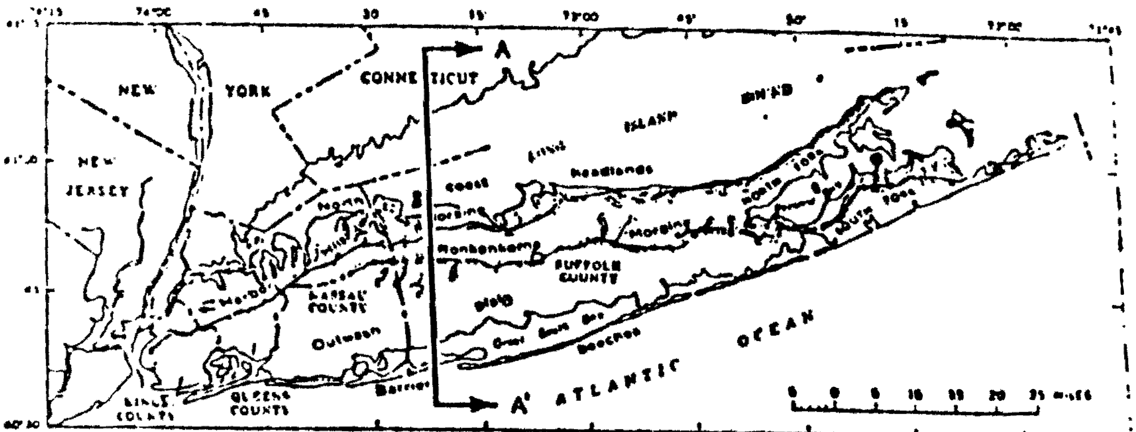
PREPARED FOR

ASTRO ELECTROPLATING, INC.

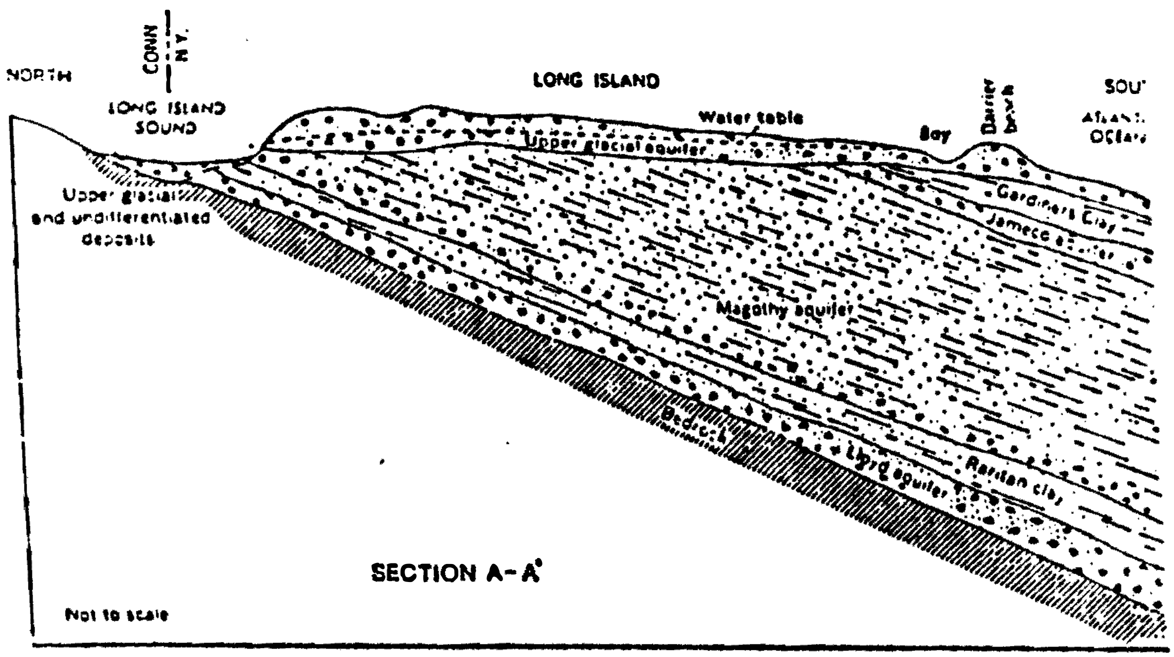
Richard D. Galli, P.E., P.C.
Environmental Engineering Services

SCALE	FIGURE
DATE 9/8/89	1.0

GENERALIZED GEOLOGICAL CROSS SECTION OF LONG ISLAND

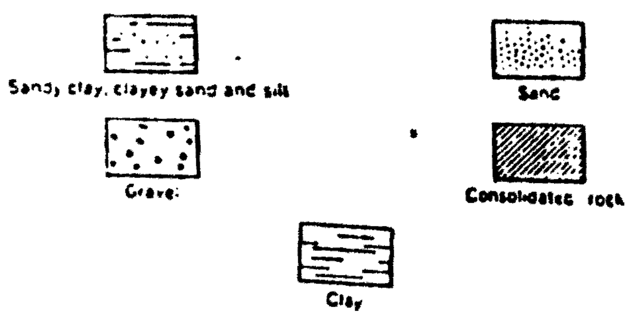


(FRANKE AND MC CLYMONDS, 1972)



(FRANKE AND MC CLYMONDS, 1972)

EXPLANATION



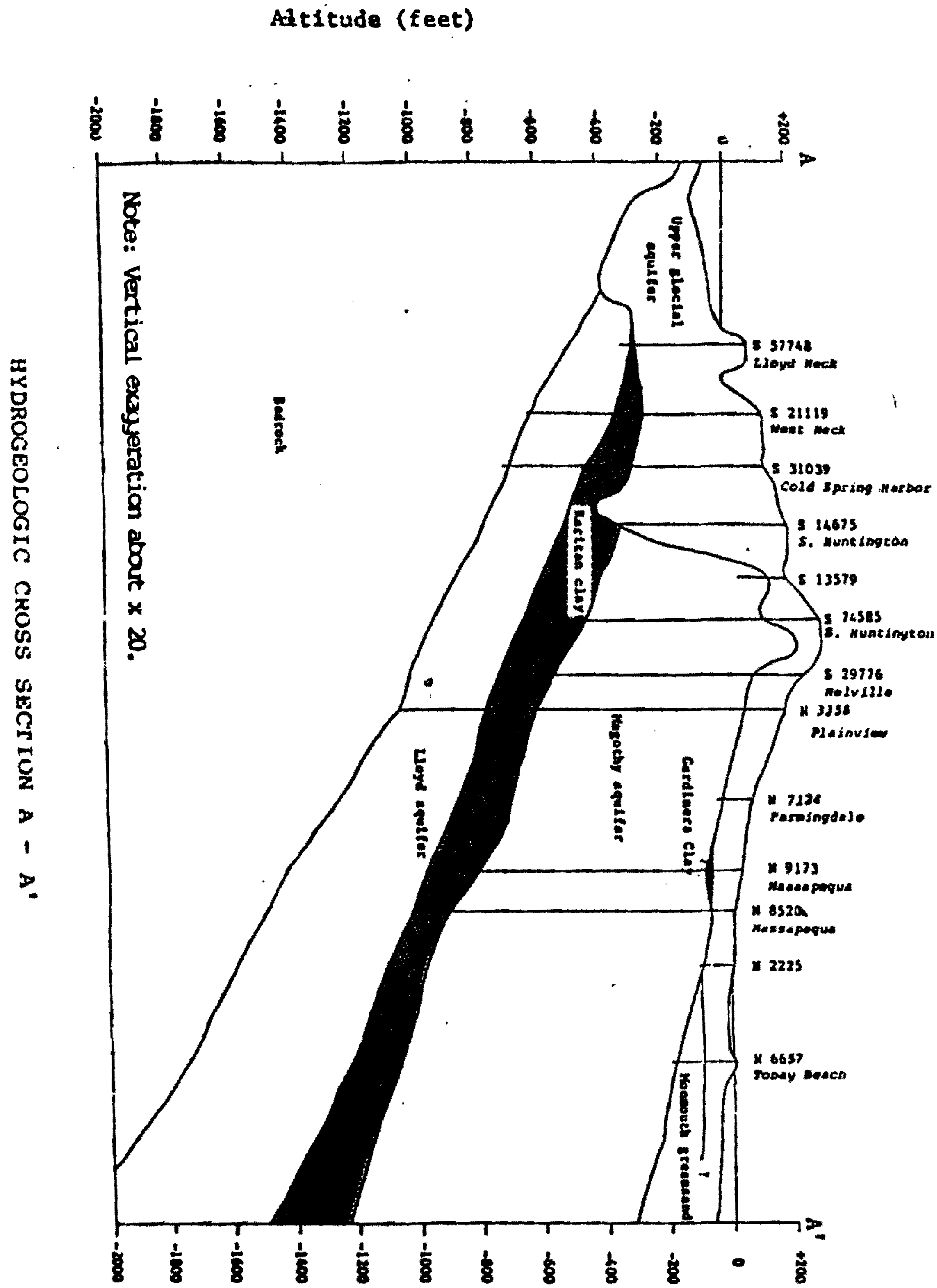
TITLE
GENERALIZED CROSS SECTION OF LONG ISLAND

SOURCE: U.S.G.S.

PREPARED FOR
ASTRO ELECTROPLATING, INC.

Richard D. Galli, P.E., P.C.
Environmental Engineering Services

SCALE
DATE 9/89
FIGURE 5.0



TITLE
CROSS SECTION OF WESTERN SUFFOLK COUNTY

SOURCE: SCDHS

PREPARED FOR
ASTRO ELECTROPLATING, INC.

Richard D. Galli, P.E., P.C.
Environmental Engineering Services

SCALE	FIGURE
DATE 9/89	5.1

…se from U.S. Geological Survey, Hartford, 1962;
…w York, 1957, and Providence, 1947

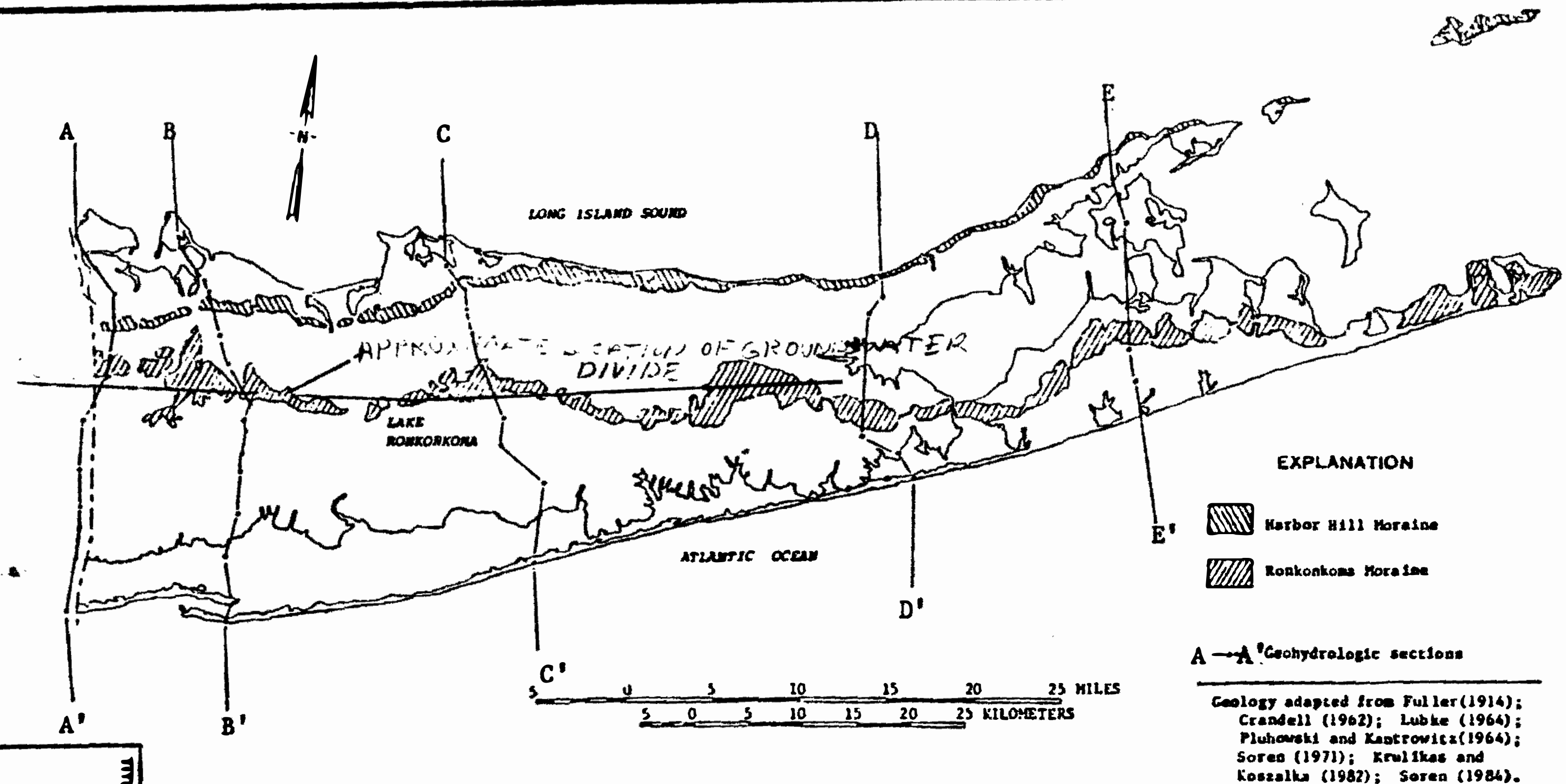
TITLE
GARDINERS CLAY UNIT

SOURCE: U.S.G.S.

PREPARED FOR
ASTRO ELECTROPLATING, INC.

Richard D. Galli, P.E., P.C.
Environmental Engineering Services

SCALE	FIGURE
DATE 9/8/89	5.2



SUFFOLK COUNTY GLACIAL MORAINES AND CROSS SECTION KEY

GROUNDWATER DIVIDE, SUFFOLK COUNTY

SOURCE: SCDHS

PREPARED FOR

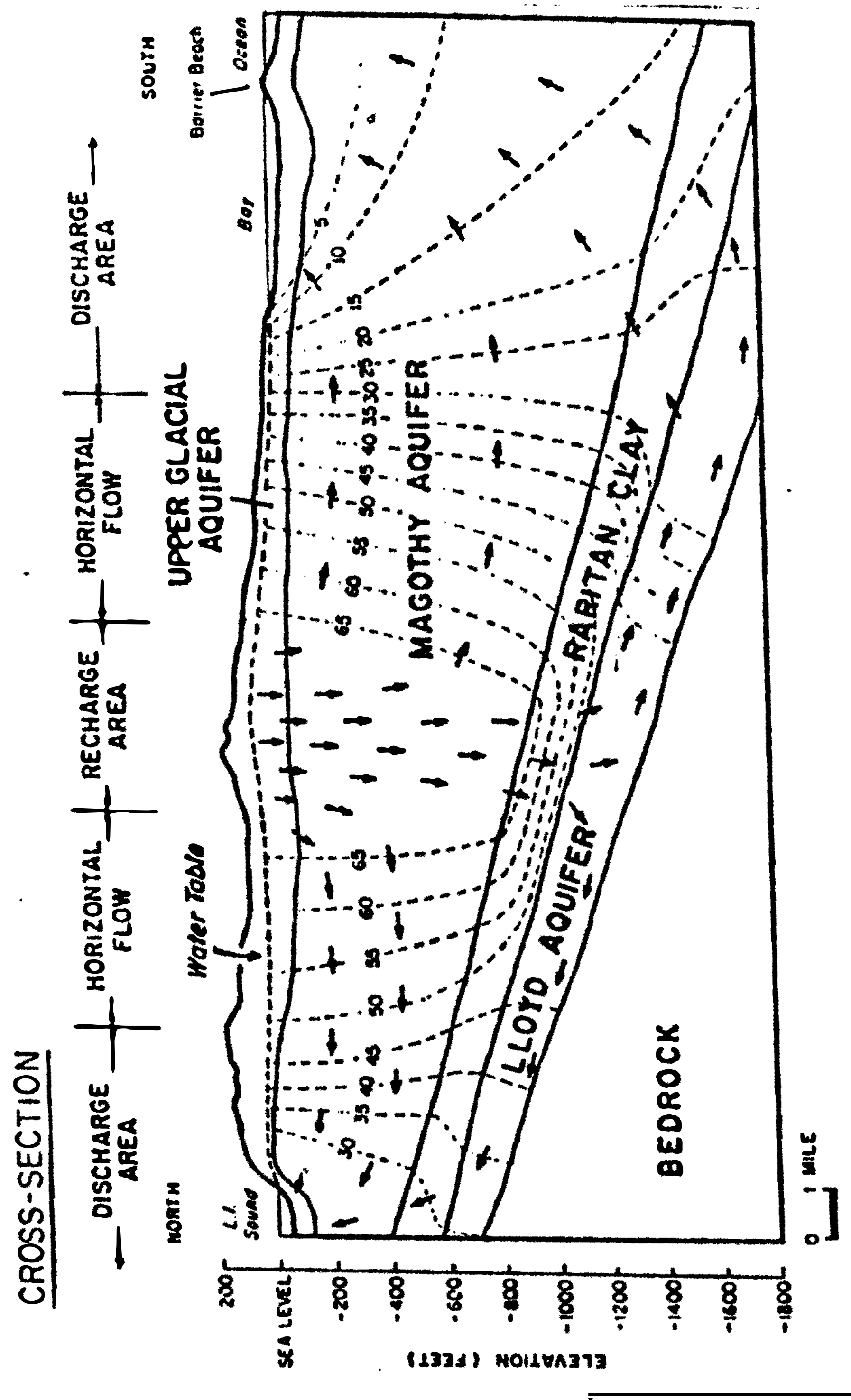
ASTRO ELECTROPLATING, INC.

Richard D. Galli, P.E., P.C.
Environmental Engineering Services

SCALE

DATE 9/89

FIGURE 5.3



TITLE

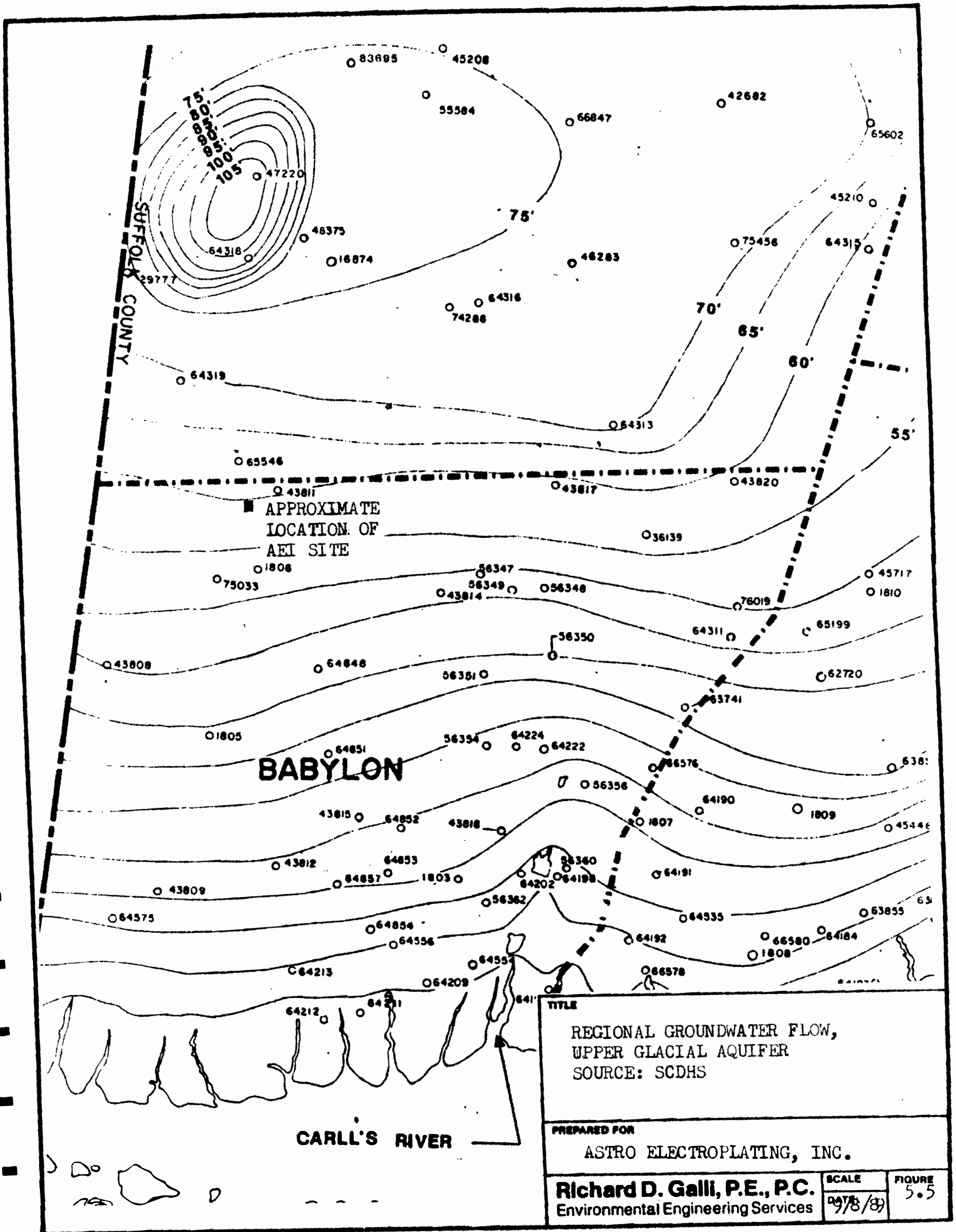
THREE DIMENSIONAL FLOW RELATIONSHIPS,
NASSAU/SUFFOLK COUNTY BORDER

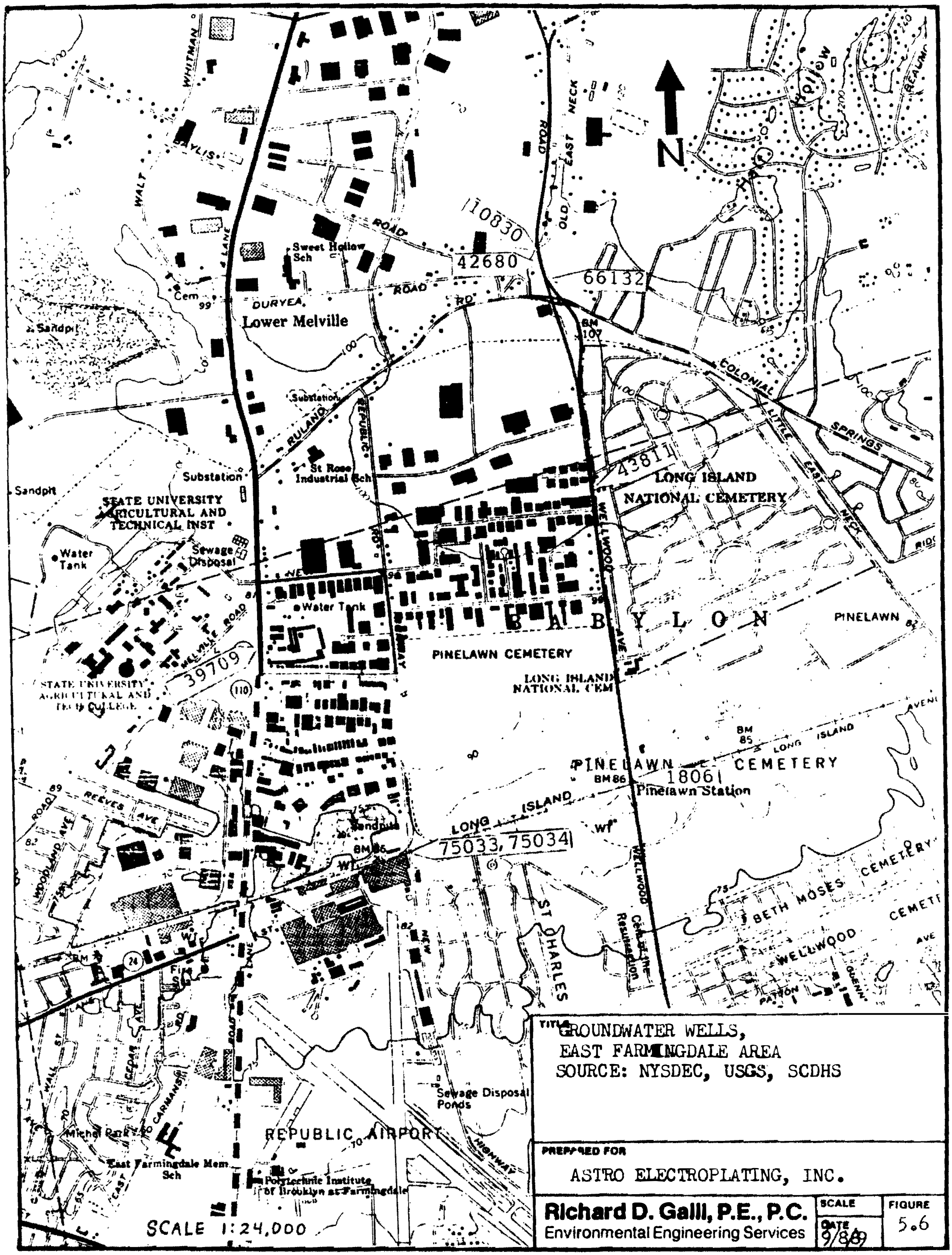
SOURCE: GERAGHTY & MILLER, INC.

PREPARED FOR

ASTRO ELECTROPLATING, INC.

Richard D. Galli, P.E., P.C. Environmental Engineering Services	SCALE	FIGURE
	DATE 9/8/89	5.4


75'
80'
85'
90'
95'
100'
105'
75'
70'
65'
60'
55'
SUFFOLK COUNTY
APPROXIMATE LOCATION OF AEI SITE
BABYLON
CARLL'S RIVER
TITLE
REGIONAL GROUNDWATER FLOW,
UPPER GLACIAL AQUIFER
SOURCE: SCDHS
PREPARED FOR
ASTRO ELECTROPLATING, INC.
Richard D. Galli, P.E., P.C.
Environmental Engineering Services
SCALE
DATE 9/8/89
FIGURE 5.5



TITLE GROUNDWATER WELLS,
EAST FARMINGDALE AREA
SOURCE: NYSDEC, USGS, SCDHS

PREPARED FOR

ASTRO ELECTROPLATING, INC.

Richard D. Galli, P.E., P.C.
Environmental Engineering Services

SCALE	FIGURE
DATE 9/89	5.6

TABLE 5.1 PRECIPITATION AND TEMPERATURE DATA

.—*Temperature and precipitation data at Riverhead, Suffolk County, New York*

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	7 years in 10 will have—		Average monthly total	3 years in 10 will have—		Snowfall	
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		More than—	Less than—	Average monthly total	4 years in 10 will have more than—
	°F.	°F.	°F.	°F.	In.	In.	In.	In.	In.
January	38	24	52	11	3.6	3.8	2.9	7	6
February	39	25	51	13	3.3	3.9	2.4	7	7
March	46	31	61	21	4.2	5.0	3.0	6	5
April	58	39	74	30	3.6	4.2	2.9	[1]	[2]2
May	69	49	81	39	3.5	4.6	2.0	0	
June	78	58	90	47	2.7	3.5	1.9	0	
July	83	64	90	55	3.3	4.0	2.1	0	
August	81	64	87	53	4.3	4.8	2.4	0	
September	75	57	84	44	3.1	3.7	1.6	0	
October	65	48	79	35	3.1	4.0	2.3	0	[1 2]
November	54	38	66	26	4.5	5.8	3.1	[1]	[2]1
December	42	28	57	14	4.2	5.5	2.9	6	7
Year	61	44	92	7	43.4	46.5	40.6	26	28

[1] Trace.
[2] One year in 10 will have more.

SOURCE: SUFFOLK COUNTY SOIL SURVEY, 1983

TABLE 5.3

SUFFOLK COUNTY STRATIGRAPHY AND HYDROGEOLOGIC UNITS

System	Series	Geologic unit	Hydrogeologic unit	Approximate thickness (feet)	Geologic Description
Quaternary	present Holocene 12,000 yrs	Recent shore, beach, and salt-marsh deposits	Upper glacial aquifer	0-60	Sand, gravel, clay, silt, organic mud, peat, loam, and shells. Colors: gray, brown, green, black, and yellow. Recent artificial-fill deposits of gravel, sand, clay, and rubbish.
	Pleistocene	Moraine deposits Glaciofluvial deposits Smithtown clay (informal usage)		0-700	Till composed of clay, sand, gravel and boulders; forms Harbor Hill and Ronkonkoma terminal moraines. Outwash deposits consist of quartzose sand, fine to very coarse, and gravel, pebble to boulder sized. Glaciolacustrine deposits (Smithtown clay) consist of silt, clay, and some sand and gravel layers. Colors are mainly gray, brown, and yellow. Contains shells and plant remains generally in finer grained beds.
		Unconformity			
		Gardiners Clay	Gardiners Clay	0-75	Marine deposits of clay and silt with some interbedded sand and gravel. Color, greenish-gray and gray. Foraminifera and lignite present, and also locally glauconite.
		Unconformity			
	200,000 yrs	post-Cretaceous(?) deposits	Upper glacial aquifer	0-140	Sand, fine to coarse. Color is brown. Identified as a distinct unit only on South Fork to date.
		Unconformity			
Cretaceous	60 mil yrs Upper Cretaceous	Monmouth Group	Monmouth greensand	0-300	Interbedded marine deposits of clay, silt, and sand. Color, dark greenish-gray to black. Contains much glauconite and lignite.
		Unconformity			
		Magothy Formation — Matawan Group undifferentiated	Magothy aquifer	0-1000	Sand, fine to coarse, clayey in part; interbedded with lenses and layers of light- to dark-gray clay. Basal 100-200 feet is generally composed of coarse sand and gravel beds. Sand and gravel are quartzose. Lignite and pyrite are common. Colors are gray, white, red, brown, and yellow.
		Disconformity?			
		Raritan Formation — clay member	Raritan confing unit	0-230	Clay, solid and silty; few lenses and layers of sand; little gravel. Lignite and pyrite common. Colors are gray, red, and white, commonly variegated.
		Disconformity			
	100 mil yrs	Raritan Formation — Lloyd Sand Member	Lloyd aquifer	0-550	Sand, fine to coarse, and gravel with interstratified beds and lenses of light- to dark-gray clay, silt, clayey and silty sand and some lignite and pyrite. Locally has gradational contact with overlying Raritan clay. Colors are yellow, gray, and white; clay is red locally.
		Unconformity			
Early Paleozoic to Precambrian(?)	400 mil yrs 550 mil yrs (?)	Bedrock	Bedrock	not known	Crystalline metamorphic and igneous rocks; muscovite-biotite schist, gneiss, and granite. Surface of bedrock is commonly highly weathered to a greenish white residual clay.

TABLE 5.4

Estimated Average Hydraulic Conductivities
for Long Island Aquifers

Aquifer	Approximate Maximum Thickness (feet)	Estimated Average Hydraulic conductivity (feet/day)	
		Horizontal	Vertical
Upper Glacial Aquifer	400	270	27
Magothy Aquifer	1,000	50	1.4
Lloyd Aquifer	300	40	7

Franke & Cohen, USGS Prof. Paper 800-C

TABLE 6.1

METALS ANALYSIS, SOILS

- All values are in mg/kg except where noted

	B-1 15-17'	B-1 23-25'	B-1 37-39'	B-2 13-15'	B-2 15-17'	B-2 37-39'	MW-1 20-22'	MW-1 35-37'	MW-2 10-12'
Aluminum	156	199	1370	3420	803	218	946	984	658
Antimony	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Arsenic	0.5 U	0.5 B	0.5 U	0.5 U	0.5 U	0.5 U	0.6 B	0.5 U	1.3
Barium	5.0 U	5.0 U	14.3 B	28.0	5.7 B	5.0 U	5.7 B	5.0 U	5.0 U
Beryllium	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cadmium	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Calcium	331 B	345 B	593	2760	681	288 B	436 B	2090	641
Chromium	104	77.1	45.6	435	171	52.3	8.2	2.6	41.1
Hexavalent Chromium	1.8	0.72	0.78	14.5	8.5	5.3	0.09	0.03	0.62
Cobalt	1.0 U	1.0 U	1.0 U	2.5 B	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Copper	41.7	16.8	28.8	195	31.1	4.8	4.9	4.3	120
Iron	1200	2640	3718	5670	2480	1040	4770	2280	1830
Lead	8.6	6.4	9.7	48.0	6.6	1.5	1.7	1.2	41.3
Magnesium	90.6 B	99.8 B	317 B	1350	294 B	87.1 B	342 B	378 B	22.8 B
Manganese	7.7	16.9	46.0	72.9	19.2	26.8	60.08	41.7	28.6
Mercury	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Nickel	3.6 B	25.4	66.4	40.2	3.4 B	3.1 B	2.6 B	2.4 B	79.5
Potassium	230 B	172 B	249	199 B	70.7 B	40.0 U	148 B	126 B	75.7 B
Selenium	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Silver	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Sodium	64.7 B	131 B	282 B	75.4 B	67.9 B	52.9 B	5.0 U	5.0 U	95.3 B
Thallium	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vanadium	1.7 B	2.3 B	5.1	8.0	1.6	1.0 U	6.6	1.9 B	1.5 B
Zinc	48.0	687	1910	15.5	4.5	6.0	16.3	11.1	836
Cyanide	0.30	0.37	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Phenol	0.33	0.07	0.07	0.34	0.21	0.30	0.12	0.45	1.1

U Indicates compound was analyzed for but not detected. Report the minimum detection limit for the same with the U (e.g. 10U) based on necessary concentration dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read U-Compound was analyzed for but not detected. The number is the minimum attainable detected limit for the sample.

J Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero (e.g.: If limit of detection is 10 ug/l and a concentration of 3 ug/l is calculated, report as 3J).

B This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

D This flag identifies all compounds identified in an analysis at a secondary dilution factor.

NOTE: Data on soil samples expressed on dry weight basis.

TABLE 6.1

METALS ANALYSIS, SOILS (CONTINUED)

- All values are in mg/kg except where noted

	MW-2 37-39'	MW-3 9-11'	MW-3 15-17'	MW-4 37-39'	MW-4 45-47'	MW-5 20-22'	MW-5 37-39'	TAP *	FIELD * BLANK (SOILS)
Aluminum	398	1660	1230	376	503	791	562	100 U	100 U
Antimony	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	50.0 U	50.0 U
Arsenic	0.5 U	1.3	0.5 U	1.1	0.6	0.5 U	0.5 U	5.0 U	5.0 U
Barium	5.8 B	32.1	19.1 B	5.0 U	5.0 U	5.0 U	5.0 U	50.0 U	5.0 U
Beryllium	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5.0 U	5.0 U
Cadmium	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5.0 U	5.0 U
Calcium	828	1960	8700	230 B	559 B	364 B	403 B	7470	744 B
Chromium	64.1	2070	283	10.0	14.9	3.2	2.9	5.0 U	5.0 U
Hexavalent Chromium	6.3	0.75	0.56	0.66	0.08	<0.005	0.11	<0.005	<0.005
Cobalt	1.0 U	2.3 B	1.0 U	1.0 U	1.0 U	1.5 B	1.0 U	10.0 U	10.0 U
Copper	33.2	191	36.2	16.3	36.8	5.6	4.4	41.0	40.0
Iron	4350	6360	2020	1380	1867	3400	1740	42.0 B	24.0 B
Lead	11.9	87.0	17.2	1.2	1.4	26.7	1.8	10.0	7.0
Magnesium	147	677	653	119 B	181 B	232 B	208 B	939 B	939 B
Manganese	55.3	47.7	26.4	20.7	47.7	88.9	25.0	10.0 U	10.0 U
Mercury	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.2 U	0.2 U
Nickel	18.2	60.4	11.2	2.0 U	9.2	2.0 U	3.0 B	23.0 B	21.0 B
Potassium	40.0 U	170 B	96.5 B	62.1 B	214 B	250 B	249 B	400 U	644 B
Selenium	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5.0 U	5.0 U
Silver	1.0 U	2.4	1.0 U	1.3	1.0 U	1.0 U	1.0 U	10.0 U	10.0 U
Sodium	5.0 U	116 B	66.3 B	42.5 B	66.0 B	42.7 B	55.9 B	8980	8910
Thallium	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5.0 U	5.0 U
Vanadium	4.7 B	2.2 B	2.2 B	1.7	2.6	2.5 B	2.4 B	10.0 U	10.0 U
Zinc	196	21.5	6.5	5.0	72.3	6.8	9.0	23.0	20.0 U
Cyanide	0.20 U	20.0	0.84	0.20 U	0.20 U	0.20 U	0.20 U	10.0 U	10.0 U
Phenol	0.38	0.39	0.27	0.21	0.23	0.99	0.76	<0.01	<0.01

U Indicates compound was analyzed for but not detected. Report the minimum detection limit for the same with the U (e.g. 10U) based on necessary concentration dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read U-Compound was analyzed for but not detected. The number is the minimum attainable detected limit for the sample.

J Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero (e.g.: If limit of detection is 10 ug/l and a concentration of 3 ug/l is calculated, report as 3J).

B This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

D This flag identifies all compounds identified in an analysis at a secondary dilution factor.

NOTE: Data on soil samples expressed on dry weight basis.

* Value in ug/l

TABLE 6.2 - DEPTH TO WATER AT SITE WELLS

Well I.D.	Total Depth of Well (ft)	Depth to Water (ft) - Date			
		5/30/89	6/27/89	7/28/89	8/31/89
MW-1	46.42	35.30	33.98	33.4	33.45
MW-2	46.67	34.98	33.66	33.19	33.11
MW-3	46.42	34.60	33.33	33.24	32.79
MW-4	45.50	34.62	33.34	33.00	32.96
MW-5	46.50	35.77	34.42	34.00	34.03

S5

TABLE 6.3 - WATER TABLE ELEVATION DATA

Well I.D.	*Elevation of Top of Well Casing	*Elevation of Water Table (ft) Well/Date			
		5/30/89	6/27/89	7/28/89	8/31/89
MW-1	97.85	62.55	63.87	64.45	64.40
MW-2	97.39	62.40	63.73	64.20	64.28
MW-3	96.96	62.36	63.63	63.72	64.17
MW-4	96.72	62.10	63.38	63.72	63.76
MW-5	97.67	61.90	63.25	63.67	63.64

TABLE 6.4

METALS ANALYSIS, GROUNDWATER

- All values are in ug/l

	MW-1	MW-2	MW-3	DUPLICATE MW-3	MW-4	MW-5	FIELD BLANK
Aluminum	1660	506	157 B	581	3780	1510	100 U
Antimony	50.0 U	50.0 U	80.0 U	50.0 U	54.0 B	50.0 U	50.0 U
Arsenic	5.0 U	11.0	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Barium	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U
Beryllium	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Cadmium	5.0 U	5.0 U	5.0 U	7.0	5.0 U	5.0 U	5.0 U
Calcium	19700	17900	41300	40500	25100	19800	147 B
Chromium	7.8 B	280	295	427	2350	25.3	5.0 U
Hexavalent Chromium	8.0	6.0	140	140	2400	17.0	5.0 U
Cobalt	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Copper	27.9	38.8	191	292	32400	77.9	10.0 U
Iron	3460	10800	1720	2840	318	4040	10.0 U
Lead	13.0	16.0	44.0	50.0	41.0	22.5	5.0 U
Magnesium	3210 B	3100 B	3930 B	3910 B	5910	4180 B	20.0 U
Manganese	567	2040	1120	1270	547	211	10.0 U
Mercury	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	20.0 U	20.0 U	220	272	6320	20.0 U	20.0 U
Potassium	3880 B	3970 B	4100 B	5260	1360 B	1570 B	40.0 U
Selenium	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Silver	10.0 U	10.0 U	10.0 U	17.1	10.0 U	10.0 U	10.0 U
Sodium	10100	16400	14000	14200	19300	12200	143 B
Thallium	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Vanadium	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Zinc	43.5	46.5	51.5	99.3	204	50.5	20.0 U
Cyanide	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U

U Indicates compound was analyzed for but not detected. Report the minimum detection limit for the same with the U (e.g. 10U) based on necessary concentration dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read U-Compound was analyzed for but not detected. The number is the minimum attainable detected limit for the sample.

J Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero (e.g.: If limit of detection is 10 ug/l and a concentration of 3 ug/l is calculated, report as 3J).

B This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

D This flag identifies all compounds identified in an analysis at a secondary dilution factor.

TABLE 6.5

VOLATILE ORGANIC ANALYSIS, GROUNDWATER

- All values are in ug/l

	MW-1	MW-1MS	MW-1MSD	MW-2	MW-3	MW-3 DUP.	MW-4	MW-5	FIELD BLANK	TRIP BLANK
Chloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromomethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Vinyl Chloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methylene Chloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	21	24	25	12	10 U	26	44	72	28	10 U
Carbon Disulfide	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	6	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethene (total)	12	11	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1,1-Trichloroethane	21	22	20	5 U	5 U	5 U	5 U	62	5 U	5 U
Carbon Tetrachloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Acetate	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromodichloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene	43	5 U	5 U	100	81	79	88	67	5 U	5 U
Dibromocnloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	2 J	2 J	2 J	4 J	3 J	3 J	3 J	3 J	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Cnlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Stryene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Xylenes (total)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U

U Indicates compound was analyzed for but not detected. Report the minimum detection limit for the same with the U (e.g. 10U) based on necessary concentration dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read U-Compound was analyzed for but not detected. The number is the minimum attainable detected limit for the sample.

J Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero (e.g.: If limit of detection is 10 ug/l and a concentration of 3 ug/l is calculated, report as 3J).

B This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

D This flag identifies all compounds identified in an analysis at a secondary dilution factor.

TABLE 6.6

INDICATOR PARAMETERS ANALYSIS, GROUNDWATER

- All values are in mg/l

	MW-1	MW-2	MW-3	DUPLICATE MW-3	MW-4	MW-5	FIELD BLANK
BOD	3.0 U	5	11	6	3.0 U	3.0 U	NA
Chloride	15	33	35	31	43	25	NA
COD	8	35	26	26	8	8	NA
Fluoride	0.02	0.08	0.13	0.13	0.08	0.02	NA
Nitrate	2.1	0.04 U	0.74	1.4	6.8	2.7	NA
Sulfate	13	17	22	22	90	23	NA
TSS	48	156	124	126	32	58	NA
TOC	4	2.5	3	5.5	4.3	1.3	NA
* Temp F	60	60	60	60	60	60	NA
*pH	5.65	6.28	8.37	8.37	4.20	4.97	NA

U Indicates compound was analyzed for but not detected. Report the minimum detection limit for the same with the U (e.g. 10U) based on necessary concentration dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read U-Compound was analyzed for but not detected. The number is the minimum attainable detected limit for the sample.

J Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero (e.g.: If limit of detection is 10 ug/l and a concentration of 3 ug/l is calculated, report as 3J).

B This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

D This flag identifies all compounds identified in an analysis at a secondary dilution factor.

* Measured in field

TABLE 6.7

N.Y.S.D.E.C. TOG (1.1.1) AMBIENT WATER QUALITY

STANDARDS/A.E.I. WATER QUALITY

- All values are in ug/l except where noted

	MW-1	MW-1MS/1MSD	MW-2	MW-3	DUPLICATE MW-3	MW-4	MW-5	FIELD BLANK	TRIP BLANK	NYS 1987 TOGS 1.1.1 CLASS GA STANDARDS
Chromium	7.8	NA	280.0	295.0	427.0	2350.0	23.0	5.0U	NA	50.0
Hexavalent Chromium	8.0	NA	6.0	140.0	140.0	2400.0	17.0	5.0U	NA	50.0
Copper	27.9	NA	38.8	191.0	292.0	32400.0	77.9	10.0U	NA	1000.0
Nickel	20.0U	NA	20.0U	228.0	272.0	6320.0	20.0U	20.0U	NA	NOT GIVEN
Zinc	43.5	NA	46.5	51.5	99.3	204.0	50.5	20.0U	NA	5000.0
1,1-Dichloroethene	6.0	5.0 U/5.0 U	5.0U	5.0U	5.0 U	5.0U	5.0U	5.0U	5.0U	NOT GIVEN
1,2-Dichloroethane (Total)	12.0	11.0 /10.0 U	5.0U	10.0U	5.0 U	5.0U	5.0U	5.0U	5.0U	NOT GIVEN
1,1,1-Trichloroethane	21.0	22.0/20.0	5.0U	5.0U	5.0 U	5.0U	62.0	5.0U	5.0U	50.0
Trichloroethene	43.0	5.0 U/5.0 U	100.0	81.0	79.0	88.0	67.0	5.0U	5.0U	10.0

U Indicates compound was analyzed for but not detected. Report the minimum detection limit for the same with the U (e.g. 10U) based on necessary concentration dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read U-Compound was analyzed for but not detected. The number is the minimum attainable detected limit for the sample.

J Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero (e.g.: If limit of detection is 10 ug/l and a concentration of 3 ug/l is calculated, report as 3J).

B This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

D This flag identifies all compounds identified in an analysis at a secondary dilution factor.

APPENDIX A
BORING LOGS

BORING LOG

PROJECT: ASTRO ELECTRO PLATING PROJECT NO. BORING NO. B-1

Location: FARMINGDALE Coord: T.F. Ground Elev:

Contractor: MPC Date Started: 4/28/89 G.W.L. Hour: Date:

Inspector: NYS DEC Date Completed: 4/28/89 G.W.L. Hour: Date:

Notes:

Depth Ft	Elev Ft.	Sample Type & No.	Test Type & No.	Blows Casing Per Ft.	Blows Sampler 6"	Blows Sampler 6"	Recovery %	P.I.D. ~~RQD %~~ READING	Drilling Rate Min./Ft.	Graphic Symbol	Description and Remarks
0											
		1-3			— / —	— / —	-	.2	9:10		Sandy loam, brown (silty sand)
5		3-5			3 / 7	5 / 5	24"	.2	9:20		Sandy brown loam, very fine no stones (Fill material moist)
		5-7			2 / 5	6 / 8	24"	.4	9:30		5-6' sandy brown loam, moist 6-7' hard brown clay-silt, very moist mica flakes
		7-9			2 / 6	4 / 7	24"	.2	9:35		7-8' (hard) brown clay silt, very moist 8-9' fine brown sand, moist
0		9-11			2 / 5	3 / 10	22"	.2	9:42		Fine brown sands and silt moist, slightly hard
		11-13			5 / 3	7 / 10	12"	.6	10:00		Fine brown sand and silt, chunk of asphalt, slightly hard
5		13-15			6 / 10	10 / 9	20"	1.0	10:14		Chunk of asphalt, med. to fine grained qtz. sands, tan to white, little gravel (native material?)
		15-17	Sent to lab		10 / 15	15 / 10	18"	.2	10:25		↓ Same, more gravel, no asphalt
		17-19			6 / 12	12 / 10	18"	1.6	10:30		Med. to coarse grained qtz. sand, some gravel, tan-white, loose Contains chunk of concrete
0		19-21			5 / 18	7 / 5	16"	.4	10:45		Coarse grained qtz. sand, with gravel white to tan, loose, moist
		21-23			10 / 15	15 / 21	18"	.2	10:50		↓ same
5		23-25	Sent to lab		10 / 15	13 / 15	16"	.4	10:57		Coarse to med. grained qtz sands loose, moist, tan Specks of dark green substance
		25-27			10 / 10	12 / 21	16"	.2	11:02		Coarse to med. grained qtz sands tan, loose, moist, no specks, little gravel
		27-29			10 / 13	10 / 11	20"	.2	11:15		↓ same
0		29-31			9 / 15	11 / 15	22"	.2	11:23		↓ same
		31-33			10 / 20	15 / 21	20"	1.8	11:36		Coarse grained qtz. sand, tan, loose w/gravel, Contained some hematite (FeO) rich rock
5		33-35			20 / 10	18 / 20	10"	.2	11:42		↓ same
		35-37			25 / 26	30 / 20	3 attempts 10"	1.8	11:50		3 attempts - very rocky, very coarse grained qtz. sands wet at 37' +
		37-39	Sent to lab		10 / 15	15 / 5	12"	.4	12:05		↓ Same, wet
0		39-41			10 / 5	20 / 18	16"	.2	12:12		very coarse grained qtz. sands and gravels wet

I.D. Casing	Wgt. Hammer on Casing	Material Notations
I.D. Spoon	Wgt. Hammer on Spoon	
Type Core Drill	Drop Hammer on Casing	
Core Dia.	Drop Hammer on Spoon	
Sample & Test Notations		

RICHARD D. GALLI, P.E.P.C.
ENVIRONMENTAL ENGINEERING SERVICE

BORING LOG

Sheet 1 of 2

PROJECT: ASTRO ELECTRO PLATING — PROJECT NO. — BORING NO. B-2

Location: FARMINGDALE — Coord: T.F. — Ground Elev:

Contractor: M.P.C. — Date Started: 4/25/89 — G.W.L. 37-39 — Hour: — Date:

Inspector: NYSDEC — Date Completed: 4/25/89 — G.W.L. — Hour: — Date:

Notes:

Depth Ft.	Elev. Ft.	Sample Type & No.	Test Type & No.	Blows Casing Per Ft.	Blows Sampler 6"	Blows Sampler 6"	Recovery %	P.I.D. READING	Drilling Rate Min./Ft.	Graphic Symbol	Description and Remarks
0											
5		3-5			10 / 10	13 / 10	10"	1.0	1:00		Silt-rich brown soils with an assortment of debris
		5-7			5 / 5	5 / 8	22"	.4	1:15		Fine grained brown sand, some silt, very well sorted, moist (fill?)
		7-9			5 / 5	9 / –	24"	.2	1:27		↓ same
0		9-11			2 / 5	5 / 7	16"	1.2	1:35		↓ same, but very moist
		11-13			5 / 5	10 / 4	3 Spoons	.6	1:50		Same but contains layer of gray sludge approx. 6" thick
5		13-15	Sent to lab		10 / 5	5 / 10	16"	.4	2:10		Fine grained sand and silt some gray sludge (or clay?)
		15-17	Sent to lab		10 / 5	5 / 14	16"	2.4	2:35		Med. to coarse grained qtz sands
		17-19			4 / 4	4 / 3	14"	.4	2:40		Coarse grained sand w/ gravel No sludge (cuttings were sludge+sand)
0		19-21			12 / 12	14 / 12	10"	<.4	2:50		Coarse grained qtz. sand loose, moist
		21-23			12 / 12	12 / 14	14"	.2	3:00		↓ same
5		23-25			10 / 10	10 / 16	16"	.4	3:15		Med. to coarse qtz. sand with some gravel, moist
		25-27			10 / 10	7 / 10	20"	.4	3:29		↓ same
		27-29			10 / 10	25 / 9	22"	.4	3:40		27-28' Coarse grained qtz sand 28'-29' fine grained sand
0		29-31			5 / 10	10 / 20	20"	.4	3:50		29-30' Fine grained sand w/ gravel 30-31' Med to coarse grained qtz sand w/gravel
		31-33			10 / 20	13 / 20	20"	<.8	3:57		Med. to coarse grained qtz sand w/ gravel, brown, loose, moist
5		33-35			9 / 19	11 / 10	18"	.4	4:05		↓ same
		35-37			20 / 10	10 / 24	14"	.4	4:12		35-36' Fine to med. grained qtz sand 36'-37' Med. to coarse grained qtz sand
		37-39	Sent to lab				18"	<.6	4:20		Med. to coarse grained qtz sand with gravel Wet at 38 1/2' (W.T.)
0											

I.D. Casing	Wgt. Hammer on Casing	Material Notations
I.D. Spoon	Wgt. Hammer on Spoon	
Type Core Drill	Drop Hammer on Casing	
Core Dia.	Drop Hammer on Spoon	
Sample & Test Notations		

RICHARD D. GALLI, P.E.P.C.
ENVIRONMENTAL ENGINEERING SERVICE

BORING LOG

PROJECT: ASTRO ELECTRO PLATING   PROJECT NO.   BORING NO. B-2

Location: FARMINGDALE   Coord: T.F.   Ground Elev:

Contractor: M.P.C.   Date Started: 4/25/89   G.W.L. 37-39   Hour: Date:

Inspector: NYSDEC   Date Completed: 4/25/89   G.W.L.   Hour: Date:

Notes:

Depth Ft.	Elev. Ft.	Sample Type & No.	Test Type & No.	Blows: Casing Per Ft.	Blows: Sampler 6"	Blows: Sampler 6"	Recovery %	P.I.D. READING	Drilling Rate Min./Ft.	Graphic Symbol	Description and Remarks
0											
		3-5			10 / 10	13 / 10	10"	1.0	1:00		Silt-rich brown soils with an assortment of debris
5		5-7			5 / 5	5 / 8	22"	.4	1:15		Fine grained brown sand, some silt, very well sorted, moist (fill?)
		7-9			5 / 5	9 / –	24"	.2	1:27		↓ same
0		9-11			2 / 5	5 / 7	16"	1.2	1:35		↓ same, but very moist
		11-13			5 / 5	10 / 4	3 Spoons	.6	1:50		same but contains layer of gray sludge approx. 6" thick
		13-15	Sent to lab		10 / 5	5 / 10	16"	.4	2:10		Fine grained sand and silt some gray sludge (or clay?)
5		15-17	Sent to lab		10 / 5	5 / 14	16"	2.4	2:35		Med. to coarse grained qtz sands
		17-19			4 / 4	4 / 3	14"	.4	2:40		Coarse grained sand w/ gravel No sludge (cuttings were sludge + sand)
0		19-21			12 / 12	14 / 12	10"	<.4	2:50		Coarse grained qtz. sand loose, moist
		21-23			12 / 12	12 / 14	14"	.2	3:00		↓ same
5		23-25			10 / 10	10 / 16	16"	.4	3:15		Med. to coarse qtz. sand with some gravel, moist
		25-27			10 / 10	7 / 10	20"	.4	3:29		↓ same
		27-29			10 / 10	25 / 9	22"	.4	3:40		27-28' Coarse grained qtz sand 28'-29' fine grained sand
0		29-31			5 / 10	10 / 20	20"	.4	3:50		29-30' Fine grained sand w/ gravel 30-31' Med to coarse grained qtz sand w/ gravel
		31-33			10 / 20	13 / 20	20"	<.8	3:57		Med. to coarse grained qtz sand w/ some gravel, brown, loose, moist
5		33-35			9 / 19	11 / 10	18"	.4	4:05		↓ same
		35-37			20 / 10	10 / 24	14"	.4	4:12		35-36' Fine to med. grained qtz sand 36-37' Med. to coarse grained qtz sand
		37-39	Sent to lab				18"	<.6	4:20		Med. to coarse grained qtz sand with gravel Wet at 38 1/2' (W.T.)
0											

I.D. Casing	Wgt. Hammer on Casing	Material Notations
I.D. Spoon	Wgt. Hammer on Spoon	
Type Core Drill	Drop Hammer on Casing	
Core Dia.	Drop Hammer on Spoon	
Sample & Test Notations		

RICHARD D. GALLI, P.E.P.C.
ENVIRONMENTAL ENGINEERING SERVICE

BORING LOG

Sheet 2 of 2

PROJECT: ASTRO ELECTRO PLATING	PROJECT NO.		BORING NO. B-2
Location: FARMINGDALE	Coord: T.F.		Ground Elev:
Contractor: M.P.C.	Date Started:	G.W.L.	Hour: Date:
Inspector: NYSDEC	Date Completed:	G.W.L.	Hour: Date:
Notes:			

Depth Ft.	Elev. Ft.	Sample Type & No.	Test Type & No.	Blows Casing Per Ft.	Blows Sampler 6"	Blows Sampler 6"	Recovery %	P.I.D. READING	Drilling Rate Min./Ft.	Graphic Symbol	Description and Remarks
0											
		39-41			10	6		.4	4:20		Coarse grained qtz sands w/gravel
					10	6					
5											
0											
5											
0											
5											
0											
5											
0											

I.D. Casing	Wgt. Hammer on Casing	Material Notations
I.D. Spoon	Wgt. Hammer on Spoon	
Type Core Drill	Drop Hammer on Casing	
Core Dia.	Drop Hammer on Spoon	
Sample & Test Notations		

RICHARD D. GALLI, P.E.P.C.

ENVIRONMENTAL ENGINEERING SERVICE

BORING LOG

Sheet 1 of 2

PROJECT: ASTRO ELECTROPLATING PROJECT NO. BORING NO. MW-1

Location: FARMINGDALE Coord: T. F. Ground Elev:

Contractor: MPC Date Started: 4/21/89 G.W.L. 38½' Hour: Date:

Inspector: NYSDEC Date Completed: 4/21/89 G.W.L. Hour: Date:

Notes:

Depth Ft.	Elev. Ft.	Sample Type & No.	Test Type & No.	Blows Casing Per Ft.	Blows Sampler 6"	Blows Sampler 6"	Recovery %	P.I.D. READING	Drilling Rate Min/Ft.	Graphic Symbol	Description and Remarks
0		1-2			– / –	– / –	–	2.4	9:20		Sand + gravel, brown urban soil dry (used trowel)
5		5-7			15 / 15	30 / 10	18"	2.4	9:45		Very coarse sand + gravel very poorly sorted, dry
0		10-12			10 / 10	17 / 10	18"	1.0	10:10		Med. grained qtz sand, brown to tan well sorted, little coarse sands, loose, slightly moist
5		15-17			10 / 7	15 / –	12"	1.0	10:15		Coarse grained qtz sand with gravel brown, loose, slightly moist
0		20-22	Sent to lab		10 / 12	10 / 10	12"	2.0* (* Let sit for more than 20 mins.)	10:28		Fine to coarse grained qtz sand light tan, some gravel, moist
5		25-27			10 / 10	14 / 10	12"	.6	10:35		↓ same
0		30-32			10 / 10	8 / 10	22"	.4	10:50		↓ same
5		35-37	Sent to lab		15 / 25	20 / 10	16"	3.0	11:15		Coarse to med. grained qtz sand, brown to tan, loose, moist, some gravel
38½' Δ →											
0											

I.D. Casing	Wgt. Hammer on Casing	Material Notations
I.D. Spoon	Wgt. Hammer on Spoon	
Type Core Drill	Drop Hammer on Casing	
Core Dia.	Drop Hammer on Spoon	
Sample & Test Notations		

RICHARD D. GALLI, P.E.P.C.
ENVIRONMENTAL ENGINEERING SERVICE

BORING LOG

Sheet 2 of 2

PROJECT: ASTRO ELECTROPLATING | PROJECT NO. | BORING NO. MW-1

Location: FARMINGDALE | Coord: T.F. | Ground Elev:

Contractor: MPC | Date Started: 4/21/89 | G.W.L. | Hour: | Date:

Inspector: NYSDEC | Date Completed: 4/21/89 | G.W.L. | Hour: | Date:

Notes:

Depth Ft.	Elev. Ft.	Sample Type & No.	Test Type & No.	Blows Casing Per Ft.	Blows Sampler 6"	Blows Sampler 6"	Recovery %	P.I.D. READING	Drilling Rate Min./Ft.	Graphic Symbol	Description and Remarks
40		40-42			5 / 10	5 / 5	24"	1.4	11:25		Coarse grained qtz sand, brown, loose, wet, some gravel
45		45-47			5 / 5	10 / 3	22"	2.0	11:55		Very coarse grained qtz sands brown, wet, loose, with grannular gravel-sized rock
0											
5											
0											
5											
0											
5											
0											

I.D. Casing	Wgt. Hammer on Casing	Material Notations
I.D. Spoon	Wgt. Hammer on Spoon	
Type Core Drill	Drop Hammer on Casing	
Core Dia.	Drop Hammer on Spoon	
Sample & Test Notations		

RICHARD D. GALLI, P.E.P.C.
ENVIRONMENTAL ENGINEERING SERVICE

BORING LOG

PROJECT: ASTRO ELECTROPLATING PROJECT NO. BORING NO. MW-2
Location: FARMINGDALE Coord: T.F. Ground Elev:
Contractor: MPC Date Started: 4/27/89 G.W.L. 39' Hour: Date:
Inspector: NYSDEC Date Completed: 4/27/89 G.W.L. Hour: Date:
Notes:

Depth Ft.	Elev. Ft.	Sample Type & No.	Test Type & No.	Blows Casing Per Ft.	Blows Sampler 6"	Blows Sampler 6"	Recovery %	P.I.D. READING	Drilling Rate Min./Ft.	Graphic Symbol	Description and Remarks
0		1-3'						.2			1-2' Urban soils, brown silt + sand 3+ Brown sands + gravel slightly moist (fill?)
5		5-7			2 5	4 8	12"	.8	9:40		Coarse to fine grained sands Brown with gravel, loose, moist
0		10-12	Sent to lab		5 5	5 10	18"	.4	9:56		Coarse grained qtz sands, brown with finer material, loose, little gravel, moist
5		15-17			5 8	7 11	20"	.2	10:05		↓ same
0		20-22			10 11	11 8	20"	.2	10:15		↓ same
5		25-27			8 12	12 14	20"	.2	10:20		Med to fine grained qtz sands Tan, loose, moist, some coarse grained material
0		30-32			2 11	8 12	20"	.4	10:30		↓ same
5		35-37					2 attempts 20"		10:59		Med. grained and coarse grained qtz. sands, little gravel
		37-39	Sent to lab		7 11	9 12	↓	1.4	↓		Wet at 39 (W.T.)
0											

I.D. Casing	Wgt. Hammer on Casing	Material Notations
I.D. Spoon	Wgt. Hammer on Spoon	
Type Core Drill	Drop Hammer on Casing	
Core Dia.	Drop Hammer on Spoon	
Sample & Test Notations		

RICHARD D. GALLI, P.E.P.C.
ENVIRONMENTAL ENGINEERING SERVICE

BORING LOG

Sheet 2 of 2

PROJECT: ASTRO ELECTROPLATING		PROJECT NO.		BORING NO. MW-2	
Location: FARMINGDALE	Coord: T. F.			Ground Elev:	
Contractor: M PC	Date Started: 4/27/89	G.W.L.		Hour:	Date:
Inspector: NYSDEC	Date Completed: 4/27/89	G.W.L.		Hour:	Date:
Notes:					

Depth Ft.	Elev. Ft.	Sample Type & No.	Test Type & No.	Blows Casing Per Ft.	Blows Sampler 6"	Blows Sampler 6"	Recovery %	P.I.D. READING	Drilling Rate Min./Ft.	Graphic Symbol	Description and Remarks
40											(Sample collected at 37'-39')
45		45-47					24"	.2			Coarse grained qtz. sands and gravel, loose, wet
0											
5											
0											
5											
0											
5											
0											

I.D. Casing	Wgt. Hammer on Casing	Material Notations
I.D. Spoon	Wgt. Hammer on Spoon	
Type Core Drill	Drop Hammer on Casing	
Core Dia.	Drop Hammer on Spoon	
Sample & Test Notations		

RICHARD D. GALLI, P.E.P.C.
ENVIRONMENTAL ENGINEERING SERVICE

BORING LOG

PROJECT: ASTRO ELECTRO PLATING PROJECT NO. BORING NO. MW-3

Location: FARMINGDALE Coord: T. F. Ground Elev:

Contractor: M.P.C. Date Started: 4/26/89 G.W.L. 38.5' Hour: Date:

Inspector: NYSDEC Date Completed: 4/26/89 G.W.L. Hour: Date:

Notes:

Depth Ft.	Elev. Ft.	Sample Type & No.	Test Type & No.	Blows Casing Per Ft.	Blows Sampler 6"	Blows Sampler 6"	Recovery %	P.I.D. READING	Drilling Rate Min./Ft.	Graphic Symbol	Description and Remarks
0											
		1-3			— / —	— / —	–	.2	9:30		Urban soil, brown silty sand, moist
5		3-5			10 / 12	10 / 10	15"	1.4	9:38		Silty sand with asphalt chunks, moist
		5-7			5 / 10	7 / 15	3"	<.4	10:00		↓Same but no asphalt Very little recovery after 2 attempts
		7-9			5 / 5	7 / 8	2 attempts 3"	<.4	10:39		Brown silt and sand with a gray-green sludge material
0		9-11	Sent to lab		5 / 7	5 / 5	18"	.1	11:05		Brown silt and clay with gray-green sludge, wet
		11-13			2 / 5	9 / 3	18"	.4	11:15		↓Same with gray-green sludge
5		13-15			5 / 8	5 / 10	18"	<.4	11:24		Med. grained sand, tan to brown, loose, moist, some remnants of gray-green sludge
		15-17	Sent to lab		5 / 5	8 / 10	2 attempts 10"	.4	11:35		Med. to coarse grained qtz. sands moist, loose, Some light green colored substance in sample
		17-19			5 / 5	5 / 6	2 attempts 10"	.4	11:53		Coarse grained qtz. sands, moist, loose, brown. No visible signs of discolorization
0		19-21			5 / 10	5 / 5	2 attempts 12"	<.4	12:00		↓ same
		21-23			5 / 6	5 / 10	18"	.4	12:15		Coarse grained qtz sand, Brown, loose, moist, with gravel
5		23-25			7 / 10	8 / 5	18"	.2	12:35		↓ same
		25-27			5 / 8	7 / 11	20"	.2	12:45		↓ same
		27-29			16 / 12	18 / 18	10"	.6	1:18		Coarse grained qtz sand, brown, loose, moist, with gravel
0		29-31			5 / 5	5 / 7	20"	.4	1:33		Med. to fine grained qtz sand Tan to brown, loose, moist, little gravel
		31-33			7 / 11	9 / 12	16"	1.2	1:38		Med. grained qtz. Sand, tan, loose, moist, little gravel
5		33-35			10 / 16	12 / 16	8"	.6	1:51		Med. to coarse grained qtz. sand, loose, moist, with gravel
		35-37			5 / 5	5 / 8	18"	.2	2:00		Med. grained qtz. sand, loose, moist, little gravel
		37-39			10 / 10	15 / 8	20"	1.6	2:10		Coarse grained qtz sands, loose, moist, little gravel Wet at 38.5' (W.T.)
0		39-41			5 / 9	4 / 17	24"	<.2	2:20		↓ same

I.D. Casing	Wgt. Hammer on Casing	Material Notations
I.D. Spoon	Wgt. Hammer on Spoon	
Type Core Drill	Drop Hammer on Casing	
Core Dia.	Drop Hammer on Spoon	
Sample & Test Notations		

RICHARD D. GALLI, P.E.P.C.
ENVIRONMENTAL ENGINEERING SERVICE

BORING LOG

Sheet 2 of 2

PROJECT: ASTRO ELECTRO PLATING　PROJECT NO.　BORING NO. MW-3
Location: FARMINGDALE　Coord: T.F.　Ground Elev:
Contractor: M.P.C.　Date Started: 4/26/89　G.W.L.　Hour:　Date:
Inspector: NYSDEC　Date Completed: 4/26/89　G.W.L.　Hour:　Date:
Notes:

Depth Ft.	Elev. Ft.	Sample Type & No.	Test Type & No.	Blows Casing Per Ft.	Blows Sampler 6"	Blows Sampler 6"	Recovery %	P.I.D. READING	Drilling Rate Min/Ft.	Graphic Symbol	Description and Remarks
40											
		41-43			5 / 8	7 / 8	8"	4.4	2:25		↓ Same as 37-39
		43-45			6 / 7	7 / 9	22"	2.2	2:30		↓ same
45		45-47			6 / 6	6 / 9	24"	2.2	2:35		Coarse grained qtz sand, wet, brown, loose
0											
5											
0											
5											
0											
5											
0											

I.D. Casing	Wgt. Hammer on Casing	Material Notations
I.D. Spoon	Wgt. Hammer on Spoon	
Type Core Drill	Drop Hammer on Casing	
Core Dia.	Drop Hammer on Spoon	
Sample & Test Notations		

RICHARD D. GALLI, P.E.P.C.
ENVIRONMENTAL ENGINEERING SERVICE

BORING LOG

Sheet 1 of 2

PROJECT: ASTRO ELECTROPLATING | PROJECT NO. | BORING NO. MW-4

Location: FARMINGDALE | Coord: T.F. | Ground Elev:

Contractor: MPC | Date Started: 5/1/89 | G.W.L. 38 | Hour: | Date:

Inspector: NYSDEC | Date Completed: 5/1/89 | G.W.L. | Hour: | Date:

Notes:

Depth Ft.	Elev. Ft.	Sample Type & No.	Test Type & No.	Blows Casing Per Ft.	Blows Sampler 6"	Blows Sampler 6"	Recovery %	P.I.D. Reading	Drilling Rate Min./Ft.	Graphic Symbol	Description and Remarks
0		1-3			– / –	– / –		.2			silty brown soil with gravel, pieces of asphalt, dry
5		5-7			10 / 25	15 / 20	15"	.2	9:47		Med. grained brown sands, loose, dry, with gravel
0		10-12			10 / 15	15 / 12	12"	.2	10:01		Med. to coarse grained qtz sands with gravel, loose, slightly moist
5		15-17			10 / 10	12 / 16	20"	.2	10:10		Med. to coarse grained qtz sands, brown to tan, loose, with gravel, moist
0		20-22			8 / 10	3 / 20	18"	.4	10:21		↓ same
5		25-27			21 / 22	23 / 15	18"	.2	10:27		Med. to fine grained qtz. sand, well sorted, brown, loose, moist, little or no gravel
0		30-32			20 / 20	22 / 24	20"	.2	10:41		Med. to coarse grained qtz sands brown, loose, moist, with gravel
5											
		37-39	Sent to lab		12 / 15	14 / 16	18"	.2	10:57		Med. to coarse grained qtz sands and gravel, loose, brown Wet at 38' (W.T.)
0											

I.D. Casing	Wgt. Hammer on Casing	Material Notations
I.D. Spoon	Wgt. Hammer on Spoon	
Type Core Drill	Drop Hammer on Casing	
Core Dia.	Drop Hammer on Spoon	
Sample & Test Notations		

RICHARD D. GALLI, P.E.P.C.
ENVIRONMENTAL ENGINEERING SERVICE

BORING LOG

PROJECT: ASTRO ELECTROPLATING PROJECT NO. BORING NO. MW-4

Location: FARMINGDALE Coord: T.F. Ground Elev:

Contractor: MPC Date Started: 5/1/89 G.W.L. Hour: Date:

Inspector: NYSDEC Date Completed: 5/1/89 G.W.L. Hour: Date:

Notes:

Depth Ft.	Elev. Ft.	Sample Type & No.	Test Type & No.	Blows Casing Per Ft.	Blows Sampler 6"	Blows Sampler 6"	Recovery %	P.I.D. READING	Drilling Rate Min./Ft.	Graphic Symbol	Description and Remarks
40		45-47	Sent to lab		13	15	20"	.2	11:20		Med. to very coarse grained qtz sands with gravel, wet
					11	18					
45		↓					↓				↓
0											
5											
0											
5											
0											
5											
0											

I.D. Casing	Wgt. Hammer on Casing	Material Notations
I.D. Spoon	Wgt. Hammer on Spoon	
Type Core Drill	Drop Hammer on Casing	
Core Dia.	Drop Hammer on Spoon	
Sample & Test Notations		

RICHARD D. GALLI, P.E.P.C.
ENVIRONMENTAL ENGINEERING SERVICE

BORING LOG

Sheet 1 of 2

PROJECT: ASTRO ELECTROPLATING	PROJECT NO.	BORING NO. MW-5	
Location: FARMINGDALE	Coord: T.F.	Ground Elev:	
Contractor: MPC	Date Started: 4/24/89 G.W.L.~38'	Hour:	Date:
Inspector: NYSDEC	Date Completed: 4/24/89 G.W.L.	Hour:	Date:
Notes:			

Depth Ft.	Elev. Ft.	Sample Type & No.	Test Type & No.	Blows Casing Per Ft.	Blows Sampler 6"	Blows Sampler 6"	Recovery %	P.I.D. READING	Drilling Rate Min./Ft.	Graphic Symbol	Description and Remarks
0		1-3			– / –	– / –	–	0.6	10:20		1': Top soil 2-3': Brown sands w/gravel, moist, slightly hard
5		5-7			10 / 10	15 / 15	10"	0.6	10:40		Med. grained sands, brown, well sorted, moist, loose
10		10-12			12 / 20	26 / 10	20"	0.2	11:00		10½-11': Clay (light gray with fine silt, moist) 11-12': Coarse grained qtz sands loose, with gravel, moist
15		15-17			5 / 10	10 / 2	20"	1.0	11:20		Coarse grained qtz sands, brown, some gravel, loose, moist
20		20-22	Sent to lab		3 / 8	10 / 12	20"	2.0	11:35		Med. grained qtz. sands, brown, loose, moist, some gravel
25		25-27			10 / 10	16 / 10	14"	0.6	11:55		↓ same
30		30-32			10 / 13	12 / 10	22"	0.6	12:25		↓ same
35											
		37-39	Sent to lab		5 / 5	10 / 4	2 attempts 20"	2.5	12:40		Med. to coarse grained qtz. sands brown to tan, moist, little gravel, Wet at 39' (W.T.)
40											

I.D. Casing	Wgt. Hammer on Casing	Material Notations
I.D. Spoon	Wgt. Hammer on Spoon	
Type Core Drill	Drop Hammer on Casing	
Core Dia.	Drop Hammer on Spoon	
Sample & Test Notations		

RICHARD D. GALLI, P.E.P.C.
ENVIRONMENTAL ENGINEERING SERVICE

BORING LOG

Sheet 2 of 2

PROJECT: ASTRO ELECTROPLATING		PROJECT NO.		BORING NO. MW-5	
Location: FARMINGDALE	Coord: T. F.			Ground Elev:	
Contractor: M PC	Date Started:	G.W.L.		Hour:	Date:
Inspector: NYSDEC	Date Completed:	G.W.L.		Hour:	Date:
Notes:					

Depth Ft.	Elev. Ft.	Sample Type & No.	Test Type & No.	Blows Casing Per Ft.	Blows Sampler 6"	Blows Sampler 6"	Recovery %	P.I.D. READING	Drilling Rate Min./Ft.	Graphic Symbol	Description and Remarks
40											
					5	10	2attempts		1:00		Very coarse grained qtz sands with gravel, tan, loose, wet
					5	7		1.2			
45											
0											
5											
0											
5											
0											
5											
0											

I.D. Casing	Wgt. Hammer on Casing	Material Notations
I.D. Spoon	Wgt. Hammer on Spoon	
Type Core Drill	Drop Hammer on Casing	
Core Dia.	Drop Hammer on Spoon	
Sample & Test Notations		

RICHARD D. GALLI, P.E.P.C.
ENVIRONMENTAL ENGINEERING SERVICE

APPENDIX B
P.I.D. DATA SHEETS

PHOTOIONIZER DETECTOR DATA
(HNu Data)

SITE NAME: ASTROELECTROPLATING
ADDRESS: FARMINGDALE, N.Y.
NYSDEC I.D. 1-52-036

DATE: 4/28/89
BOREHOLE NO. B-1
INSPECTOR NYSDEC
INSTRUMENT PI-101
DATE CALIBRATED checked 4/28/89

WEATHER CONDITIONS
Fair, sunny, Temps 65 - 70°F
Winds NW 10-15 m.p.h.
Background readings 0.4 - 0.20

SAMPLE NUMBER	DEPTH (FEET)	HNu READING	COMMENTS
B-1 1-3	1 - 3	.2	
B-1 3-5	3 - 5	.2	
B-1 5-7	5 - 7	.4	
B-1 7-9	7 - 9	.2	
B-1 9-11	9 - 11	.2	
B-1 11-13	11 - 13	.6	
B-1 13-15	13 - 15	1.0	
B-1 15-17	15 - 17	.2	Selected for analysis
B-1 17-19	17 - 19	1.6	
B-1 19-21	19 - 21	.4	
B-1 21-23	21 - 23	.2	
B-1 23-25	23 - 25	.4	Selected for analysis
B-1 25-27	25 - 27	.2	
B-1 27-29	27 - 29	.2	
B-1 29-31	29 - 31	.2	
B-1 31-33	31 - 33	1.8	
B-1 33-35	33 - 35	.2	
B-1 35-37	35 - 37	1.8	
B-1 37-39	37 - 39	.4	Selected for analysis
39-41	39 - 41	.2	

PHOTOIONIZER DETECTOR DATA
(HNu Data)

SITE NAME : ASTROELECTROPLATING

ADDRESS: FARMINGDALE, N.Y.

NYSDEC I.D. 1-52-036

DATE: 4/25/89

BOREHOLE NO. B-2

INSPECTOR T.F.

INSTRUMENT PID 101

DATE CALIBRATED Checked 4/25/89

WEATHER CONDITIONS

SAMPLE NUMBER	DEPTH (FEET)	HNu READING	COMMENTS
B-2 3-5	3-5	1.0	
B-2 5-7	5-7	.4	
B-2 7-9	7-9	.2	
B-2 9-11	9-11	1.2	
B-2 11-13	11-13	.6	
B-2 13-15	13-15	.4	
B-2 15-17	15-17	2.4	
B-2 17-19	17-19	.4	
B-2 19-21	19-21	< .4	
B-2 21-23	21-23	.2	
B-2 23-25	23-25	.4	
B-2 25-27	25-27	.4	
B-2 27-29	27-29	.4	
B-2 29-31	29-31	.4	
B-2 31-33	31-33	< .8	
B-2 33-35	33-35	.4	
B-2 35-37	35-37	.4	
B-2 37-39	37-39	< .6	
B-2 39-41	39-41	.4	

PHOTOIONIZER DETECTOR DATA
(HNu Data)

SITE NAME : ASTROELECTROPLATING

ADDRESS: FARMINGDALE, N.Y.

NYSDEC I.D. 1-52-036

DATE: 4/21/89
BOREHOLE NO. MW-1
INSPECTOR T.F
INSTRUMENT PI-101
DATE CALIBRATED checked 4/2/89

WEATHER CONDITIONS
Fair, Temps in mid 60°F
Overcast in afternoon
Winds out of the SE 5-10 mph

SAMPLE NUMBER	DEPTH (FEET)	HNu READING	COMMENTS
MW-1 1-2'	1-2'	.2	Background readings .2 to 1.0
MW-1 5-7'	5-7'	.4	
MW-1 10-12	10-12	1.0	
MW-1 15-17	15-17	1.0	
MW-1 20-22	20-22	2.0	Let sit more than 1/2 hour
MW-1 25-27	25-27	.6	
MW-1 30-32	30-32	.4	
MW-1 35-37	35-37	3.0	Selected for analysis, sent to lab
MW-1 40-42	40-42	1.4	
MW-1 45-47	45-47	2.0	
MW			

PHOTOIONIZER DETECTOR DATA
(HNu Data)

SITE NAME : ASTROELECTROPLATING

ADDRESS: FARMINGDALE, N.Y.

NYSDEC I.D. 1-52-036

DATE: 4/27/89

BOREHOLE NO. MW-2

INSPECTOR T.F.

INSTRUMENT PI-101

DATE CALIBRATED Checked 4/27/89

WEATHER CONDITIONS

SAMPLE NUMBER	DEPTH (FEET)	HNu READING	COMMENTS
MW-2 1-3'	1-3'	.2	
MW-2 5-7	5-7'	.8	
MW-2 10-12	10-12	.4	Selected for analysis Sent to lab (NYSDEC request)
MW-2 15-17	15-17	.2	
MW-2 20-22	20-22	.2	
MW-2 25-27	25-27	.2	
MW-2 30-32	30-32	.4	
MW-2 37-39	37-39	1.4	Selected for analysis - Sent to lab
MW-2 45-47	45-47	.2	

PHOTOIONIZER DETECTOR DATA
(HNu Data)

SITE NAME: ASTROELECTROPLATING

ADDRESS: FARMINGDALE, N.Y.

NYSDEC I.D. 1-52-036

DATE: 4/26/89
BOREHOLE NO. MW-3
INSPECTOR T.F.
INSTRUMENT PID 101
DATE CALIBRATED 4/26/89

WEATHER CONDITIONS

Overcast 45-55°F Winds from NW 5-10mph
Temps increased to low 60's by 1:00 PM
Background readings: .2

SAMPLE NUMBER	DEPTH (FEET)	HNu READING	COMMENTS
MW-3 1-3'	1-3'	.2	Background readings .2 to 1.0
MW-3 3-5	3-5	1.4	
MW-3 5-7	5-7	<.4	
MW-3 7-9	7-9	<.4	
MW-3 9-11	9-11	.1	Contained gray green sludge - sent to lab
MW-3 11-13	11-13	.4	
MW-3 13-15	13-15	<.4	
MW-3 15-17	15-17	.4	Contained light green substance - sent to lab
MW-3 17-19	17-19	.4	
MW-3 19-21	19-21	<.4	
MW-3 21-23	21-23	.4	
MW-3 23-25	23-25	.2	
MW-3 25-27	25-27	.2	
MW-3 27-29	27-29	.6	
MW-3 29-31	29-31	.4	
MW-3 31-33	31-33	1.2	
MW-3 33-35	33-35	.6	
MW-3 35-37	35-37	.2	
MW-3 37-39	37-39	1.6	
MW-3 41-43	41-43	<.4	
MW-3 43-45	43-45	<.2	
MW-3 45-47	45-47	<.2	

PHOTOIONIZER DETECTOR DATA
(HNu Data)

SITE NAME: ASTROELECTROPLATING

ADDRESS: FARMINGDALE, N.Y.

NYSDEC I.D. 1-52-036

DATE: 5/1/89
BOREHOLE NO. MW-4
INSPECTOR NYSDEC
INSTRUMENT PI-101
DATE CALIBRATED Checked 5/1/89

WEATHER CONDITIONS
Cloudy, fog, temps up to mid 60°F
Rain expected by afternoon
Background readings .6 to .2 PPM

SAMPLE NUMBER	DEPTH (FEET)	HNu READING	COMMENTS
MW-4 1-3	1-3	.2	
MW-4 5-7	5-7	.2	
MW-4 10-12	10-12	.2	
MW-4 15-17	15-17	.2	
MW-4 20-22	20-22	.2	
MW-4 25-27	25-27	.2	
MW-4 30-32	30-32	.2	
MW-4 37-39	37-39	.2	W.T. Selected for analysis
MW-4 40-42	40-42	—	Not collected
MW-4 45-47	45-47	.2	Selected for analysis

PHOTOIONIZER DETECTOR DATA
(HNu Data)

SITE NAME: ASTROELECTROPLATING

ADDRESS: FARMINGDALE, N.Y.

NYSDEC I.D. 1-52-036

DATE: 4/24/89
BOREHOLE NO. MW-5
INSPECTOR T.F.
INSTRUMENT PI-101
DATE CALIBRATED checked 4/24/89

WEATHER CONDITIONS

Fair, sunny, breezy. Temps up to low 60°F
Background readings .5 - 1.2 PPM

SAMPLE NUMBER	DEPTH (FEET)	HNu READING	COMMENTS
MW-5 1-3	1-3	0.6	
MW-5 5-7	5-7	0.6	
MW-5 10-12	10-12	0.2	
MW-5 15-17	15-17	1.0	
MW-5 20-22	20-22	2.0	Water moisture - reading not consistent
MW-5 25-27	25-27	0.6	
MW-5 30-32	30-32	0.6	
MW-5 37-39	37-39	2.5	Slight reading - water moisture
MW-5 45-47	45-47	1.2	

APPENDIX C
CHAIN OF CUSTODY SHEETS

nytest environmental inc

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME		NO. OF CONTAINERS
	ASTRO ELE[illegible]PLATING		
CLIENT NAME: R.D. GALLI, P.E., P.G.	LAB #		

SAMPLE I.D. NO.	DATE	TIME	COMP	GRAB	SAMPLE LOCATION	NO. OF CONTAINERS	NITROGEN	OIL & GREASE	CYANIDE	PHENOL	VOLATILE	METALS	ORGANICS	BACTERIAL	TOC COD	OTHER *	UNPRESERVED	REMARKS / ADDITIONAL REQUIREMENTS
3-1	4/28/89	10:25Am	✓		15-17'	3			✓	✓	✓	✓				✓		OTHER: HEX. CHROMIUM
3-1	4/28/89	10:57Am	✓		23-25'	3			✓	✓	✓	✓				✓		
5-1	4/28/89	12:05Am	✓		37-39	3			✓	✓	✓	✓				✓		
	4/28/89	1:31Am	✓		TAP WATER	4			✓		✓	✓				✓		
	4/28/89	12:00	✓		FIELD BLANK	4			✓		✓	✓				✓		

Shipped Via:

Relinquished by (Signature)	Date/Time	Agent of:	Rec'd. by (Signature)	Date/Time	Agent of:
Thomas P. Fox (signature) / Printed Name: Thomas P. Fox	4/28/89 2:50	R.P. Galli, P.E., P.G.	(signature) / Printed Name: [illegible]	4/28 250	NYTEST
Relinquished by (Signature) / Printed Name	Date/Time	Agent of:	Rec'd. by (Signature) / Printed Name	Date/Time	Agent of:

Relinquished by (Signature) / Printed Name	Date/Time	Received for Laboratory by: (Signature) / Printed Name	Date/Time	Remarks:
				HEX. CHROMIUM 24 HR. HOLDING TIME T.C.L. PARAMETERS

Sampler (Signature): Thomas P. Fox (signature)

Samplers Name (Print): Thomas P. Fox

nytest environmental inc

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME
	ASTRO ELECTROPLATING

CLIENT NAME	LAB #
R.D. GALLI P.E.P.C.	

SAMPLE I.D. NO.	DATE	TIME	COMP	GRAB	SAMPLE LOCATION	NO. OF CON-TAINERS	NITROGEN	OIL & GREASE	CYANIDE	PHENOL	VOLATILE	METALS	ORGANICS	BACTERIAL	TOC COD	OTHER	UNPRESERVED	REMARKS / ADDITIONAL REQUIREMENTS
B-2	4/25	2:10 PM	X		13-15'	3			✓	✓	✓	✓				✓		Other: Hex. Chromium
B-2	4/25	2:35 PM	X		15-17'	4			✓	✓	✓	✓				✓		
B-2	4/25	4:20 PM	X		37-39'	4			✓	✓	✓	✓				✓		

Shipped Via:

Relinquished by (Signature)	Date/Time	Agent of:	Rec'd. by (Signature)	Date/Time	Agent of:
Thomas P. Fox (signature) / Printed Name: Thomas P. Fox	4/25 6:00	R.D. Galli, PE, PC	(signature) / Printed Name: [illegible] KEZLA	4/25 6:00	NYTEST
Relinquished by (Signature) / Printed Name	Date/Time	Agent of:	Rec'd. by (Signature) / Printed Name	Date/Time	Agent of:

Relinquished by (Signature) / Printed Name	Date/Time	Received for Laboratory by: (Signature) / Printed Name	Date/Time	Remarks:
				Hex. Chromium 24 hour holding time TCL Parameters

Sampler (Signature): Thomas P. Fox (signature)

Samplers Name (Print): Thomas P. Fox

nytest environmental inc

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME					
	Astro Electroplating, Phase II					
CLIENT NAME:	R.D. Galli, P.E., P.C.	LAB #				

SAMPLE I.D. NO.	DATE	TIME	COMP	GRAB	SAMPLE LOCATION	NO. OF CONTAINERS	NITROGEN	OIL & GREASE	CYANIDE	PHENOL	VOLATILE	METALS	ORGANICS	BACTERIAL	TOC COD	OTHER *	UNPRESERVED	REMARKS / ADDITIONAL REQUIREMENTS
RW-1	4/21	10:28	✓		20-22 ft.	4				✓	✓	✓				✓		* - Hex. Chrom. - Cyanide -
MW-1	4/21	11:15	✓		35-37 ft.	4				✓	✓	✓				✓		

Shipped Via:

Relinquished by (Signature)	Date/Time	Agent of:	Rec'd. by (Signature)	Date/Time	Agent of:
[signature] / Printed Name: Thomas P. Fox	4/21 5:25	R.D. Galli, P.E., P.C.	[signature] / Printed Name: [illegible]	4/21 5:25	NYTEST
Relinquished by (Signature) / Printed Name	Date/Time	Agent of:	Rec'd. by (Signature) / Printed Name	Date/Time	Agent of:

Relinquished by (Signature) / Printed Name	Date/Time	Received for Laboratory by: (Signature) / Printed Name	Date/Time	Remarks:
				Hex. Chromium 24 Hr. Holding Time CLP Contract

Sampler (Signature): [signature]

Samplers Name (Print): Thomas Fox

nytest environmental inc

CHAIN OF CUSTODY RECORD

PROJECT NO	PROJECT NAME	CLIENT NAME	LAB #
	Astro Electroplating Phase II	R.D. Galli, P.E., P.C.	

SAMPLE I.D. NO.	DATE	TIME	COMP	GRAB	SAMPLE LOCATION	NO. OF CONTAINERS T.F.	NITROGEN	OIL & GREASE	CYANIDE	PHENOL	VOLATILE	METALS	ORGANICS	BACTERIAL	TOC COD	OTHER *	UNPRESERVED	REMARKS / ADDITIONAL REQUIREMENTS
MW-2	4/27	9:50	✓		10 - 12'	4 3			✓	✓	✓	✓	✓			✓		* Hexavalent Chromium
						4			✓	✓	✓	✓	✓			✓		
MW-2	4/27	10:59	✓		37 - 39'													

Shipped Via:

Relinquished by (Signature)	Date/Time	Agent of:	Rec'd. by (Signature)	Date/Time	Agent of:
Thomas P. Fox	2:45 4/27	R.D. Galli, P.E., P.C.	[signature]	4/27 2:45	NYTEST
Printed Name: Thomas Fox			Printed Name: Kelly Flechel		
Relinquished by (Signature)	Date/Time	Agent of:	Rec'd. by (Signature)	Date/Time	Agent of:
Printed Name			Printed Name		
Relinquished by (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks: TCL Parameters Hex. Chromium 24 hr. Holding Times	
Printed Name		Printed Name			

Sampler (Signature): Thomas P. Fox

Samplers Name (Print): Thomas P. Fox

nytest environmental inc

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	LAB #
	ASTRO ELECTROPLATING	

CLIENT NAME: R. D. GALLI, PE, PC.

SAMPLE I.D. NO.	DATE	TIME	COMP	GRAB	SAMPLE LOCATION	NO. OF CONTAINERS	NITROGEN	OIL & GREASE	CYANIDE	PHENOL	VOLATILE	METALS	ORGANICS	BACTERIAL	TOC COD	OTHER	UNPRESERVED	REMARKS / ADDITIONAL REQUIREMENTS
MW-3	4/26/89	11:05AM	✓		9-11'	3			✓	✓	✓	✓				✓		OTHER: HEX. CHROMIUM
MW-3	4/26/89	11:35AM	✓		15-17'	3			✓	✓	✓	✓				✓		

Shipped Via:

Relinquished by (Signature)	Date/Time	Agent of:	Rec'd. by (Signature)	Date/Time	Agent of:
Thomas P. Fox (signature); Printed Name: Thomas P. Fox	4/26 6:18		(signature); Printed Name: [illegible]	4/26 6:18	NYTEST
Relinquished by (Signature); Printed Name	Date/Time	Agent of:	Rec'd. by (Signature); Printed Name	Date/Time	Agent of:

Relinquished by (Signature); Printed Name	Date/Time	Received for Laboratory by: (Signature); Printed Name	Date/Time

Remarks: HEX. CHROMIUM 24 HR. HOLDING TIME
TCL PARAMETERS

Sampler (Signature): Thomas P. Fox

Samplers Name (Print): Thomas P. Fox

nytest environmental inc

CHAIN OF CUSTODY RECORD

PROJECT NO.:

PROJECT NAME: Astro Electroplating Phase II

CLIENT NAME: R.D. Galli P.E., P.C.

LAB.#:

SAMPLE ID. NO.	DATE	TIME	COMP	GRAB	SAMPLE LOCATION	NO. OF CONTAINERS	NITROGEN	OIL & GREASE	CYANIDE	PHENOL	VOLATILE	METALS	ORGANICS	BACTERIAL	TOC COD	OTHER	UNPRESERVED	REMARKS / ADDITIONAL REQUIREMENTS
MW-4	5/1/89	10:57	✓		37-39'	3			✓	✓	✓	✓				✓		Other: Hexavalent Chromium
MW-4	5/1/89	11:20	✓		45-47'	3			✓	✓	✓	✓				✓		
T.B.	5/1/89	-			TRIP BLANK	1					✓							

Shipped Via:

Relinquished by (Signature)	Date/Time	Agent of:	Rec'd. by (Signature)	Date/Time	Agent of:
[signature] Printed Name: Thomas P. Fix	5/1/89 3:45		Printed Name:		
Relinquished by (Signature) / Printed Name:	Date/Time	Agent of:	Rec'd. by (Signature) / Printed Name:	Date/Time	Agent of:
Relinquished by (Signature) / Printed Name:	Date/Time	Received for Laboratory by: (Signature) [signature] Printed Name: Christine Scappa	5/1 3:45		

Sampler (Signature) — Samplers Name (Print)

Remarks: TCL Parameters
Hex. Chromium (24 hr holding time)
Returned unused sample containers: 36 VOA
12 Amber

nytest environmental inc

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	CLIENT NAME	LAB #
	Astro Electroplating, Phase II	R.D. Galli, P.E., P.C.	

SAMPLE I.D. NO.	DATE	TIME	COMP	GRAB	SAMPLE LOCATION	NO. OF CONTAINERS	NITROGEN	OIL & GREASE	CYANIDE	PHENOL	VOLATILE	METALS	ORGANICS	BACTERIAL	TOC COD	OTHER *	UNPRESERVED	REMARKS / ADDITIONAL REQUIREMENTS
MW-5	4/24	11:35 Am	✓		20 - 22'	4			✓	✓	✓	✓				✓		Others: Hex.- Chromium
MW-5	4/24	12:40 pm	✓		37 - 39'	4			✓	✓	✓	✓				✓		

Shipped Via:

Relinquished by (Signature) / Printed Name	Date/Time		Agent of:	Rec'd. by (Signature) / Printed Name	Date/Time	Agent of:
Thomas P. Fox / Thomas P Fox	4/24	3:50 Pm	R.D. Galli P.E., P.C.			
[signature] / J Decker	4/24	3:50	NEI			

Relinquished by (Signature) / Printed Name	Date/Time	Received for Laboratory by: (Signature) / Printed Name	Date/Time	Remarks:
				TCL Parameters Hex.-Chrom. 24 hr. holding time

Sampler (Signature): Thomas P. Fox

Samplers Name (Print): Thomas P. Fox

nytest environmental

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	LAB #	CLIENT NAME
	[illegible]		[illegible]

SAMPLE I.D. NO.	DATE	TIME	COMP	GRAB	SAMPLE LOCATION	NO. OF CONTAINERS	NITROGEN	OIL & GREASE	CYANIDE	PHENOL	VOLATILE	METALS	ORGANICS	BACTERIAL	TOC COD	OTHER	UNPRESERVED	REMARKS / ADDITIONAL REQUIREMENTS
MW-1	5/30	[illegible] AM			MONITORING WELL	7			✓		✓					✓		OTHER: HEX CHROMIUM
MW-2	"	[illegible] PM			" "	7			✓		✓					✓		FOR ALL,
MW-3	"	[illegible] PM			" "	7			✓		✓					✓		INDICATOR PARAMETERS
MW-4	"	[illegible] PM			" "	7			✓		✓					✓		FOR MW-1, 2, 3, 4, 5
MW-5	"	[illegible] PM			" "	7			✓		✓					✓		AND DUPLICATE
[illegible]	"	~~[illegible]~~			DUPLICATE SAMPLE	7			✓		✓					✓		
FB	"	[illegible] PM			FIELD BLANK	5			✓		✓					✓		
TB	"	—			TRIP BLANK	2					✓							

Shipped Via:

Relinquished by (Signature)	Date/Time	Agent of:	Rec'd. by (Signature)	Date/Time	Agent of:
Thomas P. Fox	5/30 5:15	R.D. Galli, P.E., P.C.	[illegible]	5/30 5:15	NYTEST
Printed Name: Thomas P. Fox			Printed Name: [illegible]		
Relinquished by (Signature)	Date/Time	Agent of:	Rec'd. by (Signature)	Date/Time	Agent of:
Printed Name			Printed Name		
Relinquished by (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks.	
Printed Name		Printed Name		CLP PROTOCOL HEX CHROMIUM [illegible]	

Sampler (Signature): Thomas P. Fox

Samplers Name (Print): Thomas P. Fox

APPENDIX D
MONITORING WELL CONSTRUCTION REPORTS

MONITOR WELL CONSTRUCTION REPORT

Site ASTRO ELECTROPLATING, INC Well No. MW - 1

Total Depth 46.5 Surface Elev. 97.97 Top Riser Elev. 97.85

Water Levels (Depth, Date, Time) 38.5' Date Installed 4/21/89

	Dia.	Material	Length	
Riser:	2"	PVC	36'	
Screen:	2"	PVC	10'	Slot Size 10 mil
Prot. Csg:	6"	STEEL	N/A	

SCHEMATIC

Comments

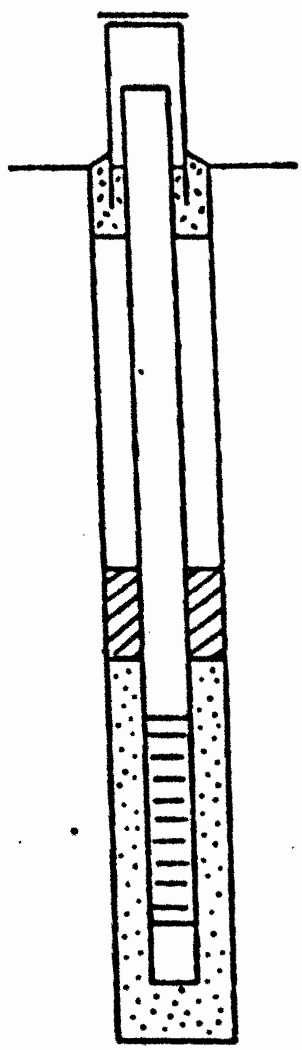
Driller MPC

Geologist T. Fox

Engineer R.D. Galli

Technical Person C. Macy

DEC Inspector C. Andersen



N/A Prot. Csg stickup

N/A Riser stickup

Ground Surface

2' Bottom Surface Seal

Surface Seal Type PORTLAND CEMENT

Grout Type BENTONITE SLURRY

Seal Type BENTONITE PELLETS

32.5' Top Seal

34.5' Top Sand Pack

36.5' Top Screen

Sand Pack Type/Size MORIE No. 1

46.5' Bottom Screen

47.0' Bottom Sump/Wellpoint

47.5' Total Depth of Boring

MONITOR WELL CONSTRUCTION REPORT

Site ASTRO ELECTROPLATING, INC Well No. MW-2

Total Depth 47' Surface Elev. 97.72 Top Riser Elev. 97.39

Water Levels (Depth, Date, Time) 39' Date Installed 4/27/89

Riser:	Dia. 2"	Material	PVC	Length	36.5'		
Screen:	Dia. 2"	Material	PVC	Length	10'	Slot Size	10 mil
Prot. Csg:	Dia. 6"	Material	STEEL	Length	N/A		

SCHEMATIC

Comments

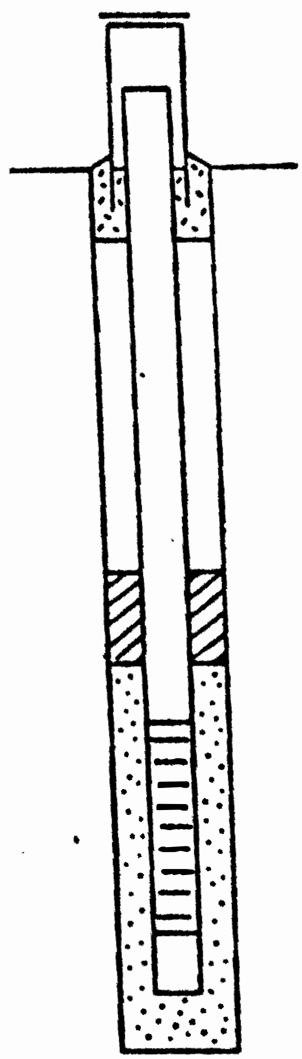
Driller MPC

Geologist T. Fox

Engineer R.D. Galli

Technical Person C. Marys

DEC Inspector C. Andersen



N/A Prot. Csg stickup

N/A Riser stickup

Ground Surface

2' Bottom Surface Seal

Surface Seal Type PORTLAND CEMENT

Grout Type BENTONITE SLURRY

Seal Type BENTONITE PELLETS

32 Top Seal

35 Top Sand Pack

37 Top Screen

Sand Pack Type/Size MORIE No. 1

47 Bottom Screen

47.5 Bottom Sump/Wellpoint

48 Total Depth of Boring

MONITOR WELL CONSTRUCTION REPORT

Site ASTRO ELECTROPLATING, INC Well No. MW - 3

Total Depth 47' Surface Elev. 97.38 Top Riser Elev. 96.96

Water Levels (Depth, Date, Time) 38.5' Date Installed 4/26/89

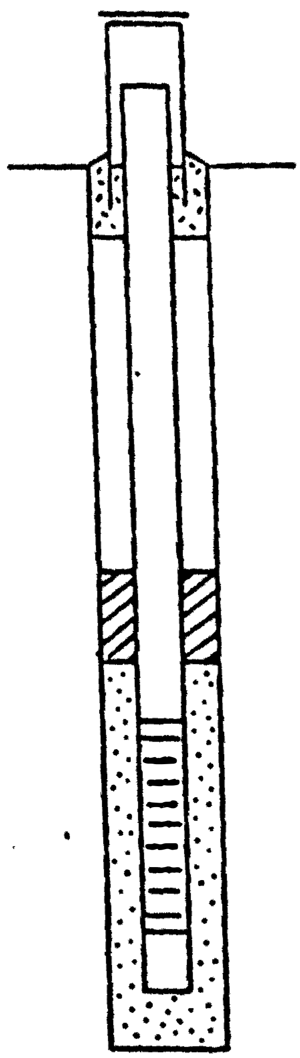
Riser: Dia. 2"	Material PVC	Length 36.5'	
Screen: Dia. 2"	Material PVC	Length 10'	Slot Size 10 mil
Prot. Csg: Dia. 6"	Material STEEL	Length N/A	

SCHEMATIC

Comments

Driller MPC
Geologist T. Fox
Engineer R.D. Galli
Technical Person C. Macys

DEC Inspector C. Andersen



N/A Prot. Csg stickup

N/A Riser stickup

Ground Surface

Surface Seal Type PORTLAND CEMENT

2' Bottom Surface Seal

Grout Type BENTONITE SLURRY

Seal Type BENTONITE PELLETS

32' Top Seal

34' Top Sand Pack

37' Top Screen

Sand Pack Type/Size MORIE No. 1

47' Bottom Screen

47.5' Bottom Sump/Wellpoint

48 Total Depth of Boring

MONITOR WELL CONSTRUCTION REPORT

Site ASTRO ELECTROPLATING, INC Well No. MW-4

Total Depth 48' Surface Elev. 96.84 Top Riser Elev. 96.72

Water Levels (Depth, Date, Time) 38.5 Date Installed 4/29/89

	Dia.	Material	Length	
Riser:	2"	PVC	36.5'	Slot Size 10 mil
Screen:	2"	PVC	10'	
Prot. Csg:	6"	STEEL	N/A	

SCHEMATIC

Comments

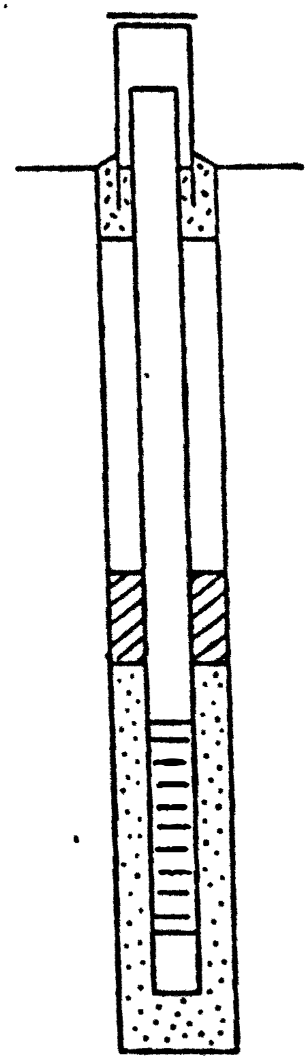
Driller MPC

Geologist T. Fox

Engineer R.D. Galli

Technical Person C. Macys

DEC Inspector C. Andersen



N/A Prot. Csg stickup

N/A Riser stickup

Ground Surface

2' Bottom Surface Seal

Surface Seal Type PORTLAND CEMENT

Grout Type BENTONITE SLURRY

Seal Type BENTONITE PELLETS

33' Top Seal

36' Top Sand Pack

37' Top Screen

Sand Pack Type/Size MORIE No. 1

47' Bottom Screen

47.5' Bottom Sump/Wellpoint

48' Total Depth of Boring

MONITOR WELL CONSTRUCTION REPORT

Site ASTRO ELECTROPLATING, INC Well No. MW - 5

Total Depth 47' Surface Elev. 98.01 Top Riser Elev. 97.67

Water Levels (Depth, Date, Time) 39' Date Installed 4/24/89

	Dia.	Material	Length	
Riser:	2"	PVC	36 1/2	
Screen:	2"	PVC	10'	Slot Size 10 mil
Prot. Csg:	12"	STEEL	N/A	

SCHEMATIC

Comments

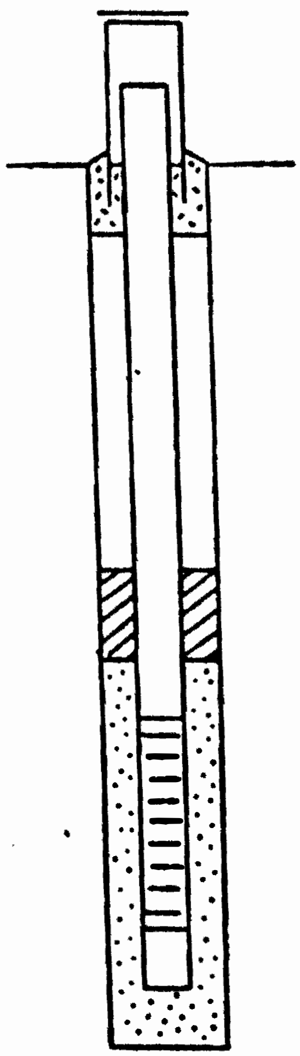
Driller MPC

Geologist T. Fox

Engineer R.D. Galli

Technical Person C. Macys

DEC Inspector C. Andersen



N/A Prot. Csg stickup

N/A Riser stickup

Ground Surface

2' Bottom Surface Seal

Surface Seal Type PORTLAND CEMENT

Grout Type BENTONITE SLURRY

Seal Type BENTONITE PELLETS

33' Top Seal

35.5' Top Sand Pack

37' Top Screen

Sand Pack Type/Size MORIE No. 1

47 Bottom Screen

47.5 Bottom Sump/Wellpoint

48.0 Total Depth of Boring

APPENDIX E
REFERENCES

Buxton, H.T., Soren, Julian, Posner, Alex, and Shernoff, P.K., 1981, Reconnaissance of the groundwater resources of Kings and Queens Counties, New York: U.S. Geological Survey Open-File Report 81-1186, 64 p., 28 figs.

Dragun, James, The Fate of Hazardous Materials in Soil, Part 2, Hazardous Materials Control, May/June 1988, p.41-65.

Erlichman, Freddy, 1979, Distribution of groundwater withdrawals on Long Island, New York, in 1973 by area, aquifer, and use: Suffolk County Water Authority, Long Island Water Resources Bulletin LIWR-10, 16 p., 6 figs, 1 pl.

Franke. O.L., and Cohen, Philip, 1972, Regional Rates of Groundwater movement on Long Island, New York: U.S.G.S. Professional Paper 800-C, p. C271-277

Getzen, R.T., 1977a, Analog-model analysis of regional three dimensional flow in the ground-water reservoir of Long Island, New York: U.S. Geological Survey Open-File Report 75-617, 154 p.

Jensen, H.M., and Soren, Julian, 1974, Hydrogeology of Suffolk County, Long Island, New York: U.S. Geological Survey Hydrologic Investigation Atlas HA-501, 2 sheets.

Kimmel, G.E., and Braids, O.C., 1980, Leachate plumes in groundwater from Bablylon and Islip landfills, Long Island, New York: U.S. Geological Survey Professional Paper 1085, 38 p., 19 figs., 2 pl.

Ku, H.F.H.,, Katz, B.G., Sulam, K.J. and Krulikas, R.K., 1978, Scavenging of Chromium and Cadmium by Aquifer Material- South Farmingdale Massapequa area, Long Island, New York, in Groundwater, V. 16, no. 2, p. 112-118.

Perlmutter, N.M., Lieber, Frauenthal, H.L., 1963, Movement of Water Borne Cadmium and Hexavalent Chromium Wastes in South Farmingdale, Nassau County, New York, U.S.G.S. Professional Paper 475-C, art. 105, P. C179-C184, 4 figs.

Shields, E.J., Pollution Control Engineers Handbook, 1985, Pudvan Publishing Co., 144 p.

Soren, Julian, 1971a, Groundwater and geohydrologic conditions in Queens County, Long Islan, New York: U.S. Geological Survey Water-Supply Paper 2001-A, 39 p., 4 figs., 2 pl.

Soren, Julian, 1977a, Diversion of the Hudson River across western Long Island, New York, near mid-Pleistocene time (abstract): in Geological Society of America Proceedings, 12th annual meeting, Binghamton, N.Y., 1977, Abstracts with Programs, v.9, no.3, p.320-321.

Veatch, A.C., Slichter, C.S. Bowman, Isaiah, Crosby, W.O., and Horton, R.E., 1906, Underground water resources of Long Island, New York: U.S. Geological Survey Professional Paper 44, 394 p.

United Stated Department of Agriculture, Soil Survey of Suffolk County, 1983.

N.Y.S.D.E.C. Publications and Files:

Inactive Hazardous Waste Disposal Sites in New York State, 1989

N.Y.S. Codes, Rules and Regulations, Title 6, Chapter X, Part 703

Division of Water Technical and Operational Guidance Series (TOGS) (1.1.1) Ambient Water Quality Stndards and Guidance Values, April 1, 1987

N.Y.S.D.E.C. Region 1, SUNY Stony Brook:

Division of Water Resources: Well Logs, Location Maps, etc.

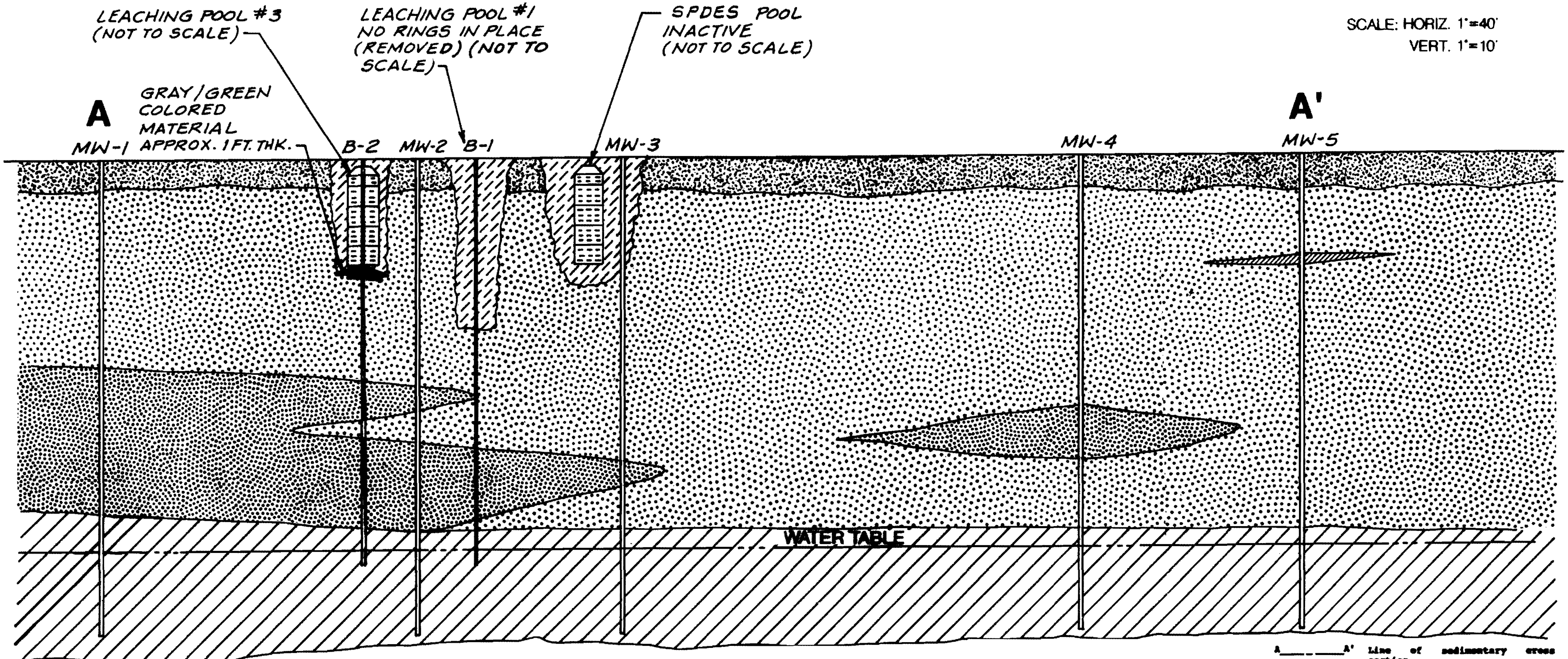
Suffolk County Department of Health:

Division of Water Resources: Water Quality Data

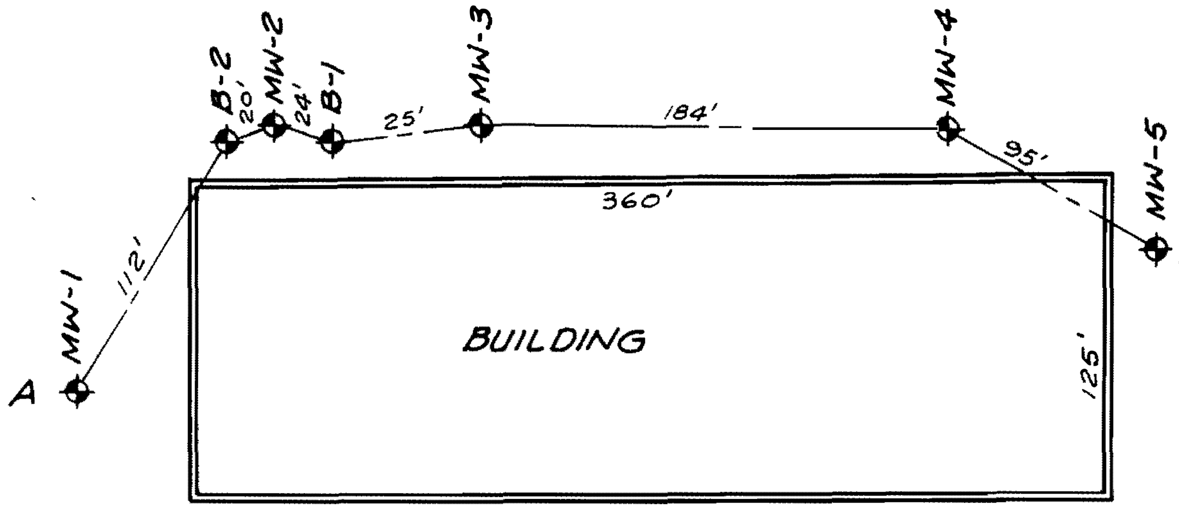
Division of Hazardous Wastes: Files regarding Hazardous Wastes Discharges within East Farmingdale, Melville Area of Suffolk County

APPENDIX F
SOILS ANALYSIS DATA
(BOUND SEPARATELY)

APPENDIX G
GROUNDWATER ANALYSIS DATA
(BOUND SEPARATELY)



SCALE: HORIZ. 1"=40'
VERT. 1"=10'



PLAN
N.T.S.

LEGEND

- SILT RICH BROWN SOILS, SANDY LOAM, URBAN SOILS (Ur) SOME GRAVEL, DRY TO MOIST
- FINE TO MEDIUM GRAINED QUARTZ SAND, BROWN - TAN, WITH GRAVEL, LOOSE, MOIST
- MEDIUM TO COARSE GRAINED QUARTZ SAN, BROWN - TAN, WITH GRAVEL, LOOSE, MOIST
- COARSE TO VERY COARSE GRAINED QUARTZ SAND, TAN, WITH GRAVEL, LOOSE, MOIST TO WET
- FINE GRAINED SILT RICH BROWN SAND CONTAINING GRAVEL AND ASSORTMENT OF MAN-MADE DEBRIS, DRY TO WET (FILL MATERIAL?)
- LIGHT GRAY CLAY WITH FINE SILT, MOIST

A____A' Line of sedimentary cross section

—— Sedimentary contact, dashed where approximately located

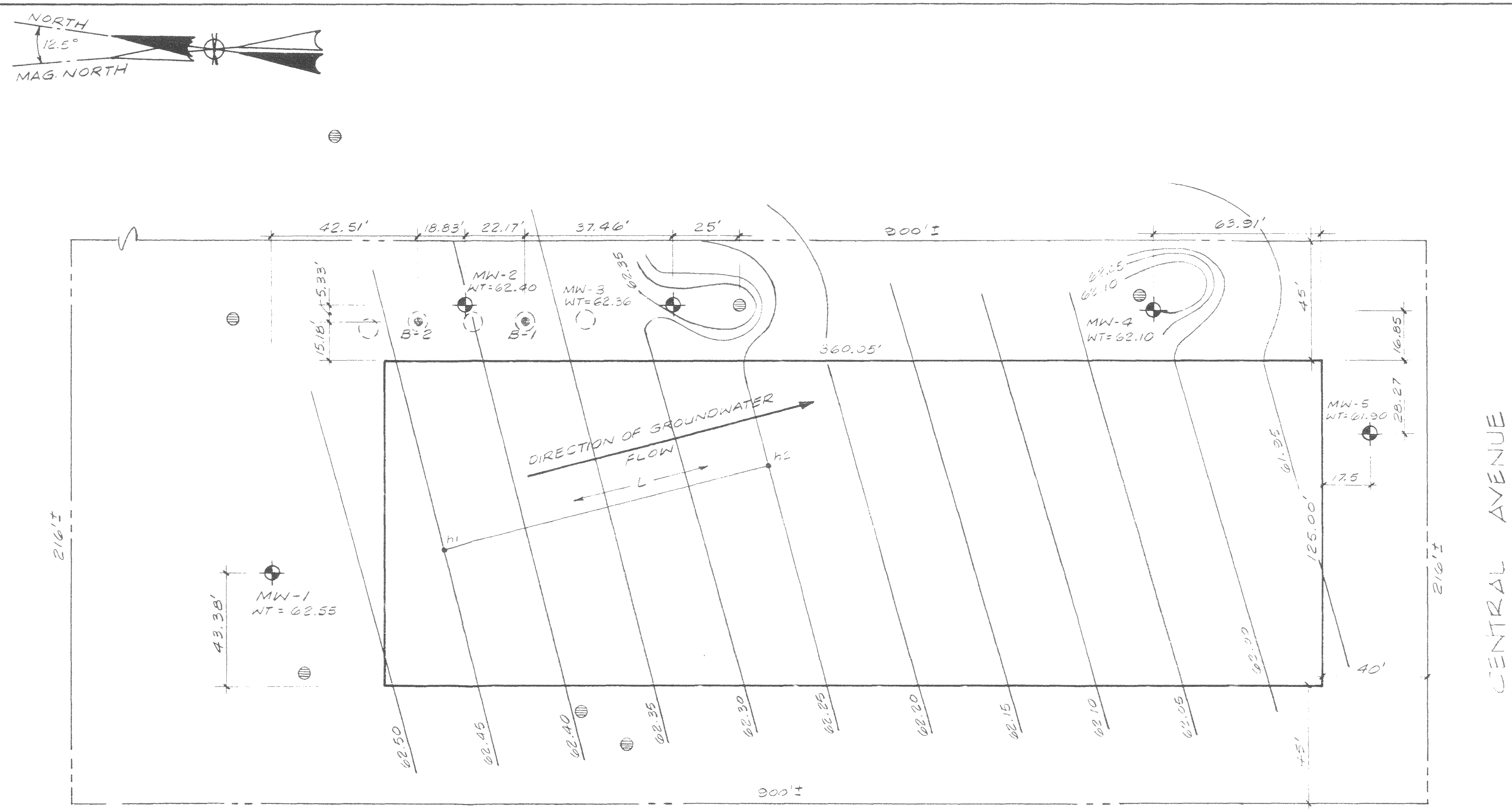
watertable Approximate location of water table during monitoring well installation

ASTRO ELECTROPLATING, INC.
170 CENTRAL AVE., EAST FARMINGDALE, N.Y.

SEDIMENTARY
CROSS SECTION

RICHARD D. GALLI P.E.,P.C.
52 BROADWAY - GREENLAWN, NY 11740

DR AXC	SCALE AS SHOWN	DWG NO 6.1
CKD TF	DATE 9-6-89	
APPD RDG		



LEGEND

- 62.00 — WATER TABLE CONTOUR LINE (VALUES IN FEET)
- MW-1 WT=62.36 — MONITORING WELL (WATER TABLE ELEVATION)
- B-1 — EXPLORATORY BORING
- LOCATION OF PAST DISCHARGE OF WASTE WATERS
- LOCATION OF STORM DRAIN

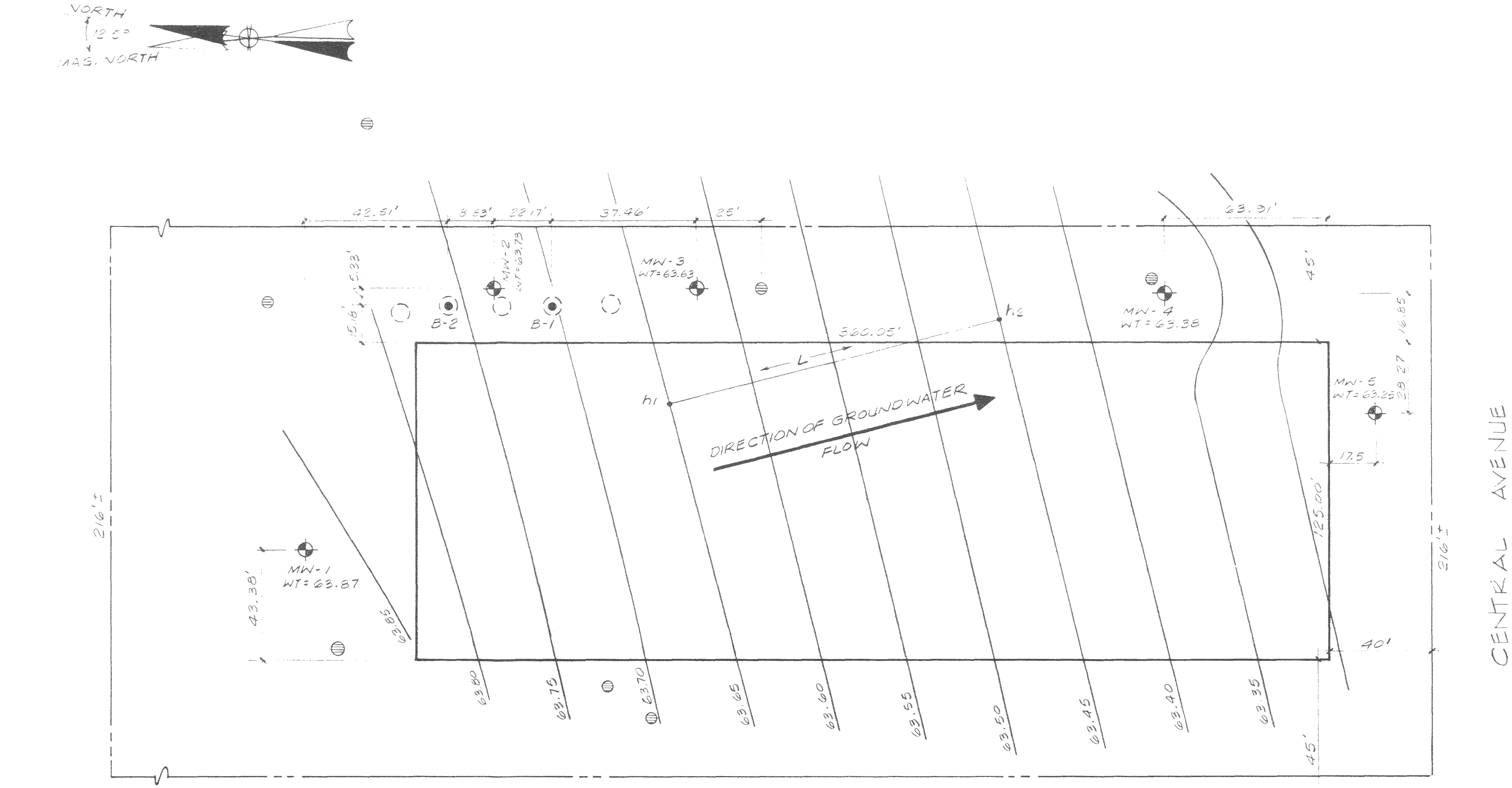
NOTE: ALL ELEVATIONS TO SUFFOLK COUNTY DATUM.

ASTRO ELECTROPLATING, INC.
170 CENTRAL AVE., EAST FARMINGDALE, N.Y.

GROUNDWATER CONTOUR MAP
UPPER GLACIAL AQUIFER
MAY 30, 1989

RICHARD D. GALLI P.E.,P.C.
52 BROADWAY - GREENLAWN, NY 11740

DR AXC	SCALE 1" = 30'	DWG NO 6.2
CKD TF	DATE 9-6-89	
APPD RDG		



LEGEND

62.00 — WATER TABLE CONTOUR LINE (VALUES IN FEET)

MW-1 WT=62.36 — MONITORING WELL (WATER TABLE ELEVATION)

B-1 — EXPLORATORY BORING

LOCATION OF PAST DISCHARGE OF WASTE WATERS

LOCATION OF STORM DRAIN

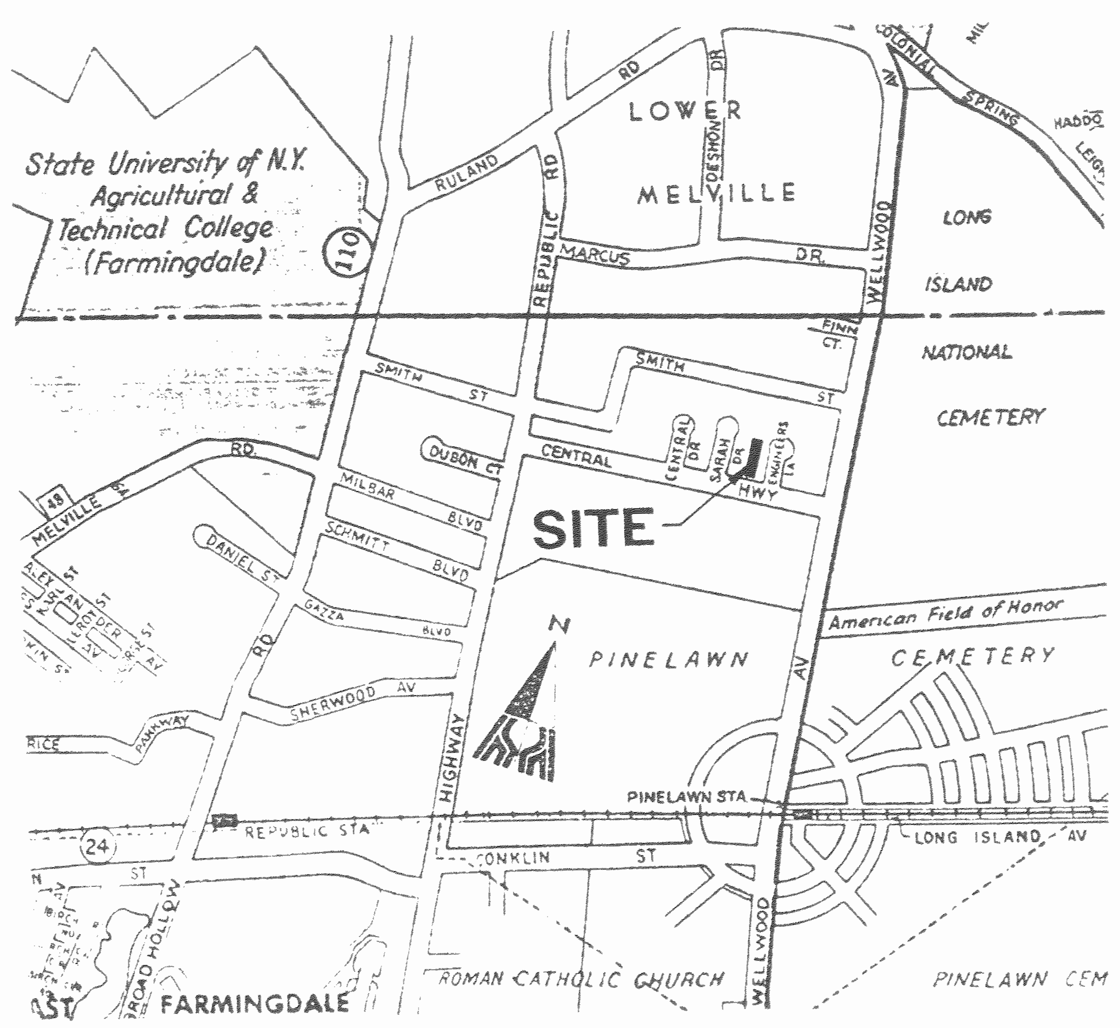
NOTE: ALL ELEVATIONS TO SUFFOLK COUNTY DATUM.

ASTRO ELECTROPLATING, INC.
170 CENTRAL AVE., EAST FARMINGDALE, N.Y.

GROUNDWATER CONTOUR MAP
UPPER GLACIAL AQUIFER
JUNE 27, 1989

RICHARD D. GALLI P.E.,P.C.
52 BROADWAY - GREENLAWN, NY 11740

DR AXC	SCALE 1" = 30'	DWG NO 6.3
CKD TF	DATE 9-6-89	
APPD RDG		



KEY MAP

LEGEND

MW-1 — MONITORING WELL

B-1 — EXPLORATORY BORING

LOCATION OF PAST DISCHARGE OF WASTE WATERS

LOCATION OF STORM DRAIN

NOTE: ALL ELEVATIONS TO SUFFOLK COUNTY DATUM.

166 CENTRAL AVENUE
LOCATION OF TRONIC PLATING, INC.
USEPA SUPERFUND SITE

ASTRO ELECTROPLATING, INC. 170 CENTRAL AVE., EAST FARMINGDALE, N.Y.	
PLOT PLAN	
RICHARD D. GALLI P.E.,P.C. 52 BROADWAY - GREENLAWN, NY 11740	
AXC / TF / RDG	SCALE 1" = 20' · DATE 9-6-89 · DWG NO. 1.1