REMEDIAL INVESTIGATION

DRAFT

LINK FLIGHT SIMULATION DIVISION

HILLCREST FACILITY
BINGHAMTON, NEW YORK

NYSDEC SITE No. 704015

PREPARED FOR

CAE-LINK CORP.

VOLUME 1

H2MGROUP

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CONSULTING ENGINEERS · ARCHITECTS · PLANNERS · SCIENTISTS · SURVEYORS

MELVILLE, N.Y. RIVERHEAD, N.Y. FAIRFIELD, N.J.

GLOSSARY

	Reference
Applicable or Relevant and Appropriate Requirements	ARARs
Bioconcentration Factor	BCF
Carcinogen Assessment Group	CAG
Clean Air Act	CAA
Chronic Daily Intake	CDI
Cancer Potency Factor	CPF
Clean Water Act	CWA
Comprehensive Environmental Response, Compensation & Liability Act	CERCLA
Contract Laboratory Protocol	CLP
Food & Drug Administration	FDA
Health Effect Assessment	HEA
Integrated Risk Information System	IRIS
Maximum Contaminant Levels	MCLs
National Ambient Air Quality Standards	NAAQs
National Contingency Plan	NCP
New York State Department of Environmental Conservation	NYSDEC
New York State Department of Health	NYSDOH
Non-carcinogens	NCs
Occupational Safety & Health Act	OSHA
Potential Carcinogens	PCs
Public Health Evaluation	PHE
Publicly-Owned Treatment Works Standards	POTWs

	Reference
Remedial Investigation	RI
Resource Conservation Recovery Act	RCRA
Risk Reference Dose	RfD
Safe Drinking Water Act	SDWA
Superfund Public Health Evaluation Manual	SPHEM
United States Department of Agriculture	USDA
United States Environmental Protection Agency	USEPA
United States Geologic Survey	USGS
Water Quality Criteria	WQC

CAE-LINK CORPORATION
LINK FLIGHT SIMULATION DIVISION
REMEDIAL INVESTIGATION REPORT
HILLCREST FACILITY
BROOME COUNTY, NEW YORK

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT'D.)

TABLE OF CONTENTS (CONT'D.)

PAGE NO.

TABLE OF CONTENTS (CONT'D.)

LIST OF TABLES

TABLE OF CONTENTS (CONT'D.)

LIST OF TABLES

TABLE OF CONTENTS (CONT'D.)

LIST OF FIGURES

TABLE OF CONTENTS (CONT'D.)

LIST OF FIGURES

FIGURE NO. PAGE NO.

LIST OF APPENDICES

CAE-LINK CORPORATION
LINK FLIGHT SIMULATION DIVISION
REMEDIAL INVESTIGATION REPORT
HILLCREST FACILITY
BROOME COUNTY, NEW YORK

MARCH 1990

EXECUTIVE SUMMARY

The purpose of conducting a remedial investigation (RI) is to determine the nature and extent of contamination present at a facility so that its' potential impact to human health and the environment can be determined. Therefore, the focal point for the remedial investigation conducted during July through September 1989 at the CAE-Link Corporation, Link Flight Simulation Division (Link), Hillcrest, New York facility was the baseline risk assessment. The baseline risk assessment used the analytical data generated during the RI to address the potential impacts to human health and the environment associated with the manufacturing operations conducted at the Hillcrest facility.

As required by United States Environmental Protection Agency (USEPA) guidelines, the baseline risk assessment was conducted using very conservative assumptions and, therefore, represents a "worst case model". The estimates presented in this analysis represent the upper end of the range of actual exposures and risks. The baseline risk assessment also allows a determination to be made whether remedial actions beyond those already implemented are required.

An evaluation of potentially completed exposure pathways determined that only one key completed exposure pathway exists. This is the human populace that may be exposed (by swimming or wading) to the surface water of the Chenango River into which the groundwater contaminant plume discharges. **The analysis conducted that constitutes the baseline risk assessment for this exposure pathway indicated no increased risk due to the discharging of impacted groundwater into the Chenango River.**

The attached remedial investigation report describes the major findings of the remedial investigation. The New York State Department of Environmental Conservation (NYSDEC) and CAE-Link Corporation entered into an Order on Consent in February 1988 which required the corporation to conduct the Remedial Investigation (RI). The RI focused on a further investigation of the on-site contaminant source area (decommissioned industrial outfall system 004). The potential pathways of contaminant migration were determined to be air, soil and groundwater, with special emphasis on the groundwater pathway. A soil gas investigation was also performed in the study area surrounding the Hillcrest facility to determine if volatile organic contamination in groundwater was migrating in the vadose zone.

The hydrogeologic portion of the remedial investigation included the installation of additional on-site and off-site monitoring wells. Two (2) rounds of groundwater sampling were performed at a total of fourteen (14) existing and new monitoring wells. Soil borings were drilled through the leaching pool system within the decommissioned industrial outfall system 004.

Groundwater and soil samples were submitted for laboratory analysis for Target Compound List (TCL) volatile organics and inorganics including cyanide and hexavalent chromium and pesticides/PCBs according to Contract Laboratory Protocols (CLP). Soil gas samples were submitted for laboratory analysis for priority pollutant volatile organics.

A volatile organic plume consisting of trichloroethylene and 1,1,1-Trichloroethane was determined to be emanating from the Hillcrest facility. **It was identified as being confined to the thin (10 to 25 feet thick) upper water table aquifer throughout the study area by the presence of a thick (approximately 140 feet) low permeability underlying silt unit. The silt unit effectively creates a lower boundary, separating the upper water table aquifer from the deeper aquifer used 2,500 feet upstream to the north of the Hillcrest facility for drinking water purposes.**

The key release mechanism of the volatile organic and inorganic contamination at the site is via rainfall with resultant infiltration to groundwater at contaminant source areas. Contaminants from the source areas travel via the groundwater environmental pathway towards the west-northwest to discharge locally at the Chenango River. The volatile organic contamination emanating from the Hillcrest facility is seen to readily migrate with groundwater flow and is not expected to be significantly sorbed by soil.

Concentrations in excess of drinking water standards of inorganic compounds were identified at the majority of monitoring wells. Overall, the elevated concentrations can be partially attributed to extreme groundwater sample turbidity. Upon comparison of filtered and unfiltered analytical data, significant reductions in inorganic compounds were found. Elevated concentrations of inorganic compounds predominantly exist at monitoring wells adjacent to the decommissioned industrial outfall system. The inorganic compounds present as contaminants currently on-site at the Hillcrest facility tend to form complexes, precipitate or adsorb to different soil particles. Inorganic and volatile organic contamination was identified in soil collected from the leaching pools within the decommissioned industrial outfall system. Based upon the physical and chemical characteristics of these types of inorganic compounds, they are not expected to be significantly mobile or to occur widely through the study area. Soil gas sampling conducted in the study area revealed that the air exposure pathway is not significant in terms of transport of volatile contaminants.

Other potential source areas of volatile organic and inorganic contamination are located within the area downgradient of the Hillcrest facility and to the east of MW-20 (refer to Figure 2-1).

On the basis of the analytical data generated during the RI and the conclusions from the baseline risk assessment, appropriate recommendations for future actions were developed. These recommendations also combine required response actions with respect to the on-site remedial activities already performed. Leaching pools A,B,C, and D in the Link industrial outfall system 004 were put out of service, excavated and removed in October 1983. In July 1986, the discharge of all industrial process water, boiler blowdown, sanitary and cafeteria wastewaters at the Hillcrest facility was transferred to the Johnson City Sewer District. The remaining leaching pools in outfall system 004 were rendered inactive by decommissioning. Sanitary systems were also rendered inactive, decommissioned and further treated by the pump out of liquids and sludges prior to backfilling. Additional remedial measures implemented by Link included the containment of hazardous waste currently stored on-site in regulated storage facilities which limits future potential releases.

RECOMMENDATIONS FOR FUTURE WORK

- Additional Monitoring Wells - The northern extent of the volatile organic plume is not well defined. The area to the north of the Hillcrest facility includes other potential sources of volatile organic contamination. Therefore, additional monitoring wells should be considered to define the above relationships particularly as they relate to the contamination found at MW-20.

- Continued Monitoring - Continued groundwater monitoring of select monitoring wells is recommended in addition to the other proposed measures. Further monitoring of the plume on and off-site is required to monitor the effects of measures already undertaken by Link and those that are proposed.

- Source Controls - Source controls are designed to prevent and minimize the migration of contaminants from source areas. Source control with respect to the Hillcrest facility is proposed to include the limiting of infiltration which is the release mechanism of contamination. This will be accomplished by a combination of measures which include the future reduction of non-contact cooling water and stormwater runoff discharge by facility process changes and the altering of present discharge methods.

1.0 - INTRODUCTION

1.1 - PURPOSE

The overall objectives of the remedial investigation (RI) were to fully determine the nature, type, extent and physical state of soil and groundwater contamination associated with the manufacturing facility owned and operated by the CAE-Link Corporation, Link Flight Simulation Division (Link) in Hillcrest, Broome County, New York. The specific objectives of the RI are as follows:

(1) Characterize all waste and other materials on-site which are possible sources of pollution at the site.

(2) Determine the nature, type and physical state(s) of pollution on-site and/or emanating from the site.

(3) Determine the horizontal and vertical extent of pollution at and/or emanating from the site.

(4) Determine the migration paths of the pollutants.

(5) Determine the impact of the pollution on human health and the environment. 6. Assess alternatives

The potential pathways of contaminant migration are air, soil and groundwater. The remedial investigation addresses these pathways with special emphasis placed on the groundwater pathway, which has been shown to be the most significant at this site.

As a result, conclusions were made concerning the potential for migration of contaminants from the site via groundwater, risks to human health and the environment, and the necessity for and extent of remedial measures to be pursued.

This report is based on data obtained by H2M during field and research activities conducted from July 1989 through September 1989. The study focused on areas of the site which are adjacent to the Hillcrest facility, with additional emphasis placed on delineating on-site source areas. Encompassed in this report are findings related to the site's history, geology, and hydrology with respect to the analytical data generated.

1.2 - SITE BACKGROUND

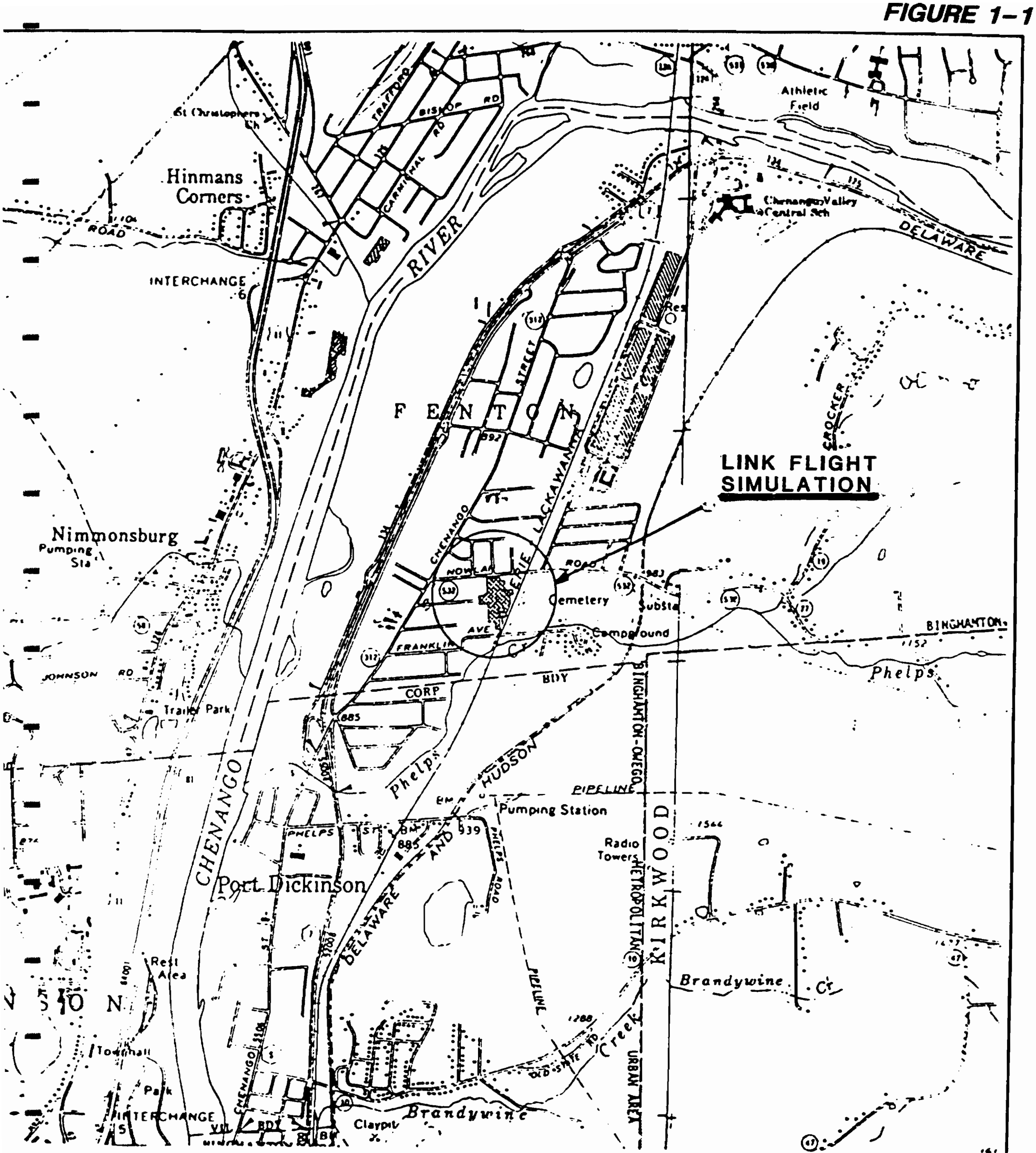
1.2.1 - Site Description - Location

The Link Flight Simulation Division, Hillcrest facility, is located at 11 Beckwith Avenue in the Town of Fenton, Broome County, New York. The 15-acre facility is located in a commercial/residential community approximately five miles northeast of the City of Binghamton as shown in Figure 1-1, Location Map. Link is involved in the manufacturing and production of flight simulators and peripheral equipment.

Along the eastern edge of the property, the Erie Lackawanna Railroad separates the site from the Chenango Valley Cemetery. The surrounding land is mostly residential; however, there are several commercial/industrial facilities located nearby. Auto body shops, industrial platers, gasoline stations, former dry cleaning establishments and residential dry wells are just a few of the facilities surrounding the Hillcrest site.

Approximately 2,500 feet west of the facility is the Chenango River, which flows south and drains a significant portion of central New York State into the Susquehanna River.

FIGURE 1-1



LOCATION MAP

Additionally, there is a small stream, Phelps Creek, that flows intermittently during wet periods from east to west located approximately 300 feet south of the site.

1.2.2 - Site History

Link's Hillcrest facility is a two-story manufacturing/office building. The building space is utilized as 50 percent office and 50 percent manufacturing, with most of the manufacturing occurring along the east side of the building and the offices along the west side.

The real estate holdings of the facility are as follows:

(1) Prior to 1919 - Hires Condensed Milk Co.
(2) Sold 8/6/19 to Universal Can Company, Inc.
(3) Leased 5/10/29 to Grand Union Co.
(4) Conveyed by merger to Nestles Milk Products, Inc.
(5) Leased 11/20/35 to Sears Roebuck & Co.
(6) Leased 5/9/40 to Endicott Johnson Shoe Co.
(7) Sold 11/20/40 to Link Aviation, Inc.
(8) Entered 12/16/40 into an emergency plant facility, Contract No. W535 a.c. 16994.
(9) Deeded 7/8/48 by USA acting by and through War Assets Administration (quit claim) to Link Aviation Devices, Inc.
(10) 1946 - Name change to Link Aviation Inc.
(11) 1954 - Acquired by General Precision Equipment Corporation.
(12) 1959 - Incorporated as subsidiary of General Precision Equipment Corporation.

(13) 1960 - Link Aviation became Link Division of General Precision Inc.

(14) 1963 - Became Simulation and Control Group of General Precision Inc.

(15) 1967 - General Precision changed to General Precision Systems Inc.

(16) 1968 - General Precision Equipment Corporation was acquired by The Singer Company.

(17) 1968 - General Precision System changed to Singer General Precision Inc., Subsidiary of The Singer Company.

(18) 1971 - Link operation known as The Singer Company, Link Division.

(19) 1972 - Link Division was omitted and replaced by Simulation Products Division.

(20) 1976 - Simulation Products Division changed to Link Division.

(21) 1981 - Link Division in Binghamton became Link Flight Simulation Division of The Singer Company.

(22) 1987 - Link Flight Simulation Division was an unincorporated division of The Singer Company following Paul Bilzman's hostile acquisition.

(23) April 1988 - Singer organized Link Flight Simulation Corporation to receive assets of Link Flight Simulation Division.

(24) August 1988 - CAE Industries Ltd. acquired Link Flight Simulation Corporation from Aerospace Holding Company.

(25) To Present - Link Flight Simulation Division was an unincorporated division of CAE - Link Corporation owned by CAE Industries Ltd.

A chronological history of known activities on the site is presented below:

- <u>Building/Facilities</u>

1917 -	Construction of the facility is completed.
1939 -	Building purchased by Link Aviation Devices, Inc.
1939 - 1984 -	No significant structural changes.
1984 - Present -	Exterior additions of prefabricated office trailers along the northwest and southwest boundaries of the building. These trailers are utilized as temporary office space. The southern portion of the "K-Dock" area was enclosed in 1987.

- <u>Processes and Equipment</u>

Link is involved in the manufacturing of flight simulators and peripheral equipment. Processes involved in the manufacturing of these simulators, which generate industrial wastewaters include:

1949 - Present -	Metal Finishing - Operations involve a variety of surface treatment processes designed to enhance the corrosion resistance, paint adhesion and cosmetic qualities of the parts being processed.
1949 -	Cadmium cyanide plating Chromic acid anodizing Nickel plating Iron phosphate coating
1956 -	Present facility installed with these processes in use: Copper plating Chromate conversion coating

1956 (cont'd.)
Chromium plating
Cadmium plating
Silver plating
Zinc phosphate coating
Sulfuric anodizing
Black oxide coatings
Paint stripping

- Photo Processing - Photographic film processing is performed by a LogE automated film processor.

- Silk Screen Lab - Operations involve transferring an image to a photo-sensitive plate which is then etched to produce the silk screen.

1960 - Printed Circuit Board Lab - Small-scale operations with prototype research and development.

- Fiberglass Shop - Operations involve the fabrication of fiberglass components from wooden molds and forms.

1961 - Rhodium plating
Gold plating
Tin/Lead alloy plating
Chromic sulfuric etching of copper

Early 1960's - Expansion of metal finishing processes.

1967 - Rhodium plating and tin/lead alloy plating discontinued.

1973 - Cadmium plating discontinued, zinc plating substituted.

1976 - Elimination of plating associated with printed circuit board production.

1977 - Discontinue black phosphate coating and electroless nickel plating.

1981 - Discontinue use of chromic anodizing, chromium, copper, gold, silver and nickel plating and electroless nickel plating.

1983 - Elimination of wet paint booth. Replaced with a dry filter type spray booth.

- Elimination of trichloroethylene in vapor degreaser.

New processes from 1985-Present include:

1985	-	Plating floor diking installed to eliminate process bath spills.
1986	-	Installed new vapor degreaser
	-	Removal of chrome tank exhaust
	-	Modifications to Plating Department air emissions
1987	-	Discontinued use of methylene chloride as a paint stripper
1989	-	Pilot Study for substituting 1,1,1-trichloroethane initiated

- Raw Materials Used and Products Made

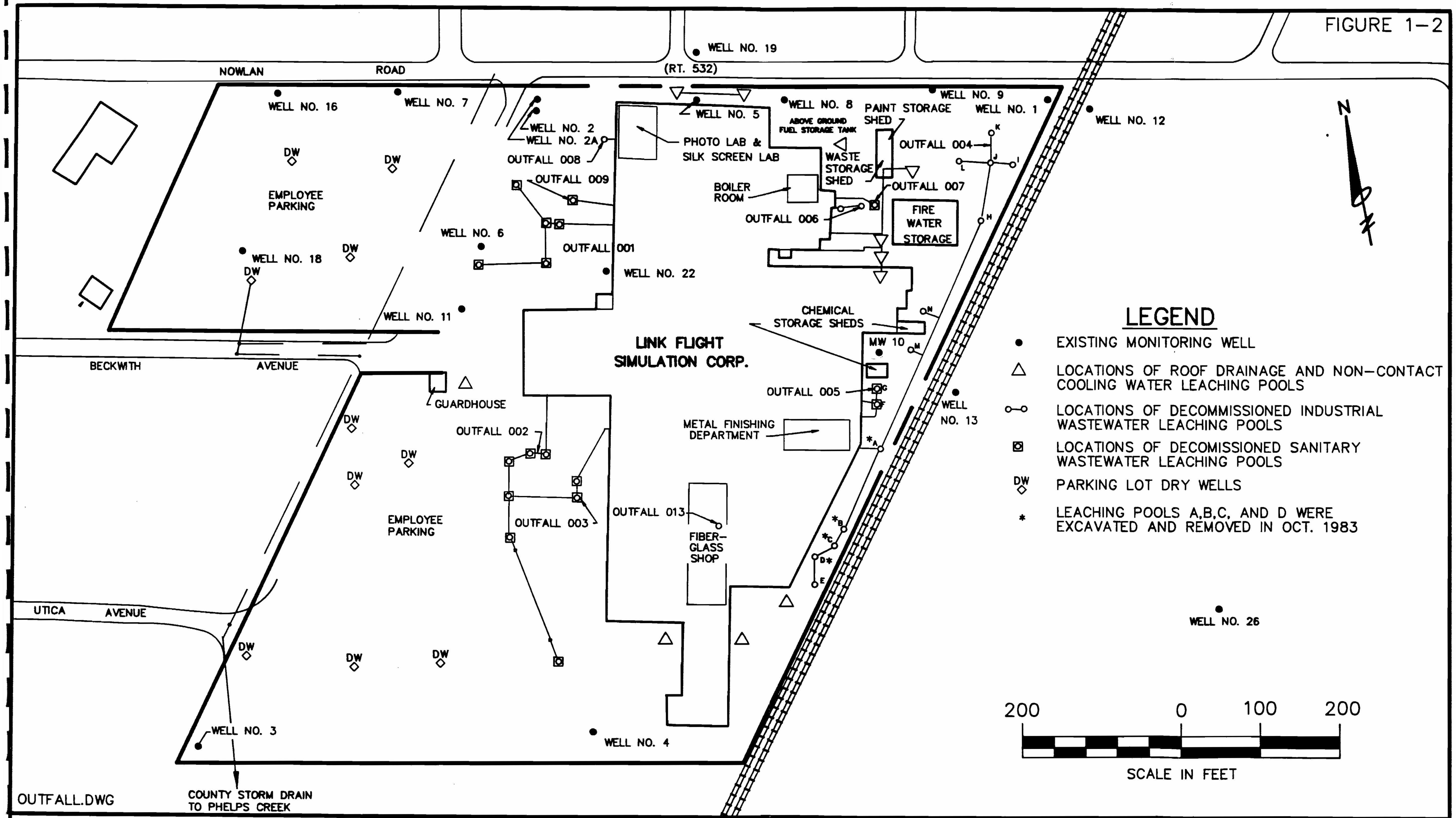
Copies of Link's Material Safety Data Sheets have been forwarded to Mr. Bill Miner (NYSDEC) in Albany. Appendix A is a listing of chemicals and/or compounds purchased for manufacturing processes at Hillcrest for the past ten (10) years. Specific constituents may not presently be in use. Utilization of these materials is necessary to comply with the strict requirements of government contracts in the production of the simulators.

- Disposal History

A chronological history of disposal practices associated with plant processes is listed below. Figure 1-2 illustrates the locations of the disposal systems and the respective locations of the metal finishing department, fiberglass shop and the photo and silk screen lab.

Prior to 1986	-	Disposal of sanitary wastewaters, cafeteria wastewaters, non-contact cooling water and industrial process wastewater was through a SPDES permitted (1981) on-site disposal system.
	-	Outfalls 001, 002, 003, 005, 007 and 009 accepted a total average flow of 15,000 gallons per day (GPD) of sanitary wastewater.

FIGURE 1–2



LINK FLIGHT SIMULATION CORP., HILLCREST SITE MAP

H2M GROUP ENGINEERS · ARCHITECTS · PLANNERS · SCIENTISTS
MELVILLE, N.Y. RIVERHEAD, N.Y. FAIRFIELD, N.J.

Prior to 1986 (cont'd.)	- Outfall 002 accepted approximately 5,000 GPD of cafeteria wastewater.
	- Outfall 004 accepted approximately 24,500 GPD of industrial process wastewater.
	- Outfall 006 accepted approximately 1,000 GPD of boiler blowdown.
	- Outfall 008 accepted approximately 500 GPD of photographic film process wastewater.
	- Numerous outfalls accepted 76,000 GPD of non-contact cooling water.
	- Four of the leaching pools in outfall 004 (A,B,C,D) were cleaned and decommissioned in October 1983.
July 1986	- Hookup to Johnson City Sewer District No. 1. Decommissioning of industrial outfall system 004 by rendering them inactive and diverting discharges to sewer district. Discharge of all industrial process wastewater, boiler blowdown, sanitary and cafeteria wastewaters transferred to the sewer system.
	- Cleanout and burial of outfalls 001, 002, 003 and 009.
	- Discharge of roof drains into non-contact water seepage pits, permitted by SPDES discharge permit.
	- Plating dike.

Tables 1-1 and 1-2 summarize the above relationships to the various outfall systems, detailing volumes discharged and status of outfall.

- <u>Water Budget</u>

The Link Hillcrest facility receives its entire water supply from the municipal supply of the Town of Fenton Water Department. Internal water usage was fairly consistent throughout the years at the Hillcrest facility. Readings from the three water meters

TABLE 1-1

SUBSURFACE DISPOSAL SYSTEMS

HILLCREST FACILITY

1) Decommissioned Industrial Wastewater Discharge Systems

Outfall 004:	Industrial process wastewater (12)
Outfall 006:	Boiler blowdown (2)
Outfall 008:	Industrial process wastewater (1)
Outfall 0013:	Fiberglass shop wastewater (1)

( ) = Number of leaching pools

2) Decommissioned Sanitary Wastewater Discharge Systems

Outfall 001:	Five leaching pools
Outfall 002:	Six leaching pools
Outfall 003:	Two leaching pools
Outfall 005:	Two leaching pools
Outfall 007:	One leaching pool
Outfall 009:	One leaching pool

3) Active Roof Drainage System

Consists of discharges to leaching pools located on site map (Figure 1-2).

4) Non-Contact Cooling System Water Discharge System

Consists of discharges to leaching pools located on site map (Figure 1-2).

5) Parking Lot Stormwater Drywell System

Consists of discharge to leaching pools (dry wells) located on site map (Figure 1-2).

NOTE:

The leaching pools are constructed similarly and are made of concrete or cinderblock rings with a diameter of up to 10 feet. The pools are up to 10 feet deep and have a pervious gravel floor.

TABLE 1-2

PREVIOUS DISPOSAL SYSTEM HISTORY

OUTFALL SYSTEMS

Outfall System	Discharge Source	Volume	Status
001	Sanitary Wastewater	(1)(2)	Decommissioned; cleaned and buried
002	Sanitary Wastewater	(1)	Decommissioned; cleaned and buried
003	Sanitary Wastewater	(1)	Decommissioned; cleaned and buried
004	Industrial Process Wastewater (inactive)	24,500 GPD	A,B,C & D - Excavated and removed October 1983; H,I,J,K,L & M decommissioned July 1986
005	Sanitary Wastewater	(1)	Decommissioned
006	Boiler Blowdown	1,000 GPD	Decommissioned
007	Sanitary Wastewater	(1)	Decommissioned
008	Industrial Wastewater	500 GPD	Decommissioned
009	Sanitary Wastewater	(1)	Decommissioned; cleaned and buried

<u>NOTES</u>:

(1) Outfalls 001, 002, 003, 005, 007 and 009 accepted a total average flow of 15,000 gallons per day (GPD) of sanitary wastewater.

(2) Outfall 002 accepted approximately 5,000 GPD of cafeteria wastewater.

(3) All of the water since July 1986 is disposed of through the Johnson City Sewer District, except for non-contact cooling water disposed through SPDES permitted seepage pits.

Numerous outfalls accepted 76,000 GPD of non-contact cooling water.

Sanitary systems were decommissioned by pumpout of liquids/sludges and buried (backfilled).

Reference is made to Figure 1-2 showing locations of outfall systems, non-contact cooling water leaching pools and dry wells.

on-site indicated that approximately 122,000 gallons total per day (GPD) of water was utilized throughout the facility in 1982. Breakdown of these volumes are outlined in the following:

Sanitary System	20,000 GPD
Boiler Feed	1,500 GPD
Cooling Water	68,500 GPD
Process Water	24,500 GPD
Evaporation	7,500 GPD

All of the water, since July 1986, is disposed of through the Johnson City Sewer District, except for the non-contact cooling water which is disposed of through SPDES permitted seepage pits on the north and south side of the building. Estimated total current water usage has decreased and is 82,000 GPD.

1.2.3 - Waste Characterization

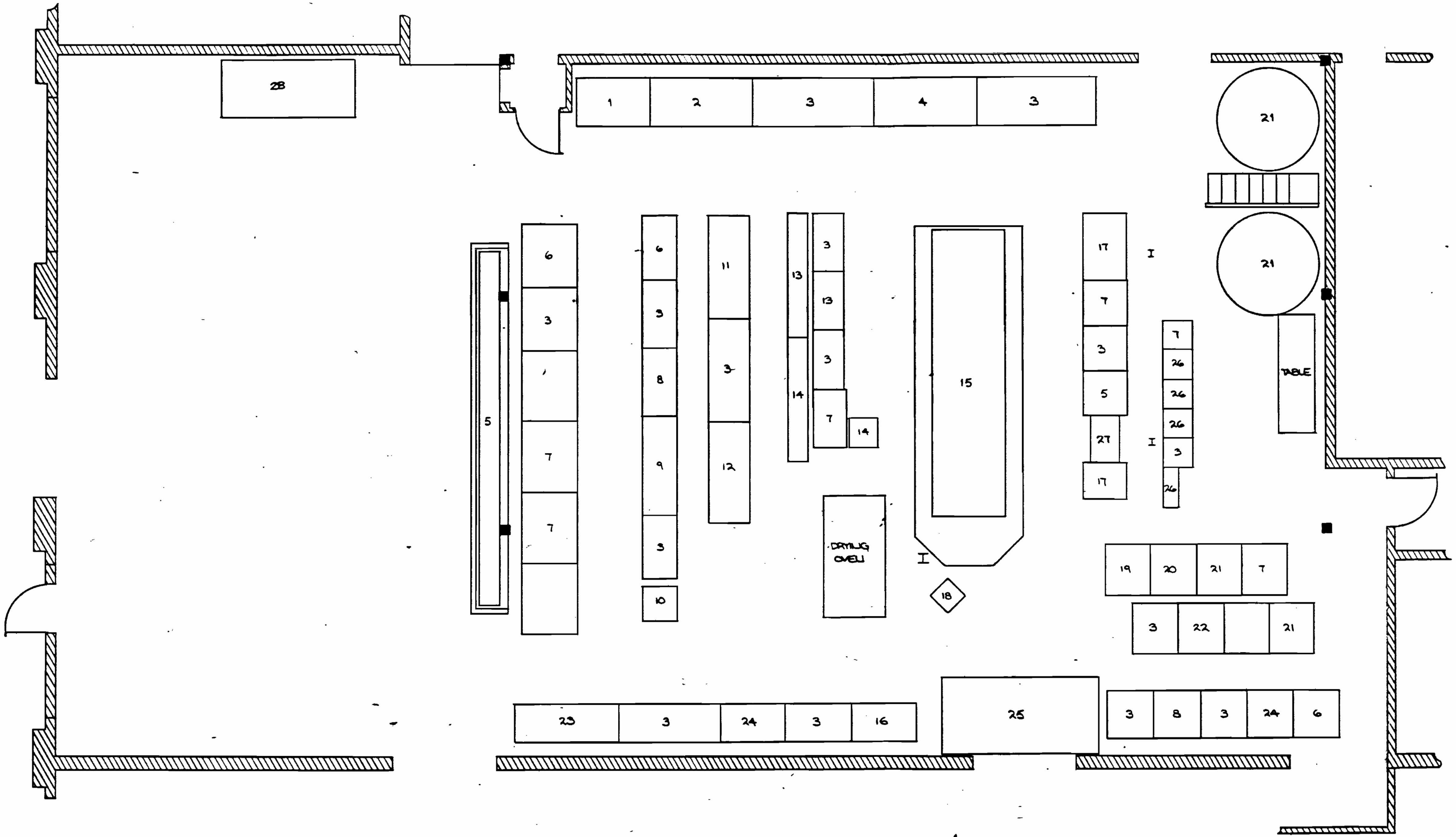
Detailed information on the past manufacturing operations performed at the facility that contributed to or affected the generation of industrial wastewaters or hazardous waste was provided in a previous assessment entitled, "Hydrogeologic Evaluation and Risk Analysis Study", prepared by H2M in 1984. As described in Section 1.2.2, prior to 1986, all of the facility's wastewaters were discharged via a system of outfalls. As of 1986, these outfalls were decommissioned (rendered inactive) with the facility's hookup to the municipal sewer system. Presently, the only wastewater not discharged to the sewer system is the non-contact cooling water from air conditioning and storm water runoff.

In order to identify waste constituents of primary concern, it is important to review past and present plant processes that utilized, generated or required disposal of wastewaters on-site. In particular, the waste characteristics of concern are associated with past discharges.

The plant processes considered potential sources of contamination in the past were: metal finishing, photo processing, the silk screen lab, the printed circuit board lab, the fiberglass shop, boiler blowdown, non-contact cooling water, and sanitary wastewaters. Of these processes, the metal finishing is the largest source of process wastewaters (>90% of the total process wastewater). Figure 1-3 illustrates the current configuration of the metal finishing department and a tabulation of the metal finishing process baths. Most of the possible contaminants were identified as metals (i.e., cadmium, chromium, copper, iron, lead, nickel and zinc), acids (chromic and sulfuric) and some organic solvents (methylene chloride as a paint stripper, trichloroethene and 1,1,1-trichloroethane as degreasers).

Possible contaminants from the other processes were identified as:

- Exhausted developer, silver and rinse water from the film processor.
- Methyl alcohol from the silk screening lab.
- Electroless and electroplating-type immersion baths from the printed circuit board R+D lab.

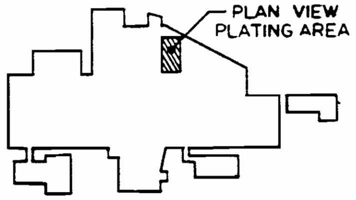


PLATING AREA - PLAN VIEW

SCALE: 1/4"=1'-0"

TANK SCHEDULE	
1	ENBOND ALKALI CLEANER
2	OAKITE ALKALI CLEANER
3	COLD WATER RINSE
4	HYDROCHLORIC ACID
5	CHROMATE
6	ALKALI
7	HOT WATER RINSE
8	DEOXIDIZER
9	CHEMICAL CHROMATE
10	PHOSPHORIC ACID
11	BONDERITE
12	PARCOLENE
13	YELLOW CHROMATE ZINC
14	KENVERT
15	ZINC TANK
16	NITRIC ACID
17	BLACK OXIDE
18	ZINCATE
19	CHROMIC ACID
20	NICKEL ACETATE
21	HOLDING TANK
22	DYE
23	PAINT STRIP
24	STRONG ALKALI
25	ANODIZE TANK
26	PASSIVATE
27	OIL
28	DEGREASER
29	
30	
31	

REVISIONS	BY	DATE



HILLCREST KEY PLAN

N.T.S. NORTH

APPROVALS

OPERATIONS		FACILITIES DIRECTORATE	
SECURITY	DATE	J. RATCLIFFE	DATE
DEPT. MGR.		H. ARMSTRONG	
DEPT. MGR.		R. DEALAMAN	
DEPT. MGR.		N. WILLIAMS	
DEPT. MGR.		L. BURNS	

CAE-LINK CORPORATION
LINK FLIGHT SIMULATION
BINGHAMTON, NEW YORK

TITLE
GENERAL LAYOUT - PLATING AREA
"C" BUILDING CENTER

PROJECT NO.	HILLCREST
DRAWN BY R. WOODRUFF	"C" BUILDING CENTER
ENGINEER M. STODDARD	SCALE AS NOTED
DATE 4-6-90	SHEET NO. 1 OF 1
D	DRAWING NO. 1196-90-04-G

- Boiler blowdown.
- Other sanitary discharges.

The current SPDES permit (renewed in 1986) was issued for only two active on-site discharges; non-contact cooling water and storm water runoff.

The facility's wastewater SPDES permit listed the following compounds of concern:

- chromium (Irridite);
- zinc (zinc coating);
- methylene chloride (paint stripper), (eliminated in 1987);
- 1,1,1-trichloroethane (degreaser), (to be eliminated); and
- toluene (cleaning, paint thinner).

In addition to the above-mentioned constituents, a 1986 industrial chemical survey conducted at the facility for the NYSDEC also indicated the presence of xylene and naphthalene.

Quantitative results from sampling and analysis of soils and groundwater monitoring data in the past also aided in the characterization of contaminants present at the facility.

Monitoring well data from 1985 showed that MW-8 had a high oil and grease value indicative of petroleum product in that area. Contamination of this well was the result of a leak in an underground fuel storage tank. Excavation of this tank and the contaminated soils surrounding it was completed in accordance with NYSDOT requirements in 1983.

The 1987 Phase III Hydrogeologic Investigation Report found contaminants in the on-site groundwater and soils including: 1,1-dichloroethylene, tetrachloroethene, trichloroethylene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, vinyl chloride, cadmium, chromium and hexavalent chromium. These contaminants were quantified in concentrations which exceeded either the USEPA drinking water or New York State groundwater quality standards.

In summary, the major characteristics of the groundwater contamination at the site are known to be from process metals, such as cadmium and chromium, oil and grease in local areas, and volatile halogenated organics. The metals and the volatile halogenated organics are the key "fingerprint" constituents used to evaluate the horizontal and vertical extent of the groundwater contaminant plume.

1.2.4 - Previous Investigations

Investigations of the pollution control practices and environmental impacts associated with them at the Link's Hillcrest facility were initiated by Link as early as 1983. A phased investigative approach in determining the environmental impacts of the operation of the facility has been on-going since completion of the H2M report "Hydrogeologic Evaluation and Risk Analysis Study", March 1984. The conclusions of that study included the findings that:

- The potential to contaminate groundwater beneath the plant site was of principal concern;
- Discharge of industrial wastewaters generally complied with the facility's SPDES permit;

- Certain past site processes provide the potential for groundwater contamination; and
- Trace organics were detected in wastewaters discharged.

The recommendations to the Link Flight Simulation Division (Link) were:

- Institute an upstream and downstream groundwater monitoring network;
- Redesign certain plant processes to limit the potential for groundwater contamination; and
- Redesign the wastewater disposal system for hookup to the local sewer district.

Subsequent to the completion of this report, Link entered into an Order on Consent with the New York State Department of Environmental Conservation (NYSDEC) in May 1985 to connect to the new municipal sewer system and initiate a hydrogeologic investigation. The facility completed the connection to the sewer system in July 1986.

The first phase of the hydrogeologic investigation was presented in the report, "Phase I Report, Hydrogeological Conditions at the Singer Company, Link Flight Simulation Division, Hillcrest Facility", October 1985. This report concluded that:

- The geology beneath the site was influenced by the Pleistocene glaciers and that an extensive silt layer (at least 60 feet thick) existed beneath the site;
- Groundwater flow direction is in a west-northwest direction;

- Groundwater contamination of volatile organics and metals existed; and
- Soil contamination did exist along the east and north-east boundaries of the facility.
- Further hydrogeologic investigations were recommended to determine the extent of groundwater contamination.

The facility was subsequently added to the New York State list of "Inactive Hazardous Waste Disposal Sites" in January 1986.

The second phase of the hydrogeologic investigation was presented in the report entitled "Phase II Report, Contaminant Plume Identification at the Singer Link Company, Hillcrest Facility" dated May 1986. Conclusions of this investigation were:

- Contamination existed in the areas north and west of the plant building;
- Additional monitoring wells were needed to determine the off-site extent of contamination; and
- Additional soil investigations should be initiated in the area of outfall system 004.

The Phase III investigation continued with the same objectives of the previous study. It was completed in September 1987 and concluded:

- The soils around Outfall 004 are a source of contamination;
- Upgradient wells indicate the presence of significant amounts of contamination that may be associated with

other off-site sources or the facility's own wastewater discharges; and

- Groundwater volatile organic contamination has migrated off-site and was identified to approximately the 50 ppb concentration contour of the plume.

Subsequent to the submission of the Phase III report to the New York State Department of Environmental Conservation, the State, in February 1988, presented a new Order on Consent to Link and requested that Link conduct a remedial investigation/feasibility study (RI/FS) as described in the RI Work Plan dated May 1988 (revised June 1989).

1.3 - REPORT ORGANIZATION

The remedial investigation report was prepared in accordance with guidelines and specifications established in the United States Environmental Protection Agency (USEPA) "Guidance on Remedial Investigations under CERCLA", and as such is divided into eight sections. The first chapter covers introductory material which discusses the site, its history and the remedial investigation in general. The second chapter provides a summary of the tasks of the remedial investigation. The third chapter details the physical characteristics of the study area incorporating analytical data from the implementation of the remedial investigation. The fourth chapter provides a key characterization of the nature and extent of the contamination quantified on and off-site within the study area. The fifth chapter provides a qualitative description of contaminant fate and transport with an identification of the primary completed exposure pathways. Chapter six is the baseline health risk assessment as well as a preliminary ecological characterization and assessment. Chapter seven is a summary of remedial activities with resultant conclusions and recommendations. Chapter eight provides a reference listing of all pertinent publications. Submitted as a separate volume (Volume 2) are appendices containing summary sheets of analytical data and other pertinent technical information.

2.0 - STUDY AREA INVESTIGATION

2.1 - REMEDIAL INVESTIGATION SUMMARY

The remedial investigation was divided into the tasks detailed in the NYSDEC approved RI work plan (revised June 1989). The purpose of this section is to describe those tasks which included the following:

(1) Contaminated source investigation - additional soil investigation of decommissioned industrial outfall system 004;

(2) Installation of additional monitoring wells to determine the extent of off-site groundwater contamination;

(3) Hydrogeologic investigation to confirm the lateral and vertical continuity of a silt lower confining layer; and

(4) Soil gas investigation of residential area adjacent to the Hillcrest facility.

2.1.1 - Contaminant Source Investigation

As determined by previous investigations, the decommissioned industrial wastewater disposal system (Outfall 004) along the east side of the Link Flight Simulation Division building is a confirmed source of soil and groundwater contamination. As part of the RI, the outfall system leaching pools were further investigated by the drilling of soil borings. Soil samples were collected during the drilling of the soil borings through the bottom of the outfall system leaching pools or adjacent to previously removed leaching pools (A, B, C and D). The locations of the existing and removed leaching pools are depicted on Figure 1-2 with the locations of soil borings shown on Figure 2-1.

Soil samples were obtained from the eight (8) still existing leaching pools (E, H, I, J, K, L, M and N) by drilling through the bottom of the pool and continuously split spoon sampling to the water table. The locations of the four (4) removed leaching pools, A, B, C and D, were identified by plant personnel and soil borings were drilled adjacent to each of the pools.

Split spoon soil samples were collected during the drilling of borings and screened upon opening the sampler with an HNu 10.2 electronvolts (eV) photoionization device (PID). The field response of the HNu PID during the split spoon sampling of these leaching pools was recorded and is assessed in Section 4.2. A maximum of three (3) soil samples for each leaching pool were submitted for laboratory analysis for Target Compound List (TCL) volatile organics, metals and pesticides/PCB parameters according to Contract Laboratory Protocol (CLP) procedures.

The three (3) soil samples were taken at each of the sampling locations at the respective depths listed below according to the following protocols:

(1) Bottom of outfall at existing leaching pools or at 10 to 12 feet below grade adjacent to removed leaching pools;

(2) Approximately 20 feet below grade; and

(3) Interface of water table or approximately 25 to 27 feet below grade.

Any deviation to this sampling program was approved in the field by on-site NYSDEC supervisory field personnel and was recorded in the permanent field record by the H2M hydrogeologist on-site.

2.1.2 - Groundwater Investigation

Additional monitoring wells were needed to fully determine the migration of groundwater contamination emanating from the Hillcrest facility. Monitoring wells employed for detection were located upgradient and downgradient of the suspected sources of groundwater contamination. Another upgradient well was required to document background baseline water quality. Additional downgradient wells were installed to examine on-site groundwater quality, confirm groundwater flow direction, and quantify the presence and magnitude of groundwater contamination downgradient of suspected source areas.

- Existing Well Locations and Construction

Twenty (20) monitoring wells were previously installed from 1985 through 1987. Fourteen (14) of the wells are located on-site and six (6) are located off-site. The off-site wells are MW-12, MW-13, MW-14, MW-15, MW-17 and MW-19. The on-site wells are MW-1, MW-2, MW-2A, MW-3, MW-4, MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, MW-11, MW-16 and MW-18. Locations of all of these wells, with respect to the facility boundaries, are shown on Figure 2-1.

All of the wells, excluding MW-2A, were installed in the overburden to an average depth of approximately 36 feet. Well MW-2A was installed to a depth of 73 feet. The wells were constructed of 2-inch I.D., Schedule 40, flush joint PVC, with threaded couplings and #10 slot screen. The 2-inch PVC casing was installed through a hollow stem auger. The annular space around the well screen was filled with clean silica sand pack extending 3 feet above the top of the well screen. A bentonite seal extending approximately 2 feet above the sand pack was then installed. Any of the wells set in silt were grouted a few feet above the screen to a distance of approximately 5 feet above the silt with a bentonite slurry to prevent seepage of contamination along the sides of the well to the screen.

All of the off-site wells were constructed to be flush with grade, while the majority of the on-site wells have a 3-inch diameter locking steel casing mounted above grade.

- New Monitoring Wells and Locations

Seven (7) additional monitoring wells (MW-20, MW-21, MW-22, MW-23, MW-24, MW-25 and MW-26) were installed August 1989 to better define the extent of the plume emanating from the site. The locations of these wells are shown on Figure 2-1. With prior NYSDEC approval, an exploratory boring program was implemented in lieu of the installation of the two (2) proposed deep monitoring wells (MW-16A and MW-24A). This boring program is discussed in detail in Section 2.1.3.

One (1) new well (MW-22) was installed on-site. This well was completed as a shallow overburden well located on the west side of the main building, east of well MW-6. It was installed to a depth of approximately 31 feet.

At the request of the Broome County Department of Health, one of the off-site wells (MW-20) was installed to serve as an "early-warning" station, to detect groundwater contamination if it were migrating in the upper water table aquifer towards the Town of Fenton Municipal Wells. Well MW-20 is approximately 40 feet deep. It was installed near the intersection of Chenango Street and Hotchkiss Avenue.

MW-21 was installed to monitor the shallow groundwater quality near the intersection of Chenango Street and Lois Avenue. Another off-site well (MW-26) was installed downgradient of the maintenance building of the Chenango Valley Cemetery. This well was located upgradient of the contamination found in the existing off-site well MW-13. It is a shallow overburden well and was used to help define the upgradient groundwater quality.

The existence of the abandoned Chenango Canal alongside the present path of the Brandywine Highway had brought forth questions regarding shallow groundwater flow near the river. Although current data indicates that the bottom of the abandoned canal is well above the saturated aquifer, three (3) monitoring wells were installed in this area (MW-23, MW-24 and MW-25) to help clarify the groundwater flow characteristics of this area. These wells were installed on the east side of the Brandywine

Highway (Route 7) as shallow overburden wells. Peat deposits and silty clay were encountered at a shallow depth at MW-25.

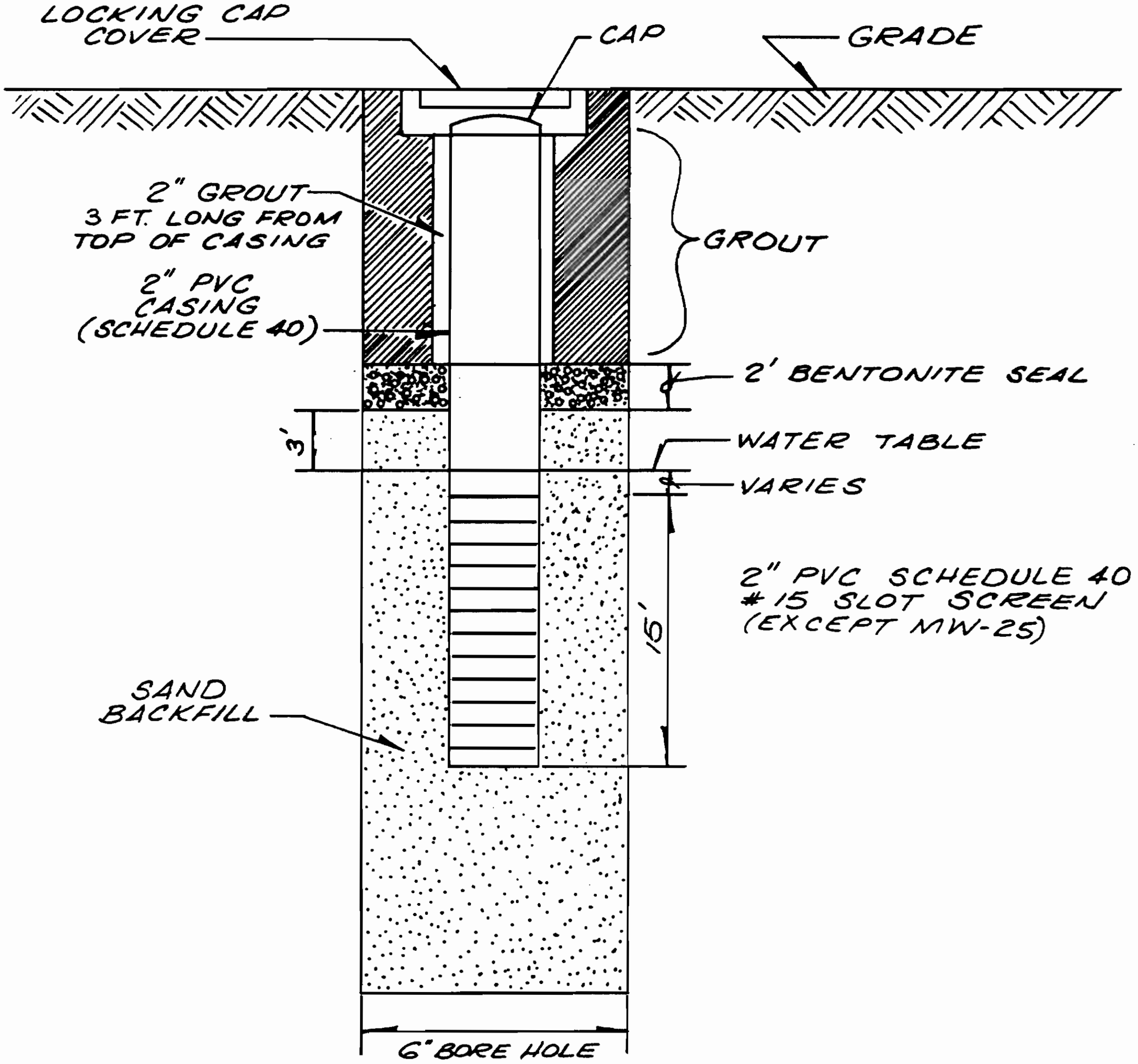
These deposits necessitated installing only a 5 foot screen from 19 to 24 feet to complete the well in a groundwater yielding zone.

- Monitoring Well Design

All new monitoring wells were installed in conformance with NYSDEC Specifications for Wells in Unconsolidated Formations.

The monitoring well construction materials consisted of 2-inch I.D., Schedule 40, flush joint PVC with threaded couplings and #10 slot screen as shown in Figure 2-2. All threaded joints were sealed using teflon tape.

The annular space around the well screen was filled with well graded clean silica sand/gravel pack extending 2 feet above the top of the well screen. A bentonite pellet seal extending 2 feet above the sand pack was then installed. A grout mix, consisting of cement/bentonite, was placed in that portion of the annular space between the drill casing and borehole wall extending from the top of the bentonite seal to the surface seal. A watertight locking cap was attached to the top of the PVC casing. A flush-to-the-ground steel cover assembly was set around the well casing of the off-site wells. This steel cover was set into a sloped concrete pad, after the grout had been allowed to set. The on-site well was installed with protective steel casing protruding approximately 2 feet above the ground. Following installation, the shallow overburden wells were surged



CONSTRUCTION DETAIL OF MONITORING WELLS OFF-SITE OF SINGER COMPANY

LINK FLIGHT SIMULATION DIVISION

HOLZMACHER, McLENDON & MURRELL, P.C.
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until they were considered adequately developed. The groundwater was noted to be extremely turbid. Successive pH and conductivity measurements were used to determine adequate development. Groundwater was noted to still be extremely turbid even after substantial development.

- <u>Collection of Split Spoon Samples</u>

Split spoon samples were collected at 5 foot intervals to obtain representative soil samples for identification purposes and laboratory tests and to obtain a measure of the resistance of the soil to penetration of the sampler. ASTM Procedure D1586-67 was used for the collection of samples using a split spoon.

The split spoon samples were screened with an HNu PID device upon opening of the sampler and after 2 minutes of heating. The raw and heated HNu responses are contained in Appendix B with drilling log data for each of the wells. If any of the soil samples screened were in excess of 5 ppm HNu units, they were to be retained and submitted for laboratory analysis. No soil samples from any of the monitoring well boreholes were in excess of 5 ppm above background. No soil samples were, therefore, submitted for laboratory analysis.

- <u>Geophysical Investigation</u>

To develop additional information on the subsurface aquifer properties, a downhole geophysical investigation was performed in one of the on-site exploratory borings (EB-2). This survey was used to provide confirmatory information regarding the vertical extent of a silt lower confining layer underlying the site. The geophysical investigation consisted of electrical resistivity, gamma ray and spontaneous potential borehole logging from grade to total depth of the boring.

- Hydraulic Conductivity Testing

Slug tests were conducted at the new water table wells to determine in situ hydraulic conductivity values. This test was conducted by causing an instantaneous change in the water level in the well through a sudden introduction of a stainless steel block causing a known displacement of water. The recovery of the water level with time was observed. Data on the slug test are provided in Appendix B.

- Groundwater Sampling

After construction, the new wells were allowed to equilibrate a minimum of ten (10) days prior to the first round of groundwater sampling. To ensure the integrity of water quality samples collected during the RI, the NYSDEC-approved quality assurance/quality control (QA/QC) program was followed. In addition to the samples taken from the groundwater, trip blanks, field blanks and matrix spike/matrix spike duplicate (ms/msd) samples were collected each day sampling was conducted and analyzed along with the regular samples. Approval was received from NYSDEC to utilize the ms/msd samples in lieu of blind duplicates for sampling day. Correspondence documenting this approval is provided in Appendix C.

As dictated by the RI work plan, two rounds of groundwater samples were collected from the seven (7) new wells as well as seven (7) existing wells (MW-6, MW-10, MW-12, MW-13, MW-15, MW-16 and MW-17).

2.1.3 - Geologic Investigation

An underlying silt layer of significant thickness (in excess of 175 feet) was encountered at the borehole of proposed deep monitoring well location MW-16A. Because of the thickness of the silt unit, it was proposed that four (4) exploratory soil borings be drilled to verify the presence of the silt unit throughout the area in lieu of completing the two deep monitoring wells. NYSDEC geologists, Kevin L. Ferrar and Timothy J. Larson, assisted in the development of an exploratory boring program which was approved and implemented in August 1989. The locations for the deep borings were selected to provide detailed subsurface data for the Hillcrest facility and adjacent study area and are shown in Figure 2-1. The boring program included split spoon sampling every 5 feet to total depth to provide sufficient lithologic information on the silt unit.

The following borings were installed to these respective depths to intersect and sample the silt unit:

Boring	Total Depth	Top of Silt*
MW-16A	177 feet	30 feet
B-1	102 feet	50 feet
B-2	102 feet	35 feet
B-3	102 feet	40 feet

* below grade

Additionally, several of the proposed monitoring well boreholes were drilled deeper to confirm the presence of the silt unit. These monitoring well boreholes are indicated as follows:

Monitoring Well	Total Depth	Top of Silt*
20	72 feet	55 feet
21	42 feet	35 feet
24	97 feet	75 feet
25	25 feet	24 feet

* below grade

Split spoon samples of the silt unit were collected and retained. Representative samples were submitted for hydrometer analysis. Detailed lithologic logging was performed during drilling and geophysical logging (gamma, spontaneous potential and resistivity) was conducted at boring EB-2.

2.1.4 - Soil Gas Investigation

A total of eighteen (18) soil gas sampling locations were utilized to investigate soil gas at the Link's Hillcrest facility and adjacent areas. The soil gas sampling locations are shown on Figure 2-3. The soil gas survey conducted in June-July 1988 entailed the collection of soil gas samples for laboratory analysis of priority pollutant purgeable organic compounds.

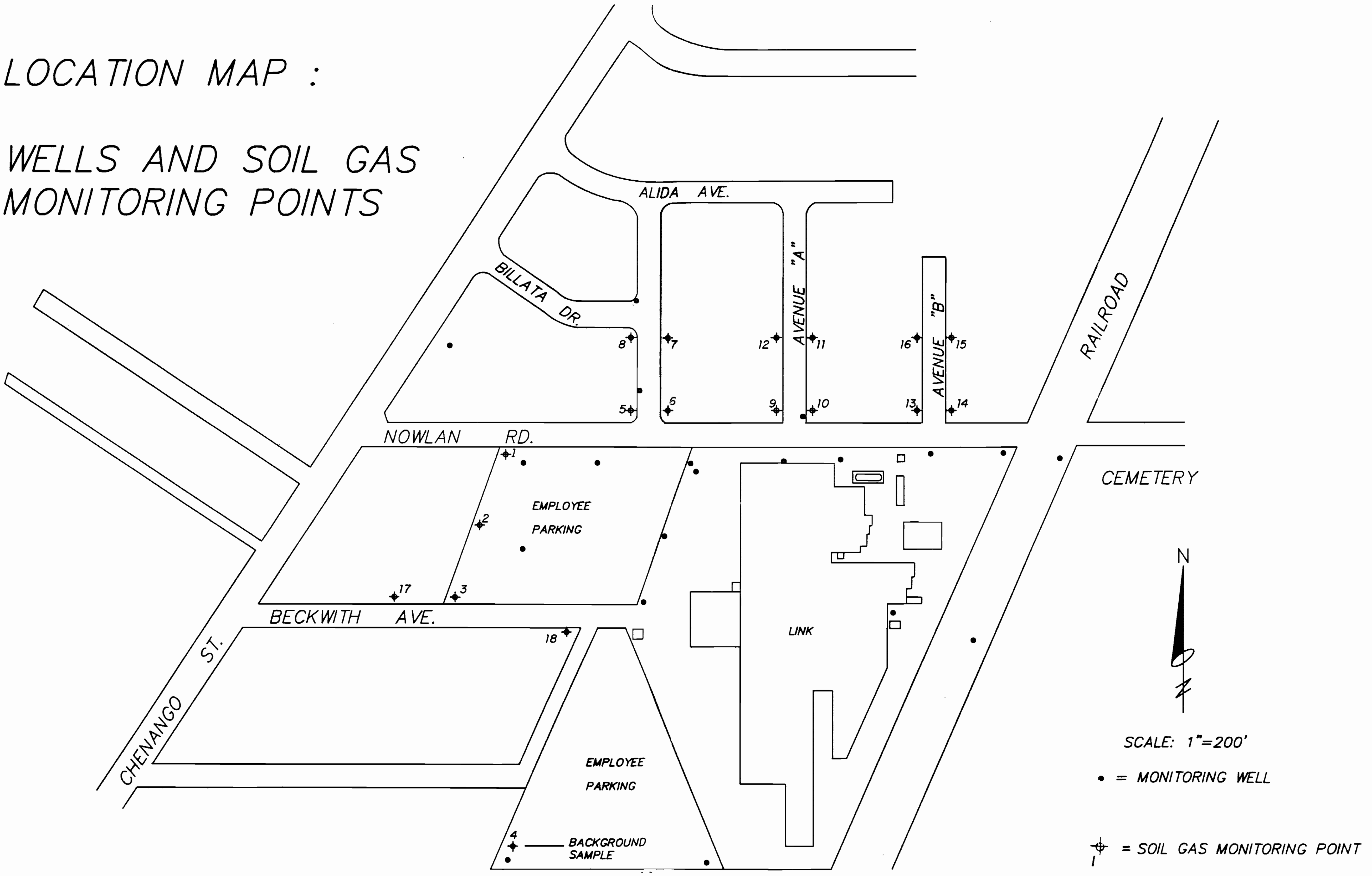
The sampling was conducted in conformance with the protocols submitted by H2M and approved by the appropriate representatives of the NYSDEC and the New York State Department of Health (NYSDOH). At each sampling point, a teflon probe was installed to a depth of approximately 4 feet and soil gas was induced to flow through sorbent tubes that were subsequently analyzed in the laboratory. These probes were removed after sampling.

A soil gas sample was obtained at each sampling location via the use of a portable battery-powered low flow pump that was used

FIGURE 2–3

LOCATION MAP :

WELLS AND SOIL GAS MONITORING POINTS



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to induce the soil gas into sorbent tubes filled with tenax, silica gel and carbon. After evacuation of three standing volumes of air from the probe, the sorbent tubes were connected and processed one liter of air through each tube in one sampling period. The sorbent tubes were desorbed by H2M Labs, Inc. onto a capillary column GC/MS/DS for analysis of purgeable organic compounds using a combination method TO-1 (tenax GC absorption and GC/MS analyses) and TO-2 (carbon molecular sieve absorption and GC/MS analyses) of the EPA Document No. 600/4-84/041.

Samples were collected during two sampling periods, June 2nd and 3rd, 1988 and July 19, 1988. Sample locations SG-1 through SG-16 were sampled in June. However, the SG-10 location sample could not be analyzed in the lab. Therefore, location SG-10 was resampled in July along with resampling of SG-3 and two additional locations (SG-17 and SG-18).

3.0 - PHYSICAL CHARACTERISTICS OF STUDY AREA

3.1 - SURFACE FEATURES

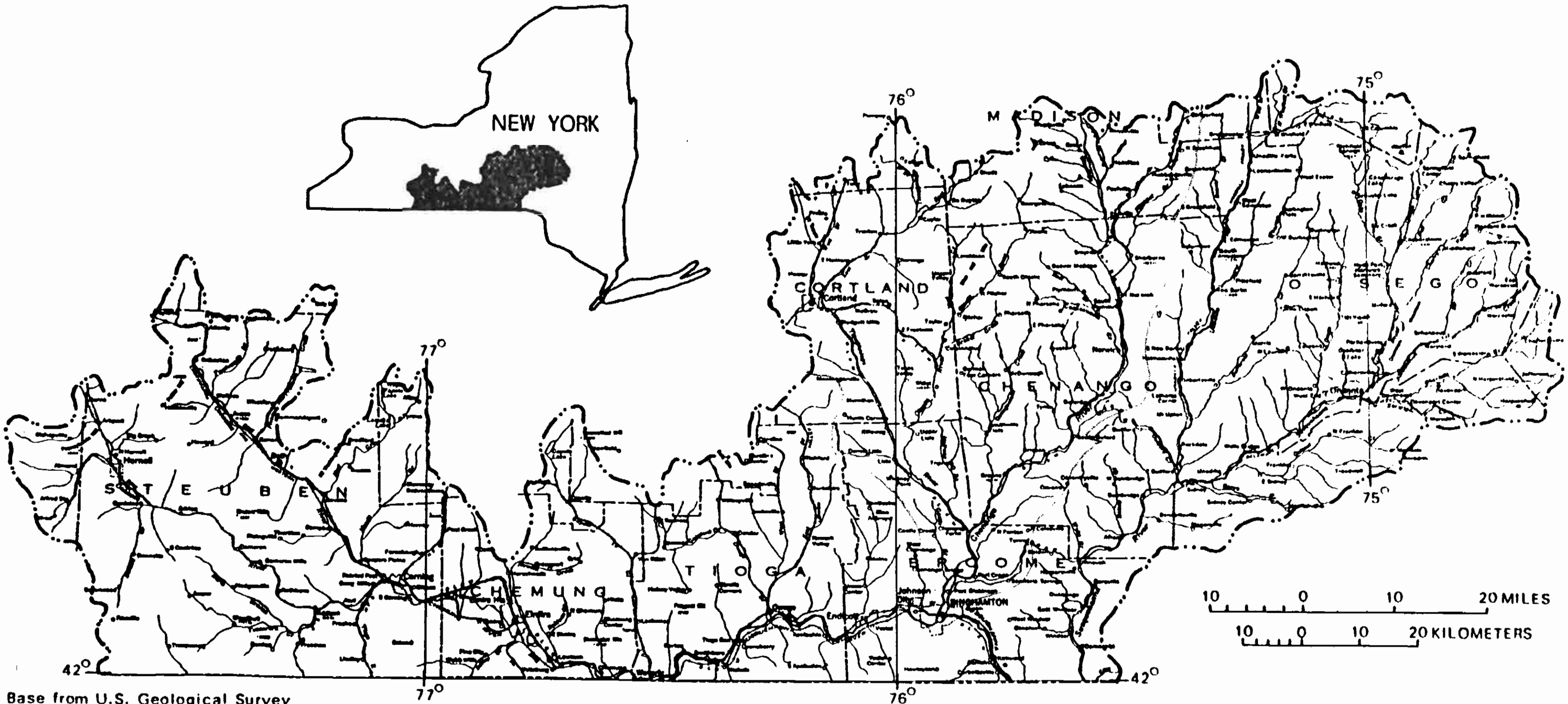
3.1.1 - Physiography - Topography and Drainage

South-central New York is part of the Appalachian Plateau Geomorphic Province, with the Catskill Mountains comprising the more rugged eastern part of the region. The Susquehanna and Delaware Rivers are the major drainage systems. The Appalachian Plateau is characterized by essentially horizontal and structureless rocks which have been naturally dissected by these rivers. Major drainages occur at the 800 to 1,000 foot elevations.

Running water and gravity are the two essential factors which resulted in the present landscapes of south-central New York. The glaciers accentuated the erosional surfaces that the rivers had already formed. This province is generally described as a maturely dissected region.

The Susquehanna River Basin occupies approximately 6,500 square miles in south-central New York as shown in Figure 3-1. An average of 55 percent of the 40-inches of precipitation which falls in the region is captured by this basin. The average flow of the Susquehanna River basin of New York into Pennsylvania is about 10,000 cubic feet per second (cfs).

The Chenango River which runs northeast to southwest is a tributary to the Susquehanna River. Gauging stations along the Chenango River monitor the flow of the river. At Hillcrest, the drainage area of the Chenango River is approximately 1,500 square miles. The average annual discharge of the river at this



Base from U.S. Geological Survey
State base map, 1:1,000,000, 1958

Location of the Susquehanna River basin in New York.

ABSTRACTED FROM STREAM FLOW IN THE N.Y. PART OF THE SUSQUEHANNA RIVER BASIN (BULLETIN 7.1 1975)

FIGURE 3-1

location is approximately 2,400 cubic feet per second (cfs) (NY-86-3). A topographic profile across the river terrace of the Chenango River has been developed and is included as Figure 3-2. Water quality data on the Chenango River is presented in Table 3-1.

3.1.2 - Meteorology

The climate of Binghamton and near vicinity is characterized by moderately cold winters and warm humid summers. The prevailing wind direction is from the west.

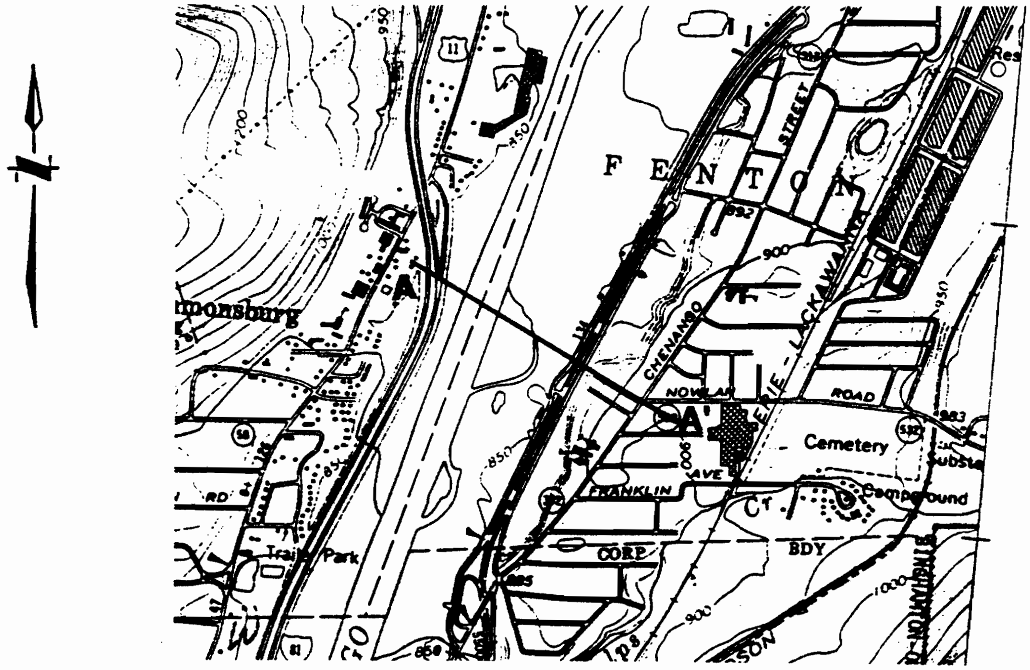
The Binghamton WSO/AP measures an average annual precipitation of 40-inches per year with an average annual temperature of 46° F. The average summer and winter temperatures are approximately 67° F and 24° F, respectively.

3.1.3 - Geology

- Regional Geology

The bedrock underlying the Binghamton study area is Upper Devonian in age and consists of sandy shales, thin-bedded sandstones and a few thin bands of impure limestone. These sedimentary beds were originally laid down horizontally and have been slightly tilted to yield a regional dip of about 40 feet per mile. Normal stream erosion naturally dissected the bedrock topography, producing major features of relief (Brown, R.H. & J.G. Ferris, 1946).

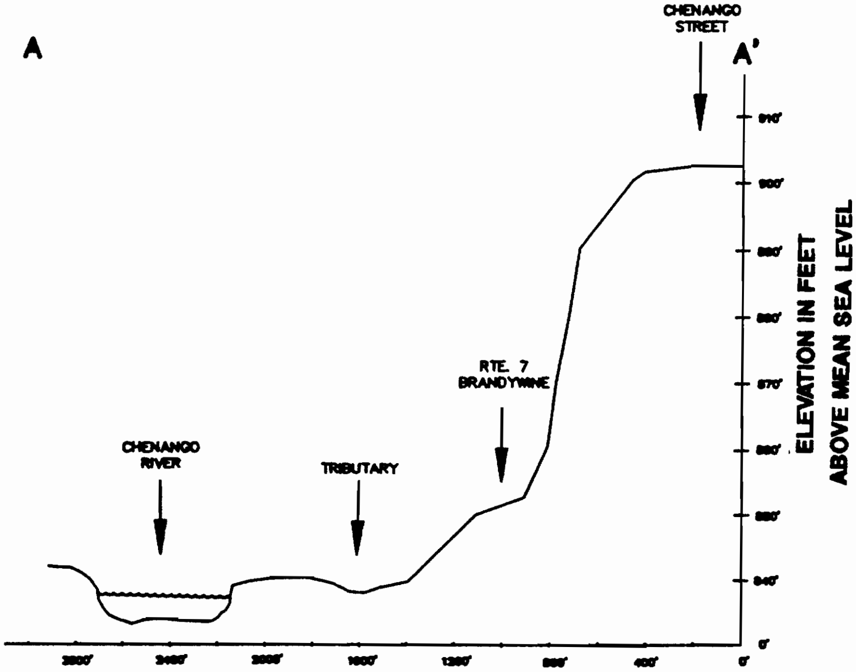
The advance of the continental glaciers during the Pleistocene modified the major features of relief and developed many minor features. The areas of high relief covered by the ice shows little evidence of notable topographic change attributable



SCALE: 1" = 2000'

PROFILE ACROSS RIVER TERRACE

CHENANGO STREET TO CHENANGO RIVER
EAST – WEST



APPROXIMATE
HORIZONTAL SCALE: 1" = 800'

TABLE 3-1

CHENANGO RIVER WATER QUALITY

USGS STATION: BINGHAMTON, 01512850

WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990*

Parameter	Value
Temperature	9.5°C
Barometric Pressure	752 mm Hg
Specific Conductance	310 µS/cm
Dissolved Oxygen	9.6 mg/L
pH	8.10
pH Lab	8.20
Hardness (as $CaCO_3$)	130 mg/L
Hardness (Non-Carbonate)	25 mg/L
Calcium, Dissolved	41 mg/L
Magnesium, Dissolved	7.6 mg/L
Sodium, Dissolved	13 mg/L
Sodium Adsorption Ratio	0.5
Sodium Percent	17%
Potassium, Dissolved	1.5 mg/L
Chloride, Dissolved	23 mg/L
Sulfate, Dissolved	16 mg/L
Fluoride, Dissolved	0.10 mg/L
Cadmium, Total	<1 µg/L
Copper, Total	4 µg/L
Iron, Total	230 µg/L
Lead, Total	2 µg/L
Manganese, Total	20 µg/L
Nickel, Total	1 µg/L
Zinc, Total	<10 µg/L
Aluminum, Total	60 µg/L
Total Dissolved Solids	168 mg/L
Dissolved Solids	0.23 tons per acre-ft.
Mercury	<0.10 µg/L
Specific Conductivity, Lab	329 µS/cm
Alkalinity, Lab, as $CaCO_3$	109 mg/L

---

* Sample data from October 21, 1989

to glaciation. In contrast, the low areas (Pre-Glacial valleys) exhibit extensive evidence of ice erosion. The general direction of ice movement was in a south, southwesterly direction. Therefore, the valleys parallel with this movement were the most affected. The course of the present Chenango and Susquehanna River Valleys lie parallel to the general direction of ice movement and show the greatest evidence of erosion.

Deposits of the continental glacier and the weathered material derived from them constitute a large part of the soil in the Binghamton region. Terminal drift is strongly concentrated in the valleys.

- Local Geology

The aquifer underlying the Chenango River near its confluence with the Susquehanna River was formed about 17,000 years ago (Cadwell, 1973) as the last glacier retreated from south-central New York. Deep valleys, originally carved by streams, had been widened and deepened by tongues of ice (Coates, 1966).

Kame terraces formed between the ice and the valley walls. As the ice melted, the terraces collapsed partially or totally and, in some areas, became covered by younger outwash or lake sediments. Kames also formed where gravel was deposited in depressions on the glacier surface; when the ice melted, these deposits were left as isolated kames. Outwash now blankets most of the valley floor; kame deposits remain along the valley sides and beneath the outwash. The outwash and buried kame deposits comprise the most productive water-bearing components of the aquifer systems present and are up to 200 feet thick.

In several places, pro-glacial lakes formed at the front of the receding glacier. Fine particles that were carried by streams into these lakes formed thick deposits of lake silt and clay. Many of these fine grained deposits are now covered by outwash and post-glacial stream deposits.

The glacial deposits contained in the study area are principally three types: outwash sands and gravels, lake clays and morainal deposits. The character of the outwash gravels and the lake clays is particularly important with respect to groundwater supply. The outwash sediments were deposited by streams supplied by meltwater that were heavily laden with sediments ranging in size from silt to coarse gravel and occurred in beds that show a fair degree of sorting (Brown, R.H. and J.G. Ferris, 1946). Thickness of these beds varies even in short distances, which is most likely the result of the erratic shifting of the glacially-fed streams. Glacial lakes existed at different times in the valleys close to the ice. Fine materials were deposited into the bottoms of these lakes, which accounted for the silts and clays associated with the glacial outwash. The outwash deposits are limited in horizontal extent, bound by the relatively impermeable rock walls of the valleys.

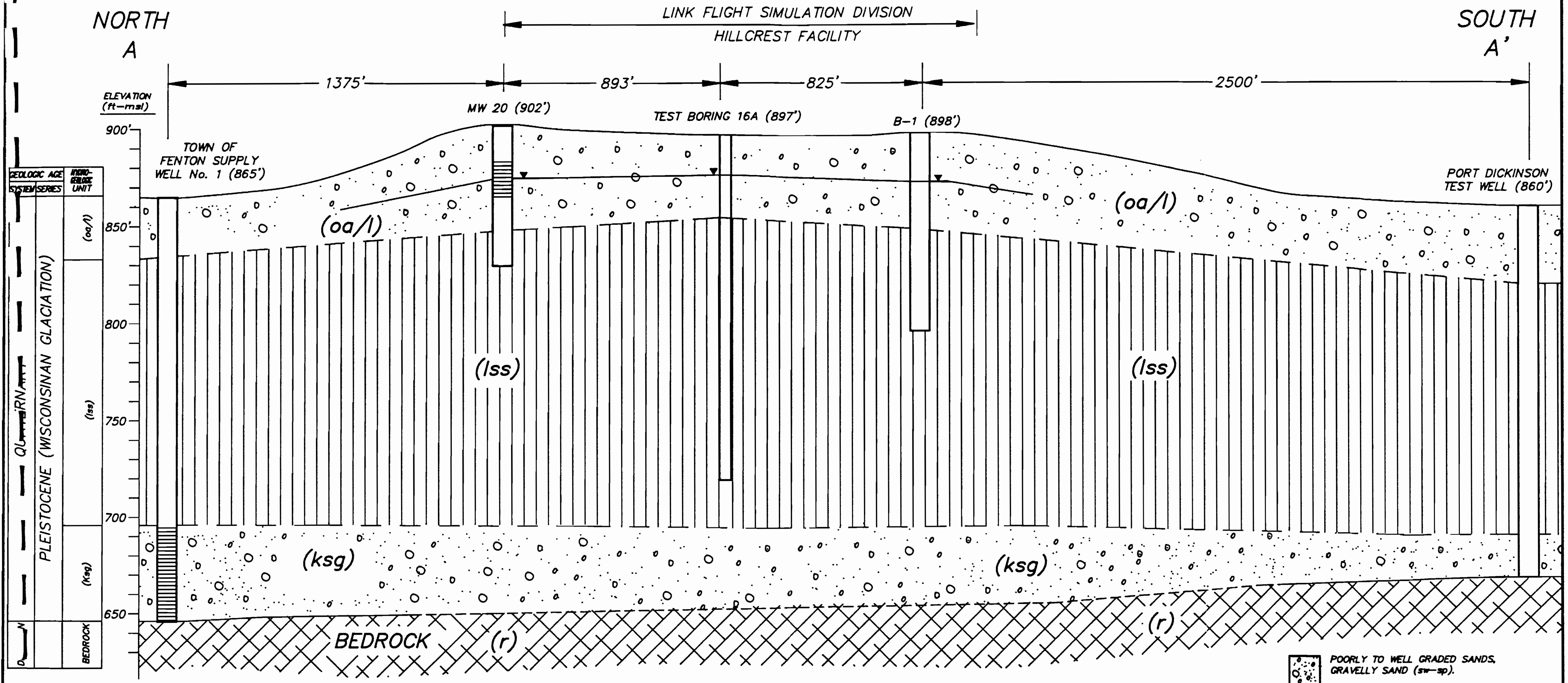
Post-glacial erosion has had very little influence on the deposits formed during the ice age. Some deposits have been removed and redeposited on the flood plains bordering the streams and in alluvial fans formed where upland streams enter the larger valley.

Detailed hydrogeologic cross-sections illustrating the localized glacial geology in the vicinity of the Hillcrest facility were developed as part of the remedial investigation. During the field investigation, soil borings were drilled to determine the lateral and vertical extent of a silt unit underlying the study area. This silt unit was deposited in a proglacial lake environment described earlier.

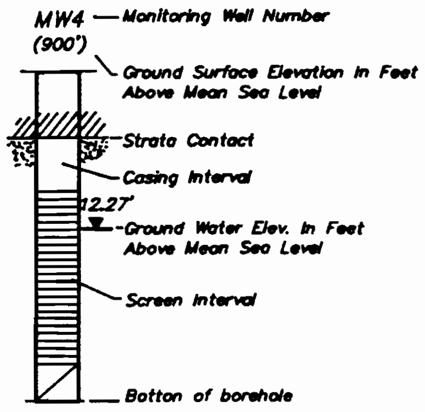
As detailed in Section 2.1.3, soil borings were drilled to develop sufficient geologic data. This geologic information is presented in the hydrogeologic cross-sections developed which are included as Figures 3-3 and 3-4. The lines of the hydrogeologic cross-section are depicted in Figure 3-5.

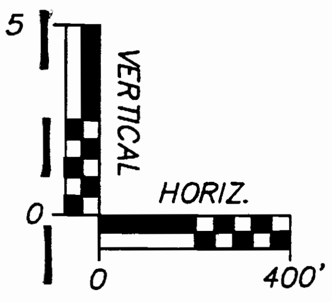
The upper water table aquifer consisting of poorly to well graded sands and gravel was mapped as a hydrostratigraphic unit from the water table interface to the top of the underlying silt unit. The saturated water table aquifer ranges up to 25 feet thick with a total thickness that ranges from 35 to 75 feet across the Hillcrest study area.

The elevation of the top of the silt unit was mapped and is depicted in Figure 3-6. The top of the silt unit primarily slopes to the northwest within the study area. According to lithologic data obtained and extrapolation using geologic interpretation, the silt unit is laterally and vertically continuous throughout the area of investigation. Its thickness is expected to range from approximately 125 to 160 feet with its thickest extent inferred to be beneath the Link facility as shown in the north to south cross-section (Figure 3-3). It consists of



NORTH TO SOUTH HYDROGEOLOGIC CROSS SECTION A–A'





▨ POORLY TO WELL GRADED SANDS, GRAVELLY SAND (sw–sp).

▥ INORGANIC SILTS, VERY FINE SANDS, CLAYEY SILTS, (ml)

▩ UNDIFFERENTIATED SHALE, SILTSTONE AND LIMESTONE, DEVONIAN AGE.

▼ APPROXIMATE WATER TABLE SURFACE SEPTEMBER 1989

REFERENCE: HYDROGEOLOGY AS ESTABLISHED IN USGS REPORT 82–268

NOTES:

1) SEE FIGURE3–5 FOR LOCATIONS OF HYDROGEOLOGIC PROFILE
2) SEE APPENDIX B FOR SOIL BORING AND MONITORING WELL LOGS.
3) UNIFIED SOIL CLASSIFICATION DESCRIPTION AND SOIL SYMBOLS WERE USED IN THE PREPARATION OF THE CROSS SECTION AND DRILLERS LOGS.
4) (oa/l) = OUTWASH SAND AND GRAVEL OVERLYING LACUSTRINE CLAY, SILT, AND FINE SAND.
5) (lss) = LAKE SILT AND FINE SAND; BEDDED TO MASSIVE; LOW TO MODERATE PERMEABILITY.
6) (ksg) = KAME AND KAME TERRACE SAND AND GRAVEL; HIGH PERMEABILITY.
7) (r) = BEDROCK (undifferentiated); SHALE AND SILTSTONE; LOW TO MODERATE PERMEABILITY IN FRACTURES AND JOINTS.
8) ELEVATION IN FEET ABOVE MEAN SEA LEVEL.

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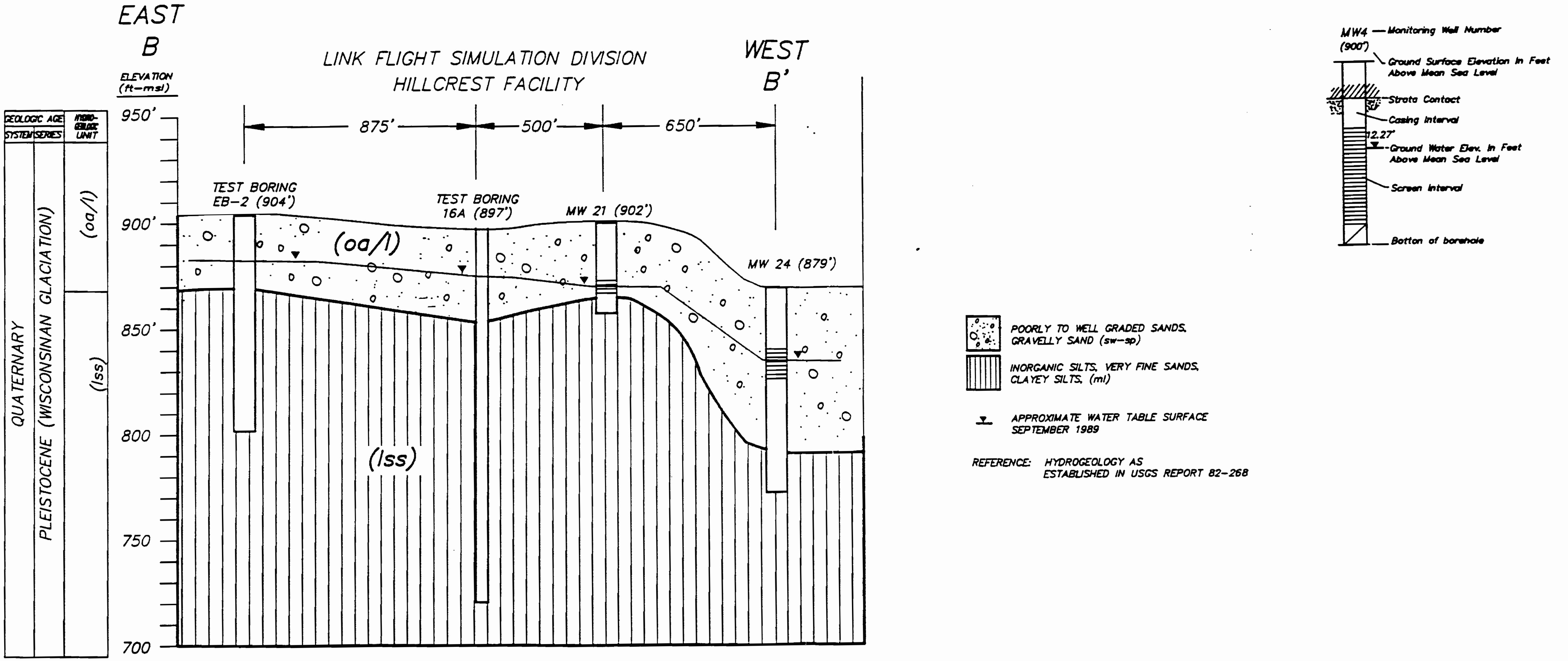
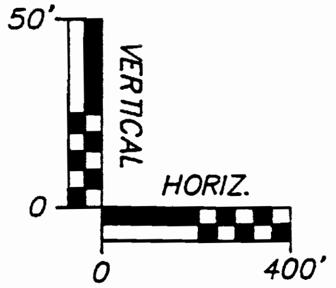
FIGURE 3- 4



EAST TO WEST
HYDROGEOLOGIC CROSS SECTION B-B'



NOTES:
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6) ELEVATION IN FEET ABOVE MEAN SEA LEVEL

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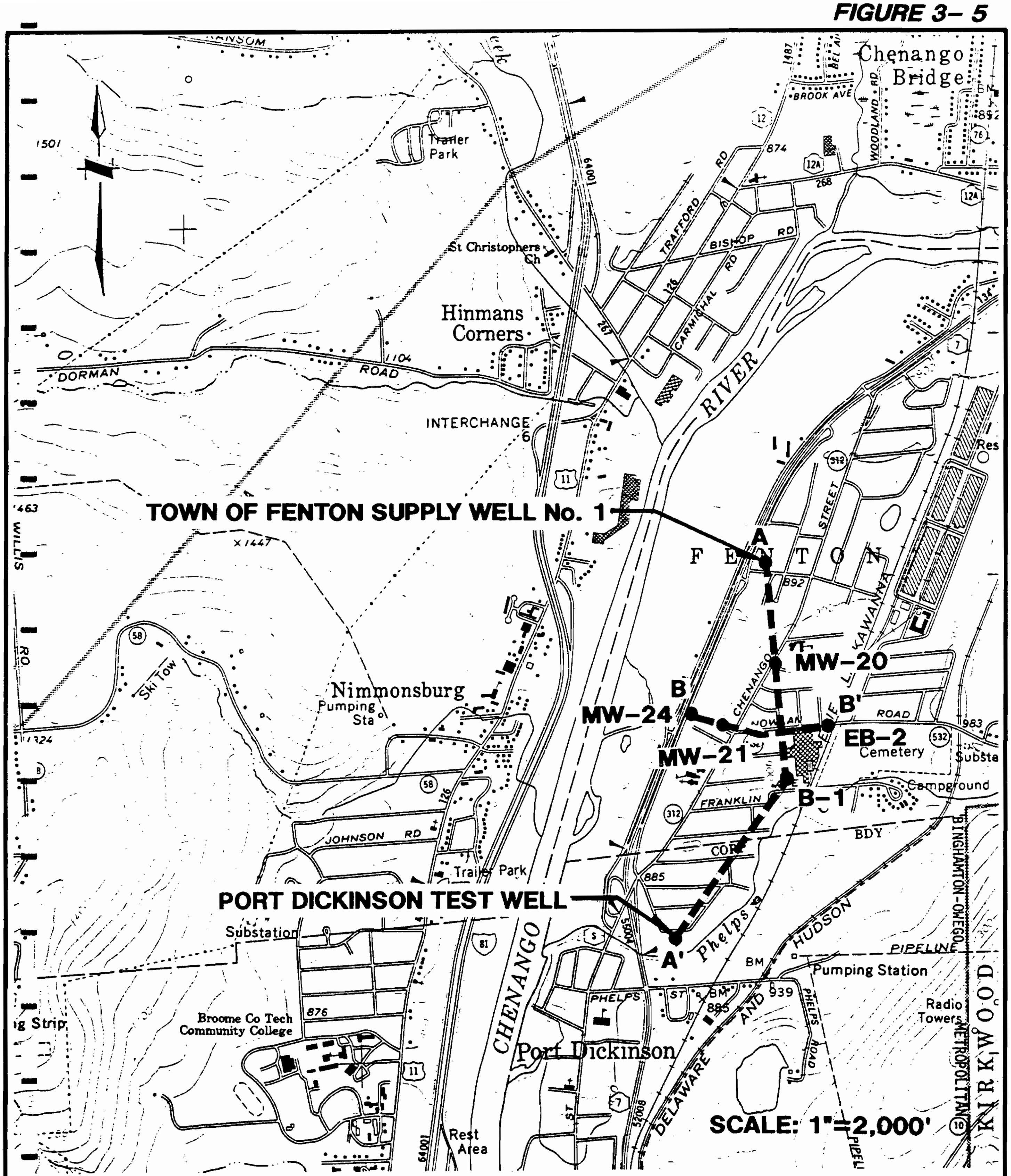

HYDROGEOLOGIC CROSS SECTION LINES
LINK FLIGHT SIMULATION DIVISION
HILLCREST, N.Y.

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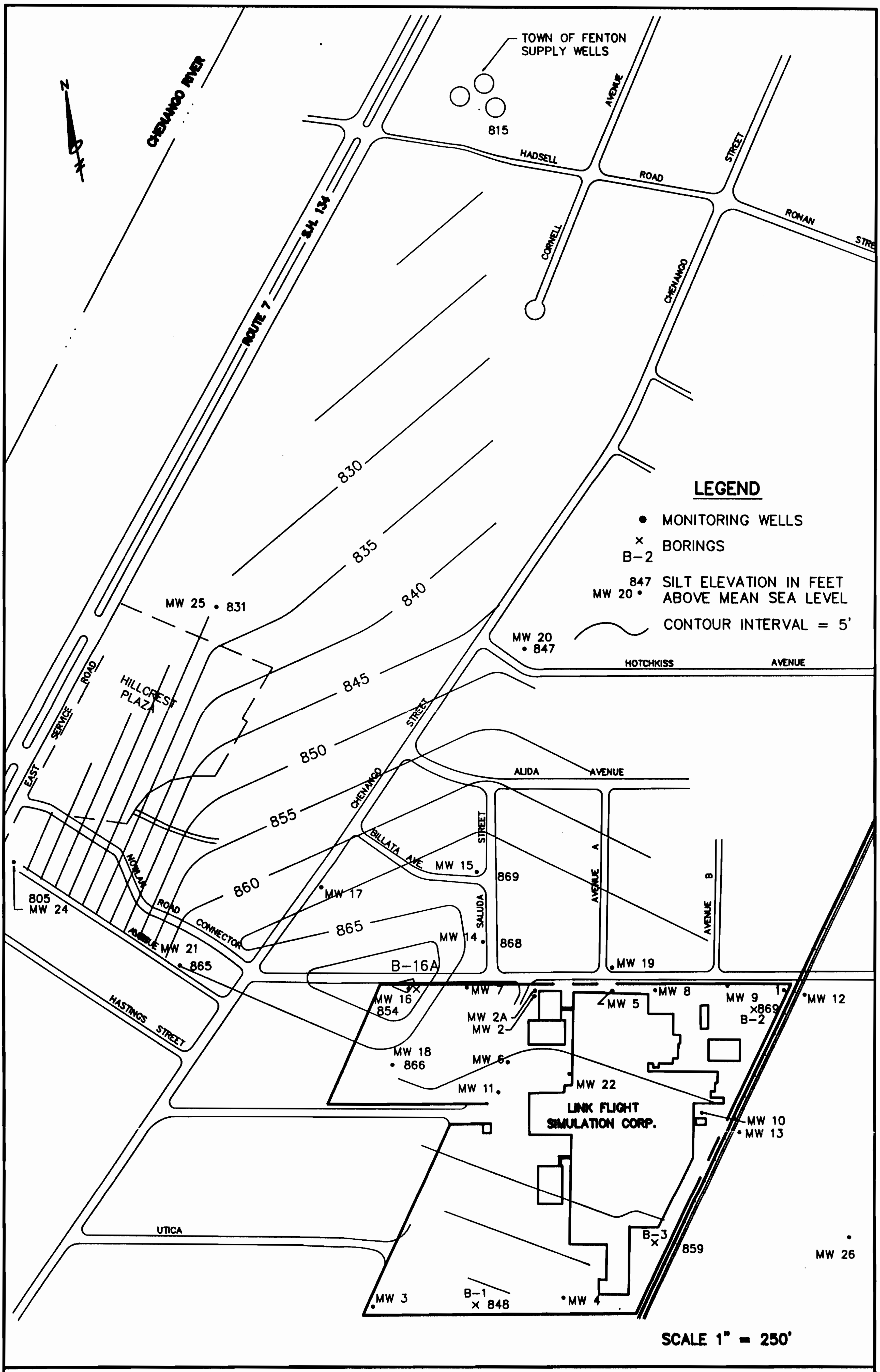

SURFACE ELEVATION MAP ON TOP OF THE SILT UNIT

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FIGURE 3-6

lake silt and fine sand deposits which possess low permeability (10^{-3} ft/day). Geophysical logging was conducted at soil boring EB-2 to provide additional physical information on the silt unit. Gamma ray, spontaneous potential and resistivity data were plotted with respect to lithologic information and depth as shown in Figure 3-7. This geophysical cross-section illustrates the verification of the uniformity of the silt unit. The gamma ray log indicates a continuous sequence of silt-clay throughout the logged depth.

The stratigraphic position of the Devonian bedrock was extrapolated using site-specific drillers' log data from the Town of Fenton water supply wells and a test well completed at Port Dickinson.

Soil samples from representative zones within both the water table aquifer (screened interval) and the clayey-silt unit were sent to a testing lab for grain size and hydrometer analysis, respectively. This data is presented in Table 3-2. Average hydraulic conductivity values were estimated from this test data.

3.1.4 - Hydrogeology

- Regional Hydrogeology

The deposits of major hydrologic significance in this region are the outwash and kame sand and gravel deposits. Although bedrock in the region primarily consists of sedimentary rocks, they are of low permeability and do not constitute a water-bearing zone. The hydrogeologic cross-section presented earlier depicted the upper outwash sediments and lower (kame sand and gravel) aquifer systems.

GEOPHYSICAL LOG CROSS SECTION

TEST BORING EB–2

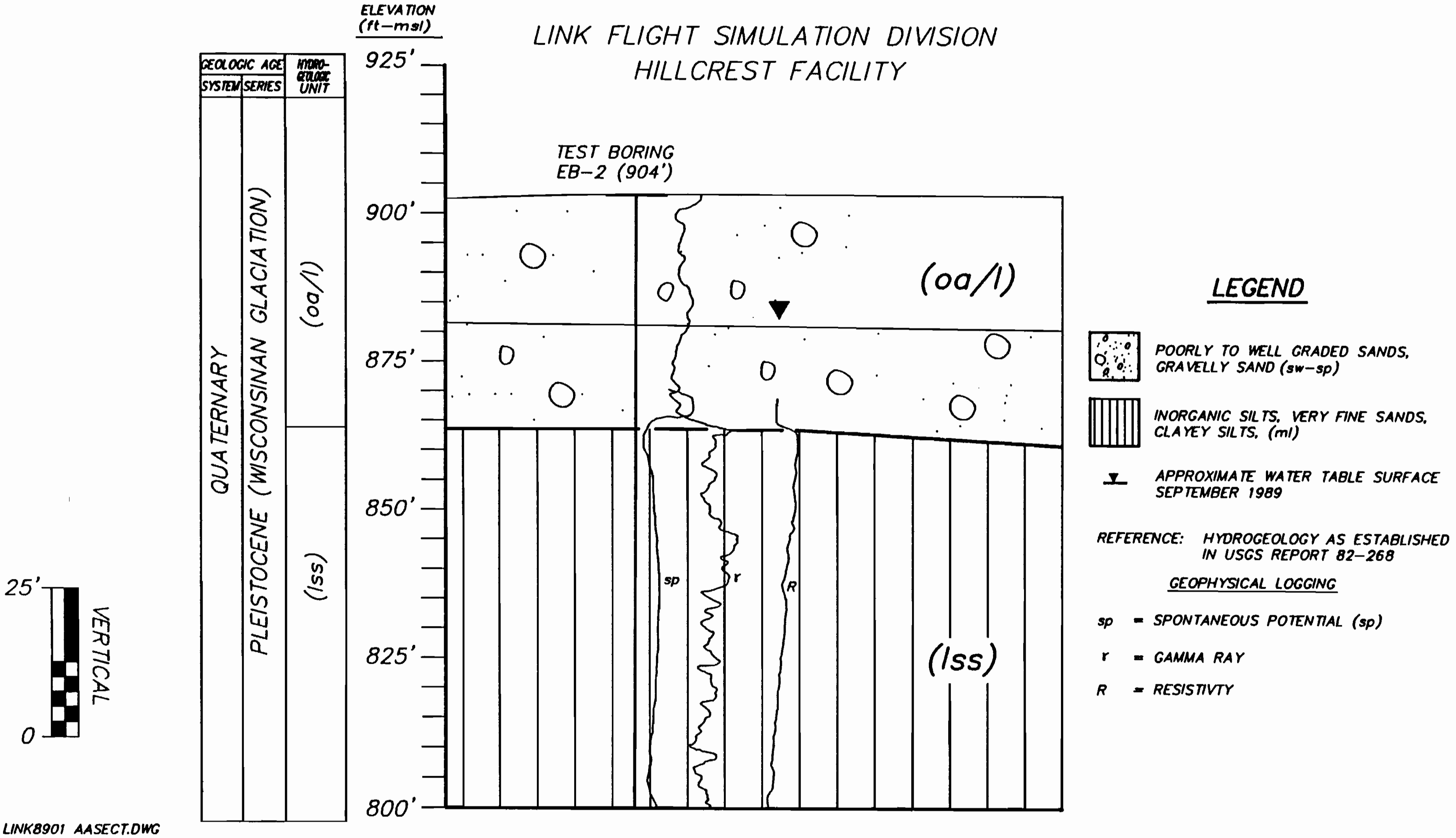

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FIGURE 3–7

TABLE 3-2

GRAIN SIZE DESCRIPTION AND HYDROMETER ANALYSIS FOR SELECTED SOIL SAMPLES WITH ESTIMATED HYDRAULIC CONDUCTIVITY

1 ft/d = 3.5 x10^{-4} cm/s

Monitoring Well/ Boring Number	Depth (Feet)	Percent Gravel	Percent Sand	Percent Silt & Clay	Estimated Hydraulic Conductivity (Ft./Day)	Slug Test Results (Ft./Day)
16A	100-102	0	10	90	1.3 x 10^{-2}	--
	150-152	2	7	91	1.3 x 10^{-2}	
	170-172	0	30	70	0.1	
20	25-27	15	70	15	5.3	0.03
	55-57	--	--	100	1.3 x [illegible]^{3}	
21	30-32	--	28	72	0.1	0.37
22	20-22	7	83	10	6.7	
23	25-27	--	82	18	1	0.04
24	30-32	57	23	20	1.4	
25	20-22	50	37	13	1.4	0.08
26	17-19	50	30	20	1.4	0.02
EB-2	85-87	--	--	100	1.3 x 10^{-3}	--

NOTES:

Grain size and hydrometer analysis raw data included in Appendix B.

The kame-terrace gravels at the glacial valley sides are generally above the top of the aquifer. Although they are insignificant as a source of water, they act as recharge areas through which water enters the aquifer from the valley walls. The buried kame gravels, which are shown in Figures 3-3 and 3-4 and comprise the lower aquifer system. They are separated from the outwash gravels by the lake silt and clay but may be hydraulically connected to them in the valley boundaries.

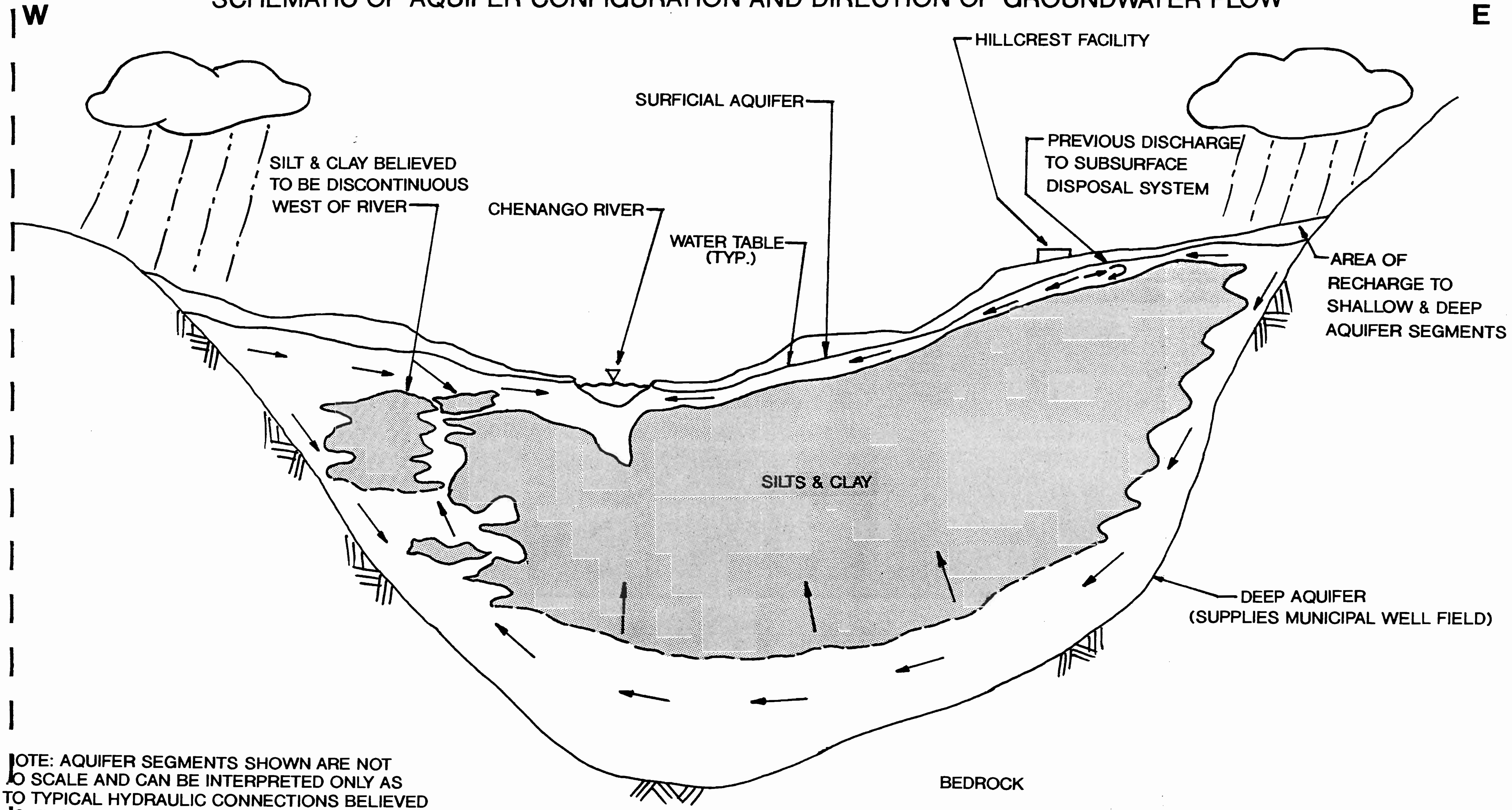
Water discharges from both of the aquifer systems by seepage into the river system, evapotranspiration and pumpage. A schematic of aquifer configuration and direction of groundwater flow in this region is shown in Figure 3-8.

- Hydrologic Budget

Groundwater is replenished primarily from recharge derived from precipitation at the valley boundaries and lateral underground flow of freshwater. Average annual precipitation for the area is approximately 40-inches. This value was derived as an average of 65 years of precipitation records collected at Binghamton Gauging Station.

Loss of recharge occurs through evapotranspiration and runoff. As precipitation hits the land surface, a portion evaporates. Another portion is absorbed by vegetation and transpired back into the atmosphere. Precipitation less the sum of water lost to evapotranspiration and runoff result in the total amount of water available for groundwater recharge.

SCHEMATIC OF AQUIFER CONFIGURATION AND DIRECTION OF GROUNDWATER FLOW



OTE: AQUIFER SEGMENTS SHOWN ARE NOT O SCALE AND CAN BE INTERPRETED ONLY AS TO TYPICAL HYDRAULIC CONNECTIONS BELIEVED O EXIST BETWEEN AQUIFER SEGMNENTS. THE XTENT OF THE SILT AND CLAY LAYER IS INFERRED BOTH FROM GEOPHYSICAL DATA AND PUBLISHED INFORMATION.

NO SCALE

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- Local Hydrogeology

Previous hydrogeologic (Phases I, II and III) investigations have been conducted in the area of the Hillcrest facility. These investigations have determined that groundwater flow is in a west-northwesterly direction approximately perpendicular to the river, and that groundwater travels as base flow through the underlying soils. A schematic cross-section showing the direction of groundwater flow was included as Figure 3-8.

A characterization of the water table aquifer including an estimation of aquifer parameters has been made as a result of previous investigations by H2M. The hydrogeologic investigations confirmed the presence of an extensive silt unit underlying the Hillcrest facility and a monitoring well network was established in the water table aquifer. Groundwater quality within the study area was identified as being impacted by volatile organics and inorganic contamination.

Groundwater velocity was shown to vary greatly depending upon aquifer lithology. The velocity of groundwater flow through fine grained strata versus sand strata was estimated to range from as low as 10^{-6} ft/day to as high as 1 to 10 ft/day.

During the remedial investigation, additional monitoring wells were installed to further expand the monitoring network to assess groundwater quality. Additional samples were obtained from representative zones within the aquifer and were submitted for grain size analysis. Slug tests were also conducted at the seven new wells to assist in defining aquifer characteristics.

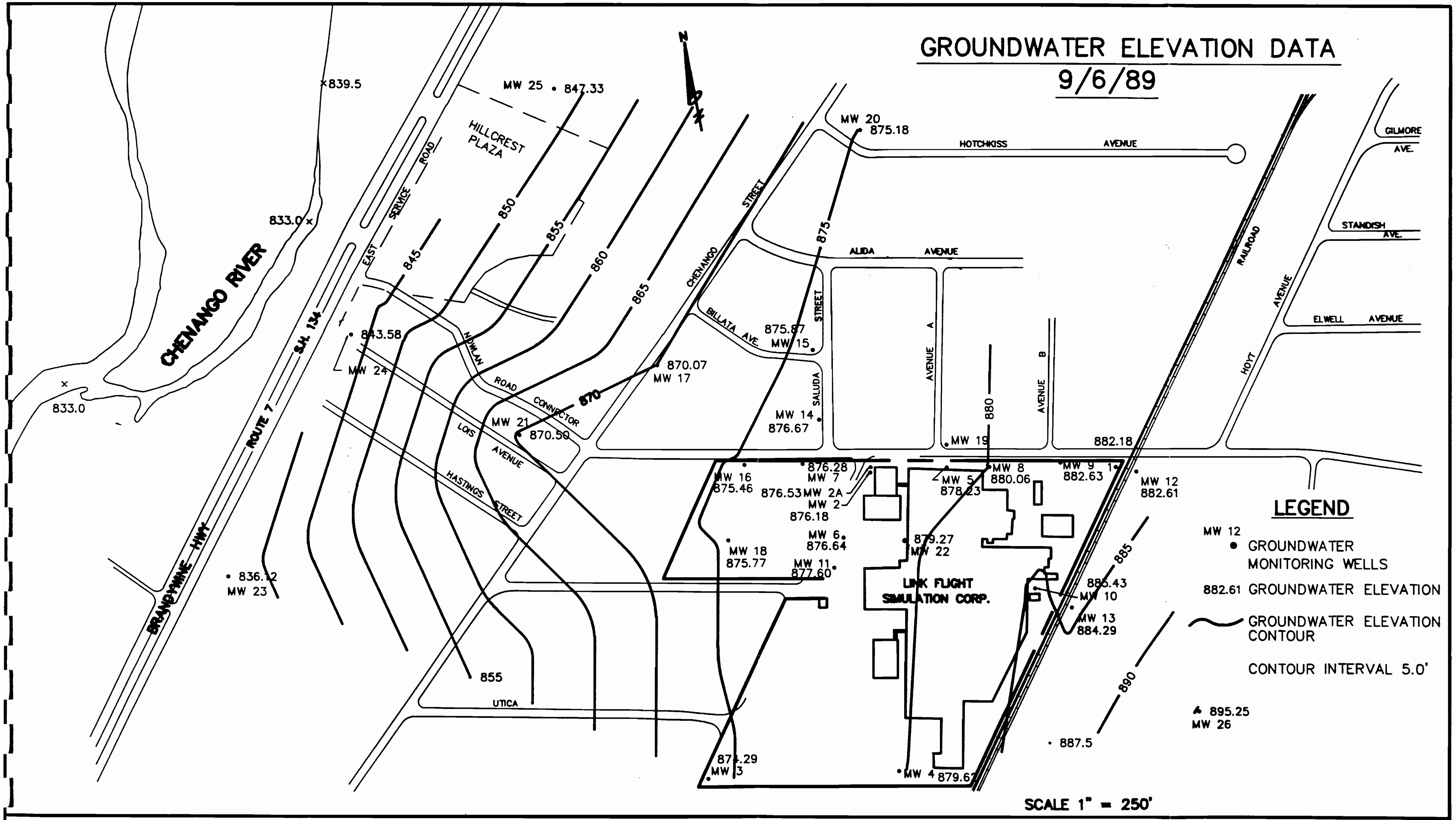
This data was presented in Table 3-2. Copies of all test data and field testing are included in Appendix B. Additional groundwater elevation maps presented in Figures 3-9 and 3-10 were developed to evaluate groundwater flow conditions with respect to impact on groundwater quality. Table 3-3 provides groundwater elevation data for September and October 1989.

The groundwater elevation data generated for September and October 1989 is very consistent with previous hydrogeologic investigation data. An average groundwater hydraulic gradient of 0.009 ft/ft was utilized to calculate groundwater velocity with a porosity of 30 percent. Utilizing an average hydraulic conductivity, groundwater flow velocity will be on the order of 32 ft/day.

- Contaminant Transport

As a result of the remedial investigation, it was determined that substantial discharges of water had previously occurred into the decommissioned industrial outfall system 004. As water infiltrates through contaminated soil, inorganics and organics are desorbed and can enter groundwater. As a result, contaminated water had been discharged to the shallow upper aquifer at fluctuating levels for years prior to the 1986 connection to the sewer system. While precise records of groundwater gradients in the vicinity of the identified discharge points are not available, the hydrogeology of the site still allows reasonable calculations for the direction and rate of contaminant transport to be made.

FIGURE 3- 9



GROUNDWATER ELEVATION DATA
9/6/89

LEGEND

MW 12
● GROUNDWATER MONITORING WELLS

882.61 GROUNDWATER ELEVATION

GROUNDWATER ELEVATION CONTOUR

CONTOUR INTERVAL 5.0'

▲ 895.25
MW 26

SCALE 1" = 250'

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FIGURE 3-10

GROUNDWATER ELEVATION DATA
10/3/89

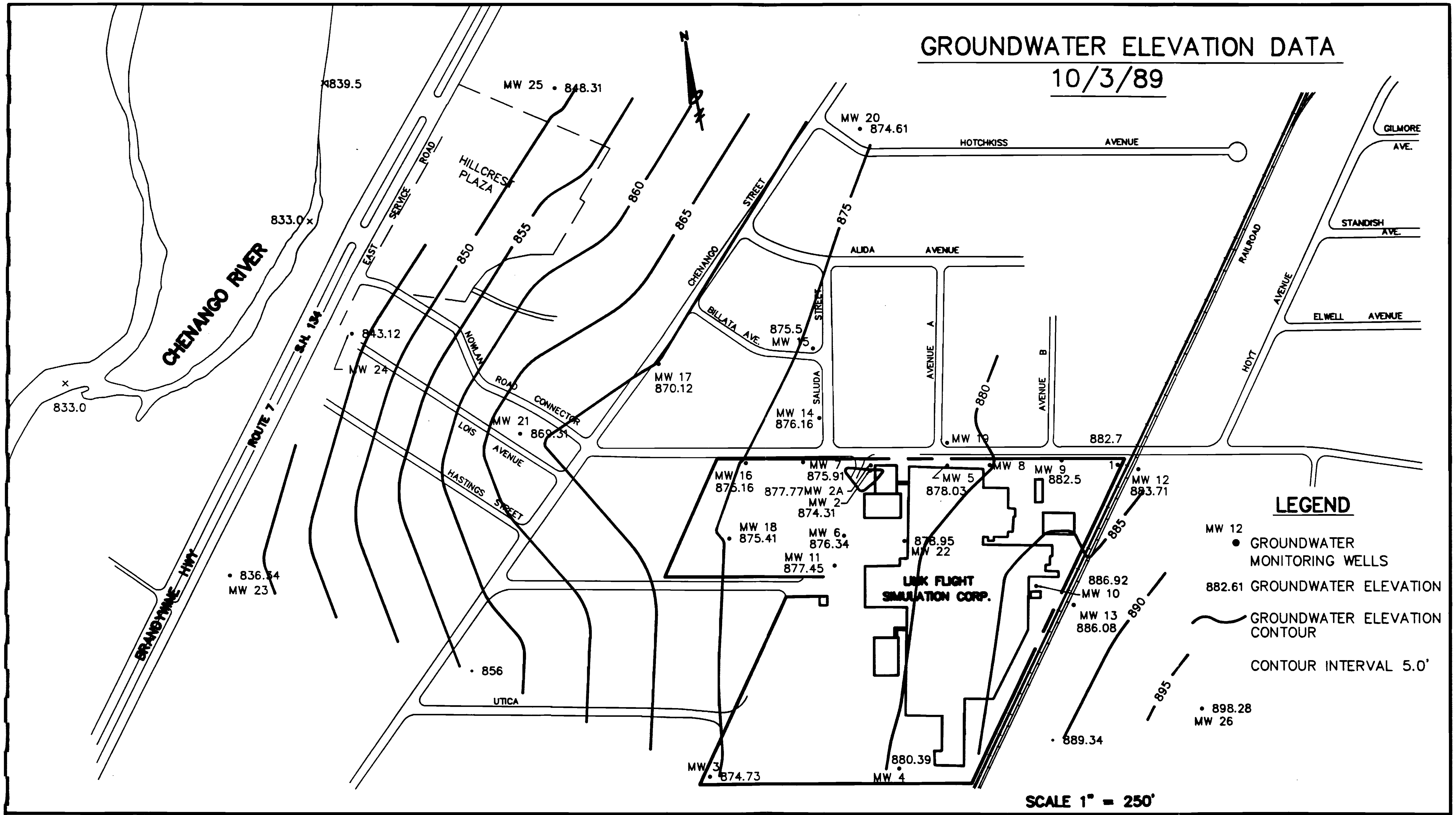

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TABLE 3-3

LINK FLIGHT SIMULATION DIVISION - HILLCREST FACILITY

GROUNDWATER ELEVATION DATA

Well Number	Measuring Point Elevation*	Water Table Elevation 9/6/89	Depth to Water 9/6/89	Water Table Elevation 10/3/89	Depth to Water 10/3/89	Screened Interval (Feet)
MW1	904.09	882.18	21.91	882.70	21.39	14.6-29.6
MW2	899.83	876.18	23.75	874.31	25.62	18.8-33.8
MW2A	901.90	876.53	25.37	877.77	24.13	63.0-73.0
MW3	898.20	874.29	23.91	874.73	23.47	23.3-38.3
MW4	898.22	879.62	18.60	880.39	17.83	14.0-29.0
MW5	901.73	878.23	23.50	878.03	23.70	20.0-35.0
MW6	900.76	876.64	24.12	876.34	24.42	40.0-55.0
MW7	896.98	876.28	20.70	875.91	21.07	25.0-40.0
MW8	902.71	880.06	22.65	**	**	20.0-35.0
MW9	904.04	882.63	21.41	882.50	21.54	20.0-35.0
MW10	903.82	885.43	18.39	886.92	16.90	15.0-30.0
MW11	900.18	877.60	22.58	877.45	22.73	25.0-40.0
MW12	901.96	882.61	19.35	883.71	18.25	14.0-29.0
MW13	900.95	884.29	16.66	886.08	14.87	15.0-30.0
MW14	897.70	876.67	21.03	876.16	21.54	20.0-35.0
MW15	899.27	875.87	23.40	875.50	23.77	25.0-40.0
MW16	896.93	875.46	21.47	875.16	21.77	25.0-40.0
MW17	898.42	870.07	28.35	870.12	28.30	30.0-45.0
MW18	894.76	875.77	18.99	875.41	19.35	20.0-35.0
MW19	900.70	**	**	**	**	25.0-40.0
MW20	901.86	875.18	26.68	874.61	27.25	35.0-40.0
MW21	900.24	870.50	29.74	869.31	30.93	32.0-37.0
MW22	903.02	879.27	23.75	878.95	24.07	15.0-30.0
MW23	852.34	836.12	16.22	836.34	16.00	12.0-27.0
MW24	879.48	843.58	35.90	843.12	36.36	27.0-42.0
MW25	854.66	847.33	7.33	848.31	6.35	19.0-24.0
MW26	911.84	895.25	16.59	898.28	13.56	12.0-27.0

* All elevations in feet above mean sea level measured at the top of PVC casing
** Not measured

Consideration must be given to the extent of distribution of the existing contaminant cloud ("zone of recharge") as well as the hydraulic properties of the aquifer. An analysis of the rather steep groundwater gradients which occur in the area together with the highly permeable materials present, reveals that a significant regional flow of groundwater will occur, directed toward the river.

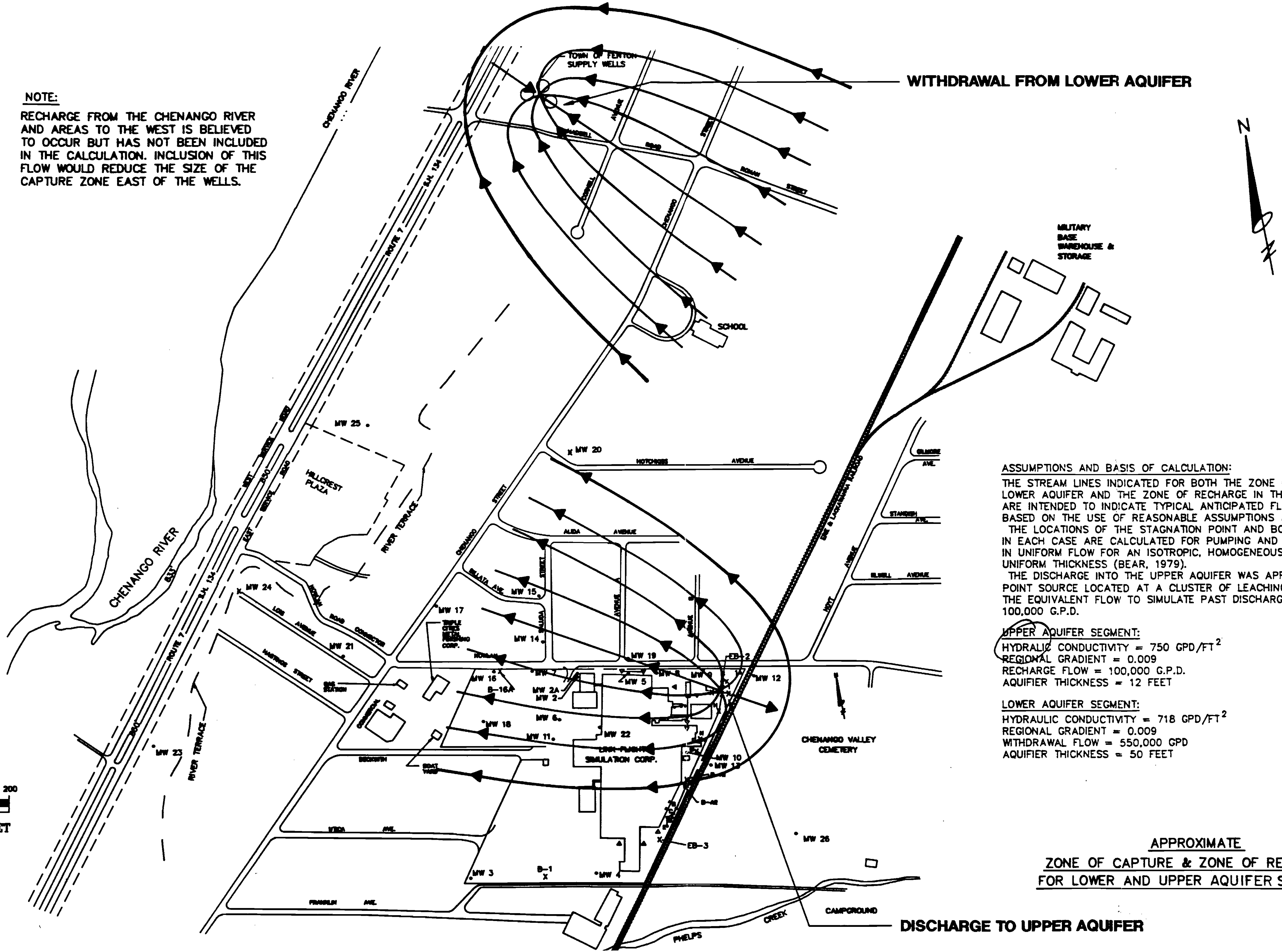
The "zone of recharge" resulting from the previous on-site SPDES discharges into the upper aquifer can be calculated by adopting values of an average continuous flow rate, taken as 100,000 gpd in this case, and an equivalent point of injection, approximated at the northern portion of outfall system 004 (leaching pools H, I, J, K and L). A regional gradient of 0.009 ft/ft with a hydraulic conductivity of 750 gpd/ft^2 results in a localized velocity of approximately 0.9 ft/day.

The locations of the stagnation point and associated streamline for a recharging well in uniform flow are given by Bear (Hydraulics of Groundwater, 1979), for an isotropic, homogeneous aquifer of uniform thickness. Taking a localized saturated aquifer thickness of 12 feet and other parameters as discussed above, the stagnation point will be located 196 feet upgradient of the injection point. The "zone of recharge" showing the predicted areal extent of the contaminant plume and typical anticipated flow directions is depicted in Figure 3-11.

The only groundwater receptors utilized for drinking water supply are the Town of Fenton's three municipal wells located

FIGURE 3-11

NOTE:
RECHARGE FROM THE CHENANGO RIVER AND AREAS TO THE WEST IS BELIEVED TO OCCUR BUT HAS NOT BEEN INCLUDED IN THE CALCULATION. INCLUSION OF THIS FLOW WOULD REDUCE THE SIZE OF THE CAPTURE ZONE EAST OF THE WELLS.



ASSUMPTIONS AND BASIS OF CALCULATION:
THE STREAM LINES INDICATED FOR BOTH THE ZONE OF CAPTURE IN THE LOWER AQUIFER AND THE ZONE OF RECHARGE IN THE UPPER AQUIFER ARE INTENDED TO INDICATE TYPICAL ANTICIPATED FLOW DIRECTIONS BASED ON THE USE OF REASONABLE ASSUMPTIONS AND BEST AVAILABLE DATA.

THE LOCATIONS OF THE STAGNATION POINT AND BOUNDING STREAMLINES IN EACH CASE ARE CALCULATED FOR PUMPING AND RECHARGING WELLS IN UNIFORM FLOW FOR AN ISOTROPIC, HOMOGENEOUS AQUIFER OF UNIFORM THICKNESS (BEAR, 1979).

THE DISCHARGE INTO THE UPPER AQUIFER WAS APPROXIMATED AS A POINT SOURCE LOCATED AT A CLUSTER OF LEACHING POOLS (OUTFALL, 004). THE EQUIVALENT FLOW TO SIMULATE PAST DISCHARGES WAS SET EQUAL TO 100,000 G.P.D.

UPPER AQUIFER SEGMENT:
HYDRALIC CONDUCTIVITY = 750 GPD/FT^2
REGIONAL GRADIENT = 0.009
RECHARGE FLOW = 100,000 G.P.D.
AQUIFIER THICKNESS = 12 FEET

LOWER AQUIFER SEGMENT:
HYDRAULIC CONDUCTIVITY = 718 GPD/FT^2
REGIONAL GRADIENT = 0.009
WITHDRAWAL FLOW = 550,000 GPD
AQUIFIER THICKNESS = 50 FEET

APPROXIMATE
ZONE OF CAPTURE & ZONE OF RECHARGE
FOR LOWER AND UPPER AQUIFER SEGMENTS

submitted for TCL metals analysis in addition to unfiltered samples from the same sampling locations. The comparison of filtered and unfiltered provides data on the effects of the high groundwater turbidity (>100 NTU) on TCL metals concentrations.

4.1.2 - Laboratory Analytical Results

Round I and Round II sampling of groundwater monitoring wells was conducted on September 6th and 7th, 1989 and October 4th and 5th, 1989, respectively.

The second sampling round was intended to confirm any anomalies encountered during Round I. Few anomalies were encountered and typically Round II results conformed with Round I, except where noted. A complete summary of analytical results from all analyses performed during Round I and Round II are presented in Tables 4-1 and 4-2. Field sampling parameters for both rounds of groundwater sampling are summarized in Tables 4-5 and 4-6.

- Volatile Organics

The volatile organic data for both rounds of groundwater sampling are consistent with each other in terms of relative concentrations and compounds quantified. Monitoring well MW-6 was diluted and reanalyzed due to the value of trichloroethylene being over the limit of the analyte. The reanalyzed data MW-6DL was utilized in data analysis.

Monitoring well MW-26 was installed upgradient to provide a source of control for background concentrations. No TCL volatile organic compounds were quantified at this monitoring well. Concentrations of the key volatile organics quantified with comparison to New York State guidance values and standards are presented in Table 4-7.

Monitoring wells MW-12 and MW-13 which are located off-site and positionally upgradient of the Link Hillcrest facility were quantified as being impacted by 1,1,1-trichloroethane and trichloroethylene above the New York State drinking water standards (5 µg/L) established for these compounds. Although these wells are located upgradient of the Hillcrest facility, they have historically exhibited significant volatile organic and inorganic impact. A potential source area for volatile organic contamination - the Chenango Valley Cemetery maintenance building, was identified during earlier investigations. On the basis of groundwater quality data from MW-26 (downgradient) this potential source area has been dismissed. This indicates that mounding from past facility discharges is the most probable source of impacted groundwater upgradient off-site at MW-12 and MW-13.

On-site monitoring wells MW-6, MW-10, MW-16 and MW-22 were also reported as impacted above New York State standards (5 µg/L) by trichloroethylene with the most significant concentrations reported at MW-6DL (700 to 760 µg/L). Other TCL volatile organics reported at MW-6 and their relative concentrations include 1,1-dichloroethene (9-10 µg/L), 1,1-dichloroethane (12-13 µg/L), 1,2-dichloroethene (44 µg/L), methylene chloride (2J µg/L) and 1,1,1-trichloroethane (10 µg/L). A concentration of 4J-7 µg/L of trichloroethylene was reported at MW-10 A concentration

TABLE 4-7

CONCENTRATIONS OF KEY INDICATOR CHEMICALS QUANTIFIED IN GROUNDWATER

OCTOBER AND SEPTEMBER 1989

Parameter	MW6	MW6DL	MW10	MW12	MW13	MW15	MW16	MW17	MW20	MW21	MW22	MW23	MW24	MW25	MW26	Field Blank 1/2*	Trip Blank 1/2*	Field Blank 3/4**	Trip Blank 3/4**	EPA MCL (a)	N.Y.S. Stds (b)	N.Y.S. Guidance Value(c)	N.Y.S DOH POC(d)
Volatile Halogenated Organics (ug/L)																							
Chloromethane	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	28/-	-/-	-/-	-/-	-/	-/-	-/-	-/-	--	--	--	5
1,1-Dichloroethene	9/10	25UD/25UD	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/	-/-	-/-	-/-	7	--	0.07	5
1,1-Dichloroethane	12J/13J	13J/12J	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/	-/-	-/-	-/-	--	--	50	5
1,2-Dichloroethene	44/44	52/41	-/-	-/-	-/-	-/-	-/-	-/-	-/-	6/6	-/-	-/-	-/-	-/-	-/-	-/	-/-	-/-	-/-	--	--	50	5
Methylene Chloride	2B/-	25UD/-	-/-	-/-	-/-	-/-	2B/-	4B/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/3J	-/3J	--	--	50	5
1,1,1-Trichloroethane	10/10	10J/11J	-/-	2J/3	25/35	8/5	7/5	9/8	5/7	29/28J	-/-	-/-	4/4	8/8	-/-	-/-	-/-	-/-	-/-	200	--	50	5
2-Butanone	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/22	--	--	--	--
Trichloroethene	590D/700D	700/760	7/4	12/13	40/51	46/54	42/40	52/77	56/51	45/42	31/23	-/-	17/14	49/52	-/-	-/	-/-	-/-	-/-	5	10	--	5
Metals (ug/L)																							
Cadmium	53/24.6	NA	7290/5950	126/88.8	334/3670	-/-	151/132	7/5.3J	12/11.6	85/68.3	13/19.9	-/33.7	17/59.7J	17/28.9J	-/18.5	-/-	NA	-/-	NA	10	10	--	10
Chromium	1220/1240	NA	21900/14900	653/519	334/2950	176/205	535/508	312/263J	269/432	808/1090	396/567	307/278	578/647J	545/537J	110/843	-/15.7	NA	-/-	NA	50	--	--	50
Hexavalent Chromium (mg/l)	0.71/0.70	NA	0.19/0.25	0.13/0.25	0.13/0.28	0.16/0.85	0.15/0.18	0.29/0.28	-/-	-/-	-/-	-/-	-/-	0.22/0.20	-/-	-/-	NA	-/-	NA	--	0.050	--	--
Cyanide	-/-	NA	395/48	40/-	10/23	30/-	-/-	-/10J	-/-	-/-	-/-	30/-	-/-	25/24J	-/-	-/-	NA	-/-	NA	--	200	--	--

NOTES:

October/September 1989 Data
-/- = Below detection limit
J = Estimated value; result less than specified detection limit but greater than zero.
D = Value over calibration limit of analyte
DL = Diluted sample
UD = Not detected in diluted sample but present in original sample

a = USEPA MCL (Maximum Contaminant Levels) for Drinking Water
b = New York State Groundwater Quality Standards, NYS Title 6, Part 703.1 guidelines
c = New York State Groundwater Quality Guidance Value
d = New York State Department of Health Principal Organic Compounds

-- = No standard or guidance value listed
NA = Not applicable

* Field and trip blanks from September 6-7, 1989, groundwater sampling
** Field and trip blanks from October 4-5, 1989, groundwater sampling

JSH:mad
(a:\4-7.wk1)

of 7 μg/L of 1,1,1-trichloroethane and 40-42 μg/L of trichloroethene was also reported at MW-16. At MW-22, a range of 23-31 μg/L of trichloroethene was quantified.

Off-site downgradient wells MW-21, MW-23, MW-24 and MW-25 were quantified as primarily impacted by trichloroethylene in concentrations ranging from 14 to 52 μg/L. Additionally, 1,2-dichloroethene (6 μg/L at MW-21) and 1,1,1-trichloroethane were quantified at MW-21 (28-29 μg/L), MW-24 (ND-4J μg/L) and MW-25 (8 μg/L). **Monitoring well MW-23 was the only sampling location impacted by chloromethane (28 μg/L) and chloroform (5 μg/L) and as such, these compounds are probably not related to the Hillcrest facility plume.**

Other off-site monitoring wells (MW-15, MW-17 and MW-20) were also impacted by volatile organics above New York State standards. At monitoring wells MW-15, MW-17 and MW-20, 1,1,1-trichloroethane was quantified at the ranges of concentrations indicated respectively - 5-8 μg/L, 8-9 μg/L and ND-7 μg/L. Trichloroethylene was also quantified at wells MW-15, MW-17 and MW-20 as listed respectively - 46-54 μg/L, 52-77 μg/L and 51-56 μg/L.

The highest concentration of 1,1,1-trichloroethane was reported at MW-13. However, it is apparent that another location exhibiting a localized high concentration occurs at MW-21. This well is downgradient of another potential contaminant source, Triple Cities Metal Finishing Corp. **The 1,1,1-trichloroethane concentrations are seen to decrease from this location (MW-21) towards the Hillcrest facility.**

Maps depicting contoured concentrations of 1,1,1-trichloroethane and trichloroethylene are included as Figures 4-1 and 4-2. Analytical data from the Phase III investigation (July 1987) was used in conjunction with the September 1989 groundwater analytical data to prepare these maps. This allowed an approximation of 1,1,1-trichloroethane and trichloroethylene concentrations at the other monitoring wells and a more realistic representation of volatile organic impact in the study area.

The highest concentration of trichloroethylene quantified during the RI occurs near MW-6. This contaminant is present at approximately 50 μg/L off-site to the west and north. Monitoring well No. 20 was installed as an "early warning well" for volatile organic contamination migrating in the water table aquifer towards the well field. As listed in Table 4-7, both trichloroethylene and 1,1,1-trichloroethane are present at this well at concentrations of 51-56 μg/L and 5-7 μg/L, respectively. **Although it is possible that the past discharges from the Link facility may have resulted in the northern distribution of contaminants (Section 3.1.4, Contaminant Transport), it is probable that other source areas to the east of MW-20 exist. Additional monitoring wells located to the north and east of MW-20 may be required to determine if other source areas are present, impacting groundwater quality and to close out the northern extent of the volatile organic plume.**

The volatile organic data generated during the remedial investigation is consistent with previous investigations and

FIGURE 4-1

CONCENTRATIONS OF TRICHLOROEHTYLENE (ug/l)
SEPTEMBER 6-7, 1989

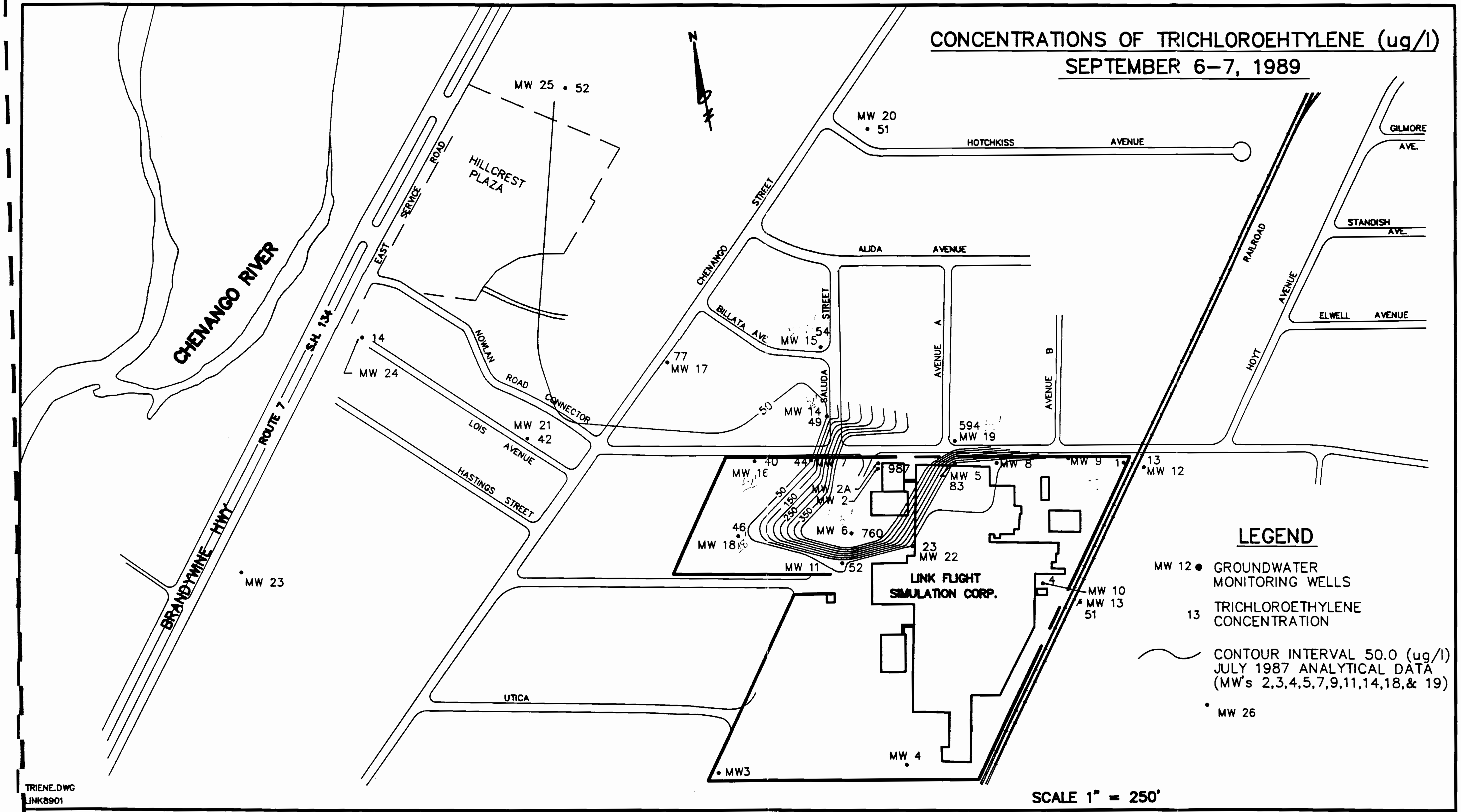


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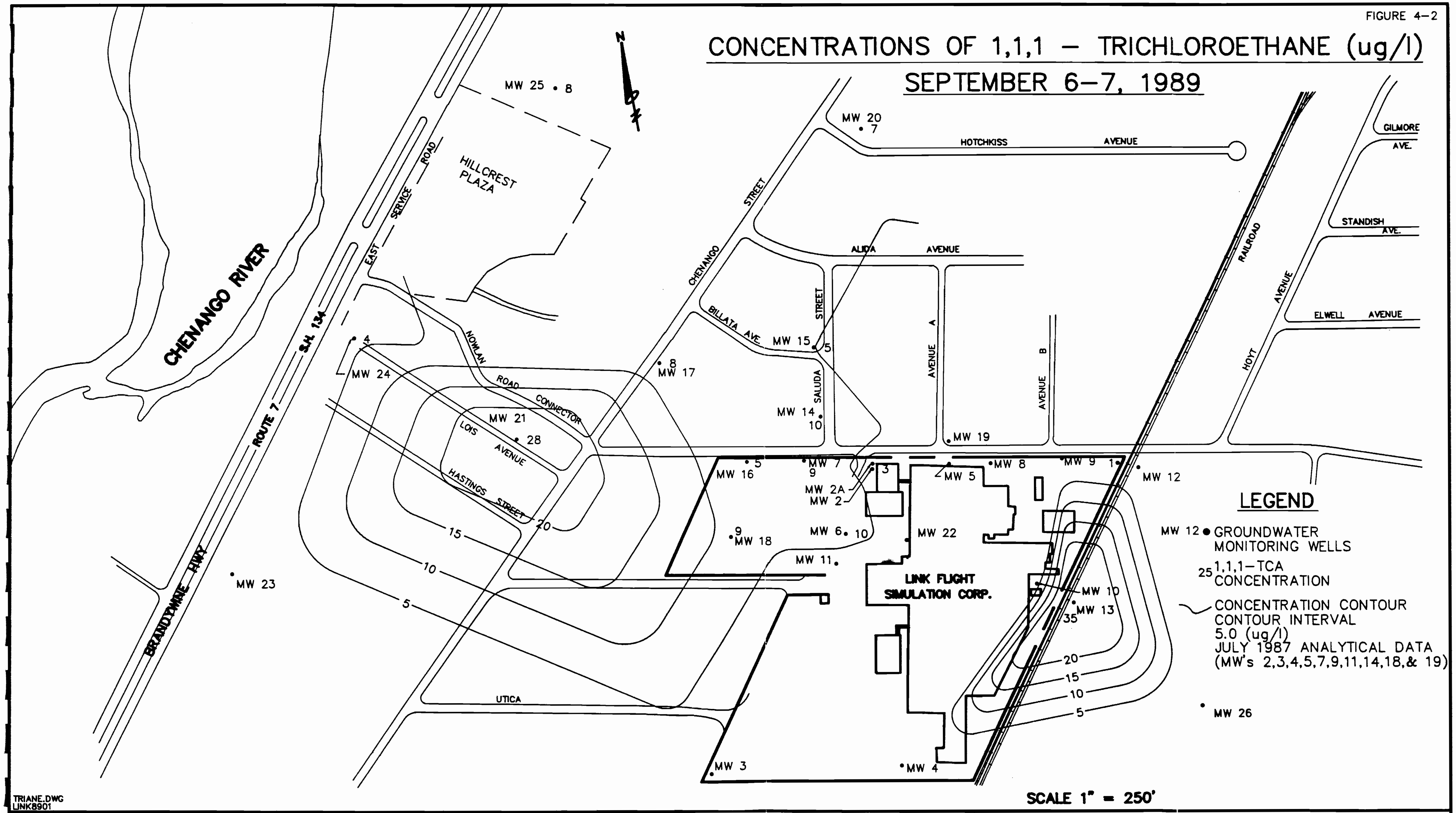
FIGURE 4–2

CONCENTRATIONS OF 1,1,1 – TRICHLOROETHANE (ug/l)

SEPTEMBER 6–7, 1989



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identifies primarily two (2) volatile organic plumes (1,1,1-trichloroethane and trichloroethylene) emanating from the Hillcrest facility with other possible source areas off-site. Concentrations of associated breakdown products of 1,1,1-trichloroethane and trichloroethylene (1,1-dichloroethylene, 1,1-dichloroethane and 1,2-dichloroethylene) are also quantified primarily on-site at a location associated with the highest concentrations of primary volatile organic contamination (MW-6).

- <u>Pesticides/PCBs</u>

No pesticides or PCBs were quantified above the detection limit established for that parameter. Therefore, no compounds were quantified above New York State standards and/or EPA MCLs in any of the fourteen monitoring wells sampled.

- <u>Tentatively Indicated Compounds (TIC)</u>

Several tentatively indicated compounds (TIC) were identified during the laboratory analysis of groundwater samples. These compounds included: 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113), cyclic hydrocarbon, dimethyloctane isomer, decane, C9H12 alkalybenzenes, udecane, methyloctane isomer, dimethylnonane isomer, laboratory artifact (column bleed) and a saturated hydrocarbon. All of the compounds (except Freon 113) identified were considered suspect and rejected because of quantification of these same compounds in a field, trip or laboratory blank sample at a similar level. The Freon 113 was quantified at monitoring well MW-21 at a concentration of 8 µg/L only in the October 1989 sampling event.

- Inorganic Compounds

Elevated levels of inorganic constituents were detected in the monitoring wells for Round I and Round II groundwater sampling events. Table 4-2 provides a complete listing of inorganics quantified in these two groundwater sampling events.

All of the Target Analyte List (TAL) inorganics with the exception of selenium and thallium were quantified at the monitoring wells, inclusive of the upgradient well, MW-26. Overall, the concentrations of the inorganics quantified at many of the monitoring wells exceeded the New York State drinking water standards established for these parameters. At the upgradient well (MW-26) which was used to establish background groundwater quality, the following inorganics were reported exceeding drinking water standards: antimony, barium, beryllium, cadmium, chromium, iron, lead, magnesium and manganese.

Overall elevated concentrations of metals may be attributed to the fact that the samples were not filtered before preservation. Extreme sample turbidity was noted during groundwater sampling (>100 NTU). NYSDEC's policy as established in the RI QA/QC plan is that groundwater samples not be filtered before preservation. For comparison purposes, to identify if turbidity is a contributing factor, key duplicate groundwater samples (MW-13, MW-16 and MW-22) of Round II were filtered and analyzed for metals. These samples were field filtered before field preservation on October 5, 1989. The filtered vs. unfiltered analytical results are presented in Table 4-8.

TABLE 4-8

INORGANIC COMPOUNDS QUANTIFIED IN GROUNDWATER

OCTOBER 1989

COMPARISON OF UNFILTERED/FILTERED SAMPLES

Compound (ug/l)	MW13	MW13F	MW16	MW16F	MW22	MW22F	Field Blank 1	Field Blank 2	EPA MCL (a)	N.Y.S. Stds. (b)	N.Y.S. Guidance (c)
Aluminum	32,400	--	241,000	--	193,000	--	--	--	NS	NS	NS
Antimony	--	--	40.5B	--	--	--	--	--	NS	NS	3
Arsenic	30.1	--	--	--	36.4	--	--	--	50	25	NS
Barium	253	165B	1,530	186B	1,230	84.4B	--	--	NS	1,000	NS
Beryllium	2.3B	--	20.6	--	16	--	--	--	NS	NS	3
Cadmium	334	82	151	--	13	--	--	--	10	10	NS
Calcium	43,200	51,100	860,000	125,000	464,000	48,300	--	--	NS	NS	NS
Chromium	334	92.8	535	590	396	--	--	--	50	NS	NS
Cobalt	21.2B	--	229	--	291	--	--	--	NS	NS	NS
Copper	293	65.4	1,050	45.5	736	41.7	--	28.5	NS	1,000	NS
Iron	68,200	106	560,000	79.6B	475,000	46.8B	75B	201	NS	300	NS
Lead	120	2.3B	690	--	540	--	--	--	50	25	NS
Magnesium	14,300	7,960	281,000	29,200	135,000	7,190	--	--	NS	NS	35,000
Manganese	5,700	195	17,400	15.2	27,700	12.3B	--	7.5B	NS	300	NS
Mercury	0.28	0.2	0.6	--	1.2	--	--	--	2	2	NS
Nickel	197	--	1,090	--	578	--	--	--	NS	NS	NS
Potassium	6,770	4,480B	20,100	2,060B	18,100	1,950B	--	--	NS	NS	NS
Selenium	--	--	--	--	--	--	--	--	10	20	NS
Silver	20	10	30	10	90	20	10	20	50	50	NS
Sodium	33,100	4100	59,700	20,900	79,900	118,000	258B	--	NS	NS	NS
Thallium	--	--	--	--	--	--	--	--	NS	NS	4
Vanadium	45.1B	--	362	--	312	--	--	--	NS	NS	NS
Zinc	373	216	2,440	384	1,550	29	--	6.9B	NS	5,000	NS

NOTES:

F = Filtered sample
B = Reported value is less than the Contract Required Detection Limit (CRDL) but greater than the Instrument Detection Limit (IDL).
-- = Below detection limit for analyte
NS = No standard or guidelines

(a) USEPA Maximum Contaminant Level (MCL) for Drinking Water
(b) New York State Groundwater Quality Standards, NYS Title 6, Part 703.
(c) New York State Groundwater Quality Guidance Value

JSH:mad
(a:\4-8.wk1)

Heavy metals are known to adhere to small particles in suspension which may result in metal analyses which do not represent flowing groundwater. In many instances, upon comparison of filtered vs. unfiltered, significant reductions in metal concentrations were found, indicating that many of the metals quantified were found in the suspended solids. Further verification of metal transport in the groundwater is required. However, the filtered and unfiltered comparison was utilized in evaluating the inorganic data from the Hillcrest facility. For the filtered vs. unfiltered samples, all inorganics with the exception of cadmium (MW-13) at 82 µg/L and chromium (MW-13 and MW-16) at 92.8 and 590 µg/L, respectively, were below the established New York State standard or EPA MCLs for the filtered sample. The upgradient monitoring well MW-26 showed a background unfiltered range in concentration of cadmium from ND - 18.5 µg/L and chromium from 110 - 843 µg/L.

In order to analyze and evaluate the unfiltered inorganic groundwater quality data, a comparison was made to the concentrations of inorganics quantified at the upgradient background monitoring well MW-26. In order to make this comparison, average values were calculated for each sampling location, incorporating both rounds of groundwater quality data (September and October, 1989) as indicated on Table 4-9.

The average value at each monitoring well was also compared to the EPA MCL and New York State standards and guidance values. The vast majority of the inorganics (with the exception of

TABLE 4-9

ESTIMATED AVERAGE CONCENTRATIONS OF INORGANIC COMPOUNDS QUANTIFIED IN GROUNDWATER

SEPTEMBER AND OCTOBER 1989

Parameter	MW6	MW10	MW12	MW13	MW15	MW16	MW17	MW20	MW21	MW22	MW23	MW24	MW25	MW26 Average (Background)	5X Background	EPA MCL (a)	N.Y.S. Standards (b)	N.Y.S. Guidance (c)
Aluminum	451,000	253,000	163,000	172,700	37,450	222,500	17,230	197,000	373,000	235,500	128,000	225,500	102,450	342,000	NA	-	-	-
Antimony	-	62.5	-	38.9	-	333	-	26.0	54.9	30.6	91	27.3	-	38.3J	192	-	-	3
Arsenic	-	39.5	79.8	30	22.3	-	12.9	-	17.5	19.7	39.3	27.1	33.3	46	230	50	25	-
Barium	3,745	2,995	1,360	1,286.5	294.5	1,420	158.5	1,405	2,375	1,675	1,755	1,680	959.5	2,054	NA	-	1,000	-
Beryllium	86.4	19.05	10.35	10.4	4.1	19.8	2.9	19.4	39.8	19.6	9.3	27.5	8.4	14.75	73.8	-	-	3
Cadmium	38.8	6,620	107.4	2,002	-	141.5	6.2	11.8	76.7	16.5	19.4	38.4	22.9	10.5	52.5	10	10	-
Calcium	5,770,000	386,000	94,950	66,800	140,500	470,050	156,000	927,000	1,630,000	640,500	181,000	1,455,000	279,000	55,950	279,750	-	-	-
Chromium	1,230	18,400	586	1,642	190.5	521.5	287.5	350.5	949	481.5	292.5	612.5	541	476.5	2,382.5	50	-	-
Cobalt	565.5	222	121	129.1	41.2	205.5	18.8	211.5	520	367.5	119.8	237	101.1	286.4	NA	-	-	-
Copper	1,285	18,000	1,410	1,311.5	139	955.5	66.2	493.5	1,245	953	278.5	789	237.5	622	3,110	-	1,000	-
Iron	1,040,000	561,000	342,500	362,600	41,250	497,500	39,750	451,500	1,365,000	597,000	283,500	600,000	216,500	678,500	NA	-	300	-
Lead	1,300	1,120	400	420	125	590	100.8	640	935	650	280	750	275	600	NA	50	25	-
Magnesium	1,413,500	199,000	52,000	49,400	48,750	283,500	40,100	265,000	570,000	181,000	65,250	475,500	98,850	97,250	486,250	-	-	35,000
Manganese	36,450	53,150	16,300	39,100	3,125	15,500	1,099.5	12,100	24,750	34,250	24,250	19,650	3,940	17,820	NA	-	300	-
Mercury	0.215	0.92	2.05	0.28	-	0.4	-	0.49	0.49	1.7	0.23	0.46	-	0.88	NA	2	2	-
Nickel	1,165	1,705	518	1,063.5	103.7	975.5	58.6	487.5	1,289	713.5	343	589.5	298.5	652.5	NA	-	-	-
Potassium	12,000	20,550	16,900	16,935	6,055	18,900	5,270	13,950	22,500	18,800	7,410	16,000	10,510	22,550	NA	-	-	-
Selenium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NA	10	20	-
Silver	10	85	140	30	20	30	15	15	10	90	10	20	10	10	NA	50	50	-
Sodium	145,000	20,500	44,950	37,350	46,800	57,600	78,950	63,500	48,000	89,950	19,200	36,300	73,600	11,400	57,000	-	-	-
Thallium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NA	-	-	4
Vanadium	450.5	385	219	232.1	59.9	334.5	30.6	302.5	722.5	372	173.5	376.5	135.5	395.5	NA	-	-	-
Zinc	3,175	4,065	1,280	1,936.5	300	2,225	128.0	1,340	3,520	2,065	860.5	1,775	705	1,644.5	NA	-	5,000	-
Cyanide	-	221.5	25	16.5	30	-	10	-	-	-	30	-	24.5	-	NA	-	200	-

NOTES:

Quantitation of these inorganics is approximate due to limitations identified in the quality assurance review.

(1) Average concentrations from both rounds of groundwater sampling were calculated.

(2) All results in µg/L

NA Not applicable

\- Below detection limit

(a) USEPA MCL (Maximum Contaminant Levels) for Drinking Water

(b) New York State Groundwater Quality Standards, NYS Title 6, Part 703.1 Guidelines

(c) New York State Groundwater Quality Guidance Value selenium, thallium and vanadium, and those compounds without applicable standards) at each well location (including the upgradient well) were quantified in concentrations above the established NYSDEC drinking water standards. The comparison of each monitoring well groundwater quality data against the background well (MW-26) indicated that the majority of the constituents (all TAL compounds except potassium, selenium and thallium) were present in concentrations above the background level. **Since the amount of turbidity present in groundwater can vary from well to well, depending on the material the well is screened in and development, it is expected that inorganic concentrations can vary accordingly and still not be significant in terms of indicating contamination.** Therefore, another analysis was performed identifying those inorganic compounds quantified at concentrations exceeding five times the background concentration. These data were also reviewed with respect to those fingerprint inorganic contaminants already identified on-site at the Hillcrest facility and other inorganics likely to be present due to facility processes.

Key fingerprint inorganic compounds quantified at five times background concentrations include antimony (MW-16), beryllium (MW-6), cadmium (MW-10, MW-12, MW-13, MW-16 and MW-21), calcium (MW-6, MW-10, MW-16, MW-20, MW-21, MW-22 and MW-24), chromium (MW-10), copper (MW-10), magnesium (MW-6), silver (MW-10, MW-12 and MW-22), sodium (MW-6, MW-16, MW-17, MW-20, MW-22 and MW-25) and cyanide (MW-10).

Because silver was not present in the background sample, all sampling locations exceeded the background concentration. However, silver was reported above the EPA MCL of 50 µg/L only at MW-10, MW-12 and MW-22. Hexavalent chromium was quantified at MW-10, MW-12, MW-13, MW-15, MW-16, MW-17 and MW-25 all above the New York State standard of 50 µg/L.

The inorganic compounds identified above as significant are generally consistent with the inorganic data previously generated during the earlier phased site investigations (H2M, 1986). The majority of earlier groundwater samples collected were filtered prior to analysis, so relative concentrations of inorganic contaminants quantified can not be correlated with the RI data. However, the key indicator inorganics present at monitoring wells close to known source areas have been confirmed to be the heavy metals such as cadmium, chromium, hexavalent chromium, cyanide and silver with new indicator compounds such as sodium, magnesium, calcium, beryllium and copper.

Monitoring well MW-10 was the location of the highest overall concentrations of inorganic compounds quantified with calcium, cadmium, chromium, hexavalent chromium, copper, silver and cyanide reported in excess of five times background concentrations.

4.1.3 - Plume Definition

In summary, the laboratory analytical results indicate on-site source areas of volatile organic and inorganic contamination. The volatile organic contaminant plume is migrating in the water table aquifer off-site with groundwater flow. Figures 4-1 and 4-2 depict the estimated areal extent of the volatile organic plumes.

Two (2) plumes consisting of volatile organic and inorganic contamination are emanating from the relative positions of monitoring wells MW-6 and MW-10 within the Hillcrest facility. Another source area of 1,1,1-trichloroethane contamination is estimated/calculated as being near or from the Triple Cities Metal Plating Company.

4.1.4 - Previous Analytical Studies

Previous hydrogeologic investigations conducted at this site have also mapped the key fingerprint contaminants detailed above. The remedial investigation analytical findings are consistent in terms of type of contaminants, predicted migration of contaminants and groundwater flow direction determination.

4.2 - SOIL SAMPLING

The objective of the soil sampling program was to conduct additional investigation in the area of the inactive industrial outfall system 004. Soil samples were obtained to: (1) determine the extent of contamination; (2) to provide a fingerprinting of potential contaminants; and (3) aid in the classification of soil.

HNu screening of split spoon samples was performed during the sampling of this outfall system. Results of the HNu screening are reported in Table 4-10. Only one soil sample

TABLE 4-10

HNu RESPONSE (ppm) FROM LEACHING POOL SAMPLING

LINK FLIGHT SIMULATION DIVISION

HILLCREST FACILITY

BINGHAMTON, NEW YORK

(JULY-AUGUST 1989)

Location	Sample Depth	HNu Response
Outfall BA-1	10'-12'	--
Outfall BA-2	14'-16'	--
	16'-18'	30
Outfall B	10'-12'	--
	12'-14'	--
	14'-16'	--
Outfall C	10'-12'	--
Outfall E	10'-12'	--
Outfall H	10'-12'	--
	12'-14'	--
Outfall I	13.5'-15.5'	0.5
Outfall J	10'-12'	0.5
	12'-14'	--
	14'-16'	--
Outfall K	10'-12'	--
	12'-14'	--
	14'-16'	--
Outfall L	10'-12'	--
	12'-14'	--
Outfall M	10'-12'	--
	12'-14'	--

NOTE: -- indicates a response consistent with background response located at Outfall BA-2 at 16 to 18 feet reported an HNu response elevated above background (30 ppm HNu response units).

Fourteen (14) soil borings were installed during the months of July and August, 1989. The results of analytical testing of soil are tabulated and listed in Table 4-3.

- <u>Volatile Organics</u>

Many of the TCL suite of volatile organics were quantified in the soil samples taken from the boreholes drilled to sample the leaching pools within the Outfall 004 system. These volatile organic compounds primarily included the following compounds: acetone, 1,1,1-trichloroethane, TIC unknowns, vinyl chloride, methylene chloride, 1,1-dichloroethylene, 1,1-dichloroethane, trichloroethylene, tetrachloroethylene, toluene, ethylbenzene, total xylenes and 1,1,2-trichloroethane.

The volatile organic compounds present in the highest concentrations (μg/kg) are indicated below with respect to their sampling location and relative depth:

<u>Outfall E</u> (10 to 12 feet) (μg/kg)

Chloroethane	46,000J
1,1-Dichloroethane	26,000
1,1,1-Trichloroethane	31,000J
Trichloroethylene	380J
Tetrachloroethylene	210J
Toluene	920J
Total Xylenes	290J

<u>Outfall E</u> (12 to 14 feet) (μg/kg)

1,1-Dichloroethane	2600J
1,1,1-Trichloroethane	45,000J
Chloroethane	480J

Outfall BA-2 (16 to 18 feet) (µg/kg)

1,1,1-Trichloroethane	530,000J
Trichloroethylene	610,000J
Tetrachloroethylene	1700J
Toluene	2000J
Ethylbenzene	300J
Total Xylenes	1500J

Outfall N (8 to 12 feet) (µg/kg)

Acetone	1900J
Carbon Disulfide	300J
1,1-Dichloroethane	49J
1,1,1-Trichloroethane	1400J
Ethylbenzene	51J
Total Xylenes	280
Toluene	160J

The following outfall sample locations were quantified as containing either low levels of volatile organics or below detection levels: Outfalls D, B, I, C, H, BA-1, K, M and L.

The analytical data from the background boring soil samples (B-1/B-2 at depths of 10 to 12 feet and 20 to 22 feet, respectively) reported no volatile organics in concentrations above the detection limits established for those compounds.

- Tentatively Indicated Compounds (TICs)

Numerous TICs were identified during the CLP analysis of outfall soil sample data. The TICs were identified primarily at Outfalls E, N, J, BA-2, BA-1, K and M. The compounds present were primarily from two classes of petroleum hydrocarbons - aromatic and aliphatic hydrocarbons. These compounds included elevated concentrations of methylcyclohexane, dimethyloctane isomers, unknown cyclic hydrocarbon, decane, methyldecane isomer, udecane, unknown hydrocarbon, decahydromethylnaphthalene, laboratory artifact (column bleed), C9H12 alkylbenzenes, dimethyldecane isomer, methyldecane isomer, unknown-chlorinated, trimethylhexane isomer, dimethyldisulfide, 1,1,2-trichloro-1,2,2-trifluoroethane, propylheptane isomer, C10H14 alkylbenzene, dichlorobenzene isomer, aromatic ketone, trimethyloctane isomer and dimethyloctane isomer.

On the basis of the range of compounds present, it is impossible to attribute them to one specific category of contaminant or make correlations as to their presence or relative concentrations.

Aliphatic hydrocarbons are dominant in the gasoline fraction of crude oil. Aromatic hydrocarbons are also present in crude oil, but in concentrations of less than 15 percent of the total in the petroleum fraction of crude oil. Aromatics are a common constituent of the burning of most organic material in addition to coal tars and petroleum.

- <u>Pesticides/PCBs</u>

PCBs (Arochlor 1254, 1260) were quantified at Outfall N (8 to 12 feet) and Outfall J (10 to 12 feet) at a concentration of 1900 and 1200J μg/kg, respectively. PCBs (Arochlor 1260) were also quantified at Outfall BA-2 (10 to 12, 16 to 18 feet) at a concentration of 240 and 2700 μg/kg, respectively. Pesticide 4,4'-DDT was quantified at Outfall K (10 to 12 feet) at a concentration of 850 μg/kg. Lindane was reported present, but as an unreliable result.

These concentrations of PCBs and pesticides were compared to background concentrations and to those standards established for these compounds. Although concentrations of quantified PCBs are elevated above background, they do not exceed the established standards or action guidelines. PCBs (Arochlor 1260) were quantified during the Phase III soil boring program at SB-4 at a concentration of 190 and 280 µg/kg. This boring is located in the close vicinity of decommissioned Outfall A. Concentrations of PCBs were considered to be low and not a threat to public health because of the characteristics that PCBs have for adhering to soils. PCBs at these concentrations would tend to not dissolve in the groundwater and generally remain in place.

The EPA announced in March 1987 a new cleanup policy for spill cleanups under the Toxic Substances Control Act (TSCA). Informal cleanup standards for PCBs of 10,000 µg/kg to 25,000 µg/kg were established dependent upon the situation. A New York State informal cleanup criteria (action level) established for PCBs and pesticides/herbicides in soil is 5000 µg/kg and 1000 µg/kg, respectively. Concentrations quantified in the outfall samples are significantly lower than these cleanup standards.

Pesticides were present only at Outfall K in a concentration below standards or guidelines established for that compound.

- Inorganics

In order to evaluate and assess the soil data generated from the sampling program conducted at the Outfall 004 system, a comparison was made to applicable soil standards and background soil data from sampling locations B-1 and B-2. The inorganic analytical data generated for these samples is presented in Table

4-3. The background samples (B-1, B-2) reported concentrations of inorganics above and below the typical ranges identified in this geographic area. Those that exceeded these concentrations included antimony, barium, copper, iron and nickel. The inorganic compounds present above background soil quality data or typical concentrations are listed in Table 4-11. The inorganic compounds present above background levels were all of the TAL inorganics with the exception of arsenic, potassium, cobalt, selenium, thallium and vanadium.

Because the majority of soil samples exhibited inorganic concentrations in excess of the background sample, an additional comparison was made to concentrations that exceeded five times the background concentration present. The inorganic compounds present at concentrations exceeding this criteria were cadmium (at all the outfall soil samples except Outfall I, 10 to 14.5 feet), antimony (at Outfall K, 12 to 14 feet), barium (at Outfalls J, 10 to 12 feet, K, 10 to 16 feet and L, 10 to 12 feet), beryllium (at Outfalls K, 10 to 14 feet and N, 8 to 12 feet), calcium (all except Outfalls B, C, D, H & I (shallow), M, 10 to 16 feet), chromium (all except Outfalls B, 10 to 16 feet, D, 20 to 24 feet, E, 12 to 14 feet, H, I, 10 to 12 feet), copper (at all outfalls except Outfall C, 14 to 16 feet and D), magnesium (at Outfalls H, 10 to 12 feet and K, 10 to 12 feet, N, 8 to 12 feet), mercury (at Outfalls J, 10 to 12 feet, K, 10 to 16 feet, L, 10 to 12 feet), nickel (Outfalls J, K, L and N), silver (Outfalls I, J, K, L and N), zinc (Outfalls BA-1, BA-2, I, J, K,

TABLE 4-11
CONCENTRATIONS OF INORGANICS QUANTIFIED (MG/KG) IN SOIL ABOVE BACKGROUND SOIL CONCENTRATION AND/OR SOIL STANDARDS

Outfall	Feet	Al	Sb	Ba	Be	Cd	Ca	Cr	Co	Cu	Fe	Mg	Hg	Ni	Ag	Zn	CN	Pb	Mn
B-A1	10-12	11,000	-	86.5J	0.84J	289J	17,900J	678J	-	797J	28,900J	5160	-	104J	8.2J	674J	141J	33.4	709
B-A1	16-18	-	-	115J	0.78J	260J	-	2200J	-	1510J	-	-	-	64.5J	-	326J	-	78.0	877
B-A2	10-12	12,300	-	164J	1.2J	326J	16,200J	1700J	9.4J	978J	33,400J	6320	-	157J	5.5J	607J	-	231	793
B-A2	16-18	10,400	-	93J	0.84J	287J	5060J	1150J	-	912J	29,700J	4770	-	87.9J	-	390J	-	64.2	670
B	10-12	14,300	-	137	0.97J	140J	2790	157J	16.2J	1230J	35,400	4140	-	124	3J	277J	-	30.1	3370J
B	14-16	-	50.6	62.6	0.61J	84.7J	2250	90.0J	10.2J	506J	-	3150	-	65.7	-	178J	-	30.4	1700J
C	10-12	12,100	-	130J	0.78J	164J	2700	612J	11.5J	240J	28,400	4480	-	90.6J	2.6J	348J	287J	88.7	-
C	14-16	11,400	-	111J	0.76J	129J	3200	192J	12.7J	178J	27,900	4380	-	87.1J	1.5J	234J	270J	35.6	1470
D	20-24	11,200	-	51.9	-	19.6J	-	45.9J	10.8J	-	26,800	3670	-	39.1	-	87.8J	-	-	-
E	10-12	14,300	-	113	0.88J	103J	13,300	308J	10.4J	485J	26,500	4620	-	109	2.5J	328J	-	41.1	1750J
E	12-14	11,200	-	79.5	0.84J	38.7J	33,800	133J	9.5J	210J	26,500	5280	-	59.0	-	231J	-	65.1	641J
H	10-12	-	-	-	1.3J	43.8J	67,100	122J	-	794J	-	18,500	-	50.0J	-	152J	-	30.4	-
H	18-20	-	-	49.2J	-	79.1J	2090J	112J	-	212J	-	-	-	56.3J	-	212J	-	15.0	-
I	10-12	-	-	120J	-	3.7J	4170J	153J	-	135J	-	-	-	41.9J	7.7J	499J	-	29.6	-
I	13.5-14.5	-	-	183J	1.2J	10.8J	40,500J	362J	-	367J	-	7030	-	114J	12.5J	956J	-	86.1	-
I	20-22	-	-	145J	0.78J	88.1J	19,100J	2710J	-	1400J	-	11,700	-	138J	13.0J	435J	-	72.5	-
J	10-12	-	25.5B	450J	1.4J	4020J	56,000J	7330J	12J	7000J	27,600	4790	0.93	4690J	50.5J	6110J	216J	327	-
J	14-16	-	-	111J	1.2J	1220J	54,000J	1630J	-	1310J	-	8050	0.12	531J	11.4J	841J	-	91.9	-
K	10-12	30,200	32.4	637	5.9J	219J	123,000	6960J	11.7J	10,700J	27,900	20,200	0.47	620	50.5J	4510J	-	1070	2170J
K	12-14	-	112	436	2.5J	423J	52,900	8410J	-	14,700J	-	5090	0.64	825	40.2J	3660J	-	619	-
K	14-16	10,500	30.3	319	1.7J	322J	65,300	6000J	10J	10,100J	-	11,500	0.3	632	31.6J	2400J	-	383	712J
L	10-12	10,600	-	239J	2.1J	28.8J	94,400J	1360J	-	1890J	27,100	15,400	0.40	179J	13.1J	1420	-	156.2	-
L	16-18	-	-	59.8J	0.74J	14.8J	36,800J	374J	-	664J	-	7650	-	53.6J	2J	146J	-	29.5	-
M	10-12	-	16.8	189	-	171J	4,300	1840J	-	6790J	-	-	-	155	-	1190J	-	7250	-
M	14-16	16,800	-	126	0.8J	165J	3120	547J	14.8J	544J	39,000	6020	-	80.5	-	493J	-	265	950J
N	8-12	15,600	20.5	180	2.5J	152J	150,000	2880J	14.5J	6810J	41,200	22,100	0.37	330	6.8J	1270J	-	70.3	952J
Background B-1		9,480	-	52.7	0.46J	2.3J	2000J	32.4B	9.2J	37.7J	26,800	3110	-	34.3J	-	74.3J	132J	15.3	70J
Background B-2		9,860	6.4B	40.2J	0.50J	3.2J	1590J	34.2B	8.7J	34.0J	25,600	3920	-	37.0J	-	80.6J	1.7J	12.8	537
Average Background		9,670	16.2	46.5	0.48	2.8	1795	33.3	9.0	35.9	26,200	3515	-	35.7	-	77.5	66.9	14.05	621
5X Average Background		48,350	81	232.4	2.4	13.8	8975	166.5	45	179.3	131,000	17,575	-	178.3	-	387.4	334.3	70.3	3105
Typical Concentration Range*		7,000-10,000	1.3-10	<1-4.5	1-2	<1-4.5	<130-3500	30-50	10-15	15-20	15,000-20,000	2000-5000	0.082-0.2	20-30	<0.5-3	74-120	NA	30-700	700-1000

\- = Below average background concentration or standard established for parameter
* = Shacklette and Boerngen (1984) and Conner and Shacklette (1975)
NA = Not available
B = This result is qualitatively suspect since this constituent was detected in a field and/or laboratory blank at a similar level.
J = Estimated concentration due to limitations identified in the quality assurance review.

L, M and N), lead (Outfalls BA-1, BA-2, C, I, J, K, L and M) and manganese (Outfall B, 10 to 12 feet).

The majority of the inorganic compounds quantified in soil at elevated concentrations have been identified as the primary inorganic constituents impacting the site. These include: antimony, barium, beryllium, cadmium, calcium, chromium, copper, magnesium, silver, nickel, zinc, lead, manganese and cyanide. Because the elevated inorganic compounds in soil contains so many of the same compounds, the industrial outfall system has been confirmed as a source area. Concentrations of the inorganics are the most elevated at monitoring well locations adjacent to the outfall system, both upgradient and downgradient. The upgradient wells (MW-12 and MW-13) were most likely affected due to mounding effects from discharge of inorganic-laden wastewater from the industrial outfall system. Wells further downgradient of the site indicate decreasing concentrations of inorganics away from the outfall system.

4.2.1 - Previous Investigation

The Phase III investigation completed in September 1987 included a preliminary investigation of the vicinity of Outfall 004 system. The Phase III investigation provided initial data on the fingerprint inorganic contamination present in the soils around Outfall 004.

4.3 - SOIL GAS SAMPLING

Soil gas samples were collected during June and July 1988 as discussed in Section 2.1.4. A report was prepared and submitted to NYSDEC on October 19, 1988 providing the results of the soil gas investigations.

Comparison of the analytical results of the air samples was made between the results and NYSDEC guidelines for the Control of Toxic Ambient Air Contaminants "New York State Air Guide - 1". The Air Guide - 1 is the combined effort of NYSDEC's Bureau of Air Toxics and Bureau of Impact Assessment and Meteorology.

Acceptable Ambient Air Levels (AALs) have been established for specific contaminants based upon all available data using risk assessment technology suitable for the contaminant. It should be noted that the AALs are considered guideline values and not standards.

As shown in Table 4-12, with the exception of trichloroethylene at location SG-3, the concentrations of volatile organics quantified were below the acceptable AALs established for these specific contaminants. The air sample from location SG-3 was impacted above the interim AAL established for trichloroethylene. A maximum concentration of 300 ppb was reported during the July 19, 1988 sampling event.

Based on the elevated concentrations of trichloroethylene at location SG-3, a nearby source other than contaminated groundwater, is assumed to exist. With maximum groundwater contaminant concentrations in the vicinity of soil gas location SG-3 at 64 ppb (MW-18) and 89 ppb (MW-11), and assuming a Henry's Law constant for trichloroethylene of 0.33 (Lappala and Thompson, "Proceedings of the Characterization and Monitoring of the Vadose

TABLE 4 -12

LINK FLIGHT SIMULATION CORPORATION

CONTAMINANTS QUANTIFIED IN SOIL GAS SAMPLES (in ppb)

PARAMETER	SG-3 Trap 468 6/2/88	SG-3 Trap 492 7/19/88	SG-3 (Dup) Tube 431 7/19/88	SG-10 Tube 24 7/19/88	SG-17 Tube 23 7/19/88	SG-18 Tube 490 7/19/88	Field Blanks 6/2/88 & 7/19/88		NYSDEC AAL(2)
1,1,1-Trichloroethane	--	41	62	--	8	--	--	--	6,957 (38000 ug/m^3)
Trichloroethene	44	260	300	--	--	--	--	--	167 (900 ug/m^3)
Benzene	--	7	13	--	--	--	--	--	31 (100 ug/m^3)
Toluene	--	5	9	4	--	3	--	--	1,988 (7500 ug/m^3)

Notes:

(1) All samples (SG-1 through SG-18, duplicates and blanks) were analyzed for priority pollutant purgeable organics; none but those indicated were detected.

(2) AAL - Interim Acceptable Ambient Levels established in the NYSDEC Division of Air Resources, (Air Guide - 1) Application of 6 NYCRR 212.

(3) -- = Not Detected

Zone", NWWA, 1983) a maximum soil gas concentration of only approximately 29 ppb could be expected at the water table interface. This concentration could be expected to be even lower at the shallow depth that samples were obtained. Therefore, the concentrations quantified in the soil gas samples obtained from location SG-3 far exceed the concentrations to be expected from gases emanating from contaminated groundwater in this vicinity.

Except for location SG-3 and trace concentrations (4 ppb and 3 ppb) of toluene at location SG-10 and SG-18, all other samples from the community surrounding the site were found to be free of soil gas contamination.

The presence of 1,1,1-trichloroethane at location SG-17, west of location SG-3 is assumed to be residual contamination from a source area near location SG-3.

The analytical results of soil gas sampling primarily indicate impact at location SG-3 related to trichloroethylene and 1,1,1-trichloroethane contamination. These chemicals are widely available solvents which are commonly used for degreasing, paint stripping, etc.

The boring at location SG-3 is surrounded by boring location SG-2, (June 2, 1988 sampling), 17 and 18 (July 19, 1988 sampling). These surrounding soil gas sampling points with the exception of 1,1,1-trichloroethane at SG-17 were found to be generally uncontaminated by purgeable organics. **This indicates that the contamination is most likely not related to groundwater contamination and concentrated in the localized area surrounding** location SG-3. A possible source of this contamination may be nearby off-site sanitary leaching/dry well systems associated with the commercial establishments located on Beckwith Avenue adjacent to location SG-3.

TABLE 4-1

GROUNDWATER ANALYTICAL DATA

SEPTEMBER 1989

VOLATILE ORGANIC ANALYSIS - ANALYTICAL RESULTS

- page 1

H2M Sample Number		MW-17	MW-23	MW-24	MW-25	Trip Blank	MW-6	MW-21	MW-20	MW-15	MW-26	FB-1	MW-16	MW-13	Trip Blank	MW-10
Laboratory Sample Number		965629	965630	965631	965632	965633	965511	965512	965513	965514	965515	965516	965517	965518	965519	965520
Remarks							Analyzed Twice					Field Blank				
Units		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
VOLATILE COMPOUNDS	Quantitation Limit															
Chloromethane	10															
Bromomethane	10															
Vinyl Chloride	10															
Chloroethane	10															
Methylene Chloride	5.0															
Acetone	10								33 B							
Carbon Disulfide	5.0															
1,1-Dichloroethene	5.0						10/-									
1,1-Dichloroethane	5.0						13/12 J									
Total 1,2-Dichloroethene	5.0						44/41	6.0								
Chloroform	5.0															
1,2-Dichloroethane	5.0															
2-Butanone	10						R/-	R	R	R	R	R	R	R	R	
1,1,1-Trichloroethane	5.0	8.0 B		4.0 B	8.0 B		10 B/11 B	28 J	7.0 B	5.0 B			5.0 B	35 J		
Carbon Tetrachloride	5.0															
Vinyl Acetate	10															
Bromodichloromethane	5.0															
1,1,2,2-Tetrachloroethane	5.0															
1,2-Dichloropropane	5.0															
trans-1,3-Dichloropropene	5.0															
Trichloroethene	5.0	77		14 B	52		700 J/760	42	51	54			40	51		4.0 B
Dibromochloromethane	5.0															
1,1,2-Trichloroethane	5.0															
Benzene	5.0						UL/UL									

TABLE 4-1 (cont'd.)

VOLATILE ORGANIC ANALYSIS - ANALYTICAL RESULTS

- page 2

H2M Sample Number Laboratory Sample Number		MW-17 965629	MW-23 965630	MW-24 965631	MW-25 965632	Trip Blank 965633	MW-6 965511	MW-21 965512	MW-20 965513	MW-15 965514	MW-26 965515	FB-1 965516	MW-16 965517	MW-13 965518	Trip Blank 965519	MW-10 965520
Remarks							Analyzed Twice					Field Blank				
Units		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
VOLATILE COMPOUNDS	Quantitation Limit															
cis-1,3-Dichloropropene	5.0															
Bromoform	5.0															
2-Hexanone	10															
4-Methyl-2-pentanone	10															
Tetrachloroethene	5.0															
Toluene	5.0						UL/UL									
Chlorobenzene	5.0						UL/UL									
Ethylbenzene	5.0						UL/UL									
Styrene	5.0						UL/UL									
Total Xylenes	5.0						UL/UL									
Quantitation Limit Multiplier		1.0	1.0	1.0	1.0	1.0	1.0/5.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Date Received by Laboratory		9/8/89	9/8/89	9/8/89	9/8/89	9/8/89	9/7/89	9/7/89	9/7/89	9/7/89	9/7/89	9/7/89	9/7/89	9/7/89	9/7/89	9/7/89
Date of Analysis		9/12/89	9/12/89	9/12/89	9/12/89	9/12/89	9/11&9/11	9/11/89	9/11/89	9/11/89	9/11/89	9/11/89	9/11/89	9/11/89	9/11/89	9/12/89
Instrument Used for Analysis		MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3

NOTES:

-	Compound was not detected
J	Quantitation is approximate due to limitations identified during the quality control review (data validation).
B	This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.
R	Unreliable result - Analyte may or may not be present in this sample.
UL	This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-1 (cont'd.)

CLP - TENTATIVELY IDENTIFIED COMPOUNDS - Estimated Concentrations - page 3

H2M Sample Number	MW-17	MW-23	MW-24	MW-25	Trip Blank	MW-6	MW-21	MW-20	MW-15	MW-26	FB-1	MW-16	MW-13	Trip Blank	MW-10
Laboratory Sample Number	965629	965630	965631	965632	965633	965511	965512	965513	965514	965515	965516	965517	965518	965519	965520
Remarks						Analyzed Twice					Field Blank				
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
COMPOUNDS															
VOLATILE COMPONENTS						-/		-	-	-	-	-	-	-	
1,1,2-Trichloro-1,2,2-trifluoroethane							74 B								
Cyclic hydrocarbon	5.0 B	23 B	14 B	18 B	26 J	-/90 B									26 B
Dimethyloctane isomer		7.0 B		11 B	11 J	-/90 B									
Decane						-/25 B									
C9H12 Alkylbenzenes	9.0 B	25 B	17 B	20 B	19 J	-/110 B									23 B
Undecane	10 B	21 B	11 B	17 B	13 J	-/65 B									18 B
Methyloctane isomer	8.0 B	14 B	10 B												12 B
Dimethylnonane isomer					6.0 J										6.0 B
Unknown		12 B		12 B											
Saturated hydrocarbon		8.0 B													

TABLE 4-1 (cont'd.)

EXTRACTABLE ORGANIC ANALYISIS - ANALYTICAL RESULTS

- page 4

H2M Sample Number			MW-17	MW-23	MW-24	MW-25	Trip Blank	MW-6	MW-21	MW-20	MW-15	MW-26	FB-1	MW-16	MW-13	Trip Blank	MW-10
Laboratory Sample Number			965629	965630	965631	965632	965633	965511	965512	965513	965514	965515	965516	965517	965518	965519	965520
Remarks													Field Blank				
Units			ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Pesticides	Aqueous Quantitation Limit	Solid Quantitation Limit															
Alpha-BHC	0.05	8.0					NA				UL					NA	
Beta-BHC	0.05	8.0					NA				UL					NA	
Delta-BHC	0.05	8.0					NA				UL					NA	
Gamma-BHC (Lindane)	0.05	8.0					NA				UL					NA	
Heptachlor	0.05	8.0					NA				UL					NA	
Aldrin	0.05	8.0					NA				UL					NA	
Heptachlor Epoxide	0.05	8.0					NA				UL					NA	
Endosulfan I	0.05	8.0					NA				UL					NA	
Dieldrin	0.10	16					NA				UL					NA	
4,4'-DDE	0.10	16					NA				UL					NA	
Endrin	0.10	16					NA				UL					NA	
Endosulfan II	0.10	16					NA				UL					NA	
4,4'-DDD	0.10	16					NA				UL					NA	
Endosulfan Sulfate	0.10	16					NA				UL					NA	
4,4'-DDT	0.10	16					NA				UL					NA	
Methoxychlor	0.50	80					NA				UL					NA	
Endrin Ketone	0.10	32					NA				UL					NA	
Alpha Chlordane	0.50	80					NA				UL					NA	
Gamma Chlordane	0.50	80					NA				UL					NA	
Toxaphene	1.0	160					NA				UL					NA	

NOTES:

-	Compound was not detected
J	Quantitation is approximate due to limitations identified during the quality control review (data validation).
B	This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.
R	Unreliable result - Analyte may or may not be present in this sample.
UL	This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-1 (cont'd.)

EXTRACTABLE ORGANIC ANALYISIS - ANALYTICAL RESULTS

- page 5

H2M Sample Number			MW-17	MW-23	MW-24	MW-25	Trip Blank	MW-6	MW-21	MW-20	MW-15	MW-26	FB-1	MW-16	MW-13	Trip Blank	MW-10
Laboratory Sample Number			965629	965630	965631	965632	965633	965511	965512	965513	965514	965515	965516	965517	965518	965519	965520
Remarks													Field Blank				
Units			ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
PCBs	Aqueous Quantitation Limit	Solid Quantitation Limit															
Aroclor-1016	0.5	80					NA				UL					NA	
Aroclor-1221	0.5	80					NA				UL					NA	
Aroclor-1232	0.5	80					NA				UL					NA	
Aroclor-1242	0.5	80					NA				UL					NA	
Aroclor-1248	0.5	80					NA				UL					NA	
Aroclor-1254	1.0	160					NA				UL					NA	
Aroclor-1260	1.0	160					NA				UL					NA	
Quantitation Limit Multiplier			1.0	1.0	1.0	1.0	NA	1.4	1.2	1.0	1.0	1.4	1.0	1.0	1.0	NA	1.0
Date Received by Laboratory			9/8/89	9/8/89	9/8/89	9/8/89	NA	9/7/89	9/7/89	9/7/89	9/7/89	9/7/89	9/7/89	9/7/89	9/7/89	NA	9/7/89
Date Sample Extracted			9/12/89	9/12/89	9/12/89	9/12/89	NA	9/10/89	9/10/89	9/10/89	9/10/89	9/10/89	9/10/89	9/11/89	9/11/89	NA	9/11/89
Date of Analysis			9/30/89	9/30/89	9/30/89	9/30/89	NA	9/29/89	9/29/89	9/30/89	9/30/89	9/30/89	9/30/89	9/30/89	9/29/89	NA	9/30/89

NOTES:

-	Compound was not detected
J	Quantitation is approximate due to limitations identified during the quality control review (data validation).
B	This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.
R	Unreliable result - Analyte may or may not be present in this sample.
UL	This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-1 (cont'd.)

VOLATILE ORGANIC ANALYSIS - ANALYTICAL RESULTS All Solids Reported on a Dry Weight Basis - page 6

H2M Sample Number		MW-12	Trip Blank	MW-22	FB-4
Laboratory Sample Number		965521	965522	965523	965524
Remarks					Field Blank
Units		ug/L	ug/L	ug/L	ug/L
VOLATILE COMPOUNDS	Quantitation Limit				
Chloromethane	10				
Bromomethane	10				
Vinyl Chloride	10				
Chloroethane	10				
Methylene Chloride	5.0				
Acetone	10	49 B			
Carbon Disulfide	5.0				
1,1-Dichloroethene	5.0				
1,1-Dichloroethane	5.0				
Total 1,2-Dichloroethene	5.0				
Chloroform	5.0				
1,2-Dichloroethane	5.0				
2-Butanone	10			R	R
1,1,1-Trichloroethane	5.0	3.0 B			
Carbon Tetrachloride	5.0				
Vinyl Acetate	10				
Bromodichloromethane	5.0				
1,1,2,2-Tetrachloroethane	5.0				
1,2-Dichloropropane	5.0				
trans-1,3-Dichloropropene	5.0				
Trichloroethene	5.0	13 B		23 J	
Dibromochloromethane	5.0				
1,1,2-Trichloroethane	5.0				
Benzene	5.0				

TABLE 4-1 (cont'd.)

VOLATILE ORGANIC ANALYSIS - ANALYTICAL RESULTS All Solids Reported on a Dry Weight Basis - page 7

H2M Sample Number		MW-12	Trip Blank	MW-22	FB-4
Laboratory Sample Number		965521	965522	965523	965524
Remarks					Field Blank
Units		ug/L	ug/L	ug/L	ug/L
VOLATILE COMPOUNDS	Quantitation Limit				
cis-1,3-Dichloropropene	5.0				
Bromoform	5.0				
2-Hexanone	10				
4-Methyl-2-pentanone	10				
Tetrachloroethene	5.0				
Toluene	5.0				
Chlorobenzene	5.0				
Ethylbenzene	5.0				
Styrene	5.0				
Total Xylenes	5.0				
Quantitation Limit Multiplier		1.0	1.0	1.0	1.0
Date Received by Laboratory		9/7/89	9/7/89	9/7/89	9/7/89
Date of Analysis		9/12/89	9/12/89	9/11/89	9/11/89
Instrument Used for Analysis		MS-70-3	MS-70-3	MS-70-3	MS-70-3

NOTES:

-	Compound was not detected
J	Quantitation is approximate due to limitations identified during the quality control review (data validation).
B	This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.
R	Unreliable result - Analyte may or may not be present in this sample.
UL	This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-1 (cont'd.)

CLP - TENTATIVELY IDENTIFIED COMPOUNDS - Estimated Concentrations - page 8

H2M Sample Number	MW-12	Trip Blank	MW-22	FB-4
Laboratory Sample Number	965521	965522	965523	965524
Remarks				Field Blank
Units	ug/L	ug/L	ug/L	ug/L
COMPOUNDS				
VOLATILE COMPONENTS				
Methylcyclohexane				
Dimethyloctane isomers	5.0 B	16 J		
Unknown cyclic hydrocarbon	5.0 B	13 J		
Decane				
Methyldecane isomer				
Undecane	19 B	17 J		
Unknown hydrocarbon				
Decahydromethylnaphthalene				
Laboratory artifact (column bleed)	101 R			
C9H12 Alkylbenzenes	19 B	19 J		
Unknown				
Dimethyldecane isomer				
Methylundecane isomer				
Unknown - chlorinated				
Trimethylhexane isomer				

TABLE 4-1 (cont'd.)

EXTRACTABLE ORGANIC ANALYSIS - ANALYTICAL RESULTS All Solids Reported on a Dry Weight Basis - page 9

H2M Sample Number			MW-12	Trip Blank	MW-22	FB-4
Laboratory Sample Number			965521	965522	965523	965524
Remarks						Field Blank
Units			ug/L	ug/L	ug/L	ug/L
Pesticides	Aqueous Quantitation Limit	Solid Quantitation Limit				
Alpha-BHC	0.05	8.0		NA		
Beta-BHC	0.05	8.0		NA		
Delta-BHC	0.05	8.0		NA		
Gamma-BHC (Lindane)	0.05	8.0		NA		
Heptachlor	0.05	8.0		NA		
Aldrin	0.05	8.0		NA		
Heptachlor Epoxide	0.05	8.0		NA		
Endosulfan I	0.05	8.0		NA		
Dieldrin	0.10	16		NA		
4,4'-DDE	0.10	16		NA		
Endrin	0.10	16		NA		
Endosulfan II	0.10	16		NA		
4,4'-DDD	0.10	16		NA		
Endosulfan Sulfate	0.10	16		NA		
4,4'-DDT	0.10	16		NA		
Methoxychlor	0.50	80		NA		
Endrin Ketone	0.10	16		NA		
Alpha Chlordane	0.50	80		NA		
Gamma Chlordane	0.50	80		NA		
Toxaphene	1.0	80		NA		

NOTES:

- \- Compound was not detected
- J Quantitation is approximate due to limitations identified during the quality control review (data validation).
- B This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.
- R Unreliable result - Analyte may or may not be present in this sample.
- UL This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-1 (cont'd.)

EXTRACTABLE ORGANIC ANALYSIS - ANALYTICAL RESULTS All Solids Reported on a Dry Weight Basis - page 10

H2M Sample Number			MW-12	Trip Blank	MW-22	FB-4
Laboratory Sample Number			965521	965522	965523	965524
Remarks						Field Blank
Units			ug/L	ug/L	ug/L	ug/L
PCBs	Aqueous Quantitation Limit	Solid Quantitation Limit				
Aroclor-1016	0.5	80		NA		
Aroclor-1221	0.5	80		NA		
Aroclor-1232	0.5	80		NA		
Aroclor-1242	0.5	80		NA		
Aroclor-1248	0.5	80		NA		
Aroclor-1254	1.0	160		NA		
Aroclor-1260	1.0	160		NA		
Quantitation Limit Multiplier			1.0	NA	1.0	1.0
Date Received by Laboratory			9/7/89	NA	9/7/89	9/7/89
Date Sample Extracted			9/11/89	NA	9/11/89	9/11/89
Date of Analysis			9/30/89	NA	9/30/89	9/30/89

NOTES:

- \- Compound was not detected
- J Quantitation is approximate due to limitations identified during the quality control review (data validation).
- B This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.
- R Unreliable result - Analyte may or may not be present in this sample.
- UL This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.
- * See the quality assurance review.

TABLE 4-1 (cont'd.)

INORGANIC ANALYSIS - ANALYTICAL RESULTS

-page 1

H2M Sample Number			MW-17	MW-23	MW-24	MW-25	Field Blank-1	Field Blank-4	MW-10	MW-12	MW-13	MW-15	MW-16
Laboratory Sample Number			965634	965635	965636	965637	965530	965536	9655333	965534	965532	965528	965531
Remarks													
Units			ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
INORGANIC ELEMENTS		Detection Limit (Aq.)											
Aluminum	P	102	6460 J	151,000 J	249,000 J	106,000 J	289 J	4170 J	225,000 J	135,000 J	313,000 J	46,600 J	204,000 J
Antimony	P	26	UL	UL	UL	UL	UL	UL	(47.2) J	UL	(51.7) J	UL	UL
Arsenic	F	3.0	(6.8) B	38.0 J				(6.4) J		80.5 J		23.0 B	
Barium	P	35	(96.1) J	2310 J	1800 J	789 J	(89.2) J	(91.1) J	2310 J	1130 J	2320 J	370 B	1310 J
Beryllium	P	2.0	(2.0) J	11.5 J	27.6 J	7.7 J	UL	UL	15.3 J	8.3 J	18.5 J	(4.6) J	18.9 J
Cadmium	P	3.0	5.3 J	33.7 J	59.7 J	28.9 J	UL	UL	5950 J	88.8 J	3670 J	UL	132 J
Calcium	P/FL	292/10	102,000 J	217,000 J	1,470,000 J	253,000 J		(1100) J	291,000 J	83,900 J	90,400 J	199,000 J	80,100 J
Chromium	P	9.0	263 J	278 J	647 J	537 J	UL	15.7 J	14,900 J	519 J	2950 J	205 J	508 J
Cobalt	P	13	UL	142 J	251 J	105 J	UL	UL	193 J	101 J	237 J	50.6 J	182 J
Copper	P	11	27.3 J	350 J	839 J	224 J		(20.8) J	13,300 J	1200 J	2330 J	149 J	861 J
Iron	P	16	13,900 J	325,000 J	650,000 J	228,000 J	514 J	9310 J	495,000 J	297,000 J	750,000 J	1,380,000 J	435,000 J
Lead	P/FL/F	41/100/2.0	11.6	370	760	190			920	360	720	140	490
Magnesium	P/FL	174/200	22,300 J	75,800 J	476,000 J	95,700 J		(2400) J	159,000 J	43,000 J	84,500 J	54,400 J	286,000 J
Manganese	P	3.0	489 J	33,800 J	20,300 J	7020 J	(12.0)	247 J	48,600 J	12,800 J	72,500 J	3790 J	13,600 J
Mercury	CV	0.20		0.20 J	0.20 J				1.0 J	3.0 J			
Nickel	P	24	(28.0) J	405 J	618 J	291 J			1420 J	422 J	1930 J	124 J	861 J
Potassium	P	445	(4460) J	8740 J	19,100 J	9420 J	UL	UL	22,300 J	14,200 J	27,100 J	6620 J	17,700 J
Selenium	F	1.0		(1.6) B	UL								
Silver	P/FL	6.0/10	10.0 J	UL	UL	UL	UL	UL	50.0 J	120 J	40.0 J	UL	UL
Sodium	P	220	76,500 J	20,000 J	39,400 J	75,100 J	352 J	(306) J	21,600 J	45,200 J	41,600 J	47,200 J	55,500 J
Thallium	F	3.0	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
Vanadium	P	17	UL	196 J	400 J	129 J	UL	UL	367 J	192 J	419 J	74.6 J	307 J
Zinc	P	5.0	51.1 J	1020 J	1880 J	697 J		64.9 J	3330 J	1140 J	3500 J	366 J	2010 J
Cyanide	DC	10	10.0 J	UL	UL	24.0 J	UL	UL	48.0 J	UL	23.0 J	UL	UL

NOTES:

-	-	Element was not detected.
(#)	-	The result is greater than or equal to the instrument detection limit, but less than the CLP required detection limit.
J	-	Quantitation is approximate due to limitations identified in the quality assurance review.
B	-	This result is qualitatively suspect since this constituent was detected in a field and/or laboratory blank(s) at a similar level.
R	-	Unreliable results - Analyte may or may not be present in this sample.
UL	-	Not detected, but the detection limit is probably higher than reported based upon a low bias identified during the quality assurance review.

ANALYTICAL METHOD:

P	-	Inductively Coupled Plasma
F	-	Graphite Furnace Atomic Absorption
CV	-	Cold Vapor Atomic Absorption
FL	-	Flame Atomic Absorption
DC	-	Distillation/ Colorimetric

TABLE 4-1 (cont'd.)

INORGANIC ANALYSIS - ANALYTICAL RESULTS ALL SOLIDS REPORTED ON A DRY WEIGHT BASIS

-page 2

H2M Sample Number			MW-20	MW-21	MW-26	MW-22	MW-6	Field Blank
Laboratory Sample Number			965527	965526	965529	965535	965525	964326
Percent Solids			-	-	-	-	-	-
Units			ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
INORGANIC ELEMENTS		Detection Limit						
Aluminum	P	102	245,000 J	708,000 J	617,000 J	278,000 J	382,000 J	
Antimony	P	26	UL	83.8 J	63.7 J	(35.1) J	(50.7) J	
Arsenic	F	3.0			56.0 J		UL	
Barium	P	35	1620 J	2750 J	3660 J	2120 J	4190 J	
Beryllium	P	2.0	23.6 J	46.2 J	25.6 J	23.2 J	101 J	
Cadmium	P	3.0	11.6 J	68.3 J	18.5 J	19.9 J	24.6 J	
Calcium	P/FL	292/10	1,170,000J	1,840,000J	76,400 J	817,000 J	7,030,000J	
Chromium	P	9.0	432 J	1090 J	843 J	567 J	1240 J	18.4
Cobalt	P	13	250 J	646 J	514 J	444 J	483 J	
Copper	P	11	598 J	1460 J	1110 J	1170 J	1320 J	(19.7)
Iron	P	16	640,000 J	1,770,000J	1,210,000 J	840,000 J	650,000 J	(28.0)
Lead	P/FL/F	41/100/2.0	690	1110	1080	760	1170	
Magnesium	P/FL	174/200	330,000 J	714,000 J	171,000 J	227,000 J	1,830,000J	
Manganese	P	3.0	13,900 J	28,900 J	31,800 J	40,800 J	39,900 J	
Mercury	CV	0.20	0.49 J	0.54 J	1.0 J	2.2 J		
Nickel	P	24	587 J	1620 J	1160 J	849 J	1020 J	
Potassium	P	445	16,500 J	27,600 J	36,600 J	19,500 J	11,600 J	
Selenium	F	1.0						
Silver	P/FL	6.0/10	UL	UL	UL	UL	UL	
Sodium	P	220	60,700 J	50,600 J	10,500 J	100,000 J	139,000 J	(241)
Thallium	F	3.0	UL	UL	UL	UL	UL	
Vanadium	P	17	370 J	901 J	692 J	432 J	156 J	
Zinc	P	5.0	1620 J	4420 J	2950 J	2580 J	2920 J	(14.4)
Cyanide	DC	10	UL	UL	UL	UL	UL	

NOTES:

- -	Element was not detected.
(#) -	The result is greater than or equal to the instrument detection limit, but less than the CLP required detection limit.
J -	Quantitation is approximate due to limitations identified in the quality assurance review.
B -	This result is qualitatively suspect since this constituent was detected in a field and/or laboratory blank(s) at a similar level.
R -	Unreliable results - Analyte may or may not be present in this sample.
UL -	Not detected, but the detection limit is probably higher than reported based upon a low bias identified during the quality assurance review.

ANALYTICAL METHOD:

P -	Inductively Coupled Plasma
F -	Graphite Furnace Atomic Absorption
CV -	Cold Vapor Atomic Absorption
FL -	Flame Atomic Absorption
DC -	Distillation/ Colorimetric

TABLE 4-2

GROUNDWATER ANALYTICAL DATA

OCTOBER 1989

VOLATILE ORGANIC ANALYSIS - ANALYTICAL RESULTS

- page 1

H2M Sample Number Laboratory Sample Number		MW-6 967780	MW-10 967776	MW-12 967777	MW-13 967778	MW-15 967781	MW-16 967783	MW-17 967782	MW-20 967770	MW-21 967768	MW-22 967767	MW-23 967773	MW-24 967771	MW-25 967772	MW-26 967769
Remarks		Analyzed Twice													
Units		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
VOLATILE COMPOUNDS	Quantitation Limit														
Chloromethane	10											28 J			
Bromomethane	10														
Vinyl Chloride	10														
Chloroethane	10														
Methylene Chloride	5.0	2.0 B/-					2.0 B	4.0 B							
Acetone	10														
Carbon Disulfide	5.0														
1,1-Dichloroethene	5.0	9.0/-													
1,1-Dichloroethane	5.0	12 J/13 J													
Total-1,2-Dichloroethene	5.0	44/52								6.0					
Chloroform	5.0											5.0			
1,2-Dichloroethane	5.0														
2-Butanone	10	R	R	R	R	R	R	R	R	R	R	R	R	R	R
1,1,1-Trichloroethane	5.0	10/10 J		2.0 J	25	8.0	7.0	9.0	5.0	29			4.0 J	8.0	
Carbon Tetrachloride	5.0														
Vinyl Acetate	10														
Bromodichloromethane	5.0														
1,1,2,2-Tetrachloroethane	5.0														
1,2-Dichloropropane	5.0														
trans-1,3-Dichloropropene	5.0														
Trichloroethene	5.0	590 J/700	7.0	12	40	46	42	52	56	45	31		17	49	
Dibromochloromethane	5.0														
1,1,2-Trichloroethane	5.0														
Benzene	5.0														

TABLE 4-2 (cont'd.)

VOLATILE ORGANIC ANALYSIS - ANALYTICAL RESULTS - page 2

H2M Sample Number Laboratory Sample Number		MW-6 967780	MW-10 967776	MW-12 967777	MW-13 967778	MW-15 967781	MW-16 967783	MW-17 967782	MW-20 967770	MW-21 967768	MW-22 967767	MW-23 967773	MW-24 967771	MW-25 967772	MW-26 967769
Remarks		Analyzed Twice													
Units		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
VOLATILE COMPOUNDS	Quantitation Limit														
cis-1,3-Dichloropropene	5.0														
Bromoform	5.0														
2-Hexanone	10														
4-Methyl-2-pentanone	10														
Tetrachloroethene	5.0														
Toluene	5.0														
Chlorobenzene	5.0														
Ethylbenzene	5.0														
Styrene	5.0														
Total Xylenes	5.0														
Quantitation Limit Multiplier		1.0/5.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Date Received by Laboratory		10/6/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89
Date of Analysis		10/9 & 10/10	10/6/89	10/6/89	10/6/89	10/9/89	10/9/89	10/9/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89
Instrument Used for Analysis		MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3

NOTES:

-	Compound was not detected
J	Quantitation is approximate due to limitations identified during the quality control review (data validation).
B	This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.
R	Unreliable result - Analyte may or may not be present in this sample.
UL	This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-2 (cont'd.)

CLP - TENTATIVELY IDENTIFIED COMPOUNDS - Estimated Concentrations - page 3

H2M Sample Number Laboratory Sample Number	MW-6 967780	MW-10 967776	MW-12 967777	MW-13 967778	MW-15 967781	MW-16 967783	MW-17 967782	MW-20 967770	MW-21 967768	MW-22 967767	MW-23 967773	MW-24 967771	MW-25 967772	MW-26 967769
Remarks	Analyzed Twice													
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
COMPOUNDS														
VOLATILE COMPONENTS	-/-	-	-	-	-			-		-	-		-	-
1,1,2-Trichloro-1,2,2-trifluoroethane									8.0 J					
Laboratory Artifact (column bleed)						.81 R	450 R					16 R		

TABLE 4-2 (cont'd.)

EXTRACTABLE ORGANIC ANALYISIS - ANALYTICAL RESULTS - page 4

H2M Sample Number Laboratory Sample Number		MW-6 967780	MW-10 967776	MW-12 967777	MW-13 967778	MW-15 967781	MW-16 967783	MW-17 967782	MW-20 967770	MW-21 967768	MW-22 967767	MW-23 967773	MW-24 967771	MW-25 967772	MW-26 967769
Remarks															
Units		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Pesticide/PCB	Quantitation Limit														
Alpha-BHC	0.05														
Beta-BHC	0.05														
Delta-BHC	0.05														
Gamma-BHC (Lindane)	0.05														
Heptachlor	0.05														
Aldrin	0.05														
Heptachlor Epoxide	0.05														
Endosulfan I	0.05														
Dieldrin	0.10														
4,4'-DDE	0.10														
Endrin	0.10														
Endosulfan II	0.10														
4,4'-DDD	0.10														
Endosulfan Sulfate	0.10														
4,4'-DDT	0.10														
Methoxychlor	0.50														
Endrin Ketone	0.10														
Chlordane	0.50														
Toxaphene	1.0														

NOTES:

-	Compound was not detected
J	Quantitation is approximate due to limitations identified during the quality control review (data validation).
B	This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.
R	Unreliable result - Analyte may or may not be present in this sample.
UL	This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-2 (cont'd.)

EXTRACTABLE ORGANIC ANALYISIS - ANALYTICAL RESULTS - page 5

H2M Sample Number Laboratory Sample Number		MW-6 967780	MW-10 967776	MW-12 967777	MW-13 967778	MW-15 967781	MW-16 967783	MW-17 967782	MW-20 967770	MW-21 967768	MW-22 967767	MW-23 967773	MW-24 967771	MW-25 967772	MW-26 967769
Remarks															
Units		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
PCBs	Quantitation Limit (Aq)														
Aroclor-1016	0.5														
Aroclor-1221	0.5														
Aroclor-1232	0.5														
Aroclor-1242	0.5														
Aroclor-1248	0.5														
Aroclor-1254	1.0														
Aroclor-1260	1.0														
Quantitation Limit Multiplier		1.14	1.04	1.04	1.0	1.04	1.04	1.0	1.12	1.12	1.12	1.04	1.12	1.04	1.12
Date Received by Laboratory		10/6/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89	10/6/89
Date Sample Extracted		10/10/89	10/10/89	10/10/89	10/10/89	10/10/89	10/10/89	10/10/89	10/9/89	10/9/89	10/9/89	10/10/89	10/9/89	10/9/89	10/9/89
Date of Analysis		10/25/89	10/25/89	10/25/89	10/25/89	10/25/89	10/25/89	10/25/89	10/24/89	10/24/89	10/24/89	10/24/89	10/24/89	10/24/89	10/24/89
Instrument Used for Analysis		HP5890-A	HP5890-A	HP5890-A	HP5890-A	HP5890-A	HP5890-A	HP5890-A	HP5890-A	HP5890-A	HP5890-A	HP5890-A	HP5890-A	HP5890-A	HP5890-A

NOTES:

-	Compound was not detected
J	Quantitation is approximate due to limitations identified during the quality control review (data validation).
B	This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.
R	Unreliable result - Analyte may or may not be present in this sample.
UL	This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-2 (cont'd.)

VOLATILE ORGANIC ANALYSIS - ANALYTICAL RESULTS -page 6

H2M Sample Number		FB-2	FB-3	Trip Blank (10/4)	Trip Blank (10/5)	
Laboratory Sample Number		967774	967779	967775	967784	
Remarks						
Units		ug/L	ug/L	ug/L	ug/L	
VOLATILE COMPOUNDS	Quantitation Limit					
Chloromethane	10					
Bromomethane	10					
Vinyl Chloride	10					
Chloroethane	10					
Methylene Chloride	5.0	3.0 J			3.0 J	
Acetone	10	47	99	74	84	
Carbon Disulfide	5.0					
1,1-Dichloroethene	5.0					
1,1-Dichloroethane	5.0					
Total 1,2-Dichloroethene	5.0					
Chloroform	5.0					
1,2-Dichloroethane	5.0					
2-Butanone	10	R	R	R	22 J	
1,1,1-Trichloroethane	5.0					
Carbon Tetrachloride	5.0					
Vinyl Acetate	10					
Bromodichloromethane	5.0					
1,1,2,2-Tetrachloroethane	5.0					
1,2-Dichloropropane	5.0					
trans-1,3-Dichloropropene	5.0					
Trichloroethene	5.0					
Dibromochloromethane	5.0					
1,1,2-Trichloroethane	5.0					
Benzene	5.0					

TABLE 4-2 (cont'd.)

VOLATILE ORGANIC ANALYSIS - ANALYTICAL RESULTS -page 7

H2M Sample Number Laboratory Sample Number		FB-2 967774	FB-3 967779	Trip Blank (10/4) 967775	Trip Blank (10/5) 967784	
Remarks						
Units		ug/L	ug/L	ug/L	ug/L	
VOLATILE COMPOUNDS	Quantitation Limit					
cis-1,3-Dichloropropene	5.0					
Bromoform	5.0					
2-Hexanone	10					
4-Methyl-2-pentanone	10					
Tetrachloroethene	5.0					
Toluene	5.0					
Chlorobenzene	5.0					
Ethylbenzene	5.0					
Styrene	5.0					
Total Xylenes	5.0					
Quantitaton Limit Multiplier		1.0	1.0	1.0	1.0	
Date Received by Laboratory		10/6/89	10/6/89	10/6/89	10/6/89	
Date of Analysis		10/9/89	10/6/89	10/6/89	10/9/89	
Instrument Used for Analysis		MS-70-3	MS-70-3	MS-70-3	MS-70-3	

NOTES:

-	Compound was not detected
J	Quantitation is approximate due to limitations identified during the quality control review (data validation).
B	This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.
R	Unreliable result - Analyte may or may not be present in this sample.
UL	This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-2 (cont'd.)

ADDITIONAL PARAMETERS - ANALYTICAL RESULTS

H2M Sample Number Laboratory Sample Number	MW-22 967785	MW-21 967787	MW-26 967788	MW-20 967789	MW-24 967790	MW-25 967791	MW-23 967792	FB-2 967793	MW-10 967794	MW-12 967795	MW-13 967796	FB-3 967798	MW-6 967799	MW-15 967800	MW-17 967801	MW-16 967802
Remarks								Field Blank				Field Blank				
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
PARAMETERS																
Hexavalent Chromium	<0.02	<0.02	<0.02	<0.02	<0.02	0.22	<0.02	<0.02	0.19	0.13	0.13	0.02	0.71	0.16	0.29	0.15
Total Organic Carbon	37.6	NA	NA	NA	NA	NA	NA	NA	54.8	17.6	17.2	<0.05	NA	NA	NA	68.0
Chemical Oxygen Demand	<15	NA	NA	NA	NA	NA	NA	NA	<15	<15	470	<15	NA	NA	NA	30
Biological Oxygen Demand (5)	<4.0	NA	NA	NA	NA	NA	NA	NA	<4.0	<4.0	10	<2.0	NA	NA	NA	5.0
Total Dissolved Solids	450	NA	NA	NA	NA	NA	NA	NA	315	340	320	540	NA	NA	NA	470
Total Organic Halides	0.198	NA	NA	NA	NA	NA	NA	NA	0.233	0.173	0.285	0.309	NA	NA	NA	0.373

TABLE 4-2 (cont'd.)

CLP - TENTATIVELY IDENTIFIED COMPOUNDS - Estimated Concentrations -page 8

H2M Sample Number	FB-2	FB-3	Trip Blank (10/4)	Trip Blank (10/5)	
Laboratory Sample Number	967774	967779	967775	967784	
Remarks					
Units	ug/L	ug/L	ug/L	ug/L	
COMPOUNDS					
VOLATILE COMPONENTS	-	-	-		
1,1,2-Trichloro-1,2,2-trifluoroethane					
Laboratory Artifact (column bleed)				7.0 R	

TABLE 4-2 (cont'd.)

EXTRACTABLE ORGANIC ANALYSIS - ANALYTICAL RESULTS -page 9

H2M Sample Number		FB-2	FB-3	Trip Blank (10/4)	Trip Blank (10/5)	
Laboratory Sample Number		967774	967779	967775	967784	
Remarks						
Units		ug/L	ug/L	ug/L	ug/L	
Pesticide/PCB	Quantitation Limit					
Alpha-BHC	0.05			N/A	N/A	
Beta-BHC	0.05			N/A	N/A	
Delta-BHC	0.05			N/A	N/A	
Gamma-BHC (Lindane)	0.05			N/A	N/A	
Heptachlor	0.05			N/A	N/A	
Aldrin	0.05			N/A	N/A	
Heptachlor Epoxide	0.05			N/A	N/A	
Endosulfan I	0.05			N/A	N/A	
Dieldrin	0.10			N/A	N/A	
4,4'-DDE	0.10			N/A	N/A	
Endrin	0.10			N/A	N/A	
Endosulfan II	0.10			N/A	N/A	
4,4'-DDD	0.10			N/A	N/A	
Endosulfan Sulfate	0.10			N/A	N/A	
4,4'-DDT	0.10			N/A	N/A	
Methoxychlor	0.50			N/A	N/A	
Endrin Ketone	0.10			N/A	N/A	
Chlordane	0.50			N/A	N/A	
Toxaphene	1.0			N/A	N/A	

NOTES:

-	Compound was not detected
J	Quantitation is approximate due to limitations identified during the quality control review (data validation).
B	This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.
R	Unreliable result - Analyte may or may not be present in this sample.
UL	This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.
N/A	This analysis not requested by client

TABLE 4-2 (cont'd.)

EXTRACTABLE ORGANIC ANALYSIS - ANALYTICAL RESULTS -page 10

H2M Sample Number		FB-2	FB-3	Trip Blank (10/4)	Trip Blank (10/5)	
Laboratory Sample Number		967774	967779	967775	967784	
Remarks						
Units		ug/L	ug/L	ug/L	ug/L	
PCBs	Quantitation Limit (Aq)					
Aroclor-1016	0.5			N/A	N/A	
Aroclor-1221	0.5			N/A	N/A	
Aroclor-1232	0.5			N/A	N/A	
Aroclor-1242	0.5			N/A	N/A	
Aroclor-1248	0.5			N/A	N/A	
Aroclor-1254	1.0			N/A	N/A	
Aroclor-1260	1.0			N/A	N/A	
Quantitation Limit Multiplier		1.0	1.0	N/A	N/A	
Date Received by Laboratory		10/6/89	10/6/89	N/A	N/A	
Date Sample Extracted		10/10/89	10/10/89	N/A	N/A	
Date of Analysis		10/24/89	10/25/89	N/A	N/A	
Instrument Used for Analysis		HP5890-A	HP5890-A	N/A	N/A	

NOTES:

-	Compound was not detected
J	Quantitation is approximate due to limitations identified during the quality control review (data validation).
B	This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.
R	Unreliable result - Analyte may or may not be present in this sample.
UL	This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-2 (cont'd.)

INORGANIC ANALYSIS - ANALYTICAL RESULTS -page 1

H2M Sample Number Laboratory Sample Number		MW-6 967799	MW-10 967794	MW-12 967795	MW-13 967796	MW-15 967800	MW-16 967802	MW-17 967801	MW-20 967789	MW-21 967787	MW-22 967785
Remarks											
Units		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
INORGANIC ELEMENTS	Detection Limit										
Aluminum FL/P	200/102	520,000	281,000 J	191,000 J	32,400 J	28,300 J	241,000 J	28,000 J	149,000 J	380,000 J	193,000 J
Antimony P	26	UL	76.1 B	UL	UL	UL	(40.5) B	UL	(26.0) B	UL	UL
senic F	3.0		49.0 J	79.0 J	30.1 J	21.5 J		18.9 J		32.0 J	36.4 J
Barium P	35	3300 J	3680 J	1590 J	253 J	219 J	1530 J	221 J	1190 J	2000 J	1230 J
Beryllium P	2.0	71.8 J	22.8 J	12.4 J	(2.3) J	(3.6) J	20.6 J	(3.7) J	15.2 J	33.4 J	16.0 J
Cadmium FL	5.0	53.0 J	7290 J	126 J	334 J		151 J	7.0 J	12.0 J	85.0 J	13.0 J
Calcium FL/P	291/292	4,510,000	481,000 J	106,000	43,200	182,000	860,000	210,000	690,000	1,420,000	464,000
Chromium FL/P	10/9.0	1220 J	21,900 J	653 J	334 J	176 J	535 J	312 J	269 J	808 J	396 J
Cobalt P	13	528 J	251 J	141 J	(21.2) J	(31.7) J	229 J	(24.5) J	173 J	394 J	291 J
Copper P	11	1250 J	22,800 J	1620 J	293 J	129 J	1050 J	105 J	389 J	1030 J	736 J
Iron FL/P	20/16	1,430,000	627,000 J	388,000 J	68,200 J	67,500 J	560,000	65,600 J	350,000 J	960,000	475,000 J
Lead FL/P	100/2.0	1430 J	1320 J	440 J	120 J	110 J	690 J	190 J	590 J	760 J	540 J
Magnesium FL/P	200/174	997,000	239,000 J	61,000 J	14,300 J	43,100 J	281,000 J	57,900 J	200,000 J	426,000 J	135,000 J
Manganese P	3.0	33,000 J	57,700 J	19,800 J	5700 J	2460 J	17,400 J	1710 J	10,300 J	20,600 J	27,700 J
rcury CV	0.2	0.23 J	0.84 J	1.1 J	0.28 J		0.60 J			0.44 J	1.2 J
Nickel P	21	1310 J	1990 J	614 J	197 J	83.4 J	1090 J	89.2 J	388 J	958 J	578 J
Potassium P	445	12,400 J	18,800 J	19,600 J	6770 J	5490 J	20,100 J	6080 J	11,400 J	17,400 J	18,100 J
Selenium F	1.0	R	R	R	R	R	R	R	R	R	R
Silver FL	10	20.0 B	120 J	160 J	20.0 B	20.0 B	30.0 B	20.0 B	20.0 B	10.0 B	90.0 B
Sodium FL/P	200/220	151,000	19,400 J	44,700 J	33,100 J	46,400 J	59,700 J	81,400 J	66,300 J	45,400 J	79,900 J
Thallium F	3.0	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
Vanadium P	17	745 J	403 J	246 J	(45.1) J	(45.1) J	362 J	(44.1) J	235 J	544 J	312 J
Zinc P	5.0	3430 J	4800 J	1420 J	373 J	234 J	2440 J	205 J	1060 J	2620 J	1550 J
Cyanide A	10		395 J	40.0 J	10.0 J	30.0 J		23 J			

NOTES:

- -	Element was not detected.
(#) -	The result is greater than or equal to the instrument detection limit, but less than the CLP required detection limit.
J -	Quantitation is approximate due to limitations identified in the quality assurance review.
B -	This result is qualitatively suspect since this constituent was detected in a field and/or laboratory blank(s) at a similar level.
R -	Unreliable results - Analyte may or may not be present in this sample.
UL -	Not detected, but the detection limit is probably higher than reported based upon a low bias identified during the quality assurance review.

ANALYTICAL METHOD:

P -	Inductively Coupled Plasma
F -	Graphite Furnace Atomic Absorption
CV -	Cold Vapor Atomic Absorption
A -	Auto Analyzer
FL -	Flame Atomic Absorption

TABLE 4-2 (cont'd.)

INORGANIC ANALYSIS - ANALYTICAL RESULTS -page 2

H2M Sample Number Laboratory Sample Number		MW-23 967792	MW-24 967790	MW-25 967791	MW-26 967788	FB-2 967793	FB-3 967798	MW-22F 967786	MW-16F 967803	MW-13 F 967797
Remarks						Field Blank	Field Blank	Filtered	Filtered	Filtered
Units		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
INORGANIC ELEMENTS	Detection Limit									
Aluminum FL/P	200/102	105,000 J	202,000 J	98,900 J	67,000 J					
Antimony P	26	156	(28.5) B	UL	UL	UL	UL	UL	UL	UL
Arsenic F	3.0	40.6 J	51.1 J	63.6 J	36.0 J					
Barium P	35	1200 J	1560 J	1130 J	448 J	UL	UL	(84.4) J	(186) J	(165) J
Beryllium P	2.0	7.1 J	27.4 J	9.1 J	(3.9) J	UL	UL	UL	UL	UL
Cadmium FL	5.0		17.0 J	17.0 J						82.0 J
Calcium FL/P	291/292	145,000	1,440,000	305,000	35,500			48,300	125,000	51,100
Chromium FL/P	10/9.0	307 J	578 J	545 J	110 J				590 J	92.8 J
Cobalt P	13	97.5 J	223 J	97.2 J	58.7 J	UL	UL	UL	UL	UL
Copper P	11	207 J	739 J	251 J	134 J		28.5 J	41.7 B	45.5 B	65.4 B
Iron FL/P	20/16	242,000 J	550,000 J	205,000 J	147,000 J	(75.0) J	201 J	(46.8) B	(79.6) B	106 B
Lead FL/P	100/2.0	190 J	740 J	360 J	120 J					(2.3) B
Magnesium FL/P	200/174	54,700 J	475,000 J	102,000 J	23,500 J			7190 J	29,200 J	7960 J
Manganese P	3.0	14,700 J	19,000 J	8610 J	3840 J		(7.5) J	(12.3) B	15.2 B	195 J
Mercury CV	0.2	0.25 J	0.71 J		0.76 J					
Nickel P	21	281 J	561 J	306 J	145 J	UL	UL	UL	UL	UL
Potassium P	445	6080 J	12,900 J	11,600 J	8500 J	UL	UL	(1950) J	(2060) J	(4480) J
Selenium F	1.0	R	R	R	R	R	R	R	R	R
Silver FL	10	10.0 B	30.0 B	10.0 B	10.0 B	10.0 J	20.0 J	20.0 B	10.0 B	10.0 B
Sodium FL/P	200/220	18,400 J	33,200 J	72,100 J	12,300 J	(258) J	UL	118,000 J	209,000	41,100
Thallium F	3.0	UL	UL	UL	UL	UL	UL	UL	UL	UL
Vanadium P	17	151 J	353 J	142 J	99.0 J					
Zinc P	5.0	701 J	1670 J	713 J	339 J		(6.9) J	29.0 B	384 J	216 J
Cyanide A	10	30.0 J		25.0 J				NA	NA	NA

NOTES:

-	Element was not detected.
(#)	The result is greater than or equal to the instrument detection limit, but less than the CLP required detection limit.
J	Quantitation is approximate due to limitations identified in the quality assurance review.
B	This result is qualitatively suspect since this constituent was detected in a field and/or laboratory blank(s) at a similar level.
R	Unreliable results - Analyte may or may not be present in this sample.
UL	Not detected, but the detection limit is probably higher than reported based upon a low bias identified during the quality assurance review.
NA	Not analyzed.

ANALYTICAL METHOD:

P	Inductively Coupled Plasma
F	Graphite Furnace Atomic Absorption
CV	Cold Vapor Atomic Absorption
A	Auto Analyzer
FL	Flame Atomic Absorption

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ANALYTICAL DATA

JULY-AUGUST 1989

VOLATILE ORGANIC ANALYSIS - ANALYTICAL RESULTS   All Solids Reported on a Dry Weight Basis   - page 1

H2M Sample Number Laboratory Sample Number		Outfall D 20-24 964312	Outfall B 10-12 964313	Outfall B 14-16 964314	Outfall E 10-12 964315	Outfall E 12-14 964316	Outfall N 8-12 964317	Field Blank 964318	Trip Blank 964319	Outfall J 10-12 963289	Outfall J 14-16 963290	Outfall L 10-12 963291
Remarks		Analyzed Twice	Analyzed Twice	Analyzed Twice	Analyzed Twice	Analyzed Twice	Analyzed Twice			Analyzed Twice		
Units		ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/L	ug/L	ug/kg	ug/kg	ug/kg
VOLATILE COMPOUNDS	Quantitation Limit											
Chloromethane	10	UL/UL	UL/UL	UL/UL	R/-	UL/-	UL/UL					
Bromomethane	10	UL/UL	UL/UL	UL/UL	R/-	UL/-	UL/UL					
Vinyl Chloride	10	UL/UL	UL/UL	UL/UL	570 J/-	UL/-	UL/UL					
Chloroethane	10	UL/UL	UL/UL	UL/UL	46,000 J/-	480 J/-	UL/UL					
Methylene Chloride	5.0	UL/UL	UL/17 J	UL/14 J	140 J/-	34 J/-	UL/UL			30 J/-		
Acetone	10	UL/190 J	UL/130 B	UL/220 J	520 J/-	UL/-	1100J/1900J			590 J/520 J		
Carbon Disulfide	5.0	UL/UL	UL/UL	UL/UL	R/-	UL/-	25 J/300 J			16 J/56 J	4.0 J	
1,1-Dichloroethene	5.0	UL/UL	UL/UL	UL/UL	63 J/-	47 J/-	UL/UL					
1,1-Dichloroethane	5.0	UL/UL	UL/UL	UL/9.0 J	22,000J/26,000	2600 J/-	49 J/UL					
Total 1,2-Dichloroethene	5.0	UL/UL	UL/UL	UL/UL	190 J/-	UL/-	UL/UL					
Chloroform	5.0	UL/UL	UL/UL	UL/UL	R/-	UL/-	UL/UL					
1,2-Dichloroethane	5.0	UL/UL		UL/-	R/-	61 J/-	-/UL					
2-Butanone	10	UL/UL	UL/UL	UL/UL	R/-	UL/-	480 J/UL			97 J/54 J		
1,1,1-Trichloroethane	5.0	9.0 B/ 70 J	UL/ 110 J	UL/ 120 J	19,000J/ 31,000J	14,000J/ 45,000J	450J/ 1400J			58 J/ 640 J	2.0 B	7.0 B
Carbon Tetrachloride	5.0	UL/UL		UL/-	R/-	UL/-	-/UL			UL/-		
Vinyl Acetate	10	UL/UL	UL/UL	UL/UL	R/-	UL/-	UL/UL					
Bromodichloromethane	5.0	UL/UL		UL/-	R/-	UL/-	-/UL			UL/-		
1,1,2,2-Tetrachloroethane	5.0	UL/UL	UL/UL	UL/UL	R/-	UL/-	UL/UL			UL/-		
1,2-Dichloropropane	5.0	UL/UL		UL/-	R/-	UL/-	-/UL			UL/-		
trans-1,3-Dichloropropene	5.0	UL/UL	UL/UL	UL/UL	R/-	UL/-	UL/UL			UL/-		
Trichloroethene	5.0	8.0B/13B	-/17 B	UL/9.0 B	380 J/-	88 J/-	-/UL			90 J/630 J	10 B	10 B
Dibromochloromethane	5.0	UL/UL	UL/UL	UL/UL	R/-	UL/-	UL/UL			UL/-		
1,1,2-Trichloroethane	5.0	UL/UL	UL/UL	UL/UL	R/-	51 J/-	UL/UL			UL/-		
Benzene	5.0	UL/UL		UL/-	R/-	UL/-	-/UL			UL/-		

TABLE 4-3 (cont'd.)

VOLATILE ORGANIC ANALYSIS - ANALYTICAL RESULTS   All Solids Reported on a Dry Weight Basis   - page 2

H2M Sample Number		Outfall D 20-24	Outfall B 10-12	Outfall B 14-16	Outfall E 10-12	Outfall E 12-14	Outfall N 8-12	Field Blank	Trip Blank	Outfall J 10-12	Outfall J 14-16	Outfall L 10-12
Laboratory Sample Number		964312	964313	964314	964315	964316	964317	964318	964319	963289	963290	963291
Remarks		Analyzed Twice	Analyzed Twice	Analyzed Twice	Analyzed Twice	Analyzed Twice	Analyzed Twice			Analyzed Twice		
Units		ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/L	ug/L	ug/kg	ug/kg	ug/kg
VOLATILE COMPOUNDS	Quantitation Limit											
cis-1,3-Dichloropropene	5.0	UL/UL		UL/-	R/-	UL/-	-/UL			UL/-		
Bromoform	5.0	UL/UL	UL/UL	UL/UL	R/-	UL/-	UL/UL			UL/-		
2-Hexanone	10	UL/UL	UL/UL	UL/UL	R/-	UL/-	UL/UL			UL/-		
4-Methyl-2-pentanone	10	UL/UL		UL/-	R/-	UL/-	-/UL			UL/-		
Tetrachloroethene	5.0	UL/UL	UL/UL	UL/UL	210 J/-	52 J/-	UL/UL			UL/-		
Toluene	5.0	UL/UL	UL/UL	UL/UL	920 J/-	300 J/-	160 J/100 J			UL/-	27	
Chlorobenzene	5.0	UL/UL	UL/UL	UL/UL	R/-	UL/-	UL/UL			UL/-		
Ethylbenzene	5.0	UL/UL	UL/UL	UL/UL	R/-	20 B/-	51 J/UL			UL/-		
Styrene	5.0	UL/UL	UL/UL	UL/UL	R/-	UL/-	UL/UL			UL/-		
Total Xylenes	5.0	UL/UL	UL/UL	UL/UL	290 J/-	83 J/-	280/-			UL/-		
Quantitation Limit Multiplier		1.2	1.3	1.2	1.2/1500	1.3/1500	3.1/11.0	1.0	1.0	2.4/4.6	1.3	1.7
Date Received by Laboratory		8/18/89	8/18/89	8/18/89	8/18/89	8/18/89	8/18/89	8/18/89	8/18/89	8/3/89	8/3/89	8/3/89
Date of Analysis		8/22&8/24	8/23&8/24	8/23&8/24	8/23 & 8/24	8/23 & 8/24	8/23 & 8/24	8/22/89	8/22/89	8/9 & 8/10	8/9/89	8/9/89
Instrument Used for Analysis		MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3

NOTES:

- Compound was not detected

J Quantitation is approximate due to limitations identified during the quality control review (data validation).

B This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.

R Unreliable result - Analyte may or may not be present in this sample.

UL This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-3 (cont'd.)

CLP - TENTATIVELY IDENTIFIED COMPOUNDS - Estimated Concentrations - page 3

H2M Sample Number Laboratory Sample Number	Outfall D 20-24 964312	Outfall B 10-12 964313	Outfall B 14-16 964314	Outfall E 10-12 964315	Outfall E 12-14 964316	Outfall N 8-12 964317	Field Blank 964318	Trip Blank 964319	Outfall J 10-12 963289	Outfall J 14-16 963290	Outfall L 10-12 963291
Remarks	Analyzed Twice	Analyzed Twice	Analyzed Twice	Analyzed Twice	Analyzed Twice	Analyzed Twice			Analyzed Twice		
Units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/L	ug/L	ug/kg	ug/kg	ug/kg
COMPOUNDS											
VOLATILE COMPONENTS	/-	-/	-/					-			-
Methylcyclohexane						1000 J/-			2500 J/-	200 J	
Dimethyloctane isomers				5100 J/-	300 J/-	2600J/8400J			13,200J/12,000J	330 J	
Unknown cyclic hydrocarbon				9200J/18,000J	280 J/-	-/5300 J			11,200J/11,300J	250 J	
Decane					2700 J/-	17,000J/29,000J			14,000J/12,700J	1080 J	
Methyldecane isomer				24,800 J/-	1520 J/-	17,000J/16,800J			9100J/7800J	1160 J	
Undecane				24,000J/48,000J	4900 J/-	18,000J/31,000J			7200J/6800J	970 J	
Unknown hydrocarbon				-/7500 J	450J/13,000J	-/15,000J			1900 J/-		
Decahydromethylnaphthalene					360 J/-					240 J	
Laboratory artifact (column bleed)											
C9H12 Alkylbenzenes											
Unknown	7.0 J/-	-/19 J	-/17 J	-/23,000 J		-/11,000 J	6.0 J				
Dimethyldecane isomer				22,000J/23,800J		1600 J/-					
Methylundecane isomer				2500 J/-		1100 J/5800 J					
Unknown - chlorinated					2400 J/-						
Trimethylhexane isomer						1300 J/-					

TABLE 4-3 (cont'd.)

EXTRACTABLE ORGANIC ANALYSIS - ANALYTICAL RESULTS   All Solids Reported on a Dry Weight Basis   - page 4

H2M Sample Number			Outfall D 20-24	Outfall B 10-12	Outfall B 14-16	Outfall E 10-12	Outfall E 12-14	Outfall N 8-12	Field Blank	Trip Blank	Outfall J 10-12	Outfall J 14-16	Outfall L 10-12
Laboratory Sample Number			964312	964313	964314	964315	964316	964317	964318	964319	963289	963290	963291
Remarks													
Units			ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/L	ug/L	ug/kg	ug/kg	ug/kg
Pesticides	Aqueous Quantitation Limit	Solid Quantitation Limit											
Alpha-BHC	0.05	8.0								NA			
Beta-BHC	0.05	8.0								NA	180 R		
Delta-BHC	0.05	8.0								NA			
Gamma-BHC (Lindane)	0.05	8.0						49 R		NA			
Heptachlor	0.05	8.0								NA			
Aldrin	0.05	8.0								NA	2200 R		
Heptachlor Epoxide	0.05	8.0								NA	110 R		
Endosulfan I	0.05	8.0								NA			
Dieldrin	0.10	16								NA			
4,4'-DDE	0.10	16								NA			
Endrin	0.10	16								NA			
Endosulfan II	0.10	16								NA			
4,4'-DDD	0.10	16								NA			
Endosulfan Sulfate	0.10	16								NA			
4,4'-DDT	0.10	16								NA			
Methoxychlor	0.50	80								NA			
Endrin Ketone	0.10	16								NA			
Alpha Chlordane	0.50	80								NA			
Gamma Chlordane	0.50	80								NA			
Toxaphene	1.0	80								NA			

NOTES:

-	Compound was not detected
J	Quantitation is approximate due to limitations identified during the quality control review (data validation).
B	This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.
R	Unreliable result - Analyte may or may not be present in this sample.
UL	This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-3 (cont'd.)

EXTRACTABLE ORGANIC ANALYSIS - ANALYTICAL RESULTS All Solids Reported on a Dry Weight Basis - page 5

H2M Sample Number			Outfall D 20-24	Outfall B 10-12	Outfall B 14-16	Outfall E 10-12	Outfall E 12-14	Outfall N 8-12	Field Blank	Trip Blank	Outfall J 10-12	Outfall J 14-16	Outfall L 10-12
Laboratory Sample Number			964312	964313	964314	964315	964316	964317	964318	964319	963289	963290	963291
Remarks													
Units			ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/L	ug/L	ug/kg	ug/kg	ug/kg
PCBs	Aqueous Quantitation Limit	Solid Quantitation Limit											
Aroclor-1016	0.5	80								NA			
Aroclor-1221	0.5	80								NA			
Aroclor-1232	0.5	80								NA			
Aroclor-1242	0.5	80						*		NA	*		
Aroclor-1248	0.5	80						*		NA	*		
Aroclor-1254	1.0	160						1900		NA			
Aroclor-1260	1.0	160								NA	1200 J		
Quantitation Limit Multiplier			1.25	1.25	1.25	1.25	1.25	1.25	1.0	NA	4.75	1.25	1.75
Date Received by Laboratory			8/18/89	8/18/89	8/18/89	8/18/89	8/18/89	8/18/89	8/18/89	NA	8/3/89	8/3/89	8/3/89
Date Sample Extracted			8/27/89	8/22/89	8/22/89	8/22/89	8/22/89	8/22/89	8/22/89	NA	8/3/89	8/3/89	8/3/89
Date of Analysis			9/27/89	9/27/89	9/27/89	9/27/89	9/27/89	9/27/89	9/27/89	NA	8/12/89	8/12/89	8/12/89

NOTES:

- \- Compound was not detected
- J Quantitation is approximate due to limitations identified during the quality control review (data validation).
- B This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.
- R Unreliable result - Analyte may or may not be present in this sample.
- UL This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.
- * See the quality assurance review.

TABLE 4-3 (cont'd.)

VOLATILE ORGANIC ANALYSIS - ANALYTICAL RESULTS All Solids Reported on a Dry Weight Basis - page 6

H2M Sample Number Laboratory Sample Number		Outfall H 10-12 963292	Outfall H 18-20 963293	Outfall I 10-12 963294	Outfall I 20-22 963295	Outfall C 10-12 963296	Outfall C 14-16 963297	Outfall BA-2 10-12 963298	Outfall BA-2 16-18 963299	Outfall BA-1 16-18 963301	Outfall BA-1 10-12 963300	Outfall B-1 10-12 963302	Outfall B-2 20-22 963303	Trip Blank 963304	Field Blank 963305	Outfall K 10-12 963013
Remarks								Analyzed Twice	Analyzed Twice	Analyzed Twice						
Units		ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/L	ug/L	ug/kg
VOLATILE COMPOUNDS	Quantitation Limit															
Chloromethane	10															
Bromomethane	10															
Vinyl Chloride	10															
Chloroethane	10															
Methylene Chloride	5.0					13 J	12 J	13 J/-	19 J/-							
Acetone	10				110 B					65 B/200 B						
Carbon Disulfide	5.0															
1,1-Dichloroethene	5.0								1100 J/-							
1,1-Dichloroethane	5.0								110 J/-	7.0/-						
Total 1,2-Dichloroethene	5.0															
Chloroform	5.0															
1,2-Dichloroethane	5.0															
2-Butanone	10								-/R					R	R	
1,1,1-Trichloroethane	5.0							250 J/170	9400J/530,000J	480 J/330	7.0 B					
Carbon Tetrachloride	5.0															
Vinyl Acetate	10															
Bromodichloromethane	5.0															
1,1,2,2-Tetrachloroethane	5.0							UL/-								
1,2-Dichloropropane	5.0															
trans-1,3-Dichloropropene	5.0							UL/-								
Trichloroethene	5.0	9.0 B	4.0 B	16 B	17 B	5.0 B	5.0 B	580 J/470	7800J/610,000J	250/210	67	3.0 B				8.0 B
Dibromochloromethane	5.0							UL/-								
1,1,2-Trichloroethane	5.0							UL/-	47 J/-							
Benzene	5.0													UL	UL	

TABLE 4-3 (cont'd.)

VOLATILE ORGANIC ANALYSIS - ANALYTICAL RESULTS All Solids Reported on a Dry Weight Basis - page 7

H2M Sample Number Laboratory Sample Number		Outfall H 10-12 963292	Outfall H 18-20 963293	Outfall I 10-12 963294	Outfall I 20-22 963295	Outfall C 10-12 963296	Outfall C 14-16 963297	Outfall BA-2 10-12 963298	Outfall BA-2 16-18 963299	Outfall BA-1 16-18 963301	Outfall BA-1 10-12 963300	Outfall B-1 10-12 963302	Outfall B-2 20-22 963303	Trip Blank 963304	Field Blank 963305	Outfall K 10-12 963013
Remarks								Analyzed Twice	Analyzed Twice	Analyzed Twice						
Units		ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/L	ug/L	ug/kg
VOLATILE COMPOUNDS	Quantitation Limit															
cis-1,3-Dichloropropene	5.0															
Bromoform	5.0							UL/-								
2-Hexanone	10							UL/-								
4-Methyl-2-pentanone	10															
Tetrachloroethene	5.0							14 J/-	1700 J/-							
Toluene	5.0							UL/-	2000 J/-					UL	UL	
Chlorobenzene	5.0							UL/-						UL	UL	
Ethylbenzene	5.0							UL/-	300 J/-					UL	UL	
Styrene	5.0							UL/-						UL	UL	
Total Xylenes	5.0							UL/-	1500 J/-					UL	UL	
Quantitation Limit Multiplier		1.1	1.1	1.3	1.4	1.3	1.2	1.2/5.5	1.4/1700	1.5/5.9	1.3	1.2	1.3	1.0	1.0	2.6
Date Received by Laboratory		8/3/89	8/3/89	8/3/89	8/3/89	8/3/89	8/3/89	8/3/89	8/3/89	8/3/89	8/3/89	8/3/89	8/3/89	8/3/89	8/3/89	7/29/89
Date of Analysis		8/9/89	8/9/89	8/9/89	8/9/89	8/10/89	8/10/89	8/10/89	8/10/89	8/10/89	8/10/89	8/10/89	8/10/89	8/10/89	8/10/89	8/3/89
Instrument Used for Analysis		MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3

NOTES:

-	Compound was not detected
J	Quantitation is approximate due to limitations identified during the quality control review (data validation).
B	This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.
R	Unreliable result - Analyte may or may not be present in this sample.
UL	This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-3 (cont'd.)

CLP - TENTATIVELY IDENTIFIED COMPOUNDS - Estimated Concentrations All Solids Reported on a Dry Weight Basis - page 8

H2M Sample Number Laboratory Sample Number	Outfall H 10-12 963292	Outfall H 18-20 963293	Outfall I 10-12 963294	Outfall I 20-22 963295	Outfall C 10-12 963296	Outfall C 14-16 963297	Outfall BA-2 10-12 963298	Outfall BA-2 16-18 963299	Outfall BA-1 16-18 963301	Outfall BA-1 10-12 963300	Outfall B-1 10-12 963302	Outfall B-2 20-22 963303	Trip Blank 963304	Field Blank 963305	Outfall K 10-12 963013
Remarks							Analyzed Twice	Analyzed Twice	Analyzed Twice						
Units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/L	ug/L	ug/kg
COMPOUNDS															
VOLATILE COMPONENTS				-							-	-	-	-	
Dimethyldisulfide															16 J
1,1,2-Trichloro-1,2,2-trifluoroethane	25 B	11 B	14 B		69 B										
Laboratory artifacts			258 R							223 R					
Unknown hydrocarbon						6.0 J									
Dimethyloctane isomers							250 J/550 J	9900 J/-	22 J/-						
Propylheptane isomer							42 J/-								
Unknown cyclic hydrocarbon							247 J/640 J	3200 J/8700 J	-/41 J						
Decane							350 J/660 J								
Undecane							420 J/910 J	7300J/21,000J	69 J/-						
Decahydronaphthalene							150 J/330 J		-/116 J (3)						
Unknown (number of peaks)							81J(1)/180 J	-/8700 J							
C9H12 Alkylbenzene								4300 J/-							
Methyldecane isomer								5100 J/-							
C10H14 Alkylbenzene								3600 J/-							
Dichlorobenzene isomer								3000 J/-							
Aromatic ketone								-/8700 J							
Trimethyloctane isomer									89 J/-						
Methylundecane isomer									-/35 J						

TABLE 4-3 (cont'd.)

EXTRACTABLE ORGANIC ANALYSIS - ANALYTICAL RESULTS All Solids Reported on a Dry Weight Basis - page 9

H2M Sample Number			Outfall H 10-12	Outfall H 18-20	Outfall I 10-12	Outfall I 20-22	Outfall C 10-12	Outfall C 14-16	Outfall BA-2 10-12	Outfall BA-2 16-18	Outfall BA-1 16-18	Outfall BA-1 10-12	Outfall B-1 10-12	Outfall B-2 20-22	Trip Blank	Field Blank	Outfall K 10-12
Laboratory Sample Number			963292	963293	963294	963295	963296	963297	963298	963299	963301	963300	963302	963303	963304	963305	963013
Remarks																	
Units			ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/L	ug/L	ug/kg
Pesticides	Aqueous Quantitation Limit	Solid Quantitation Limit															
Alpha-BHC	0.05	8.0															
Beta-BHC	0.05	8.0															
Delta-BHC	0.05	8.0															
Gamma-BHC (Lindane)	0.05	8.0															170 R
Heptachlor	0.05	8.0															
Aldrin	0.05	8.0															
Heptachlor Epoxide	0.05	8.0															
Endosulfan I	0.05	8.0															
Dieldrin	0.10	16															
4,4'-DDE	0.10	16															
Endrin	0.10	16															
Endosulfan II	0.10	16															
4,4'-DDD	0.10	16															
Endosulfan Sulfate	0.10	16															
4,4'-DDT	0.10	16															850
Methoxychlor	0.50	80															
Endrin Ketone	0.10	16															
Gamma Chlordane	0.50	80															
Alpha Chlordane	0.50	80															
Toxaphene	1.0	160															

NOTES:

-	Compound was not detected
J	Quantitation is approximate due to limitations identified during the quality control review (data validation).
B	This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.
R	Unreliable result - Analyte may or may not be present in this sample.
UL	This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-3 (cont'd.)

EXTRACTABLE ORGANIC ANALYSIS - ANALYTICAL RESULTS

All Solids Reported on a Dry Weight Basis

- page 10

H2M Sample Number Laboratory Sample Number			Outfall H 10-12 963292	Outfall H 18-20 963293	Outfall I 10-12 963294	Outfall I 20-22 963295	Outfall C 10-12 963296	Outfall C 14-16 963297	Outfall BA-2 10-12 963298	Outfall BA-2 16-18 963299	Outfall BA-1 16-18 963301	Outfall BA-1 10-12 963300	Outfall B-1 10-12 963302	Outfall B-2 20-22 963303	Trip Blank 963304	Field Blank 963305	Outfall K 10-12 963013
Remarks																	
Units			ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/L	ug/L	ug/kg
PCBs	Aqueous Quantitation Limit	Solid Quantitation Limit															
Aroclor-1016	0.5	80													NA		
Aroclor-1221	0.5	80													NA		
Aroclor-1232	0.5	80													NA		
Aroclor-1242	0.5	80													NA		
Aroclor-1248	0.5	80													NA		
Aroclor-1254	1.0	160													NA		
Aroclor-1260	1.0	160							240	2700					NA		
Quantitation Limit Multiplier			1.12	1.25	1.25	1.62	1.25	1.25	1.25	2.75	1.25	1.12	1.12	1.25	NA	1.0	5.12
Date Received by Laboratory			8/3/89	8/3/89	8/3/89	8/3/89	8/3/89	8/3/89	8/3/89	8/3/89	8/3/89	8/3/89	8/3/89	8/3/89	NA	7/29/89	7/29/89
Date Sample Extracted			8/3/89	8/3/89	8/3/89	8/3/89	8/3/89	8/3/89	8/4/89	8/4/89	8/4/89	8/4/89	8/4/89	8/4/89	NA	8/1/89	7/31/89
Date of Analysis			8/12/89	8/12/89	8/12/89	8/12/89	8/12/89	8/12/89	8/12/89	8/12/89	8/12/89	8/12/89	8/12/89	8/12/89	NA	8/19/89	8/18/89

NOTES:

-	Compound was not detected.
J	Quantitation is approximate due to limitations identified during the quality control review (data validation).
B	This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.
R	Unreliable result - Analyte may or may not be present in this sample.
UL	This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-3 (cont'd.)

VOLATILE ORGANIC ANALYSIS - ANALYTICAL RESULTS All Solids Reported on a Dry Weight Basis - page 11

H2M Sample Number		Outfall K 12-14	Outfall K 14-16	Outfall M 10-12	Outfall M 14-16	Trip Blank	Field Blank
Laboratory Sample Number		963014	963015	963016	963017	963018	963019
Remarks							
Units		ug/kg	ug/kg	ug/kg	ug/kg	ug/L	ug/L
VOLATILE COMPOUNDS	Quantitation Limit						
Chloromethane	10						
Bromomethane	10						
Vinyl Chloride	10						
Chloroethane	10						
Methylene Chloride	5.0						
Acetone	10				95 B		
Carbon Disulfide	5.0						
1,1-Dichloroethene	5.0						
1,1-Dichloroethane	5.0						
Total 1,2-Dichloroethene	5.0						
Chloroform	5.0						
1,2-Dichloroethane	5.0						
2-Butanone	10						
1,1,1-Trichloroethane	5.0			62			
Carbon Tetrachloride	5.0						
Vinyl Acetate	10						
Bromodichloromethane	5.0						
1,1,2,2-Tetrachloroethane	5.0						
1,2-Dichloropropane	5.0						
trans-1,3-Dichloropropene	5.0						
Trichloroethene	5.0	12 B	27	14 B	9.0 B		
Dibromochloromethane	5.0						
1,1,2-Trichloroethane	5.0						
Benzene	5.0						

TABLE 4-3 (cont'd.)

VOLATILE ORGANIC ANALYSIS -	ANALYTICAL RESULTS	All Solids Reported on a Dry Weight Basis					-page 12
H2M Sample Number Laboratory Sample Number		Outfall K 12-14 963014	Outfall K 14-16 963015	Outfall M 10-12 963016	Outfall M 14-16 963017	Trip Blank 963018	Field Blank 963019
Remarks							
Units		ug/kg	ug/kg	ug/kg	ug/kg	ug/L	ug/L
VOLATILE COMPOUNDS	Quantitation Limit						
cis-1,3-Dichloropropene	5.0						
Bromoform	5.0						
2-Hexanone	10						
4-Methyl-2-pentanone	10						
Tetrachloroethene	5.0						
Toluene	5.0						
Chlorobenzene	5.0						
Ethylbenzene	5.0						
Styrene	5.0						
Total Xylenes	5.0						
Qauntitation Limit Multiplier		2.1	2.0	1.2	1.6	1.0	1.0
Date Received by Laboratory		7/29/89	7/29/89	7/29/89	7/29/89	7/29/89	7/29/89
Date of Analysis		8/3/89	8/2/89	8/3/89	8/2/89	8/2/89	8/2/89
Instrument Used for Analysis		MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3	MS-70-3

NOTES:

-	Compound was not detected
J	Quantitation is approximate due to limitations identified during the quality control review (data validation).
B	This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.
R	Unreliable result - Analyte may or may not be present in this sample.
UL	This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-3 (cont'd.)

CLP - TENTATIVELY IDENTIFIED COMPOUNDS - Estimated Concentrations -page 13

H2M Sample Number Laboratory Sample Number	Outfall K 12-14 963014	Outfall K 14-16 963015	Outfall M 10-12 963016	Outfall M 14-16 963017	Trip Blank 963018	Field Blank 963019
Remarks						
Units	ug/kg	ug/kg	ug/kg	ug/kg	ug/L	ug/L
COMPOUNDS						
VOLATILE COMPONENTS	-			-	-	-
Unknown hydrocarbons (number of peaks)		83 J (4)				
Methyldecane isomers		38 J (2)				
Undecane		31 J	13 J			
Unknown (number of peaks)		40 J (2)	81 J (5)			
Unknown cyclic hydrocarbon			21 J			
Dimethyloctane isomer			12 J			

TABLE 4-3 (cont'd.)

EXTRACTABLE ORGANIC ANALYSIS - ANALYTICAL RESULTS   All Solids Reported on a Dry Weight Basis   -page 14

H2M Sample Number Laboratory Sample Number			Outfall K 12-14 963014	Outfall K 14-16 963015	Outfall M 10-12 963016	Outfall M 14-16 963017	Trip Blank 963018	Field Blank 963019
Remarks								
Units			ug/kg	ug/kg	ug/kg	ug/kg	ug/L	ug/L
Pesticides	Aqueous Quantitation Limit	Solid Quantitation Limit						
Alpha-BHC	0.05	8.0					NA	
Beta-BHC	0.05	8.0					NA	
Delta-BHC	0.05	8.0					NA	
Gamma-BHC (Lindane)	0.05	8.0					NA	
Heptachlor	0.05	8.0					NA	
Aldrin	0.05	8.0					NA	
Heptachlor Epoxide	0.05	8.0					NA	
Endosulfan I	0.05	8.0					NA	
Dieldrin	0.10	16					NA	
4,4'-DDE	0.10	16					NA	
Endrin	0.10	16					NA	
Endosulfan II	0.10	16					NA	
4,4'-DDD	0.10	16					NA	
Endosulfan Sulfate	0.10	16					NA	
4,4'-DDT	0.10	16					NA	
Methoxychlor	0.50	80					NA	
Endrin Ketone	0.10	16					NA	
alpha Chlordane	0.50	80					NA	
gamma Chlordane	0.50	80					NA	
Toxaphene	1.0	160					NA	

NOTES:

-	Compound was not detected
J	Quantitation is approximate due to limitations identified during the quality control review (data validation).
B	This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.
R	Unreliable result - Analyte may or may not be present in this sample.
UL	This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-3 (cont'd.)

EXTRACTABLE ORGANIC ANALYSIS - ANALYTICAL RESULTS — All Solids Reported on a Dry Weight Basis — -page 15

H2M Sample Number Laboratory Sample Number			Outfall K 12-14 963014	Outfall K 14-16 963015	Outfall M 10-12 963016	Outfall M 14-16 963017	Trip Blank 963018	Field Blank 963019
Remarks								
Units			ug/kg	ug/kg	ug/kg	ug/kg	ug/L	ug/L
PCBs	Aqueous Quantitation Limit	Solid Quantitation Limit						
Aroclor-1016	0.5	80					NA	
Aroclor-1221	0.5	80					NA	
Aroclor-1232	0.5	80					NA	
Aroclor-1242	0.5	80					NA	
Aroclor-1248	0.5	80					NA	
Aroclor-1254	1.0	160					NA	
Aroclor-1260	1.0	160					NA	
Quantitation Limit Mulitplier			4.25	3.75	1.5	1.5	NA	1.0
Date Sample Received by Laboratory			7/29/89	7/29/89	7/29/89	7/29/89	NA	7/29/89
Date Sample Extracted			7/31/89	7/31/89	7/31/89	7/31/89	NA	8/1/89
Date of Analysis			8/18/89	8/18/89	8/18/89	8/18/89	NA	8/19/89

NOTES:

-	Compound was not detected.
J	Quantitation is approximate due to limitations identified during the quality control review (data validation).
B	This result is qualitatively suspect since this compound was detected in a field and/or laboratory blank(s) at a similar level.
R	Unreliable result - Analyte may or may not be present in this sample.
UL	This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-3 (cont'd.)

INORGANIC ANALYSIS - ANALYTICAL RESULTS   ALL SOLIDS REPORTED ON A DRY WEIGHT BASIS   -page 1

H2M Sample Number Laboratory Sample Number			Outfall B 10-12 964321	Outfall B 14-16 964322	Outfall D 20-24 964320	Outfall E 10-12 964323	Outfall E 12-14 964324
Percent Solids			80.5%	82.3%	80.3%	82.9%	85.5%
Units			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
INORGANIC ELEMENTS		Detection Limit					
Aluminum	P	102	14,300	9060	11,200	14,300	11,200
Antimony	P	26		50.6			
Arsenic	F	3.0	8.7 J	15.5 J	11.1 J	8.5 J	6.6 J
Barium	P	35	137	62.6	51.9	113	79.5
Beryllium	P	2.0	(0.97) J	0.61 J		(0.88) J	(0.84) J
Cadmium	P	3.0	140 J	84.7 J	19.6 J	103 J	38.7 J
Calcium	P/FL	292/10	2790	2250	1440	13,300	33,800
Chromium	P	9.0	157 J	90.0 J	45.9 J	308 J	133 J
Cobalt	P	13	16.2 J	10.2 J	(10.8) J	(10.4) J	(9.5) J
Copper	P	11	1230 J	506 J	30.9 J	485 J	210 J
Iron	P	16	35,400	24,200	26,800	26,500	26,500
Lead	P/FL/F	41/100/2.0	30.1	30.4	9.5	41.1	65.1
Magnesium	P/FL	174/200	4140	3150	3670	4620	5280
Manganese	P	3.0	3370 J	1700 J	604 J	1750 J	641 J
Mercury	CV	0.20					
Nickel	P	24	124	65.7	39.1	109	59.0
Potassium	P	445	(910)	(576)	(601)	2010	1640
Selenium	F	1.0	UL	UL			
Silver	P/FL	6.0/10	3.0 J	UL	UL	2.5 J	UL
Sodium	P	220	(859)	(795)	(843)	1700	2220
Thallium	F	3.0	(0.99)	(0.66)	(1.1)		
Vanadium	P	17	20.2 J	14.0 J	13.8 J	25.9 J	18.4 J
Zinc	P	5.0	277 J	178 J	87.8 J	328 J	231 J
Cyanide	DC	10	5.2 J	6.5 J	1.2 J	4.3 J	1.6 J

NOTES:

-	- Element was not detected.
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J	- Quantitation is approximate due to limitations identified in the quality assurance review.
B	- This result is qualitatively suspect since this constituent was detected in a field and/or laboratory blank(s) at a similar level.
R	- Unreliable results - Analyte may or may not be present in this sample.
UL	- Not detected, but the detection limit is probably higher than reported based upon a low bias identified during the quality assurance review.

ANALYTICAL METHOD:

P	- Inductively Coupled Plasma
F	- Graphite Furnace Atomic Absorption
CV	- Cold Vapor Atomic Absorption
FL	- Flame Atomic Absorption
DC	- Distillation/ Colorimetric

TABLE 4-3 (cont'd.)

INORGANIC ANALYSIS - ANALYTICAL RESULTS ALL SOLIDS REPORTED ON A DRY WEIGHT BASIS -page 2

H2M Sample Number Laboratory Sample Number		Outfall N 8-12 964325	Outfall K 10-12 963020	Outfall K 12-14 963021	Outfall K 14-16 963022	Outfall M 10-12 963023	Outfall M 14-16 963024	Field Blank 963025	Outfall J 10-12 963306	Outfall J 14-16 963307	Outfall L 10-12 963308	Outfall L 16-18 963309
Percent Solids		37.4%	39.3%	46.7%	53.4%	78.6%	66.0%	-	41.6%	79.7%	56.4%	81.3%
Units		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	ug/L	mg/kg	mg/kg	mg/kg	mg/kg
INORGANIC ELEMENTS	Detection Limit											
Aluminum P	102	15,600	30,200	9310	10,500	8860	16,800	279	8960	5590	10,600	3510
Antimony P	26	(20.5)	32.4	112	30.3	16.8			(25.5) B	UL	UL	UL
Arsenic F	3.0	9.7 J	10.6 J	7.8 J	6.1 J	4.9 J	7.6 J		22.6 J	4.6 J	7.7 J	3.2 J
Barium P	35	180	637	436	319	189	126		450 J	111 J	239 J	59.8 J
Beryllium P	2.0	2.5 J	5.9 J	2.5 J	(1.7) J		(0.8) J		(1.4) J	1.2 J	2.1 J	(0.74) J
Cadmium P	3.0	152 J	219 J	423 J	322 J	171 J	165 J		4020 J	1220 J	28.8 J	14.8 J
Calcium P/FL	292/10	150,000	123,000	52,900	65,300	4300	3120		56,000 J	54,000 J	94,400 J	36,800 J
Chromium P	9.0	2880 J	6960 J	8410 J	6000 J	1840 J	547 J	15.5	7330 J	1630 J	1360 J	374 J
Cobalt P	13	(14.5) J	(11.7) J	(7.7) J	(10.0) J	(5.9) J	14.8 J		(12.0) J	(7.3) J	(8.9) J	(3.2) J
Copper P	11	6810 J	10,700 J	14,700 J	10,100 J	6790 J	544 J	(19.8)	7000 J	1310 J	1890 J	664 J
Iron P	16	41,200	27,900	23,100	25,200	19,200	39,000	569	27,600 J	16,400 J	27,100 J	9480 J
Lead P/FL/F	41/100/2.0	70.3	1070	619	383	7250	265	100	327	91.9	156.2	29.5
Magnesium P/FL	174/200	22,100	20,200	5090	11,500	2910	6020		4790	8050	15,400	7650
Manganese P	3.0	952 J	2170 J	524 J	712 J	187 J	950 J	(13.2)	585	586	480	503
Mercury CV	0.20	0.37	0.47	0.64	0.30				0.93	0.12	0.40	
Nickel P	24	330	620	825	632	1551551551	80.5		4690 J	531 J	179 J	53.6 J
Potassium P	445	(1190)	3270	(402)	(564)	(405)	1280		(484) J	(488) J	(861) J	(485) J
Selenium F	1.0		(1.5) B	(0.83) B	(0.66) B	(0.52) B			UL	UL	UL	UL
Silver P/FL	6.0/10	6.8 J	50.5 J	40.2 J	31.6 J	UL	UL		50.5 J	11.4 J	13.1 J	(2.0) J
Sodium P	220	(2220)	2650	(2010)	(1460)	(754)	934	(287)	(2270) J	(811) J	(1500) J	(1050) J
Thallium F	3.0											
Vanadium P	17	35.7 J	34.0 J	(13.6) J	(14.2) J	(10.2) J	18.6 J		(14.4) J	10.2 J	23.4 J	(9.1) J
Zinc P	5.0	1270 J	4510 J	(3660) J	2400 J	1190 J	493 J	(17.3)	6110 J	841 J	1420 J	146 J
Cyanide DC	10	14.4 J	57.3 J	65.3 J	34.5 J	21.0 J	18.0 J		216 J	12.8 J	12.9 J	4.8 J

NOTES:

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ANALYTICAL METHOD:

P	- Inductively Coupled Plasma
F	- Graphite Furnace Atomic Absorption
CV	- Cold Vapor Atomic Absorption
FL	- Flame Atomic Absorption
DC	- Distillation/ Colorimetric

TABLE 4-3 (cont'd.)

INORGANIC ANALYSIS - ANALYTICAL RESULTS ALL SOLIDS REPORTED ON A DRY WEIGHT BASIS -page 3

H2M Sample Number		Outfall H 10-12	Outfall H 18-20	Outfall I 10-12	Outfall I 13.5-14.5	Outfall I 20-22	Outfall C 10-12	Outfall C 14-16	Outfall BA-2 10-12	Outfall BA-2 16-18	Outfall BA-1 10-12	Outfall BA-1 16-18
Laboratory Sample Number		963310	963311	963312	963313	963314	963315	963316	963317	963318	963319	963320
Percent Solids		92.0%	84.4%	81.9%	81.4%	64.4%	76.6%	78.7%	83.1%	71.8%	86.9%	77.0%
Units		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
INORGANIC ELEMENTS	Detection Limit											
Aluminum P	102	4620	7840	6230	8270	5980	12,100	11,400	12,300	10,400	11,000	7850
Antimony P	26	UL	UL	UL	UL	UL	UL	UL	UL	(8.1) B	UL	(11.7) J
Arsenic F	3.0	3.4 J	6.8 J	7.7 J	9.8 J	8.0 J	12.5 J	12.9 J	8.7 J	7.9 J	7.9 J	6.6 J
Barium P	35	(34.1) J	49.2 J	120 J	183 J	145 J	130 J	111 J	164 J	93.7 J	86.5 J	115 J
Beryllium P	2.0	1.3 J	(0.34) J	(0.35) J	1.2 J	(0.78) J	(0.78) J	(0.76) J	1.2 J	(0.84) J	(0.84) J	(0.78) J
Cadmium P	3.0	43.8 J	79.1 J	3.7 J	10.8 J	88.1 J	164 J	129 J	326 J	287 J	289 J	260 J
Calcium P/FL	292/10	67,100 J	2090 J	4170 J	40,500 J	19,100 J	2700 J	3200 J	16,200 J	5060 J	17,900 J	1770 J
Chromium P	9.0	122 J	112 J	153 J	362 J	2710 J	612 J	192 J	1700 J	1150 J	678 J	2200 J
Cobalt P	13	(4.3) J	(7.9) J	(8.0) J	8.9 J	(7.0) J	(11.5) J	12.7 J	(9.4) J	(7.8) J	(8.8) J	(5.2) J
Copper P	11	794 J	212 J	135 J	367 J	1400 J	240 J	178 J	978 J	912 J	797 J	1510 J
Iron P	16	13,000 J	20,200 J	16,200 J	21,700 J	17,800 J	28,400 J	27,900 J	33,400 J	29,700 J	28,900 J	22,200 J
Lead P/FL/F	41/100/2.0	30.4	15.0	29.6	86.1	72.5	88.7	35.6	231	64.2	33.4	78.0
Magnesium P/FL	174/200	18,500	2920	3330	7030	11,700	4480	4380	6320	4770	5160	2390
Manganese P	3.0	393	816	532	539	591	716	1470	793	670	709	877
Mercury CV	0.20											
Nickel P	24	50.0 J	56.3 J	41.9 J	114 J	138 J	90.6 J	87.1 J	157 J157 J157	87.9 J	104 J	64.5 J
Potassium P	445	(545) J	(611) J	(272) J	(593) J	(608) J	(775) J	(1020) J	(761) J	1690 J	(641) J	(787) J
Selenium F	1.0	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
Silver P/FL	6.0/10	UL	UL	7.7 J	12.5 J	13.0 J	2.6 J	(1.5) J	5.5 J	UL	8.2 J	UL
Sodium P	220	(910) J	(610) J	(748) J	(1050) J	(1010) J	(899) J	(869) J	1210 J	4730 J	(663) J	(962) J
Thallium F	3.0				(0.76)		(0.99)	(0.79)				
Vanadium P	17	(7.8) J	(10.6) J	9.0 J	13.0 J	14.0 J	19.1 J	17.5 J	23.9 J	20.6 J	18.0 J	13.5 J
Zinc P	5.0	152 J	212 J	499 J	956 J	435 J	348 J	234 J	607 J	390 J	674 J	326 J
Cyanide DC	10	13.5 J	5.0 J	7.6 J	10.0 J	UL	287 J	270 J	51 J	38.3 J	141 J	UL

NOTES:

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(#)	The result is greater than or equal to the instrument detection limit, but less than the CLP required detection limit.
J	Quantitation is approximate due to limitations identified in the quality assurance review.
B	This result is qualitatively suspect since this constituent was detected in a field and/or laboratory blank(s) at a similar level.
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ANALYTICAL METHOD:

P	Inductively Coupled Plasma
F	Graphite Furnace Atomic Absorption
CV	Cold Vapor Atomic Absorption
FL	Flame Atomic Absorption
DC	Distillation/ Colorimetric

TABLE 4-3 (cont'd.)

INORGANIC ANALYSIS - ANALYTICAL RESULTS ALL SOLIDS REPORTED ON A DRY WEIGHT BASIS -page 4

H2M Sample Number Laboratory Sample Number		B-1 10-12 963321	B-1 20-22 963322	Field Blank 963323
Percent Solids		87.0%	80.6%	-
Units		mg/kg	mg/kg	ug/L
INORGANIC ELEMENTS	Detection Limit			
Aluminum P	102	9480	9860	
Antimony P	26	UL	6.4 B	
Arsenic F	3.0	8.3 J	7.2 J	
Barium P	35	52.7 J	(40.2) J	
Beryllium P	2.0	(0.46) J	(0.50) J	
Cadmium P	3.0	2.3 J	3.2 J	
Calcium P/FL	292/10	2000 J	1590 J	
Chromium P	9.0	32.4 B	34.2 B	31.0
Cobalt P	13	(9.2) J	(8.7) J	
Copper P	11	37.7 J	34.0 J	(16.0)
Iron P	16	26,800 J	25,600 J	(93.0)
Lead P/FL/F	41/100/2.0	15.3	12.8	(2.3)
Magnesium P/FL	174/200	3110	3920	
Manganese P	3.0	705	537	(3.0)
Mercury CV	0.20			
Nickel P	24	34.3 J	37.0 J	
Potassium P	445	(775) J	(866) J	
Selenium F	1.0	UL	UL	
Silver P/FL	6.0/10	UL	UL	
Sodium P	220	(1080) J	(749) J	(401)
Thallium F	3.0			
Vanadium P	17	17.7 J	16.4 J	
Zinc P	5.0	74.3 J	80.6 J	35.0
Cyanide DC	10	132 J	1.7 J	

NOTES:

- \- Element was not detected.
(#) - The result is greater than or equal to the instrument detection limit, but less than the CLP required detection limit.
J - Quantitation is approximate due to limitations identified in the quality assurance review.
B - This result is qualitatively suspect since this constituent was detected in a field and/or laboratory blank(s) at a similar level.
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5.0 - CONTAMINANT FATE AND TRANSPORT

5.1 - POTENTIAL ROUTES OF MIGRATION

This section provides a qualitative consideration of the pathways for migration of contaminants from the site, and a discussion on the persistence and migration pathways for the category of indicator chemicals at the site. Section 6.0, Baseline Risk Assessment discusses in detail the site-specific exposure assessment with respect to media to address the potential impacts to human health and the environment. Potential pathways for contaminant migration from the site are presented conceptually in Figure 5-1.

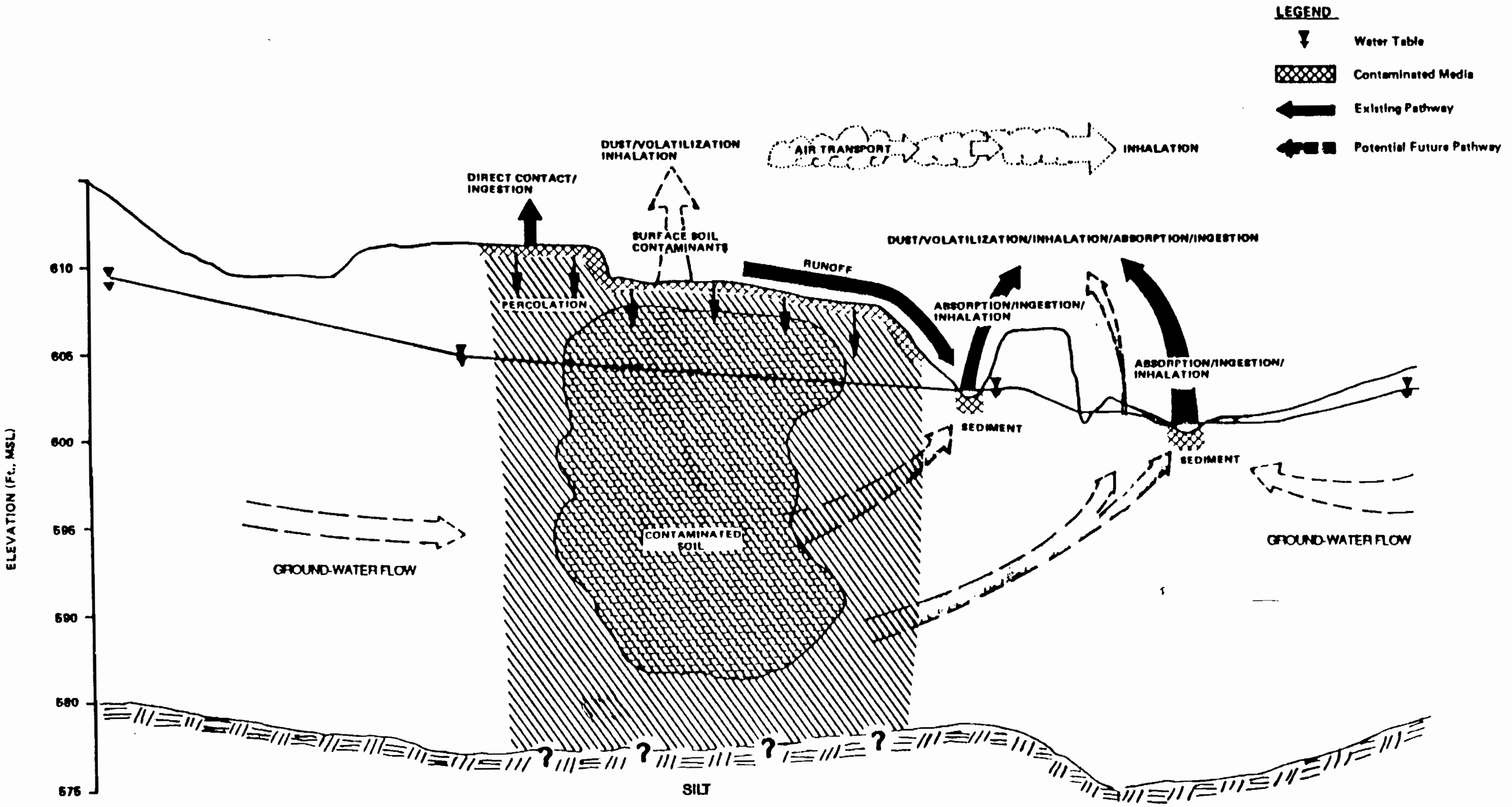
5.1.1 - Groundwater

As water infiltrates through the contaminated soil, it may desorb inorganic constituents and organic compounds that could enter the groundwater. After contaminants have entered the groundwater, several migration pathways are possible. In general, groundwater tends to flow through a porous medium perpendicularly to the groundwater contours, toward the west-northwest as shown in Figures 3-7 and 3-8. Groundwater ultimately discharges into the Chenango River.

5.1.2 - Surface Water

Contaminants discharging from groundwater into the surface water may volatilize or precipitate and adsorb onto sediment. They could also remain in solution and be eventually transported downstream.

FIGURE 5-1



Identification of exposure pathways.

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Contaminants within the sediment might disassociate and re-enter solution, or be scoured and resuspended during periods of high stream flow. During low or no flow periods, contaminated sediment may be exposed along the streambanks and possibly transported as dust. Finally, organisms that might bioaccumulate substances from the soils, sediment or surface waters at the site could also be considered as carriers of contamination to off-site areas.

5.1.3 - Soils

Subsurface contaminated soils could be transported to the surface as a result of excavation activities. Organic contaminants could be volatilized with excavation activities.

5.1.4 - Air

Release and transport mechanisms associated with air exposure include primarily wind erosion of contaminated subsurface soils brought to the surface during excavation. The RI air investigation results do not indicate cause for immediate attention to this exposure route.

5.2 - CONTAMINANT PERSISTENCE

This section discusses the characteristics and the probable environmental behavior of the types of chemical contaminants found at the Hillcrest facility. The specific pertinent physical and chemical characteristics of the individual contaminants found in the groundwater and soil at the site are discussed in detail in Appendix D.

The water solubility of a contaminant is the maximum concentration of a chemical that dissolves in pure water at a specific temperature and pH. Water solubility affects environmental fate of a chemical, since highly soluble chemicals leach rapidly into groundwater. Soluble chemicals are also more readily biodegradable. Highly soluble components are less strongly adsorbed in both surface and groundwater. High solubility is also generally associated with lower volatilization.

Vapor pressure and Henry's Law constant are two measures of chemical volatility. They are thus important in evaluating air exposure pathways and also degree of adsorption, water solubility and soil conditions. Henry's Law constant in particular is good for estimating releases from contaminated water-bodies. If air exposure pathways are not important, these two factors are likely not that important. The Henry's Law constant is essential for the design of aeration processes for volatile organic removal from water.

The organic carbon partition coefficient, Koc, is a sorption potential measure for organics, especially for aqueous pathways. This value is a tendency of organic chemicals to be adsorbed, which is also dependent on soil properties. The normal range is 1 to 10. For groundwater, low Koc values indicate more leaching and are directly related to the retardation factor. In surface water, high Koc indicates tight binding of organics to soil and, therefore, less will dissolve in site runoff. However, a low Koc in soil indicates that the chemical may be released to groundwater in the future. A high Koc also indicates a tendency to bioaccumulate. The Koc is essential in evaluating the efficiency of a chemical to be adsorbed by activated carbon as a treatment process.

Persistence of a chemical is measured through half-lives in air, soil, groundwater and surface water. For the chemical contaminant at the site, only persistence data are available for air and surface water. Half-lives are based on all removal processes, i.e., phase transfer, chemical transformation and biological transformation. Degradation products, it may be noted, may have higher toxicity or environmental mobility than the original chemical.

The octanol-water partition coefficient, Kow, is a measure of how a chemical is distributed at equilibrium between octanol and water. This is useful in predicting the fate of organic chemicals.

The bioconcentration factor is a measure of the tendency of the chemical contaminant in water to accumulate in fish tissue. This factor is important in determining human intakes via the aquatic food ingestion route.

Discussed below are brief profiles of each category of contaminant identified at the Link facility with a detailed discussion in Appendix D. The discussion for each contaminant includes the probable sources (natural and otherwise) of the contaminant in the environment and the probable fate, as far as available evidence indicates, of the contaminant in groundwater, surface water and/or soil. These fate processes may include one or more of the following: sorption, hydrolysis, biodegradation, oxidation/reduction, photolysis and/or volatilization.

- Inorganics - Heavy Metals

Heavy metal inorganics include arsenic, beryllium, barium, cadmium, chromium, copper, lead, selenium, zinc, silver and mercury. In general, they behave similarly in groundwater. They form complexes and will adsorb to different soil particles. They will precipitate under neutral or alkaline conditions. They are generally from point source discharges and related to metal processes (e.g., electroplating, photographic). They are also naturally occurring in soils, although usually not in a leachable form under natural conditions (neutral pH).

- Organics

There are no natural sources of 1,1,1-trichloroethane or trichloroethylene as they are synthetic chemicals. They are commonly used as metal degreasers. These chemicals, when not lost by evaporation, can become contaminated with oil and grease. Release of this contaminant occurs primarily in industrialized areas, but other sources may be significant.

1,1,1-Trichloroethane readily migrates to groundwater and is not significantly sorbed by soil. It slowly hydrolyzes in water. It occurs widely in the environment and especially in groundwater as a contaminant. Trichloroethylene does not degrade rapidly and migrates readily to groundwater. It remains in groundwater for months to years. Under anaerobic conditions, trichloroethylene will degrade to cis/trans 1,2-dichloroethene and ultimately to vinyl chloride which will migrate with groundwater. If present, vinyl chloride in groundwater is indicative of considerable residence time. Trichloroethylene may be a degradation product of tetrachloroethylene. Trichloroethylene does not bioaccumulate. Trichloroethylene occurs widely in ground and surface waters as a contaminant.

5.3 - CONTAMINANT MIGRATION

This section summarizes the probable environmental pathways of exposure and probable receptors, both human and environmental, of the significant chemical contaminants from the Hillcrest site. For each environmental pathway, a potential source, a release transport medium, release mechanism, and exposure points where the human population comes in direct contact with the contaminant are discussed.

The potential environmental pathways of exposure in order of importance are: (1) groundwater and surface water, (2) soil, and (3) air. The predominant potential sources of contamination at the Hillcrest facility are the Outfall 004 system and the contaminant plumes on-site migrating off-site.

The release mechanism from the source area to the release/transport media is the physical and/or chemical process that the chemical contaminant will theoretically experience. The release mechanism is dependent on the physical/chemical properties of the contaminant and the interaction with the various transport media of the site.

Additionally, exposure factors related to each release/transport media and human exposure are considered. The media includes groundwater, surface water, soil and air. For each release/transport media, the probable exposure routes and exposure points are identified. Many of these pathways represent minimal exposures to the human population due to low expected contaminant concentrations.

5.3.1 - Groundwater and Surface Water

The primary environmental exposure route of chemical contaminants at the Hillcrest site is through the water table aquifer. A volatile organic contamination plume has been detected migrating west-northwest from the Hillcrest site. According to public records and available information, all homes in the affected area are currently connected to a public water supply for drinking, showering and cooking purposes.

The hydrogeology was analyzed as part of the remedial investigation. This helped to identify the natural groundwater flow patterns, natural rate of flow, total area and volume of the inferred plume of contamination and the effect of other factors, as discussed in the previous sections. The plume is identified as still moving to the west-northwest with groundwater flow.

The plume locally discharges to a surface water-body, the Chenango River located west of the site. The area of probable discharge is fresh and open to fishing. This water-body is rated as Class B, which is suitable for primary contact recreation.

5.3.2 - Soil

Direct ingestion of soil and exposure to contaminated soil was considered a potential exposure route only during excavation at this site. Exposure is highest for people who would be involved in the excavation of soil. This pathway is also directly related to air exposure due to excavation of contaminated soils.

5.3.3 - Air

Exposure to airborne organic and inorganic contaminants is possible primarily for those involved in excavation activities. Airborne contamination is due to volatilization and resuspension of substances from subsurface soils stockpiled during excavation. Other than during excavation, the RI air investigation analytical results do not indicate any other mechanisms for this exposure route.

6.0 - BASELINE RISK ASSESSMENT

The primary environmental exposure route of contaminants in the study area is through the discharge of impacted groundwater locally into the Chenango River. A conditional exposure pathway will also exist if contaminated subsurface soil present in Outfall System 004 is excavated and stored on-site.

The Baseline Risk Assessment (BRA) evaluated these two exposure pathways utilizing the analytical data generated by the RI. Maximum concentrations of contaminants in groundwater were used to predict concentrations of these same contaminants in surface water. The estimated risks for the site due to cumulative totals of non-carcinogens and carcinogens does not exceed the established reference hazard index or risk value. This indicates, therefore, no increased risk evident due to impacted groundwater discharging into the Chenango River.

An analysis of the other conditionally completed exposure pathway indicates a potential health risk to site workers if excavation of impacted subsurface soils occurs. Appropriate precautions during excavation activities would be necessary with stringent health precautions.

This assessment addresses the potential impacts to human health and the environment associated with the Link Flight Simulation Hillcrest facility. This assessment, therefore, constitutes an evaluation of the no action alternative required under Section 300.68 (f)(v) of the National Contingency Plan (NCP).

It should be noted that this BRA has been conducted using conservative assumptions according to the general guidelines outlined by the United State Environmental Protection Agency (USEPA) as detailed in Superfund Public Health Evaluation Manual (SPHEM) 1986 guidelines.

The purpose of using conservative assumptions is to explore the potential for adverse health and environmental effects using conditions that tend to overestimate risk. Consequently, the final estimates will usually be near or higher than the upper end of the range of actual exposures and risks. As a result, this risk assessment should not be construed as presenting an absolute estimate of risk to human populations or the environment. Rather, it is a conservative analysis intended to indicate the potential for adverse impact to occur.

This assessment is based on data generated during the Remedial Investigation (RI) conducted in the Summer of 1989. The baseline risk assessment is organized into two evaluations: the human health evaluation and the environmental evaluation.

6.1 - SELECTION OF INDICATOR CHEMICALS

USEPA Guidance on the Performance of Public Health Evaluations (USEPA, 1986a) states that indicator chemicals should be selected from the contaminants known to be on-site in order to identify the "highest risk" chemicals for the assessment. The chosen indicator chemicals should represent the most prevalent, toxic, mobile and persistent chemicals at the site. The indicator chemicals were selected from the following environmental media sampled in the remedial investigation: groundwater and subsurface unsaturated soil.

As a conservative approach in this BRA, all organic chemicals that were detected were selected as indicator chemicals. Organic chemicals may be attributable to unnaturally occurring constituents placed in or released from sources at the site. However, inorganics are also naturally occurring and may be present in soil or groundwater as a result of natural background conditions. Where it has been determined that an inorganic chemical is present greater than twice the maximum background levels, it was selected as an indicator chemical. An assessment of the risk associated with the background concentration is also presented. The chemicals are then dismissed as contributing to potential risk, if the background risk is equal to or greater than the risk at on-site or downgradient points. Tentatively Identified Compounds (TICs) were not considered in this assessment due to the criteria identified in risk assessment guidance for Superfund Human Health Evaluation Manual USEPA 12/89. This guidance manual suggests that TICs should not be included in the risk assessment when: (1) few TICs are present in comparison to Target Compound List (TCL) compounds; (2) historical site information does not indicate that a particular TIC may indeed be present at the site; and (3) the estimated concentration of TIC may be high. The TICs identified at Hillcrest facility may be a byproduct of a chemical operation conducted at the site. The estimated concentrations of TICs identified are highly uncertain and could be orders of magnitude higher or lower than the actual concentrations. For TICs, therefore, assigned identities may be inaccurate and quantification is certainly inaccurate.

Validated Contract Laboratory Protocol (CLP) analytical data for the above media were reviewed in selecting indicator chemicals. For each potential indicator chemical, the range of concentration values, the representative concentration, the frequency of occurrence of values detected above the detection level and the total number of samples obtained are given. These values were determined for sampling points in the study area and for background points. The representative concentration is the mean of all values, including those below detection levels per chemical. For those reported below detection levels, one-half of the detection value is used in calculating the mean.

These data were used to select indicator chemicals for subsurface soils and groundwater media at the site. Tables 6-1 and 6-2 list the chemicals detected in those media.

Soil was sampled from twelve (12) inactive leaching pools which comprised the abandoned industrial wastewater disposal system 004 along the east side of the Link Flight Simulation facility. Two (2) background samples were obtained on the property as well. Split spoon samples were obtained as described in detail in Section 2.1.1. Samples were obtained from leaching pools K and M on July 29, 1989; BA (to the west and east of decommissioned leaching pool A), C, H, I, J, L and background locations B-1 and B-2 on August 3, 1989; and leaching pools B, D, E and N on August 18, 1989 as seen in Figure 2-1. Soil samples

TABLE 6-1

CHEMICALS DETECTED IN SUBSURFACE UNSATURATED SOILS

	Background			Site		
Chemical	Range of Concentration (mg/kg)	Mean Concentration (mg/kg)	Frequency of Occurrence (Values>DL)	Range of Concentration (mg/kg)	Mean Concentration (mg/kg)	Frequency of Occurrence (Values>DL)
Aluminum	9480-9860	9670	2/2	3510-30,200	10,808.1	26/26
Antimony	BDL(6)-6.4	4.7	1/2	BDL(4.3)-112	13.87	9/26
Arsenic	7.2-8.3	7.75	2/2	3.2-22.6	8.75	26/26
Barium	40.2-52.7	46.45	2/2	34.1-637	171.1	26/26
Beryllium	0.46-0.5	0.48	2/2	BDL(0.5)-5.9	1.23	24/26
Cadmium	2.3-3.2	2.75	2/2	3.7-4020	339.8	26/26
Calcium	1590-2000	1795	2/2	1440-150,000	33,608.5	26/26
Chromium	32.4-34.2	33.3	2/2	45.9-8410	1852.5	26/26
Cobalt	8.7-9.2	8.95	2/2	3.2-17.8	9.5	26/26
Copper	34-37.7	35.85	2/2	30.9-14,700	2715.5	26/26
Iron	25,600-26,800	26,200	2/2	9480-46,800	25,376.2	26/26
Lead	12.8-15.3	14.05	2/2	9.5-7250	430.9	26/26
Magnesium	3110-3920	3515	2/2	2390-22,100	7759.6	26/26
Manganese	537-705	621	2/2	187-3370	923.5	26/26
Mercury	BDL(0.07)	NR	0/2	BDL(0.05)-0.93	0.16	7/26
Nickel	34.3-37	35.65	2/2	41.9-4690	361.3	26/26
Potassium	775-866	820.5	2/2	272-3270	912.3	26/26
Selenium	BDL(0.38)	NR	0/2	BDL(0.2)-1.5	0.30	4/26
Silver	BDL(1.4)	NR	0/2	BDL(1)-50.5	10.36	17/26
Sodium	749-1080	914.5	2/2	610-4730	1381.7	26/26
Thallium	BDL(0.58)	NR	0/2	BDL(0.5)-1.1	0.5	6/26
Vanadium	16.4-17.7	17.05	2/2	7.8-35.7	17.2	26/26
Zinc	74.3-80.6	77.45	2/2	87.8-6110	1079.7	26/26
Cyanide	1.7-132	66.85	2/2	1.2-287	51.6	24/26

TABLE 6-1 (CONT'D.)

CHEMICALS DETECTED IN SUBSURFACE UNSATURATED SOILS

	Background			Site		
Target Compound List	Range of Concentration (mg/kg)	Mean Concentration (mg/kg)	Frequency of Occurrence (Values>DL)	Range of Concentration (mg/kg)	Mean Concentration (mg/kg)	Frequency of Occurrence (Values>DL)
Vinyl Chloride	BDL(12)	NR	0/2	BDL(11)-570	NR	1/34
Chloroethane	BDL(12)	NR	0/2	BDL(11)-46,000	2067.8	2/34
Methylene Chloride	BDL(6)	NR	0/2	BDL(5)-8700	488.4	12/34
Acetone	BDL(12)	NR	0/2	BDL(11)-1900	861.7	2/34
Carbon Disulfide	BDL(6)	NR	0/2	BDL(5)-300	NR	5/34
1,1-DCE	BDL(6)	NR	0/2	BDL(5)-8700	483	3/34
1,1-DCA	BDL(6)	NR	0/2	BDL(5)-26,000	1859.7	8/34
1,2-DCE	BDL(6)	NR	0/2	BDL(5)-90	NR	1/34
1,2-DCA	BDL(6)	NR	0/2	BDL(5)-61	NR	1/34
2-Butanone	BDL(12)	NR	0/2	BDL(11)-480	NR	3/34
1,1,1-TCA	BDL(6)	NR	0/2	BDL(5)-530,000	19,194.4	22/34
TCE	BDL(6)-3	NR	0/2	BDL(6)-610,000	18,477.9	28/34
1,1,2-TCA	BDL(6)	NR	0/2	BDL(5)-8700	482.6	3/34
Tetrachloroethene	BDL(6)	NR	0/2	BDL(5)-8700	538.1	6/34
Toluene	BDL(6)	NR	0/2	BDL(5)-8700	581.7	7/34
Ethylbenzene	BDL(6)	NR	0/2	BDL(5)-8700	491.3	5/34
Xylene (total)	BDL(6)	NR	0/2	BDL(5)-8700	542.8	5/34
4,4'-DDT	BDL(18)	NR	0/2	BDL(17)-850	61.2	1/24
Arochlor 1254	BDL (180)	NR	0/2	BDL(174)-1900	275.4	1/24
Arochlor 1260	BDL (180)	NR	0/2	BDL(174)-2700	298.7	3/24

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TABLE 6-2

CHEMICALS DETECTED IN GROUNDWATER

	Background			Site		
Target Analyte List	Range of Concentration (μg/L or ppb)	Mean Concentration (μg/L or ppb)	Frequency of Occurrence (Values>DL)	Range of Concentration (μg/L or ppb)	Mean Concentration (μg/L or ppb)	Frequency of Occurrence (Values>DL)
Aluminum	67,000-617,000	342,000	2/2	289-708,000	211,487	26/26
Antimony	26U-63.7	38.35	1/2	26U-156	30.4	10/26
Arsenic	36-56	46	2/2	3U-80.5	25.53	14/26
Barium	448-3660	2054	2/2	96.1B-4190	1623.7	26/26
Beryllium	3.9B-25.6	14.75	2/2	2B-101	21.23	26/26
Cadmium	5U-18.5	10.5	1/2	5U-7290	700.2	23/26
Calcium	35,500-76,400	55,950	2/2	43,200-4,510,000	942,061.5	26/26
Chromium	110-843	476.5	2/2	176-21,900	2006.5	26/26
Cobalt	58.7-514	286.4	2/2	13U-646	311.4	25/26
Copper	134-1110	622	2/2	27.3-22,800	2093.4	26/26
Iron	147,000-1,210,000	678,500	2/2	13,900-1,770,000	329,776	26/26
Lead	120-1080	600	2/2	11.6-1320	583.5	26/26
Magnesium	23,500-171,000	97,250	2/2	22,300-1,830,000	287,834	26/26
Manganese	3840-31,800	17,820	2/2	489-72,500	22,119	26/26
Mercury	0.76-1	0.88	2/2	0.2U-3.0	0.53	15/26
Nickel	145-1160	652.5	2/2	83.4-1990	716.2	26/26
Potassium	8500-36,600	22,550	2/2	5490-36,600	13,944.6	26/26
Silver	10U-10	2.75	1/2	10U-160	32.5	17/26
Sodium	10,500-12,300	11,400	2/2	10,500-209,000	58,592.3	26/26
Vanadium	99-692	395.5	2/2	17U-901	291.5	25/26
Zinc	339-2950	1644.5	1/2	51.1-4800	1800.05	26/26
Cyanide	10U-10U	5U	0/2	10U-395	26.83	9/26
Hexavalent Chromium	20U-20U	20U	0/2	20U-850	254.3	18/26

TABLE 6-2 (CONT'D.)

CHEMICALS DETECTED IN GROUNDWATER

	Background			Site		
Target Compound List	Range of Concentration (μg/L or ppb)	Mean Concentration (μg/L or ppb)	Frequency of Occurrence (Values>DL)	Range of Concentration (μg/L or ppb)	Mean Concentration (μg/L or ppb)	Frequency of Occurrence (Values>DL)
Methylene Chloride	ND	ND	ND	5U-4J	2.8	3/28
1,1-DCE	ND	ND	ND	5U-9	7.42	4/28
1,1-DCA	ND	ND	ND	5U-12/13J	3.5	4/28
c/t-1,2-DCE	ND	ND	ND	5U-52	8.9	6/28
1,1,1-TCA	ND	ND	ND	5U-29	9.15	22/28
TCE	ND	ND	ND	5U-760	127.6	26/28
Acetone	ND	ND	ND	10U-33	8.99	2/28
Chloromethane	ND	ND	ND	10U-28	7.23	1/28
Chloroform	ND	ND	ND	5U-5	3.29	1/28

ND = Not detected

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were analyzed for TCL (Target Compound List) volatile organics and pesticides/PCBs and TAL (Target Analyte List) inorganics.

Groundwater was sampled from fourteen (14) wells in two rounds during September and October 1989. Seven (7) of these wells were selected for sampling out of twenty (20) previously installed wells and were MW-6, MW-10, MW-12, MW-13, MW-15, MW-16 and MW-17. Seven (7) of these fourteen (14) wells sampled were installed as part of the remedial investigation and are MW-20, MW-21, MW-22, MW-23, MW-24, MW-25 and MW-26. The upgradient (background) well for this site is MW-26. The groundwater samples were analyzed for TAL inorganics, and TCL organics (volatile organics and pesticides/PCBs).

Table 6-3 lists the selected chemicals and the environmental media in which they were detected. These chemicals are evaluated for the baseline human health and environmental evaluations of this baseline risk assessment. Appendix D discusses each indicator chemical in terms of its occurrence, physical properties, environmental fate and toxicity.

6.2 - HUMAN HEALTH EVALUATION

The human health evaluation is organized as follows:

- Exposure Assessment. Potential pathways by which populations may be exposed to contaminants from the site are identified. Concentrations of chemicals in environmental media at potential exposure points are estimated.

TABLE 6-3

SELECTED INDICATOR CHEMICALS

Indicator Chemical	Media Detected in: Subsurface Soil		Groundwater	
Target Analyte List (TAL)	Site	Background	Site	Background
Aluminum	X	X	X,NI	X,NI
Antimony	X	X	X	X
Arsenic	X	X	X,NI	X,NI
Barium	X	X	X,NI	X,NI
Beryllium	X	X	X	X
Cadmium	X	X	X	X
Calcium	X	X	X	X
Chromium (Total)	X	X	X	X
Copper	X	X	X	X
Lead	X	X	X,NI	X,NI
Magnesium	X	X	X	X
Manganese	X	X	X	X
Mercury	X	-	X	X
Nickel	X	X	X,NI	X,NI
Potassium	X	X	X,NI	X,NI
Selenium	X	-	-	-
Silver	X	-	X	X
Sodium	X	X	X	X
Zinc	X	X	X,NI	X,NI
Cyanide	X	X	X	-
Hexavalent Chromium	-	-	X	-

TABLE 6-3 (CONT'D.)

SELECTED INDICATOR CHEMICALS

Indicator Chemical	Media Detected in: Subsurface Soil		Groundwater	
Target Compound List (TCL)	Site	Background	Site	Background
Volatile Organics				
1,1,1-Trichloroethane	X	-	X	-
1,1,2-Trichloroethane	X	-	-	-
1,1-Dichloroethane	X	-	X	-
1,1-Dichloroethylene	X	-	X	-
1,2-Dichloroethane	X,NR	-	-	-
2-Butanone	X	-	X	-
Acetone	X	-	X	-
Carbon Disulfide	X	-	-	-
Chloroethane	X	-	-	-
Chloroform (Trichloromethane)	-	-	X	-
Chloromethane	-	-	X	-
cis/trans 1,2-DCE	X,NR	-	X	-
Ethyl Benzene	X	-	-	-
Methylene Chloride (Dichloromethane)	X	-	X	-
Tetrachloroethylene	X	-	-	-
Trichloroethylene	X	X	X	-
Toluene	X	-	-	-
Total Xylenes	X	-	-	-
Vinyl Chloride	X,NR	-	-	-
Pesticides/PCBs				
4,4'-DDT	X	-	-	-
Arochlor 1254 (a PCB)	X	-	-	-
Arochlor 1260 (a PCB)	X	-	-	-

NOTES

X = Detected in sample
NI = Detected but is not an indicator chemical as based on comparison with background maximum values.
- = Not detected in sample
NR = Not reported; mean is greater than maximum due to values below the detection limit.

- Comparison to ARARs. Estimated concentrations of chemicals are then compared to Applicable or Relevant and Appropriate Requirements (ARARs) such as Maximum Contaminant Levels (MCLs) and New York State Drinking Water Standards.
- Toxicity Assessment. In this section, the toxic characteristics of the indicator chemicals are discussed and toxicity criteria are identified. The methodology for the quantitative risk assessment is also reviewed.
- Risk Characterization. Since ARARs are not available for all chemicals in all media, quantitative risk estimates are also developed by combining the estimated intakes of potentially exposed populations with health effects criteria.

6.2.1 - Exposure Assessment

Exposure pathways describe the mechanisms by which humans may come in contact with (be exposed to) contaminants. An exposure pathway will depend on the physical and chemical properties of the contaminants, use of the site and surrounding area, and site characteristics such as geology, hydrology, soil properties and climate. USEPA guidance on Superfund risk assessments (1986c) defines an exposure pathway as consisting of the following elements:

1. A source and mechanism of chemical release to the environment;

2. An environmental transport medium for the released chemical (e.g., air, groundwater);
3. A point of potential human contact with the contaminated medium (referred to as an exposure point); and
4. A route of exposure at the exposure point (e.g., ingestion, dermal contact).

If all of the elements of the exposure pathway are present, then that pathway is said to be "completed". Completed exposure pathways are subject to evaluation in the BRA.

In this assessment, both current and potential future exposure pathways are considered. Future exposure pathways are developed assuming continued use of the site. Future development for residential or commercial use is not anticipated in the foreseeable future and is, therefore, not considered in this assessment. For the purposes of this assessment, the sources of contamination at the Link Flight Simulation site are the decommissioned industrial outfall systems.

6.2.1.1 - Exposure Media

The following sections address release and transport mechanisms, potentially exposed populations, and exposure routes relative to each of the potential exposure media: subsurface soil, groundwater, surface water and air.

- Subsurface Soils

Exposure to subsurface soils may occur only as a result of remediation (i.e., excavation). Employees, local inhabitants and workers engaged in these activities may risk exposure through incidental ingestion, dermal absorption or inhalation of remediation-generated dust. This will only be considered a completed exposure pathway if excavation of the leaching pools and the soils around them occur. For the purposes of the remedial investigation and baseline risk assessment, this is not considered a completed exposure pathway.

- <u>Groundwater</u>

Contaminants may be released to groundwater by leaching from contaminated soils with transport to downgradient areas off-site. All residents in the downgradient area are supplied by municipal water from the Town of Fenton. In early 1989, a municipal water main was installed to complete service to this area and provide municipal water supply. According to County and State health agencies, it was reported that there were not any groundwater users in this area.

Thus, the groundwater exposure media is not a completed exposure pathway because the people in this downgradient area are not exposed to the contaminated medium. Because there is no exposure, the potential migration of contaminants with groundwater is not evaluated in this assessment.

Because groundwater discharges to the Chenango River, contaminants may also be released from groundwater to the river. Exposure could occur to nearby residents who swim or wade in the river or who may consume fish from the river downstream of the point of potentially contaminated groundwater discharge. This is addressed later in the surface water assessment. This is considered a conditionally completed exposure pathway. Phelps Creek, an intermittent stream, is not considered in this assessment because it is not hydrologically downgradient from the source area and only receives storm water runoff.

- Air

Release and transport mechanisms associated with air exposure includes only the potential volatilization of organics from subsurface soils during remediation activities. Therefore, volatilization is only considered a completed exposure pathway during soil excavation or groundwater treatment. If excavation occurs at the outfall system, these chemicals may diffuse into the air and reach nearby residents, although greatly diluted, thus representing a completed exposure pathway. Ambient air monitoring at the site, however, does not reveal any detectable level of contamination. Consequently, any potential risk from this completed exposure pathway cannot be quantified until such activities occur.

Table 6-4 summarizes the discussion of exposure pathways presented above. Figure 5-1 depicts a conceptual diagram of the fate and transport processes. The following potential exposure pathways will be evaluated in the following sections:

- Direct contact with subsurface soils by on-site workers; and
- Ingestion of surface water from the local groundwater discharge area (Chenango River).

TABLE 6-4

EXPOSURE PATHWAYS

Exposure Medium	Release/Transport Mechanism	Potentially Exposed Population	Completed Exposure Pathway?
Subsurface Soil	Direct contact during excavation of leaching pool subsurface soil.	Remediation workers on site; trespassers on cemetery property line.	Conditional no. Without excavation, this is not a completed pathway because there would be no exposure. If excavation occurs, appropriate precautions will be taken to protect the health and safety of remediation workers. Impacted soil would be contained and isolated to protect workers and the community.
Groundwater	Contaminant migration.	Nearby businesses using groundwater.	No. This applies only to those businesses with downgradient private wells still using these wells instead of municipal water against NYSDOH recommendations.

TABLE 6-4 (CONT'D.)

EXPOSURE PATHWAYS

Exposure Medium	Release/Transport Mechanism	Potentially Exposed Population	Completed Exposure Pathway?
Groundwater (cont'd.)	Discharge to Chenango River.	People who swim or wade in the river or who may consume fish from the river.	Conditional yes. Although samples were not obtained from the river, predictions were made in the exposure assessment. According to risk assessment, this exposure pathway does not pose an increased health risk
	Excavation of subsurface soil to the water table.	Remediation workers on site.	Conditional yes, but excavation will occur primarily in the zone above the water table
Air	Volatization from excavated subsurface soil stockpiles.	Remediation workers on site. Trespassers on cemetery property line.	Conditional no. Results indicate that the soils contain volatile organic compounds. Air quality would be monitored during this process. Data does not exist now to quantify this exposure pathway. Any stockpiled soils should be covered and then quickly disposed of off-site.
	Wind erosion.	Remediation workers on site. Trespassers on cemetery property line.	

6.2.1.2 - Estimation of Exposure Point Concentrations in Surface Water

Exposure concentrations were estimated in surface water using a simple groundwater to surface water discharge model. Representative concentrations reported for each groundwater indicator chemical were used to predict the concentration change as the chemicals migrate from the source area at the site to the Chenango River tributary (the receptor area). The maximum initial concentrations and the predicted exposure concentrations for each indicator chemical is seen in Table 6-5.

The most conservative approach was used to estimate surface water exposure concentrations. The surface water exposure estimation method is comprised of two steps and these are briefly discussed below.

The amount of groundwater discharged to surface water, Qg (in cubic feet per day) is calculated in Step 1. This is expressed by the following relationship:

$$Qg = KiA \tag{6-1}$$

Where, K = average hydraulic conductivity (ft/day)

i = hydraulic gradient (dimensionless)

A = cross-sectional area of groundwater discharge (ft^2) which is equal to the average saturated thickness of the aquifer (ft) times the length of the discharge face perpendicular to groundwater flow (ft)

Hydraulic conductivity was estimated from data derived during the remedial investigation and based upon grain size

TABLE 6-5

SURFACE WATER EXPOSURE CONCENTRATIONS

A. SITE

Indicator Chemical	Maximum Concentration in Groundwater CG (µg/L)	Predicted Concentration in Surface Water CS* (µg/L)
Acetone	3.30E+01	3.97E-02
Chloromethane	2.80E+01	3.37E-02
Chloroform	5.00E+00	6.02E-03
1,1-DCA	1.30E+01	1.56E-02
1,1-DCE	9.00E+00	1.08E-02
c/t-1,2-DCE	5.20E+01	6.26E-02
Methylene Chloride	4.00E+00	4.81E-03
1,1,1-TCA	2.90E+01	3.49E-02
TCE	7.60E+02	9.15E-01
Antimony	1.56E+02	1.88E-01
Beryllium	1.01E+02	1.22E-01
Cadmium	7.29E+03	8.77E+00
Calcium	4.50E+06	5.42E+03
Chromium	2.19E+04	2.64E+01
Copper	2.28E+04	2.74E+01
Magnesium	1.83E+06	2.20E+03
Manganese	7.25E+04	8.73E+01
Mercury	3.00E+00	3.61E-03
Silver	1.60E+02	1.93E-01
Sodium	2.09E+05	2.52E+02
Cyanide	3.95E+02	4.75E-01
Chromium - Hexavalent	8.50E-01	1.02E+00

NOTES:

*CS = QG/QS * CG
where QG = K*I*L*B

K = 100 ft/day
I = 0.009 ft/ft
B = 12 feet
L = 1300 feet
QS = 11,664,000 CFD or
135 CFS (personal communication with NYSDEC, 1/90)

TABLE 6-5 (CONT'D.)

SURFACE WATER EXPOSURE CONCENTRATIONS

B. BACKGROUND

Indicator Chemical	Maximum Concentration in Groundwater CG (µg/L)	Predicted Concentration in Surface Water CS* (µg/L)
Antimony	6.37E+01	7.67E-02
Beryllium	2.56E+01	3.08E-02
Cadmium	1.85E+01	2.23E-02
Calcium	7.64E+04	9.20E+01
Chromium	8.43E+02	1.01E+00
Copper	1.11E+03	1.34E+00
Magnesium	1.71E+05	2.06E+02
Manganese	3.18E+04	3.83E+01
Mercury	1.00E+00	1.20E-03
Silver	1.00E+01	1.20E-02
Sodium	1.23E+04	1.48E+01

NOTES:

*CS = QG/QS * CG
where QG = K*I*L*B

K = 100 ft/day
I = 0.009 ft/ft
B = 12 feet
L = 1300 feet
QS = 11,664,000 CFD or
135 CFS (personal communication with NYSDEC, 1/90)

analysis. The hydraulic gradient was based on the water level contour map for September 6, 1989. The cross-sectional area is based on groundwater flow patterns and inferred plume areal extent from September 1989 as well.

Step 2 is the calculation of the predicted concentration (C_s) in surface water. The simple mass balance equation incorporates the groundwater discharge Qg calculated in Step 1 and accounts for dilution by surface water. The predicted concentration is expressed as:

$$C_s = \frac{Qg}{Q_s} Cg \qquad (6\text{-}2)$$

Where: Qg = amount of groundwater discharged to surface water (ft^3/day)

Q_s = seven day ten year low flow of the river (ft^3/day)

Cg = maximum concentration of the contaminant in groundwater (μg/L)

6.2.2 - Comparison of Applicable or Relevant and Appropriate Requirements

Federal and State potentially Applicable or Relevant and Appropriate Requirements (ARARs) and available "TBC" (To Be Considered criteria) were compared to predicted concentrations in surface water and to detected indicator chemical concentrations in subsurface unsaturated soils. Although not considered in this assessment, groundwater ARARs are presented just the same. The ARAR comparison helps to determine the extent to which Federal, State and other environmental and public health requirements are applicable or relevant and appropriate to the study site. Such criteria, advisories or guidance and standards are to be used in determining allowable exposure levels to human health and for developing appropriate action for the protection of human health and the environment.

"Applicable" requirements are defined as Federal requirements for hazardous substances that would be legally applicable or enforceable by either a Federal or an authorized State program if this response were not undertaken pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), Section 104 or 106. Certain Federal requirements, such as those under the Safe Drinking Water Act (SDWA), are "applicable" although other Federal requirements may not be "applicable".

"Relevant and appropriate" requirements are defined as those Federal requirements designed to apply to problems similar to those encountered at the CERCLA site and their application is appropriate, even though they are not "legally applicable". Just the same, they should be considered for the development of cleanup levels relying on professional judgement and taking into consideration environmental and technical factors at the site.

TBC criteria are also considered when Federal or State chemical-specific standards or guidelines are <u>not</u> available. TBC criteria are based on other cleanup levels, which although they are not ARARs, should be considered in establishing cleanup levels because they are intended to provide a means to protect public health or the environment.

- Cleanup to Levels Set by Risk Assessment Methodology

In performing the baseline risk assessment, individual pollutants were separated into two (2) categories of chemical toxicity, depending on whether they exhibit carcinogenic or non-carcinogenic effects. For potential carcinogens, a "no threshold" mechanism or "zero" (detection limit) was used since there is no level of exposure to a carcinogen which will not result in some finite possibility of causing the disease. Non-carcinogens, however, may have a threshold with a measurable permissible concentration. These risk based concentrations for contaminants, although not ARARs, were used in establishing the protective cleanup levels for required actions.

Table 6-6 lists available Federal and State ARARs for this site and the probable applicability (applicable, relevant and appropriate or TBC). The applicable ARARs and TBC information is discussed below in relation to the RI results.

- Surface Water

Table 6-7 provides the standards and guidance values established under the Federal and State ARARs for ambient surface water. The NYSDEC has classified the Chenango River as Class B, therefore, only those standards apply.

A comparison of the most stringent ARARs can be seen in Table 6-8. The most stringent standards are those established under the New York State Ambient Water Quality regulations for Class B surface water. The predicted surface water exposure concentrations for cadmium, copper and silver, exceeded the New

TABLE 6-6

LIST OF POTENTIAL FEDERAL AND STATE ARARs

Safe Drinking Water Act (SDWA)	
Maximum Contaminant Levels (MCLs)	Applicable
MCL Goals (MCLGs)	Potentially Applicable
Secondary MCLs (SMCLs)	Potentially Applicable
National Interim Primary Drinking Water Regulation (NIPDWR)	Potentially Applicable
New York Surface Water Standards	
6 NYCRR 701	Applicable
New York SPDES Standards/Limitations	
6 NYCRR 750-758	Applicable
New York SPDES Discharge Requirements to Groundwater	
6 NYCRR 703	Applicable
Clean Water Act	
Ambient Water Quality Criteria (WQC)	Potentially Applicable
Publicly-Owned Treatment Works (POTW) Standards	Not Applicable
Effluent Limitations and Guidelines	Applicable
Requirements for Dredge and Fill Activities	Not Applicable
Toxic Substances Control Act (TSCA)	
Polychlorinated biphenals (PCB) Standards	Applicable
Clean Air Act (CAA)	
National Ambient Air Quality Standards (NAAQs)	Potentially Applicable

TABLE 6-6 (CONT'D.)

Resource Conservation and Recovery Act (RCRA)	
Subtitle C (Hazardous Waste Requirements)	Not Applicable
Subtitle D (Solid Waste Requirements)	Not Applicable
Potential TBC Soils ARARs	Applicable
Occupational Safety & Health Act (OSHA)	
Worker Safety Standards 20 CFR 1904, 1910	Applicable (during Remediation)
NYSDEC, Groundwater Standards and Guidance Values Class GA, 6 NYCRR Part 703	Applicable
NYSDOH, Public Drinking Water Standards, Sanitary Code Support S-1	Applicable
Clean Air Act (CAA), Site Implementation Plan (SIP)	Not Applicable

TABLE 6-7

POTENTIAL SURFACE WATER ARARS

	N.Y.S. Ambient Water Quality Standards - Class B (µg/L)	Federal Ambient Water Quality Criteria (WQC) for the Protection of Human Health - Drinking Water (µg/L)	Background - Chenango River Water Quality* (µg/L)	Federal TBC Health Based Soil Criteria	
				Carcinogens (µg/L)	Systematic Toxicants (µg/L)
Target Compound List					
Volatile Organics					
1,1-DCE	NA	0 (33 ng/L)	NA	0	0
1,1-DCA	NA	NA	NA	NA	NA
c/t-1,2-DCE	NA	NA	NA	NA	NA
1,1,1-TCA	NA	NA	NA	NA	NA
TCE	NA	0 (2.8)	NA	NA	
Acetone	NA	NA	NA	NA	4000
Chloromethane	NA	NA	NA	NA	NA
Chloroform	NA	0 (0.19)	NA	NA	400
Methylene Chloride	NA	0 (0.19)	NA	4.7	2000
Target Analyte List					
Antimony	NA	146	NA	NA	10
Beryllium**	11	0 (39 ng/L)	NA	7.14E-03	200
Cadmium**	0.65	10	<1	10	NA
Calcium	NA	NA	41000+	NA	NA
Chromium (Total)**	53	NA	NA	NA	
Copper**	3.5	1 mg/L (organoleptic)	4	NA	NA
Manganese	NA	NA	7600+	NA	NA
Magnesium	NA	NA	20	NA	NA
Mercury	0.2 (guidance)	10	<0.1	NA	NA

TABLE 6-7 (CONT'D.)

POTENTIAL SURFACE WATER ARARS

	N.Y.S. Ambient Water Quality Standards - Class B (µg/L)	Federal Ambient Water Quality Criteria (WQC) for the Protection of Human Health - Drinking Water (µg/L)	Background - Chenango River Water Quality* (µg/L)	Federal TBC Health Based Soil Criteria	
				Carcinogens (µg/L)	Systematic Toxicants (µg/L)
Target Analyte List					
Silver (Ionic)	0.1	50	NA	NA	50
Sodium	NA	NA	13000+	NA	NA
Cyanide (Total)	5.2	200	NA	NA	1E+03
Chromium (+6)	11	50	NA	50	50

NOTES:

* USGS Station 01512850, Chenango River, Binghamton, New York, sample date 10/11/89

** In order to calculate New York State Standards for these metals in surface water, the hardness total (in mg/L as calcium carbonate) was obtained from the USGS from Station 01512850 (Chenango River at Binghamton) for the April to September 1989 time period (19 mg/L).

The hardness value is then substituted into one of the following equations to determine the appropriate standard in µg/L:

For Cd: exp(0.7852[ln(ppm hardness)] - 3.490) = 0.65 µg/L
For Cu: exp(0.8545[ln(ppm hardness)] - 1.465) = 3.5 µg/L
For Cr: exp(0.819[ln(ppm hardness)] + 1.561 = 53 µg/L
For Be: 11 µg/L (hardness ≤75 ppm)

\+ = Dissolved
NA = Guideline or standard not available

TABLE 6-8

COMPARISON OF ARARS TO PREDICTED SURFACE WATER EXPOSURE CONCENTRATIONS

Indicator Chemical	New York State Ambient Water Quality Standards (μg/L)	Predicted Exposure Concentration (μg/L)		Predicted Exposure Concentration: Standard Ratio	
Target Compound List					
Volatile Organic Compounds		Site	Background	Site	Background
Acetone	NA	3.97E-02	NA	--	--
Chloromethane	NA	3.37E-02	NA	--	--
Chloroform	NA	6.02E-03	NA	--	--
1,1-Dichloroethane	NA	1.56E-02	NA	--	--
1,1-Dichloroethene	NA	1.08E-02	NA	--	--
1,2-Dichloroethene	NA	6.26E-02	NA	--	--
Dichloromethane (Methylene Chloride)	NA	4.81E-03	NA	--	--
1,1,1-Trichloroethane	NA	3.49E-02	NA	--	--
Trichloroethene	NA	9.15E-01	NA	--	--

TABLE 6-8 (CONT'D.)

COMPARISON OF ARARS TO PREDICTED SURFACE WATER EXPOSURE CONCENTRATIONS

Indicator Chemical	New York State Ambient Water Quality Standards (μg/L)	Predicted Exposure Concentration (μg/L)		Predicted Exposure Concentration: Standard Ratio	
Target Analyte List		Site	Background	Site	Background
Antimony	NA	1.88E-01	7.67E-02	--	--
Beryllium	11	1.22E-01	3.08E-02	0.011	0.0028
Cadmium	0.65	8.77E+00	2.23E-02	13.5	0.034
Calcium	NA	5.42E+03	9.20E+01	--	--
Chromium - Hexavalent	NA	1.02E+00	NA	--	--
Chromium (Total)	53	2.64E+01	1.01E+00	0.49	0.02
Copper	3.5	2.74E+01	1.34E+00	7.8	0.38
Magnesium	NA	2.20E+03	2.06E+02	--	--
Manganese	NA	8.73E+01	3.83E+01	--	--
Mercury	0.2	3.61E-03	1.20E-03	0.018	0.006
Silver	0.1	1.93E-01	1.20E-02	1.93	0.12
Sodium	NA	2.52E+02	1.48E+01	--	--
Cyanide	5.2	1.02E+00	NA	0.23	--

York State Ambient Water Quality standards or guidelines established for these compounds. However, the predicted exposure concentrations for cadmium and silver of 8.77E+00 µg/L and 1.93E-01 µg/L, respectively, are less than the Federal Ambient Water Quality standards established for drinking water for these respective compounds of 10 µg/L and 50 µg/L. There are no standards or guidelines established for volatile organic compounds in Class B waters.

- Soil

Soil standards at the Federal and State level do not exist. The applicable ARARs which can be used for comparison include background values, Federal human health based TBC values, and typical regional concentration ranges of the indicator chemicals in soil. These ARARs are presented in Table 6-9.

New York State does not have formal "action levels" for soil at this time. However, the New York State Department of Environmental Conservation (NYSDEC) does promote (but does not enforce) the comparison of background soil with the levels detected at the site. Exceedances of five times the background value is a cause for concern. Detailed comparison of RI soil data and ARAR's is presented in Section 4.2.

The typical concentration ranges for metals are based on two United States Geological Survey (USGS) reports. These are: (1) Shacklette, H.T. and Boerngen, J.G., 1984, Elemental Concentrations in Soils and Other Surficial Materials of the Conterminous United States, USGS Professional Paper 1270; and (2) Connor, J.J.

TABLE 6-9

POTENTIAL SOIL ARARS

	Health Based Criteria				
Chemical	Carcinogens[a] (mg/kg)	Systematic Toxicants[b] (mg/kg)	Typical Concentration Ranges[c] (mg/kg)	Background Concentrations[d] Mean	Maximum
Target Analyte List					
Aluminum	NA	NA	7000-10,000	9670	9860
Antimony	NA	3E+01	1.3-10	4.7	6.4
Arsenic	NA	NA	10-16	7.7	8.3
Barium	NA	4E+03	<15-300	46.5	52.7
Beryllium	1.43E-01	4E+02	1-2	0.48	0.50
Cadmium	NA	NA	<1-4.5	2.75	3.2
Calcium	NA	NA	<130-3500	1795	2000
Chromium (Total)	NA	NA	30-50	33.3	34.2
Copper	NA	NA	15-20	35.85	37.7
Lead	NA	NA	30-700	14.05	15.3
Magnesium	NA	NA	2000-5000	3515	3920
Manganese	NA	NA	700-1000	621	705
Mercury	NA	NA	0.082-0.2	ND	ND
Nickel	NA	NA	20-30	35.65	37
Potassium	NA	NA	11,000-16,000	820.5	866
Selenium	NA	NA	0.7-5	ND	ND
Silver	NA	2E+02	<0.5-3	ND	ND
Sodium	NA	NA	7000-10,000	914.5	1080
Zinc	NA	NA	74-120	77.45	80.6
Cyanide	NA	2E+03	NA	66.85	132

TABLE 6-9 (CONT'D.)

POTENTIAL SOIL ARARS

	Health Based Criteria				
Chemical	Carcinogens(a) (mg/kg)	Systematic Toxicants(b) (mg/kg)	Typical Concentration Ranges(c) (mg/kg)	Background Concentrations(d) Mean	Maximum
Volatile Organic Compounds					
1,1,1-TCA	NA	7E+03	NA	ND	ND
1,1,2-TCA	1.2E+02	2E+04	NA	ND	ND
1,1-DCA	NA	NA	NA	ND	ND
1,1-DCE	1.2E+01	7E+02	NA	ND	ND
1,2-DCA	7.7E+00	NA	NA	ND	ND
1,2-DCE	NA	NA	NA	ND	ND
2-Butanone	NA	NA	NA	ND	ND
Acetone	NA	8.3E+03	NA	ND	ND
Carbon Disulfide	NA	8E+03	NA	ND	ND
Chloroethane	NA	NA	NA	ND	ND
Ethyl Benzene	NA	8E+03	NA	ND	ND
Methylene Chloride	9.3E+01	5E+03	NA	ND	ND
PCE	NA	NA	NA	ND	ND
TCE	6.4E+01	NA	NA	3	3
Toluene	NA	2E+04	NA	ND	ND
Vinyl Chloride	NA	NA	NA	ND	ND
Xylenes	NA	2E+05	NA	ND	ND

TABLE 6-9 (CONT'D.)

POTENTIAL SOIL ARARS

Chemical	Health Based Criteria Carcinogens[a] (mg/kg)	Systematic Toxicants[b] (mg/kg)	Typical Concentration Ranges[c] (mg/kg)	Background Concentrations[d] Mean	Maximum
Pesticides/PCBs					
4,4'-DDT	2.1E+00	4E+01	NA	ND	ND
Arochlor 1254 (PCB)	9.1E-02	NA	NA	ND	ND
Arochlor 1260 (PCB)	9.1E-02	NA	NA	ND	ND

(a) Health-Based Criteria for Carcinogens, Oral Exposure Route RSQ, Table 8-6 of Development of an RFI Work Plan and General Considerations for RCRA Facility Investigations. EPA 530/SW-87-001, July 1987.

(b) Health-Based Criteria for Systematic Toxicants, Table 8-7 of Development of an RFI Work Plan and General Considerations for RCRA Facility Investigations. EPA 530/SW87-001, July 1987.

(c) Shacklette and Boerngen (1984) and Connor and Shacklette (1975).

(d) Link Background Values for Subsurface Soil Samples.

NA - Not available
ND - Not detected

and Shacklette, H.T., 1975, <u>Background Geochemistry of Some Rocks, Soils, Plants and Vegetables in the Conterminous United States</u>, USGS Professional Paper 574-F. Reference (1) discusses samples collected at sites in the Binghamton area and is applicable to all priority pollutant metals except thallium, cadmium and silver. Reference (2) discusses samples collected from glaciated soil in Missouri and applies to cadmium and silver.

- Groundwater

Table 6-10 provides the concentration values of Federal and State ARARs for groundwater and drinking water.

6.2.3 - Toxicity Assessment

For risk assessment purposes, individual pollutants are separated into two categories of chemical toxicity, depending on whether they exhibit non-carcinogenic or carcinogenic effects. This distinction relates to the currently held scientific opinion that the mechanism of action for each category is different. USEPA has adopted, for the purpose of assessing risks associated with potential carcinogens, the scientific position that a small number of molecular events can cause changes in a single cell or a small number of cells that can lead to tumor formation. This is described as a "no threshold" mechanism, since there is essentially no level of exposure (i.e., a threshold) to a carcinogen which will not result in some finite possibility of causing the disease. In the case of chemicals exhibiting non-carcinogenic effects, however, it is believed that organisms

TABLE 6-10

POTENTIAL GROUNDWATER ARARS

Indicator Chemical	NYSDEC (a) Groundwater Standards (Class GA) (µg/L)	NYSDOH (b) Public Drinking Water Standards (µg/L)	NIPDWR (c) (µg/L)	SDWA MCLG (d) (µg/L)	SDWA MCL (e) (µg/L)	SDWA SMCL (f) (µg/L)	RCRA MCLS (g) (µg/L)
Target Compound List -							
Volatile Organic Compounds							
Acetone	NA	50	NA	NA	NA	NA	NA
Chloromethane	NA	5	NA	NA	NA	NA	NA
Chloroform	100	50	100	NA	NA	NA	NA
1,1-Dichloroethane	50 (f)	5	NA	NA	NA	NA	NA
1,2-Dichloroethene	0.07 (f)	5	NA	7	7	NA	NA
Dichloromethane (Methylene Chloride)	50 (f)	5	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	50 (f)	5	NA	200	200	NA	NA
Trichloroethene	10	5	NA	0	5	NA	NA

TABLE 6-10 (CONT'D.)

POTENTIAL GROUNDWATER ARARS

Indicator Chemical	NYSDEC (a) Groundwater Standards (Class GA) (μg/L)	NYSDOH (b) Public Drinking Water Standards (μg/L)	NIPDWR (c) (μg/L)	SDWA MCLG (d) (μg/L)	SDWA MCL (e) (μg/L)	SDWA SMCL (f) (μg/L)	RCRA MCLS (g) (μg/L)
<u>Target Analyte List</u>							
Aluminum	NA	NA	NA	NA	NA	50	NA
Antimony	3 (f)	NA	NA	NA	NA	NA	NA
Arsenic	25	50	50	0	30	NA	50
Barium	1000	1000	1000	5000	5000	NA	1000
Beryllium	3 (e)	NA	NA	NA	NA	NA	NA
Cadmium	10	10	10	5	5	NA	10
Calcium	NA	NA	NA	NA	NA	NA	NA
Chromium - Hexavalent	50	NA	NA	NA	NA	NA	NA
Chromium (Total)	50	50	50	100	100	NA	50
Cobalt	NA	NA	NA	NA	NA	NA	NA
Copper	1000	1000	NA	NA	NA	100	NA
Iron	300	300	NA	NA	NA	NA	NA
Lead	25	50	NA	NA	60	NA	NA
Magnesium	35000 (e)	NA	NA	NA	NA	NA	NA
Manganese	300	300 (i)	NA	NA	NA	50	NA
Mercury	2	2	2	2	2	NA	2
Nickel	NA	NA	NA	NA	NA	NA	NA

TABLE 6-10 (CONT'D.)

POTENTIAL GROUNDWATER ARARS

Indicator Chemical	NYSDEC [a] Groundwater Standards (Class GA) (µg/L)	NYSDOH [b] Public Drinking Water Standards (µg/L)	NIPDWR [c] (µg/L)	SDWA MCLG [d] (µg/L)	SDWA MCL [e] (µg/L)	SDWA SMCL [f] (µg/L)	RCRA MCLS [g] (µg/L)
Target Analyte List (cont)							
Potassium	NA	NA	NA	NA	NA	NA	NA
Silver	50	50	50	NA	NA	50	50
Sodium	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA
Zinc	5000	5000	NA	NA	NA	5000	NA

[a] N.Y.S. Department of Environmental Conservation, Groundwater Quality Regulation 6 NYCRR Part 703

[b] N.Y.S. Official Compilation of Codes, Vol. 10 Subpart 5-1. Revision of NYSDOH Subpart 5-1 State Sanitary Code effective 1/9/89. 5 ppb for principal organic compounds (POCs) and 50 ppb for unspecified organic compounds (UOCs)

[c] National Interim Primary Drinking Water Regulation (NIPDWR). Interim enforceable drinking water regulations first established under the Safe Drinking Water Act (SDWA) that are protective of public health to the extent feasible.

[d] SDWA MCL Goals (MCLGs) are non-enforceable health goals for public water systems (40 CFR 141.52 and 50 FR 46936).

[e] SDWA Maximum Contaminant Level (MCLs) are adopted as enforceable standards for public drinking water systems (40 CFR 141.11-141 1.6).

[f] Guidance value

[g] SDWA Secondary MCLs based on taste and odor detection limits

[h] RCRA MCLs have been adopted as part of RCRA groundwater protection standards (40 CFR 264.94).

[i] If iron and manganese are present, the total concentration of both should not exceed 0.3 mg/L.

NA Standard or guideline not available

have protective mechanisms that must be overcome before the toxic endpoint is manifested. For example, if a large number of cells perform the same or similar functions, it would be necessary for significant damage or depletion of these cells to occur before an effect could be seen. This threshold view holds that a range of exposures from just above zero to some finite value can be tolerated by the organism without appreciable risk of causing the disease (USEPA, 1986c).

6.2.3.1 - Health Effects Criteria for Non-Carcinogens

Health criteria for chemicals exhibiting non-carcinogenic effects are generally developed using risk reference doses (RfDs) developed by the USEPA RfD Work Group as listed in USEPA's Integrated Risk Information System (IRIS) database, or RfDs obtained from Health Effect Assessments (HEAs). The RfD, expressed in units of mg/kg/day, is an estimate of the daily exposure to the human population (including sensitive subpopulations) that is likely to be without an appreciable risk of deleterious effects during a lifetime. These RfDs are usually derived either from human studies involving workplace exposures or from animal studies and are adjusted using uncertainty factors. The RfD provides a benchmark to which chemical intakes by other routes (e.g., via exposure to contaminated environmental media) may be compared.

6.2.3.2 - Health Effects Criteria for Potential Carcinogens

Cancer potency factors (CPFs), developed by USEPA's Carcinogen Assessment Group (CAG) for potentially carcinogenic chemicals and expressed in units of $(mg/kg/day)^{-1}$, are derived from the results of human epidemiological studies or chronic animal bioassays. The animal studies must usually be conducted using relatively high doses in order to detect possible adverse effects. Since humans are expected to be exposed at lower doses than those used in the animal studies, the data are adjusted by using mathematical models. The data from animal studies are typically fitted to the linearized multistage model to obtain a dose-response curve. The 95th percentile upper confidence limit slope of the dose-response curve is subjected to various adjustments and an interspecies scaling factor is applied to derive the CPF for humans. Thus, the actual risks associated with exposure to a potential carcinogen quantitatively evaluated based on animal data are not likely to exceed the risks estimated using these CPFs, but they may be much lower. Dose-response data derived from human epidemiological studies are fitted to dose-time-response curves on an ad hoc basis. These models provide rough, but plausible estimates of the upper limits on lifetime risk. CPFs based on human epidemiological data are also derived using very conservative assumptions and, as such, they too are unlikely to underestimate risks. Therefore, while the actual risks associated with exposures to potential carcinogens are unlikely to be higher than the risks calculated using a CPF, they could be considerably lower.

USEPA assigns weight-of-evidence classifications to potential carcinogens. Under this system, chemicals are classified as either Group A, Group B1, Group B2, Group C, Group D, or Group E. Group A chemicals (human carcinogens) are agents for which there is sufficient evidence to support the casual association between exposure to the agents in human and cancer. Groups B1 and B2 chemicals (probable human carcinogens) are agents for which there is limited (B1) or inadequate (B2) evidence of carcinogenicity from animal studies. Group C chemicals (possible human carcinogens) are agents for which there is limited evidence of carcinogenicity in animals, and Group D chemicals (not classified as to human carcinogenicity) are agents with inadequate human and animal evidence of carcinogenicity or for which no data are available. Group E chemicals (evidence of non-carcinogenicity in humans) are agents for which there is no evidence of carcinogenicity in adequate human or animal studies.

Table 6-11 summarizes the toxicity criteria used in this assessment along with their associated safety factors (for non-carcinogens) and weight-of-evidence classifications (for carcinogens). The table also lists the source of the criteria while listing the criteria for oral exposure only, since no exposures via inhalation are considered in this assessment. The table lists subchronic as well as chronic criteria for non-carcinogens. USEPA has not established subchronic RfDs; however, many of the HEA documents list subchronic criteria. These criteria apply to short-term exposures of 90 days or less.

A summary of the toxic effects of each of the chemicals and the basis for the derivation of the CPF and RfD is given in Appendix D, Indicator Chemical Profiles.

TABLE 6-11

HEALTH EFFECTS CRITERIA FOR INDICATOR CHEMICALS

	Non-Carcinogens				Potential Carcinogens	
	Chronic		Sub-Chronic		Carcinogenic Effects	
	Reference Dose (RFD) (mg/kg/d)	Source[a]	Reference Dose (RFD) (mg/kg/d)	Source[a]	EPA/CAG Cancer Potency Factor $(mg/kg/d)^{-1}$	Weight of Evidence[b]
Aluminum	NA	NA	NA	NA	NA	NA
Antimony	4.00E-04	RFD	NA	NA	NA	NA
Arsenic	1.00E-03	HEA	1.00E-03	HEA	1.75	A
Barium	5.10E-02	HEA	NA	NA	NA	NA
Beryllium	5.00E-04	RFD	NA	NA	NA	B1
Cadmium (Soil)	1.00E-03	IRIS	NA	NA	NA	NA
(Water)	5.00E-04	IRIS	NA	NA	NA	NA
Calcium	NA	NA	NA	NA	NA	NA
Chromium	5.00E-03	IRIS	2.00E-02	HEA	NA	NA
Cobalt	NA	NA	NA	NA	NA	NA
Copper	3.70E-02	HEA	3.70E-02	HEA	NA	NA
Iron	NA	NA	NA	NA	NA	NA
Lead	1.40E-03	HEA	NA	NA	NA	NA
Magnesium	NA	NA	NA	NA	NA	NA
Manganese	2.00E-01	HEA	5.00E-01	HEA	NA	NA
Mercury	2.00E-03	HEA	3.00E-04	HEA	NA	NA
Nickel	2.00E-02	IRIS	2.00E-02	HEA	NA	A
Potassium	NA	NA	NA	NA	NA	NA
Selenium	3.00E-03	HEA	4.00E-03	HEA	NA	NA
Silver	3.00E-03	IRIS	NA	NA	NA	NA
Sodium	NA	NA	NA	NA	NA	NA
Thallium	7.00E-05	HEA	7.00E-04	HEA	NA	NA
Vanadium	2.00E-02	RFD	NA	NA	NA	NA
Zinc	2.00E-01	HEA	NA	NA	NA	NA
Cyanide	2.00E-02	RFD	NA	NA	NA	NA

TABLE 6-11 (CONT'D.)

HEALTH EFFECTS CRITERIA FOR INDICATOR CHEMICALS

	Non-Carcinogens				Potential Carcinogens	
	Chronic		Sub-Chronic		Carcinogenic Effects	
	Reference Dose (RFD) (mg/kg/d)	Source [a]	Reference Dose (RFD) (mg/kg/d)	Source [a]	EPA/CAG Cancer Potency Factor $(mg/kg/d)^{-1}$	Weight of Evidence[b]
Chloroethane	NA	NA	NA	NA	NA	NA
Carbon Disulfide	1.00E-01	RFD	NA	NA	NA	NA
2-Butanone	NA	NA	NA	NA	NA	NA
Ethyl Benzene	1.00E-01	RFD	9.70E-01	RFD	NA	NA
1,1-DCE	9.30E-03	IRIS	9.30E-03	HEA	6.1E-01	C
1,1-DCA	1.00E-01	HEA	1.00E+00	HEA	9.1E-02	C
1,2-DCE	2.00E-02	IRIS	NA	NA	NA	NA
1,2-DCA	NA	NA	NA	NA	9.1E-02	B2
Toluene	3.00E-01	IRIS	4.00E-01	HEA	NA	NA
PCE	1.00E-02	IRIS	1.00E-01	HEA	5.1E-02*	B2
TCE	7.35E-03	HEA	--	NA	1.1E-02	B2
1,1,2-TCA	NA	NA	NA	NA	5.73E-02	C
1,1,1-TCA	5.40E-01	HEA	NA	NA	NA	
Vinyl Chloride	NA	NA	NA	NA	2.30E+00	A
Total Xylenes	1.00E-02	HEA	1.00E-01	HEA	NA	
Methylene Chloride	6.00E-02	IRIS	6.00E-02	HEA	7.5E-03	B2
Acetone	1.00E-01	RFD	NA	NA	NA	NA
<u>Pesticides/PCBs</u>						
4,4'-DDT	5.00E-04	RFD	NA	NA	3.40E-01	B2
Arochlor 1254	NA	NA	NA	NA	4.34E+00	B2
Arochlor 1260	NA	NA	NA	NA	4.34E+00	B2

TABLE 6-11 (CONT'D.)

HEALTH EFFECTS CRITERIA FOR INDICATOR CHEMICALS

FOOTNOTES

(a) Sources of Reference Doses:

IRIS = chemical files of the Integrated Risk Information System
HEA = Health Effects Assessment
HA = Health Advisory
RFD = Agency-wide reference dose value

(b) Weight of Evidence Classification Scheme for Carcinogens:

A -- human carcinogen; sufficient evidence from human epidemiological studies
B1 -- probable human carcinogen; limited evidence from human epidemiological studies and adequate evidence from animal studies.
B2 -- probable human carcinogen; inadequate evidence from human epidemiological studies and adequate evidence from animal studies.
C -- possible human carcinogen; limited evidence in animals in the absence of human studies.

* Review pending

\- No criteria have been established by EPA for these endpoints of exposure.

NA Not available

6.2.4 - Risk Characterization - Potential Exposure to Surface Water

To quantitatively assess the potential risks to human health associated with the exposure scenarios considered in this assessment, the exposure point concentrations developed in the previous sections are converted to chronic daily intakes (CDIs). CDIs are expressed as the amount of a substance taken into the body per unit body weight per unit time or mg/kg/day. A CDI is averaged over a lifetime for carcinogens (USEPA, 1986b) and over the exposure period for non-carcinogens (USEPA, 1986c).

For potential carcinogens, excess lifetime cancer risks are obtained by multiplying the daily intake of the contaminant under consideration by its cancer potency factor. USEPA has implemented actions under Superfund associated with total cancer risks ranging from 10^{-4} to 10^{-7} (i.e., the probability of one excess cancer is one in 10,000 to 10,000,000, respectively, under the conditions of exposure). A risk level of 10^{-6}, representing a probability of one in 1,000,000 that an individual could contract cancer due to exposure to the potential carcinogen, is often used as a benchmark by regulatory agencies.

Potential risks for non-carcinogens are presented as the ratio of the chronic daily intake exposure to the reference dose (CDI:RfD). The sum of the ratios of chemicals under consideration is called the hazard index. The hazard index is useful as a reference point for gauging the potential effects of environmental exposures to complex mixtures. In general, hazard indices which are less than one are not likely to be associated with any health risk and are therefore less likely to be of concern than hazard indices greater than one. A conclusion should not be categorically drawn, however, that all hazard indices less than one are "acceptable" or that hazard indices of greater than one are "unacceptable". This is a consequence of the perhaps order of magnitude or greater uncertainty inherent in estimates of the RfD and CDI in addition to the fact that the uncertainties associated with the individual terms in the hazard index calculation are additive.

In accordance with USEPA's guidelines for evaluating the potential toxicity of complex mixtures (USEPA, 1986c), it was assumed that the toxic effects of the site-related chemicals would be additive. Thus, lifetime excess cancer risks and the CDI:RfD ratios were summed to indicate the potential risks associated with mixtures of potential carcinogens and non-carcinogens, respectively. In the absence of specific information on the toxicity of the mixture to be assessed or on similar mixture, USEPA guidelines generally recommend assuming that the effects of different components of the mixture are additive when affecting a particular organ or system. Synergistic or antagonistic interactions may be taken into account if there is specific information on particular combinations of chemicals. In this risk assessment, it was assumed that the potential effects of site-related chemicals would be additive.

Exposure to surface water may occur through ingestion of water from the Chenango River by people who wade or swim downstream of point of discharge of potentially contaminated groundwater. The chronic daily intake (CDI) estimate of surface water ingestion is based on the following expression:

$$\text{CDI} = (\text{Cp}) * (\text{I}) \tag{6-5}$$

Where, CDI = chronic daily intake (mg/kg/d)

Cp = predicted concentration in surface water (mg/L)

I = surface water ingestion rate (L/kg/day)

The predicted concentrations in surface water were estimated using the maximum concentrations of indicator chemicals in groundwater (refer to Section 6.2.1.2 - Estimation of Exposure Concentrations in Surface Water). The surface water ingestion rate (or human intake factor) is equal to 0.029 L/kg/day. This is based on the standard drinking water intake per day (roughly 2 L/day) divided by the standard adult body weight (70 kg). This ingestion rate is highly unlikely due to normal surface water activities (i.e., swimming) and uses at this site.

Table 6-12 lists the predicted concentrations for each indicator chemical, Chronic Daily Intake (CDI) values and cumulative risks associated with potential exposure to people who come in contact with Chenango River water. The indicator chemicals are grouped into two categories: the potential carcinogens (PCs) and the non-carcinogens (NCs).

Table 6-12 presents the potential exposures and risks based on site conditions using predicted concentrations of indicator chemicals in surface water. Table 6-12 also presents the potential exposure and risks based on background conditions. The estimated risks due to non-carcinogens (hazard index) and carcinogens (cancer risk) are summarized below from Table 6-12 for predicted surface water concentration of indicator chemicals:

	Estimated Cumulative Non-Carcinogen Hazard Index	Estimated Cumulative Cancer Risk
Site	4.53E-01	5.39E-07
Background	1.95E-02	0.00E+00
Reference Value	1.0 E+00	1.0 E-06

A comparison is made between the estimated cumulative non-carcinogen and carcinogen risk values and the reference value established for each category. **The risk due to estimated cumulative non-carcinogens does not exceed the reference value (1.0E+00) for the hazard index for either the site or background conditions. The estimated cumulative risk due to carcinogens also does not exceed the reference value of 1.0E-06 for either the site or background conditions. This level of risk characterization indicates that there are no increased risks due to either estimated cumulative non-carcinogens or carcinogens.**

6.2.5 - Summary

The baseline risk assessment provides a review and estimate of the potential risks to humans due to one primary exposure pathway in the vicinity of the Hillcrest facility. The other conditional exposure pathway, exposure due to excavated subsurface soil is also discussed.

TABLE 6-12

RISK CHARACTERIZATION FOR INGESTION OF SURFACE WATER

A. SITE

Non-Carcinogenic	Predicted Surface Water Concentration (mg/L)	CDI Ingestion (mg/kg/d)	Chronic Reference Dose (mg/kg/d)	CDI:RfD Ratio
Acetone	3.97E-05	1.15E-06	1.00E-01	1.15E-05
Chloromethane	3.37E-05	9.77E-07	1.00E-02	9.77E-05
Chloroform	6.02E-06	1.75E-07	1.00E-02	1.75E-05
1,1-DCA	1.56E-05	4.52E-07	1.00E-01	4.52E-06
1,1-DCE	1.08E-05	3.13E-07	9.30E-03	3.37E-05
c/t-1,2-DCE	6.26E-05	1.82E-06	2.00E-02	9.08E-05
Methylene Chloride	4.81E-06	1.39E-07	6.00E-02	2.32E-06
1,1,1-TCA	3.49E-05	1.01E-06	5.40E-01	1.87E-06
TCE	9.15E-04	2.65E-05	7.35E-03	3.61E-03
Antimony	1.88E-04	5.45E-06	4.00E-04	1.36E-02
Beryllium	1.22E-04	3.54E-06	5.00E-04	7.08E-03
Cadmium	8.77E-03	2.54E-04	1.00E-03	2.54E-01
Calcium	5.42E+00	1.57E-01	NA	NA
Chromium	2.64E-02	7.66E-04	5.00E-03	1.53E-01
Copper	2.74E-02	7.95E-04	NA	NA
Magnesium	2.20E+00	6.38E-02	NA	NA
Manganese	8.73E-02	2.53E-03	2.00E-01	1.27E-02
Mercury	3.61E-06	1.05E-07	2.00E-03	5.23E-05
Silver	1.93E-04	5.60E-06	3.00E-03	1.87E-03
Sodium	2.52E-01	7.31E-03	NA	NA
Cyanide	4.75E-04	1.38E-05	3.70E-02	3.72E-04
Chromium - Hexavalent	1.02E-03	2.96E-05	5.00E-03	5.92E-03
			Hazard Index:	4.53E-01

Carcinogenic	Predicted Surface Water Concentration (mg/L)	CDI Ingestion Average (mg/kg/d)	Potency Factor $(mg/kg/d)^{-1}$	Excess Lifetime Cancer Risk Average
1,1-DCE	1.08E-05	3.13E-07	6.10E-01	1.91E-07
1,1-DCA	1.56E-05	4.52E-07	9.10E-02	4.12E-08
TCE	9.15E-04	2.65E-05	1.10E-02	2.92E-07
Methylene Chloride	4.81E-06	1.39E-07	7.50E-03	1.05E-09
Chloroform	6.02E-06	1.75E-07	8.10E-02	1.41E-08
			Total Risk:	5.39E-07

TABLE 6-12 (CONT'D.)

RISK CHARACTERIZATION FOR INGESTION OF SURFACE WATER

B. BACKGROUND

Non-Carcinogenic	Predicted Surface Water Concentration (mg/L)	CDI Ingestion (mg/kg/d)	Chronic Reference Dose (mg/kg/d)	CDI:RfD Ratio
Antimony	7.67E-05	2.22E-06	4.00E-04	5.56E-03
Beryllium	3.08E-05	8.93E-07	5.00E-04	1.79E-03
Cadmium	2.23E-05	6.47E-07	1.00E-03	6.47E-04
Calcium	9.20E-02	2.67E-03	NA	NA
Chromium	1.01E-03	2.93E-05	5.00E-03	5.86E-03
Copper	1.34E-03	3.89E-05	NA	NA
Magnesium	2.06E-01	5.97E-03	NA	NA
Manganese	3.83E-02	1.11E-03	2.00E-01	5.55E-03
Mercury	1.20E-06	3.48E-08	2.00E-03	1.74E-05
Silver	1.20E-05	3.48E-07	3.00E-03	1.16E-04
Sodium	1.48E-02	4.29E-04	NA	NA
			Hazard Index:	1.95E-02

Carcinogenic	Predicted Surface Water Concentration (mg/L)	CDI Ingestion Average (mg/kg/d)	Potency Factor $(mg/kg/d)^{-1}$	Excess Lifetime Cancer Risk Average
None				
			Total Risk:	0.00E+00

- Exposure Pathway - Ingestion of Chenango River Surface Water

The primary completed exposure pathway is the ingestion of Chenango River surface water which is the ultimate groundwater discharge area. Based upon the potential exposure concentrations in surface water and risks predicted by the assessment, the risks due to non-carcinogens and carcinogens do not exceed the reference values or hazard index established for these compounds. **Therefore, using the above criteria, no increased risk is evident due to impacted groundwater discharging into the Chenango River. Remediation of surface water is not warranted based on the assumptions and scenarios used.**

- Conditional Exposure Pathway - Ingestion and Dermal Exposure of Excavated Subsurface Soil

This will only be a completed exposure pathway, if there is excavation of subsurface soils. These soils may pose a potential health risk to employees, inhabitants and site workers during excavation and when the soils are stockpiled on-site before treatment and/or disposal. Appropriate safety precautions during remediation would be necessary with very stringent health and safety protection for workers.

6.3 - ENVIRONMENTAL ASSESSMENT

The objectives of the environmental assessment is to evaluate the flora and fauna in the vicinity of site and characterize ecological habitat types and related fish and wildlife.

The ecological assessment was done at the habitat level which describes five major habitat types as follows:

1. Link site.
2. Surrounding woodland/forested areas.
3. Freshwater wetlands.
4. Open water.
5. Flood plains.

The project area was inspected utilizing aerial photography. Observed vegetation was horizontally stratified into different vegetative units. Each unit was characterized utilizing existing local literature and cross referenced with telephone calls to State and local agencies. Wildlife traditionally associated with each particular habitat is described and was verified utilizing existing local literature and by telephone conversations with State and local agencies. The listed species were then compared to the New York State species lists of "Endangered, Threatened and Special Concern Species" dated December 9, 1985.

The New York State Environmental Conservation Law (ECL), §11-0535 (Endangered and Threatened Species), provides legal protection for listed endangered and threatened animals. The taking, importation, possession or sale of any endangered or threatened species of fish, shellfish, crustacea, wildlife or hides thereof, or the sale and possession with intent to sell any article made in whole or in part from the skin, hide or other parts of any endangered or threatened species of fish, shellfish, crustacea or wildlife is prohibited, except under license or permit from NYSDEC.

In addition to endangered and threatened listings, New York State has a listing entitled, "Species of Special Concern". This category includes those native species which are not yet recognized as endangered or threatened, but for which documented concern exists for their continued welfare in New York State. It is possible that these species could become threatened or endangered in the future. Thus, these species are more closely monitored than non-classified animals. Unlike endangered and threatened categories, species of special concern receive no legal protection under ECL §11-0535 (Endangered and Threatened Species). The special concern category is presented primarily to enhance public awareness of this group of species which bear additional attention.

Faunal species which are listed by the NYSDEC as being endangered, threatened or of special concern are indicated by (E), (T) or (SC), respectively, after their name.

1. <u>Project Site</u> - The ecology of the project site is somewhat limited. Natural vegetation is mainly absent or shows signs of extreme suburban impact. Ornamental landscape interdispersed among blacktop and concrete creates a habitat promoting typical "weedy" floral species and typical "backyard" faunal species. No plant or animal species identified would typically be involved in human consumption.

2. <u>Surrounding Forested Areas</u> - Surrounding forested areas are generally classified as broadleaf deciduous woodland. Woodlands are generally undisturbed, with the exception of

firebreaks, utility right-of-ways and some paved roadways. Typical species noted in the vicinity of the project site include:

Common Name	Scientific Name
Red Oak	Quercus sp.
White Oak	Quercus alba
Red Maple	Acer rubrum
Sugar Maple	Acer saccharum
White Ash	Fraxinus americana
American Beech	Fagus grandifolia
White Birch	Betula sp.
Yellow Birch	Betula alleghaniensis
Black Cherry	Prunus serotina

Some coniferous species can be noted intermixed into the broadleaf deciduous woodland, most notably:

Common Name	Scientific Name
Eastern Hemlock	Tsuga canadensis
Cedar	Juniperus sp.
Pine	Pinus sp.

Animal species typically associated with woodland habitats in this area include:

Common Name	Scientific Name
White-tail Deer	Odocoileus virginianus
Red Fox	Vulpes vulpes
Grey Fox	Vrocyon cinereoargenteus
Cottontail Rabbit	Sylvilegus floridans
Porcupine	Erethizon dorsatum
Skunk	Methitis mephitis
Eastern Black Bear	Ursus americanus
Wood Chuck	Marmota monax
Red Squirrel	Tamiasciurus hudsonicus
Gray Squirrel	Scuirus carolinensis
Eastern Chipmunk	Tamias striatus
Muskrat	Ondatra zibethicus

Common Name	Scientific Name
Racoon	_Procyon lotor_
Fisher	_Martes pennanta_
Pine Marten	_Martes american_
Mink	_Mustela vison_
Eastern Mole	_Scalopus aquaticus_
White-footed Mouse	_Peramyscus leucopus_
House Mouse	_Mus musculus_
Norway Rat	_Rattus norvegicus_
Domestic Dog	_Kanis familiaris_
Domestic Cat	_Felis catus_

Bird species typically associated with this woodland include:

Common Name	Scientific Name
House Sparrow	_Passer domesticus_
European Starling	_Sturnus vulgaris_
Blue Jay	_Cyanocitta cristata_
Blackcrested Titmouse	_Parus bicolor_
Common Crow	_Corvus brachyrhynchos_
Pileated Woodpecker	_Dryocopus pileatus_
Hairy Woodpecker	_Picoides villosus_
Downey Woodpecker	_Dendrocopos pubescens_
Redheaded Woodpecker	_Melanerpes erythrocephalus_
Yellowbellied Sapsucker	_Sphyrapicus varius_
Redtailed Hawk	_Buteo jamaicaensis_
Redshouldered Hawk (T)	_Buteo lineatus_
Robin	_Turdus migratorius_
Wood Thrush	_Hylocichla mustelina_
Catbird	_Dumetella carolinensis_
House Wren	_Troglodytes aedon_
Yellowthroat	_Geothlypis trichas_
American Red Start	_Setophaga ruticilla_
Barn Swallow	_Hirundo rustica_
Bank Swallow	_Riparia riparia_
Song Sparrow	_Melospiza melodia_
Redwinged Blackbird	_Agelaius phoeniceus_
Eastern Meadowlark	_Sturnella magna_
Orchard Oriole	_Icterus spurius_

Common Name	Scientific Name
Baltimore Oriole	Icterus galbula
Eastern Kingbird	Tyrannus tyrannus
Peewee	Contopus sp.
Chimney Swift	Chaetura pelagica
Belted Kingfisher	Megaceryle alcyon
Cuckoo	Coccyzus americanus
Ruffed Grouse	Bonasa umbellus
Hungarian Partridge	Perdix perdix
Ringed-neck Pheasant	Phasianus colchicus
Killdeer	Charadrius vociferus
Virginia Rail	Rallus limicola

Reptiles commonly associated with these woodlands are:

Common Name	Scientific Name
Garter Snake	Thamnophis sirtalis
Copperhead	Agkistrodon contortrix
Black Racer	Coluber constrictor
Milk Snake	Lampropeltis triangulum
Eastern Box Turtle	Terrpene carolina

Some animal species particularly rabbit, deer, grouse and pheasant are directly related to human consumption.

Typical forest/woodland ecology can be found in any ecological text. Generally, the food chain begins with the primary producers (specifically vegetation in the form of grass and trees) which are able to convert energy from the sun into biomass or plant mass. Primary consumers known as "herbivores", i.e., deer, rabbit, etc., consume vegetation and convert plant biomass to animal tissue. "Carnivores", i.e., hawks, man, etc., in turn, consume herbivores and convert this animal tissue into their own. When any animal or plant dies, the sun's stored energy in the form of biomass is returned to the environment via decomposition. Some species of plants convert the sun's energy to biomass at the tail end of this process. The decomposers or "saprophytes" (for example, mushrooms) are not able to convert sunlight energy to biomass and hence, draw energy from decomposing plant and animal matter.

The above process would be typical for the woodlands in the area of the project site.

3. Freshwater Wetlands - Freshwater wetlands in the immediate area of the project site include Phelps Creek directly to the south of the project site. Phelps Creek has its headwaters in the forested areas to the east and drains roughly southwest past the project site to the Chenango River.

Wetland vegetation which typically characterizes these habitats include:

Common Name	Scientific Name
Sedge	*Caret* sp.
Small Cranberry	*Vaccinium oxycoccus*
Iris	*Iris versicolot*
Sweet Gale	*Myrica gale*
Sour Gum	*Nyssa sylvatica*
Shadbush	*Amelanchier* sp.
Hawthorn	*Crataegus* sp.
Higbush Blueberry	*Vaccinium corymbosum*
Swamp Azalea	*Rhododendron viscocum*
Sweet Pepperbush	*Clethra alnifolia*
Skunk Cabbage	*Simplocarpus foetidus*

Phelps Creek is classified as Class D surface waters. Class D waters are generally best suited for secondary contact recreation, such as fishing, even though other facts may limit the use for that purpose. Due to such natural conditions as intermittence of flow, water conditions not conducive to propagation of game fishery or stream bed conditions, the waters will not support fish propagation (6 NYCRR 701.19).

Animal species typically important to small freshwater wetlands are listed as the following amphibian and reptile species. Some fish species as found in the Chenango River may also be present. However, for the sake of brevity, they are only listed under the section for open water. In addition, some mammal, bird and reptile species may also frequent freshwater wetlands due to their mobility. They too are only listed once for brevity.

Amphibian species typically associated with freshwater wetlands include:

Common Name	Scientific Name
Frogs	Rona sp.
Toads	Bufo sp.
Newts	Salamandridae
Salamanders	Ambystomidae
Turtles	Testudines

Typically these species are not associated with commercial harvesting for human consumption, however, they are known to be edible and are considered to be a delicacy.

- Open Water

Open water habitats in the area of the project site consist primarily of the Chenango River. The Chenango River is a wide shallow water-body with a current flow generally to the south toward the Susquehanna River. This segment of the Chenango River, by the project site, is classified by the NYSDEC as Class B waters. Class B waters are primarily used for primary contact recreation and any other uses except as a source of water supply for drinking, culinary or food processing purposes (6 NYCRR 701.19).

Fish species generally associated with the Chenango River in the vicinity of the study site include:

Common Name	Scientific Name
Yellow Perch	Perca flavescens
Darters	Etheostoma sp.
Common Suckers	Catostomus
Bullhead	Ictalurus
Rock Bass	Ambloplites rupestris
Shiner	Notropis sp.
Bluntnose Minnow	Pimephales notatus
Chain Pickerel	Esox niger

- Flood Plains

Flood plains have been added in the habitat descriptions mainly as an opportunity to list migratory waterfowl commonly occurring in the vicinity of the project site. Waterfowl are known to consume anything from aquatic vegetation, fish, snails, frogs, etc., and are important elements in the ecology of the various habitats described in the study area.

Vegetation types are generally a mixture of wetland and woodland species previously described. Species of birds can be observed utilizing the waters and marshes around the project site for feeding, nesting, wading or roosting. The listing includes indigenous and migratory waterfowl, shore and wading birds, and upland song birds.

Waterfowl which may be expected to occur in the project area include:

Common Name	Scientific Name
Common Loon (SC)	Galvia immer
Horned Grebe	Podiceps auritus
Pied-billed Grebe	Podilymbus podiceps
Great Blue Heron	Ardea herodias

Common Name	Scientific Name
American Egret	Casmerodius albus
Snowy Egret	Egretta thula
Green Heron	Butorides striatus
Little Blue Heron	Florida caerula
Glossy Ibis	Pelagades falcinellus
Mute Swan	Cygnus olor
Canada Goose	Branta canadensis
Mallard Duck	Anas platyrynchos
Black Duck	Anas rubripes
Pintail Duck	Anas acuta
Wood Duck	Aix sponsa
Bufflehead	Bucephala albeola
Canvasback Duck	Aythya valisineria
Common Goldeneye	Bucephala clangula
Shoveler Duck	Anas clypeata
Greater Scaup Duck	Althya marila
Ruddy Duck	Oxyura jamaicansis
Hooded Merganser	Lophdytes cucullatus
Common Merganser	Mergys merganser
American Oystercatcher	Haematopus palliatus
Semipalmated Plover	Charadrius semipalmata
Ruddy Turnstone	Arenaria interpres
Greater Yellowlegs	Tringa melanoleuca
Lesser Yellowlegs	Tringa flavipes
Sanderling	Calidres alba
Least Bittern	Ixobrychus exilis
Great Black-backed Gull	Larus marinis
Herring Gull	Larus argentatus
Ring-billed Gull	Larus delawarensis
Black Skimmer	Rhychops niger
Long-billed Marsh Wren	Cistothorus palustris
Gannet	Morus bassanus
Double-crested Cormorant	Phalacrocorax auritus
Snow Goose	Chen hyperborea
American Widgeon	Mareca americana
European Widgeon	Mareca penelope
Blue-winged Teal	Anas discors
Green-winged Teal	Anas carolinensis
Redhead	Aythya americana
Ring-necked Duck	Aythya collaris
Lesser Scaup	Aythya affinis
Oldsquaw	Clangula hyemalis

Common Name	Scientific Name
Red-breasted Merganser	*Mergus serrator*
Black-crowned Night Heron	*Nycticorax nycticorax*
American Bittern	*Botaurus lentiginosus*
Clapper Rail	*Rallus longirostris*
Black Rail	*Laterallus jamaicensis*
American Coot	*Fulica americana*

7.0 - CONCLUSIONS AND RECOMMENDATIONS

7.1 - CONCLUSIONS OF REMEDIAL INVESTIGATION

The remedial investigation focused on identifying the physical nature and extent of soil and groundwater contamination associated with the Hillcrest facility owned and operated by CAE-Link Corporation, Link Flight Simulation Division. The specific objectives of the remedial investigation were: (1) determine the nature, type, physical state(s) and extent (vertical and horizontal) of contamination on-site and/or emanating from the site; (2) determine the migration pathways of contaminants; and (3) determine the impact to human health and the environment.

To accomplish the above objectives, the remedial investigation focused on a further investigation of the on-site contaminant source area (industrial outfall system 004). The potential pathways of contaminant migration were determined to be air, soil and groundwater. The remedial investigation addressed these pathways with special emphasis on the groundwater pathway. A soil gas investigation was also performed in the study area surrounding the Hillcrest facility to determine if volatile organic contamination in groundwater was migrating in the vadose zone.

7.1.1 - Study Area Characterization

As part of the remedial effort, a detailed study area characterization was performed. This included a determination of the following physical characteristics of the study area:

surface features; meteorology; surface water hydrology; geology; soils; hydrogeology; land use and ecology. The results of the remedial investigation field activities and previous site investigations were used to develop an updated determination of the physical characteristics of the study area using data from the physical and chemical monitoring of these systems.

7.1.2 - Nature and Extent of Contamination

The results of the physical and chemical monitoring during the RI were used to determine the nature and extent of contamination in the following media: vadose zone soils; groundwater and air. Groundwater and soil samples were submitted for laboratory analysis for Target Compound List (TCL) volatile organics and inorganics including cyanide and hexavalent chromium and pesticides/PCBs according to Contract Laboratory Protocols (CLP). Soil gas samples were submitted for laboratory analysis for priority pollutant volatile organics.

Groundwater samples were obtained from fourteen (14) monitoring wells throughout the study area during two separate sampling events conducted one month apart. Soil borings were drilled through existing leaching pools and adjacent to decommissioned leaching pools of the decommissioned industrial outfall system 004.

The RI analytical data confirmed the presence of the on-site groundwater plume consisting of volatile organic and inorganic contamination and determined the configuration of the off-site volatile organic plume. Volatile organic contamination was quantified above New York State guidance values or standards for drinking water. The majority of inorganic contaminants appear to be limited in mobility and are found predominantly on-site in the near vicinity of the source area - decommissioned Outfall System 004. The predominant volatile organic contaminants were trichloroethylene and 1,1,1-trichloroethane. The highest concentrations of these two compounds occur near MW-6 and MW-13. Lower levels (approximately 50 ug/l) of the same volatile organic compounds were identified at the off-site monitoring wells.

The volatile organic plume was identified as confined to the thin (10 to 25 feet thick) upper water table aquifer throughout the study area by the presence of a thick (approximately 140 feet) low permeability underlying silt unit. The silt unit effectively creates a lower boundary, separating the upper water table aquifer from the deeper aquifer used 2,500 feet to the north of the Hillcrest facility for drinking water purposes.

The majority of inorganic compounds analyzed for were present in concentrations exceeding drinking water standards. However, overall elevated concentrations of inorganics may be attributed to extreme sample turbidity. Upon comparison of filtered and unfiltered analytical data, significant reductions in inorganic concentrations were found. In unfiltered groundwater samples, elevated concentrations of inorganic compounds (cadmium, chromium, silver, hexavalent chromium and cyanide) were predominant at monitoring wells adjacent to the decommissioned outfall system (MW-10 and MW-13). Inorganics compounds quantified in excess of five times background concentrations in the turbid groundwater samples included antimony, beryllium, cadmium, calcium, chromium, copper, silver, sodium and cyanide.

The twelve (12) leaching pools within Outfall System 004 were sampled by the drilling and collection of soil samples. Background soil samples were also obtained for comparison purposes. Inorganic compound concentrations reported in soil were compared to background concentrations, NYSDEC "informal action levels" and typical concentrations of metals in soils. Many of the heavy metals (cadmium, chromium, nickel, lead and zinc) were reported substantially above background levels, typical concentrations or informal action levels. Concentrations of inorganics such as antimony, barium, beryllium, cadmium, calcium, chromium, copper, magnesium, manganese, mercury, nickel, zinc and lead were quantified as elevated at the majority of leaching pools with highest concentrations noted at leaching pools H, I, J, K, L and M. The highest concentrations of volatile organic contamination (primarily trichloroethylene, 1,1,1-trichloroethane and their daughter products) were detected at soil samples taken from Outfalls E, N, J K, M and excavated leaching pool A at sampling locations B-A1 and B-A2.

Eighteen (18) soil gas sampling locations were utilized to investigate the vadose zone at the Hillcrest facility and adjacent area. Soil gas was induced through sorbent tubes and submitted for laboratory analysis of volatile organics. With the exception of one sampling location, all concentrations of volatile organics were below the acceptable ambient air levels for specific contaminants. The one sampling location with an elevated concentration of volatile organics was determined to be a result of residual contamination from a nearby source other than the Hillcrest facility.

7.1.3 - Fate and Transport

The key release mechanism of the volatile organic and inorganic contamination at the site is via percolation of rainfall through contaminant source areas and down to groundwater. As water infiltrates through contaminated soil, it can desorb inorganic and organic compounds. Contaminants from the source areas travel via groundwater environmental pathway towards the west-northwest to discharge locally at the Chenango River. Contaminants contained in groundwater discharging to the river are expected to volatilize to some extent. There is also some potential to precipitate or adsorb onto sediment. Some contaminants can also remain in solution and be eventually transported downstream. **However, the contaminant loading to the river resulting from groundwater discharge is expected to be insignificant, because of the high flow rate of the river relative to discharge from groundwater.**

The volatile organic contamination emanating from the Hillcrest facility is seen to readily migrate with groundwater flow and is not expected to be significantly sorbed by soil. Physically, it can remain in groundwater for years, prior to degrading. The inorganic compounds present as contaminants currently on-site at the Hillcrest facility tend to form complexes and will adsorb to different soil particles. They will also precipitate under neutral or alkaline conditions. **Based upon these physical and chemical characteristics, this type of inorganic contamination is not expected to be significantly mobile or to occur widely through the study area.**

7.1.4 - Baseline Risk Assessment

The information developed on the nature and extent of contamination, with respect to contaminant fate and transport in different media is utilized in the baseline health risk assessment. Based upon an evaluation of potential completed exposure pathways, a determination of receptor areas in the Hillcrest study area was made. The key receptor area was determined to be downgradient groundwater discharging locally into the surface waters of the Chenango River. Subsurface soil within the decommissioned Outfall System 004, if excavated, would create a localized receptor area and therefore a completed exposure pathway. Air was not identified to be a receptor area with the exception of an exposure pathway that would be created during excavation of impacted subsurface soils.

The baseline health risk assessment incorporates an exposure assessment in conjunction with toxicity assessment and a risk characterization. Based upon the potential exposure concentrations and risk predicted by the assessment from the discharging of impacted groundwater into the Chenango River, the risk does not exceed the reference value or hazard index established for the site. **Therefore, on this basis, there is no increased risk evident due to impacted groundwater discharging into the Chenango River.** If soils are excavated from Outfall System 004, a potential health risk may be present to site workers involved in remediation. Appropriate precautions such as very stringent health and safety protection for workers during remediation would be necessary. An ecological assessment of the flora and fauna in the vicinity of the site was also conducted as part of baseline risk assessment.

7.2 - BASIS OF RECOMMENDATIONS

The baseline risk assessment addressed the potential impacts to human health and the environment associated with the Hillcrest facility. The baseline risk assessment was conducted using very conservative assumptions as required in this type of analysis and therefore represents a "worst case model". The estimates presented in this analysis represent the upper end of the range of actual exposures and risks.

The baseline risk assessment allows a determination to be made whether remedial actions beyond those already implemented are required. The results of the assessment indicate no increased risk due to the discharging of impacted groundwater into the Chenango River. Therefore, appropriate recommendations for future actions were developed based upon this primary conclusion of the baseline risk assessment. These recommendations also combine required response actions with respect to the on-site remedial activities already performed.

Leaching pools A, B, C, and D in Outfall system 004 were put out of service, excavated and removed in October 1983. In July 1986, the discharge of all industrial process water, boiler blowdown, sanitary and cafeteria wastewaters at the Hillcrest facility was transferred to the Johnson City Sewer District. The remaining leaching pools in the Outfall System 004 were rendered inactive by decommissioning. Sanitary systems were also rendered inactive, decommissioned and further treated by the pump out of liquids and sludges prior to backfilling. Additional remedial measures implemented by Link included the containment of hazardous waste currently stored on-site in regulated storage facilities with the limiting of future potential releases. The Link Hillcrest facility has been reclassified from a hazardous waste treatment, storage and disposal facility to a generator only. Link is also currently in compliance with the NYCRR Part 373 regulations pertaining to hazardous waste generators.

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