NYSEG

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Mr. Frank Ricotta
Regional Water Engineer
New York State Department of
Environmental Conservation
6274 East Avon-Lima Road
Avon, NY 14414

RECEIVED
MAY 0 7 1990
HAZ. WASTE REM.
D.E.C. REG. #8

Subject: Penn Yan Coal Gasification Site
Task 2 Report

Dear Mr. Ricotta:

Enclosed is the Task 2 Report for the Penn Yan coal gasification site investigation. This study includes an analysis of ground and surface water, subsurface and surface soils and stream sediments. NYSEG's consultant, TRC Environmental Consultants, will proceed with a risk assessment to determine if the site represents a risk to public health or the environment. However, preliminary risk estimates indicate there are no imminent hazards associated with the site.

Should you have any questions regarding this investigation, please contact Mr. Thomas O'Meara of my staff at (607) 729-2551, extension 4242.

Sincerely,

Peter Carney

P.G. Carney
Manager, Environmental Matters

PGC/TMO/kgt

Enclosure

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FINAL TASK 2 REPORT
NEW YORK STATE ELECTRIC AND GAS CORPORATION
INVESTIGATION OF THE FORMER COAL GASIFICATION SITE
PENN YAN, NEW YORK

VOLUME I
TECHNICAL REPORT

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Project Geologist

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February 21, 1990

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A TRC Company

EXECUTIVE SUMMARY

This report describes the Task 2 field investigation activities performed by TRC Environmental Consultants, Inc. (TRC) for New York State Electric and Gas Corporation (NYSEG) at a former coal gasification (town gas) plant located on Water Street in Penn Yan, New York. The purpose of this portion of the investigation was to determine if residues associated with gas production exist at the site.

Town gas plants were constructed to provide local communities with gas that was used primarily for illumination. Gas was produced by heating coal under controlled conditions in vessels known as retorts. Impurities were removed by passing the gas stream through a vessel containing a chemically (generally iron oxide) impregnated media which usually consisted of wood chips or corn cobs. Wastes generated at the site include coal tars, oils, cooling water, coke, and wood chips containing iron and cyanides. The town gas plant described in this report was constructed in 1899 and produced gas until 1930.

Task 1 of the investigation consisted of research into the history of the site and conducting a geophysical survey and an air quality survey of the site. Task 1 provided information on the locations of former site structures and regional geologic and hydrogeologic conditions. Task 1 was completed in December 1986.

The Task 2 investigation described in this report involved the excavation of seventeen test pits, the drilling of exploratory borings at four locations and the installation of six ground water monitoring wells. Samples of surface soil, ground water, surface water, stream sediments and air were collected and analyzed.

Before Task 2 was completed, a decision was made by NYSEG to initiate an expanded Task 2 (Task 2A) field program to expedite additional field work so that a risk assessment could proceed in a timely manner. The expanded Task 2 field program was designed to provide more detailed information on site conditions for the primary purpose of risk evaluation. Additional samples of stream sediment, ground water and surface water were collected.

The Task 2 investigation concluded the following:

- Water level measurements indicate that shallow ground water flows to the southeast.
- Test pit excavations confirmed locations of former coal gasification plant structures including the former gas relief holder and the tar storage vessel.
- Analytical results of four rounds of water samples indicate that purgeable aromatics, acid extractables and base/neutral extractable compounds were not detected above NYSDEC regulatory criteria in the ground water or surface water. However, when comparing the organic compounds to the NYSDOH criteria, Principal Organic Contaminant (POC) levels were exceeded in the ground water. Only iron, zinc, sulfate and total cyanide exhibited levels elevated above NYSDEC regulatory criteria in the ground water or NYSDOH criteria for drinking water.
- Two rounds of sediment samples and one round of surface soil sampling indicate that PAH compounds and metals are present in these two media.

TRC recommends that the investigation proceed to Task 4, which will include a detailed risk assessment.

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

FIGURE

LIST OF TABLES

TABLE

LIST OF TABLES
(Continued)

TABLE

VOLUME II - APPENDICES A - I

APPENDIX

VOLUME II - APPENDICES A - I
(Continued)

APPENDIX

F LABORATORY RESULTS - GROUNDWATER (Continued)

G LABORATORY RESULTS - SURFACE WATER

VOLUME II - APPENDICES A - I

APPENDIX

G LABORATORY RESULTS - SURFACE WATER (Continued)

H LABORATORY RESULTS - STREAM SEDIMENT

I LABORATORY RESULTS - AIR

1.0 INTRODUCTION

In October 1986, TRC Environmental Consultants, Inc. (TRC) received authorization from the New York State Electric and Gas Corporation (NYSEG) to begin Task 2 of the investigation of the former Penn Yan coal gasification site located on Water Street, Penn Yan, New York. The field investigation began in mid-November 1986.

The site is located on Water Street, approximately 10 feet north of Keuka Lake Outlet in Yates County, New York (see Figure 1-1). The former coal gasification plant was built between 1899 and 1900, and produced retort coal gas under the names of Penn Yan Gas Light Company and the New York Central Electric Corporation until 1930, when the coal gasification operation ceased. Most of the site is currently owned and occupied by Lake Country Maxi-Mini Storage and Lake Country Ford Mercury, Inc. The remainder of the site area is occupied by a small regulator house which NYSEG owns and maintains. The locations of the present site buildings, as well as the configurations of former structures, are depicted in Figure 1-2.

1.1 Previous Investigations

TRC completed Task 1 of its investigation of the former Penn Yan coal gasification site in September 1986, and submitted the final Task 1 report to NYSEG on December 19, 1986. This initial phase of the site investigation included research on the site history, the regional and local geological setting, and the hydrological setting of the site. Preliminary fieldwork also performed during Task 1 included a geophysical survey, an air quality survey, and a visual inspection of the site and the adjacent river. The results of the Task 1 investigations are briefly summarized in the following sections. A detailed description of the work is presented in the Task 1 report.

1.1.1 Historical Review

The historical review of the Penn Yan Gas Light Company examined site ownership, operating procedures, and waste disposal practices. The review was based upon information gathered from the local library, the county clerk, the county historian, historic Yates County and Sanborne Atlas maps, and interviews with Penn Yan residents. The historical review presented in the Task 1 report has been summarized in Section 2.0 of this report.

1.1.2 Geophysical Survey

During the week of September 12, 1986, TRC conducted an electromagnetic survey using a Geonics Limited EM-31 instrument at the site. The instrument transmits electrical energy which induces a secondary magnetic field in the earth. The instrument is able to measure the ratio of this secondary magnetic field to the earth's primary magnetic field. This ratio is in turn directly proportional to the ground conductivity. This instrument consists of a transmitter coil, a receiver coil, and an instrument panel which is calibrated to give values of ground conductivity (millimhos/meter) directly. The EM-31 is a one-person unit with a fixed inter-coil spacing of 3.7 meter (21.1 feet). The changes in the ground conductivity, measured as magnetic anomalies by the EM-31, can be the result of a variety of site conditions including changes in the conductivity of ground water (contaminant plumes), lateral changes in the geology, or particularly the presence of buried metal objects. The sensitivity of the EM-31 meter and its detection depth of up to 18 feet make it very useful for the detection of buried tanks or pipes.

A grid system was laid out with 15 feet between each point, except in the area along the river where the grid points were placed 10 feet apart. Figure 1-3 graphically summarizes the EM-31 conductivity readings.

Measurements in areas of known conductive interferences, such as railroad tracks, automobiles, power lines or other metallic structures, were omitted from the contour construction. An area of high conductivity was located west of the gas relief holder remains, where ash and wood chips were at one time stockpiled prior to off-site disposal.

1.1.3 Air Quality Survey

During the Task 1 investigation, TRC performed an ambient air quality survey of the Penn Yan site using a Century Organic Vapor Analyzer (OVA). The survey was conducted to obtain background air concentrations prior to the initiation of field activities. The ambient air concentration of total organic vapors was measured at each grid point used for the EM-31 survey (see Figure 1-3). During the site survey, the temperature was between 68 and 72 degrees Fahrenheit (°F) with a moderate northwest breeze and overcast skies. The readings ranged between 0.6 ppm and 1.0 ppm total organic vapors as benzene (instrument was calibrated to benzene; actual response to other organic vapors would vary). At three points along the survey, values slightly greater than 1.0 ppm were measured. However, at two of these locations, TRC personnel detected odors from the winery which existed on-site during the air quality survey. These odorous compounds associated with the fermentation process or other processes at the winery may have accounted for the higher instrument readings. The moderate breeze experienced during the survey may have decreased the possibility of detecting low concentrations of organic vapors from the site.

Measurements were also taken in the tar storage vessel. The OVA measurement ranged between 0.8 and 1.7 ppm total organic vapors (calibrated to benzene).

1.1.4 Soil and Water Quality

There were no previous soil or water quality investigations conducted at the Penn Yan site. In November 1981, NYSEG collected one sludge sample from a tar storage vessel near the Keuka Lake outlet. The sample was leached following the Extraction Procedure Toxicity (EP Toxicity) method and analyzed by NYSEG for the eight EP Toxicity metals as well as copper, zinc, total phenols, ortho- and para-cresol, naphthalene, and quinoline. In addition, the sample was analyzed for cyanide, sulfide, pH, and flash point. Barium, zinc, total phenols, cresol, naphthalene, quinoline, and sulfide were detected in the sample. The analytical results are summarized in Table 1-1. The cresols, naphthalene, and quinoline in the leachate of the sludge are typical constituents present in coal gasification residues.

1.2 Nature and Extent of the Problem

The Task 1 investigation provided information on the disposal of both solid and liquid wastes. The solid wastes (i.e., ash, wood chips, coke) were stored in several piles along the western and northwestern portion of the site prior to off-site disposal. The cooling and condensation water were discharged into Keuka Lake Outlet. The coal tar was accumulated in two on-site tar storage vessels and later sold. Overflow from one of the vessels discharged to Keuka Lake Outlet.

The only visible manufactured gas plant waste deposits on-site are in the tar storage vessel adjacent to Keuka Lake Outlet. The analysis of the sludge sample from the tar storage vessel revealed that the material in the tar storage vessel contained cresols, naphthalene, and quinoline in the leachate. These compounds are common parameters present in coal tar or coal gasification by-products. The fate of the second tar storage vessel is unknown; it may have been covered by additions to the old gas works building.

1.3 Purpose and Scope of Task 2

The purpose of the Task 2 field investigation was to determine the following:

- The presence and nature of coal gasification constituents on-site.
- The approximate horizontal and vertical extent of these constituents in site soils and ground water.
- The general impacts of the constituents on ground water quality.
- The potential routes of constituent migration.
- The extent to which on-site and off-site receptors may be exposed to the detected constituents.
- Potential public health and environmental impacts.

The Task 2 field activities involved the excavation of seventeen test pits, the drilling and installation of six ground water monitoring wells, and air quality monitoring to determine background conditions and the effects on the air quality from subsurface work. Samples collected as part of the Task 2 field investigations included surface soils, subsurface soils from test borings and test pits, sediment from Keuka Lake Outlet, and ground water and surface water (four rounds). In addition to the presentation of field investigation results, Task 2 includes a qualitative assessment of the potential risk to human health and the environment posed by the constituents at the site.

2.0 SITE HISTORY

A review of the Penn Yan site history was conducted as part of Task 1 and is briefly summarized in this section. The review of the site conditions and operations was conducted to determine locations of the gas manufacturing facilities, potential sources of waste, areas in which the waste was handled, and waste disposal practices. Most of the information on plant operations came from interviews with Penn Yan residents. Additional historical information was also located in several local newspaper articles and atlas maps of Yates County.

Industrial activity at the Water Street site began with the H. Tuttle and Son Malt House and Wool Storage facility. The malt house existed until July 1899, when Mr. William T. Morris (president of the Penn Yan Gas Light Company) purchased the property. The coal gasification plant was constructed on the southeastern portion of the property, and gas production began shortly thereafter. On April 1, 1926, the Penn Yan Gas Light Company was purchased by New York Central Electric Corporation, and the plant continued to produce gas for approximately four more years, until early 1930. In 1937, New York Central Electric Company merged with NYSEG. On August 16, 1943, NYSEG sold the property to Penn Yan Wine Cellars, Inc., but retained a 400-square-foot parcel for the gas regulator house.

Penn Yan Wine Cellars, Inc., was the property owner during the preparation and submittal of the Task 1 report (December 1986), and most of the Task 2 field activities (including the three of the four water sampling rounds). However, by February 1988, Penn Yan Wine Cellars, Inc. sold the property. Currently, the property is owned by two businesses: the one-story block building and adjacent 2½-story stone building (see Figure 1-2) are now owned by Lake Country Ford® Mercury, Inc.; the three-story block warehouse building (see Figure 1-2) is currently owned by Lake Country Maxi-Mini Storage. Lake Country Ford Mercury subsequently covered the former gas holder location with dirt fill. In addition, an adjacent two-story brick building owned by Yates Blodgett on the east portion of the site was demolished in the spring of 1987.

2.1 Former Plant Operations

The Water Street coal gasification plant used fifteen horizontal retort ovens (300 to 450 pounds feed fuel capacity per retort) to produce gas by the coal-carbonization process. Each retort was approximately ten-feet long by two-feet high by thirty-inches wide, and was filled with coal from front to back until the coal was level inside. The retorts were heated by coke fires, which provided the heat necessary to pyrolize the coal. The retorts were emptied and recharged with coal every six to eight hours. The spent coal (coke) was raked onto the floor and cooled with water. After the coke was cooled, it was removed to a waste pile located outside the gas works building.

The "exhauster" or steam boiler would "pump" the gas from the retort, together with entrained liquid particles, upward through a cast-iron gooseneck. From the gooseneck, the gas moved into a horizontal steel pipe which was connected to all the retorts in series. The pipe was alternatively known as the collecting or hydraulic main. As the gas left the retorts, it was sprayed with weak ammonia water. This condensed some of the tar and ammonia from the gas into liquid. The liquids moved through the main with the gases until reaching a settling tank where density separation occurred.

After venting through the hydraulic main and into the settling tank, the gas was directed into the condenser where it was cooled with water. During this process, naphthalene separated from the gas, and any residual coal tars drained into the tar storage vessel. Additional cooling of the gas was achieved in the scrubber.

The final step in preparing the coal gas for consumer use was purification. The purifiers consisted of boxes that were approximately ten feet long by seven or eight feet wide, and filled to a three foot depth with iron oxide-impregnated wood chips. The iron oxide reacted with and removed hydrogen sulfide and cyanides from the gas. The wood chips were regenerated by allowing contact with air and "dried" once a week. Eventually, the iron oxide could not be regenerated (due to the accumulation of sulfur and fouling by traces of tar) and the wood chips were replaced. The spent wood chips were placed on the ash pile for disposal.

Purified retort gas was held in the 40,000 cubic foot gas relief holder, prior to distribution. The gas relief holder consisted of a telescoping adjustable-volume tank, 40 feet in diameter, that could be elevated to a height of 23 feet. The gas reached the consumer through buried mains that ran from the street into the basements of houses.

2.2 Waste Generation and Disposal

Some of the solid and liquid wastes generated by the coal gasification process remained on-site. The majority of these waste materials were collected and sold.

Solid wastes generated from the process included iron oxide-impregnated wood chips from the purification building (which included tars, cyanides and sulfur) coal ash and spent coal (coke). These materials were stored in several piles along the northwestern and western portion of the site (see Figure 2-1). The wood chips and ash were removed and used in the winter to improve traction on local roads. The coke was sold by the bushel each fall.

The liquid waste was comprised of coal tar (separated from the gas) and cooling water. The coal tar was contained in two tar storage vessels adjacent to the old gas works building. Periodically, the coal tar was pumped from the storage vessels and sold. If the coal tar or water separated from the coal tars exceeded a certain level in the storage vessel, a drain allowed the excess to discharge into Keuka Lake Outlet. The cooling wastewater from the plant's operation was also allowed to discharge onto the ground and eventually into the Keuka Lake Outlet through floor drains.

2.2.1 Chemical Characteristics of Wastes

To accurately assess the impact of plant residues on adjacent soil and water, chemical characteristics of the materials which remain on-site must be understood. The materials of greatest concern are the coal tars, purifier wastes, and cooling waters. Although it is believed that the majority of these wastes were removed from the site, any wastes accidentally spilled on-site or remaining on-site after plant closure may have contributed to soil and/or water contamination. A chemical characterization of this category of wastes is provided in Table 2-1.

2.3 Plant Closure

Few details are known about plant closure other than the closure coincided with the completion of a gas main from the Empire Gas and Electric plant at Geneva. Based on gas production records (New York Public Service Commission Report, 1960), the Water Street plant ceased operating in early 1930 (see Table 2-2).

2.4 Present Conditions

The gas works building, a portion of the gas relief holder foundation (now covered with fill), and the tar storage vessel still remain. The gas works building has been modified slightly to accommodate two additions to it's western side. In addition, a parcel of property (approximate dimensions 20 feet by 20 feet) located in the northeast corner is retained as a gas regulator house. This portion of the site is still owned by NYSEG.

3.0 SITE SETTING

The geology, hydrology, and demography of the site environs, as well as a land use analysis of the area within a one mile radius of the site, are discussed in the Task 1 report and are briefly summarized in this section.

3.1 Geology

The geology of the Penn Yan site is presented in discussions of physiography, bedrock geology, unconsolidated deposits and surficial soils. There is very limited site-specific information available; therefore, the information presented in the following sections is limited and tends to be regional in nature.

3.1.1 Physiography

The Village of Penn Yan is situated on the border of two physiographic provinces. To the north is the Central Lowland Physiographic Province, a relatively flat region characterized by poor drainage and north-trending landforms composed of unconsolidated glacial deposits. To the south is the Allegheny Plateau Physiographic Province, a region of rolling uplands cut by broad streams and lake valleys (Crain, 1974). The two physiographic provinces are shown in Figure 3-1. Topographic features in both provinces have been heavily modified by intensive continental glaciation.

The Finger Lakes, including Keuka Lake, are the most dominating physiographic features in the Penn Yan region. These lakes are located in deep preglacial stream valleys. The narrow valleys were scoured and deepened by advancing glaciers and later partially filled with sediment as the glaciers retreated northward (Fairchild, 1926). The stream and glacial erosion in these valleys have resulted in great relief of the bedrock surface, in some areas as much as 3,000 feet (Crain, 1974). Bedrock is exposed along the valley walls but is deeply buried by unconsolidated glacial sediments in the major valleys.

3.1.2 Bedrock Geology

The bedrock in the northern Allegheny Plateau and the southern Central Lowland Physiographic Provinces consists of Devonian and Silurian marine sedimentary sequences. Rock types include shales, siltstones, sandstones, and carbonates. In general, the bedrock is relatively flat with a slight dip (50 feet per mile) to the south (Crain, 1974). A stratigraphic column of the regional bedrock geology with physical descriptions is presented in Figure 3-2.

The bedrock in the Penn Yan area is the Penn Yan Shale member of the Devonian Genesee Formation. The bedrock is characterized by thinly bedded black shales and interbedded mudstones. The bedrock in the area is generally flat lying. However, gentle northeast plunging folds disturb the generally southwest dipping (25 feet/mile) bedrock (Bergin, 1964). The dominant joint pattern cutting the Penn Yan shale is fold-related, with an average trend of N 26°W. This joint set is folded with dip angles ranging greater than 45° (Bergin, 1964). The openings along joint surfaces in the shale tend to be minute. At depth, the weight of overlying rock closes the openings. Near the surface, however, the openings are wider and are capable of transmitting ground water. A northeast-trending fault is inferred along the west side of Keuka Lake, 4,000 feet west of the site (Bergin, 1964) (see Figure 3-3). The fault cannot be seen at the surface.

3.1.3 Unconsolidated Deposits

The bedrock in the Penn Yan region is overlain by thick unconsolidated Quaternary glacial deposits. The glacial material was deposited during the northward retreat of the ice during the last glaciation episode. When the retreating glacier blocked the northward stream drainage out of Keuka Lake Valley, a large proglacial lake formed (Fairchild, 1926). As a result, interbedded clays and silts were deposited over the bedrock. Glacial meltwater also deposited thick layers of sorted sand and gravel over the area. Along the Keuka Lake Outlet, a thin layer of post-glacial alluvium overlays the glacial deposits (Bergin, 1964).

3.1.4 Soils

The site is in an area mapped as Ontario fine sandy loam (Soil Survey, Yates County, 1916). Its description is as follows:

- 0-10" Surface soil - brown, fine sandy loam, with rounded limestone and sandstone fragments.
- 10-36" Subsurface soil - yellowish-brown, fine sandy loam containing limestone boulders.

3.2 Hydrology

Site-specific hydrological information for the Penn Yan site is limited. Regional data for surface water hydrology and ground water hydrology are presented in this section.

The surface water hydrology of the site area is dominated by Keuka Lake Outlet, situated approximately 10 feet south of the site. The former coal gasification plant lies in a low, flat area on the north bank of Keuka Lake Outlet.

The major ground water aquifer of the Penn Yan area occurs within thick layers of unconsolidated Quaternary glacial deposits near the Keuka Lake outlet and extending north along the Jacobs Brook Valley. The ability of these deposits to transmit water is closely related to their composition. The fine-grained lacustrine clay deposits are relatively impermeable layers and will yield only small quantities of ground water. The alluvium and gravel deposits are more permeable and will yield higher amounts of ground water. The most productive aquifers in the area are reportedly under confined conditions (Crain, 1974), i.e., they are overlain by the less permeable silts and clays.

The municipal water supply for Penn Yan is acquired from Keuka Lake. The intake for the municipal water supply is located approximately 7,200 feet to the southwest of the site on West Lake Road.

3.3 Demography

The Village of Penn Yan, with a population of 5,242 (1980 census) is the population center closest to the former coal gasification plant. Other nearby centers include Benton Center, four miles north of Penn Yan, and Bluff Point, four miles southeast.

3.4 Site Area Land Use

An analysis of land use within a one-mile radius of the former coal gasification site was performed using a tax map of the Village of Penn Yan (1962) and the U.S.G.S. Penn Yan quadrangle topographic map and verified in the field as part of TRC's Phase I investigation in 1986. The land use evaluation identifies sensitive areas, such as schools, hospitals, and public recreation areas, and will aid in the performance of a risk assessment. A generalized land use map was constructed from these sources and is presented in Figure 3-4.

Within a one-mile radius of the site, land use is roughly divided into 40-percent residential, 20-percent commercial, 20-percent agricultural, 15-percent open land, and 5-percent industrial. In the area immediately surrounding the site, land use is approximately 98-percent commercial and 2-percent residential. The site is bordered on the west by Liberty Street and on the east by the Yates-Blodgett Grainery. Water Street forms the northern border of the site, with a car dealership located on the north side of the street directly across from the site. On the north side of the corner of Water and Liberty Streets are two residences. Keuka Lake Outlet forms the southern boundary of the site.

Five schools and one hospital were located within a one-mile radius of the site area (see Table 3-1). All of these facilities are located to the north and northwest of the site, in directions believed to be hydraulically upgradient of the site.

The Penn Yan Water and Sewer Department provided information on the locations of the sewers near the site. The two streets bordering the site, Liberty and Water Streets, are included in the municipal sewer system. The flow direction through the sewers is north on Liberty to Water Street, then east along Water Street.

A wetland area is located north of Keuka Lake Outlet and 1000 feet west upgradient of the site. This is a Class 1 wetland regulated by the NYSDEC.

4.0 FIELD INVESTIGATION PROGRAM

The Task 2 field investigation was designed to determine the presence and nature of contamination in the soil, water and air at the site. The initial field investigation was conducted during November 1986, with ground water and surface water sampling events occurring in January, April and July 1987, and May 1989.

The initial Task 2 field investigation included the excavation and sampling of test pits, the drilling of test borings, surface soil sampling, monitoring well installation and sampling, stream sediment sampling and air quality monitoring. In addition, two stream sediment sampling events were performed at the site. The following sections describe the scope and rationale of the field investigation. The results of the analytical program are presented in Sections 5.0, 6.0, 7.0, and 8.0.

4.1 Field Investigation Plans

The field work conducted during the Task 2 investigation is described in detail in the "Task 2 Sampling Plan for the Site Investigation of the Former Penn Yan Coal Gasification Plant" (TRC, 1986). The Task 2 Sampling Plan was submitted to NYSEG on December 19, 1986. The plan contains proposed surface soil, test pit, monitoring well, ground water, surface water and stream sediment sampling locations. The plan also contains a detailed description of the sampling methods used for each sampled medium during the field investigation.

The Quality Assurance/Quality Control (QA/QC) procedures followed by TRC personnel during the collection, field analysis, and shipping of environmental samples are presented in the TRC Technical Standards listed in the Field Sampling Plan (TRC, 1986). By utilizing and following the QA/QC procedures, a high level of quality was maintained throughout the field investigation.

4.2 Site Topographic Survey

Weiler Mapping Inc. of Horseheads, New York, was contracted by TRC to perform a site topographic survey as well as provide base maps for recording, evaluating, and presenting all site investigation data. A topographic map was prepared at a scale of one inch equals 50 feet with a two-foot elevation contour interval (referenced to mean sea level datum). A copy of this map is included in the pocket at the end of this report.

4.3 Surface Soil Sampling

Two surface soil grab samples were collected from locations at the site to determine if MGP residues were present and the extent of risk associated with direct contact with any potentially contaminated dust and soils. It should be noted that much of the site surface soils consist of gravel and asphalt paved areas, which significantly limits the exposure to contaminated dusts and soils. Therefore, two locations were selected for surface soil samples which were considered to have the greatest potential for MGP residue exposure to the general public. The two areas include the south side of the gas house building (SS-1) where floor drains reportedly discharged wastewater to the outside near the banks of Keuka Lake Outlet. The other location (SS-2) is located northeast of the old gas holder foundation remains, where people pass by on the sidewalk marking the northern boundary of the site. Locations for these samples were determined during the Task 1 site reconnaissance and are illustrated in Figure 4-1.

Sampling of the surface soils was performed in accordance with TRC Technical Standard T/S-971, Field Procedures for Collection of Surface Soil Samples. All surface soil samples were collected on the same day, prior to any test pit excavations. Table 4-1 presents a summary of the location and rationale for each sample.

Surface soil samples were collected from the upper 6 inches at each location to determine the concentration of potential contaminants in the near-surface soils. The samples were collected by a TRC geologist using a laboratory-cleaned stainless steel sampling spoon and hand auger.

4.4 Subsurface Soil Investigation

The objective of the subsurface investigations (test pits and borings) was to define the presence and nature of potential contaminants, including possible contaminant migration rates and directions, and to locate former MGP structures. As part of the subsurface investigations, a ground water monitoring system was established to determine if past site uses were impacting shallow ground water quality.

4.4.1 Test Pits

A total of 17 test pits were excavated at the Penn Yan site during the period of November 21 through 24, 1986. The purpose of these excavations was to identify areas of soil contamination, define the near-surface geology, determine potential pathways for contaminant migration, locate former tank foundations and associated structures and collect soil samples.

The test pits were excavated by City Hill Construction, Inc. of Penn Yan, New York. The depth of each pit ranged from 3 to 12 feet, with the final depth determined by ground water influx, refusal, or a decision by TRC personnel that the excavation had progressed beyond the deepest extent of visible contamination. In addition, the decision to terminate excavation was to be based on the following:

- The appearance of gross contamination.
- A confining layer (lens) encountered below a layer of contamination.

- A heavy influx of contaminated ground water or contaminants.
- A maximum depth of 12 feet (maximum reach of backhoe).

Test pits were monitored continuously with an OVA during the excavation to provide real-time measurements of vapor emission concentrations and to assure worker safety. Air quality monitoring was also performed to identify and quantify any air contaminants. The results of the air quality monitoring program will be discussed in detail in Section 4.5.

Most of the test pit excavations were located in areas where anomalous values were found during the Task 1 geophysical survey or where soil contamination was suspected based on historical maps and interviews conducted during the Task 1 investigation. Figure 4-2 shows the locations of the test pits. Test pit depths and locations are listed in Table 4-2. A TRC geologist logged the subsurface materials exposed during the excavation. The test pit logs are presented in Appendix A.

4.4.2 Test Boring

During the Task 2 field investigation, TRC personnel determined that the original proposed background test pit location (TP-1) at the Penn Yan site was not feasible due to underground utilities. Therefore, one subsurface sample was collected at a 6 to 8-foot depth from monitoring well boring MW-1S, located approximately 20 feet south of the proposed location of test pit TP-1 (see Figure 4-2). The sampling indicated the presence of waste, such as coal clinkers, brick fragments, wood chips, sand and silt. This sample was analyzed for the same parameters as the test pit soil samples, and served to provide additional documentation on soil quality at the site.

4.5 Air Quality Monitoring

The air monitoring program was specifically designed to monitor the release of any organic gases during the subsurface investigations and to characterize and quantify air contaminants released during the subsurface investigation.

Two types of ambient air monitoring systems were utilized at the Penn Yan site. The first type involved the use of portable instrumentation that yields "real-time" results, used primarily for worker protection. The second type involved the use of stationary sampling equipment to obtain longer duration or time-averaged results. The time-averaged samples were analyzed and results were used to characterize the on-site air quality, as well as aid in an evaluation of potential air quality impacts associated with remedial action alternatives.

The portable sampling device employed at the site was the Century Organic Vapor Analyzer Model 128 (OVA). The OVA was used for monitoring ambient air conditions at the test pit excavations and for screening test pit and boring samples. The results of the OVA monitoring program are presented in the test pit and boring logs (see Appendices A and B). Organic vapor concentrations in ambient air ranged between 1.0 and 2.0 ppm relative to benzene. (The instrument was calibrated to benzene, but responds to other volatile organics.)

OVA measurements taken above the test pits and piles of excavated soil near the test pits were uniformly at ambient (background) conditions. Headspace analysis was performed for test pit and test boring soil samples. ("Headspace" refers to vapors present in a closed sample container containing soil; vapors are interpreted to represent outgassing from the sample.) The headspace analysis was conducted by filling a 500 ml jar approximately 1/3 full with soil. The top of the jar was then covered with foil and sealed with a teflon-lined lid. Each headspace soil sample was set aside and allowed to volatilize for a minimum of 1/2 hour. The headspace samples were analyzed by carefully unscrewing the lid, sticking the tip of the OVA probe through the foil, and recording the resulting organic vapor measurements. Organic vapors of test pit soil samples measured using this method ranged between 1.0 and 26.3 ppm. Organic vapor measurements taken on the boring headspace samples ranged between 1.0 and 10 ppm. It should be noted that the test pit excavations and drilling program were performed during cold (20-30°F) weather periods when volatilization may not have been as rapid as in warm weather.

During test pit excavations and soil borings, time-averaged samples were also collected. The sampling strategy provided that three sets of samples be taken on each day - one set upwind of the site, a second set downwind of the site, and the third set adjacent to the excavated (source) test pit.

Each sampling tube set consisted of a charcoal tube on one pump and a teflon filter and sorbent sampling train on the second pump (2 microns, 37 millimeter, PTFE plus washed XAD-2 100 mg/50 mg), following the National Institute for Occupational Safety and Health (NIOSH) Analytical Method 5515 issued May 15, 1985. This analytical method suggests that the volume of air sampled should be between a range of 200 to 1,000 liters. In order to detect trace amounts of polynuclear aromatic hydrocarbons in air, a sampling flow rate was selected that would draw a volume near the high end of this range.

The open end of each sampling train was placed horizontal to the surface of the ground and pointed in the direction from which the wind was blowing. The wind vane on the meteorological station and observed odors (when present) were used to determine air sampling locations. The upwind sampling set was placed in an area which would minimize the possibility of eddies that would carry gases, aerosols and/or particulates from excavated areas; the set was placed approximately three feet above the ground surface. The downwind sampling set was situated in a location central to all places where excavating was to occur that day and placed three feet above the ground surface and within one hundred fifty feet from all excavation activities. The third (source) sampling set was placed adjacent to the test pit (TP-17) on the downwind side, usually near the pile of material removed from the pit. This source sampling set was consistently placed three feet above the ground surface and never more than two feet from the pit.

The sampling sets were set up and activated when the first test pit of the day was excavated. The pumps were checked hourly and continued running until the last test pit was filled in at the end of each day. The locations of the air sampling stations are shown in Figure 4-3. The air sampling analytical results are presented in Section 7.6.

4.6 Soil Borings and Monitoring Wells

Six borings were drilled and completed as monitoring wells by Empire Soils Investigation, Inc. (Empire), of Groton, New York between November 22 and 27, 1986. The monitoring wells were drilled and installed as two multi-depth pairs, one east and one west of the site, and two non-paired shallow wells located along Keuka Lake Outlet. The monitoring well locations are presented in Figure 4-2.

The deep borings were drilled using 6-inch inside-diameter (I.D.) casing spun through the unconsolidated sediments. The shallow borings were drilled using 4-inch I.D. hollow stem augers.

Continuous split spoon sampling was performed on the deep borings and on the two non-paired shallow wells. A TRC geologist screened the samples with an OVA for volatile organics utilizing procedures outlined in the Field

Sampling Plan. In addition, the TRC geologist logged the borings and prepared a geologic log. These boring logs are presented in Appendix B.

A summary of the locations and purpose of each monitoring well is presented in Table 4-3. Table 4-4 presents the depths of the monitoring wells, screened intervals, and the depths to water measured during the water sampling events. Subsurface stratigraphy and monitoring well construction diagrams are presented in Appendix B. The monitoring wells are constructed of 2-inch I.D., flush-threaded stainless-steel casing. The well screen is flush threaded, 10-slot (0.010-inch) wire-wrapped stainless-steel. Shallow monitor wells were completed with 15-foot screens; deep monitor wells were completed with 10-foot screens. Road curb ("christy") boxes with locking steel covers were emplaced around the stainless steel riser and set in concrete to provide well security. After construction was completed, the wells were developed by Empire by pumping and bailing. Well development was performed until the discharge water attained visual clarity.

4.7 Soil, Surface Water, Ground Water and Sediment Sampling Methods

Surface soil, subsurface soil, ground water, surface water, and sediment samples were collected during the Task 2 field investigation. The analytical results were used to characterize on-site chemical constituents, define potential migration pathways, and aid in defining areas containing coal gasification by-products. The analytical results of these samples are discussed in detail in Sections 7.0 and 8.0.

Surface and subsurface soil samples were collected for analysis during the field investigation. Surface soil samples were collected prior to the initiation of the drilling program and test pit excavations, and subsurface soil samples were collected from the test pit excavations and borehole drilling.

Several rounds of ground water, surface water, and sediment samples were collected. The initial sampling event took place from January 12 through 14, 1987, and included the collection of six ground water samples, three surface water samples, and three sediment samples. Three additional ground water and surface water sampling events occurred in April and July 1987, and May 1989. In addition, a second stream sediment sampling event occurred during the May 1989 water sampling round. The May 1989 stream sediment samples were collected from 10 selected sampling locations used to define the areal extent of PAH compounds found during the January 1987 stream sediment sampling round.

During the field investigation, quality assurance/quality control (QA/QC) field blanks were taken for each sample matrix collected, except for the ground water samples. Field blanks were obtained for ground water collected during the first sampling event only, since permanent dedicated teflon bailers were installed in each monitoring well at that time. In addition, one blind duplicate per 10 samples (minimum of one duplicate per matrix) was taken during the three sampling events for QA/QC purposes. All samples were analyzed by NYSEG's Binghamton, NY, laboratory. In addition, during the first and second sampling events, duplicate ground water samples were sent to CompuChem Laboratories of Research Triangle Park, North Carolina for priority pollutant analyses (excluding the pesticide/PCB fraction).

4.7.1 Surface Soil Sampling

Two surface soil samples were collected on November 20, 1986, following procedures described in TRC Technical Standard TS-971, Field Procedures for Collection of Surface Soil Samples. Two samples were collected from the upper 6 inches at each location to determine the near-surface soil quality. These samples were collected prior to the drilling program and test pit excavations.

4.7.2 Test Pit Subsurface Soil Sampling

Sixteen subsurface soil samples were collected during test pit excavations on November 14, and November 18 and through 21, 1986. The subsurface soils were collected in accordance with TRC Technical Standard TS-973, Procedures for Logging and Collecting Subsurface Soil in Test Pit Excavations. Composite soil samples were collected from all test pit excavations. Samples were collected from zones of fill/waste material or from "visually clean" soil from beneath the contaminated zones to determine if leaching of contaminants into the "clean" soil is occurring. Sample descriptions are provided in Table 4-5.

4.7.3 Ground Water Sampling

Prior to ground water sampling, the water levels in the monitoring wells were recorded using an electronic water level indicator. Water level measurements were taken to the nearest one-hundredth foot (0.01) from a reference mark on top of the stainless steel riser and are presented in Table 4-4.

Prior to sampling, four times the volume of standing water in the well was evacuated from the monitoring wells using either an Instrumentation Specialties (ISCO) peristaltic pump or a dedicated teflon bailer. Dedicated lengths of 0.75-inch diameter clear flexible PVC tubing were used for discharge from the ISCO pumps.

Dedicated teflon bailers were installed during the first sampling event (January 12 through 14, 1987). Ground water samples were collected with these bailers in accordance with TRC Technical Standard T/S-975, Field Procedures for Collection of Ground Water Samples. Samples were preserved in the field in accordance with TRC Technical Standard T/S-959, Recommendations for Water and Soil Sample Volumes, Preservatives, and Holding Times. Samples for metals analysis were filtered prior to preservation in the field. In addition, measurements of pH, temperature, and specific conductance were taken for each monitoring well during sample collection.

4.7.4 Surface Water Sampling

Three surface water samples were collected during each sampling event. The samples were collected from Keuka Lake Outlet, which forms the southern boundary of the site. The surface water locations are presented in Figure 4-4. The sampling rationale for these locations is presented in Table 4-6.

Surface water samples were collected by submerging a dedicated laboratory-cleaned one-liter glass jar into the stream and filling sample jars from the contents of the one-liter jar. Collection of the samples started at the downstream sample location and continued to the upstream sample location (see Figure 4-4). This procedure was carried out to prevent downstream samples from becoming contaminated by artificially suspended sediment particles.

Samples were collected in accordance with TRC Technical Standard T/S-972, Field Procedures for Collection of Surface Water and Sediment Samples.

4.7.5 Stream Sediment Sampling

Three stream sediment samples were collected in conjunction with the first water sampling event in January at the locations shown on Figure 4-4. The rationale for the sediment sample locations is presented in Table 4-7. The sediment samples were collected in accordance with TRC Technical Standard T/S-972, Field Procedures for Collection of Surface Water and Sediment Samples.

A second stream sediment sampling round was performed during the fourth (May 1989) water sampling event. These stream sediment samples were collected from locations selected to better define the areal extent of PAH compounds found during the January 1987 sediment sampling event (Figure 4-5). The same sampling procedures described earlier were used during the May 1989 sediment sampling round.

4.8 Summary of Task 2 Field Investigation

The Penn Yan Task 2 field investigation was conducted in November 1986, with subsequent ground water and surface water sampling events in January, April, and July 1987, and May 1989. The work included the excavation of seventeen test pits, with concurrent air quality monitoring, and the installation of six monitoring wells. Soil samples were taken from surface soils, test pits, and test borings. Three sediment samples were collected during the first water sampling event, and ten sediment samples were collected during the fourth water sampling event.

5.0 LOCAL GEOLOGY, HYDROGEOLOGY AND SITE FEATURES

The Task 2 subsurface investigations, along with the geophysical survey conducted in Task 1, provided information on the geological and hydrological setting of the site. In addition, several suspected plant-related features and others of unknown origin were encountered during test pit excavations. These features are described in the following sections.

5.1 Site Geology

Data gathered during the drilling program and test pit excavations were used to define the bedrock and surficial geology beneath the Penn Yan site and are discussed in detail below.

5.1.1 Soils and Surficial Geology

The stratigraphy of the unconsolidated deposits at the site was determined through subsurface observations using test pit excavations and split spoon sampling in the boreholes. Continuous split spoon sampling was performed to a depth of between 40 and 55 feet at two locations within the site.

The unconsolidated sediments encountered were found to consist of three distinct units: 1) fill, 2) layers of brown clay, silt and sand, and 3) fine-to-coarse-grained sand with gravel and silt. Geologic profiles of each borehole are presented in Appendix B.

The fill appears to consist of a thin veneer of recent gravel fill over a thicker layer of fill containing rubble. The rubble fill was generally dark in color and contained large amounts of brick, foundation fragments, ash and wood chips. In addition, intact railroad ties were also encountered in the fill layer in the test pit excavations along Keuka Lake Outlet. In the northern portion of the site, test pit excavations encountered up to 11.3 feet of fill (TP-3); in the southern portion of the site the thickness of the fill was found to be from 9 (MW-2S) to 11 feet (MW-4S). Wood fragments were detected at monitoring well boring MW-3S at a depth of 15 feet, although this material was not clearly identifiable as fill.

Beneath the fill is a fine-grained unit consisting of a series of reddish-brown to dark brown layers of silt, clay, and sand. The upper portion of the unit, identified at all four boring locations, is predominantly silt; the lower portion of the unit, identified only in the two deep well borings, consists of layers of silt, clay, and fine sand. This stratigraphic unit extends down to a depth of approximately 35 feet below grade.

The fine-grained stratigraphic unit is underlain by fine-to-coarse-grained sand with gravel, cobbles, and silt that extends to a depth of at least 55 feet below-grade. The borehole drilling was terminated at this depth. Figure 5-1 presents a geologic cross-section of the site.

5.1.2 Bedrock Geology

Bedrock investigations were not performed during the Task 2 field investigation at the Penn Yan site. No information was located on the depth to bedrock for the Penn Yan site. The deepest monitoring well (MW-1D) drilled on site (55 feet) did not encounter bedrock and was completed in unconsolidated sediments. Bedrock underlying the Penn Yan site is expected to be the uppermost part of Genesee Formation, which consists of interbedded shales and mudstones (see Section 3.1.2 for description).

5.2 Hydrology

The site surface water and ground water hydrology are discussed in the following sections.

5.2.1 Surface Water

As previously mentioned, the former coal gasification plant lies in a low, flat area on the north bank of Keuka Lake Outlet. The surface runoff flows across the entire site from north to south and discharges into Keuka Lake Outlet (see Figure 5-2).

A United States Geological Survey (U.S.G.S.) gaging station is located on Keuka Lake Outlet 1/4 mile upstream of the site and has recorded data from 1965 to 1984. The average discharge at the station is 206 cubic feet per second (cfs). A minimum discharge of 3.2 cfs was recorded on September 6 through 10, 1982 (U.S.G.S, 1984). Flow into Keuka Lake Outlet is controlled by the Village of Penn Yan. The greatest percentage of annual surface runoff occurs during the months of March and April, while September is usually the low-flow month.

Average annual precipitation in the Penn Yan area is 32 inches. The highest average precipitation (17 inches total) occurs during the months of May through October. From November through April, most of the precipitation (15 inches total) occurs as ice or snow. The average mid-summer temperature is 71°F, while the average mid-winter temperature is 25°F (Crain, 1974). The average mean evapotranspiration (computed) is 22.1 inches with the highest rate occurring during the months of April through October (see Table 5-1) (Crain, 1974).

5.2.2 Ground Water Hydrology

The major aquifer of the Penn Yan area occurs within the thick layers of unconsolidated Quaternary glacial deposits. Measurements of depth to ground water and hydraulic conductivity tests were performed to characterize the hydrogeologic conditions of the Penn Yan site. Actual ground water elevations were calculated from the measured depths to water in the monitoring wells and the surveyed well riser elevations (see Table 5-2).

Water level elevation data from the shallow monitoring wells were used to develop water table contour maps. Water level measurements were taken during the four sampling events (January 1987, April 1987, July 1987, and May 1989), and during the hydraulic conductivity tests performed in February 1988 (Figures 5-3 through 5-7). The contours indicate that the general direction of shallow ground water flow is southeasterly from the site towards Keuka Lake Outlet. Ground water flow direction in the deeper sand zone screened by monitor wells MW-1D and MW-4D could not be determined with two wells.

Slug tests were performed in the monitoring wells at the Penn Yan site to provide estimates of the spatial variation of the hydraulic conductivity of the upper (water table) aquifer and to provide a limited amount of hydraulic information concerning the deeper aquifer. To perform a slug test, the water level in the monitoring well is raised or lowered instantaneously (or nearly instantaneously). The rate at which the water level in the well returns to its pre-test level is proportional to the hydraulic conductivity of the materials in which the well is screened.

For monitoring wells MW-4S and MW-4D, TRC used the displacement variation of the slug withdrawal technique to determine the hydraulic conductivity. A 10-foot section of solid stainless steel pipe was lowered into each well, displacing an amount of water equal to its volume. The water level was then allowed to return to its pre-test level. At this point, the stainless-steel pipe was quickly withdrawn thus lowering the water level by an amount equal to its volume. Water level measurements were periodically made with an electronic water level indicator as ground water in the wells recovered to its pre-test level.

Slug tests in monitoring wells MW-1S, 1D, 2S, and 3S were performed by extracting a known volume of water from the well and recording the water level recovery. This was completed using either a gas-powered centrifugal pump to quickly lower the water level or by quickly removing a known volume of water from the well by hand bailing. Water level measurements were made with a pressure transducer or an electronic water level indicator as the wells recovered to their static level.

The results of the slug tests at the Penn Yan site are presented in Appendix C and summarized in Table 5-3. Slug test data were analyzed using a computer program which computes hydraulic conductivities using the methods of Cedergren (1967) and Hvorslev (1951) (Thompson, 1987). Results from the slug tests show that the hydraulic conductivity of the upper aquifer varies across the site from 0.1 ft/day to 1.8 ft/day. It should be stressed that slug test results are highly dependent on well construction and well development techniques. In addition, for wells partially screened in fill material (MW-2S, 3S, 4S) variations of hydraulic conductivity values by over an order of magnitude are not unusual. Therefore, results from these tests should be considered only as order-of-magnitude estimates as the test measures the hydraulic conductivity in the immediate vicinity of the well screen.

The average linear ground water flow velocity can be estimated using the equation $\bar{V} = (K/n)(dH/dL)$ (Freeze and Cherry, 1979) where:

$\bar{V}$ = the average linear velocity (ft/day)
K = the hydraulic conductivity (ft/day)
n = the effective porosity of the aquifer (dimensionless)
dH = the difference in the water level or potential at two points on a line
dL = the horizontal distance measured between two points perpendicular to contours on the water table surface.

Values of hydraulic conductivity (K) were estimated based on the results of the slug tests. Porosities were estimated to be 30 percent. The average horizontal ground water gradient of 0.03 ft/ft was calculated from water level contour maps, and the average hydraulic conductivity of the shallow aquifer computed from the slug tests was 0.7 ft/day. The calculated average linear flow velocity of shallow ground water, based on the values presented above, is estimated to be 0.07 ft/day or 26 ft/year. Formations screened by the deep monitoring wells demonstrated a slighlty higher hydraulic condcutivty compared to the shallow zones. Flow velocities could not be calculated as gradient data was not available. As discussed earlier, values of hydraulic conductivity determined from slug tests provide only order-of-magnitude estimates of the hydraulic properties of the aquifer. Therefore, the calculated ground water flow velocity at the Penn Yan site should only be considered an estimate.

The vertical hydraulic gradient between shallow and deep aquifer zones is of interest for determining whether there is a potential for vertical contaminant migration. At the Penn Yan site, downward vertical hydraulic gradients were measured in the unconsolidated sediments at the monitoring well pair MW-1S/1D in the western portion of the site (see Table 5-2). The consistently higher hydraulic head (water level elevation) in monitoring well MW-4D compared to that of monitoring well MW-4S indicates the potential for upward flow across the silt and clay layers under the southeastern portion of the site.

5.3 Plant-Related Features

Test pit excavations were instrumental in confirming the location of gas-plant-related features, including the tar storage vessel, gas relief holder, and waste disposal areas.

The foundation of the former gas relief holder was encountered in test pit TP-9. The concrete base of the relief holder was encountered at a depth of 3.8 feet, and the inside of the relief holder was observed to contain "clean" sandy fill.

Manufactured gas plant-related wastes were found in test pits TP-15, 16, 17, 18 and 19 (in between the building and Keuka Lake Outlet). The wastes included ash, coal clinkers, brick and wood pieces, and coal-tar-stained clay. These five test pits ranged from 4 to 6 feet in total depth. Test pit TP-9, excavated near the former holder, encountered fill, including clinkers, and the brick holder wall. Test pits TP-2, 3, 4, 8, 10, 14 and 20 contained minor amounts of miscellaneous construction debris including wood chips and brick pieces. Test pits TP-5, 6, 7, and 11 contained no evidence of coal tar or coal gasification-related wastes. The soils observed in these test pits are considered to represent background conditions at the Penn Yan site.

Figure 4-2 does not show test pits TP-1, 12 and 13 as indicated in the original work plan since they were omitted from the excavation program. Test pit TP-1 was omitted due to existing underground utilities. Test pits TP-12 and TP-13 were located in areas of densely packed gravel and were nearly impossible to dig with a backhoe. Therefore, these test pits were relocated and renumbered as B-1, 19, and 20, respectively.

5.4 Summary

The subsurface investigations conducted during Task 2 determined the site stratigraphy to a depth of approximately 55 feet. The site stratigraphy includes fill, fine-grained sand, silt, and clay which is underlain by sand. If continuous, these silt and clay units may act as a confining layer, separating the limited upper aquifer from the lower fine-to-coarse-grained sand aquifer.

The hydrological data indicates that the shallow ground water beneath the site flows generally to the southeast toward Keuka Lake Outlet. Horizontal hydraulic conductivity measurements obtained from the shallow monitoring wells are at the low end of the published range for a silty sand, 1×10^{-1} to 1×10^{-5} cm/sec (300 to 0.03 ft/day) (Freeze and Cherry, 1979). The locations of the gas relief holder and former plant waste disposal areas were confirmed by the test pit excavations.

6.0 ANALYTICAL METHODS

TRC, CompuChem, ENSECO-ERCO, and NYSEG laboratories performed the laboratory analyses on soil, ground water, surface water, sediment and air quality samples collected at the Penn Yan site during the Task 2 investigation.

The TRC, NYSEG, and ENSECO-ERCO analytical laboratories were certified by the New York State Health Department to perform analysis on potable and non-potable water sources, soils, and sediment samples (the TRC laboratory is no longer operating). CompuChem and ENSECO-ERCO are United States Environmental Protection Agency (U.S. EPA) approved laboratories and perform analytical programs in accordance with Contract Laboratory Protocols.

6.1 Soil Analysis

All soil and stream sediment samples collected during the Task 2 field investigation were analyzed for organic and inorganic parameters. The subsurface soil samples collected during test pit operations were analyzed with a gas chromatograph (GC); however, Method 8100 was modified by the use of a capillary column on the GC, resulting in better peak resolution than is ordinarily possible with packed columns. The samples were analyzed according to the following EPA methods:

- Method 8020 - Aromatic Volatile Organics
- Method 8040 - Phenols
- Method 8100 - Polynuclear Aromatic Hydrocarbons

Inorganic chemical analyses were also performed on the soil samples. The following list presents the parameters and the EPA method numbers for the inorganic compounds analyzed:

Parameter	Method Number
Arsenic	7060
Cadmium	7130
Chromium	7190
Iron	7380
Lead	7420
Zinc	7950
Organic Nitrogen	351.3
Total Cyanide	9010
Complex Ferro/Ferric Cyanide	9010
Sulfate	9035

In addition, duplicate splits of two subsurface soil samples (TP-4, TP-19) and all of the stream sediment samples were analyzed for organic compounds by gas chromatograph/mass spectrometer (GC/MS) techniques according to the following EPA Methods:

- Method 8240 - Volatile Organics
- Method 8250/8270 - Acid/Base-Neutral Extractables

The two subsurface soil samples (TP-4 and TP-19) were analyzed according to EPA Methods for the following compounds:

Parameter	Method Number
Antimony	7040
Arsenic	7060
Beryllium	7090
Cadmium	7130
Chromium	7190
Copper	7210
Lead	7420
Mercury	7470
Nickel	7520
Selenium	7740
Silver	7760
Thallium	7840
Zinc	7950
Phenol	9065
Cyanide	9010

The stream sediment samples were analyzed according to EPA Methods for the following compounds:

Parameter	Method Number
Iron	7380
Zinc	7950
Total Cyanide	9010
Amenable Cyanide	9010
Total Organic Carbon	9060
Total Solids	3050

6.2 Water Analysis

Ground water and surface water samples, which were collected during four sampling rounds, were analyzed for organic compounds by GC/MS techniques in accordance with the following methods:

Method 624 - Purgeables
Method 625 - Base/Neutral and Acid Extractables

Inorganic chemical analyses were also performed on the water samples. The following presents the parameters, and method numbers for the inorganic compounds analyzed:

Parameter	Method Number
Arsenic	206.2
Cadmium	213.2
Chromium	218.2
Iron	236.1
Lead	243.2
Mercury	245.2
Zinc	289.1
Sulfate	375.2
Organic Nitrogen	351.3
Total Cyanide	335.2
Total Organic Carbon (TOC)	415.1

During each of the first two sampling events, a duplicate pair of ground water samples (MW-4S in round 1, MW-2S in round 2) were also analyzed for organic compounds by GC/MS techniques in accordance with the following methods:

Method 624 - Purgeables
Method 625 - Acid and Base/Neutral Extractables

Inorganic chemical analyses were also performed on the water samples; the samples were analyzed for the following chemical constituents:

Parameter	Method Number
Antimony	204.1
Arsenic	206.2
Beryllium	210.2
Cadmium	213.2
Chromium	218.2
Copper	220.2
Lead	243.2
Mercury	245.2
Nickel	249.2
Selenium	270.2
Silver	272.2
Thallium	279.2
Zinc	289.1
Total Cyanide	335.2

6.3 Air Sample Analyses

Various air quality samples were taken on-site utilizing charcoal tubes, XAD-2 (silica gel) tubes, and teflon filters. Each filter set consisted of a charcoal tube on one pump and a filter and sorbent sampling train on the second pump (2 micron, 37 millimeter PTFE plus washed XAD-2 100 milligrams/50 milligrams). The air samples were analyzed using GC/MS techniques in accordance with NIOSH Method 5515.

7.0 ANALYTICAL RESULTS

The analytical results from soil, ground water, surface water, stream sediment, and air quality samples taken during the Task 2 field investigation are presented in this section, including a summary discussion on the analytical aspects of the data. A detailed interpretation of the data is discussed in Section 8, Data Analysis.

The tables included in this section are summary tables which include only detected compounds; i.e., a value is entered if it is greater than the detection limit. Some constituents which were analyzed do not appear on these tables because they were not detected in any samples. The complete analytical data packages are presented in Appendices D, E, F, and G.

7.1 Surface Soil Samples

Two surface soil samples were analyzed for purgeable aromatics, polynuclear aromatic hydrocarbons, non-chlorinated phenols, and inorganic compounds. The positive analytical results for the two surface soil samples are presented in Table 7-1.

One volatile organic compound, benzene, was detected in trace concentrations in both surface soil samples. Nine polynuclear aromatic hydrocarbon compounds (PAHs) were detected in trace concentrations in one surface soil sample, PY-SS-02. The compounds include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-c,d)pyrene, phenanthrene, and pyrene. The concentration of total PAHs in sample PY-SS-02 was 29.2 parts per million (ppm).

7.2 Subsurface Soil Samples

Fifteen subsurface test pit soil samples and one boring subsurface soil sample were collected for purgeable aromatic, PAH, non-chlorinated phenol and inorganic analysis. Subsurface samples were not collected from test pits TP-7 or TP-20 (no apparent MGP wastes or positive OVA readings were observed, and nearby test pits were sampled). Two additional (duplicate) samples were collected from TP-4 and TP-19 and analyzed for priority pollutants, excluding the pesticide/PCB fractions. The sampling locations are shown in Figure 7-1. The analytical results for the subsurface soil samples are presented in Table 7-2.

Four purgeable aromatic compounds were detected in trace concentrations in the test pit subsurface soil samples. The compounds include benzene, 1,4-dichlorobenzene, ethylbenzene, and toluene.

Four test pit samples contained trace concentrations of purgeable aromatics with the highest concentration (11.76 ppm) detected at test pit TP-15. Approximately 75 percent of the samples submitted for analyses did not have any detectable concentrations of purgeable aromatic compounds.

Sixteen polynuclear aromatic hydrocarbon compounds were detected in various concentrations in the test pit subsurface soil samples. The compounds include acenaphthylene, acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-c,d)pyrene, naphthalene, phenanthrene and pyrene. In addition, four non-chlorinated phenols (2,4-dimethylphenol, 2-methyl-4,6-dimitrophenol, 4-nitrophenol, and phenol) were detected in various concentrations.

The majority of the test pit soil samples contained at least minor concentrations of some PAHs. The concentration of total detected PAHs ranged from below detection limits in test pit samples TP-2 and TP-14 to 637 ppm in TP-19.

Three samples (test pits TP-15, TP-16, and TP-19) contained detectable concentrations of non-chlorinated phenols. The concentrations ranged from 6.9 ppm in test pit TP-19 to 35.3 ppm in test pit TP-15.

The following presents a brief summary of the heavy metal and inorganic compounds detected in the test pit subsurface soils:

- Arsenic concentrations ranged from 6.17 ppm in test pit TP-17 to 15.3 in test pit TP-10.
- Cadmium was not detected in the test pit analyses.
- Chromium concentrations ranged from 7.18 ppm in test pit TP-17 to 20.8 ppm in test pit TP-2.
- Iron concentrations ranged from 9,270 ppm in test pit TP-17 to 25,200 ppm in test pit TP-2.
- Lead concentrations ranged from 27.4 ppm in test pit TP-5 to 708 ppm in test pit TP-4.
- Zinc concentrations ranged from 43.4 ppm in test pit TP-6 to 403 ppm in test pit TP-4.
- Organic nitrogen concentrations ranged from 180 ppm in test pit TP-6 to 2,720 ppm in test pit TP-17.
- Sulfate concentrations ranged from 50 ppm in test pit TP-2 to 1,080 ppm in boring sample PY-B-1S.
- Ferro-ferric cyanide concentrations ranged from 0.23 ppm in boring sample PY-B-1S to 8.14 ppm in test pit TP-15.

Most test pits and the boring (B-1/MW-1S) encountered fill materials of some kind. The soil sample from test pit TP-2 showed no detectable concentrations of PAHs, aromatic hydrocarbons, phenols or cyanides, so, for purposes of comparison, analytical results for sample PY-TP-2 will be used for "background" comparison (Section 8.1.1).

7.3 Ground Water Samples

Task 2 ground water samples were collected in January, April, and July 1987 and May 1989. The ground water samples were analyzed for purgeable aromatics, polynuclear aromatic hydrocarbons, non-chlorinated phenols, heavy metals, and inorganic compounds. During the January and April sampling events, two additional duplicate water quality samples were collected and submitted for priority pollutant analyses excluding the pesticide/PCB fractions.

The analytical results for the ground water quality samples are presented in Table 7-3. Specific conductance, pH, and temperature were measured at each sampling location at the time of collection and the results are presented in Table 7-4. (NOTE: Third round (July 1987) samples for purgeable aromatics exceeded holding times, and should be considered low-end concentrations.)

The following presents a summary of compounds detected in the ground water samples collected from the on-site monitoring wells:

- Three purgeable aromatic compounds, acetone, methylene chloride, and trichloroethene, were detected.
- No acid extractable compounds were detected.
- Four base/neutral extractable compounds were detected in trace concentrations: bis(2-ethylhexyl) phthalate, di-n-octyl phthalate, 2,6-dinitro-toluene, and n-nitrosodimethylamine.
- Four heavy metals were detected: arsenic (only at MW-1D), chromium (only at MW-1S), iron, and zinc.
- Total organic carbon concentrations ranged between 1.1 mg/l (MW-4D) and 57 mg/l (MW-2S).
- Sulfate concentrations ranged between 6.3 mg/l (MW-4D) and 438 mg/l (MW-1S).

- Organic nitrogen concentrations ranged between 0.04 mg/l (MW-4S and MW-4D) and 9.22 mg/l (MW-4S).
- Total cyanide concentrations ranged between 0.08 mg/l (MW-3S) and 0.23 mg/l (MW-1S). Cyanide was not detected in MW-1D, 2S or 4D.
- Ferro-ferric cyanide was detected (0.04 mg/l) in monitoring well MW-3S during the first sampling round only.
- pH values ranged between 5.93 and 8.00 standard units.
- Specific conductivity ranged between 175 and 1,960 µmhos/cm.

Three purgeable aromatic compounds were detected in the ground water samples: acetone, methylene chloride and trichloroethene. In the first round, a trace concentration of methylene chloride was detected in the ground water samples from monitor wells MW-1D and MW-4D. Methylene chloride was also detected in the method and/or instrument blank, and so is attributed to laboratory or equipment contamination. In the second round, a trace concentration of trichloroethene (TCE) was detected in the ground water sample from monitor well MW-3S. TCE was also detected in a surface water field blank (Appendix G, Table G-33) collected and analyzed on the same dates as the MW-3S sample, therefore, the TCE was most likely introduced in the laboratory. The only other purgeable aromatic compound detected in the ground water samples was acetone. Acetone was detected in all of the ground water samples collected during the first sampling event and in trace concentrations during the second sampling event in the ground water sample from monitoring well MW-3S. Sources of acetone contamination are attributed to residual acetone present on the teflon bailers from the initial cleaning process performed on January 1, 1987. Equipment blanks collected on that date showed the presence of acetone (Appendix F, Table F-41). Acetone was not detected in the ground water samples during the third or fourth sampling events. Acetone, methylene chloride and trichloroethene are not chemicals associated with the manufactured gas process.

Four base/neutral extractable compounds were detected in trace concentrations in the ground water samples. Two of the base/neutral extractable compounds [bis(2-ethylhexyl)phthalate and di-n-octyl phthalate] are common phthalate esters present in many laboratories. In addition, the presence of phthalate compounds (plasticizers) in environmental samples can also be attributed to the gloves used by field personnel when collecting samples. Detectable bis(2-ethyl hexyl) phthalate concentrations ranged between 0.017 mg/l (MW-1S, second round) and 0.17 mg/l (MW-1D, third round). Detectable di-n-octyl phthalate concentrations ranged between 0.011 mg/l (MW-1S, second round) and 0.022 mg/l (MW-4S, second round). Detectable concentrations of 2,6-dinitrotoluene ranged between 0.026 mg/l (MW-4S, third round) and 0.142 mg/l (MW-3S, third round). In addition, n-nitrosodimethylamine was detected in monitoring wells MW-2S, MW-3S and MW-4S during the third sampling round but not detected in samples collected during the other three sampling rounds. Concentrations ranged between 0.041 mg/l (MW-2S) and 0.046 mg/l (MW-4S). These four base/neutral compounds are not typically associated with MGP wastes (GRI, 1987).

7.4 Surface Water Samples

Three surface water samples were collected during each of the ground water sampling events. The surface water samples were analyzed for purgeable aromatics, polynuclear aromatic hydrocarbons, non-chlorinated phenols, heavy metals, and inorganic compounds. The analytical results for the surface water samples are presented in Table 7-5. In addition, specific conductance, pH, and temperature were measured at each sampling location at the time of collection and the results are presented in Table 7-6.

The following presents a summary of compounds detected in the surface water samples:

- One purgeable aromatic compound (acetone) was detected in all of the surface water samples during the first sampling round. Concentrations ranged between 0.027 mg/l (SW-3) and 0.615 mg/l (SW-1).
- No acid extractable compounds were detected in the surface water samples.
- Three base/neutral extractable compounds were detected in the surface water samples. The compounds include acenaphthene, acenaphthylene, and bis(2-ethylhexyl) phthalate.
- Five heavy metals were detected in the surface water samples. The metals include cadmium, iron, lead, mercury and zinc. Low values of lead were detected at SW-1 only during the fourth sampling round.
- pH values ranged between 5.90 and 9.25 standard units.
- Specific conductivity values ranged between 190 and 320 µmhos/cm.
- Total organic carbon concentrations ranged between 2.2 mg/l and 7.0 mg/l.
- Sulfate concentrations ranged between 20.6 mg/l and 30.3 mg/l.
- Organic nitrogen concentrations ranged between not detected and 0.46 mg/l.
- Total cyanide concentrations ranged between not detected and 0.02 mg/l. Cyanide was detected only once during the Task 2 surface water sampling (at SW-1, third sampling round).
- Ferro-ferric cyanide was not detected in the surface water samples.

The only purgeable aromatic compound detected in the surface water samples was acetone. Acetone was detected in all the surface water samples during the first sampling round. The highest concentration (0.615 mg/l) was detected at the upgradient surface water sampling location. The lowest concentration (0.027 mg/l) was detected at the downgradient surface water sampling location. Acetone was also detected in a field blank (Appendix G, Table

G-33). Therefore, the concentrations found in the surface water samples are concluded to be related to the glassware cleaning prior to sampling or laboratory interference, as acetone is used by many laboratories.

Three base/neutral extractable compounds were detected in trace concentrations in the surface water samples. Acenaphthene (0.011 mg/l) and acenaphthylene (0.074 mg/l) were detected at the upgradient sampling location (SW-1) during the third sampling round. These two PAH compounds were not detected in surface water locations SW-2 and SW-3. The concentrations found at SW-1 are possibly related to asphalt material and runoff from the Liberty Street Bridge. Bis(2-ethylhexyl) phthalate was detected at all three sampling locations during the second sampling round. Concentrations ranged between 0.024 mg/l and 0.733 mg/l. As noted earlier, the phthalate compounds are attributed to gloves used by field personnel when collecting water samples or to laboratory contamination, as these compounds are not associated with MGP wastes.

7.5 Stream Sediment Samples

Stream sediment samples were collected during the first (1/13/87) water sampling round and the fourth (5/4/89) water sampling round. During the first sampling round, three stream sediment samples were collected at the same locations as the surface water samples. Based on the results of the initial three sediment samples, a second round of sediment sampling was performed. The second round included 10 sediment sample locations which were placed to verify the results of the first round and define the areal extent of contamination. All the sediment samples were analyzed for purgeable aromatics, polynuclear aromatic hydrocarbons, non-chlorinated phenols, heavy metals, and inorganic compounds. The analytical results for the sediment samples are presented in Table 7-7. The following presents a summary of compounds detected in the sediment samples:

- No purgeable aromatic or acid extractable compounds were detected in the sediment samples.
- Eighteen base/neutral extractable compounds were detected in the sediment samples. The compounds include acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene, bis(2-ethylhexyl)phthalate, butyl benzyl phthalate, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-c,d)-pyrene, naphthalene, phenanthrene, and pyrene. Polynuclear aromatic hydrocarbons were detected in 5 sediment samples (SD-2 and SD-3 round 1 and SD-2, SD-4 and SD-5 in round 2). Total PAH concentrations ranged between not detected at SD-1 to 2,674 at SD-2 during round 1. During round 2, total PAH concentrations ranged from not detected to 27.0 ppm at SD-2.
- Seven heavy metals, arsenic, cadmium, chromium, iron, mercury, lead, and zinc, were detected in the sediment samples.
- Total organic carbon concentrations ranged between 1,500 ppm and 129,000 ppm.
- Sulfate, organic nitrogen, total cyanide, or ferro-ferric cyanide were not detected in the sediment samples.

7.6 Air Samples

The charcoal tube samples, XAD tubes, and teflon filters were analyzed for volatile organic compounds (using charcoal tubes) and polynuclear aromatic hydrocarbons (using XAD tubes and teflon filters). The analytical results are presented in Table 7-8.

The only two volatile organics detected in the air samples were benzene (0.0008 mg/m^3 - 0.0031 mg/m^3) and trace concentrations of toluene. The reported values for benzene in the upwind and source samples should be considered as estimated (trace) concentrations. Benzene was found at detectable levels in the method blank and is typically found in the carbon disulfide solution used to desorb charcoal tubes. Therefore, this value was subtracted out of the detected concentrations found in the three air quality samples. However, when this evaluation was completed for the upwind and source air sample locations, the resultant concentration was below the instrument detection limits. Naphthalene was the only PAH compound detected in the air samples; concentrations ranged from 0.008 mg/m^3 to 0.010 mg/m^3.

8.0 DATA EVALUATION

The data presented in this report are evaluated with respect to the distribution of constituents in the environment, measured concentrations of the constituents, potential health risks due to the presence of these constituents, and remedial alternatives which may need to be considered.

8.1 Environmental Interpretation

In the following sections the distribution of constituents in the environment is related to past and present land uses.

8.1.1 Soil and Sediment

PAHs were detected in the test pit soils, surface soils, and sediment samples. The highest concentration of total PAHs was found in stream sediment sample SD-2 from Keuka Lake Outlet.

Of the two surface soil samples, relatively low levels of PAH compounds were detected in SS-2, located in the former gas relief holder area. Surface soil sample SS-1, collected just southeast of the stone building, did not contain any detectable levels of PAH compounds.

The highest concentrations of total PAHs in the test pit soil samples were in samples from test pits TP-16, 17 and 19. These test pits are located in the southeast portion of the property. Test pit TP-16 was located adjacent to the tar storage vessel. Test pits TP-17 and TP-19 are located east and west of the tar storage vessel along the former railroad spur. The elevated concentrations in these test pits and evidence of coal tar in TP-19 suggest that coal gas manufacturing residues remain in this area, possibly related to transfer of accumulated coal tars into railcars. However, the lower PAH concentrations observed in soil samples from test pits TP-14 and TP-15 (located between TP-19 and the tar storage vessel) suggest that the PAH occurrences in this area are not continuous. Most of these test pits also contained detectable concentrations of the other chemical groups (purgeable aromatics, phenols, cyanides, and other organic compounds).

PAH compounds were detected at five of the ten stream sediment sampling locations. The highest PAH concentration was found at SD-2 (round 1), which is adjacent to the tar storage vessel. The four remaining sediment samples where PAHs were detected [SD-3 (round 1) and SD-2, 4, 5 (round 2)] contained total PAH concentrations two orders of magnitude lower. The presence of high concentrations of PAHs in sediment samples from adjacent to the tar storage vessel suggests the storage vessel as a source. PAH occurrence at locations SD-2 and SD-5 (second round) and SD-3 (first round), in the absence of upstream sediment samples containing PAHs, suggest the site as a source but no clear pattern of occurrence is apparent. Figure 8-1 displays the distribution of PAHs in the sediments during round 1 and round 2.

8.1.2 Ground Water and Surface Water

The ground water and surface water samples contained low concentrations of selected base/neutral and volatile organic compounds. However, most of the compounds detected in these two chemical groups are attributed to residual contamination from decontamination of field equipment (acetone), common laboratory contaminants (acetone, methylene chloride and phthalate esters) or were present in a field blank (trichloroethene).

The base/neutral compounds 2,6-Dinitrotoluene and n-Nitrosodimethylamine were detected in ground water samples from three monitor wells collected in July 1987. As these compounds were not detected in previous or subsequent sample rounds, the source and significance of these observations are not known. Other than these compounds, all other base/neutral compounds in the ground water matrix are below detection limits.

Ground water sample results for volatile organic compounds show no positive results for analytes other than those attributed to external contaminants. (Although the data reported for the third round purgeable aromatics were all below detection limits, these samples exceeded the maximum 14-day holding time before the samples were extracted and should be considered low-end concentrations.) Ground water samples collected during the fourth round also do not indicate the presence of purgeable aromatic compounds in the samples.

Also worthy of note are the concentrations of sulfate and total cyanide and the specific conductivity of ground water samples from monitor wells MW-1S, MW-3S and MW-4S. In the case of sulfate, the highest concentrations were consistently observed at the background well MW-1S, with lesser but consistent observations of sulfate in other ground water samples. Total cyanides appear consistently only in samples from the three shallow wells noted above; no consistent pattern of concentrations across the site was noted. Specific conductivity was consistently greater at the MW-1S background location than at other locations; this may be due to the presence of other ions not analyzed for, such as those derived from road salt or from sanitary sewers. The boring for monitor well MW-1S did encounter fill materials, therefore, any analytes detected in samples from MW-1S may not represent true background conditions. Despite the presence of these analytes, no consistent pattern of increase across the site was noted.

Two PAH compounds, acenaphthene and acenaphthylene, were detected in the upgradient surface water sample SW-1, during only the third sampling round. No PAH compounds were detected in the downgradient surface water samples during any of the four rounds of samples. No volatile organic compounds, other than those attributed to external contamination, were detected in the surface water samples.

8.1.3 Air Quality

The air quality samples collected during the test pit excavation program show that only one PAH compound (naphthalene) was detected in all the samples. The concentration of naphthalene was similar in the three samples (within 0.02 ppm) and was, in fact, the same for the upwind and source samples. This is due largely to the locations of the upwind and source samples (see Figure 4-2), where small changes in wind direction could easily transport airborne contaminants to the upwind sampling location.

The reported values for the volatile organic compounds indicate that only trace concentrations of toluene were found in the upwind sample. Benzene was detected in all air quality samples, including the blank. After compensating for the concentration of benzene in the blank, no significant concentrations of benzene were detected in the ambient air samples.

8.2 Comparison to Regulatory Standards

In this section, the concentrations of constituents detected at the site are compared to state standards and guidance values. Standards differ from guidance values in that the latter have not yet been made into law. Regulatory information was used from the New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH). These two sources differ in that the NYSDOH focuses on criteria developed for public drinking water supply companies and is included in Part 5 of the State Sanitary Code. The NYSDEC criteria includes a listing of individual organic parameters and other compounds, each of which have a standard or guidance value. The NYSDEC regulatory criteria have been developed to protect New York State waters for their best classified use. Because NYSDEC standards and guidance values are in all cases equal to or stricter than federal criteria, federal standards and guidance values will be considered only when NYSDEC and NYSDOH criteria do not exist. No state or federal standards or guidance values exist for soils or sediments.

8.2.1 Ground Water

Table 8-1 lists the NYSDEC and NYSDOH criteria for each analyte detected (except those detected in blank or common lab contaminants) and the sample locations which exceeded a given standard or guidance value. In most cases, compounds detected in ground water samples from all six monitor wells were below the regulatory criteria for the volatile organic compounds, acid extractables and the base/neutral extractable (PAH) compounds. The only exception was the presence of dinitrotoluene in samples from the three downgradient monitor wells during the third sampling round only. Detectable concentrations of cyanide appear consistently in monitor wells MW-1S, MW-3S and MW-4S and were occasionally above NYSDEC standards. In addition, the ground water samples from all six monitor wells were within the NYSDEC-regulated total organics value of 0.1 ppm. The observed concentrations for iron were above the NYSDEC and NYSDOH criteria in several samples; however, the iron concentrations may be due to natural occurring high background concentrations found in the area. Values for sulfate (NYSDEC and NYSDOH criteria) were exceeded in MW-1S during the first and second sample rounds. In addition, NYSDEC criteria for pH was found outside the range of 6.5-8.5 at MW-1S (second and fourth round) and MW-4S (second round).

8.2.2 Surface Water

Keuka Lake Outlet is classified by NYSDEC as a Class C surface water body in the Western Oswego River Basin. Class C status is defined as protection for fishing and fish propagation. When comparing the results of the surface water samples to the Class C regulatory criteria, all analyzed parameters for the three locations were within the Class C regulatory criteria during all four sampling rounds, except for pH. Values of pH were found outside the range of 6.5-8.5 at all three sample locations during only the third and fourth sample rounds. This suggests that an upstream source was responsible for the pH changes during these two sampling events. However, when comparing to NYSDOH standards, SW-1 exceeded Unspecified Organic Contaminant (UOC) criteria (third round only) and iron (fourth round only).

8.2.3 Air Quality

Two air guidance documents were examined to determine guidance values for the air quality samples collected at the site. The sources included the NYSDEC Air Guide-1 and the American Conference of Governmental Industrial Hygienists (ACGIH). The NYSDEC Air Guide-1 includes guidelines for the control of toxic ambient air contaminants. The ACGIH establishes threshold limit values (TLVs) regarding airborne concentrations of substances under which nearly all workers may be repeatedly exposed without adverse effect. Of these two sources, the ACGIH guidance values seem more appropriate since the air quality samples were collected during the Task 2 subsurface excavations. (Similarly, workers involved with on-site excavations for maintenance, construction, or remediation could be subjected to inhalation exposure.) Therefore, the compounds detected in the air quality samples were compared to

TLVs established by the ACGIH. The concentrations of the detected compounds were more than two orders of magnitude less than their TLVs.

8.3 Preliminary Risk Assessment

The health and environmental concerns at the Penn Yan Site are a function of contaminant concentrations, exposure routes, and potential receptors. In the previous section, constituent concentrations were compared to existing criteria. In this section, pathways of exposure and potential receptors are identified. This preliminary risk assessment was developed to assess the site as it presently exists. Terms and concepts are explained in the text and potential exposure routes are discussed.

8.3.1 Transport and Exposure Pathways

The pathway of exposure involves both the transport of the constituents through the various media and a route of exposure into the human body or other biological receptors.

Transport is largely governed by the physical and chemical characteristics of the constituents and the media involved. Thus, the transport and fate of the PAHs are more strongly linked to the transport of soil (windborne dust) because of the low solubility of PAHs and high tendency of PAHs to adsorb to the soil. Metals also tend to adsorb to soil particles. Phenols, however, are highly soluble and tend to be transported with the ground water. Their transport is somewhat limited, however, by bacteria which consume them. The purgeable aromatics tend to volatilize or dissolve in ground water.

Variations from these generalizations do occur. Naphthalene, with the lowest molecular weight of the PAHs, is both moderately soluble and volatile.

Furthermore, because of their potency as animal carcinogens, transport of even trace levels of some PAHs in ground water constitutes significant transport.

The other half of the exposure pathway equation involves routes of exposure to the human body. They include inhalation, ingestion, and dermal absorption. Any airborne contaminants that can be classified as gases, vapors, or particulate matter can be inhaled directly into the lungs. Inhalation as a route of entry is of particular concern due to the rapidity with which a toxic material can be absorbed in the lungs, pass into the blood stream, and reach vital organs. Ingestion as a route of entry involves the actual eating or drinking of contaminated soil or water and absorption of soluble toxins through the gastrointestinal tract. Chemicals may also enter the bloodstream through the swallowing of inhaled dust or by placing contaminated fingers on food or directly in the mouth. Dermal exposure (direct contact between the constituents and skin) can occur by contacting contaminated soil or water, or by the absorption of chemicals when dust settles on the skin.

8.3.2 Potential Receptors

The Penn Yan site is in a commercial area. The site is bordered on the west by Liberty Street and on the east by the Yates-Blodgett Grainery. Water Street forms the northern border, with a car dealership and two residences on the northern properties. A small park/picnic area exists south of the site, across Keuka Lake Outlet. Children and adults pass by on Liberty and Water Street. The site is periodically visited by NYSEG employees to check and maintain the on-site gas monitoring block building. Other on-site activities include: indoor and outdoor work by employees of the car dealership, visits by customers to the car dealership, and use of the self-storage warehouse by customers or employees. In addition, Keuka Lake Outlet is used as a recreational stream attracting boaters and fisherman. Future site activities may include remediation.

This section describes the fate and transport mechanisms leading to potential exposures at the Penn Yan sites. Each media sampled during the Task 2 investigation (soils, ground water, sediment, surface water and air) will be discussed.

8.3.2.1 Soils

Two surface soil samples were collected at the site. The highest concentration of PAH compounds detected in the surface soils at the Penn Yan site was 29.2 ppm at location SS-2. Risks to the general public are considered to be relatively minimal since this location was recently covered with a layer of dirt fill by the current owner. Surface soil sample SS-2 was collected at the former gas relief holder location. The PAH concentrations in surface soil sample SS-1 collected between the old Gas Works building and Keuka Lake Outlet could not be detected.

At two select areas on-site the subsurface soils could pose a slight risk to workers involved in subsurface excavations. These areas are the former gas relief holder and the area adjacent to the tar storage vessel. Workers completing excavations on-site either for utility maintenance, construction or remediation could be subjected to risks associated with inhalation or dermal exposure.

8.3.2.2 Ground Water

Based on the results of the chemical analyses, the ingestion of ground water is considered to be a low-risk at the Penn Yan site. Ground water production rates in the vicinity of the site are estimated to be between 0.5 to 1 million gallons per day per square mile (Crain, 1974). However, Penn Yan receives its drinking water through the municipal water supply coming from Keuka Lake located approximately 1½ miles upstream of the site. This is based on all potential recharge and available storage capacity. Due to the exclusive use of the municipal water supply, none of the three known wells in the vicinity are used as a domestic water source. Of the three wells existing in the area (Crain, 1974), two were unused and one was used as an industrial water source. This well (U.S.G.S. #23-30) was drilled in 1966 and used by Comstock Foods, Inc. However, a recent conversation with Mr. John Jensen, the Penn Yan water treatment plant operator, said that Comstock Foods sold their facility to Roto Salt, Inc. in the early 1970s. Mr. Ed Monaghan, the facility engineer of Roto Salt Inc., said that all the water used in the facility comes from the municipal water supply, and that the on-site well has been inactive since the early 1970s.

8.3.2.3 Surface Water

The results of the Task 2 investigation indicate that all analyzed parameters were within the NYSDEC drinking water criteria (except pH) but exceeded NYSDOH criteria for UOCs and iron. It is assumed that some degree of hydraulic connection exists between the shallow ground water in the site area and Keuka Lake Outlet. This would result in some discharge of shallow ground water to the surface water. However, ingestion of the surface water as a drinking water source is not considered a risk factor at Penn Yan, since a city water system serves the community, as stated previously. A potential does exist for ingestion and/or dermal contact by the general public using Keuka Lake Outlet as a recreational stream (i.e., fishing, swimming, etc.).

8.3.2.4 Stream Sediment

PAH compounds were detected in the stream sediment at the Penn Yan site. Since Keuka Lake Outlet is assumed to be used by the general public as a recreational area, exposure to the stream sediments via ingestion (directly from sediment or eating fish) and dermal contact is a potential risk factor.

8.3.2.5 Air

The air quality samples collected during the Task 2 investigation did not contain concentrations of the analyzed parameters above the ACGIH TLVs; therefore, exposure to above-ground air pathways is not considered a risk factor. In addition, fugitive dust is not considered a significant risk since the majority of the site is covered with asphalt, gravel or vegetated, thereby lowering the possibility of airborne particle emissions.

8.4 Preliminary Remedial Alternatives

Table 8-2 contains a list of potential remedial alternatives that could be applied at the Penn Yan site. As a result of the review and assimilation of the Penn Yan Task 2 information, several alternatives have been eliminated from further consideration. The final selection of remedial alternatives, if required, will be made at the conclusion of the risk assessment (Task 4).

9.0 CONCLUSIONS AND RECOMMENDATIONS

In November, 1986, TRC began the Task 2 investigation of the former coal gasification plant in Penn Yan. The investigation consisted of field activities for the collection of geological, hydrogeological and chemical data. These activities included the excavation of 17 test pits with concurrent air quality monitoring, drilling of six borings and installation of six monitoring wells, and sampling of surface soil, subsurface soil, surface water, stream sediments, ground water, and air.

The data which were collected during Task 2, along with those compiled in Task 1, allow some conclusions to be drawn about existing conditions and recommendations to be made for future studies.

9.1 Summary of Findings

The site stratigraphy was determined using the geological boring logs of the six on-site borings. The site is underlain by fill, fine-grained sand and silt, clay, and coarse-grained sand to a depth of 55 feet. The water table is approximately 16 feet below ground level at the northwest portion of the site and 3 feet below ground level at the southeast portion of the site near Keuka Lake Outlet.

Water level measurements indicate that shallow ground water is flowing southeasterly, with an average gradient of 0.03 ft/ft for the water table aquifer. The range of horizontal hydraulic conductivities measured in the shallow wells was 3.0×10^{-5} cm/sec to 6.0×10^{-4} cm/sec. The resulting average linear ground water velocity at the water table was estimated to be 0.07 ft/day.

The test pits confirmed areas of former coal gasification plant processes. These included the former gas relief holder and the areas adjacent to the tar storage vessel.

Four rounds of ground water sampling results indicate that no notable concentrations of purgeable aromatics, acid extractables and base/neutral extractable compounds were detected above NYSDEC regulatory criteria in the ground water. However, when comparing the organic compounds to the NYSDOH criteria, POC levels were exceeded in three monitoring wells during the third sampling round. The only other compounds exhibiting elevated levels (above NYSDEC or NYSDOH regulatory criteria) were iron, sulfate, pH and total cyanide.

Four rounds of surface water sampling results did not detect purgeable aromatics, acid extractables, and base/neutral extractable compounds or inorganics exceeding NYSDEC regulatory criteria. Only pH was found outside the NYSDEC criteria at all three locations during the last two sampling rounds. However, NYSDOH standards were exceeded at only SW-1 for UOCs (third round) and iron (fourth round).

The surface soil and sediment sample results showed that PAH compounds and metals were present in these two media. Acid extractables were not detected in the sediment or surface soil samples. Purgeable aromatics were detected in the surface soil samples; however, they were not detected in the sediment samples.

9.2 Potential Health and Environmental Concerns

Penn Yan appears to be a relatively low-risk site as far as an immediate threat to human health is concerned. The potential risks identified are exposure to PAH compounds in the stream sediments directly adjacent to the site and dermal exposure of workers involved with subsurface excavations.

9.3 Task 4 Recommendations

Based on the results of the Task 2 investigation, TRC recommends that the Penn Yan program proceed into Task 4-Risk Assessment. This recommendation is based of the following:

- Persons having access to the site (utility employees, site workers, city employees, etc.) may be potential receptors (especially in subsurface investigations) of coal gasification residues.

- Persons using the Keuka Lake Outlet as a recreational stream (fisherman, boaters, swimmers) may be potential receptors of coal gasification residues present in the stream sediment.

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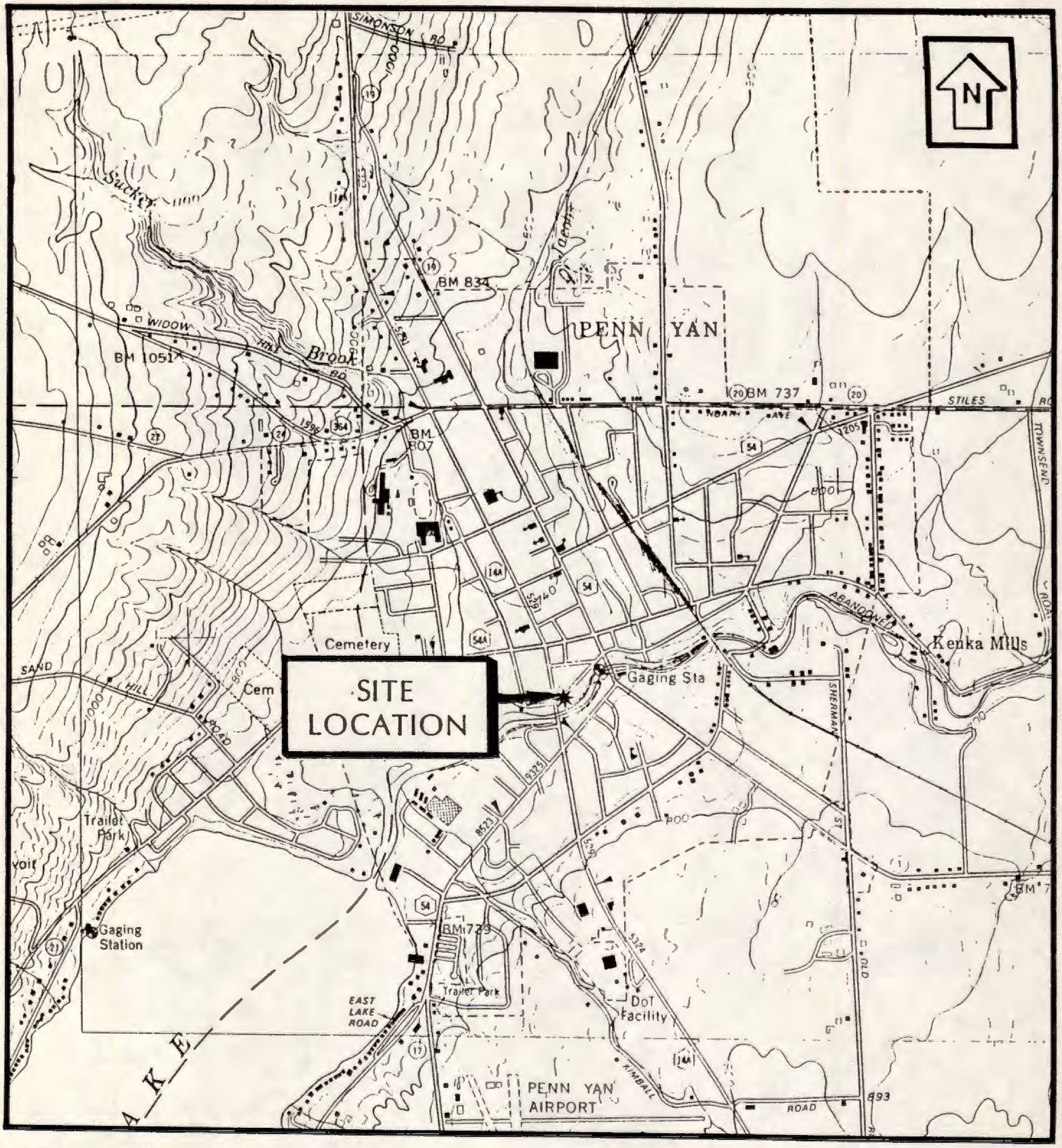
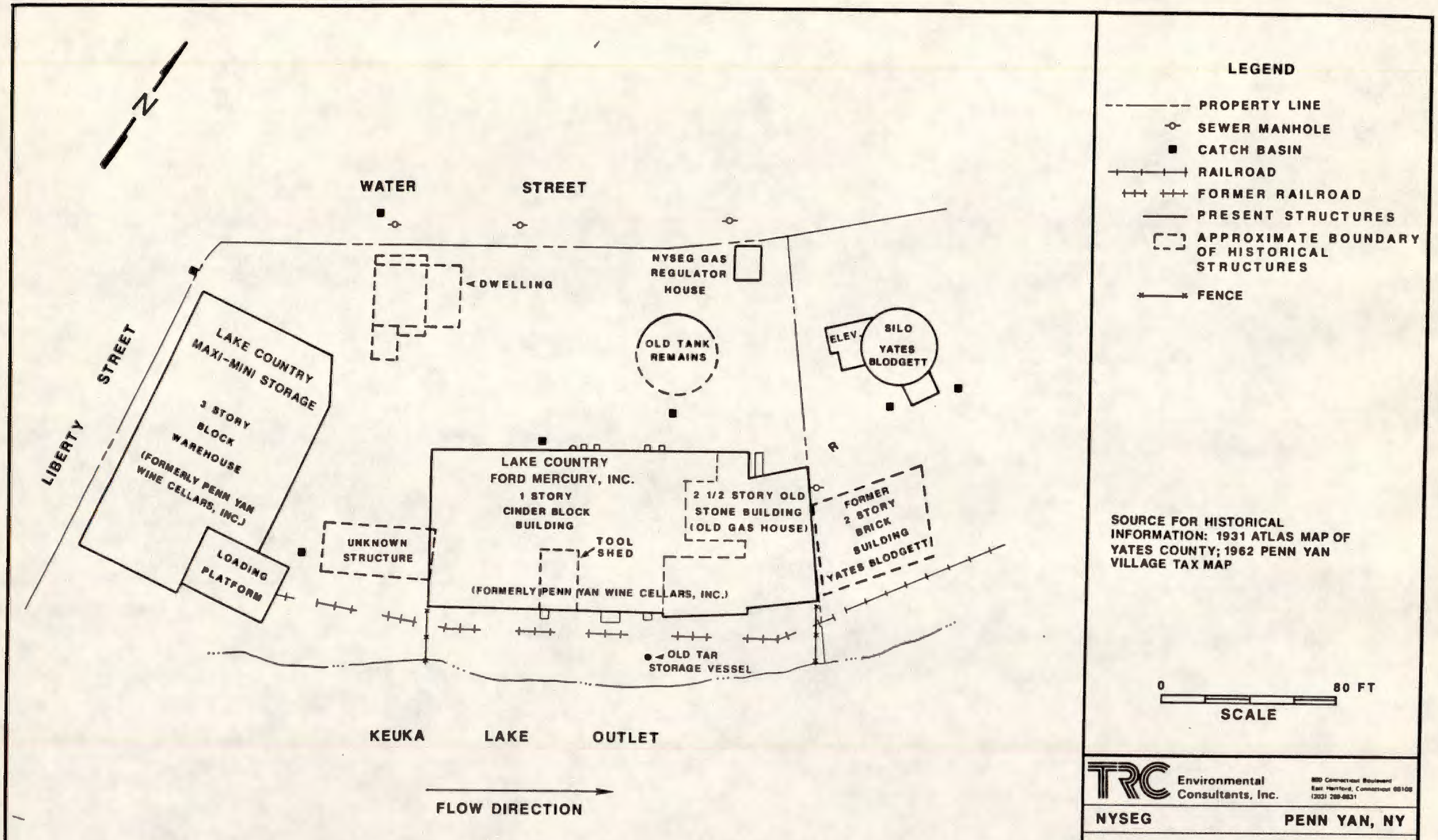
FIGURES



from Penn Yan Quadrangle, 1977

Figure 1-1. Penn Yan Site Location Map



SOURCE FOR HISTORICAL INFORMATION: 1931 ATLAS MAP OF YATES COUNTY; 1962 PENN YAN VILLAGE TAX MAP

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PENN YAN, NY

FIGURE 1-2

LOCATIONS OF HISTORICAL STRUCTURES AND PRESENT SITE CONDITIONS

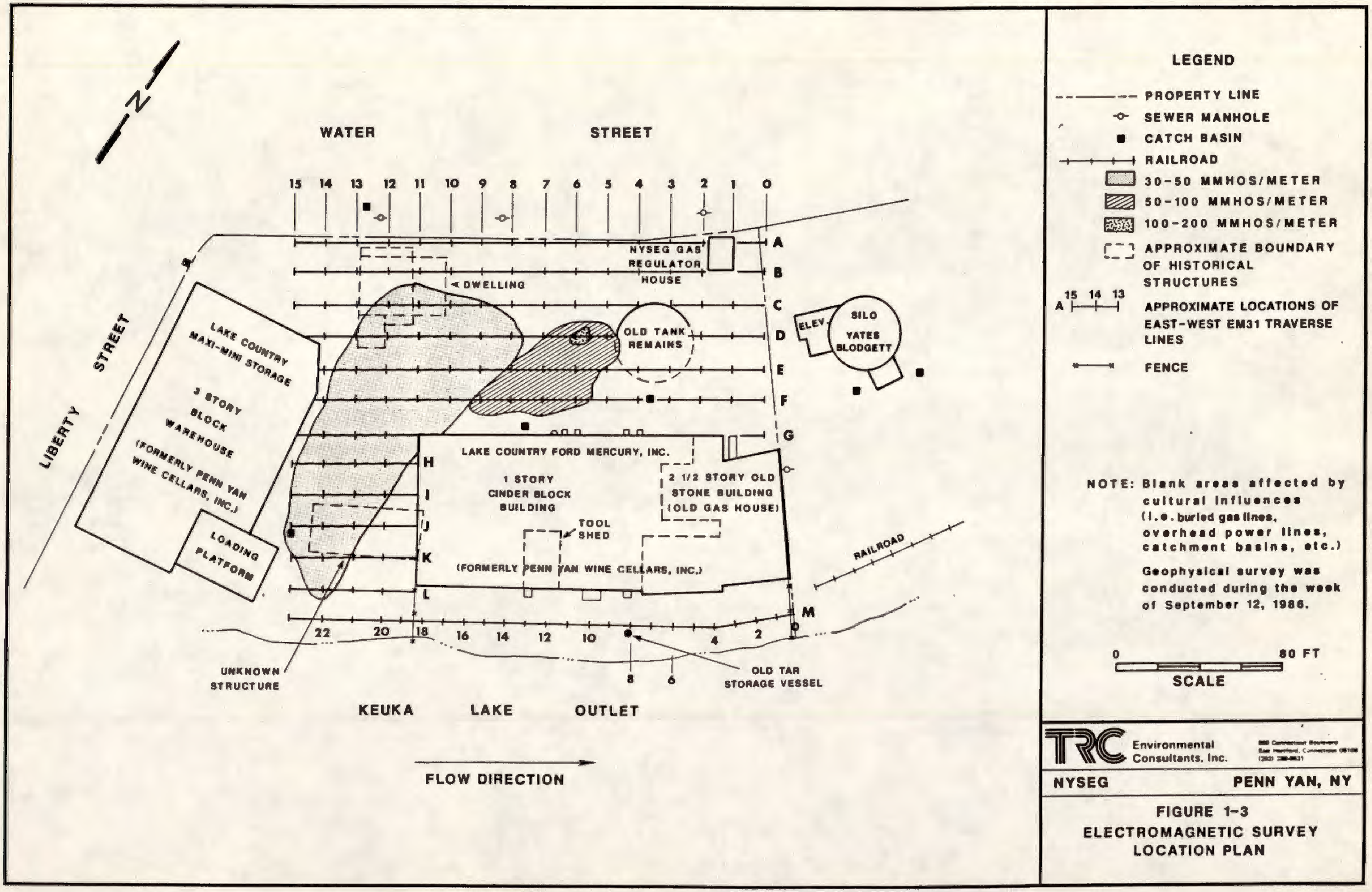

FIGURE 1-3
ELECTROMAGNETIC SURVEY
LOCATION PLAN

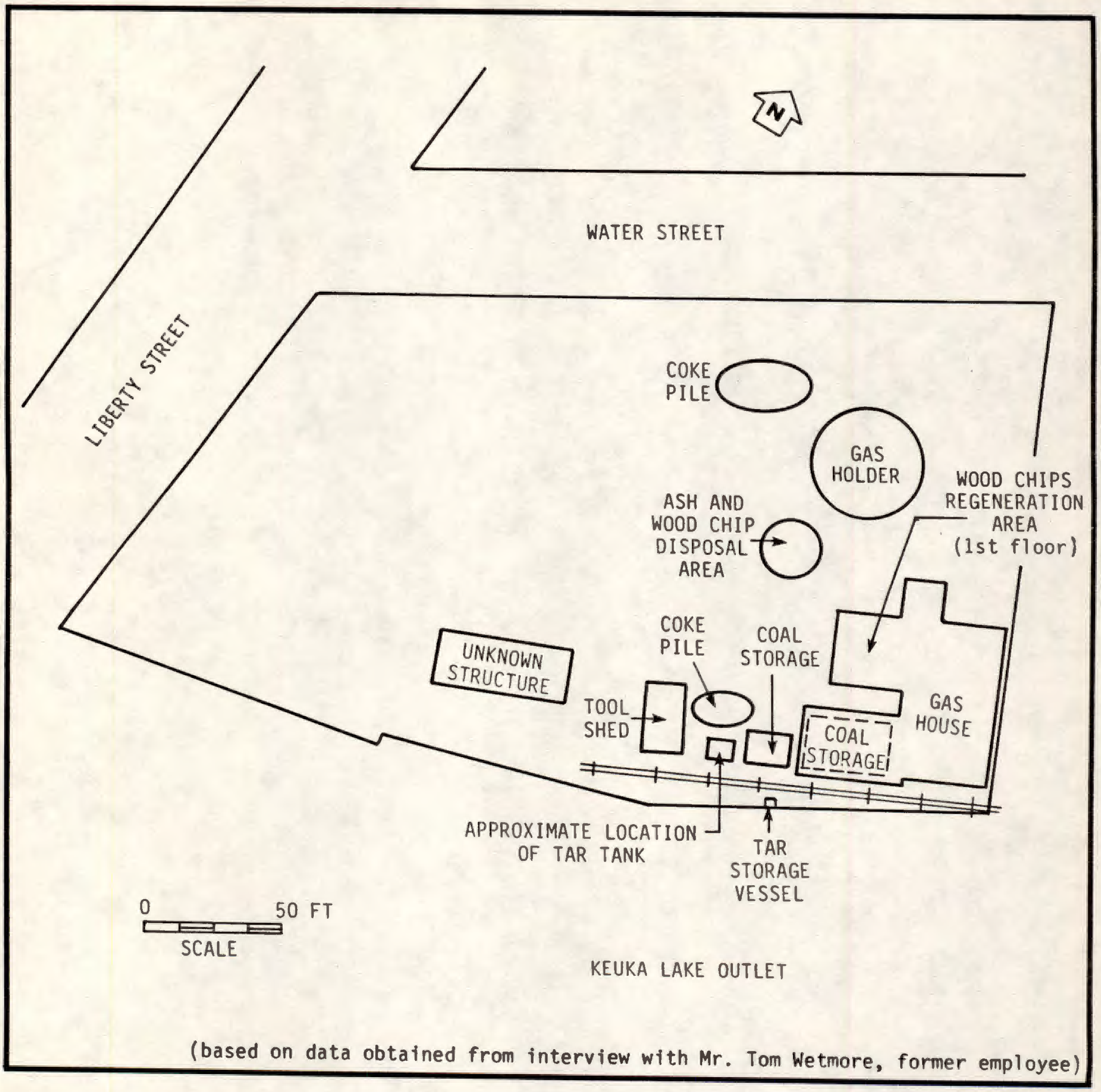

Figure 2-1. Penn Yan Gas Light Company Storage and Disposal Areas (circa 1926).

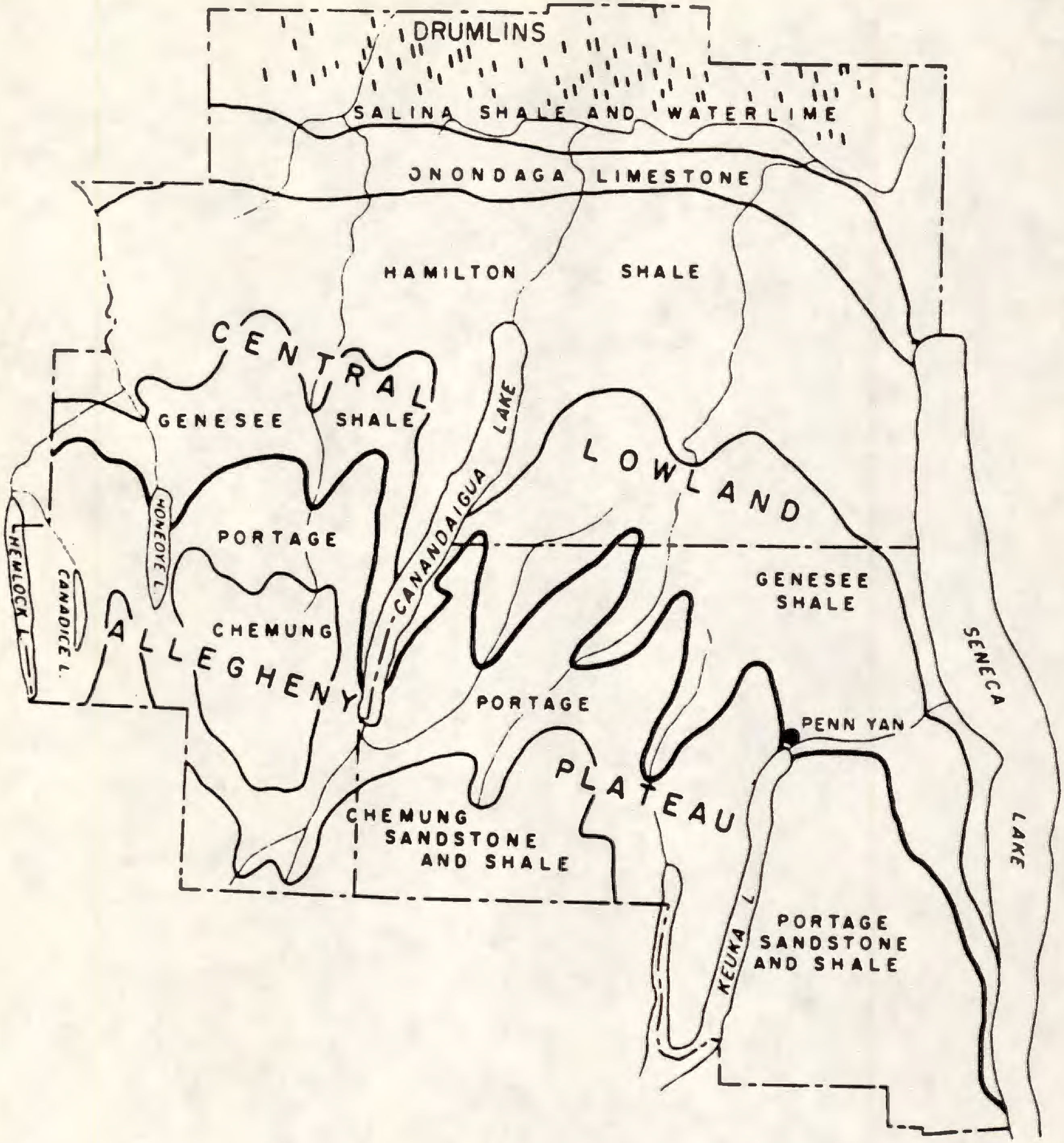

Figure 3-1. Physiography and bedrock geology of Ontario and Yates Counties, New York. The heavy black line between the Central Lowland and the Allegheny Plateau marks the Portage Escarpment. (from Soil Survey Series 1949, No. 5)

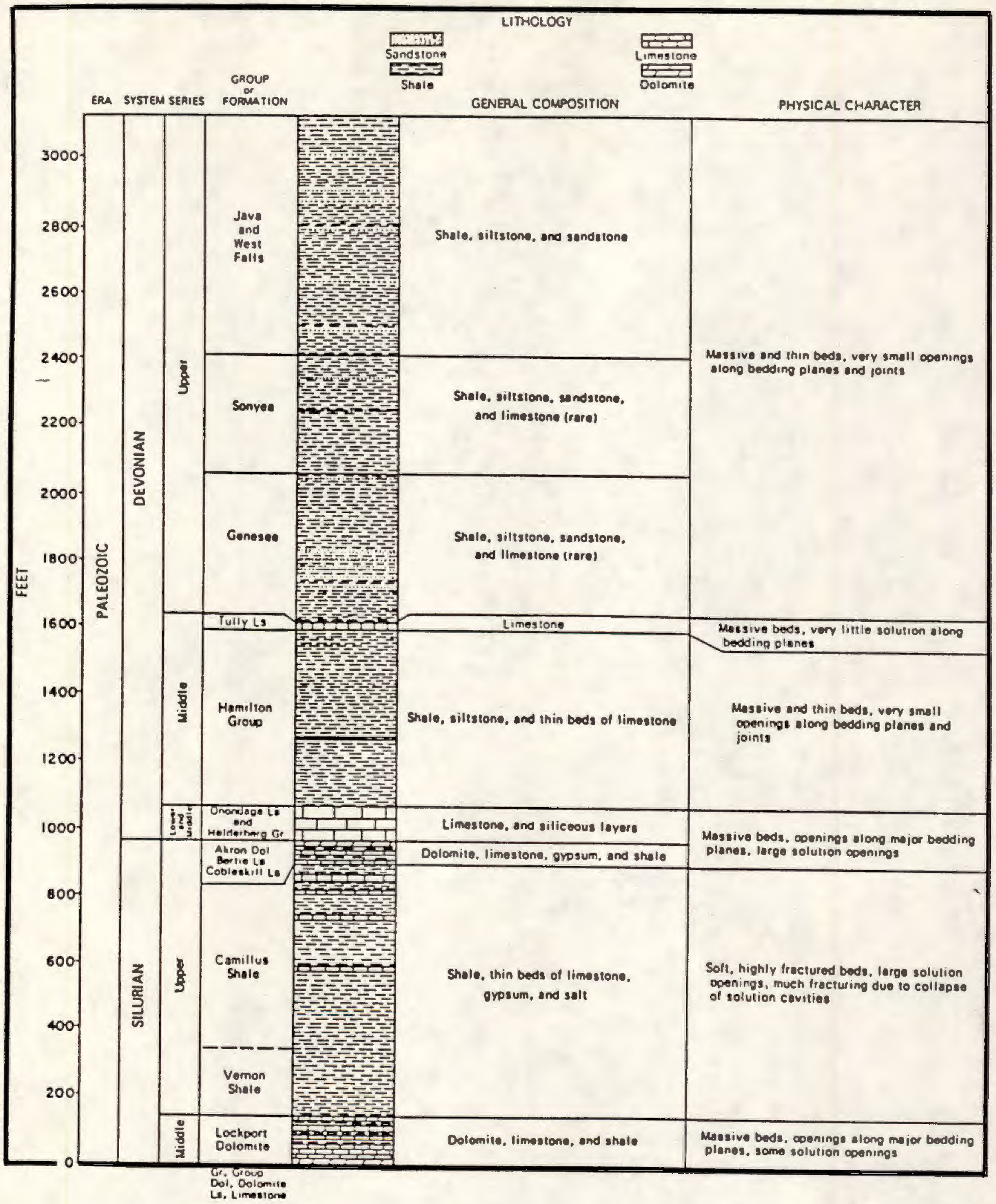

Figure 3-2. Generalized Stratigraphic Column of Bedrock in the Western Oswego River Basin. (from Crain, 1974).

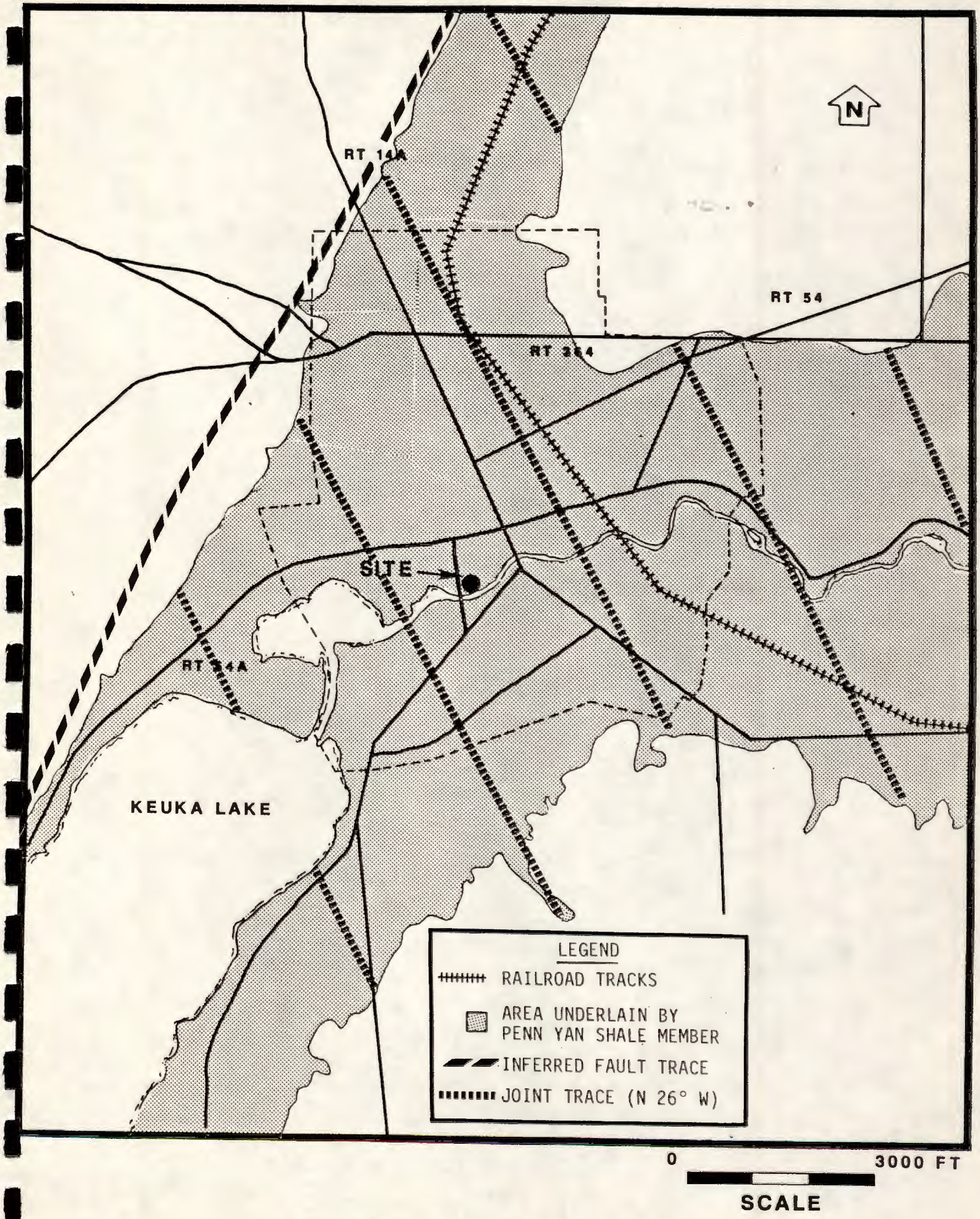

Figure 3-3. Bedrock Geology of Penn Yan

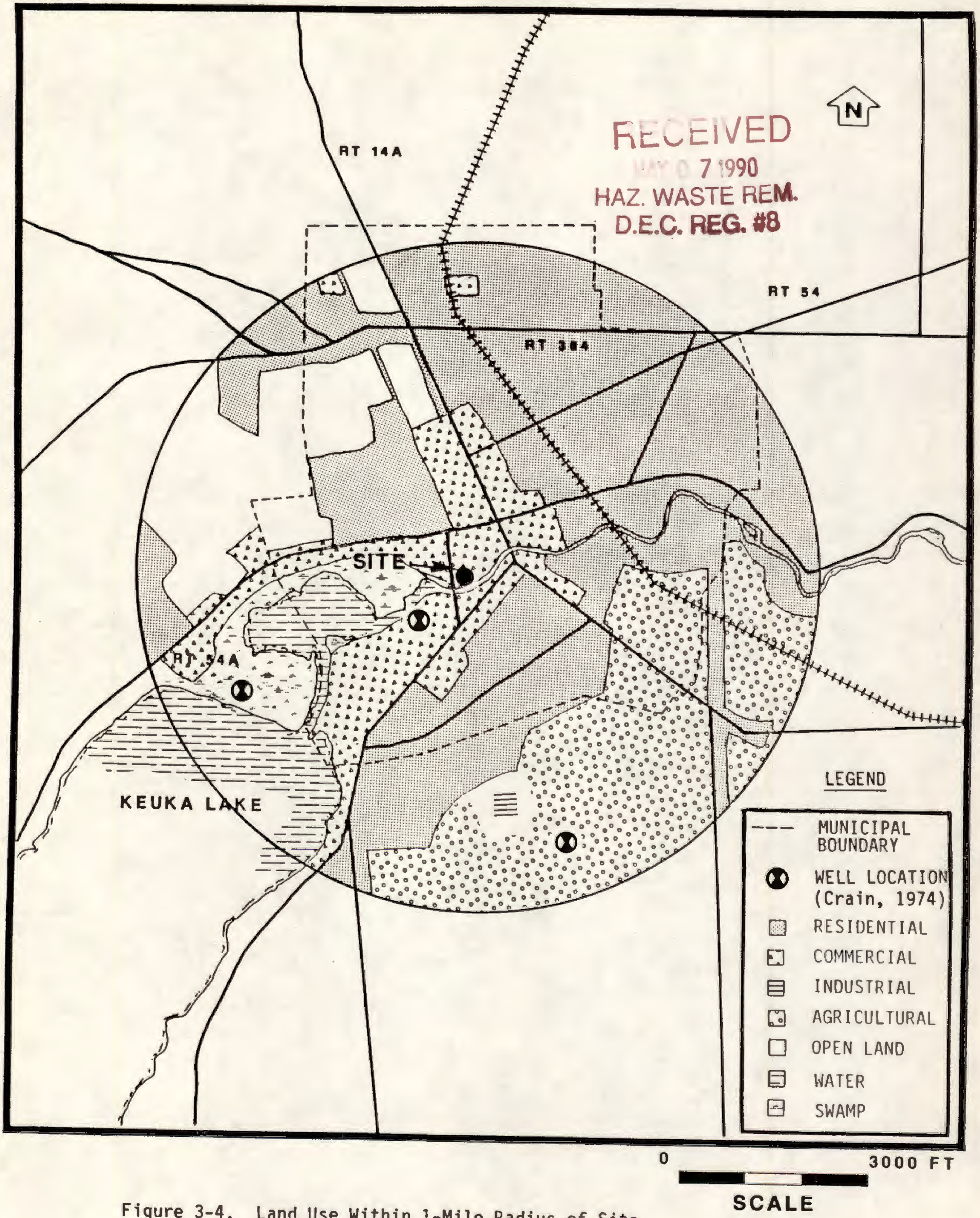

Figure 3-4. Land Use Within 1-Mile Radius of Site
(based on 1962 tax map and 1986 field verification)

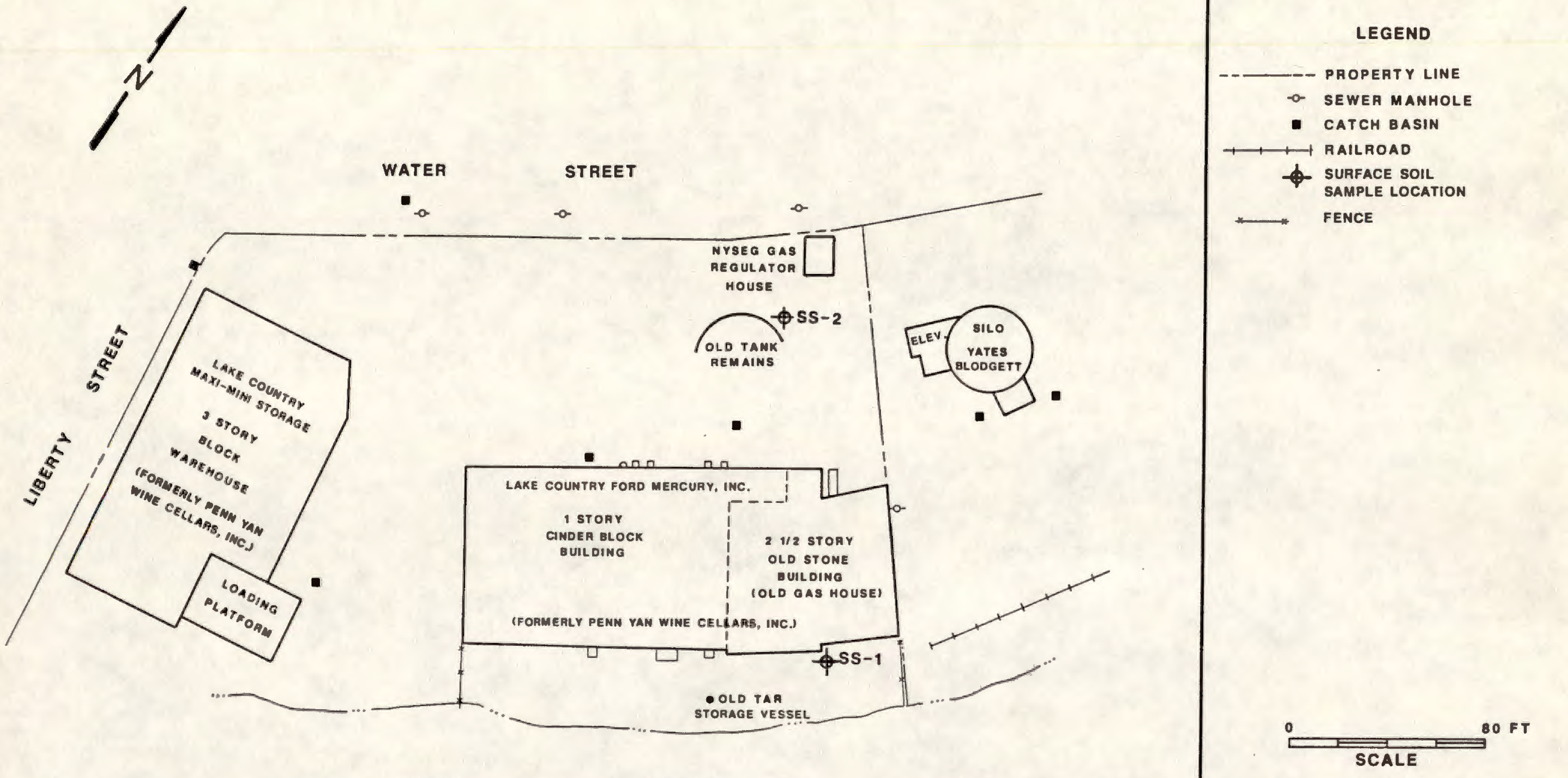

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FIGURE 4-1

SURFACE SOIL SAMPLING LOCATIONS

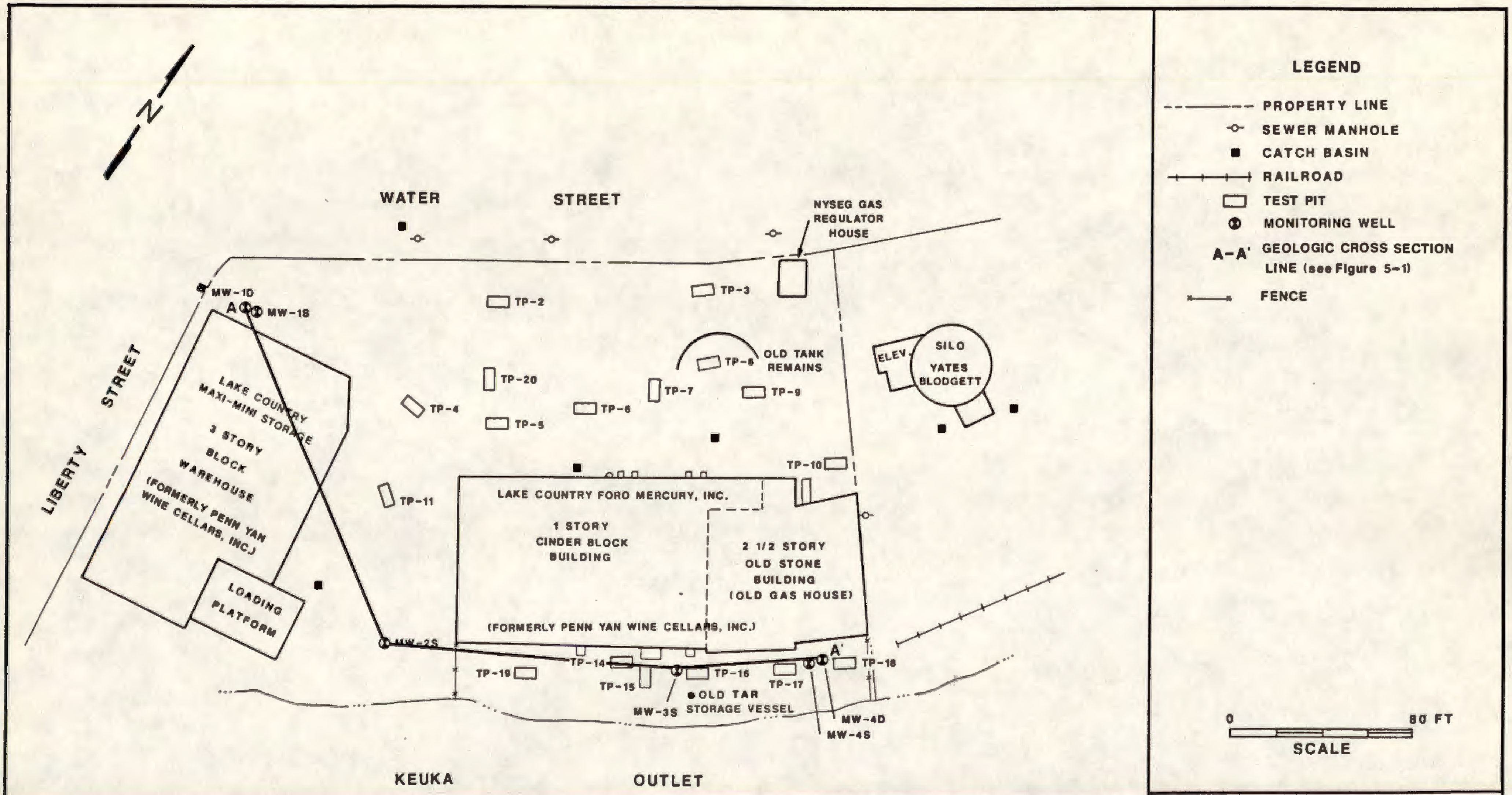

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FIGURE 4-2

TEST PIT AND MONITORING WELL LOCATIONS

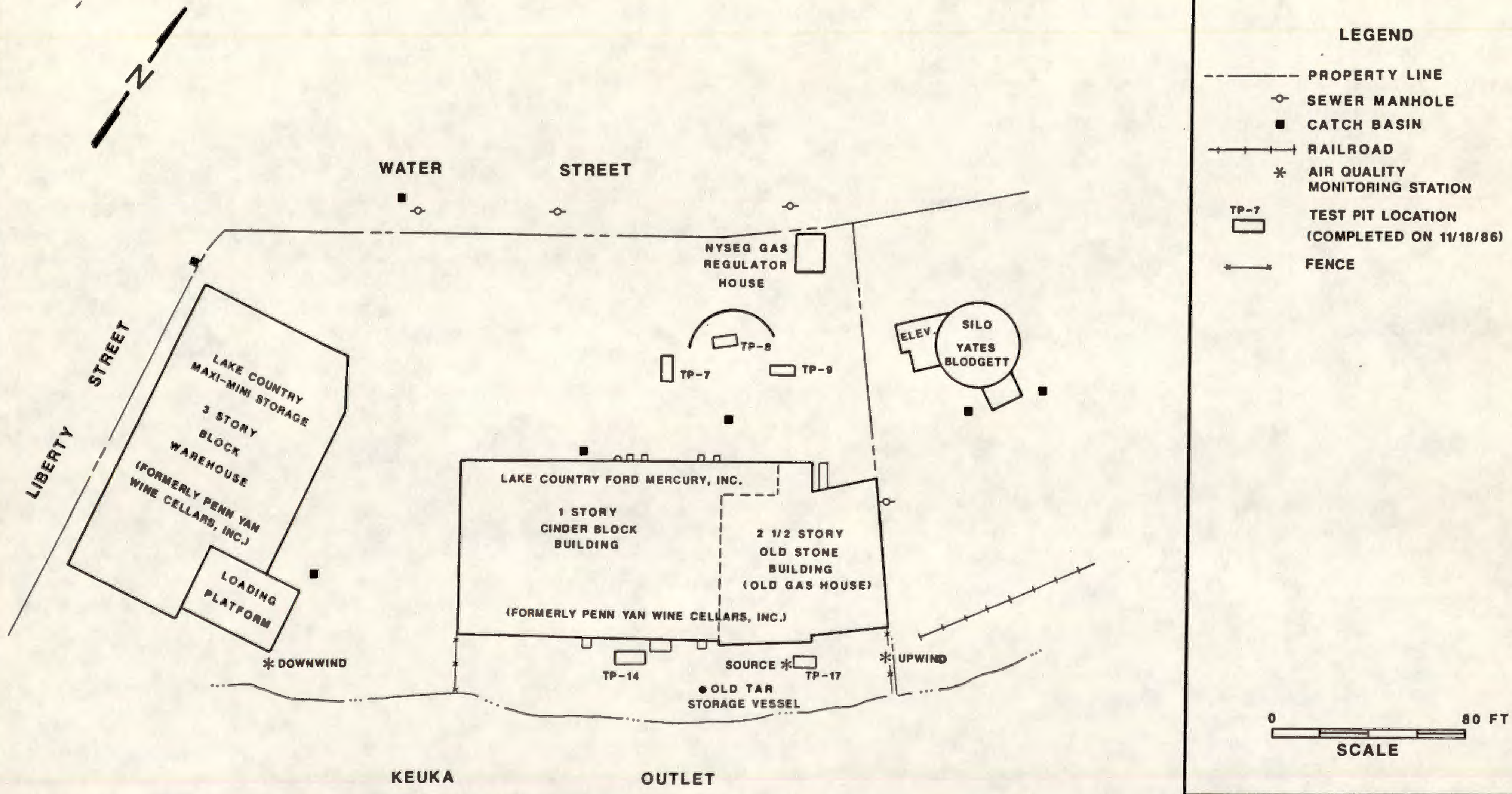

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FIGURE 4-3
AIR QUALITY SAMPLING LOCATIONS
NOVEMBER 18, 1986

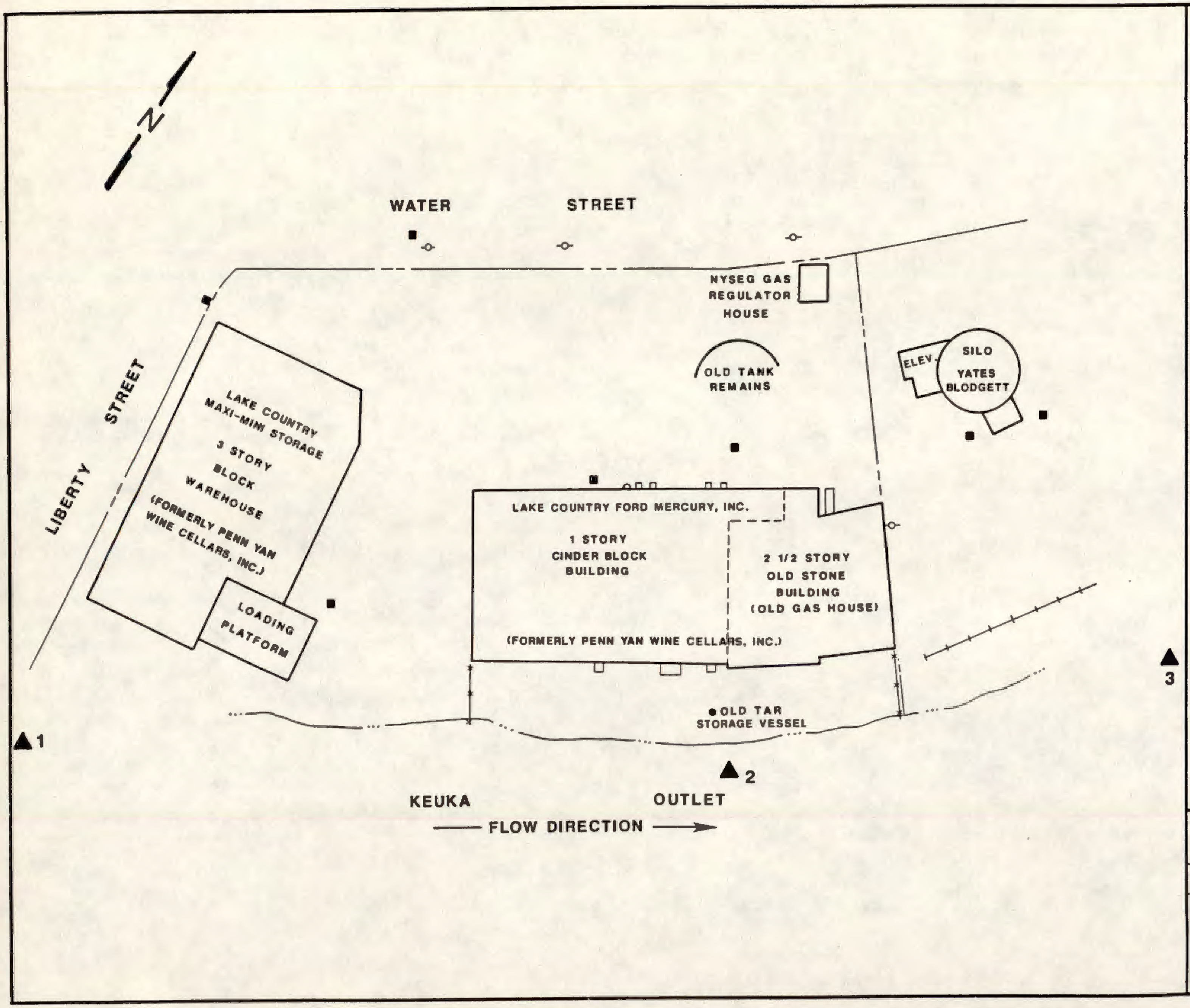

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FIGURE 4-4

SURFACE WATER/SEDIMENT SAMPLE LOCATIONS

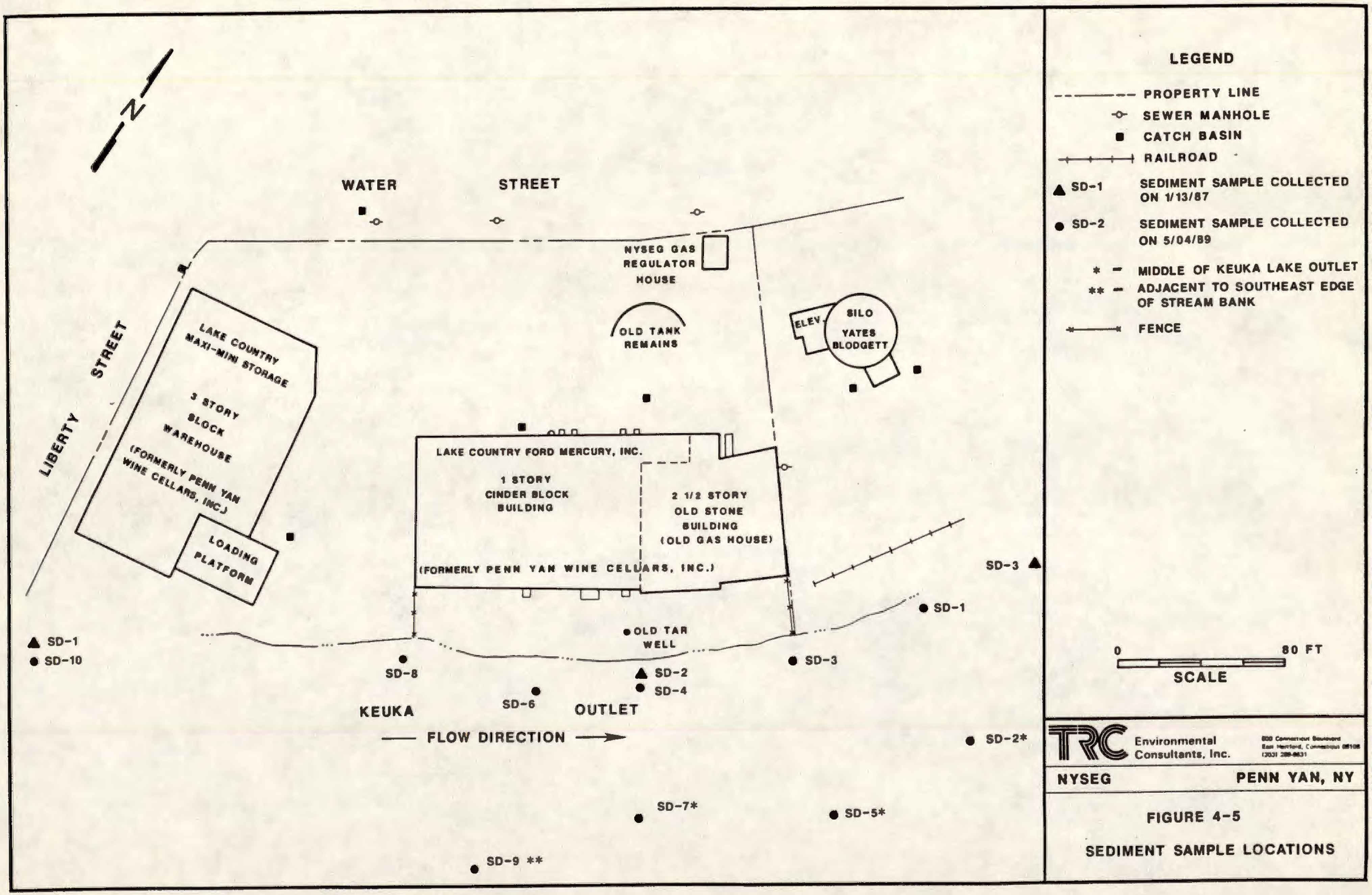

FIGURE 4-5

SEDIMENT SAMPLE LOCATIONS

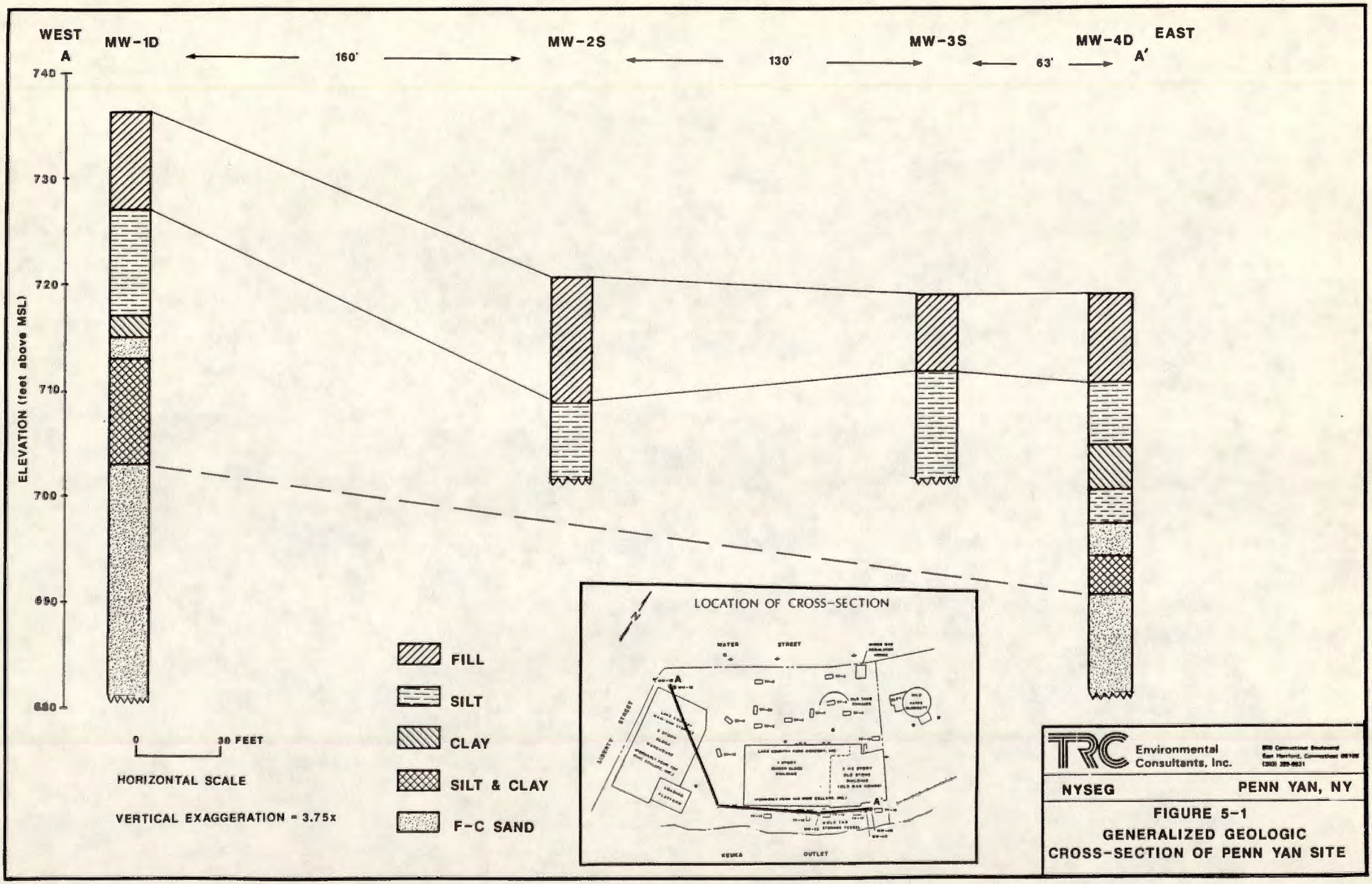

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FIGURE 5-1
GENERALIZED GEOLOGIC
CROSS-SECTION OF PENN YAN SITE

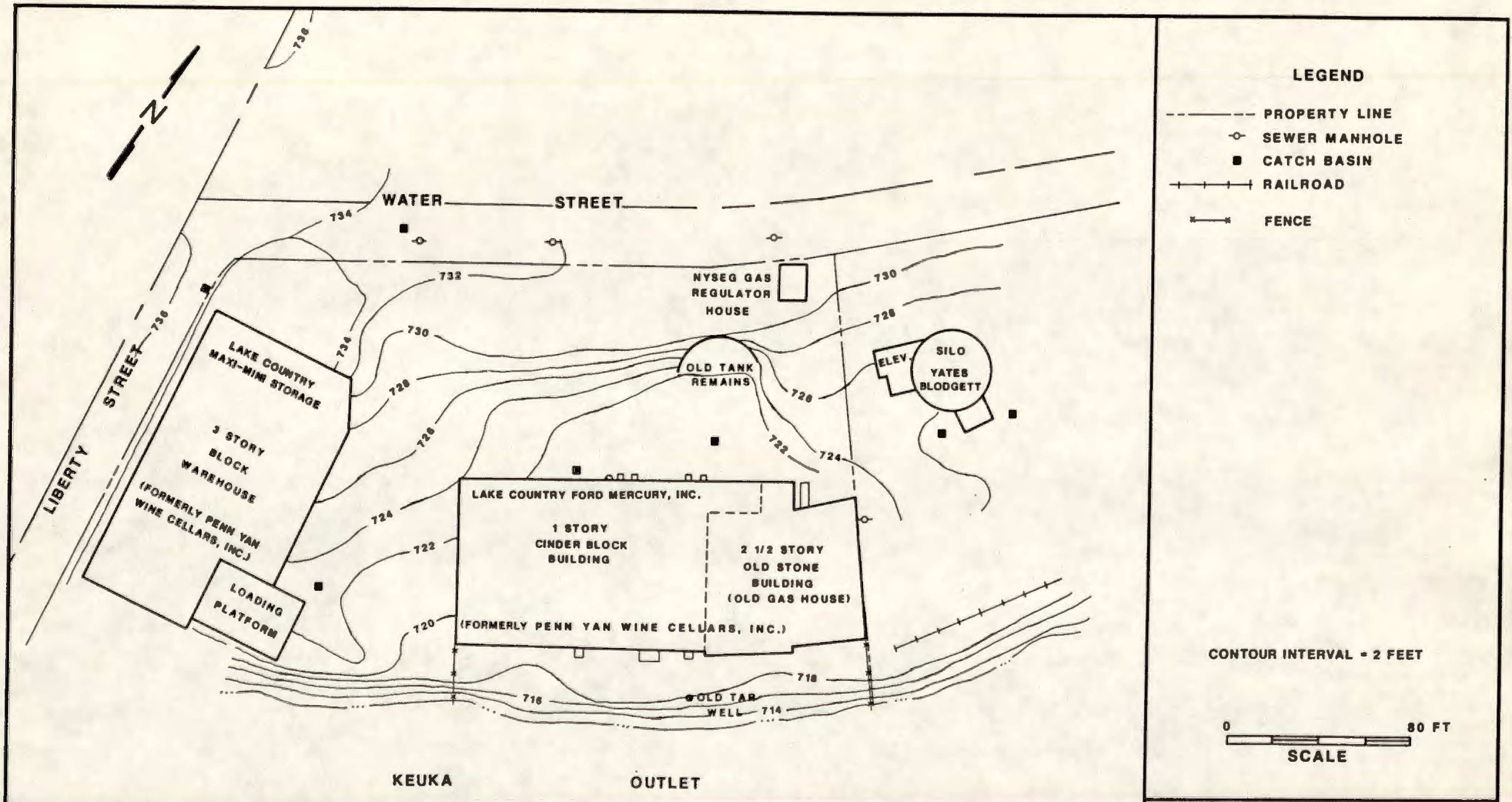

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FIGURE 5-2

SITE TOPOGRAPHY
(1986)
WEILER MAPPING, INC.

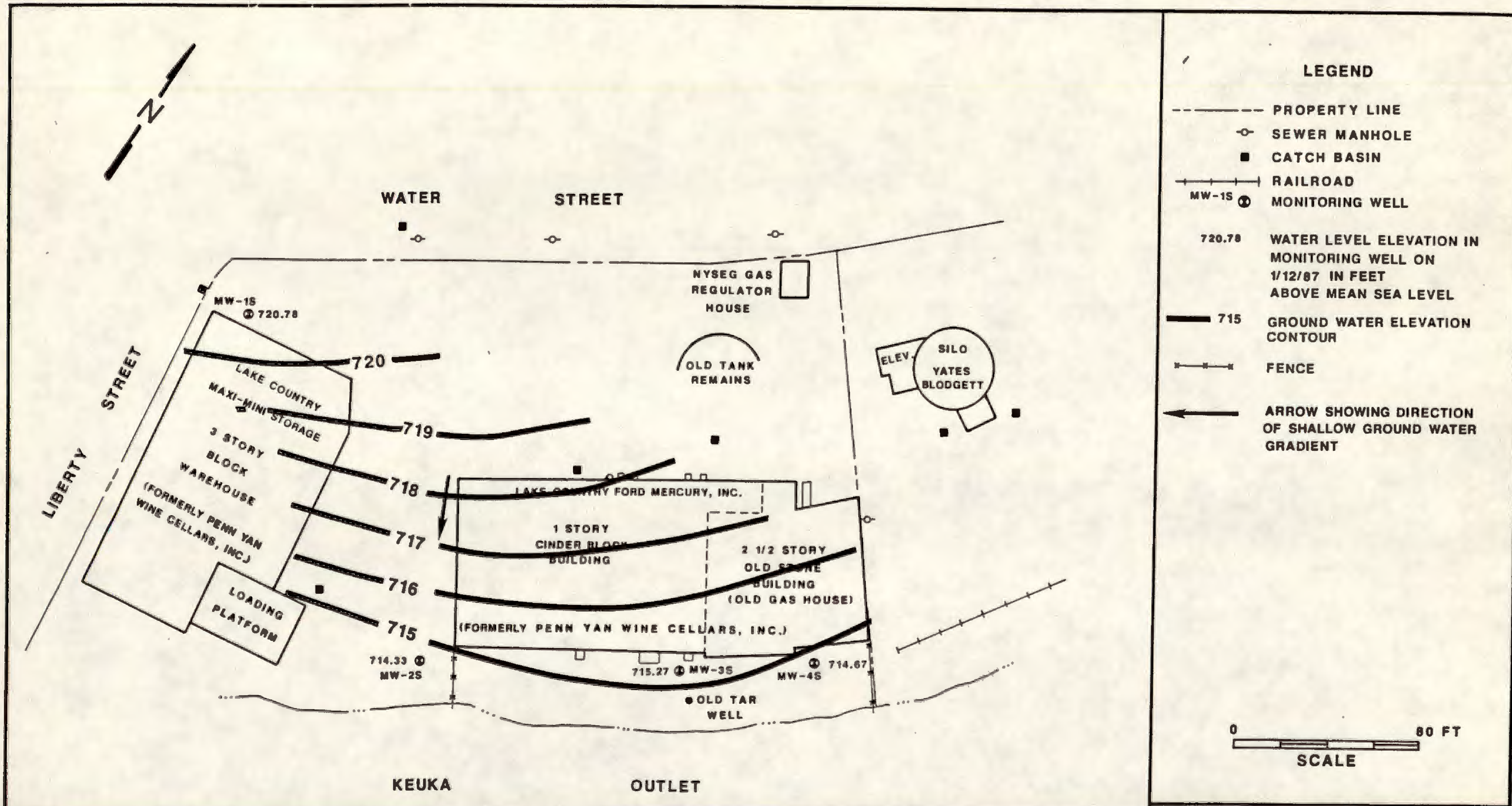

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FIGURE 5-3

GROUND WATER ELEVATION CONTOUR MAP FOR SHALLOW MONITORING WELLS 1/12/87

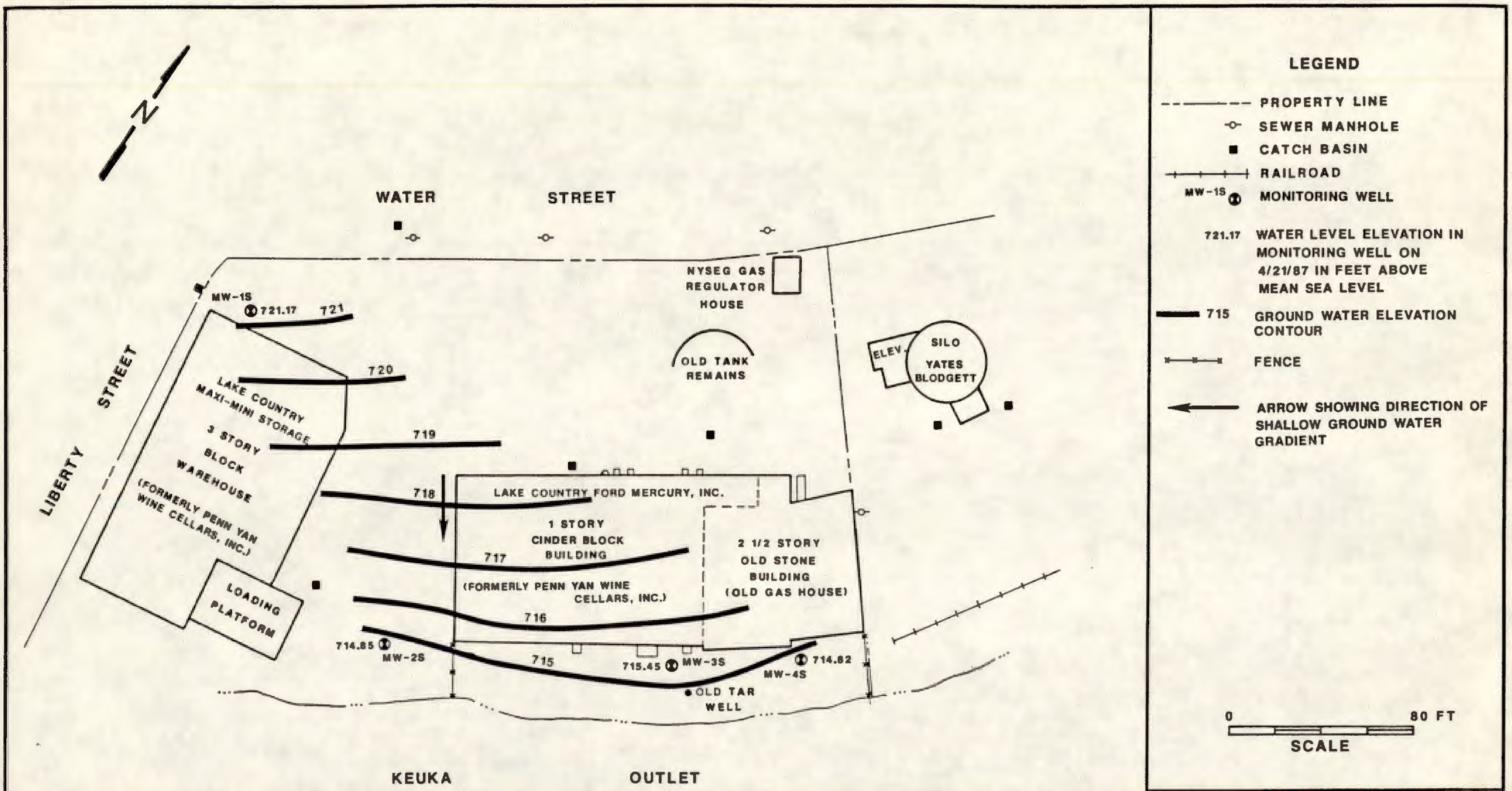

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FIGURE 5-4

GROUND WATER ELEVATION CONTOUR MAP FOR SHALLOW MONITORING WELLS 4/21/87

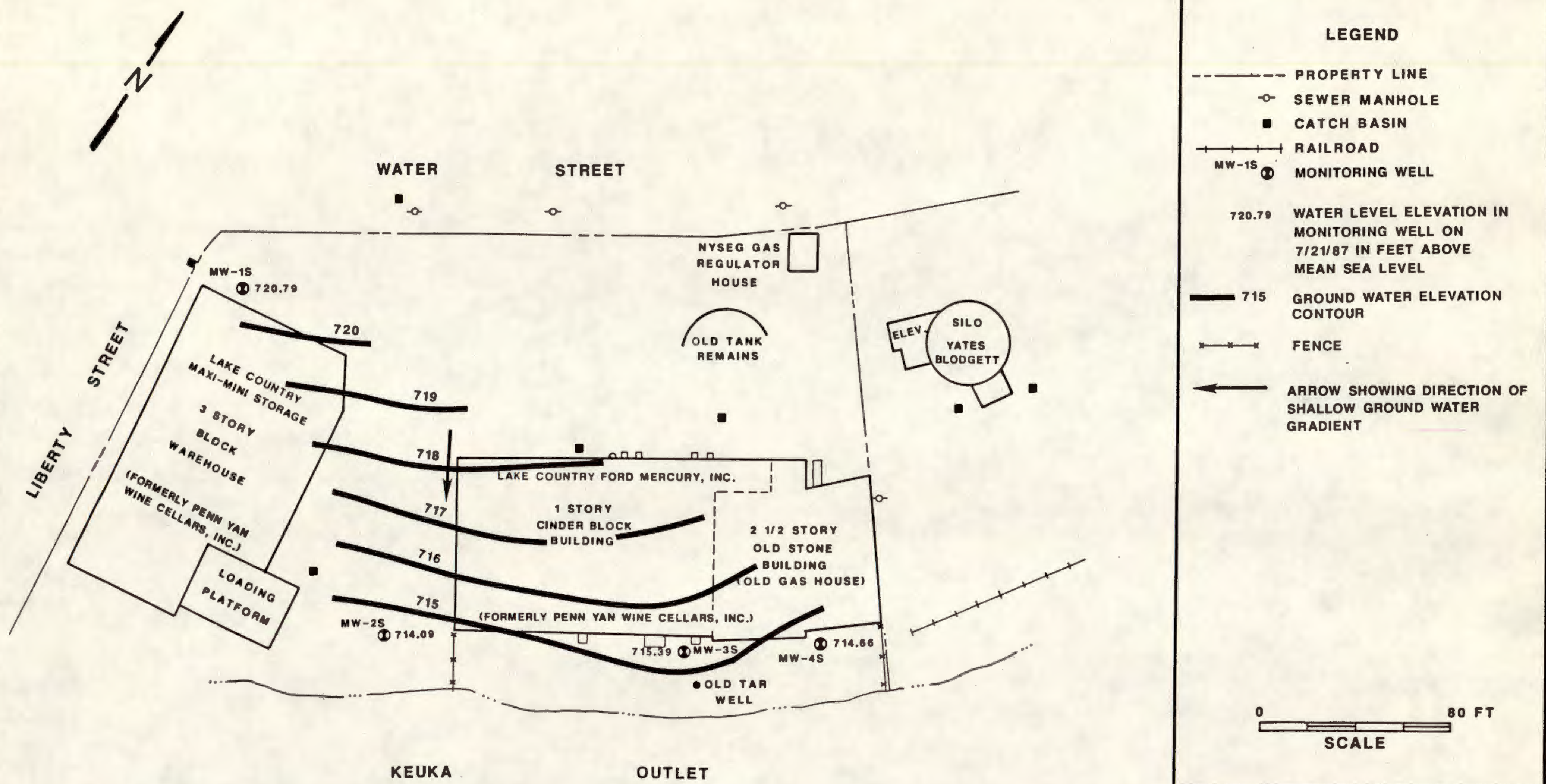

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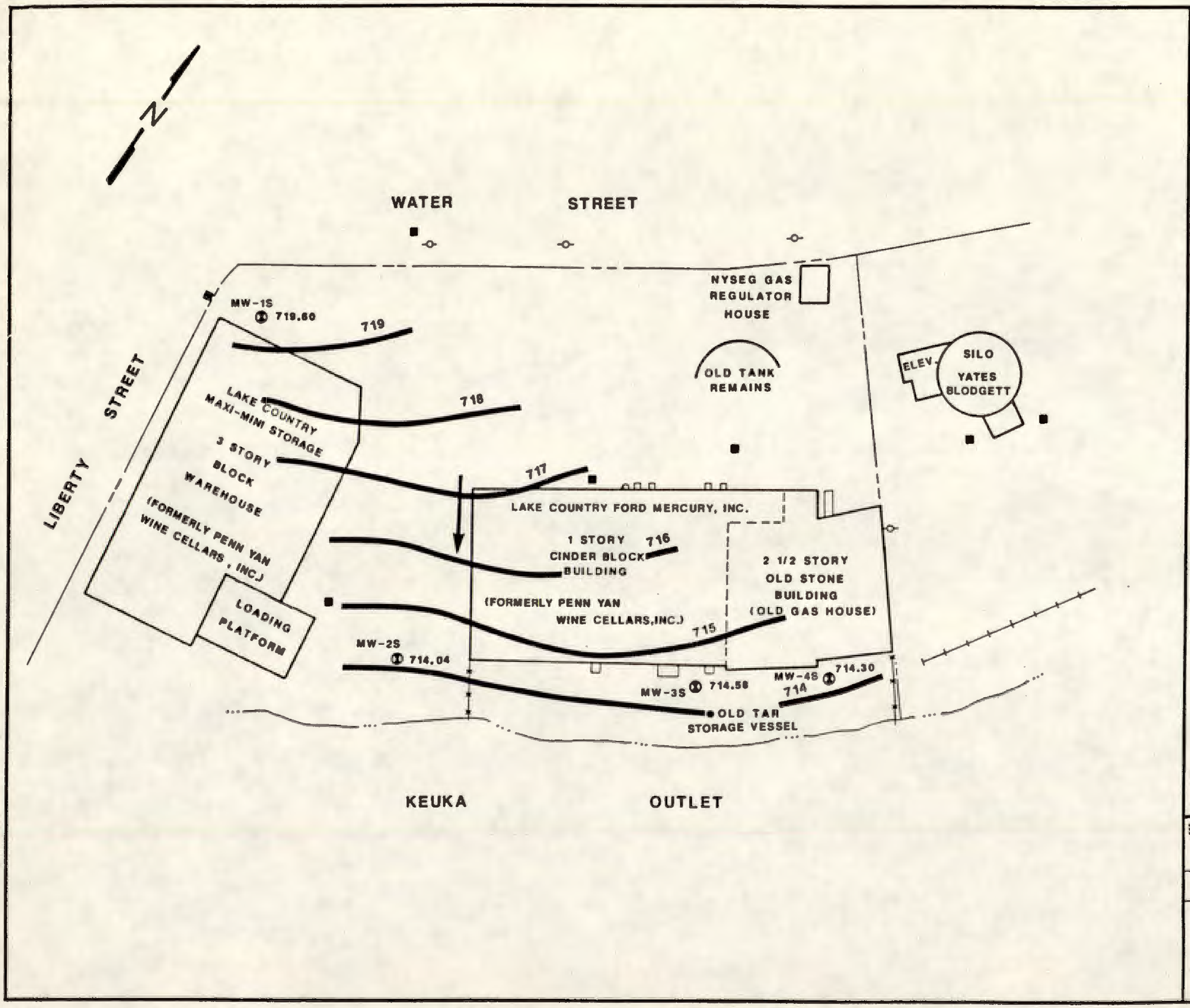
FIGURE 5-5

GROUND WATER ELEVATION CONTOUR MAP FOR SHALLOW MONITORING WELLS 7/21/87



LEGEND

- – – –+– – – PROPERTY LINE
- -○- SEWER MANHOLE
- ■ CATCH BASIN
- +—+—+—+ RAILROAD
- MW-1S ① MONITORING WELL
- 719.60 WATER LEVEL ELEVATION IN MONITORING WELL ON 2/2/88 IN FEET ABOVE MEAN SEA LEVEL
- ▬ 715 GROUND WATER ELEVATION CONTOUR
- ×—×—× FENCE
- ← ARROW SHOWING DIRECTION OF SHALLOW GROUND WATER GRADIENT

0 80 FT

SCALE

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FIGURE 5-6

GROUND WATER ELEVATION CONTOUR MAP FOR SHALLOW MONITORING WELLS 2/2/88

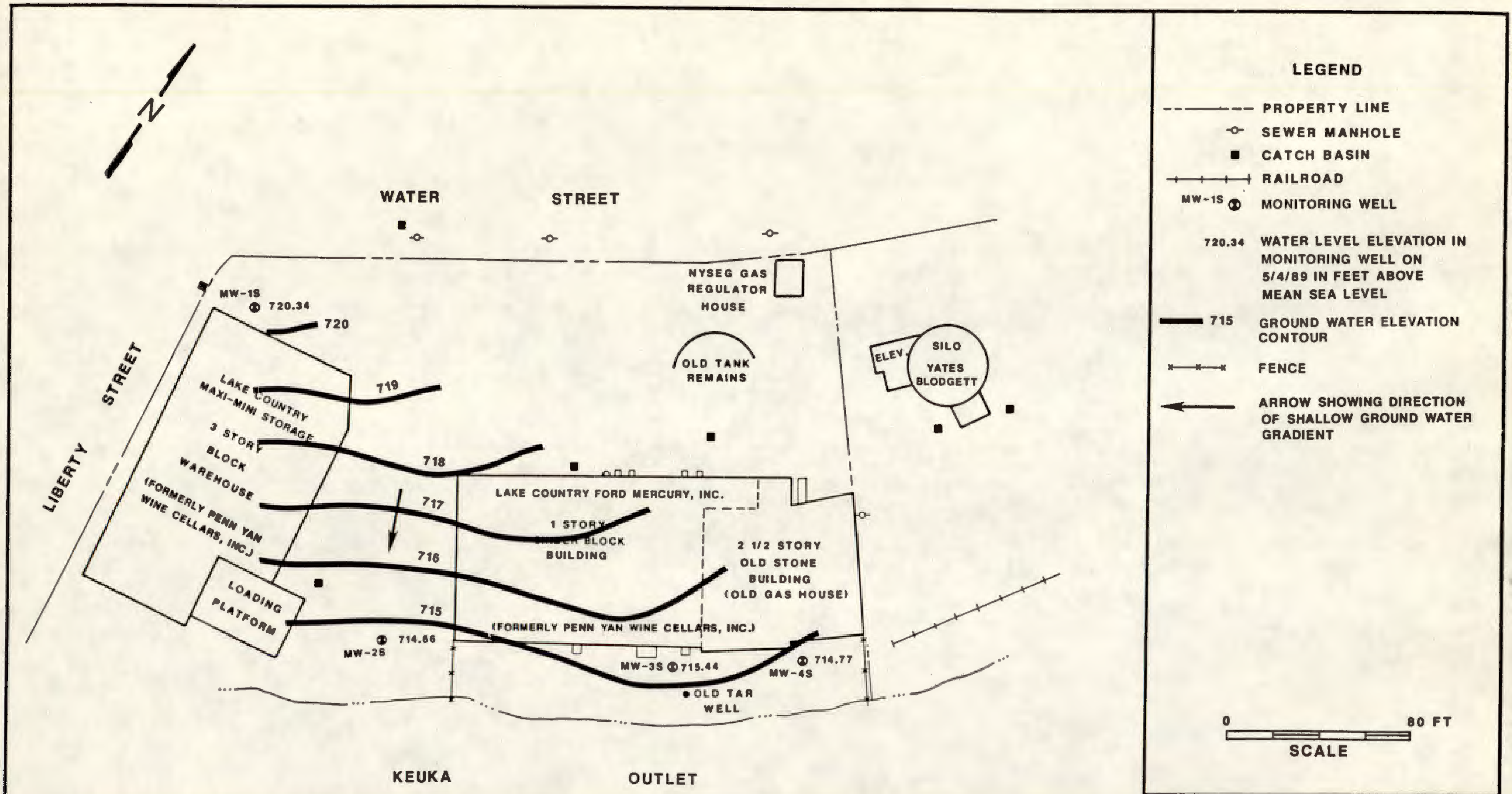

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FIGURE 5-7

GROUND WATER ELEVATION CONTOUR MAP FOR SHALLOW MONITORING WELLS 5/4/89

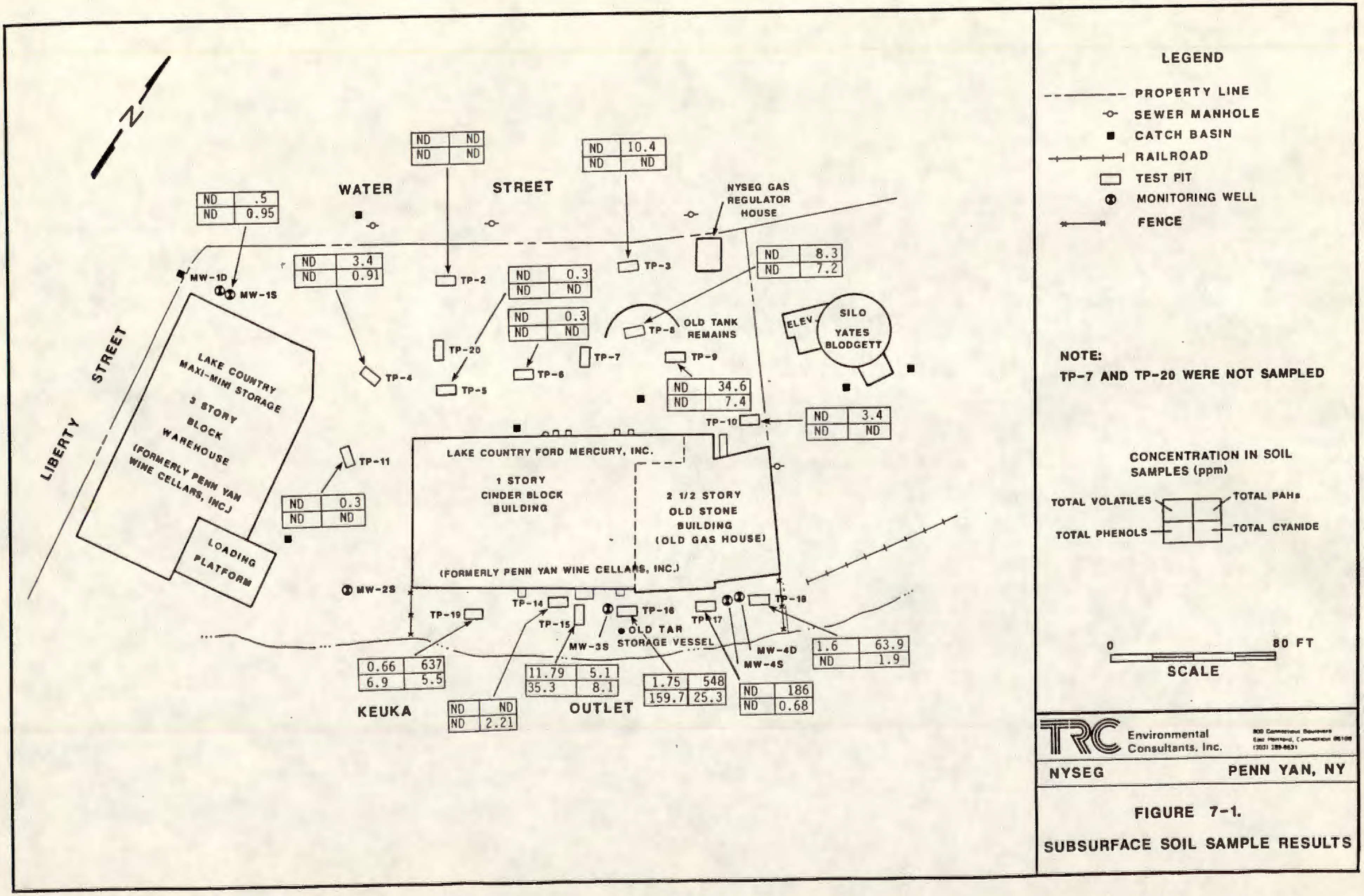
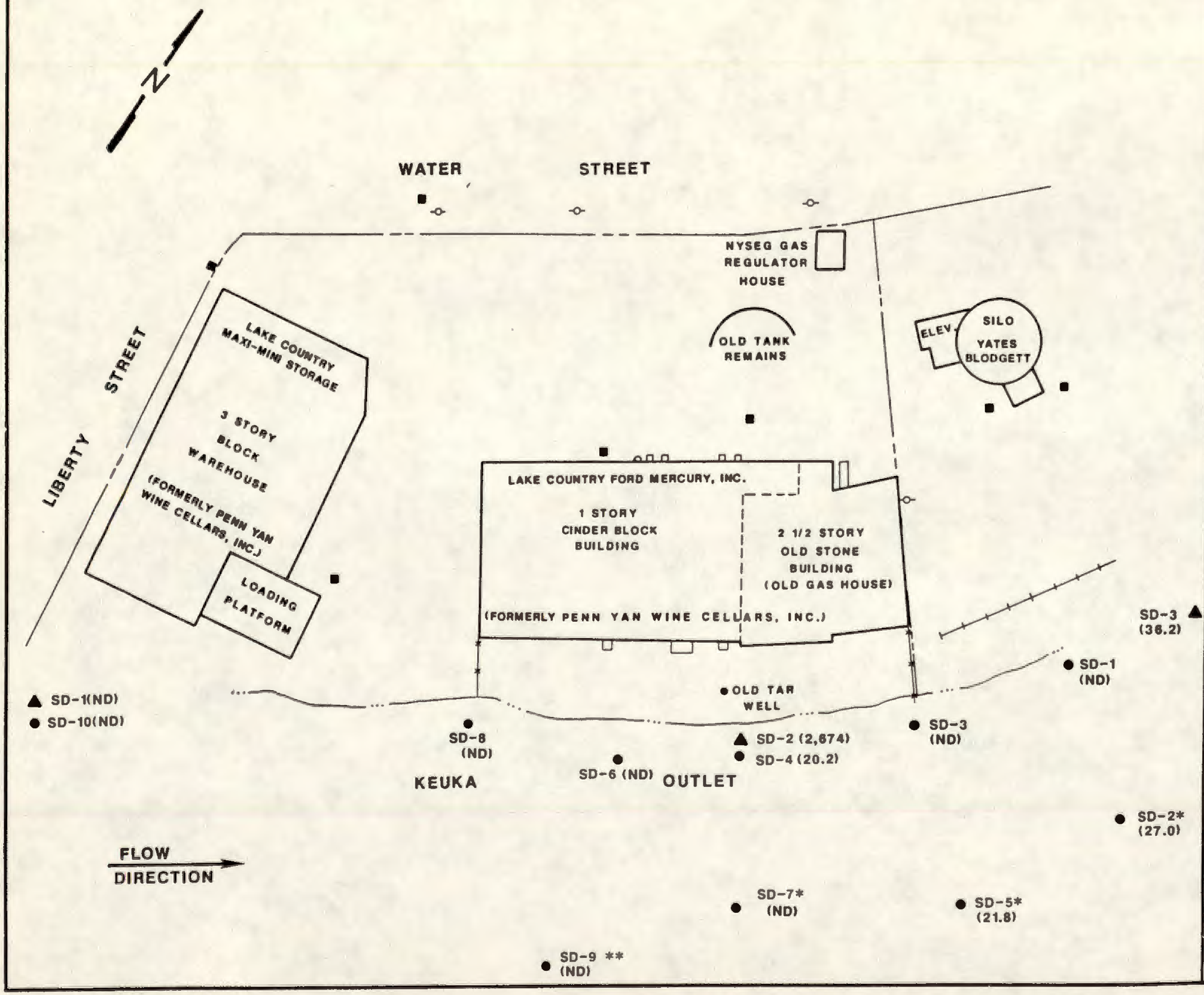


FIGURE 7-1.

SUBSURFACE SOIL SAMPLE RESULTS



LEGEND

- - - - PROPERTY LINE
-○- SEWER MANHOLE
■ CATCH BASIN
+-+-+-+ RAILROAD

▲ SD-1 (ND)	SEDIMENT SAMPLE COLLECTED ON 1/13/87
● SD-2 (27.0)	SEDIMENT SAMPLE COLLECTED ON 5/04/89
ND	BELOW DETECTION LIMITS

CONCENTRATIONS NOTED IN PARENTHESES ARE IN PARTS PER MILLION (ppm)

* – MIDDLE OF KEUKA LAKE OUTLET
** – ADJACENT TO SOUTHEAST EDGE OF STREAM BANK

-x-x- FENCE

0 80 FT
SCALE

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FIGURE 8-1

DISTRIBUTION OF PAH CONTAMINATION IN SEDIMENT SAMPLES

TABLES

TABLE 1-1

SUMMARY TABLE OF CHEMICAL DATA FOR THE PENN YAN COAL GASIFICATION SITE - PENN YAN, NEW YORK(1)

Compound	Units	Sample ID: PEN-01 Date: 11/04/81 Lab No.: 81-1821
Arsenic	mg/l	ND<0.025(2)
Barium	mg/l	0.43
Cadmium	mg/l	ND<0.002
Chromium	mg/l	ND<0.010
Copper	mg/l	ND<0.05
Lead	mg/l	ND<0.05
Mercury	mg/l	ND<0.0004
Selenium	mg/l	ND<0.002
Silver	mg/l	ND<0.05
Zinc	mg/l	0.24
Phenols, total	mg/l	175
o-Cresol	mg/l	24.18
p-Cresol	mg/l	45.82
Naphthalene	mg/l	5.76
Quinoline	mg/l	7.18
pH	-	7.4
Flashpoint	°F	>170
Cyanide	mg/kg	ND<1
Sulfide	mg/kg	95

---

(1) Data supplied by New York State Electric and Gas Corporation. Analyses performed by Ecology & Environment, Inc.

(2) ND = None Detected.

Note: Extraction Procedure Toxicity Method.

TABLE 2-1

CHEMICAL COMPOUNDS COMMONLY FOUND IN THE BY-PRODUCT LIQUID WASTES OF COAL GASIFICATION

Acenaphthene
Acrylonitrile
Benzene
2-Chlorophenol
2-Methylphenol
4-Methylphenol
2,4-Dimethylphenol
Ethylbenzene
Fluoranthene
Naphthalene
2-Methylnaphthalene
Phenol
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(k)fluoranthene
Benzo(b)fluoranthene
Chrysene
Acenaphthylene
Anthracene
Benzo(g,h,i)perylene
Fluorene
Fluoranthene
Phenanthrene
Dibenzofuran
Dibenzo(a,h)anthracene
Pyrene
Toluene
Xylene

Aluminum
Antimony
Arsenic
Barium
Cadmium
Chromium
Copper
Iron
Lead
Manganese
Mercury
Nickel
Selenium
Silver
Vanadium
Zinc

Ammonia
Cyanide
Nitrate
Sulfate
Sulfide
Thiocyanates

Source: Gas Research Institute, 1987.

TABLE 2-2

OPERATING STATISTICS FOR THE PENN YAN GAS PLANT ON WATER STREET

Year	Total Gas Manufactured (MCF)	Number of Customers	Length of Main (miles)
1907	9092	525	6.20
1908	(1)	(1)	(1)
1909	9030	(1)	(1)
1910	9063	601	6.83
1911	9065	607	7.23
1912	9380	597	7.39
1913	9076	625	7.12
1914	9221	643	7.14
1915	9070	661	7.52
1916	8707	680	7.61
1917	9173	682	7.62
1918	9624	633	7.64
1919	(2)	(2)	(2)
1920	(2)	(2)	(2)
1921	13,725	704	7.68
1922	15,035	716	7.81
1923	16,647	768	8.00
1924	17,385	807	8.57
1925	17,638	833	(1)
1926	17,528	(1)	(1)
1927	20,185	(1)	(1)
1928	21,107	(1)	(1)
1929	846	(1)	(1)
1930	Penn Yan Gas Service Discontinued		

Notes: Data is from Annual Report of the N.Y. Public Service Commission 1907 through 1930.

(1) Data not reported

(2) Report not available

MCF = Thousand cubic feet

TABLE 3-1

DISTANCE TO SCHOOLS AND HOSPITALS THAT ARE WITHIN A ONE-MILE RADIUS OF THE PENN YAN SITE

	Distance from Site	Direction from Site
<u>SCHOOL</u>		
Emmanuel Christian School	1,400 feet	Northwest
Saint Michael's Church School	1,600 feet	Northwest
Penn Yan Junior High School	2,800 feet	North-Northwest
Penn Yan Senior High School (Penn Yan Academy)	2,800 feet	North-Northwest
Penn Yan Elementary School	3,500 feet	North-Northwest
<u>HOSPITAL</u>		
Soldiers and Sailors Memorial Hospital	5,000 feet	North

TABLE 4-1

SUMMARY OF SURFACE SOIL SAMPLING LOCATIONS
PENN YAN - TASK 2

Sample Number	Location*	Purpose
SS-1	South side of old gas house building	Areas where floor drains reportedly discharged wastewater to the outside
SS-2	Northeast of old gas holder foundation remains	Surface soil sample near former MGP structure

* See Figure 4-1 for surface soil sampling locations

TABLE 4-2

SUMMARY OF TEST PIT EXPLORATION LOCATIONS
PENN YAN - TASK 2

Test Pit Number	Total Depth (feet)	Area Investigated
TP-1	-	Omitted because of underground utilities
B-1/MW-1S	30.0	Presumed background
TP-2	8.0	Adjacent to unknown building
TP-3	11.3	Coke pile storage
TP-4	5.0	High conductance area
TP-5	8.4	High conductance area
TP-6	8.9	Ash and wood chip disposal
TP-7	6.8	Ash and wood chip disposal
TP-8	2.9	Location of gas relief holder
TP-9	3.8	Location of gas relief holder
TP-10	4.8	Downgradient of gas relief holder
TP-11	10.0	Adjacent to unknown structure
TP-12	-	Omitted, backhoe could not penetrate ground surface
TP-13	-	Omitted, backhoe could not penetrate ground surface
TP-14	5.5	Tar storage vessel
TP-15	6.0	Tar storage vessel
TP-16	5.8	Tar storage vessel
TP-17	5.5	Floor drainage area
TP-18	6.0	Floor drainage area
TP-19	4.0	Area near unknown structure
TP-20	3.9	Elevated conductance area

TP = Test pit
B = Boring

Note: TP-1, TP-12 and TP-13 were replaced by B-1, TP-19 and TP-20, respectively.

TABLE 4-3

SUMMARY OF MONITORING WELL LOCATIONS
PENN YAN - TASK 2

Well Number	Description
MW-1S MW-1D	Upgradient monitoring wells based on surface topography. Monitoring well MW-1S intended to provide background data for shallow ground water conditions. Monitor well MW-1D to provide deep water quality information at same location.
MW-2S	Located downgradient of the site (based on topography and drainage) to define ground water quality and to determine the ground water gradient.
MW-3S	Located downgradient of the site (based on topography and drainage) and adjacent to the tar storage vessel.
MW-4S MW-4D	Monitor well MW-4D provides deep ground water quality information at same location. Monitoring well MW-4S provides shallow ground water quality data at the presumed downgradient corner of the site. Located downgradient (based on topography and drainage) of the former gas house.

TABLE 4-4

SUMMARY OF MONITORING WELL CONSTRUCTION DATA
PENN YAN - TASK 2

Well Number	Top of Protective Casing Elevation (ft msl)(1)	Material Screened	Screened Interval (ft bgl)(2)	Screen Elevation (ft msl)(1)		Depth to Water (ft btoc)(3) (February 1988)	Water Level Elevation (ft msl)(1)	Stainless Steel Riser Stickup (ft bgl)(2)(4)	Ground Elevation (ft msl)(1)
				Top	Bottom				
MW-1S	735.96	SILT/CLAY	15.0-30.0	721.5	706.5	16.36	719.60	-0.52	736.48
MW-1D	736.03	F-C SAND	44.0-54.0	692.0	682.0	17.45	718.58	-0.33	736.36
MW-2S	720.04	FILL/F SAND	3.3-19.0	717.3	701.6	6.00	714.04	-0.57	720.61
MW-3S	718.17	FILL/F SAND	2.0-17.0	715.2	701.2	3.59	714.58	-0.56	718.73
MW-4S	718.70	FILL/F SAND	2.0-17.0	716.7	701.7	4.40	714.30	-0.28	718.98
MW-4D	718.87	SILT/F-M SAND	29.0-39.0	689.9	679.9	0.20	718.67	-0.49	719.36

(1) ft msl = feet above mean sea level
(2) ft bgl = feet below grade level
(3) ft btoc = Feet below top of stainless-steel casing
(4) Top of stainless steel riser is below ground level

TABLE 4-5

SUMMARY OF SUBSURFACE SOIL SAMPLES
PENN YAN - TASK 2

Sample No.	Sample Location(1)	Depth Interval (ft bgl)(2)	Interval Description(3)
PY-TP-02	TP-2	5-7	Dark brown silt and clay fill with bricks and boulders
PY-TP-03	TP-3	4-8	Dark brown fill with cobbles, bricks, clinkers and wood fragments
PY-TP-04	TP-4	3-5	Black sandy fill with wood, concrete and brick fragments
PY-TP-05	TP-5	3-7	Brown clay, some silt, fine sand, and coarse gravel (below fill)
PY-TP-06	TP-6	5-7	Brown clay, some silt, little fine sand and gravel
PY-TP-08	TP-8	2-2.9	Fill, including wood, brick and glass fragments
PY-TP-09	TP-9	2.5-3.5	Sandy fill from inside of tank
PY-TP-10	TP-10	2-4.5	Brown sand and gravel, and reddish-brown clay fill with brick fragments
PY-TP-11	TP-11	5-10	Brown clay (below fill)
PY-TP-14	TP-14	3-5.5	Fill, including brick and wood fragments
PY-TP-15	TP-15	4-6	Black clay, coal odor
PY-TP-16	TP-16	2.5-3.9	Sandy fill with clay, and stained zone (blue-green and orange)
PY-TP-17	TP-17	3-5.5	Black sandy fill with ash, clinkers, wood chips, and brick fragments
PY-TP-18	TP-18	3-6	Black fill with bricks, wood beams, and purifier wastes
PY-TP-19	TP-19	2.5-4	Brown-black clay fill; coal tar evident
PY-B-1S	B-1/MW-1S	6-8	Brown sand and silt with brick fragments, coal clinkers, and wood chips

---

(1) Test pit or boring number
(2) Feet below grade level; all samples were composites over depth interval
(3) From test boring or boring log

TABLE 4-6

SUMMARY OF SURFACE WATER SAMPLING LOCATIONS
PENN YAN - TASK 2

Sampling No.	Location*	Purpose
SW-1	West of site, below Liberty Street Bridge	Water quality conditions upstream of the site
SW-2	Adjacent to site south of MW-3S	Water quality conditions adjacent to site (near tar storage vessel)
SW-3	East of site, below railroad tracks	Water quality conditions downstream of the site

* See Figure 4-4 for surface water locations.

TABLE 4-7

SUMMARY OF STREAM SEDIMENT SAMPLING LOCATIONS
PENN YAN - TASK 2

Sampling No.	Location*	Purpose
SD-1	West of site, below Liberty Street Bridge	To examine and analyze potential contaminants in the sediment upstream of the site
SD-2	Adjacent to site, south of MW-3S	To examine and analyze potential contaminants in the sediment adjacent to the site
SD-3	East of site, below railroad tracks	To examine and analyze potential contaminants in the sediment downstream of the site

* See Figure 4-4 for stream sediment locations.

TABLE 5-1

SUMMARY OF PRECIPITATION, EVAPOTRANSPIRATION, AND WATER SURPLUS FOR PENN YAN, N.Y.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
T°F	25	26	34	46	57	67	72	69	63	52	40	29	48
P	2.0	1.9	2.7	2.9	3.2	3.0	3.5	3.0	2.2	2.8	2.4	1.9	31.5
PE	0	0	0.1	1.3	3.1	4.7	5.8	5.0	3.3	1.4	0.5	0	25.2
AE	0	0	0.1	1.3	3.1	4.7	5.8	3.0	2.2	1.4	0.5	0	22.1
SM	4.0	4.0	4.0	4.0	4.0	2.3	0	0	0	1.4	3.3	4.0	NA
SP	2.0	1.9	2.6	1.6	0.1	0	0	0	0	0	0	1.2	9.1

NOTE:

(Altitude 720 ft)

T°F - Mean air temperature, in degrees Fahrenheit (long-term average).

P - Mean precipitation, in inches (long-term average).

PE - Mean potential evapotranspiration, in inches (computed).

AE - Mean actual evapotranspiration, in inches (computed).

SM - Available soil moisture, in inches.

SP - Mean water surplus (surplus precipitation), in inches (computed).

Source: Crain, L.F., 1974, Ground Water Resources of the Western Oswego River Basin, N.Y.

NA = Not Applicable

TABLE 5-2

GROUND WATER LEVELS AND ELEVATIONS IN MONITOR WELLS
PENN YAN SITE

Well Number	Top of Casing Elevation (ft msl)[1]	JANUARY 1987		APRIL 1987		JULY 1987		FEBRUARY 1988		MAY 1989	
		Depth to Water in Well (ft btoc)[2]	Water Level Elevation (ft msl)[1]	Depth to Water in Well (ft btoc)[2]	Water Level Elevation (ft msl)[2]	Depth to Water in Well (ft btoc)[2]	Water Level Elevation (ft msl)[1]	Depth to Water in Well (ft btoc)[2]	Water Level Elevation (ft msl)[1]	Depth to Water in Well (ft btoc)[2]	Water Level Elevation (ft msl)[1]
MW-1S	735.96	15.8	720.78	14.79	721.17	15.17	720.79	16.36	719.60	15.62	720.34
MW-1D	736.03	17.15	718.88	16.20	719.83	17.39	718.64	17.45	718.58	17.70	718.33
MW-2S	720.04	5.81	714.23	5.29	714.75	6.05	713.99	6.00	714.04	5.38	714.66
MW-3S	718.17	2.90	715.27	2.72	715.45	2.78	715.39	3.59	714.58	2.73	715.44
MW-4S	718.70	4.03	714.67	3.88	714.82	4.04	714.66	4.40	714.30	3.93	714.77
MW-4D	718.87	(flowing)	718.87+	(flowing)	718.87+	(flowing)	718.87+	0.20	718.67	0.82	718.05

(1) Feet above mean sea level.
(2) Feet below top of stainless-steel casing.

TABLE 5-3

SUMMARY OF HYDRAULIC CONDUCTIVITY VALUES OBTAINED FROM SLUG TESTS PENN YAN - TASK 2

Well Number	Regression Coefficient* (Absolute Value)	Estimated Hydraulic Conductivity (cm/s)	(ft/day)	Screened Lithology
MW-1S	0.975	3×10^{-4}	0.8	Silty clay
MW-1D	0.988	1×10^{-3}	3.9	Fine-to-coarse sand
MW-2S	0.990	3×10^{-5}	0.1	Fill/fine sand
MW-3S	0.996	7×10^{-5}	0.2	Fill/fine sand
MW-4S	0.978	6×10^{-4}	1.8	Fill/fine sand
MW-4D	0.996	3×10^{-4}	0.9	Silt, fine-to-medium sand

* Regression coefficient indicates how well data fit along the straight line predicted by theory. A coefficient of 1.0 is a perfect match.

TABLE 7-1

SUMMARY OF POSITIVE ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES(1)
PENN YAN - TASK 2

SAMPLE ID:	PY-SS-01	PY-SS-02
DATE:	11/20/86	11/20/86
SAMPLE TYPE:	GRAB	GRAB
PARAMETERS		
VOLATILES: (μg/g)		
Benzene	0.09	0.36
ACID EXTRACTABLES: (μg/g)	ND	ND
BASE/NEUTRAL EXTRACTABLES: (μg/g)		
Benzo(a)anthracene	ND	2.5
Benzo(a)pyrene	ND	3.0
Benzo(b)fluoranthene	ND	1.8
Benzo(k)fluoranthene	ND	2.7
Chrysene	ND	2.7
Fluoranthene	ND	5.8
Indeno(1,2,3-c,d)pyrene	ND	2.9
Phenanthene	ND	3.0
Pyrene	ND	4.8
TOTAL PAHs	ND	29.2
METALS: (μg/g)		
Arsenic	10.1	8.53
Cadmium	1.89	1.6
Chromium	21.4	12.7
Iron	27,700	15,900
Lead	127	189
Zinc	401	110
INORGANIC COMPOUNDS: (μg/g)		
Total Cyanide	0.39	1.70
Ferro-Ferric Cyanide	0.39	1.05
Organic Nitrogen	2,300	2,620
Sulfate	500	ND

ND = Indicates none detected.

(1) = Complete analytical data is present in Appendix D.

μg/g = Micrograms per gram (ppm).

TABLE 7-2
SUMMARY OF POSITIVE ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES
PENN YAN - TASK 2

SAMPLE ID:	PY-B-1S	PY-TP-2	PY-TP-3	PY-TP-4	PY-TP-4
DATE:	11/20/86	11/19/86	11/20/86	11/20/86	11/20/86
DEPTH (feet):	6.0-8.0	5.0-7.0	4.0-8.0	3.0-5.0	3.0-5.0
SAMPLE TYPE:	Composite	Composite	Composite	Composite	Composite
LABORATORY:	TRC	TRC	TRC	TRC	CC
PARAMETERS					
VOLATILES: (µg/g)					
Benzene	-	-	-	-	-
1,4-Dichlorobenzene	-	-	-	-	-
Ethylbenzene	-	-	-	-	-
Methylene Chloride	NA	NA	NA	NA	0.020B
Toluene	-	-	-	-	-
TOTAL VOCs	-	-	-	-	0.020 B
ACID EXTRACTABLES: (µg/g)					
2,4-Dimethyl phenol	-	-	-	-	-
2-Methyl-4,6-Dinitrophenol	-	-	-	-	NA
2-Nitrophenol	-	-	-	-	-
4-Nitrophenol	-	-	-	-	-
Phenol	-	-	-	-	-
BASE/NEUTRAL EXTRACTABLES: (µg/g)					
Acenaphthylene	-	-	-	-	-
Acenaphthene	-	-	-	-	-
Anthracene	0.5	-	0.5	-	-
Benzo(a)anthracene	-	-	0.9	-	-
Benzo(a)pyrene	-	-	0.8	0.4	-
Benzo(g,h,i)perylene	-	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-	-
Benzo(k)fluoranthene	-	-	0.6	-	-
Chrysene	-	-	0.7	-	-
Dibenzo(a,h)Anthracene	-	-	-	-	-
Fluoranthene	-	-	2.3	1.3	-
Fluorene	-	-	-	-	-
Indeno(1,2,3-c,d)pyrene	-	-	0.6	-	-
Naphthalene	-	-	-	-	-
Phenanthrene	-	-	1.7	0.4	-
Pyrene	-	-	2.3	1.0	-
TOTAL PAHs	0.5	-	10.4	3.4	-
METALS: (µg/g)					
Antimony	NA	NA	NA	NA	5.0 J
Arsenic	11.2	11.1	9.38	12.8	12
Cadmium	-	-	-	-	0.55
Chromium	16.1	20.8	12.9	16.9	126
Copper	NA	NA	NA	NA	34
Iron	22,200	25,200	17,300	17,100	NA
Lead	39.6	-	106	708	444
Mercury	NA	NA	NA	NA	1.7
Nickel	NA	NA	NA	NA	19
Zinc	69.2	64.1	69.2	403	176
INORGANIC COMPOUNDS: (µg/g)					
Total Cyanide	0.95	-	-	0.91	0.33
Ferro-Ferric Cyanide	0.23	-	-	0.91	NA
Sulfate	1080	-	330	350	NA
Organic Nitrogen	422	385	502	890	NA

B = Indicates target compound was also detected in the blank

J = Indicates estimated value; used to indicate values below the method detection method limit at a concentration estimated to be .009 µg/g

NA = Not analyzed

\- = Indicates nothing detected above method detection limits

TRC = TRC Environmental Consultants Laboratory

CC = CompuChem Laboratory

Micrograms Per Gram (µg/g) = Parts Per Million (ppm)

TABLE 7-2 (Continued)
SUMMARY OF POSITIVE ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES
PENN YAN – TASK 2

SAMPLE ID:	PY-TP-5	PY-TP-6	PY-TP-8	PY-TP-9	PY-TP-10
DATE:	11/19/86	11/19/86	11/18/86	11/18/86	11/21/86
DEPTH (feet):	3.0-7.0	5.0-7.0	2.0-2.9	2.5-3.5	2.0-4.5
SAMPLE TYPE:	Composite	Composite	Composite	Composite	Composite
LABORATORY:	TRC	TRC	TRC	TRC	TRC
PARAMETERS					
VOLATILES: (µg/g)					
Benzene	–	–	–	–	–
1,4-Dichlorobenzene	–	–	–	–	–
Ethylbenzene	–	–	–	–	–
Methylene Chloride	NA	NA	NA	NA	NA
Toluene	–	–	–	–	–
TOTAL VOCs	–	–	–	–	–
ACID EXTRACTABLES: (µg/g)					
2,4-Dimethyl phenol	–	–	–	–	–
2-Methyl-4,6-Dinitrophenol	–	–	–	–	–
2-Nitrophenol	–	–	–	–	–
4-Nitrophenol	–	–	–	–	–
Phenol	–	–	–	–	–
BASE/NEUTRAL EXTRACTABLES: (µg/g)					
Acenaphthylene	–	–	–	–	–
Acenaphthene	–	–	–	–	–
Anthracene	0.3	–	–	–	–
Benzo(a)anthracene	–	–	0.7	2.4	–
Benzo(a)pyrene	–	–	0.8	6.4	0.3
Benzo(g,h,i)perylene	–	–	–	–	–
Benzo(b)fluoranthene	–	–	–	2.7	1.5
Benzo(k)fluoranthene	–	–	1.9	3.8	–
Chrysene	–	–	0.8	2.3	–
Dibenzo(a,h)Anthracene	–	–	–	0.9	–
Fluoranthene	–	–	1.4	3.2	0.7
Fluorene	–	–	–	–	–
Indeno(1,2,3-c,d)pyrene	–	0.3	0.7	8.5	0.3
Naphthalene	–	–	–	–	–
Phenanthene	–	–	0.7	1.3	–
Pyrene	–	–	1.3	3.1	0.6
TOTAL PAHs	0.3	0.3	8.3	34.6	3.4
METALS: (µg/g)					
Antimony	NA	NA	NA	NA	NA
Arsenic	8.8	8.09	13.3	8.94	15.3
Cadmium	–	–	–	–	–
Chromium	16.1	12.7	13.2	8.94	11.9
Copper	NA	NA	NA	NA	NA
Iron	21,300	15,400	21,800	16,200	16,200
Lead	27.4	–	191	153	65.6
Mercury	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA
Zinc	60.1	43.4	225	88.4	58.0
INORGANIC COMPOUNDS: (µg/g)					
Total Cyanide	–	–	7.13	7.40	–
Ferro-Ferric Cyanide	–	–	2.62	–	–
Sulfate	83	89	270	–	120
Organic Nitrogen	226	180	846	1,700	451

B = Indicates target compound was also detected in the blank

J = Indicates estimated value; used to indicate values below the method detection method limit at a concentration estimated to be .009 µg/g

NA = Not analyzed

– = Indicates nothing detected above method detection limits

TRC = TRC Environmental Consultants Laboratory

CC = CompuChem Laboratory

Micrograms Per Gram (µg/g) = Parts Per Million (ppm)

TABLE 7-2 (Continued)
SUMMARY OF POSITIVE ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES
PENN YAN - TASK 2

SAMPLE ID:	PY-TP-11	PY-TP-14	PY-TP-15	PY-TP-16	PY-TP-17
DATE:	11/21/86	11/18/86	11/14/86	11/14/86	11/18/86
DEPTH (feet):	5.0-10.0	3.0-5.5	4.0-6.0	2.5-3.9	3.0-5.5
SAMPLE TYPE:	Composite	Composite	Composite	Composite	Composite
LABORATORY:	TRC	TRC	TRC	TRC	TRC
PARAMETERS					
VOLATILES: (µg/g)					
Benzene	-	-	3.80	0.27	-
1,4-Dichlorobenzene	-	-	2.44	1.17	-
Ethylbenzene	-	-	2.84	-	-
Methylene Chloride	NA	NA	NA	NA	NA
Toluene	-	-	2.68	0.35	-
TOTAL VOCs	-	-	11.76	1.52	-
ACID EXTRACTABLES: (µg/g)					
2,4-Dimethyl phenol	-	-	2.4	-	-
2-Methyl-4,6-Dinitrophenol	-	-	23.5	16.9	-
2-Nitrophenol	-	-	-	13.5	-
4-Nitrophenol	-	-	6.9	7.8	-
Phenol	-	-	2.5	-	-
BASE/NEUTRAL EXTRACTABLES: (µg/g)					
Acenaphthylene	-	-	-	1.4	-
Acenaphthene	-	-	-	7.6	1.9
Anthracene	0.3	-	-	17.7	7.2
Benzo(a)anthracene	-	-	-	47.9	17.5
Benzo(a)pyrene	-	-	-	42.0	15.0
Benzo(g,h,i)perylene	-	-	-	18.2	5.8
Benzo(b)fluoranthene	-	-	-	37.2	10.4
Benzo(k)fluoranthene	-	-	-	26.8	18.1
Chrysene	-	-	-	54.4	19.1
Dibenzo(a,h)Anthracene	-	-	-	4.2	1.2
Fluoranthene	-	-	-	115	37.2
Fluorene	-	-	-	5.8	0.9
Indeno(1,2,3-c,d)pyrene	-	-	-	23.2	6.8
Naphthalene	-	-	5.1	5.9	1.7
Phenanthene	-	-	-	50.6	12.9
Pyrene	-	-	-	90.0	30.2
TOTAL PAHs	0.3	-	5.1	547.9	185.9
METALS: (µg/g)					
Antimony	NA	NA	NA	NA	NA
Arsenic	12.3	10.0	7.65	9.48	6.17
Cadmium	-	-	-	-	-
Chromium	19.2	11.2	17.2	13.6	7.18
Copper	NA	NA	NA	NA	NA
Iron	24,100	20,000	18,100	24,300	9,270
Lead	-	192	68.3	273	243
Mercury	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA
Zinc	67.1	112	76.5	105	48.4
INORGANIC COMPOUNDS: (µg/g)					
Total Cyanide	-	2.21	8.14	25.3	0.68
Ferro-Ferric Cyanide	-	1.39	8.14	4.40	0.23
Sulfate	85	-	-	280	79
Organic Nitrogen	383	710	2,540	1,110	2,720

B = Indicates target compound was also detected in the blank
J = Indicates estimated value; used to indicate values below the method detection method limit at a concentration estimated to be .009 µg/g
NA = Not analyzed
\- = Indicates nothing detected above method detection limits
TRC = TRC Environmental Consultants Laboratory
CC = CompuChem Laboratory
Micrograms Per Gram (µg/g) = Parts Per Million (ppm)

TABLE 7-2 (continued)
SUMMARY OF POSITIVE ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES
PENN YAN - TASK 2

SAMPLE ID:	PY-TP-18	PY-TP-19	PY-TP-19
DATE:	11/14/86	11/20/86	11/20/86
DEPTH (feet):	3.0-6.0	2.5-4.0	2.5-4.0
SAMPLE TYPE:	Composite	Composite	Composite
LABORATORY:	TRC	TRC	CC
PARAMETERS			
VOLATILES: (µg/g)			
Benzene	-	0.18	-
1,4-Dichlorobenzene	1.59	0.41	-
Ethylbenzene	-	-	-
Methylene Chloride	NA	NA	0.029 B
Toluene	-	0.07	-
TOTAL VOCs	1.59	0.66	0.029 B
ACID EXTRACTABLES: (µg/g)			
2,4-Dimethyl phenol	-	-	-
2-Methyl-4,6-Dinitrophenol	-	4.5	NA
2-Nitrophenol	-	-	-
4-Nitrophenol	-	2.4	-
Phenol	-	-	-
BASE/NEUTRAL EXTRACTABLES: (µg/g)			
Acenaphthylene	-	4.7	1.2 J
Acenaphthene	0.6	8.4	0.68 J
Anthracene	1.1	29.5	6.6
Benzo(a)anthracene	5.4	54.6	18
Benzo(a)pyrene	6.4	49.6	13
Benzo(g,h,i)perylene	4.0	21.0	6.4
Benzo(b)fluoranthene	4.2	34.8	21
Benzo(k)fluoranthene	6.4	27.2	21
Chrysene	5.1	55.4	14
Dibenzo(a,h)Anthracene	0.8	4.6	0.73 J
Fluoranthene	10.2	134	29
Fluorene	-	8.5	2.2
Indeno(1,2,3-c,d)pyrene	4.1	26.2	5.5
Naphthalene	-	7.0	-
Phenanthene	7.3	66.5	18
Pyrene	8.3	105	23
TOTAL PAHs	63.9	637	177.7
METALS: (µg/g)			
Antimony	NA	NA	-
Arsenic	12	12.3	12
Cadmium	-	-	-
Chromium	8.25	17.7	6.7
Copper	NA	NA	51
Iron	11,800	22,700	NA
Lead	190	154	143
Mercury	NA	NA	0.15
Nickel	NA	NA	9.7
Zinc	69.8	130	109
INORGANIC COMPOUNDS: (µg/g)			
Total Phenol	NA	NA	0.56
Total Cyanide	1.94	5.52	1.0
Ferro-Ferric Cyanide	1.52	4.52	NA
Sulfate	-	360	NA
Organic Nitrogen	1,640	790	NA

B = Indicates target compound was also detected in the blank

J = Indicates estimated value; used to indicate values below the method detection method limit at a concentration estimated to be .009 µg/g

NA = Not analyzed

\- = Indicates nothing detected above method detection limits

TRC = TRC Environmental Consultants Laboratory

CC = CompuChem Laboratory

Micrograms Per Gram (µg/g) = Parts Per Million (ppm)

TABLE 7-3

SUMMARY OF COMPOUNDS DETECTED IN GROUND WATER SAMPLES
PENN YAN - TASK 2

SAMPLE ID: DATE: SAMPLE TYPE:	MW-1S 1/13/87 Grab	MW-1S 4/22/87 Grab	MW-1S 7/21/87 Grab	MW-1S 5/3/89 Grab	MW-1D 1/13/87 Grab	MW-1D 4/22/87 Grab	MW-1D 7/21/87 Grab	MW-1D 5/3/89 Grab	MW-2S 1/13/87 Grab	MW-2S 4/21/87 Grab	MW-2S 7/21/87 Grab	MW-2S 5/3/89 Grab
PARAMETERS												
PURGEABLE AROMATICS: (mg/l)												
Acetone	0.321*	-	-	-	0.312*	-	-	-	0.358*	-	-	-
Methylene chloride	-	-	-	-	0.006F	-	-	-	-	-	-	-
Trichloroethene	-	-	-	-	-	-	-	-	-	-	-	-
ACID EXTRACTABLES: (mg/l)	-	-	-	**	-	-	-	-	-	-	-	-
BASE/NEUTRAL EXTRACTABLES: (mg/l)												
bis(2-ethylhexyl)phthalate	-	0.017	-	**	-	0.02	0.17	-	-	0.062	-	-
Di-n-octyl phthalate	-	0.011	-	**	-	-	-	-	-	-	-	-
2,6-Dinitrotoluene	-	-	-	**	-	-	-	-	-	-	0.033	-
n-Nitrosodimethylamine	-	-	-	**	-	-	-	-	-	-	0.041	-
DISSOLVED METALS: (mg/l)												
Arsenic	-	-	-	-	0.01	-	0.006	-	-	-	-	-
Chromium	-	0.02	-	-	-	-	-	-	-	-	-	-
Iron	-	0.87	2.66	0.049	0.26	-	0.20	0.36	-	-	-	0.39
Zinc	0.03	0.03	0.08	-	-	0.06	0.07	-	-	-	0.02	-
OTHER COMPOUNDS (mg/l)												
Total Organic Carbon	40	6.2	8.3	6.8	10	1.6	3.2	-	57	2.8	3.4	1.7
Sulfate	288	438	240	250	25.7	15.1	13.2	16	75.9	87.3	57.9	100
Organic Nitrogen	-	-	0.60	-	-	-	-	-	-	-	5.1	-
Total Cyanide	0.19	0.22	0.23	0.13	-	-	-	-	-	-	-	-
Ferro-Ferric Cyanide	-	-	-	-	-	-	-	-	-	-	-	-

- = Not detected, below detection limits
* = Attributed to equipment, laboratory or other outside interference - see text for explanation
** = Sample container was broken before extraction
F = Target compound was detected in the field blank

NOTE: Purgeable aromatic analyses performed on Round 3 (July 1987) samples exceeded holding times

TABLE 7-3 (Continued)

SUMMARY OF COMPOUNDS DETECTED IN GROUND WATER SAMPLES
PENN YAN - TASK 2

SAMPLE ID:	MW-3S	MW-3S	MW-3S	MW-3S	MW-4S	MW-4S	MW-4S	MW-4S	MW-4D	MW-4D	MW-4D	MW-4D
DATE:	1/13/87	4/21/87	7/21/87	5/3/89	1/13/87	4/21/87	7/21/87	5/3/89	1/13/87	4/22/87	7/21/87	5/3/89
SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
PARAMETERS												
<u>PURGEABLE AROMATICS</u>: (mg/l)												
Acetone	0.130*	0.014*	-	-	0.157*	-	-	-	0.315*	-	-	-
Methylene chloride	-	-	-	-	-	-	-	-	0.005F	-	-	-
Trichloroethene	-	0.005B	-	-	-	-	-	-	-	-	-	-
<u>ACID EXTRACTABLES</u>: (mg/l)	-	-	-	-	-	-	-	-	-	-	-	-
<u>BASE/NEUTRAL EXTRACTABLES</u>: (mg/l)												
bis(2-ethylhexyl)phthalate	-	0.019*	-	-	-	0.019*	-	-	-	-	0.017*	-
Di-n-octyl phthalate	-	-	-	-	-	0.022*	-	-	-	-	-	-
2,6-Dinitrotoluene	-	-	0.142	-	-	-	0.026	-	-	-	-	-
n-Nitrosodimethylamine	-	-	0.044	-	-	-	0.046	-	-	-	-	-
<u>DISSOLVED METALS</u>: (mg/l)												
Arsenic	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	-	-	-	-	-	-	-	-	-	-	-	-
Iron	0.78	2.0	1.09	2.67	0.10	0.72	0.22	0.32	-	0.30	0.51	0.74
Zinc	0.02	0.05	0.09	-	-	0.02	0.04	-	0.41	0.06	0.10	-
<u>OTHER COMPOUNDS</u> (mg/l)												
Total Organic Carbon	22	6.3	7.3	5.1	12	3.8	4.7	5.0	3.0	1.1	3.4	-
Sulfate	38.1	173	27.9	33	96.2	12.6	74.2	130	22.9	6.3	10.3	9
Organic Nitrogen	6.1	9.2	0.46	8.4	0.04	5.0	9.22	3.8	0.04	0.76	0.61	-
Total Cyanide	0.08	-	0.13	0.4	0.20	0.14	0.19	.12	-	-	-	-
Ferro-Ferric Cyanide	0.04	-	-	-	-	-	-	-	-	-	-	-

- = Not detected, below detection limits
* = Attributed to equipment, laboratory or other outside interference - see text for explanation
** = Sample container was broken before extraction
F = Target compound was detected in the field blank

NOTE: Purgeable aromatic analyses performed on Round 3 (July 1987) samples exceeded holding times.

TABLE 7-4

SUMMARY OF SPECIFIC CONDUCTANCE, pH, AND TEMPERATURE OF GROUND WATER SAMPLES
PENN YAN - TASK 2

SAMPLE ID:	MW-1S	MW-1S	MW-1S	MW-1S	MW-1D	MW-1D	MW-1D	MW-1D	MW-2S	MW-2S	MW-2S	MW-2S
DATE:	1/13/87	4/22/87	7/21/87	5/3/89	1/13/87	4/22/87	7/21/87	5/3/89	1/13/87	4/21/87	7/21/87	5/3/89
SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
PARAMETERS												
pH (standard units)	6.85	5.93	6.95	6.30	7.43	-	8.00	6.50	7.14	7.09	7.40	6.50
Specific Conductivity (μmhos/cm)	1,892	1,960	1,350	1,650	370	322	310	320	763	846	550	700
Water Temperature (°C)	11.0	12.0	13.0	12.0	11.5	-	13.5	12.0	10.5	11.0	14.0	9.0

"-" Not Measured

TABLE 7-4 (Continued)

SUMMARY OF SPECIFIC CONDUCTANCE, pH, AND TEMPERATURE OF GROUND WATER SAMPLES
PENN YAN - TASK 2

SAMPLE ID: DATE: SAMPLE TYPE:	MW-3S 1/13/87 Grab	MW-3S 4/21/87 Grab	MW-3S 7/21/87 Grab	MW-3S 5/3/89 Grab	MW-4S 1/13/87 Grab	MW-4S 4/21/87 Grab	MW-4S 7/21/87 Grab	MW-4S 5/3/89 Grab	MW-4D 1/13/87 Grab	MW-4D 4/22/87 Grab	MW-4D 7/21/87 Grab	MW-4D 5/3/89 Grab
PARAMETERS												
pH (standard units)	7.02	6.95	7.20	6.60	6.68	6.08	7.15	6.60	7.88	6.77	7.80	6.80
Specific Conductivity (µmhos/cm)	1,012	1,038	820	900	1,149	1,185	800	1,100	342	322	175	280
Water Temperature (°C)	11	13.5	17.0	10.0	10.5	-	18.0	10.0	10.5	12.5	18	10.0

"-" Not Measured

TABLE 7-5

SUMMARY OF POSITIVE ANALYTICAL RESULTS FOR SURFACE WATER SAMPLES
PENN YAN - TASK 2

SAMPLE ID:	SW-1	SW-1	SW-1	SW-1	SW-2	SW-2	SW-2	SW-2	SW-3	SW-3	SW-3	SW-3
DATE:	1/13/87	4/22/87	7/21/87	5/3/89	1/13/87	4/22/87	7/21/87	5/3/89	1/13/87	4/22/87	7/21/87	5/3/89
SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
PARAMETERS												
PURGEABLE AROMATICS: (mg/l)												
Acetone	0.615*	-	-	-	0.034*	-	-	-	0.027*	-	-	-
ACID EXTRACTABLES: (mg/l)	-	-	-	-	-	-	-	-	-	-	-	-
BASE/NEUTRAL EXTRACTABLES: (mg/l)												
acenaphthene	-	-	0.011	-	-	-	-	-	-	-	-	-
acenaphthylene	-	-	0.074	-	-	-	-	-	-	-	-	-
bis(2-ethylhexyl)phthalate	-	0.167*	-	-	-	0.733*	-	-	-	0.024*	-	-
METALS: (mg/l)												
Cadmium	-	0.001	-	-	-	-	-	-	-	0.001	-	.17
Iron	0.07	-	-	.33	-	-	0.14	.11	0.09	-	0.28	-
Lead	-	-	-	.01	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	0.0003	-	-	-
Zinc	-	-	-	-	-	-	-	-	0.01	-	-	-
INORGANIC COMPOUNDS (mg/l)												
Total Organic Carbon	5.0	2.3	5.1	3.0	7.0	2.2	5.0	2.7	4.0	2.4	6.1	2.6
Sulfate	28.5	21.4	21.5	28.0	30.3	21.1	20.6	30.0	27.6	21.6	21.6	24.0
Organic Nitrogen	-	-	0.42	-	-	0.40	-	-	-	-	0.46	-
Total Cyanide	-	-	0.02	-	-	-	-	-	-	-	-	-
Ferro-Ferric Cyanide	-	-	-	-	-	-	-	-	-	-	-	-

- = Indicates nothing detected above method detection limits.
* = Compound detected in field blank or other outside interference - see text for explanation.

TABLE 7-6

SUMMARY OF SPECIFIC CONDUCTANCE, pH, AND TEMPERATURE OF SURFACE WATER SAMPLES
PENN YAN - TASK 2

SAMPLE ID:	SW-1	SW-1	SW-1	SW-1	SW-2	SW-2	SW-2	SW-2	SW-3	SW-3	SW-3	SW-3
DATE:	1/13/87	4/22/87	7/21/87	5/3/89	1/13/87	4/22/87	7/21/87	5/3/89	1/13/87	4/22/87	7/21/87	5/3/89
SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
PARAMETERS												
pH (standard units)	7.74	8.16	8.95	6.3	7.74	8.13	9.25	6.3	7.74	8.11	9.00	5.9
Specific Conductivity (µmhos/cm)	235	279	270	195	223	250	280	190	223	233	275	190
Water Temperature (°C)	3.5	11.5	28.0	8.0	4.5	16.0	29.5	8.0	4.5	16.0	29.0	8.0

TABLE 7-7

SUMMARY OF POSITIVE ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

	FIRST SAMPLING ROUND (1/13/87)			SECOND SAMPLING ROUND (5/4/89)									
SAMPLE ID:	SD-1	SD-2	SD-3	SD-1	SD-2	SD-3	SD-4	SD-5	SD-6	SD-7	SD-8	SD-9	SD-10
DATE:	1/13/87	1/13/87	1/13/87	5/4/89	5/4/89	5/4/89	5/4/89	5/4/89	5/4/89	5/4/89	5/4/89	5/4/89	5/4/89
SAMPLE TYPE:	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
PARAMETERS													
PURGEABLE AROMATICS: (ppm)	-	-	-	-	-	-	-	-	-	-	-	-	-
ACID EXTRACTABLES: (ppm)	-	-	-	-	-	-	-	-	-	-	-	-	-
BASE/NEUTRAL EXTRACTABLES: (ppm)													
Acenaphthene	-	130	-										
Acenaphthylene	-	-	-										
Anthracene	-	120	-										
Benzo(a)anthracene	-	190	2.9	-	3.8	-	3.3	2.9	-	-	-	-	-
Benzo(b)fluoranthene	-	340	11										
Benzo(k)fluoranthene	-	-	-	-	-	2.4	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	68	-										
Benzo(a)pyrene	-	150	3.3	-	-	-	2.6	-	-	-	-	-	-
bis(2-ethylhexyl)phthalate	-	-	-										
butyl benzyl phthalate	-	-	-										
Chrysene	-	120	3.4	-	-	-	2.6	-	-	-	-	-	-
Dibenzo(a,h)anthracene	-	-	-										
Fluoranthene	-	430	6.5	-	9.7	-	4.1	7.6	-	-	-	-	-
Fluorene	-	120	-										
Indeno(1,2,3-c,d)pyrene	-	86	-										
Naphthalene	-	-	-										
Phenanthrene	-	610	3.9	-	7.8	-	2.5	6.5	-	-	-	-	-
Pyrene	-	310	5.2	-	5.7	-	2.7	4.8	-	-	-	-	-
TOTAL PAHs	-	2,674	36.2	-	27.0	-	20.2	21.8	-	-	-	-	-
METALS: (ppm)													
Arsenic	NA	NA	NA	9.33	6.03	8.33	3.35	0.80	3.65	1.99	4.97	-	3.95
Cadmium	NA	NA	NA	0.73	0.68	1.00	0.58	0.14	0.38	0.32	0.31	0.67	0.59
Chromium	NA	NA	NA	23.3	21.7	25.9	13.1	6.66	10.8	11.2	14.3	1.92	18.6
Iron	16,300	15,700	23,300	24,200	14,800	22,500	12,600	4,270	12,200	7,130	16,200	38.0	15,400
Mercury	NA	NA	NA	0.78	0.058	0.14	0.18	-	1.48	0.035	-	-	-
Lead	NA	NA	NA	138	112	135	61.3	38.2	70.6	77.6	51.8	51.8	450
Zinc	130	150	320	176	151	248	134	46.5	114	93.2	137	227	196
OTHER COMPOUNDS:													
Total Organic Carbon	45,200	76,900	129,000	4,800	2,400	4,400	5,100	5,800	7,000	5,400	1,500	8,890	5,700
Total Phenols	-	-	-	2.7	.64	1.1	.77	1.5	3.3	-	-	-	1.5
Organic Nitrogen (NH_3^-)	-	-	-	170	150	210	120	130	150	120	180	130	120

- = Below detection limits

TABLE 7-8

SUMMARY OF COMPOUNDS DETECTED IN AIR SAMPLES
PENN YAN - TASK 2

		CHARCOAL TUBES			SILICA GEL TUBE WITH TEFLON FILTER		
	LOCATION:	Downwind	At Source	Upwind	Downwind	At Source	Upwind
	SAMPLE ID:	028-3437	031-3437	034-3437	002-3437	005-3437	008-3437
	DATE:	11/20/86	11/20/86	11/20/86	11/17/86	11/17/86	11/17/86
PARAMETERS	Detection Limit (mg/m^3)						
<u>VOLATILE ORGANIC COMPOUNDS</u> (mg/m^3)							
Benzene	0.008	ND	0.0008(3)	0.003(3)	(1)	(1)	(1)
Toluene	0.008	ND	ND	TR	(1)	(1)	(1)
<u>POLYNUCLEAR AROMATIC HYDROCARBONS</u> (mg/m^3)							
Naphthalene	0.006	(2)	(2)	(2)	0.008	0.010	0.009

(1) These parameters were analyzed from the charcoal tube.

(2) These parameters were analyzed from the silica gel tube.

(3) Results after blank correction are lower than the detection limit; concentrations are estimated (trace).

ND - Below detection limit, not detected

TR - Trace concentrations detected below the detection limit.

TABLE 8-1

SUMMARY OF GROUND WATER AND SURFACE WATER ANALYTICAL RESULTS WHICH EXCEED REGULATORY CRITERIA PENN YAN - TASK 2

Analytes Detected	Regulatory Criteria (ppm)	Results Which Exceed Criteria*
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION(a)		
Volatile Organic Compounds	-	None
Acid Extractables	-	None
Base/Neutral Extractables		
2,6-dinitrotoluene	0.00007(G)	MW-2S^{3}, MW-3S^{3}, MW-4S^{3}
Dissolved Metals		
Iron	0.300(S)	MW-1S$^{2\wedge3}$, MW-1D^{4}, MW-2S^{4}, MW-3S$^{1\wedge2\wedge3\wedge4}$, MW-4S$^{2\wedge4}$, MW-4D$^{3\wedge4}$
Other Compounds		
Total Cyanide	0.200(S)	MW-1S$^{2\wedge3}$, MW-3S^{4}, MW-4S^{1},
Sulfate	250(S)	MW-1S^{12}
pH	6.5-8.5(S)	MW-1S^{2,4}, MW-4S^{2}, SW-1^{3,4},SW-2^{3,4},SW-3^{3,4}
NEW YORK STATE DEPARTMENT OF HEALTH(b)		
Principal Organic Contaminant (POC)	0.005	MW-2S^{3}, MW-3S^{3}, MW-4S^{3}
Unspecified Organic Contaminant (UOC)	0.050	SW-1^{3}
Total of POCs and UOCs	0.10	MW-3^{3}, SW-1^{3}
Dissolved Metals		
Iron	0.300	MW-1S$^{2\wedge3}$, MW-1D^{4}, MW-2S^{4}, MW-3S$^{1\wedge2\wedge3\wedge4}$, MW-4S$^{2\wedge4}$, MW-4D$^{3\wedge4}$, SW-1^{4}
Other Compounds		
Sulfate	250	MW-1S^{1,2}

(a) NYSDEC Standards and Guidance Values for Class GA ground water:
S = standard; G = guidance value

(b) NYSDOH criteria from Part 5 of the State Sanitary Code
POC = Princincipal Organic Contaminant; UOC = Unspecified Organic Contaminant

* Ignores common laboratory contaminants and analytes present in method, trip, or field blanks

1, 2, 3, 4 = represent sample round

TABLE 8-2

PRELIMINARY IDENTIFICATION OF REMEDIAL ALTERNATIVES
FOR THE PENN YAN SITE

Medium	Conceptual Action	Remedial Measure	Remarks
Soils	Removal	Excavation and Disposal or Incineration • contaminated soils • waste deposits	Off-site disposal will involve excavation and removal of contaminated soils and waste deposits with subsequent transportation to another location for disposal or incineration. Potential impact on air quality during excavation.
	Containment	Capping, Grading Revegetation • wastes • contaminated soils	Commonly implemented together, they will prevent the movement of wastes and contaminated soils into the environment from erosion. The cap will also reduce infiltration and, therefore, the rate of leaching of chemicals from the soils into the ground water.
		Slurry Wall	Generally used in conjunction with extraction and treatment of ground water.
	Treatment	Extraction (soil flushing)	Not applicable for large quantities of material with diverse compositions. A variety of treatment technologies are potentially applicable to extracted wastes. Extracted soils may still contain much contamination.
	No Action	Posting, Fencing, Land Use Restrictions	May not be applicable for a complete remedial action plan, but may be used as an element of a comprehensive plan. Will be considered in conjunction with other technologies.
Ground Water	No Action		To be considered in conjunction with other technologies.
Surface Water	No Action		To be considered in conjunction with other technologies.
Stream Sediments	Removal/Treatment	Dredge Contaminated Soils	May be necessary if coal tars have penetrated stream sediments. To be considered in conjunction with other technologies.