ENGINEERING INVESTIGATIONS AT INACTIVE HAZARDOUS WASTE SITES

PHASE 1 INVESTIGATION

Quiogue Landfill

Site No. 152061

Town of Southampton, Suffolk County

Final - June 1987

New York State Department of Environmental Conservation

50 Wolf Road, Albany, New York 12233

Henry G. Williams, Commissioner

Division of Solid and Hazardous Waste
Norman H. Nosenchuck, P.E., Director

Prepared by:

EA SCIENCE AND TECHNOLOGY
A Division of EA Engineering, Science, and Technology, Inc.

EA REPORT DEC63A

ENGINEERING INVESTIGATIONS AT INACTIVE HAZARDOUS WASTE SITES IN THE STATE OF NEW YORK PHASE I INVESTIGATIONS

QUIOGUE LANDFILL
TOWN OF SOUTHAMPTON, SUFFOLK COUNTY
NEW YORK I.D. NO. 152061

Prepared for

Division of Solid and Hazardous Waste
New York State Department of Environmental Conservation
50 Wolf Road
Albany, New York 12233-0001

Prepared by

EA Science and Technology
R.D. 2, Goshen Turnpike
Middletown, New York 10940

A Division of EA Engineering, Science, and Technology, Inc.

June 1987

CONTENTS

1. EXECUTIVE SUMMARY

The Quiogue landfill (New York I.D. No. 152061, EPA No. NY D980762462) is an inactive landfill located along South Country Road in the Town of Southampton, in Suffolk County (Figures 1-1 and 1-2, and Photos 1-1 through 1-8). The landfill is owned by the Town of Southampton. The Town operated the 12-acre site as a municipal landfill from 1968 until 1978. During the 10 years of operation, cesspool wastes and household trash were deposited at this site. The site has no liner. A 4-ft thick cap of loam was applied after the site was closed. No records were kept of the quantities of waste. Allegations have been made that drums of DDT and electrical components containing PCBs were buried at this site, however, the allegations are unsubstantiated.

Jet fuel spills totaling 90,000 gal have occurred at a tank farm on Suffolk County Airport property, 500 ft north of the landfill. Extensive ground-water investigations directed at the Suffolk County Airport and immediate vicinity, including the Quiogue landfill, have documented contamination from jet fuel spills at the airport but have not established that hazardous materials are migrating from the Quiogue landfill.

EA has researched all pertinent agency files, interviewed the site owner's representative, conducted a site inspection, and has found no documented hazardous waste or contamination at this site. Therefore, it is not appropriate to provide a Hazard Ranking Score (or documentation) for this site. In order to prepare a final HRS score for this site, analytical data regarding the quality of the ground water and sediment will be necessary, thus requiring performance of a Phase II investigation. The proposed Phase II study would include geophysical surveys, the installation of five test borings/observation wells, and the collection and analysis of ground-water samples. The estimated total cost to complete a Phase II investigation of the Quiogue Landfill site is $84,550.

Site Coordinates:

Latitude: 40° 47' 47"
Longitude: 72° 37' 52"

QUIOGUE LANDFILL

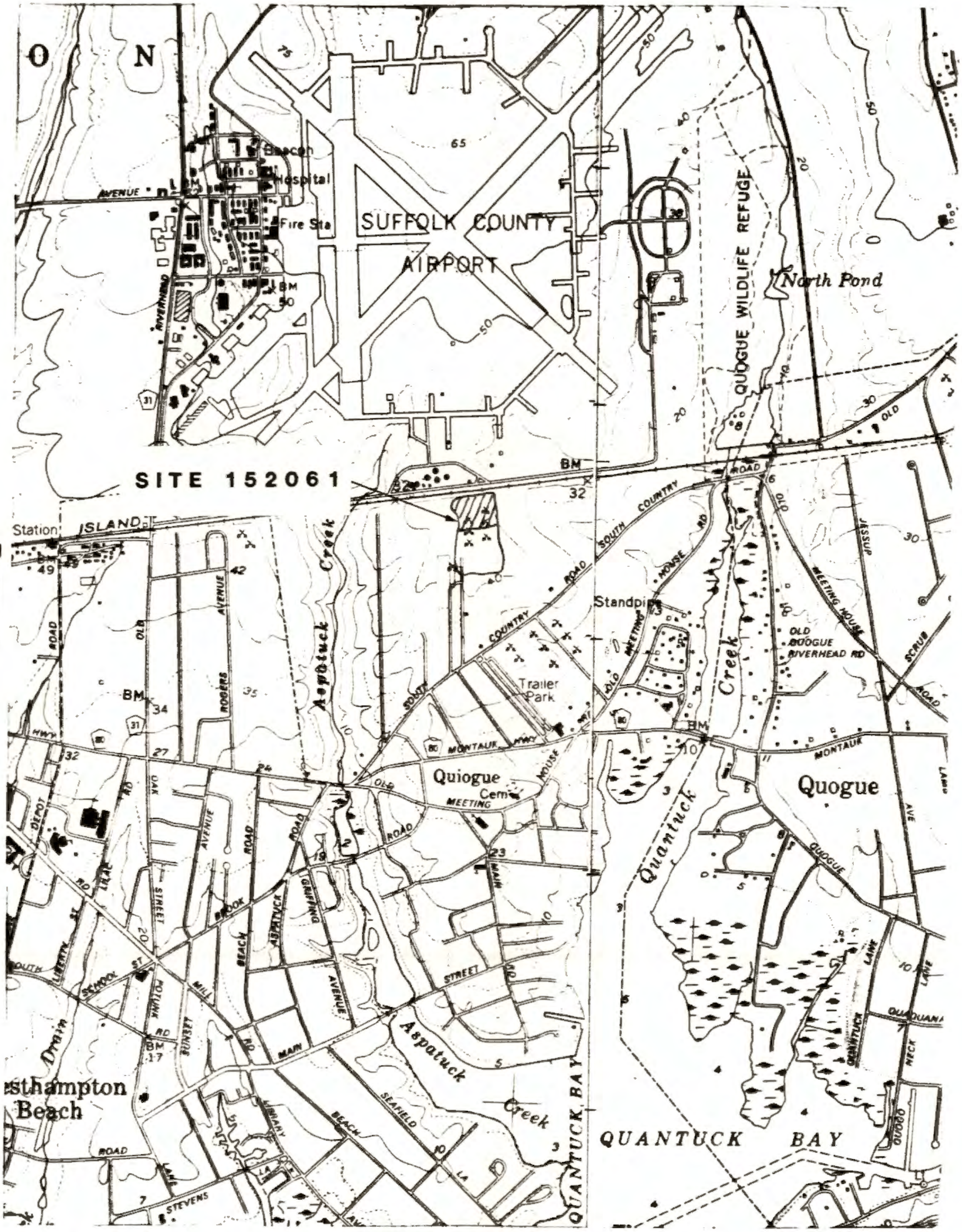

Figure 1-1. **EASTPORT & QUOGUE QUADS.**

Scale 1:24,000

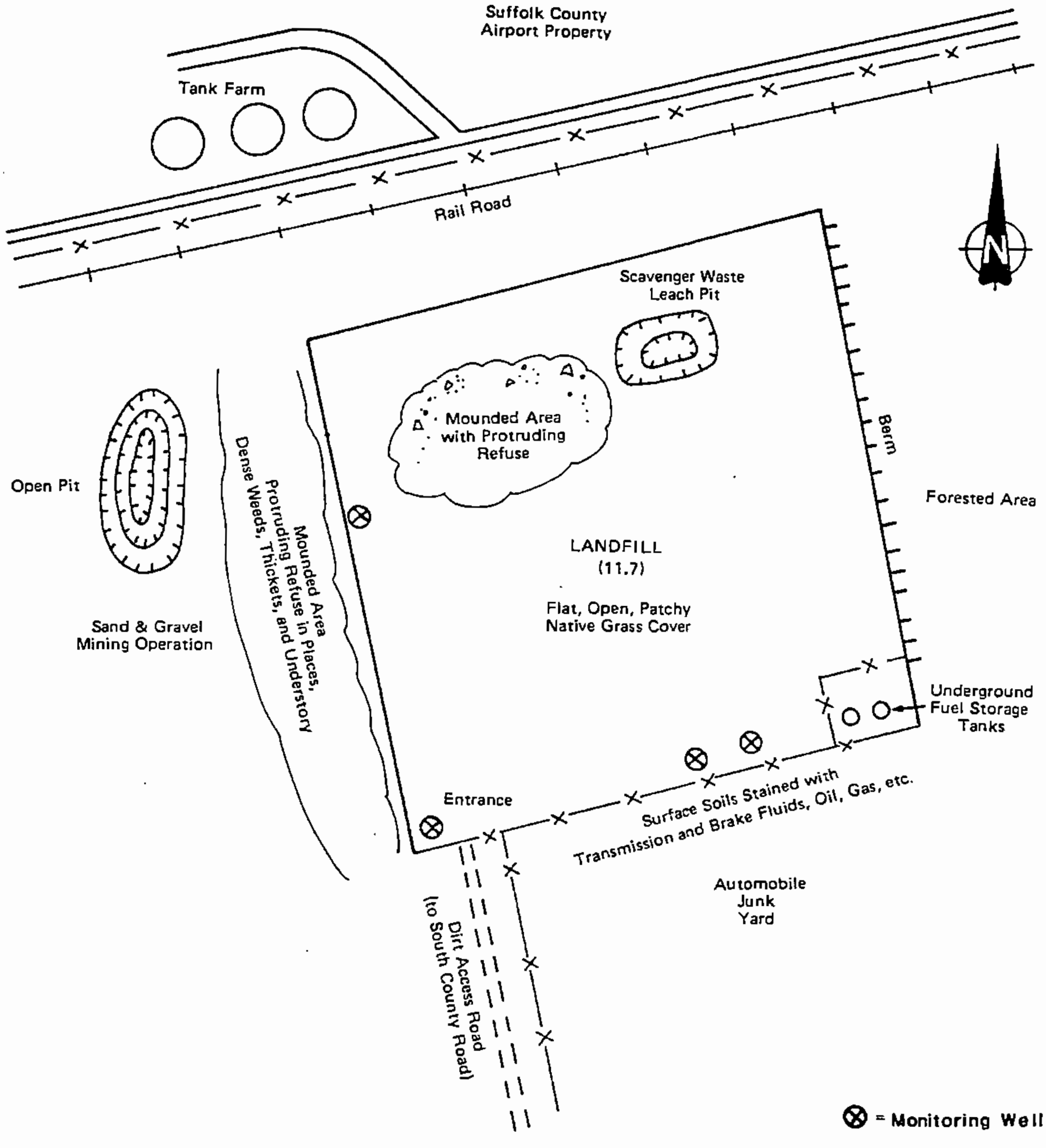

Figure 1-2. Site sketch. Quiogue Landfill, 22 January 1986. (Not to scale)

industrial area. The owners have been trying in vain to sell the property to escape the liability. The parent company is also in financial trouble and is apparently going out of business at their new plant in Ronkonkoma.

LA ✓ 2. EMR Circuits - Site No. 152105

We concur with the report as written. A note that can be added is that Stew Wood was convicted of a felony and served a jail term for the offense.

AG ✓ 3. Quiogue Landfill - Site No. 152061

This landfill remains a highly suspect site because of its location and the statements of landfill employees. This location, no doubt, received all the refuse from the Suffolk County Airport during all the years the landfill was in operation. The waste would include anything the airbase occupants chose to throw out since there were no landfill restrictions at the time. The fact that airbase refuse was deposited here should be confirmed.

A Phase II study should include borings made through the septic leaching pits to sample the soil immediately beneath for toxic chemicals. Borings should be made into the landfill to perform vapor analyses in addition to the dowstream groundwater analysis. Sampling wells should be carefully located since flow from the landfill appears to be to the southwest instead of to the south and southeast where most of the wells for the airport oil spill investigation were located.

AG ✓ 4. NTU Circuits, Inc. - Site No. 152086

We concur with the report finding that a Phase II is needed to gain groundwater information. However, accurate placement of the necessary wells will be difficult and the plume may be missed since so much time has elapsed since the discontinuation of discharge.

AG ✓ 5. Holtsville Landfill Site No. 152010

We concur with the findings of the report.

AG ✓ 6. Brookhaven Landfill - Horseblock Rd. - Site No. 152041

We concur with the findings of the report.

Continue....

7. Commercial Envelope Mfg. Co., Inc. - Site No. 152103

We concur with the findings of the report except that it may be necessary to proceed with the Phase II in order to get the upstream well installed since the owner has not yet installed it.

Very truly yours,

James Pim, P.E.
Bureau of Hazardous Materials

JP/lr

New York State Department of Environmental Conservation

RECEIVED

MEMORANDUM

AG

BUREAU OF HAZARDOUS SITE CONTROL
DIVISION OF SOLID AND HAZARDOUS WASTE

TO: A. Candella

FROM: C. Magee

SUBJECT: Comments on Quogue Landfill Phase I Report - Site No. 152061

DATE: January 15, 1987

To file

1. The "monitoring wells" labeled on Figure 1-2 may be methane vents (see photolog descriptions). A positive determination should be made as to whether or not methane was a problem at this site as it may effect drilling.

2. Page 4-3. - The presence or absence of the Gardners Clay is not addressed in this report. This clay unit has played a role as an aquitard at other south shore landfil sites and may have similar importance here.

3. Page 6-1 Section 6.3.1 - It is unfortunate that much useful information about the existing monitoring wells in the area has been lost due to lack of documentation, however, many of these wells may still be in existence. Surviving wells in the area surrounding the site should be inventoried and surveyed to a common bench mark, water levels may then be taken to draw up a site specific water table map.

4. Page 6-3 Section 6.3.4 - Through the use of existing data potential monitoring well sites should be identified and plotted on a diagram.

5. Page 6-3 Section 6.3.4 - EA has not identified the foundation upon which their recommendation to limit the investigation to five wells is based. This makes the 5 well limit appear arbitrary.

6. Page 6-3 Section 6.3.4 - Geophysical logging of the bore holes such as gama logging will provide information that can be combined with data from the seive analysis and boring logs to increase our knowledge of the litho stratigraphy of the site.

7. Page 6-4 - A staging area should be constructed for the storage of "down hole" equipment after cleaning. A poly-sheet is not considered a sufficient staging area.

8. Page 6-4 - The explanation of the protocol for testing soil samples with photoinoization meters is insufficient.

9. Page 6-4 - More information should be provided on seive analysis of split spoon samples. How many samples will be analyzed, and from what wells will they be taken? *for Ph II Workplan*

10. Page 6-4 - In the description of well construction, itis stated that a 10 foot screen will be used. Consideration should be given to installing 20 foot screens, 15 feet into the water table. Wells constructed in this manner will allow for fluetuation in the water table and be able to intercept any floating second phase. *dilution factor*

11. Page 6-4 - The work plan should specify that the auger should be sized to permit a tremie pipe to be inserted along side the casing. B.H.S.C. guidance <u>requires</u> that the gravel pack, bentonite seal, and grout be placed with a <u>tremie</u>, this should be written into the work plan. *for the Ph II Workplan*

12. Page 6-4 - Aquifer parameters should be determined regardless of the yeild of the well.

13. Page 6-5 e and f - NYSDEC does not suspend waste disposal regulations for its own projects, contaminated materials must be disposed of properly. *see Generic Workplan*

14. Page 6-5 - It is the contractors responsibility to obtain permits and permissions for all activities associated with the investigation. NYSDEC is under no obligation to assist in these matters and the Departments intersection should not be assumed or requested lightly. *see Generic Workplan* *ECL Say otherwise*

15. Page 6-5 Section 6.3.5 - In addition to the analysis proposed it may be advantageous to analyze for bicarbonate, sulfate and ammonia to confirm the down-gradient samples are indeed from areas enriched with landfill leachate. *LF parameters are usually covered.*

16. Page 6-6 - There is a possibility that leachate from this site is flowing as pulsations of high density fluids as has been postulated for other landfills in similar settings (Kimmel & Braids 1980). In light of this situation a second round of sampling after a period of high recharge may provide some very interesting data. *True, but, beyond scope of Ph II*

17. General - Because of its proximity to the site and the refuse protruding from its surface, the mounded area to the west of the site should be considered as part of the investigation. *should be clarified in Registry site boundaries!*

CM:jf
cc: R. Becherer
M. Sosnow

(47-15-11 (10/83)

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SOLID AND HAZARDOUS WASTE
INACTIVE HAZARDOUS WASTE DISPOSAL SITE REPORT

PRIORITY CODE: ____________ SITE CODE: 152061

NAME OF SITE: Quiogue Landfill REGION: I

STREET ADDRESS: South Country Road

TOWN/CITY: Southampton COUNTY: Suffolk

NAME OF CURRENT OWNER OF SITE: Town of Southampton

ADDRESS OF CURRENT OWNER OF SITE: Hampton Road, Southampton, New York 11968

TYPE OF SITE: OPEN DUMP [ ] STRUCTURE [ ] LAGOON [ ]
LANDFILL [X] TREATMENT POND [ ]

ESTIMATED SIZE: 12 ACRES

SITE DESCRIPTION:

The site is an inactive municipal landfill. It is approximately 12 acres in size. It received household waste and cesspool sludge from 1968 through 1978. After 1978 the site was capped with a reported 4 ft of sandy loam. The site has no liner. Allegations have been made that pesticide and PCB waste have been buried at the site, however these allegations are unsubstantiated.

HAZARDOUS WASTE DISPOSED: CONFIRMED [ ] SUSPECTED [ ]

TYPE AND QUANTITY OF HAZARDOUS WASTES DISPOSED:

TYPE	QUANTITY (POUNDS, DRUMS, TONS, GALLONS)
None documented	None documented

TIME PERIOD SITE WAS USED FOR HAZARDOUS WASTE DISPOSAL:

________, 19 ___ TO ________, 19 ___

OWNER(S) DURING PERIOD OF USE: Town of Southampton

SITE OPERATOR DURING PERIOD OF USE: Town of Southampton

ADDRESS OF SITE OPERATOR: Jackson Avenue, Hampton Bays, New York 11968

ANALYTICAL DATA AVAILABLE: AIR [ ] SURFACE WATER [ ] GROUNDWATER [X]
SOIL [ ] SEDIMENT [ ] NONE [ ]

CONTRAVENTION OF STANDARDS: GROUNDWATER [ ] DRINKING WATER [ ]
SURFACE WATER [ ] AIR [ ]

SOIL TYPE: Sand and gravel

DEPTH TO GROUNDWATER TABLE: 32 feet

LEGAL ACTION: TYPE: ________ STATE [ ] FEDERAL [ ]
STATUS: IN PROGRESS [ ] COMPLETED [ ]

REMEDIAL ACTION: PROPOSED [ ] UNDER DESIGN [ ]
IN PROGRESS [ ] COMPLETED [ ]

NATURE OF ACTION: ________

ASSESSMENT OF ENVIRONMENTAL PROBLEMS:

None documented

ASSESSMENT OF HEALTH PROBLEMS:

None documented

PERSON(S) COMPLETING THIS FORM:

FOR NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION	NEW YORK STATE DEPARTMENT OF HEALTH
NAME EA Science and Technology	NAME
TITLE	TITLE
NAME	NAME
TITLE	TITLE
DATE: 8 April 1986	DATE:


1-1


1-2


1-3


1 4


1-5


1-6


1-7


1-8

PHOTO LOG - QUIOGUE LANDFILL

Photo	Description
1-1	An area in the southeast corner of the site which was fenced in. The photo was taken facing southwest. Empty drums and three galvanized steel pipes protruding from the ground were found in this enclosure.
1-2	A close-up view of the pipes found in the enclosed area. They appear to lead to an underground tank. The odor of diesel fuel was evident.
1-3	A view from the southwest corner of the site looking north. The site is bordered by a sand mining operation to the west, and by the LIRR to the north. The site is capped with sandy loam, and has been graded flat.
1-4	A 2-in. PVC well casing at the southwest corner of the site. The well casing was found to be 10 ft deep and dry.
1-5	A view of the entire site from the southwest corner facing north. The fuel tank farm north of the LIRR is visible.
1-6	A well located along the southern border of the site. A strong odor of petroleum was evident.
1-7	A view of the southern border of the site from the southwest corner where an auto scrap yard is located.
1-8	The only secured well on the site. It had a 4-in. PVC casing and a locked metal cap. It was located along the southern border of the site.

2. PURPOSE

The Quiogue Landfill site was listed on the New York State Registry of Inactive Hazardous Waste Sites because of allegations that drums of DDT and electrical components containing PCBs may have been buried there.

The goal of the Phase I investigation of this site was to: (1) obtain available records on the site history from state, federal, county, and local agencies; (2) obtain information on site topography, geology, local surface water and ground-water use, previous contamination assessments, and local demographics; (3) interview site owners, operators, and other groups or individuals knowledgeable of site operations; (4) conduct a site inspection to observe current conditions; and (5) prepare a Phase I report. The Phase I report includes an assessment of the available information and a recommended work plan for Phase II studies.

3. SCOPE OF WORK

The Phase I investigation of the Quiogue Landfill site involved a site inspection by EA Science and Technology, as well as record searches and interviews. The following agencies or individuals were contacted:

Contact	Information Received
Mr. Thomas Lovalle Town of Southhampton Highway Department 20 Jackson Avenue Hampton Bays, New York 11946 (516) 728-3600	Site interview
Ms. Laine Vignona Environmental Protection Bureau New York State Department of Law #2 World Trade Center Room 4527 New York, New York 10047 (212) 488-3805	Selected files/interview
Mr. Dan Raviv Dan Raviv Associates, Inc. 5 Central Avenue West Orange, New Jersey 07052	Hydrogeological information
Mr. Anthony Candela, P.E. New York State Department of Environmental Conservation Division of Solid Waste SUNY Campus - Buliding 40 Stonybrook, New York 11790 (516) 751-7900	Site file
Ms. Elaine Bennett Concerned Citizens Group 120 North Road Hampton Bays, New York 11946 (516) 283-7673	Waste characateristics

Contact	Information Received
Mr. James Pim, P.E. Suffolk County Department of Health Services Hazardous Materials Management 15 Horseblock Road Farmingville, New York 11738 (516) 451-4634	Interview and site file
Mr. Steve Carey/Mr. Dennis Moran Suffolk County Department of Health Services Bureau of Water Resources 225 Rabro Drive East Hauppauge, New York 11788 (516) 348-2893	Ground-water use; public water supplies and ground-water monitoring information
Mr. Dan Fricke Suffolk County Cooperative Extension Association 264 Griffing Avenue Riverhead, New York 11901 (516) 727-7850	Ground-water and surface water use for irrigation
Mr. William Schickler/Mr. Robert Bowen Suffolk County Water Authority Sunrise Highway and Pond Road Oakdale, New York 11769 (516) 589-5200	Public water supply and distribution
Mr. Doug Pica New York State Department of Environmental Conservation Division of Water SUNY Campus - Building 40 Stony Brook, New York 11794 (516) 751-7900	Ground-water use for irrigation
Mr. Allan S. Connell District Conservationist U.S. Department of Agriculture Soil Conservation Survey 127 East Main Street Riverhead, New York 11091	Ground-water use for irrigation
Mr. Ken Jones Chief Fire Marshal Town of Southampton 116 Hampton Road Southampton, New York 11968 (516) 283-6020	Information regarding the threat of fire and/or explosion at the site

Contact	Information Received
Mr. Kevin Walter, P.E. New York State Department of Environmental Conservation Division of Hazardous Waste Enforcement 50 Wolf Road Albany, New York 12233-0001 (518) 457-5637	No file/information
Mr. John Iannotti, P.E. New York State Department of Environmental Conservation Bureau of Remedial Action 50 Wolf Road Albany, New York 12233-0001 (518) 457-5637	No file/information
Mr. Earl Barcomb, P.E. New York State Department of Environmental Conservation Landfill Operations Vatrano Road Albany, New York 12205 (518) 457-2051	Site file
Mr. Ron Tramontano/Mr. Charlie Hudson Bureau of Toxic Substance Assessment New York State Department of Health Tower Building 84 Holland Avenue Albany, New York 12237 (518) 473-8427	Site file
Mr. James Covey, P.E. New York State Department of Health Nelson A. Rockefeller Empire State Plaza Corning Tower Building Albany, New York 12237 (518) 473-4637	Community Water Supply Atlas
Mr. Rocky Paggione, Atty./ Mr. Louis A. Evans, Atty. New York State Department of Environmental Conservation Division of Environmental Enforcement 202 Mamaroneck Avenue White Plains, New York 10601-5381 (914) 761-6660	No file/information

Contact	Information Received
Mr. Marsden Chen, P.E. New York State Department of Environmental Conservation Bureau of Site Control 50 Wolf Road Albany, New York 12233-0001 (518) 457-0639	Site file
Mr. John W. Ozard Senior Wildlife Biologist New York State Department of Environmental Conservation Wildlife Resources Center Significant Habitat Unit Delmar, New York 12054 (518) 439-7486	Significant habitats
Mr. Perry Katz U.S. Environmental Protection Agency Region II Room 757 26 Federal Plaza New York, New York 10278 (212) 264-4595	General/regional information
Mr. Martin Trent Senior Sanitarian Suffolk County Department of Health Services Bureau of Drinking Water 225 Rabro Drive Hauppage, New York 11788 (576) 348-2895	Information regarding ground-water investigations

4. SITE ASSESSMENT - QUIOGUE LANDFILL

4.1 SITE HISTORY

The Quiogue Landfill is an inactive municipal landfill located along South County Road in the Town of Southampton in Suffolk County, New York. The Town of Southampton owns the 12-acre site, which they operated as a landfill from 1968 until 1978. The site originated as a sand mine pit and has no liner. The site was capped with 4 ft of loam when it was closed. There are no records or documentation of the type or amount of wastes that were received at the landfill, although household garbage and septage wastes are reportedly buried there (Appendixes 1.1-1, 1.1-2, and 1.1-2a). There are rumors and allegations that industrial wastes, waste oils and chemicals, pesticide wastes, and/or old transformers were buried at the site (Appendixes 1.1-2 through 1.1-4), however, hese rumors and allegations are unsubstantiated.

jet fuel and oil storage tank farm, part of the Suffolk County Airport, is cated approximately 500 ft north (evidently upgradient) of the landfill gure 1-1, and EA Site Inspection). The tank farm was the site of an 8 000-gal JP-4 fuel spill in 1966, and a 10,000-gal spill of JP-4 (jet fuel) 974 (Appendix 1.1-5). As a result of those fuel spills, the ground water he area was contaminated (Appendix 1.1-1, 1.1-2, and 1.1-5). The New York Department of Transportation (NYSDOT), Suffolk County Department of h Services (SCDHS), Suffolk County Water Authority (SCWA), and New York uard have installed numerous monitoring wells (generally to the first encountered) at varying times and have performed sampling and analysis

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A jet fuel and oil storage tank farm, part of the Suffolk County Airport, is located approximately 500 ft north (evidently upgradient) of the landfill (Figure 1-1, and EA Site Inspection). The tank farm was the site of an 80,000-gal JP-4 fuel spill in 1966, and a 10,000-gal spill of JP-4 (jet fuel) in 1974 (Appendix 1.1-5). As a result of those fuel spills, the ground water in the area was contaminated (Appendix 1.1-1, 1.1-2, and 1.1-5). The New York State Department of Transportation (NYSDOT), Suffolk County Department of Health Services (SCDHS), Suffolk County Water Authority (SCWA), and New York Air Guard have installed numerous monitoring wells (generally to the first water encountered) at varying times and have performed sampling and analysis generally for JP-4 jet fuel and its constituents to evaluate the area south (downgradient) of the Suffolk County Airport tank storage area. The investigations do not establish that hazardous materials are migrating from the landfill.

SCDHS conducted another investigation of private residential wells located immediately south and downgradient of the landfill in 1982. Tapwater from more than 30 homes in the vicinity was analyzed for water quality parameters including conductivity, pH, metals and volatile organics. SCDHS's position regarding the analytical data obtained is that it did not specifically implicate the Quiogue Landfill (Appendix 1.1-6). In addition, SCDHS reports that their well field on nearby Meeting House Road (0.3 mi southeast of the landfill) is currently in compliance with all applicable drinking water standards (Appendix 1.1-7).

4.2 SITE TOPOGRAPHY

The Quiogue Landfill is located centrally on Long Island in Suffolk County at an elevation of approximately 40 ft above mean sea level (Appendix 1.2-1). Regional slope is 1-2 percent to the south, east, and west. Site slope is generally less than 1 percent toward the center from all sides. The site is bordered on the north by the Long Island Railroad and the Suffolk County Airport. Beyond the railroad is a large tank farm on Suffolk County Airport property where jet fuels and oils are stored. To the east is a densely wooded area, to the south is an automobile junkyard, and to the west is an active sand and gravel mining operation. The Quiogue Wildlife Refuge is located approximately 1 mi east of the site. Nearest surface water is the Aspatuck Creek, located 0.3 mi west of the site. The nearest residence is 0.1 mi west of the site along Peter's Lane. The nearest commercial establishment is the junkyard which borders the site to the south. The nearest private well is 0.2 mi southeast of the site on South Country Road (Appendix 1.2-1).

4.3 SITE HYDROGEOLOGY

The site is directly underlain by Pleistocene Age glacial deposits. This deposit is then in turn underlain by Cretaceous Age Magothy Formation, the Clay Member and Lloyd Sand Member of the Raritan Formation, and finally by Precambrian Age gneiss and schist bedrock (Appendixes 1.3-1 and 1.3-2). The ground surface elevation at the site averages approximately 20 ft above MSL. The Pleistocene deposits are estimated to be 100 ft in thickness (Appendix 1.1-5) and largely comprised of sand and gravel. Based upon Appendix 1.3-2a, the site may be underlain by the Gardiners Clay, however depth to and thickness of are unkown.

Water pumped from aquifers underlying Suffolk County is the sole source of water for public supply, agriculture, and industry (Appendix 1.3-3). The glacial and Magothy aquifers act as a single hydrologic unit (Appendix 1.3-3). Apparently, only the glacial aquifer portion has been developed for water supply within 3 mi of the site, however, both the glacial and Magothy aquifers are designated as the aquifer of concern.

Recharge to the upper glacial aquifer is derived entirely from precipitation. The average annual precipitation in the area is 45 in. of which approximately 22 in. is estimated to infiltrate to the water table (Appendix 1.3-4). The remainder of the precipitation is returned to the atmosphere by evaporation and transpiration, except for a small amount of runoff to stream. Recharge to the Magothy aquifer is derived entirely from the downward movement of water from the overlying glacial aquifer.

Site specific permeability data are not available. However, infiltration tests performed in the upper Pleistocene glacial deposits in the vicinity of the Brookhaven National Laboratory (Warren et al. 1968) indicate that water may move from the land surface to the water table at rates of up to 30 ft/day (Appendix 1.3-4). Warren et al. (1968) also reports an average porosity value of 0.33 and vertical permeabilities ranging from 75-350 gpd/ft^2 for the saturated portion of the upper Pleistocene glacial deposits (upper glacial aquifer).

Based upon Figures 3 and 5 of Appendix 1.1-5 and the March 1985 ground-water table contour map (SCDHS), the depth to ground water is estimated to be approximately 30-35 ft below ground surface, and the regional ground-water natural (unaffected by pumping) flow direction appears to be toward the southeast. Within 3 mi of the site, the aquifer of concern has been reportedly developed by two Suffolk County Water Authority well fields and numerous private wells. Appendix 1.3-5 provides a list of the municipal wells located within 3 mi of the site. The developed area within 3 mi of the site is served by the Suffolk County Water Authority and numerous private wells.

4.4 SITE CONTAMINATION

Waste Types and Quantities

No records exist of the types or amounts of material deposited at the Quiogue Landfill. The site accepted municipal trash and cesspool waste from 1968 through 1978 (Appendix 1.1-1). Allegations have been made that drums containing DDT and transformers containing PCBs were buried at the site, however, these allegations are unsubstantiated (Appendixes 1.1-2, 1.1-3, and 1.1-4). The ground water in the vicinity is known to be contaminated with jet fuel from spills at the Suffolk County Airport tank farm (Appendixes 1.1-5 and 1.5-6).

Ground Water

Although numerous monitoring wells have been installed into the first water encountered in the area south of the Suffolk County Airport fuel tank storage area (including the Quiogue Landfill area), generally the methods of well installation and sampling are undocumented (Appendix 1.1-5). Also, these studies were designed to investigate ground-water contamination by JP-4 jet fuel and its constituents from the airport tank storage area, not potential contaminants from the Quiogue Landfill. However, there is a NYSDOT monitoring well (No. 17) located at the upgradient edge of the landfill site and one (No. 19) located at the downgradient edge of the site. Both of these wells were sampled during March 1982. Chlorobenzene was the only quantified volatile organic compound detected in the sample from downgradient well No. 19 (16 ppb). Although chlorobenzene was not detected in the sample from upgradient well No. 17 (<10 ppb), the detected downgradient concentration of 16 ppb is less than three

20ppb = guid. val

times the upgradient detection limit of 10 ppb and thus is not considered by HRS to be a significant increase above ambient conditions and cannot be used to confirm a release to ground water from the Quiogue Landfill.

Surface Water

No data available.

Soil

No data available.

Air

During EA's site inspection on 22 January 1986, total volatiles were measured using a photoionization detector (HNU). No readings above background were recorded except a head-space reading of 2 ppm above background above an unsecured monitoring well located along the south-central site boundary. No other air quality data are available (Chapter 3).

QUIOGUE LANDFILL

TOWN OF SOUTHAMPTON, SUFFOLK COUNTY

The Quiogue landfill is an inactive landfill located along South Country Road in the Town of Southampton, in Suffolk County. The landfill is owned by the Town of Southampton. The Town operated the 12-acre site as a municipal landfill from 1968 until 1978. During the 10 years of operation, cesspool wastes and household trash were deposited at this site. The landfill is unlined. A 4-ft thick cap of loam was applied after the site was closed. No records were kept of the quantities of waste. Allegations have been made that drums of DDT and electrical components containing PCBs were buried at this site, however, the allegations are unsubstantiated.

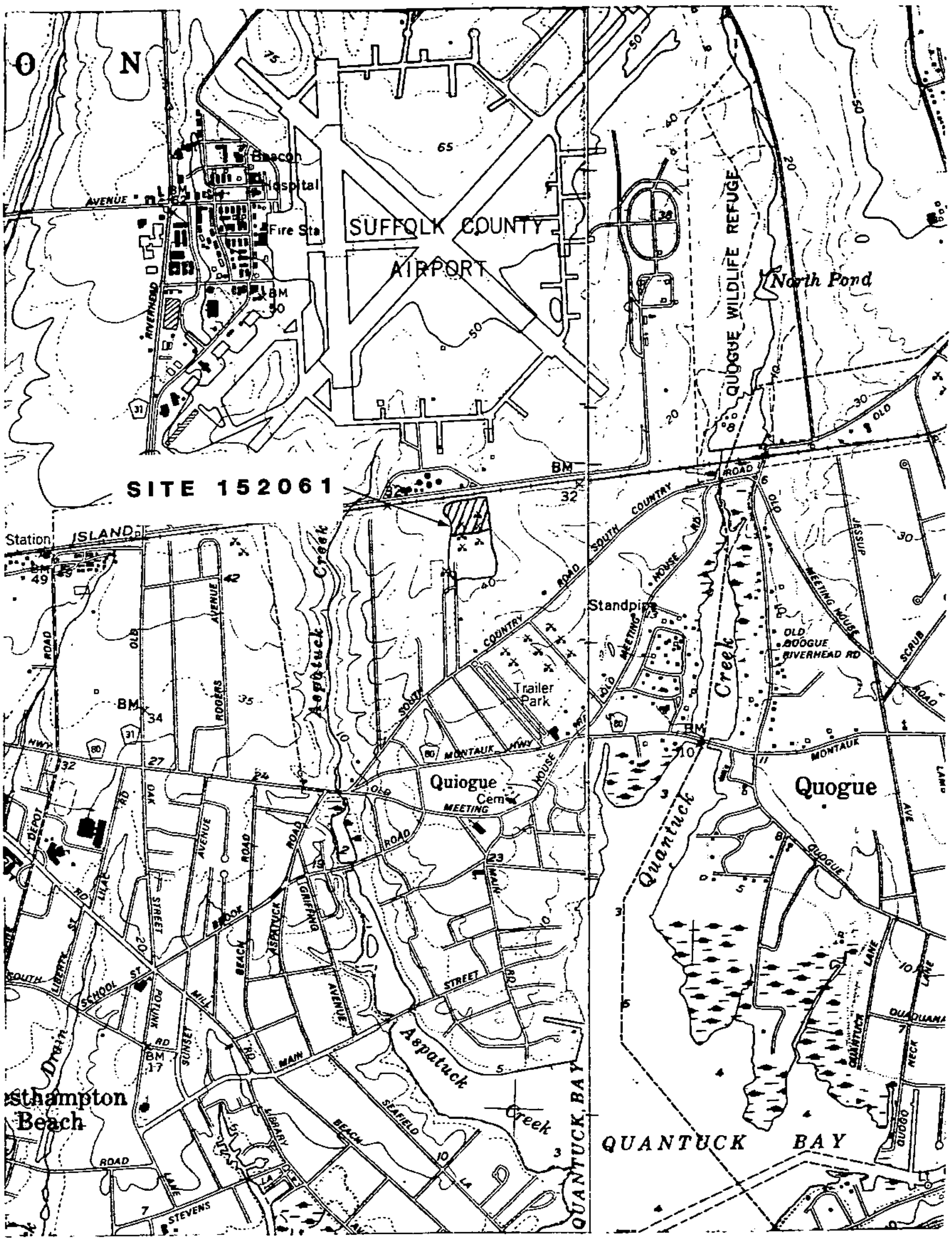
Jet fuel spills totaling 90,000 gal have occurred at a tank farm on Suffolk County Airport property, 500 ft north of the landfill. Extensive ground-water investigations directed at the Suffolk County Airport and immediate vicinity, including the Quiogue landfill, have documented contamination from jet fuel spills at the airport but have not established that hazardous materials are migrating from the Quiogue landfill.

EA has researched all pertinent agency files, interviewed the site owner's representative, conducted a site inspection, and has found no documented hazardous waste or contamination at this site.

Site Coordinates:

Latitude: 40° 47' 47"
Longitude: 72° 37' 52"

QUIOGUE LANDFILL



EASTPORT & QUOGUE QUADS.

Scale 1:24,000

Facility name: Quiogue Landfill

Location: Town of Southampton, Suffolk County

EPA Region: II

Person(s) in charge of the facility: Highway Department, Town of Southampton

20 Jackson Avenue

Hampton Bays, New York 11946

Name of Reviewer: EA Science and Technology Date: 7 April 1986

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

The site is an inactive municipal landfill. It is approximately 12 acres in size. It received household waste and cesspool sludge from 1968 through 1978. After 1978 the site was capped with 4 ft of sandy loam. The site has no liner. Allegations have been made that pesticide and PCB wastes have been buried at the site, however, the allegations are unsubstantiated. EA has researched all pertinent agency files, interviewed the site owner's representative, conducted.

Scores: S_M = (S_{gw} = S_{sw} = S_a =)

S_{FE} =

S_{DC} =

FIGURE 1
HRS COVER SHEET

a site inspection, and has found no documented hazardous waste or contamination at this site. Therefore, it is not appropriate to provide a Hazard Ranking Score (or documentation) for this site. In order to prepare a final HRS score for this site, analytical data regarding the quality of the ground water and sediment will be necessary, thus requiring performance of a Phase II investigation.

DOCUMENTATION RECORDS
FOR
HAZARD RANKING SYSTEM

INSTRUCTIONS: The purpose of these records is to provide a convenient way to prepare an auditable record of the data and documentation used to apply the Hazard Ranking System to a given facility. As briefly as possible, summarize the information you used to assign the score for each factor (e.g., "Waste quantity = 4,230 drums plus 800 cubic yards of sludges"). The source of information should be provided for each entry and should be a bibliographic-type reference that will make the document used for a given data point easier to find. Include the location of the document and consider appending a copy of the relevant page(s) for ease in review.

FACILITY NAME: Quiogue Landfill

LOCATION: Town of Southampton, Suffolk County

DATE SCORED: 8 April 1986

PERSON SCORING: EA Science and Technology

PRIMARY SOURCES(S) OF INFORMATION (e.g., EPA region, state, FIT, etc.)

Suffolk County Department of Health Services
Town of Southampton Highway Department

FACTORS NOT SCORED DUE TO INSUFFICIENT INFORMATION:

COMMENTS OR QUALIFICATIONS:

EA has researched all pertinent agency files, interviewed the site owner's representative, conducted a site inspection, and has found no documented hazardous waste or contamination at this site. Therefore, it is not appropriate to provide a Hazard Ranking Score (or documentation) for this site.

United States
Environmental Protection
Agency

Office of Emergency and
Remedial Response
Washington, DC 20460

EPA Form 2070-12
July, 1981

Quiogue Landfill

EPA

Potential Hazardous Waste Site

Preliminary Assessment

EPA

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT
PART 1 - SITE INFORMATION AND ASSESSMENT

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
NY	D980762462

II. SITE NAME AND LOCATION

01 SITE NAME *(Legal, common, or descriptive name of site)*: Quiogue Landfill

02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER: South Country Road

03 CITY: Quiogue | 04 STATE: NY | 05 ZIP CODE: 11968 | 06 COUNTY: Suffolk | 07 COUNTY CODE: | 08 CONG DIST:

09 COORDINATES LATITUDE: 40° 49' 49" LONGITUDE: 72° 37' 52"

10 DIRECTIONS TO SITE *(Starting from nearest public road)*

Montauk Highway to South Country Road. Left turn onto a dirt road east of a scrap yard.

III. RESPONSIBLE PARTIES

01 OWNER *(If known)*: Town of Southampton

02 STREET *(Business, mailing, residential)*: Hampton Road

03 CITY: Southampton | 04 STATE: NY | 05 ZIP CODE: 11968 | 06 TELEPHONE NUMBER: (516) 728-3600

07 OPERATOR *(If known and different from owner)*: Town of Southampton Department of Highways

08 STREET *(Business, mailing, residential)*: 20 Jackson Avenue

09 CITY: Hampton Bays | 10 STATE: NY | 11 ZIP CODE: 11946 | 12 TELEPHONE NUMBER: (516) 728-3600

13 TYPE OF OWNERSHIP *(Check one)*

☐ A. PRIVATE ☐ B. FEDERAL: ______ *(Agency name)* ☐ C. STATE ☐ D. COUNTY ☒ E. MUNICIPAL

☐ F. OTHER: ______ *(Specify)* ☐ G. UNKNOWN

14 OWNER/OPERATOR NOTIFICATION ON FILE *(Check all that apply)*

☐ A. RCRA 3001 DATE RECEIVED: __/__/__ (MONTH DAY YEAR) ☐ B. UNCONTROLLED WASTE SITE *(CERCLA 103 c)* DATE RECEIVED: __/__/__ (MONTH DAY YEAR) ☐ C. NONE

IV. CHARACTERIZATION OF POTENTIAL HAZARD

01 ON SITE INSPECTION

☒ YES DATE 1/22/86 (MONTH DAY YEAR)
☐ NO

BY *(Check all that apply)*

☐ A. EPA ☐ B. EPA CONTRACTOR ☐ C. STATE ☒ D. OTHER CONTRACTOR
☐ E. LOCAL HEALTH OFFICIAL ☐ F. OTHER: ______ *(Specify)*

CONTRACTOR NAME(S): EA Science and Technology

02 SITE STATUS *(Check one)*

☐ A. ACTIVE ☒ B. INACTIVE ☐ C. UNKNOWN

03 YEARS OF OPERATION: 1968 (BEGINNING YEAR) | 1978 (ENDING YEAR) ☐ UNKNOWN

04 DESCRIPTION OF SUBSTANCES POSSIBLY PRESENT, KNOWN, OR ALLEGED

Municipal refuse and septage. Alleged barrels of DDT and old transformers containing PCBs. Rumored that industrial wastes and waste oils from a nearby former Air Force base, were deposited in the landfill.

05 DESCRIPTION OF POTENTIAL HAZARD TO ENVIRONMENT AND/OR POPULATION

Potential ground-water contamination.

V. PRIORITY ASSESSMENT

01 PRIORITY FOR INSPECTION *(Check one. If high or medium is checked, complete Part 2 - Waste Information and Part 3 - Description of Hazardous Conditions and Incidents)*

☐ A. HIGH *(Inspection required promptly)* ☐ B. MEDIUM *(Inspection required)* ☐ C. LOW *(Inspect on time available basis)* ☐ D. NONE *(No further action needed, complete current disposition form)*

VI. INFORMATION AVAILABLE FROM

01 CONTACT	02 OF *(Agency/Organization)*	03 TELEPHONE NUMBER
Rebecca Ligotino	EA Science and Technology	(914) 692-6706

04 PERSON RESPONSIBLE FOR ASSESSMENT	05 AGENCY	06 ORGANIZATION	07 TELEPHONE NUMBER	08 DATE
Larry Wilson		EA	(914) 692-6706	3/26/86

EPA

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT
PART 2 - WASTE INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
NY	D980762462

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 PHYSICAL STATES (Check all that apply)

- [X] A. SOLID
- [ ] B. POWDER, FINES
- [X] C. SLUDGE
- [ ] D. OTHER ________ (Specify)
- [ ] E. SLURRY
- [ ] F. LIQUID
- [ ] G. GAS

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)

TONS ________

CUBIC YARDS Unknown

NO. OF DRUMS ________

03 WASTE CHARACTERISTICS (Check all that apply)

- [ ] A. TOXIC
- [ ] B. CORROSIVE
- [ ] C. RADIOACTIVE
- [ ] D. PERSISTENT
- [ ] E. SOLUBLE
- [ ] F. INFECTIOUS
- [ ] G. FLAMMABLE
- [ ] H. IGNITABLE
- [ ] I. HIGHLY VOLATILE
- [ ] J. EXPLOSIVE
- [ ] K. REACTIVE
- [ ] L. INCOMPATIBLE
- [X] M. NOT APPLICABLE

III. WASTE TYPE

CATEGORY	SUBSTANCE NAME	01 GROSS AMOUNT	02 UNIT OF MEASURE	03 COMMENTS
SLU	SLUDGE	Unknown		Cesspool waste
OLW	OILY WASTE	Unknown		Alleged PCBs
SOL	SOLVENTS			
PSD	PESTICIDES	Unknown		Alleged DDT
OCC	OTHER ORGANIC CHEMICALS			
IOC	INORGANIC CHEMICALS			
ACD	ACIDS			
BAS	BASES			
MES	HEAVY METALS			

IV. HAZARDOUS SUBSTANCES (See Appendix for most frequently cited CAS Numbers)

01 CATEGORY	02 SUBSTANCE NAME	03 CAS NUMBER	04 STORAGE/DISPOSAL METHOD	05 CONCENTRATION	06 MEASURE OF CONCENTRATION
	Unknown				

V. FEEDSTOCKS (See Appendix for CAS Numbers)

CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER	CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER
FDS	Not applicable		FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

EA site inspection, 22 January 1986.

Thomas Lovalle, Town of Southampton Highway Department, personal communication, 22 January 1986.

Suffolk County Department of Health Services files.

United States Environmental Protection Agency

Office of Emergency and Remedial Response Washington, DC 20460

EPA Form 2070-13 July, 1981

Quiogue Landfill

EPA

Potential Hazardous Waste Site

Site Inspection Report

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 1 - SITE LOCATION AND INSPECTION INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	D980762462

II. SITE NAME AND LOCATION

01 SITE NAME (Legal, common, or descriptive name of site): Quiogue Landfill	02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER: South Country Road				
03 CITY: Southampton	04 STATE: NY	05 ZIP CODE: 11968	06 COUNTY: Suffolk	07 COUNTY CODE:	08 CONG DIST:
09 COORDINATES LATITUDE: 40° 49' 49" LONGITUDE: 72° 37' 32"	10 TYPE OF OWNERSHIP (Check one): ☐ A. PRIVATE ☐ B. FEDERAL ____ ☐ C. STATE ☐ D. COUNTY ☒ E. MUNICIPAL ☐ F. OTHER ____ ☐ G. UNKNOWN				

III. INSPECTION INFORMATION

01 DATE OF INSPECTION: 1, 22, 86 (MONTH DAY YEAR)	02 SITE STATUS: ☐ ACTIVE ☐ INACTIVE	03 YEARS OF OPERATION: 1968 / 1978 (BEGINNING YEAR / ENDING YEAR) ___ UNKNOWN

04 AGENCY PERFORMING INSPECTION (Check all that apply)

☐ A. EPA ☐ B. EPA CONTRACTOR ____ (Name of firm) ☐ C. MUNICIPAL ☐ D. MUNICIPAL CONTRACTOR ____ (Name of firm)

☐ E. STATE ☒ F. STATE CONTRACTOR EA Science and Tech (Name of firm) ☐ G. OTHER ____ (Specify)

05 CHIEF INSPECTOR	06 TITLE	07 ORGANIZATION	08 TELEPHONE NO.
A. Lapins	Geologist	EA	(914) 692-6706
09 OTHER INSPECTORS	**10 TITLE**	**11 ORGANIZATION**	**12 TELEPHONE NO.**
L. Wilson	Environmental Scientist	EA	(914) 692-6706
			( )
			( )
			( )
			( )

13 SITE REPRESENTATIVES INTERVIEWED	14 TITLE	15 ADDRESS	16 TELEPHONE NO
Mr. Thomas Lovalle	Highway Supervisor	Town of Southampton	(516) 728-3600
		20 Jackson Avenue	( )
		Hampton Bays, NY 11946	( )
			( )
			( )
			( )

17 ACCESS GAINED BY (Check one)	18 TIME OF INSPECTION	19 WEATHER CONDITIONS
☒ PERMISSION ☐ WARRANT	1400	Clear, 15° C, no snow cover

IV. INFORMATION AVAILABLE FROM

01 CONTACT	02 OF (Agency/Organization)			03 TELEPHONE NO.
R. Ligotino	EA Science and Technology			(914) 692-6706
04 PERSON RESPONSIBLE FOR SITE INSPECTION FORM	**05 AGENCY**	**06 ORGANIZATION**	**07 TELEPHONE NO.**	**08 DATE**
L. Wilson		EA	(914) 692-6706	04, 08, 86 (MONTH DAY YEAR)

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 2 - WASTE INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	D980762462

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 PHYSICAL STATES (Check all that apply)

- [X] A. SOLID
- [ ] B. POWDER, FINES
- [ ] C. SLUDGE
- [ ] D. OTHER ________ (Specify)
- [ ] E. SLURRY
- [ ] F. LIQUID
- [ ] G. GAS

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)

TONS ________
CUBIC YARDS unknown
NO. OF DRUMS ________

03 WASTE CHARACTERISTICS (Check all that apply)

- [ ] A. TOXIC
- [ ] B. CORROSIVE
- [ ] C. RADIOACTIVE
- [ ] D. PERSISTENT
- [ ] E. SOLUBLE
- [ ] F. INFECTIOUS
- [ ] G. FLAMMABLE
- [ ] H. IGNITABLE
- [ ] I. HIGHLY VOLATILE
- [ ] J. EXPLOSIVE
- [ ] K. REACTIVE
- [ ] L. INCOMPATIBLE
- [X] M. NOT APPLICABLE

III. WASTE TYPE Household garbage and cesspool wastes documented

CATEGORY	SUBSTANCE NAME	01 GROSS AMOUNT	02 UNIT OF MEASURE	03 COMMENTS
SLU	SLUDGE			
OLW	OILY WASTE			
SOL	SOLVENTS			
PSD	PESTICIDES			
OCC	OTHER ORGANIC CHEMICALS			
IOC	INORGANIC CHEMICALS			
ACD	ACIDS			
BAS	BASES			
MES	HEAVY METALS			

IV. HAZARDOUS SUBSTANCES (See Appendix for most frequently cited CAS Numbers) unknown

01 CATEGORY	02 SUBSTANCE NAME	03 CAS NUMBER	04 STORAGE/DISPOSAL METHOD	05 CONCENTRATION	06 MEASURE OF CONCENTRATION

V. FEEDSTOCKS (See Appendix for CAS Numbers) Not applicable

CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER	CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER
FDS			FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Appendixes 1.1-1, 1.1-2, 1.1-3, and 1.1-4.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	D980762462

II. HAZARDOUS CONDITIONS AND INCIDENTS None known

01 ☐ A. GROUNDWATER CONTAMINATION — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ 04 NARRATIVE DESCRIPTION

01 ☐ B. SURFACE WATER CONTAMINATION — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ 04 NARRATIVE DESCRIPTION

01 ☐ C. CONTAMINATION OF AIR — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ 04 NARRATIVE DESCRIPTION

01 ☐ D. FIRE/EXPLOSIVE CONDITIONS — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ 04 NARRATIVE DESCRIPTION

01 ☐ E. DIRECT CONTACT — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ 04 NARRATIVE DESCRIPTION

01 ☐ F. CONTAMINATION OF SOIL — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
03 AREA POTENTIALLY AFFECTED: ______ (Acres) 04 NARRATIVE DESCRIPTION

01 ☐ G. DRINKING WATER CONTAMINATION — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ 04 NARRATIVE DESCRIPTION

01 ☐ H. WORKER EXPOSURE/INJURY — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
03 WORKERS POTENTIALLY AFFECTED: ______ 04 NARRATIVE DESCRIPTION

01 ☐ I. POPULATION EXPOSURE/INJURY — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ 04 NARRATIVE DESCRIPTION

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	D980762462

II. HAZARDOUS CONDITIONS AND INCIDENTS (Continued)

01 ☐ J. DAMAGE TO FLORA — 02 ☐ OBSERVED (DATE. ________) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ K. DAMAGE TO FAUNA — 02 ☐ OBSERVED (DATE: ________) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION (Include name(s) of species)

01 ☐ L. CONTAMINATION OF FOOD CHAIN — 02 ☐ OBSERVED (DATE. ________) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ M. UNSTABLE CONTAINMENT OF WASTES (Spills/Runoff/Standing liquids, Leaking drums) — 02 ☐ OBSERVED (DATE. ________) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ________
04 NARRATIVE DESCRIPTION

01 ☐ N. DAMAGE TO OFFSITE PROPERTY — 02 ☐ OBSERVED (DATE. ________) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ O. CONTAMINATION OF SEWERS, STORM DRAINS, WWTPs — 02 ☐ OBSERVED (DATE. ________) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ P. ILLEGAL/UNAUTHORIZED DUMPING — 02 ☐ OBSERVED (DATE. ________) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

05 DESCRIPTION OF ANY OTHER KNOWN, POTENTIAL, OR ALLEGED HAZARDS

III. TOTAL POPULATION POTENTIALLY AFFECTED: ________

IV. COMMENTS

No documented hazardous waste at the site. Unsubstantiated allegations of DDT and PCB buried at site.

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

EA Site Inspection, 22 January 1986.
Appendixes 1.1-1 through 1.1-4.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION
PART 4 - PERMIT AND DESCRIPTIVE INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	D980762462

II. PERMIT INFORMATION

01 TYPE OF PERMIT ISSUED (Check all that apply)	02 PERMIT NUMBER	03 DATE ISSUED	04 EXPIRATION DATE	05 COMMENTS
☐ A. NPDES				
☐ B. UIC				
☐ C. AIR				
☐ D. RCRA				
☐ E. RCRA INTERIM STATUS				
☐ F. SPCC PLAN				
☐ G. STATE (Specify)				
☐ H. LOCAL (Specify)				
☐ I. OTHER (Specify)				
☒ J. NONE				

III. SITE DESCRIPTION

01 STORAGE/DISPOSAL (Check all that apply)	02 AMOUNT	03 UNIT OF MEASURE
☐ A. SURFACE IMPOUNDMENT		
☐ B. PILES		
☐ C. DRUMS, ABOVE GROUND		
☐ D. TANK, ABOVE GROUND		
☐ E. TANK, BELOW GROUND		
☒ F. LANDFILL	unknown	
☐ G. LANDFARM		
☐ H. OPEN DUMP		
☐ I. OTHER (Specify)		

04 TREATMENT (Check all that apply)

- ☐ A. INCENERATION
- ☐ B. UNDERGROUND INJECTION
- ☐ C. CHEMICAL/PHYSICAL
- ☐ D. BIOLOGICAL
- ☐ E. WASTE OIL PROCESSING
- ☐ F. SOLVENT RECOVERY
- ☐ G. OTHER RECYCLING/RECOVERY
- ☐ H. OTHER (Specify)

05 OTHER

- ☐ A. BUILDINGS ON SITE

06 AREA OF SITE

12 (Acres)

07 COMMENTS

IV. CONTAINMENT

No doucmented hazardous wastes

01 CONTAINMENT OF WASTES (Check one)

☐ A. ADEQUATE, SECURE ☐ B. MODERATE ☐ C. INADEQUATE, POOR ☐ D. INSECURE, UNSOUND, DANGEROUS

02 DESCRIPTION OF DRUMS, DIKING, LINERS, BARRIERS, ETC.

Trash and cesspool wastes were accepted. Cesspool waste were dumped in a leaching pond. Trash was buried daily. No liner. Cap of 4 ft of sandy loam.

V. ACCESSIBILITY

01 WASTE EASILY ACCESSIBLE: ☐ YES ☐ NO

02 COMMENTS

Site has no security, but all materials are buried.

VI. SOURCES OF INFORMATION (Cite specific references, e.g. state files, sample analysis, reports)

Appendix 1.1-1
EA Site Inspection

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION

01 STATE: NY | 02 SITE NUMBER: D980762462

II. DRINKING WATER SUPPLY

01 TYPE OF DRINKING SUPPLY (Check as applicable)

	SURFACE	WELL
COMMUNITY	A. ☐	B. ☐
NON-COMMUNITY	C. ☐	D. ☐

02 STATUS

ENDANGERED	AFFECTED	MONITORED
A. ☐	B. ☐	C. ☒
D. ☐	E. ☐	F. ☐

03 DISTANCE TO SITE

A. 0.3 (mi)
B. 0.1 (mi)

III. GROUNDWATER

01 GROUNDWATER USE IN VICINITY (Check one)

☒ A. ONLY SOURCE FOR DRINKING
☐ B. DRINKING (Other sources available) COMMERCIAL, INDUSTRIAL, IRRIGATION (No other water sources available)
☐ C. COMMERCIAL, INDUSTRIAL, IRRIGATION (Limited other sources available)
☐ D. NOT USED, UNUSEABLE

02 POPULATION SERVED BY GROUND WATER 18,939

03 DISTANCE TO NEAREST DRINKING WATER WELL 0.1 (mi)

04 DEPTH TO GROUNDWATER 32 (ft)

05 DIRECTION OF GROUNDWATER FLOW SSE

06 DEPTH TO AQUIFER OF CONCERN 32 (ft)

07 POTENTIAL YIELD OF AQUIFER unknown (gpd)

08 SOLE SOURCE AQUIFER ☒ YES ☐ NO

09 DESCRIPTION OF WELLS (Including useage, depth, and location relative to population and buildings)

There are 3 Suffolk County Water Authority well fields within 3 miles of the site. They penetrate the Upper Glacial aquifer at depths ranging from 70 to 161 ft. They serve the Westhampton Beach water district. There are also several private residences on South Country Road which have private wells (0.1 mi south of the site).

10 RECHARGE AREA ☒ YES ☐ NO COMMENTS

11 DISCHARGE AREA ☐ YES ☐ NO COMMENTS

IV. SURFACE WATER

01 SURFACE WATER USE (Check one)

☒ A. RESERVOIR, RECREATION DRINKING WATER SOURCE
☐ B. IRRIGATION, ECONOMICALLY IMPORTANT RESOURCES
☐ C. COMMERCIAL, INDUSTRIAL
☐ D. NOT CURRENTLY USED

02 AFFECTED/POTENTIALLY AFFECTED BODIES OF WATER

NAME:	AFFECTED	DISTANCE TO SITE
Aspatuck Creek	☐	0.3 (mi)
	☐	(mi)
	☐	(mi)

V. DEMOGRAPHIC AND PROPERTY INFORMATION

01 TOTAL POPULATION WITHIN

ONE (1) MILE OF SITE	TWO (2) MILES OF SITE	THREE (3) MILES OF SITE
A. 1,289 NO. OF PERSONS	B. 4,133 NO. OF PERSONS	C. 6,767 NO. OF PERSONS

02 DISTANCE TO NEAREST POPULATION 0.1 (mi)

03 NUMBER OF BUILDINGS WITHIN TWO (2) MILES OF SITE ______

04 DISTANCE TO NEAREST OFF-SITE BUILDING ______ (mi)

05 POPULATION WITHIN VICINITY OF SITE (Provide narrative description of nature of population within vicinity of site, e.g., rural, village, densely populated urban area)

The site is surrounded on 3 sides by commercial properties and on one side by a forested lot. The nearest residences are 0.1 mi west. The village of Quiogue is less than 0.5 mi to the south.

EPA

POTENTIAL HAZARDOUS WASTE SITE SITE INSPECTION REPORT
PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
NY	D908762462

VI. ENVIRONMENTAL INFORMATION

01 PERMEABILITY OF UNSATURATED ZONE (Check one)

☐ A. $10^{-6} - 10^{-8}$ cm/sec ☐ B. $10^{-4} - 10^{-6}$ cm/sec ☐ C. $10^{-4} - 10^{-3}$ cm/sec ☒ D. GREATER THAN 10^{-3} cm/sec

02 PERMEABILITY OF BEDROCK (Check one) unknown

☐ A. IMPERMEABLE (Less than 10^{-6} cm/sec) ☐ B. RELATIVELY IMPERMEABLE ($10^{-4} - 10^{-6}$ cm/sec) ☐ C. RELATIVELY PERMEABLE ($10^{-2} - 10^{-4}$ cm/sec) ☐ D. VERY PERMEABLE (Greater than 10^{-2} cm/sec)

03 DEPTH TO BEDROCK	04 DEPTH OF CONTAMINATED SOIL ZONE	05 SOIL pH
>1,000 (ft)	unknown (ft)	4.8

06 NET PRECIPITATION	07 ONE YEAR 24 HOUR RAINFALL	08 SLOPE: SITE SLOPE	DIRECTION OF SITE SLOPE	TERRAIN AVERAGE SLOPE
22 (in)	2.8 (in)	<1 %	inward	1-2 %

09 FLOOD POTENTIAL: SITE IS IN N/A YEAR FLOODPLAIN

10 ☐ SITE IS ON BARRIER ISLAND, COASTAL HIGH HAZARD AREA, RIVERINE FLOODWAY

11 DISTANCE TO WETLANDS (5 acre minimum)

ESTUARINE A. 0.7 (mi) OTHER B. ______ (mi)

12 DISTANCE TO CRITICAL HABITAT (of endangered species) ______ (mi)

ENDANGERED SPECIES: None

13 LAND USE IN VICINITY

DISTANCE TO:

COMMERCIAL/INDUSTRIAL	RESIDENTIAL AREAS; NATIONAL/STATE PARKS, FORESTS, OR WILDLIFE RESERVES	AGRICULTURAL LANDS: PRIME AG LAND	AG LAND
A. 0.07 (mi)	B. 0.1 (mi)	C. 1.8 (mi)	D. 1 8 (mi)

14 DESCRIPTION OF SITE IN RELATION TO SURROUNDING TOPOGRAPHY

Site slope is generally less than 1 percent toward the center from all sides Site elevation is approximately 40 ft above mean sea level. The site is bordered on the north by the Long Island Railroad and the Suffolk County Airport. Just beyond the railroad is a large tank farm on Suffolk County Airport property where jet fuels and oils are stored. To the east is a densely wooded area to the south is an automobile junkyard, and to the west is an active sand and gravel mining operation. The Quiogue Wildlife Refuge is located approximately one mi east of the site

VII. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

U.S. Department of Interior Geological Survey 1956, Eastport Quandrangle, 7.5-Minute Series.

Ozard, J. 1986. NYSDEC Significant Habitat Units, Personal Communication. 6 March.

NYSDOT. 1982. NYS Atlas of Community Water System Services.

EA Site Inspection, 22 January. 1986.

Long Island Regional Planning Board 1985. Population Survey 1985. Current Population

Estimates for Nassau and Suffolk Counties. Hauppage, New York.

USGS. 1967. Map of Flood-Prone Areas. Eastport Quandrangle. 7.5-Minute Series.

LIRPB. 1982. Quantification and Analysis of Land Use for Nassau and Suffolk Counties. Appendixes 1.1-1 through 1.1-5.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 6 - SAMPLE AND FIELD INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
NY	D980762462

II. SAMPLES TAKEN None

SAMPLE TYPE	01 NUMBER OF SAMPLES TAKEN	02 SAMPLES SENT TO	03 ESTIMATED DATE RESULTS AVAILABLE
GROUNDWATER			
SURFACE WATER			
WASTE			
AIR			
RUNOFF			
SPILL			
SOIL			
VEGETATION			
OTHER			

III. FIELD MEASUREMENTS TAKEN

01 TYPE	02 COMMENTS
Volatile Organics	No readings above background at site except: a head-space reading of 2 ppm above background was recorded with
	an HNU meter above an unsecured monitoring well located along the
	south-central site boundary.
Slope	Suunto Clinometer
Bearings	Compass

IV. PHOTOGRAPHS AND MAPS

01 TYPE ☒ GROUND ☐ AERIAL

02 IN CUSTODY OF EA Science and Technology (Name of organization or individual)

03 MAPS ☒ YES ☐ NO

04 LOCATION OF MAPS EA Science and Technology

V. OTHER FIELD DATA COLLECTED (Provide narrative description)

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

EA Site Inspection, 22 January 1986.

EPA

POTENTIAL HAZARDOUS WASTE SITE SITE INSPECTION REPORT PART 7 - OWNER INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	D980762462

II. CURRENT OWNER(S) / PARENT COMPANY (if applicable)

II. CURRENT OWNER(S)				PARENT COMPANY (if applicable)		
01 NAME: Town of Southampton		02 D+B NUMBER:		08 NAME:		09 D+B NUMBER:
03 STREET ADDRESS (P.O. Box, RFD #, etc.): Hampton Road		04 SIC CODE:		10 STREET ADDRESS (P.O. Box, RFD #, etc.):		11 SIC CODE:
05 CITY: Southampton	06 STATE: NY	07 ZIP CODE: 11968		12 CITY:	13 STATE:	14 ZIP CODE:
01 NAME:		02 D+B NUMBER:		08 NAME:		09 D+B NUMBER:
03 STREET ADDRESS (P.O. Box, RFD #, etc.):		04 SIC CODE:		10 STREET ADDRESS (P.O. Box, RFD #, etc.):		11 SIC CODE:
05 CITY:	06 STATE:	07 ZIP CODE:		12 CITY:	13 STATE:	14 ZIP CODE:
01 NAME:		02 D+B NUMBER:		08 NAME:		09 D+B NUMBER:
03 STREET ADDRESS (P.O. Box, RFD #, etc.):		04 SIC CODE:		10 STREET ADDRESS (P.O. Box, RFD #, etc.):		11 SIC CODE:
05 CITY:	06 STATE:	07 ZIP CODE:		12 CITY:	13 STATE:	14 ZIP CODE:
01 NAME:		02 D+B NUMBER:		08 NAME:		09 D+B NUMBER:
03 STREET ADDRESS (P.O. Box, RFD #, etc.):		04 SIC CODE:		10 STREET ADDRESS (P.O. Box, RFD #, etc.):		11 SIC CODE:
05 CITY:	06 STATE:	07 ZIP CODE:		12 CITY:	13 STATE:	14 ZIP CODE:

III. PREVIOUS OWNER(S) (List most recent first) / IV. REALTY OWNER(S) (If applicable; list most recent first)

III. PREVIOUS OWNER(S)				IV. REALTY OWNER(S)		
01 NAME:		02 D+B NUMBER:		01 NAME:		02 D+B NUMBER:
03 STREET ADDRESS (P.O. Box, RFD #, etc.):		04 SIC CODE:		03 STREET ADDRESS (P.O. Box, RFD #, etc.):		04 SIC CODE:
05 CITY:	06 STATE:	07 ZIP CODE:		05 CITY:	06 STATE:	07 ZIP CODE:
01 NAME:		02 D+B NUMBER:		01 NAME:		02 D+B NUMBER:
03 STREET ADDRESS (P.O. Box, RFD #, etc.):		04 SIC CODE:		03 STREET ADDRESS (P.O. Box, RFD #, etc.):		04 SIC CODE:
05 CITY:	06 STATE:	07 ZIP CODE:		05 CITY:	06 STATE:	07 ZIP CODE:
01 NAME:		02 D+B NUMBER:		01 NAME:		02 D+B NUMBER:
03 STREET ADDRESS (P.O. Box, RFD #, etc.):		04 SIC CODE:		03 STREET ADDRESS (P.O. Box, RFD #, etc.):		04 SIC CODE:
05 CITY:	06 STATE:	07 ZIP CODE:		05 CITY:	06 STATE:	07 ZIP CODE:

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Appendix 1.1-1.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 8 - OPERATOR INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	D980762462

II. CURRENT OPERATOR *(Provide if different from owner)*

01 NAME			02 D+B NUMBER
03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*			04 SIC CODE
05 CITY	06 STATE	07 ZIP CODE	
08 YEARS OF OPERATION	09 NAME OF OWNER		

OPERATOR'S PARENT COMPANY *(If applicable)*

10 NAME			11 D+B NUMBER
12 STREET ADDRESS *(P.O. Box, RFD #, etc.)*			13 SIC CODE
14 CITY	15 STATE	16 ZIP CODE	

III. PREVIOUS OPERATOR(S) *(List most recent first; provide only if different from owner)*

01 NAME			02 D+B NUMBER
03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*			04 SIC CODE
05 CITY	06 STATE	07 ZIP CODE	
08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD		
01 NAME			02 D+B NUMBER
03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*			04 SIC CODE
05 CITY	06 STATE	07 ZIP CODE	
08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD		
01 NAME			02 D+B NUMBER
03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*			04 SIC CODE
05 CITY	06 STATE	07 ZIP CODE	
08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD		

PREVIOUS OPERATORS' PARENT COMPANIES *(If applicable)*

10 NAME			11 D+B NUMBER
12 STREET ADDRESS *(P.O. Box, RFD #, etc.)*			13 SIC CODE
14 CITY	15 STATE	16 ZIP CODE	
10 NAME			11 D+B NUMBER
12 STREET ADDRESS *(P.O. Box, RFD #, etc.)*			13 SIC CODE
14 CITY	15 STATE	16 ZIP CODE	
10 NAME			11 D+B NUMBER
12 STREET ADDRESS *(P.O. Box, RFD #, etc.)*			13 SIC CODE
14 CITY	15 STATE	16 ZIP CODE	

IV. SOURCES OF INFORMATION *(Cite specific references, e.g., state files, sample analysis, reports)*

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 9 - GENERATOR/TRANSPORTER INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
NY	D980762462

II. ON-SITE GENERATOR

01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE

III. OFF-SITE GENERATOR(S)

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE
01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE

IV. TRANSPORTER(S)

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE
01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE

V. SOURCES OF INFORMATION *(Cite specific references, e.g., state files, sample analysis, reports)*

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	D980762462

II. PAST RESPONSE ACTIVITIES None

01 ☐ A. WATER SUPPLY CLOSED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ B. TEMPORARY WATER SUPPLY PROVIDED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ C. PERMANENT WATER SUPPLY PROVIDED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ D. SPILLED MATERIAL REMOVED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ E. CONTAMINATED SOIL REMOVED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ F. WASTE REPACKAGED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ G. WASTE DISPOSED ELSEWHERE — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ H. ON SITE BURIAL — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ I. IN SITU CHEMICAL TREATMENT — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ J. IN SITU BIOLOGICAL TREATMENT — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ K. IN SITU PHYSICAL TREATMENT — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ L. ENCAPSULATION — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ M. EMERGENCY WASTE TREATMENT — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ N. CUTOFF WALLS — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ O. EMERGENCY DIKING/SURFACE WATER DIVERSION — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ P. CUTOFF TRENCHES/SUMP — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ Q. SUBSURFACE CUTOFF WALL — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION

01 STATE: NY | 02 SITE NUMBER: D980762462

II. PAST RESPONSE ACTIVITIES (Continued)

01 ☐ R. BARRIER WALLS CONSTRUCTED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ S. CAPPING/COVERING — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ T. BULK TANKAGE REPAIRED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ U. GROUT CURTAIN CONSTRUCTED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ V. BOTTOM SEALED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ W. GAS CONTROL — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ X. FIRE CONTROL — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ Y. LEACHATE TREATMENT — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ Z. AREA EVACUATED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ 1. ACCESS TO SITE RESTRICTED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ 2. POPULATION RELOCATED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ 3. OTHER REMEDIAL ACTIVITIES — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

III. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Section 3.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 11 - ENFORCEMENT INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	D980762462

II. ENFORCEMENT INFORMATION

01 PAST REGULATORY/ENFORCEMENT ACTION ☐ YES ☒ NO

02 DESCRIPTION OF FEDERAL, STATE, LOCAL REGULATORY/ENFORCEMENT ACTION

III. SOURCES OF INFORMATION *(Cite specific references, e.g., state files, sample analysis, reports)*

Section 3.

6. ASSESSMENT OF DATA ADEQUACY AND RECOMMENDATIONS

6.1 ADEQUACY OF EXISTING DATA

The available data are considered insufficient to prepare a final HRS score for this site. There is no documentation of hazardous waste disposal and no records available related to specific waste types or quantities. Also, ground-water quality data are lacking.

6.2 RECOMMENDATIONS

In order to prepare a final HRS score for this site, analytical data regarding the quality of the site-specific ground water will be necessary, thus requiring performance of a Phase II investigation. The proposed Phase II study would include the installation of five test borings/observation wells, and the collection and analysis of ground-water samples.

6.3 PHASE II WORK PLAN

6.3.1 Task 1 - Mobilization and Site Reconnaissance

Project mobilization includes review of the Phase I report and updating the site data base with any new information made available since completion of the Phase I report. Based on that review, a draft scope of work for this site will be agreed to and a project schedule developed. At this time, a draft Quality Assurance/Quality Control (QA/QC) document will be prepared in accordance with the most up-to-date NYSDEC guidelines.

Site reconnaissance will be performed to examine general site access for Phase II studies. Site reconnaissance will familiarize key project personnel with the site, enable the project geologists to evaluate potential boring/well locations, and enable the project Health and Safety Officer to develop specific health and safety requirements for the field activities. Emergancy, fire, and hospital services will be identified. Standard practice during site reconnaissance is an air survey with a photoionization detector (HNU or similar instrument). The air survey would be performed around the site perimeter and thoughout the site for safety reasons. Detection of releases to air during site reconnaissance may warrant further confirmation studies. Based on the Phase I study, it is expected that field activities will require only Level D health and safety protective measures, including continuous monitoring with HNU and explosimeter type instruments.

6.3.2 Task 2 - Geophysics

Multidepth EM and earth resistivity surveying will be performed around the site area perimeter to evaluate the potential presence of ground-water contaminant plumes and stratigraphic conditions. Additionally, an EM and proton magnetometer survey would be performed to evaluate the presence of buried masses of metal, potentially the drums and capacitors which were alleged to have been buried at the site. However, the potential presence of metal within the domestic trash received at the site, could interfere with such a survey. The number of stations and value of depth settings will be determined on the basis of field conditions. Results of the geophysics will be used to refine the specifications for locations, depths, and number of observation wells to be installed.

6.3.3. Task 3 - Preparation of Final Sampling Plan

All data collected during Tasks 1 and 2 will be evaluated to finalize sampling and boring/well locations. The final sampling plan will be developed and submitted to NYSDEC for approval. The plan will include final sampling locations, boring and well specifications, and reference pertinent portions of the QA/QC plan. A final budget will be developed to complete the drilling and sampling program.

6.3.4 Task 4 - Test Borings and Observation Wells

Because there are hundreds of feet of unconsolidated sediment underlying the site, EA recommends that the subsurface investigations be confined, at this time, to the shallow glacial aquifer to confirm if site-related ground-water contamination is present. Although, there are two NYSDOT monitoring wells located adjacent to the site and three monitoring wells were observed during EA's site reconnaissance (Figure 1-2), the manner of installation and integrity of these wells is unknown. Based upon currently available information, EA recommends the installation of five test borings/observation wells. This work would be performed under the fulltime supervision of a geologist. It is anticipated that the hollow-stem auger drlling method will be used. Prior to the drilling of each boring/well, and at the completion of the last boring/

well, the drilling equipment which comes in contact with subsruface materials will be steam-cleaned, as well as the split spoon sampler after obtaining each sample. Soil sampling will be performed using a split spoon sampler at approximately 5-ft intervals and at detected major stratigraphic changes. An HNU, or similar instrument, and an explosimeter would be used to monitor the potential organic vapors emitted during drilling operations and from each soil sample. Samples of major soil/unconsolidated sediments will be collected for grain-size and/or Atterburg Limits analysis.

It is anticipated that the wells to be installed at this site will be completed in the unconsolidated sediment, approximately 10 ft below the ground-water table. Standard construction of such a well would include 10 ft of 2-in. diameter threaded-joint PVC screen and an appropriate length of PVC riser with a bottom plug cap, sand pack, bentonite seal, and protective surficial steel casing with a locking cap.

Upon completion and development of the wells by air surging/pumping, the vertical elevation of the upper rim of each well casing and the horizontal location will be surveyed in order to aid in evaluation of the ground-water flow direction. Depending upon the yield of each Phase II well, a short-term, low-yield pumping test will be performed in each well.

Fo cost estimating purposes, it is assumed that:

a. The depth of each of the five monitoring wells will be 40 ft below ground surface.
b. The five wells will require 13 days to install, develop, and test.

c. All drill sites are accessible by truck-mounted drilling rigs as determined by the driller.

d. There are no excessive amounts of cobbles/boulders which would increase drilling time.

e. Steam-cleaning of drilling/sampling equipment will be performed at each boring/well location. The fluids will be discharged to ground surface.

f. All drill cuttings, fluids, and development water will be left on, or discharged to, the ground surface in the immediate area of the activity.

g. That permission from appropriate land owners to drill borings/wells on their property will be a simple process (expedited by the NYSDEC, if necessary), so that delays during field operations are not incurred.

6.3.5 Task 5 - Sampling

All sampling and analysis will be conducted in accordance with the project QA/QC Plan. The analytical program for every water and sediment sample will include the 130 organic and 25 inorganic parameters listed in Statement of Work No. 784, New York State Department of Environmental Conservation Superfund and Contract Laboratory Protocol, January 1985. Also, all additional non-priority pollutant GC/MS major peaks will be identified and quantified. Major peaks will be considered as those whose area is 10 percent or greater than the calibrating standard(s). Based upon the curently available information, collection and analysis of the following numbers and types of samples is recommended:

5 Ground-water samples (one from each Phase II well).

6.3.6 Task 6 - Contamination Assessment

EA will evaluate the data obtained during the records search and field investigation: prepare a final HRS scores and documentation forms; complete EPA Form 2070-13; summarize site history, site characteristics, available sampling and analysis data; and determine the adequacy of the existing data to confirm release, and if there is a population at risk.

6.3.7 Task 7 - Remedial Cost Estimate

EA will evaluate remedial alternatives for the site and develop a list of potential options given the information available on the nature and extent of contamination. Approximate cost estimates for the selected potential remedial options will be computed. This work is not intended to be, or a substitute for, a formal cost effectiveness analysis of potential remedial actions.

6.3.8 Task 8 - Final Phase II Report

In accordance witb current (January 1985) NYSDEC guidelines, the Phase II report will include:

a. The results of the Phase II investigation, complete with boring logs, photos, and sketches developed as part of the Phase II field work.
b. Final HRS scores with detailed documentation.
c. Selected potential remedial alternatives and associated cost estimates.

In addition to the final Phase II report, the following raw data and resulting reduction would be provided to NYSDEC.

a. geophysical
b. well logs
c. all sampling forms and data.
d. all analytical data.
e. chain-of-custody forms
f. other pertinent collected information

6.3.9 <u>Task 9 - Project Management/Quality Assurance</u>

A Project Manager will be responsible for the supervision, direction, and review of the project activities on a day-to-day basis. A Quality Assurance office will ensure that the QA/QC Program protocols are maintained and that the resultant analytical data are accurate.

6.4 PHASE II COST ESTIMATE

Based on the scope of work and assumptions described above, the estimated costs to complete the Phase II investigations of the Quiogue Landfill site are as follows:

Consultant Costs	$47,650
(including labor, direct costs, fee)	
Drilling Contractor	26,900
Laboratory	10,000
Total	$84,550

Appendix 1.1-1

INTERVIEW ACKNOWLEDGEMENT FORM

Site Name: Quiogue Dump

I.D. Number: 152061

Person Contacted: Thomas Lovall

Date: 22 January 1986

Title: Highway Supervisor

Affiliation: Town of Southhampton

Phone No.: (516) 728-3600

Address: Highway Department
Jackson Avenue
Hampton Bays, New York 11946

Persons Making Contact:
EA Representatives:

Larry Wilson

Type of Contact: In person

Interview Summary:

Quiogue Dump is a 12-acre site. Prior to use as a dump, about 6 of the 12 acres were used as a sand mine. The pits were not down to ground water. The site was open for 10 years, from 1968 to 1978, and accepted household waste brought by carters and home cesspool wastes. Trash was buried daily. The site was capped with 4 feet of loam after closing. It has not been used for anything since. There are no private wells in the area because of the 1974 oil spill at the tank farm adjacent to the dump which fouled the areas' ground water. No remedial action is planned for this site.

Acknowledgement:

I have read the above transcript and I agree that it is an accurate summary of the information verbally conveyed to EA Science and Technology interviewers, or as I have revised below, is an accurate account.

Revisions (please write in corrections to above transcript):

THIS SITE IS LOCATED IN QUIOGUE

Signature: Thomas A. Lovall

Date: 3/21/86

EA SCIENCE AND TECHNOLOGY
A Division of EA Engineering, Science, and Technology, Inc.

Appendix 1.1-2a

COMMUNICATIONS RECORD FORM

Distribution: ( ) ____________, ( ) ____________
( ) ____________, ( ) ____________
( ) Author

Person Contacted: Major Harris Date: 23 June 87

Phone Number: (516) 288-4200 Title:

Affiliation: U.S. National Guard Type of Contact: Telephone

Address: Suffolk County Airport Person Making Contact: Ellen Metzger
Westhampton, New York 11977

Communications Summary: I contacted Major Harris as to whether he knew if the waste from the airbase were deposited in the Quiogue Landfill. He said he had no idea nor would anyone he could recommend.

(see over for additional space)

Signature: Ellen B. Metzger

BD-17-1 (5/76)
Formerly GA-4

DEC Reg 1

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Received from NYSDEC Region 1

p.144

TRANSMITTAL SLIP

Appendix 1.1-2

TO Bob Beckerer ~ Region 1, Stoney Brook

FROM Tom Koch ~ Hazardous Site Control

DATE 4/9/84

RE:

Bob – I've attached a copy of the report that I prepared about our trip to the sites in the town of Southampton. I hope that it will be of benifit to you.

FOR ACTION AS INDICATED:

- ☐ Please Handle
- ☐ Prepare Reply
- ☐ Prepare Reply for ________ Signature
- ☐ Information
- ☐ Approval
- ☐ Prepare final/draft in ______ Copies
- ☐ Comments
- ☐ Signature
- ☐ File
- ☐ Return to me
- ☐ ________
- ☐ ________

RECEIVED
APR 12 ...
SOLID WASTE MANAGEMENT
DEC REG. 1

5/14/84

Phil,
I think you'll find the attached very interesting. Especially #4, 5, 9 and 11
Bob

Received from
NYSDEC Region I

15 (12/75)

New York State Department of Environmental Conservation

MEMORANDUM

TO: Robert Olazagasti, Supervisor, Site Control Section
FROM: Thomas Koch, Solid Waste Management Specialist II, Site Control Secti
SUBJECT: Investigation of Potential Inactive Hazardous Waste Sites in the Town of Southampton, Suffolk County, Region I
DATE: April 4, 1984

On the 27th and 28th of March, we met with members of an environmental group called the "Concerned Citizens of Southampton Town". The intent of our meeting was to investigate sites in the town that the group believes contain hazardous waste. The Concerned Citizens Group is headed by Elaine Bennett and has been instrumental in the investigation of potentially harmful inactive hazardous and septage waste sites in the town.

Our meeting began on the morning of March 27. Attending from the Concerned Citizens Group were the following:

Elaine Bennett
Cindy Hulse
Virginia Styler

Attending the meeting from the Region I office was Bob Beckerer. Before proceeding to visit the alleged hazardous waste sites, Elaine Bennett outlined her perception of the problems that the Town of Southampton faced. Basically, there are three main concerns. First, the soil on the eastern part of Long Island is primarily sand and gravel and consequently, it is extremely permeable. Therefore, any hazardous waste that may have been dumped anywhere on the surface of the ground would tend to perculate down to the water table where it could potentially contaminate the drinking water supply of the residents. Unfortunately, almost all of the drinking water supply for the eastern part of the Island is taken from groundwater. The second concern is the fact that there used to be a large number of potato farms on the eastern part of the Island. A tremendous amount of pesticides and herbicides were used in raising the potato crop over the years. Most of the spent pesticides and herbicides were disposed of in totally unsecured "dumps" where the residue was able to pass through the soil and enter groundwater. Also, it has been alleged that the scavenger waste haulers in the eastern part of the Island have mixed waste solvents, etc., in with septage and also dumped it at unsecured "dumps" throughout the eastern part of the Island. The third concern mentioned was the fact that the political leaders of the Town of Southampton are totally unconcerned with the proper operation of their existing landfill at North Sea and the transfer stations at Westhampton, Qugue, East Quogue and Sag Harbor.

After our discussion of the basic problems encountered in eastern Long Island, we proceeded to visit the sites for a

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NYSDEC Region 1

p.3 of 4

3. Quiogue Landfill 152061

NUS Report

South Country Road, Westhampton. This was formerly an active landfill which closed in 1978. The site was extensively used for septage disposal over the years. According to Mrs. Bennett, there are allegations that numerous barrels of spent DDT and old transformers containing PCB's were buried on site. Along with this were old car bodies, municipal refuse and other waste. Currently, excavation is being done on site. The extensive excavation in one section has intercepted areas where the old septage lagoons were located. The resulting oder from this operation was almost overpowering. Adjacent to this site is a residential area, Peter Lane. The source of water for people living on this street is from private wells. A number of people using this well water have experienced severe contamination of their drinking water. The source of contamination is from two massive fuel spills that took place on the property of the Suffolk County Airport in 1966-67 and again in 1974. In the first instance, it is believed that approximately 80,000 gallons of fuel was spilled. In the second case, it is estimated that 10,000 gallons of JP-4 jet fuel was lost. The location of where the fuel spills took place is less than 500 ft. from the Quiogue Landfill. It is very conceivable that the leachate plume from the landfill could be mixing in with the jet fuel plume and spreading with it to Peter Lane. It would be highly suggested that more sampling be done here. Especially perhaps sampling the residents drinking water on Peter Lane for priority pollutants.

4. Suffolk County Airport "Demo" Site, Westhampton

BE CAREFUL HERE SUPPOSEDLY AMMUNITION WAS BURIED HERE.

From first appearance, this site looked rather innocent. It appeared to be a former demolition waste site with a few loads of municipal refuse strewn about and mixed in. Closer inspection revealed that the demolition waste was from buildings on the Suffolk County Airport that were once used by the Air Force at the time when this airport was operated as an Air Force Base. Strewn in with the demolition waste was waste from the jet airplane maintenance shops, such as spent oil filters, empty oil cans, as well as several empty 55 gallon drums with unknown chemical contamination. Mrs. Bennett has spent a considerable amount of time investigating this site. She has learned from unconfirmed sources that an incredible amount of waste was dumpled into trenches here and then covered over with earth and old chunks of pavement from a section of airport runway that was renovated. Among the wastes allegely dumped were numerous cans of solvents (probably 1-1-1 trichlorethane), waste oil, jet fuel pods, old transformers containing PCB liquids and oil filters. It is highly suggested that this site be sampled sometime over the summer. Especially considering the close proximity of this site to the old Quiogue landfill and Peter Lane.

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NYSDEC Region 1

p.4 of 4

base of the pit which was at least one acre in surface area and probably 2-3 feet deep. There was significant refuse, old rotted animal carcasses and numerous dead seagulls in the pond and on the shores of it. About 300 feet south of this excavated abomination was the septage pit lagoon system. It consisted of about 120 deep pits interconnected by trenches. There was a substantial amount of septage that had already been dumped here. According to Mrs. Bennett, the septage has definitely been contaminated with something not yet determined. This was discovered in recent tests performed on the sludge back in March of 1983.

This facility definitely warrants sampling. It might also be a good idea to consider groundwater sampling downgradient from the site both in and out of the leachate plume. According to Mrs. Bennett, several drinking water supply wells are severely contaminated already and the residents must bring in water from elsewhere.

In conclusion, our trip to the Town of Southampton was extremely enlightening. We now have evidence of three new sites that deserve to be added to the Registry. Those three sites being the Suffolk County Airport Demo Site, the Suffolk County Airport Canine Kennel Corp site and the Bridgehampton sites, east and west. These three sites warrant a classification of 2a at this time. Obviously, sampling must be done to determine the true extent of the problems there. The North Sea Landfill truly deserves the attention of Phase I investigation. Judging from the number of drums that were noted protruding through the soil, it could be construed that there could be a very significant amount of hazardous waste leaching into the groundwater. Hopefully, we will be able to initiate a sampling schedule for many of the sites this coming summer. In the meantime, we will keep in contact with the Concerned Citizens Group to keep them abreast of our schedule for sampling. Hopefully, someday we will initiate remediation for some of these sites.

TMK:cl

cc: C. Goddard
cc: B. Beckerer

Appendix 1.1-3
p1 of 2

EA SCIENCE AND TECHNOLOGY
A Division of EA Engineering, Science, and Technology, Inc.

COMMUNICATIONS RECORD FORM

Distribution: (✓) Quiogue Landfill, ( ) ______
( ) ______, ( ) ______
( ) Author

Person Contacted: Jim Pim, P.E. Date: 12/10/85

Phone Number: 516 451 4634 Title: Public Health Engineer

Affiliation: SCDHS - Haz. Mat. Mngt. Type of Contact: In person

Address: 15 Horseblock Rd Farmingville NY Person Making Contact: Ligotino/Garg/Wilson

Communications Summary: RE: Quiogue LF 152061

Attached Comments.

(see over for additional space)

Signature: William L. Going

SUPER FUND SITE REPORT REVIEW COMMENTS

SUFFOLK COUNTY DEPARTMENT OF HEALTH SERVICES

HAZARDOUS MATERIALS MANAGEMENT SECTION

Site Name: Westhampton Landfill (Quiogue) N.Y.I.D. # 152061

Report Type: I Contractor NUS EPA ✓ State

Date of Report 6/ /83 Date of Review 9/24/84 Reviewer J. Pim

Comments: This landfill is located directly south of the Suffolk Co. Airport which was operated for several decades as an Air Force Base. It is rumored that all the waste from the airbase including industrial wastes and waste oils and chemicals were deposited in the landfill. Wells should be installed to completely define the contamination plume and to determine if toxic materials are present.

Appendix 1.1-4

EA SCIENCE AND TECHNOLOGY
A Division of EA Engineering, Science, and Technology, Inc.

COMMUNICATIONS RECORD FORM

Distribution: ( ) Quogue Landfill, ( ) ____________
( ) ____________, ( ) ____________
( ) Author

Person Contacted: Elaine Bennett Date: 7-17-86

Phone Number: (516) 283-7673 Title: Private citizen

Affiliation: Concerned Citizen Group. Type of Contact: Phone

Address: ____________ Person Making Contact: Larry Wilson

Communications Summary: Mrs Bennett indicated she had contacted persons who had worked at the Quogue L.F. also known as the Westhampton L.F. These workers claimed to have witnessed drums containing pesticides and transformer-containing oil from the airbase being buried on this site.

She will send her collection of information.

8-14-86 W. Going Contacted Ms Bennett regarding documentation for evidence of hazardous waste at Quogue Landfill, and she indicated she had discussed the issue w/ former employees of the landfill (who wish to remain unnamed); and their general recollection and/or belief was that pesticide containers (drums) and capacitors (assumed contained oil and PCB's) were buried at the site; but they had no proof or evidence, and didn't wish to make a formal complaint or statement for the record. William Going

(see over for additional space)

Signature: Larry Wilson

Appendix 1.1-5
1 of 63

Dan Raviv Associates, Inc.
Consultants in ground water hydrology, water quality and landfill hydrology

PHASE I EVALUATION
GEOHYDROLOGIC/WATER QUALITY CONDITIONS
SUFFOLK COUNTY AIRPORT AND VICINITY
WESTHAMPTON, NEW YORK

Job No. 83C146

Prepared
for the

Environmental Protection Bureau
New York State Department of Law

Attention: Nancy Sterns, Esq.
Norman Spiegel, Esq.
Greg Shkuda, Ph.D.

October 25, 1983
Revised: April 1984

5 Central Avenue, West Orange, New Jersey 07052 (201) 325-0806

2 of 5

CONTENTS

3863

LIST OF FIGURES

LIST OF TABLES

5863

APPENDICES

APPENDIX A	Literature Reference List
APPENDIX B	Water Quality Laboratory Data Sheets: New York Department of Transportation Wells Private, Residential Wells Suffolk County Department of Health Wells New York Air Guard Wells Quogue Wildlife Refuge Wells
APPENDIX C	Composition and Components of JP-4 Fuels
APPENDIX D	Field Report - Ground Water Sampling Trip, August 8, 1983

PHASE I EVALUATION
GEOHYDROLOGIC/WATER QUALITY CONDITIONS
SUFFOLK COUNTY AIRPORT AND VICINITY
WESTHAMPTON, NEW YORK

1.0 CONCLUSIONS AND RECOMMENDATIONS

1.1 Summary of Conclusions

The findings of our evaluation of the geohydrologic and water quality conditions in the vicinity of the Suffolk County Airport fuel storage tank farm are based on review and evaluation of subsurface information, water quality sampling and analyses conducted by various County and State agencies such as Suffolk County Department of Health Services (SCDH) or its predecessor, Suffolk County Department of Environmental Conservation, New York Air Guard (NYAG), as well as the U.S. Air Force, New York Department of Transportation (NYDOT), and New York Department of Law (NYDOL). In addition, short reports, memoranda and field investigative logs were reviewed for the purpose of piecing together, in chronological order, the events leading to the current study. The following conclusions are based on our interpretation and analysis of the data collected through 1982:

(1) Based on the terrain and surface drainage in the immediate vicinity of the tank farm, a spill of large quantity of fuel will follow the land slope toward the southwest and the Aspatuck Creek.

(2) Due to high ground water recharge rate, some of the fuel introduced on the surface by spills will reach the water table

beneath the tank farm and will move in the general direction of ground water flow.

(3) Based on known hydrogeologic parameters for the upper glacial aquifer and the local hydraulic gradient, ground water movement rate was computed to be on the order of 0.7 to 1 foot per day.

(4) Based on ground water travel time, the direction of ground water movement and the location of various monitoring wells, JP-4 fuel contamination was found within eight to eleven years of travel time from the tank farm.

(5) Most monitoring wells drilled following the reported spills were not deep enough into the aquifer, nor were they completed with long enough screens to allow representative sampling of its saturated thickness.

(6) In general, sampling of existing wells or of newly drilled wells was not properly documented. Depth below the water table, method of sampling, and well development were not documented. Sampling of domestic wells was done at faucets accompanied by qualitative appraisals of the appearance, taste and odor of the water. However, although various volatile organic compounds may have been lost during sampling, the presence of ground water pollution south of the tank farm was established.

(7) With the exception of wells drilled by the SCDH, documentation of field work and sampling is not detailed enough nor traceable, in some cases, to the persons actually conducting field work.

(8) Aspatuck Creek marshland was not explored by early field investigations for the possibility of providing the jet fuel escape route via surface runoff.

(9) Aspatuck Creek, which is maintained mainly by ground water discharge, will divert ground water flow toward it in the vicinity of Peters Lane. No sampling was conducted in the creek during the period following the reported spills at the tank farm.

(10) Twenty-five (25) organic compounds, including JP-4 and its components, were detected in various monitoring wells between two and sixteen times. Some of the repeated detections were at the same well. Tetrahydrofuran (THF) was detected up to twenty times, at high concentrations, in the new wells installed by the NYDOT. This is probably contamination introduced during well construction and utilizing PVC glue compound. THF should not be considered as part of the general ground water contamination problem emanating from the tank farm.

(11) Background levels of the various contaminants north (the upgradient direction) of the tank farm and the airport in general are not known.

(12) High JP-4 concentrations in ground water near the tank farm could be the result of one or a combination of the following modes of fuel spills: (a) slow and continuous leaks prior to 1974, (b) slow and continuous leak from 1974 through 1977, and (c) the spill of 1974.

(13) The airport landfill situated near the southeast corner of the property does not affect the quality of surface water in the Wildlife Refuge.

(14) Distinction between ground water contamination due to spills of JP-4 and jet A fuel is not clear at this time.

(15) The ground water travel time between the tank farm and South Country Road (the approximate length of Peters Lane) is the equivalent of between 7 and 10 years.

(16) The availability of monitoring wells in the area bounded by the tank farm to the north, Peters Lane to the west, Montauk Highway to the south and the eastern boundary of the scrap yard is sufficient. However, most of their depths and screen setting are unknown. In other areas such as south of the Montauk Highway, and east of South Country Road, additional domestic wells may be available for future water level measurements and sampling.

1.2 Recommendations

The following recommendations are divided into two parts: (1) the area outside airport property, and (2) the immediate vicinity of the tank farm and the airport area in general. The recommendations include data base deficiencies to be supplemented by the NYAG or additional field work during Phase II.

Off-site:

(1) All existing monitoring wells, a selected number of private wells and all water supply wells should be surveyed to provide a unified base map for elevation and water table contour determination.

(2) Total depth of the available monitoring wells and depth to water should be measured and determined, from either files or interviews with well owners.

(3) Water table contour maps and the inferred ground water flow lines should be constructed quarterly.

(4) From testing of a few selected wells (i.e., SCWA water supply wells and/or selected monitoring wells) hydrogeologic parameters should be determined. From these, ground water travel time and equal travel-time map should be constructed.

(5) Existing private wells located to the south of Montauk Highway should be surveyed and added to the overall monitoring system.

(6) New wells should be drilled to completely penetrate the upper glacial aquifer. Screen intervals should be specified to cover the total saturated thickness of the aquifer.

(7) Three wells should be drilled along the Aspatuck Creek from the head waters to the head of its tidal water.

(8) Ground water and surface water sampling, at key existing wells, new wells and along Aspatuck and Quantuck Creeks should be conducted to complete the base line data.

(9) Table-top (laboratory column) experiments should be conducted with local sands and JP-4 fuel to study the dispersion/adsorption properties of the fuel.

(10) Background water quality information for other adjacent areas should be documented.

<u>On-site</u>:

(1) Conduct a complete inventory and survey of all existing wells including depth and water level measurements. A map showing the location of all NYAG monitoring wells should be obtained.

(2) Request all water quality data from NYANG, especially for wells located near the fire pit.

(3) Request any chemical analysis of soils which may have been conducted by the NYAG. If such an analysis is not available, a test well should be drilled near the southwest area of the tank farm and soil samples collected above the water table for chemical analysis.

(4) Hydrogeologic parameters near the fire pit and the landfill in the southwest corner of the airport property should be determined. Water table configuration for these areas should be determined.

(5) A "background" well north of the fire pit area, and within the airport property should be drilled, logged and sampled. Both soil and water samples should be analyzed for the components of JP-4 fuel.

2.0 INTRODUCTION

2.1 Purpose

This report presents the Phase I portion of the review and evaluation of the geohydrologic and water quality conditions in the vicinity of the Suffolk County Airport, located near the Village of Westhampton, New York. The evaluation was based on data made available to Dan Raviv Associates, Inc. (DRAI) by the Environmental Protection Bureau, State of New York Department of Law (NYDOL)(Appendix A). The purposes of this evaluation were to, (1) establish, based on existing data, the extent of ground water contamination due to the reported jet fuel spill occurrences at the fuel storage facilities located near the southern boundary of the airport property; and (2) identify data deficiencies and proposed methods of data acquisition.

2.2 Scope of Review

In order to evaluate the data base and develop conclusions and recommendations relative to the geohydrologic conditions in the area, we directed our efforts in four tasks:

Task 1: Review of reports and, in particular, of data and information on water quality, water levels, and water usage near the airport;

Task 2: Field reconnaissance and meetings with technical personnel of the Suffolk County Water Authority and Suffolk County Health Services (previously Suffolk County DEC);

Task 3: Conducted limited field investigation, including water quality sampling and water level measurements in monitoring wells near the fuel storage area;

Task 4: Data analysis, presentation and report preparation including recommendations for remedial actions to mitigate ground water pollution and protect public water supplies.

For Task 1, the data and reports listed in Appendix A were reviewed. These data were provided by the Environmental Protection Bureau of the New York State Department of Law at the onset of this evaluation or were requested by DRAI.

The Task 2 field reconnaissance was conducted. Dr. Greg Shkuda and Mr. Richard Markel of the NYDOL accompanied Dan Raviv of DRAI during the site visit. Our survey of the land features at the spill sites consisted of a specific inspection of the area by driving and walking along the road on the southern airport boundary, visiting the fuel storage tanks, airport landfill and the fire pit location. Limited field investigation was performed as described in Task 3. DRAI personnel conducted a field investigation on August 8, 1983. Three Department of Transportation wells (Nos. 19, 16 and 14) south of the NYAG tank farm were measured for water levels and sampled. The memo documenting the field trip may be found in Appendix D.

2.3 Chronology of Spills and Subsequent Actions

Outlined below are the major events relating to the Jet Fuel spills which occurred at the Suffolk County Airport at Westhampton (from Markel investigation, December, 1980, Ref. 240).

Date	Event
1966 or 1967	84,000 gallons of JP-4 Jet Fuel lost by Air Force (Air Force never admitted this)
Feb. 25, 1974	A spill of 10,700 gallons of JP-4 Jet fuel reported spilled by the New York Air Guard (NYAG acknowledges this spill).
April 16, 1974	John Miller, a local well driller, discovers fuel in some of the wells he is drilling-500 ft. south of tank farm.
May 3, 1974	Commissioner John Flynn (SCDEC) receives a request from Legislator N.W. Daniels to commence an investigation into fuel spills at the Air Base.
May 10, 1974	Meeting was held to discuss the fuel spills and

possible abatement actions to be taken. The meeting was attended by representatives from the NYAG, Suffolk County Department of Environmental Control (SCDEC), New York State Department of Environmental Conservation (NYSDEC), USEPA, Suffolk County Department of Health (SCDH), Suffolk County Water Authority SCWA), and Suffolk County Aviation Department (SCAD).

July 1, 1974	NYSDEC proposes a program to clean up the 10,700 gallon JP-4 spill of February 25, 1974. The cost of this program was estimated at $400,000 and was never implemented).
Feb. 24, 1975	Summary Report by Fred Van Alstyne, Senior Engineering Geologist of NYSDEC concludes "since it does not appear that the public water supply is endangered, removal of the contaminant does not appear necessary or feasible". This marks the end of the 1974 fuel spill investigation.
June 24, 1977	Fuel pollution is discovered in wells along Peters Lane during routine investigation of leachate and oil plume by SCDEC, Fresh Water Resource Section. Five homes and one apartment building (housing four families) had their wells contaminated by

	fuel - as was evident by fuel odor emanating from faucets.
June-July, 1977	SCDEC drilled wells near Peters Lane and north of tank farm at Air Base. Conclusion reached was that the northern portion of Peters Lane water supply was contaminated by fuel at a depth of about 55-75 ft. below surface (depth to water table 30feet).
July 14, 1977	Meeting held to discuss new findings of contamination of ground water on Peters Lane. Agencies involved were SCDEC, NYAG, NYSDEC, SCHS, SCWA, USEPA, and the consulting firm Geraghty & Miller, Inc. The main outcome of this meeting was that public water should be provided to Peters Lane.
Sept. 26, 1977	National Guard water truck and containers are set up on Peters Lane so that residents can have potable water.
November, 1977	Water main is installed on Peters Lane and the homeowners are hooked up, NYSDEC has intentions of suing the Defense Department.
Dec. 19, 1977	Geraghty & Miller, Inc. submitted a preliminary estimate for cleanup of Westhampton Air Base fuel spills.

March 14, 1978	Meeting held at Air Base to review events to date. Joan Sherb, NYSDEC indicated she would initiate a lawsuit against U.S. Defense Department.
August 9, 1978	Air Guard offers laboratory support and requests that the wells in the affected area be sampled.
Feb. 5, 1979	Meeting held at Air Base. NYAG admitted to the 10,700 gallon fuel spill. The NYAG requested citations of the law under which they would have to clean up the fuel spill.
Feb. 6, 1979	Joan Scherb, Regional NYSDEC attorney sends a letter to NYAG outlining laws under which it is illegal to spill hydrocarbons into the groundwater reservoir.
May 1, 1979	Water samples are collected from two wells near Peters Lane. Samples could not be collected from homes on Peters Lane because their original well pumps were inactivated when they were hooked up to the public supply.
June 23, 1980	SCHS prepares estimates to clean up the aquifer contaminated by the 1966-67 spill (84,000 gallons) and the 1974 spill(10,700 gallons). The contaminated area is estimated to extend over 600

	acres and the cost of cleanup was determined to be approximately $45,000,000.
July 2, 1980	The above cost of cleanup is forwarded to Joan Scherb (NYSDEC).
November, 1980	NYSDEC files a $45,000,000 notice of claim against the federal government for Jet-fuel pollution of the ground water near the Suffolk County Airport in Westhampton.

A summary of water quality sampling and analyses relating to the investigation by the SCHD during the period 1974-1977 is presented in Table I. This summary was extracted from the file material attached to the December 24, 1980 memo from Richard Markel to Joseph Baier, of the Suffolk County Department of Health (SCHD). Field investigations, including well drilling and ground water sampling, were conducted during the period from 1974 through 1980 and in subsequent years. These are summarized in Section 3.3.

result of the reported spills. The responsibility for well installation, number of wells, well use and their characteristics are summarized below for clarity. The location of these wells is shown on Figure 2 and their history, ownership and properties listed in the respective tables.

(1) New York Department of Transportation Wells (Table II)

NYDOT installed 22 wells in March 1982 in an area from just south of the tank farm to just south of Montauk Highway. These wells penetrate the top of the water table and are screened three to five feet into the water table. Water level measurements and water quality samples were obtained in these wells in March 1982.

(2) Private Wells (Table III)

A number of private wells have been sampled at various times since 1974. In general, well construction details and pump setting depths are not known.

(3) Suffolk County Department of Health Wells (Table IV)

In December 1981, the SCDH drilled 6 wells in an area just south of the tank farm. These wells ranged in total depth from 37 to 82 feet and completed with a 5-foot screen at the bottom. Wells 4, 6 and 7 were sampled in December, 1981; Wells 4 and 6 were sampled again in March 1982 and May 1982. Wells 2 and 5 have been sampled during drilling and were not completed as monitoring wells.

(4) Suffolk County Water Authority Monitoring Wells (Table V)

Five wells were installed by the SCWA in August 1974. These were installed after contamination problems were first discovered south of the airport. They were installed in a location between the SCWA public supply well field of Meetinghouse Road and the southern end of the airport. These wells are relatively shallow and are screened into the top of the water table.

(5) SCWA Water Supply Wells (Table V)

These wells were constructed from 1903 to 1962 and collectively pump on the order of 3,000 gallons per minute (gpm). They range from 46 to 78 feet in total depth. Screened intervals are generally from 20 to 25 feet from the three-foot bottom tailpiece.

(6) Additional SCWA Monitoring Wells (Table V)

These wells were drilled in June 1974 and are located throughout the project area. The wells were installed as part of the SCWA monitoring system. They range from 8 feet to 44 feet in depth and are screened 3 to 5 feet from the bottom. No recent sampling data is available for these wells.

(7) New York Air Guard Wells (Table VI)

Twenty-three wells were drilled in May 1982 in the area in and around the airport. These wells range from 10 to 40 feet in depth with ten feet of screen at the bottom. These wells were sampled in May 1982.

(8) Quogue Wildlife Refuge (Table VII)

In March, 1983, six monitoring wells were installed in the area proposed for development adjacent to the wildlife refuge. The wells range from 24 to 65 feet in depth and are screened 3 feet at the bottom. These wells were sampled March 29, 1983 by DRAI as part of a baseline study.

(9) SCDH Investigation Wells (Table VIII)

Six (100 series) wells were installed during the June-July 1977 investigation in the Peters Lane and tank farm area by SCDH. These wells were augered to 82 feet with water or soil samples taken at different depths These wells were screened and completed either at the top of the water table or at about 65 feet.

Three wells (S-series) were installed in March 1982 in the vicinity of the airport landfill. These wells were augered to 62 feet and sampled at several depths. Two wells were screened from 60 to 62 feet and the remaining well was screened from 20 to 22 feet.

4.0 EVALUATION OF AVAILABLE DATA

4.1 Methodology

Base Map

The Suffolk County Airport and vicinity base map was constructed from an aerial photograph mosaic dated April 6, 1976. Roads, bodies of water, and other pertinent land features were drawn on the map. This base map was used for water quality, water level and water table contour interpretation presentations.

Well Location and Identification Map

Through review of the data received from NYDOL, well classifications were assigned and locations approximated. These well locations were marked with a symbol as to ownership or designation on a copy of the base map (Figure 2) and assigned their respective numbers. A tabulation of the available well data was also placed on Figure 2 listing the type of well or ownership, well number, date drilled and well depth when available.

A grid with a scale of 1,000 feet by 1,000 feet was also drawn over the base map (Figure 2). The purpose of this grid is to illustrate the location and density of available wells throughout the study area. The grid will also serve as a reference for well locations and the evaluation of the monitoring system adequacy.

Water Table Contour Map

An attempt was made to contour water table elevations with the data available from all wells. However, the only series of wells measured within a reasonable period of time to allow for proper contouring were the NYDOT wells. These measurements were taken between 9:00 a.m. and 1:00 p.m. on March 18, 1982. A tabulation of these measurements was reported on a drawing dated 3/22/82 for NYDOT (Reference No. 224, Appendix A). The elevations for these measurements were related to an elevation reference point designated as 100 feet. The location of this point is approximately at the 25 foot mean sea level elevation as taken from a USGS topographic map. The 25 foot elevation was substituted as the reference point. As a result, adjusted ground water elevations were tabulated (See Table IX). The ground water elevations were adjusted to agree with the area mean sea level elevations. These adjusted elevations were then plotted on the map at their respective well locations and ground water contours were drawn (Figure 3). From the ground water contour lines a flow net was then constructed to determine the approximate local ground water flow. Also included on Figure 3 are the designated locations of the two hydrogeologic profiles A-A' and B-B'.

Hydrogeologic Profiles

Two hydrogeologic profiles were constructed (Figures 4 and 5). One profile is oriented in a north-south direction and the other is oriented in a southwest-northeast direction. Geologic logs were not available for any of the wells except those installed by the NYAG. The general area geology consists of glacial tills and related outwash sands and gravels. The sands and gravels are approximately 100 feet below sea level in depth. Most of the wells are less than eighty feet deep and the lithology they penetrate is most likely these glacial sands and gravels.

The surface elevations for most wells (except the SWCA monitoring wells) were not available from the file data. The surface elevations used on the profiles were approximated from the USGS topographic sheet.

After the surface elevations were determined, the well depths and depths to water were placed on the hydrogeologic profiles (Figures 4 and 5). The NYDOT wells are drawn in dashed lines, due to the fact that no positive well depth is known. The NYDOT wells are reported as having their screens penetrating the top part of the water table, therefore only the reported depth to water was placed on the profile.

For some of the wells found on the map, data were not available for either well depth or depth to water.

Water table elevations indicated on the profiles (although from various periods) is in general agreement with the water table contour map (Figure 3). They indicate ground water discharge to the Creeks and general ground water flow direction from north to south. However, two anomalously high water table elevations were recorded near the tank farm in December 1981 and May 1982 (Figure 5).

Water Quality Map

Water quality distribution in the water table aquifer for sampling conducted at the end of 1981 and the beginning of 1982 was plotted on the base map for all the available wells and the respective sampling periods (Figure 6). Limited sampling of the Wildlife Refuge took place in March 1983. To obtain this information, the laboratory data sheets were extracted from the file received from the NYDOL. These data sheets ar presented in Appendix B. In addition, the reported composition and the various chemical components of the JP-4 fuels were compiled and are presented in Appendix C.

A list of organic compounds was compiled from the laboratory data sheets (Table X). The densities of the compounds were determined and listed and a numerical index was assigned for reference on the map (1,1- dichloroethlyene was accidentally omitted, but was only present in one sample at 4 ppb). These compounds were also listed alphabetically with a cross-reference to index numbers (Table XI). The laboratory data results were reviewed and compared to memos, notes, and letters to assess any additional information pertaining to the samples. Information from qualitative testing in the field (i.e. odor, taste and appearance) of some the samples is available from the files, but has not been presented on the water quality map. Some of these data are presented in Table I for the period 1974 through 1977.

After the locations of the samples had been placed on the map, the data from the laboratory results were then transferred. Near each well location, the compounds found were listed in an increasing order according to the index number (Table X). If the compound was present or detected, the assigned index number is listed. If the compound was present and quantified, the index number is listed with the concentration (in parts per billion) in parenthesis next to the number.

A line was drawn under the listing of compounds present in the sample, and the following information was placed underneath it:

(1) Sample number

(2) Well or sample depth (when available); and

(3) Month sampled

Water quality data presented on Figure 6 ranges from non-detected concentrations to about 1,000,000 ppb. Many of the compounds were reported as present and were not quantified. Taking into account that the high concentrations may have been an analytical error, a contaminated ground water area south of the tank farm can nevertheless be delineated.

Number of Detected Compounds

A graphic representation of the most frequently detected organic compounds in ground water versus the type of compound found was constructed (Figure 7).

The reported detection for the monitoring wells were tabulated for all compounds detected in two or more samples and were placed on the graph. This graph represents the frequency of compounds detected in ground water samples regardless of their concentrations.

4.2 Geology

The geology of the region has been extensively studied, primarily because of the importance of ground water to Long Island. Glacial deposits, consisting of till and outwash sands and gravels of Pleistocene Age, mantle much of Long Island. In this area, they are found to a depth of about 100 feet below sea level and unconformably overlie the sediments of the Cretaceous Magothy Formation on an erosional surface. The Magothy Formation consists of silts, sands, gravels, and clays and is reported to be 800 to 1,200 feet thick in this area (Jacob, 1968; Anderson & Berkebile, 1976). The underlying Cretaceous sediments and bedrock are not considered here because they are found well below the depth of the fresh water aquifer and the contamination.

Descriptions of samples obtained during drilling for installation of monitoring wells in the vicinity of the Suffolk County Airport indicate that the glacial material is composed primarily of fine to coarse sand with some silt and gravel. Glacial material is often variable in lithology and depositional mode within relatively small areas. Local variations could affect ground water quality, in particular clay particles may adsorb organic compounds in percolating water. Variations in depositional mode, resulting in different bedding structures, could affect ground water flow paths. Detailed logs, continuous from the surface to the total depth of any monitoring well should be obtained whenever possible.

The constructed hydrogeologic profiles (Figures 4 and 5) display the depths of some of the wells and the lithologies encountered. Based on available information about the area, the lithology is described in the profiles as fine to coarse glacial sands and gravels.

4.3 Geohydrology

Geohydrologic conditions of the region are known based on numerous investigations (Nemickas, 1982; Berkebile, 1975; Holzmacher, McLendon and Murrel, 1968). Underneath Long Island fresh ground water occurs in a lenticular shaped deposit overlying salt water. The deposit is thickest toward the center of the island, thinning rapidly along the coasts. The fresh ground water near the Suffolk County Airport is usually under phreatic water table conditions. As a result, the elevation of the water table generally parallels the topography. The principal aquifers in the area are the upper Glacial aquifer and the deeper Magothy aquifer. These aquifers have hydraulic properties which are similar. For the purpose of this study, we are mainly concerned with the upper Glacial aquifer. The transmissivity of the upper Glacial aquifer ranges from about 45,000 to 75,000 gallons per day per foot (gpd/ft) (Nemickas, 1982). The horizontal hydraulic conductivity is on the average about 350 ft/day and the specific yield ranges from 0.20 to 0.30. The saturated thickness of the aquifer is about 50 feet.

The water level contour map, constructed from the March 1982 measurements in the NYDOT wells indicate that the water table in the study area generally slopes to the south and is affected by streams to the SE and SW (Figure 3). We have assumed that these measurements indicate "static" conditions because: (a) most private wells in the area have not been in use since 1977; (b) we do not have pumping records from the SCWA supply wells along Meetinghouse Road to indicate variations in the pumping rate from 3,000 gpm; and (c) water level measurements have not been obtained from the monitoring wells on a consistent basis to indicate water level changes with time. Based on the water table elevations from Figure 3, the hydraulic gradient is on the order of 1.5×10^{-3} ft/ft. The velocity of ground water flow in the glacial aquifer is computed from on Darcy's Law:

$$v = \frac{Ti}{dn} \qquad (1)$$

where: v = acutal velocity of ground water, ft/day

T = transmissivity - ranges from 6,000 to 10,000 ft^2/day

i = hydraulic gradient, ft/ft

d = saturated thickness of the aquifer, feet

n = porosity, assumed equal to specific yield

The computed groundwater velocity is therefore about 0.6 to 1.5 ft/day.

The depth to water in the vicinity of the tank farm is on the order of 30-36 feet. The NYDOT elevations are tied into an assumed elevation which was adjusted for the construction of the contour map (Figure 3). Most of the elevations of the few other wells in which water levels have been measured are not known. Water levels in private wells usually cannot be measured due to the inaccessibility of the wells. Without water level measurements tied into an elevation, and taken at regular intervals over a period of time, it is difficult to correlate water table fluctuations with precipitation, stream flow, artificial recharge, or variations in pumpage. Since many of the wells are only installed into the top of the water table, relatively large variations in the water table elevation may not be measurable. As stated earlier, we have assumed that the NYDOT well measurements reflect current conditions. We have also assumed that the water table elevation does not fluctuate more than an inch or two in response to factors mentioned above and its configuration remains relatively constant.

The available depths to water were indicated on the hydrogeologic profiles (Figures 4 and 5). Some surface elevations, which were not available from the files, were approximated from the contours on the regional topographic sheet. These profiles display the general topography with relationship to the depth to water. In addition, considering the fact that the aquifer extends to a depth between 50 and 100 feet below land surface, it is apparent from the hydrogeologic profiles that ground water sampling is not representative of the total aquifer depth. In most cases, only the top few feet of the aquifer were sampled.

4.4 Surface Water and Recharge

The area south of the airport is bounded by two streams (Aspatuck and Quantuck Creeks) that join to form Quantuck Bay to the south. The Quogue Wildlife Refuge ponds and streams, which are on the east side of the airport, drain south into Quantuck Creek. Aspatuck Creek also flows south on the western side of Peters Lane. Although no culvert is present under the railroad and road to the north of Aspatuck Creek, it was noted through our field observation that this area (which is adjacent to the tank farm) slopes toward the creek.

The average precipitation for the area is 43 inches per year, based on the 30-year precipitation records of the National Weather Service (Nemickas, 1982). The amount of overland runoff from precipitation is relatively low because the soil and subsurface are highly permeable. Much of the precipitation is infiltrated through the unsaturated zone to the water table. Therefore, the surface water consists mainly of ground water discharge.

The division between infiltration and runoff of a contaminant "slug" such as the 10,000 gallons of fuel spilled is dependent upon several factors including: precipitation amount and duration, land surface slope and the characteristics of the unsaturated material above the water table. It is generally assumed that the soils and glacial sands allow for rapid infiltration and recharge. However, based on local drainage, a spill of such magnitude could in part reach surface water bodies.

4.5 Water Quality

4.5.1 Ground Water

The water quality of the glacial aquifer in the area has generally been found to be potable in most parts. Iron, chloride and nitrate often occur in concentrations higher than drinking water standards of background concentrations. Concentrations of iron in the majority of water samples (March 1983) taken from the wells installed adjacent to the Quogue Wildlife Refuge were found to be above the New York State limits for drinking water (0.3 mg/l). The remaining parameters tested were within the drinking water standards. No volatile organics were detected in the surface water of the Wildlife Refuge. Other studies of the glacial aquifer ground water have found the water to be of good quality (Nemickas and Koszalka, 1982).

 34963

Grid Area(s)	Approximate Number of Homesites or Land Use
5-I	2 homesites and Quantuck Creek
6-C	Open area, SCWA well field
6-E	8 homesites
6-F	8 homesites
6-G	2 homesites and Quantuck Creek

This evaluation will be considered when determining recommended well placement for remedial measures as discussed in Section 7.0.

5.2 Frequency and Consistency of Sampling

The purpose of monitoring ground water quality in the study area was to: (1) determine if ground water is contaminated, (2) determine the extent of contamination; and (3) determine the rate and direction of contamination movement and the resultant natural dilution, if any.

The sampling of ground water should be conducted on a regular schedule, which has not been done in the past. The periodic sampling of designated groups of wells located along approximate flow lines was not done. At various sampling times the parameters tested for were not consistent. For proper definition and mapping of contaminants and their movement, sampling must be on a regular schedule, utilizing the same wells of known depth and construction and analyzing for the same type of parameters. Based on ground water flow rate and distances between adjacent monitoring wells, quarterly to semi-annual sampling would have been sufficient. However, in the past no consistent sampling schedule was followed.

6.0 DATA DEFICIENCIES

The data deficiencies for the evaluation of the geohydrologic and water quality conditions in the vicinity of the tank farm can be separated into four categories:

1) The characteristics of the ground water monitoring wells.
2) The extent of the monitoring network.
3) The operation of the monitoring network.
4) Aquifer and surface stream parameters.

The approach during much of the previous field work has apparently been based on the existence of a simplified ground water system. The basic conclusion was that ground water pollution exists south (down-gradient) of the tank farm. However, for a more accurate evaluation of the migration of pollutants, the physical and chemical interactions of the ground water with other factors must also be taken into account. These factors are: type of contaminants, movement of contaminants through the unsaturated soils (recharge from spills), ground water movement toward surface water bodies, ground water movement in the vertical plane, and the influence of pumping wells on the movement of contaminants.

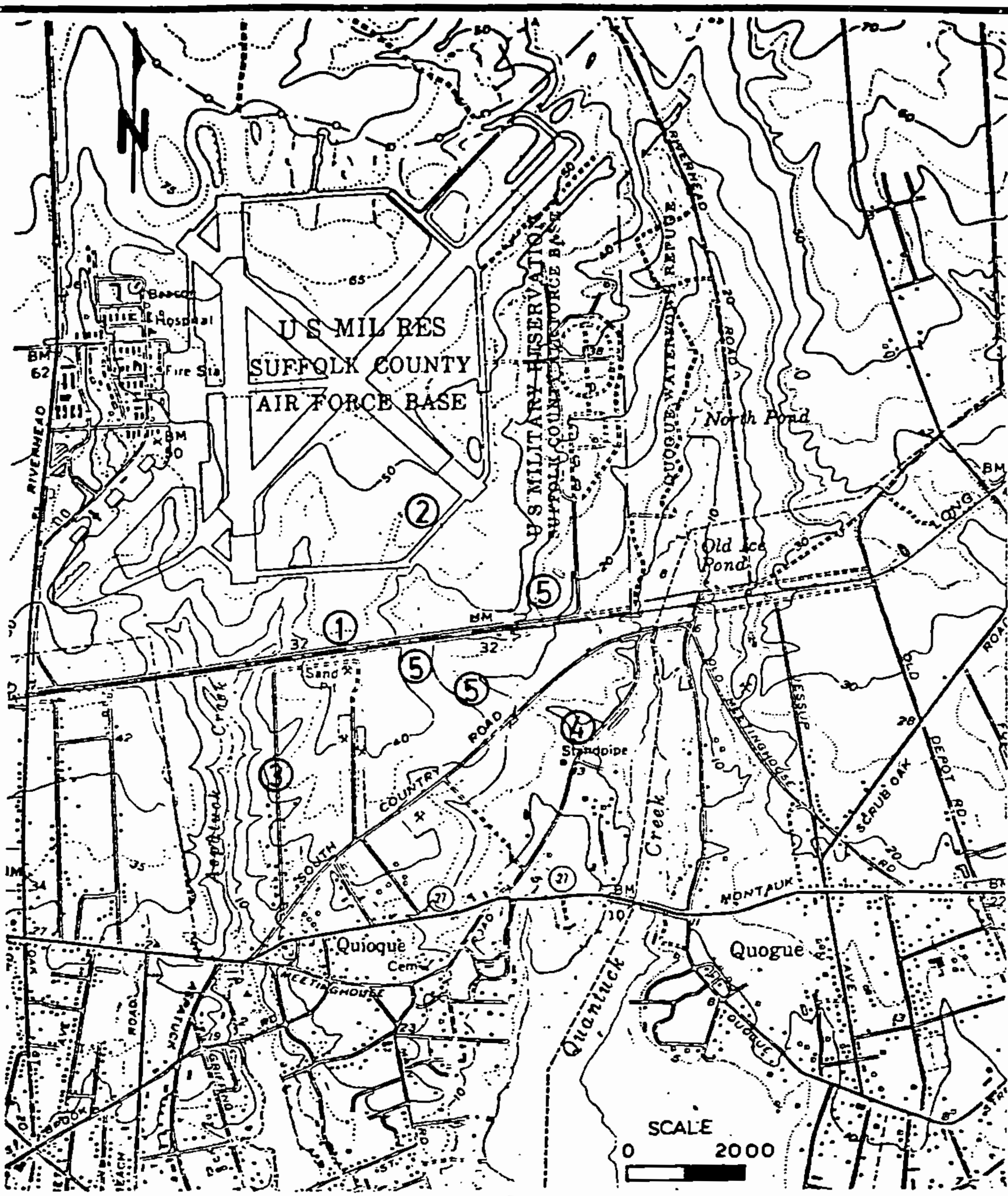
The characteristics of the ground water monitoring wells are deficient in that no survey (i.e., reference elevations and distances) of all the monitoring points was conducted. In addition, no distinction has been made between different sampling depths in the aquifer. A survey is necessary for construction of ground water contour maps to determine water table configuration, direction of flow and flow rates. Sampling at different, known depths is necessary in order to describe the spread of contaminants, because of vertical as well as lateral migration of contaminants. This type of ground water movement occurs as a result of the vertical component of flow, differences between the specific gravity of the water and the contaminants, the influence of pumping wells, and the general anisotropy of the aquifer. In addition, completely penetrating wells, screened throughout the saturated thickness of the aquifer, are also necessary to obtain "average" head measurements. These deficiencies have resulted in the absence of usable data needed to delineate the plume of contamination.

The ground water monitoring network is sparse or non-existent in some areas, including the critical areas of ground water discharge near surface water. There is a need for wells located in "background" areas. These areas should not have been affected by the movement of the contaminants. Both on-site and off-site background wells should be designated or constructed. The on-site location is some distance north of the tank farm. It is not known from the available data if the NYANG had found such an area north of the tank farm.

The operation of the monitoring network used in previous samplings is incomplete. The wells which have been used are part of various monitoring systems (Figure 2) and are not integrated into a single network. There has seldom been any uniformity or regularity to the sampling and water level measurements program. Several agencies have been involved without a continuous effort of utilizing the same wells, sampling schedule and procedures, and comparison of results. The method of sampling is particularly important where volatile organics are concerned. The monitoring program must be on a regular schedule so that ground water contour maps and contaminant distribution may be described for a specific sampling and subsequently compared with other monitoring periods to determine ground water and contaminant movement as a function of time.

There are deficiencies in information on wells which are located on-site in the areas of suspected spills and other sources of contamination such as the fire pit. Specifically, the location, dimensions and properties of each monitoring well (existing or plugged) are needed. In addition, results of water level measurements, sampling and analyses should be collected and added to the baseline information of this report. Access to those wells should be allowed to the staff of the NYDOL so that they may conduct independent testing and sampling.

Data deficiencies also exist with regard to aquifer and surface streams characteristics. These include characteristics such as aquifer transmissivity, hydraulic conductivity, effective porosity, the relationship between ground water discharge and creek flow, the rate of infiltration, and the gain or removal of contaminants during recharge or discharge. Without knowledge of these factors, the mass balance and movement of contaminants is difficult to quantify.



APPROXIMATE LOCATION OF:

① TANK FARM

② FIRE PIT

③ PETERS LANE

④ SCWA WELL FIELD

⑤ LANDFILL

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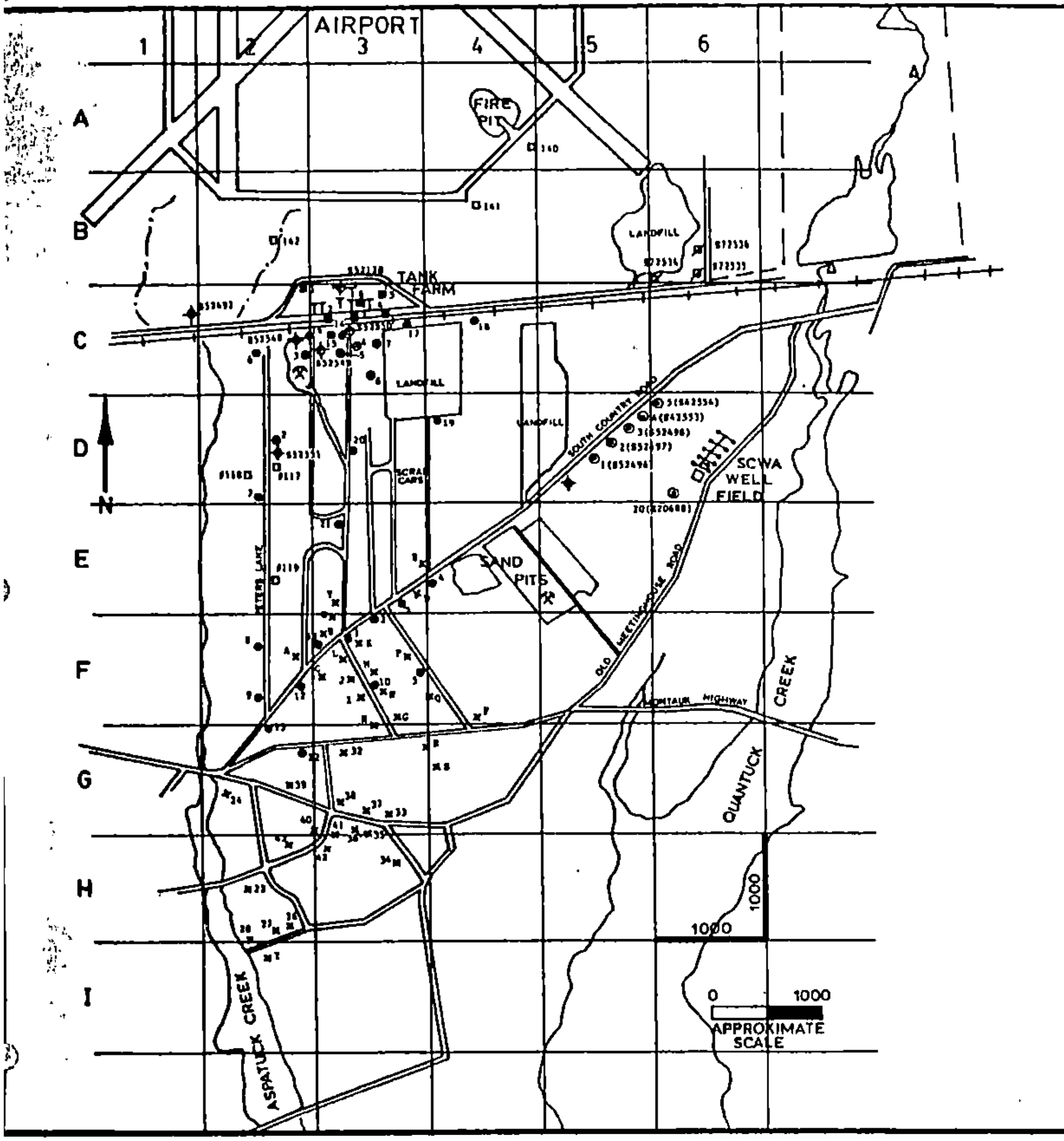
SUFFOLK COUNTY AIRPORT
PROJECT LOCATION MAP

NEW YORK DEPARTMENT OF LAW
ENVIRONMENTAL PROTECTION BUREAU

Prepared By JMH	Date AUG./SEPT. 1983
Job No. 83C146	Figure No. 1



WELL DESIGNATION AND DATA

SYMBOL	WELL NO.	DATE DRILLED	WELL DEPTH (ft.)	COMMENTS
■	NEW YORK AIR GUARD			
	1	MAY 1982	30	
	2	MAY 1982	30	
	3	MAY 1982	38	
	4	MAY 1982	38	
	5	MAY 1982	38	
	6	MAY 1982	36	
●	NEW YORK DEPARTMENT OF TRANSPORTATION (DOT)			
	1 - 22	MARCH 1982	-	SCREENED IN THE TOP OF THE WATER TABLE
⊗	SUFFOLK COUNTY DEPARTMENT OF HEALTH (SCDH)			
	2	DECEMBER 1981	82	REMOVED
	3	DECEMBER 1981	82	
	4	DECEMBER 1981	37	
	5	DECEMBER 1981	83	REMOVED
	6	DECEMBER 1981	40	
	7	DECEMBER 1981	40	
□	SCDH INVESTIGATION (MARKEL)			
	117	JUNE 1977	80	
	118	JUNE 1977	80	
	119	JUNE 1977	80	
	140	JULY 1977	80	
	141	JULY 1977	85	
	142	JULY 1977	95	
ø	872534	March 1982	43	
	872535	March 1982	43	
	872536	March 1982	22	
⊕	MONITORING WELLS OF SCDH SYSTEM			
	852128	JUNE 1974	37	
	851692	JULY 1974	8	
	852548	AUGUST 1974	40	
	852549	AUGUST 1974	43	
	852550	AUGUST 1974	44	
	852551	AUGUST 1974	39	
⊙	SUFFOLK COUNTY WATER AUTHORITY (SCWA) MONITORING WELLS			
	1(852496)	AUGUST 1974	26	
	2(852497)	AUGUST 1974	23	
	3(852498)	AUGUST 1974	21	
	4(853553)	AUGUST 1974	18	
	5(853554)	AUGUST 1974	19	
	20(S20688)	JANUARY 1962	78	
	SCWA SUPPLY WELL FIELD SUCTION SYSTEM	FROM 1903 TO 1967	FROM 46 TO 58	
X	PRIVATE, RESIDENTIAL			
	A	-	-	
	B	-	-	
	C	-	70	
	D	-	-	
	E	-	90	
	F	-	-	
	G	-	34	
	H	-	150	
	I	-	70	
	J	-	45	
	K	-	70	
	L	-	34	
	M	-	-	
	N	-	33	
	O	-	33	
	P	-	-	
	Q	-	-	
	R	-	28	
	S	-	-	
	T	-	-	
	U	-	-	
	24	-	-	
	25	-	-	
	26	-	30	ESTIMATED DEPTH
	27	-	30	
	28	-	-	
	32	-	-	
	33	-	-	
	34	-	21	ESTIMATED DEPTH
	35	-	-	
	36	-	-	
	37	-	54	ESTIMATED DEPTH
	38	-	-	
	39	-	-	
	40	-	-	
	41	-	35	ESTIMATED DEPTH
	42	-	33	ESTIMATED DEPTH
	43	-	50	ESTIMATED DEPTH
	36	-	-	

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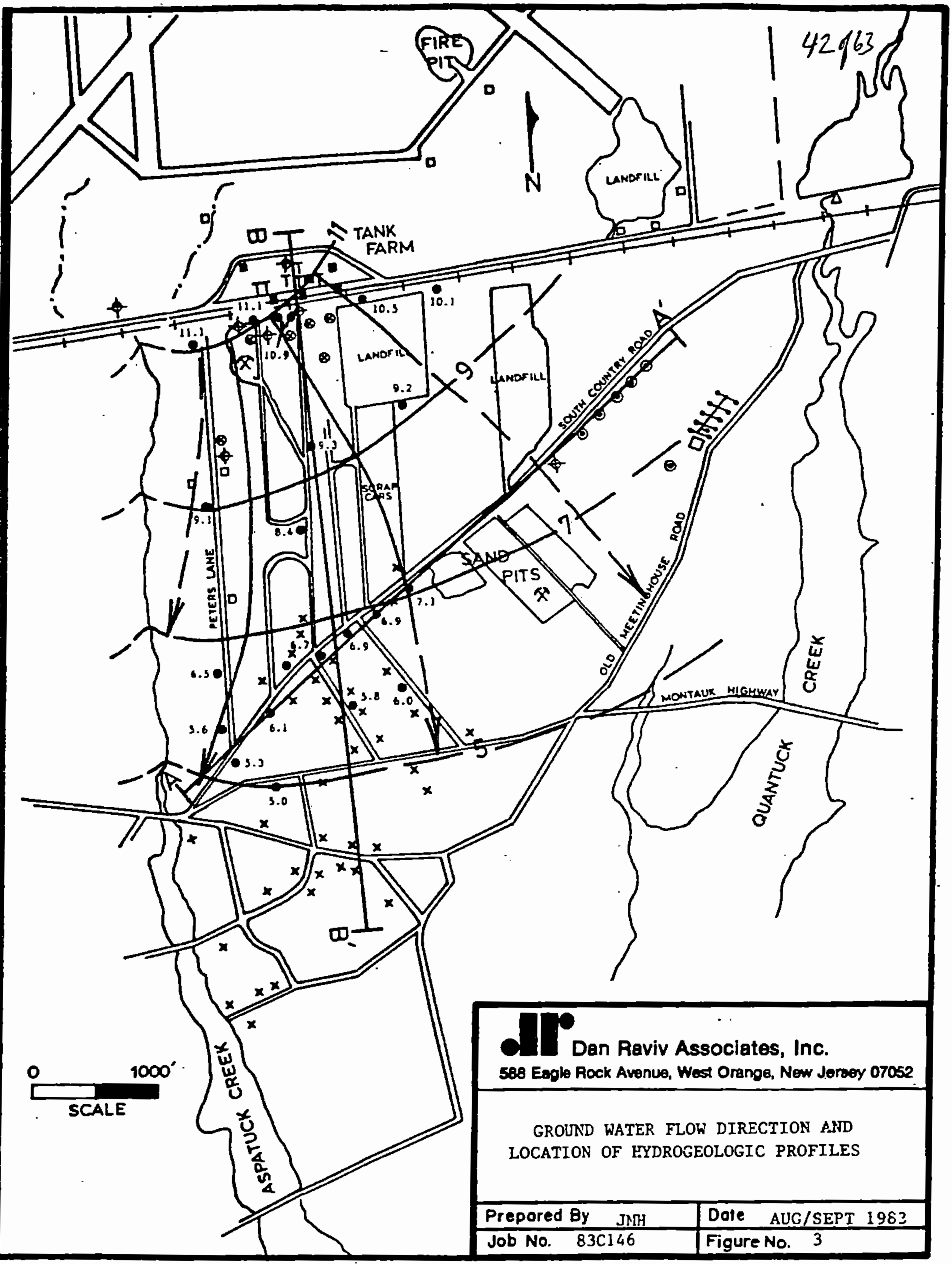
WELL LOCATION, OWNERSHIP, DESIGNATION AND INFORMATION

SUFFOLK COUNTY AIRPORT - NYSDOL

Prepared By JMH	Date AUG/SEPT 1983
Job No. 83C146	Figure No. 2

4/9/85



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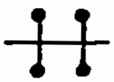
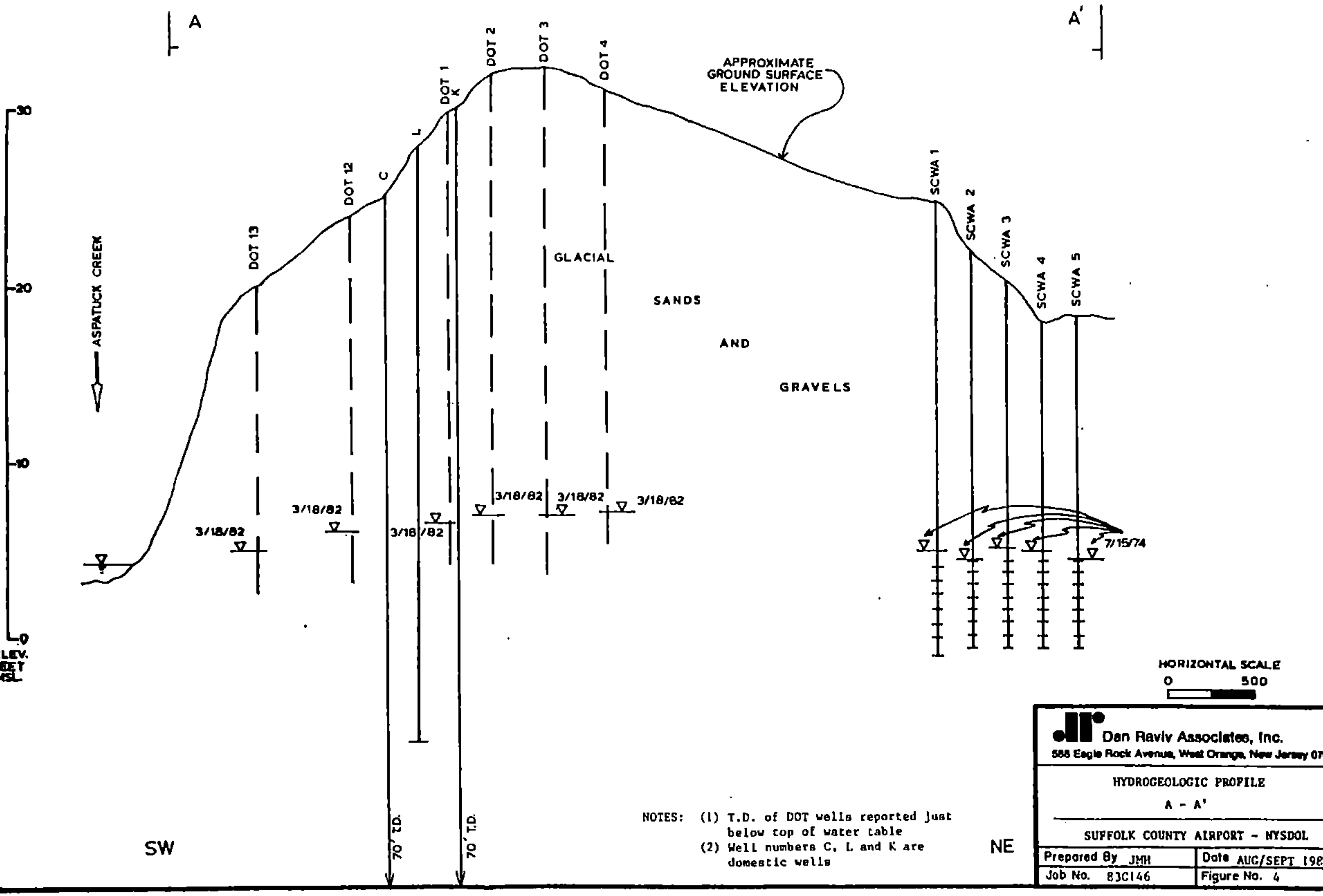
GROUND WATER FLOW DIRECTION AND LOCATION OF HYDROGEOLOGIC PROFILES

Prepared By JMH	Date AUG/SEPT 1983
Job No. 83C146	Figure No. 3

Figure No. 3 cont'd

EXPLANATION

SYMBOL	DESCRIPTION
●	NEW YORK DEPARTMENT OF TRANSPORTATION WELL Sampled 3/82
×	PRIVATE, RESIDENTIAL WELL Sampled 2-3/82
⊗	SUFFOLK COUNTY DEPARTMENT OF HEALTH (SCDH) WELL Sampled 12/81 & 3/82
⊙	SUFFOLK COUNTY WATER AUTHORITY (SCWA) MONITORING WELL Sampled 12/81 & 1/82
	SCWA PUBLIC SUPPLY WELLS
■	NEW YORK AIR GUARD WELL Sampled 5/82
△	QUOGUE WILDLIFE REFUGE WELL OR SURFACE WATER SAMPLE POINT Sampled 3/83
⌖	"S" MONITORING WELL OF SCDH SYSTEM
□	SCDH INVESTIGATION WELL (no sample data since 1977)



NOTES: (1) T.D. of DOT wells reported just below top of water table
(2) Well numbers C, L and K are domestic wells

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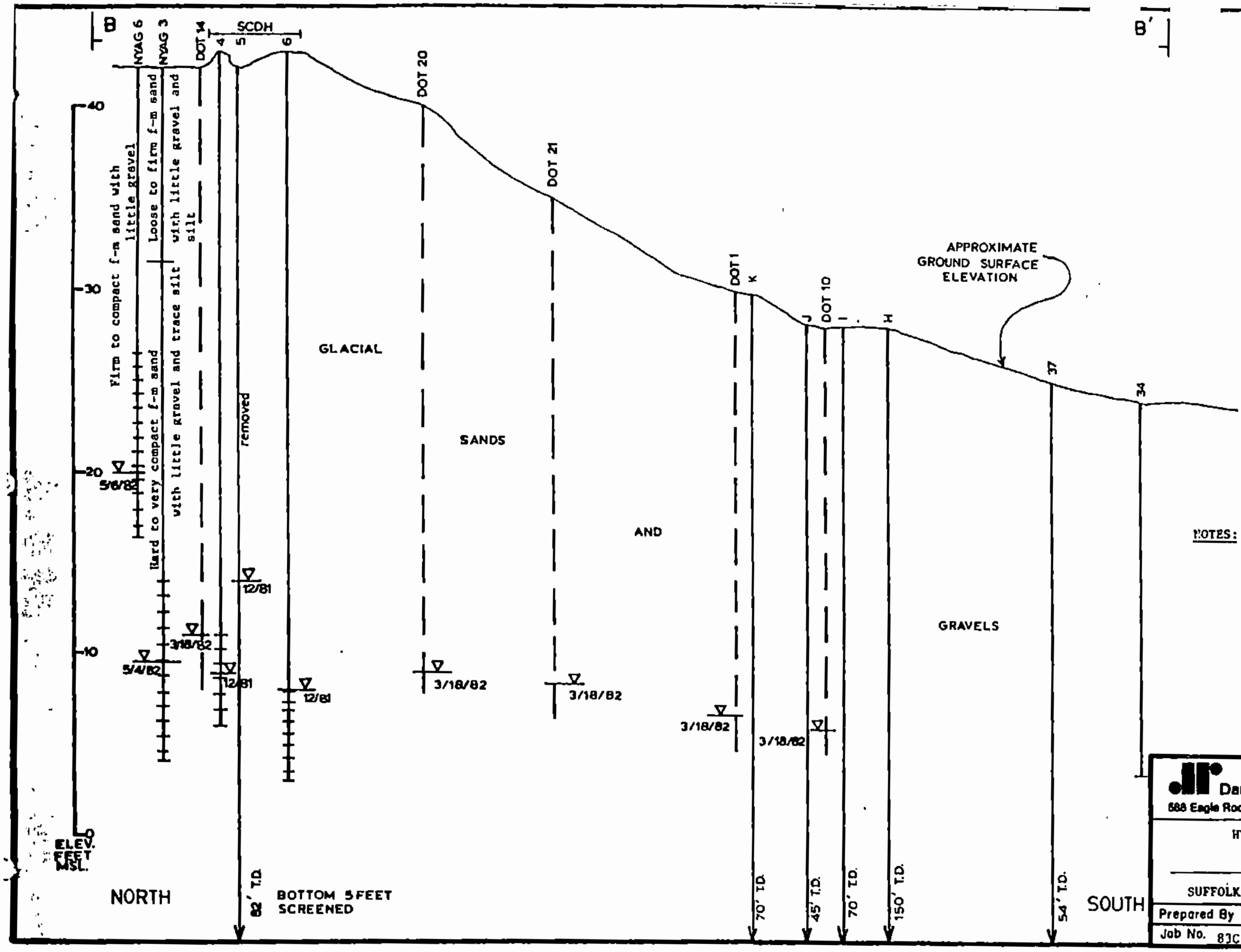
HYDROGEOLOGIC PROFILE

A - A'

SUFFOLK COUNTY AIRPORT - NYSDOL

Prepared By JMH	Date AUG/SEPT 1983
Job No. 83C146	Figure No. 4



NOTES: (1) T.D. of DOT wells reported just below top of water table

(2) Well numbers 34, 37 H, I, J, and K are domestic wells

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HYDROGEOLOGIC PROFILE

B - B'

SUFFOLK COUNTY AIRPORT - NYSDOL

Prepared By JHH	Date AUG/SEPT 1983
Job No. 83C146	Figure No. 5

45963

TABLES

TABLE I

Summary of Water Quality Analyses Conducted in the Vicinity of Tank Farm[1] 1974, 1975 and 1977

Date	Sample	Depth Sampled	Tested By	Comments[2]
4/18/74	M&P Scrap Iron	20' - 30'	Newing Labs	No hydrocarbons from GC results
	M&P Scrap Iron	40'	Newing Labs	No nydrocarbons from GC results
	M&P Scrap Iron	40' - 60'	Newing Labs	Presence of hydrocarbons from GC results
5/31/74	106 S. Country Rd.	faucet	SCECL[3]	Tested for general chemistry
	Aspatuck Creek	surface water	SCECL	Tested for general chemistry
	Suffolk Scrap Yard	faucet	SCECL	Tested for general chemistry
6/6/74	74-C-94 Well 1-1 (location unknown)		AFL[4]	JP-4 0.7 ppm
	74-C-95 Well 1-2 (location unknown)		AFL	JP-4 0.5 ppm
6/10/74	74-C-96 Well 1-3 (location unknown)		AFL	JP-4 0.3 ppm
	74-C-97 Well 1-4 (location unknown)		AFL	JP-4 2.1 ppm
6/14/74	74-C-98 Sump Hole (location unknown)		AFL	JP-4 3.0 ppm (water layer)
	"near POL Farm" (location unknown)		AFL	JP-4 773.0 ppm (silt)
10/18/74	S52551		SCECL	Tested for general chemistry (TOC-4.0 mg/l)
	S52550		SCECL	Tested for general chemistry (TOC-37.0 mg/l, sample described) as "too oily")
	S52549		SCECL	Tested for general chemistry (TOC-6.0 mg/l)
12/3/74	SCWA-Monitoring Wells 1-5		SCWA	Tested for general chemistry and sent to USEPA Labs where GC/MS results were negative for fuel or gasoline.

1) Based on information and laboratory sheets compiled by R. Markel of the SCHD (December, 1980).
2) Comments on reported results as to fuel or hydrocarbons present, all other parameters are not applicable.
(3) Suffolk County Environmental Control Laboratory.
4) Aerospace Fuels Laboratory.

Date	Sample	Depth Sampled	Tested By	Comments[2]
4/30/75	S52551		SCECL	TOC-9.0 mg/l
	S52550		SCECL	TOC-69.0 mg/l
	S52552		SCECL	TOC-41.0 mg/l
	S52548		SCECL	TOC-6.0 mg/l
8/30/77	93 Peters La.	faucet	NYSDH[5]	Gasoline less than 0.25 ppb. No hydrocarbons present
	95 Peters La.	faucet	NYSDH	Gasoline less than 0.25 ppb. Hydrocarbons present
	98 Peters La.	faucet	NYSDH	Gasoline less than 0.25 ppb. No hydrocarbons present
	106 Peters La.	faucet	NYSDH	Gasoline less than 0.25 ppb. Hydrocarbons present
	Auto Scrap	faucet	NYSDH	Gasoline less than 0.25 ppb. No hydrocarbons present
	Well #117	25'(WT)	NYSDH	Gasoline less than 0.25 ppb. Hydrocarbons present
	Well #118	25'(WT)	NYSDH	Gasoline less than 0.25 ppb. Hydrocarbons present
8/30/77	93 Peters La.	faucet	NYSDEC[6]	Fuel taste and odor[7]
	95 Peters La.	faucet	NYSDEC	Fuel taste and odor
	98 Peters La.	faucet	NYSDEC	No fuel taste and odor
	106 Peters La.	faucet	NYSDEC	Fuel taste and odor
	Well #117		NYSDEC	Fuel taste and odor
	Well #118		NYSDEC	Fuel taste and odor
9/8/77	106 Peters La.	faucet	SCECL	All wells tested for lead and results were less than 0.01 mg/l
	98 Peters La.	faucet	SCECL	
	95 Peters La.	faucet	SCECL	
	93 Peters La.	faucet	SCECL	
	Well #118	faucet	SCECL	
12/13/77	Private homes on Fairview and Homestead Avenues	faucets	NYSDEC	Tested for taste and odor for presence of leachate.

(5) New York State Department of Health, Division of Laboratories and Research, Environmental Health Center.
(6) New York State Department of Environmental Conservation.
(7) Qualitative survey conducted for fuel taste and odor by NYSDEC.

TABLE II

New York Department of Transportation Wells

Well No	Screen Interval	Depth to Water from TOC (ft.)	
1	All wells	26	3/18/82
2	screened	28	3/18/82
3	from 2 to	28	3/18/82
4	5 feet into	27	3/18/82
5	the top of	26	3/18/82
6	the water	26	3/18/82
7	table.	24	3/18/82
8		21	3/18/82
9		16	3/18/82
10		26	3/18/82
11		24	3/18/82
12		19	3/18/82
13		20	3/18/82
14		34	3/18/82
15		34	3/18/82
16		32	3/18/82
17		36	3/18/82
18		26	3/18/82
19		33	3/18/82
20		33	3/18/82
21		31	3/18/82
22		25	3/18/82

TABLE III

Private Wells

Location or Owner	Sample No. on Map	Well[(1)] Depth (ft)
Public Works Garage	Y	-
J. Phares	A	-
Chesterfield Assoc.	B	-
J. Valdez	C	70
V. Allen	D	-
P. Vella	E	98
Stain (SCWA?)	F	-
W. Burding	G	34
M. Barauskas	H	150
H. Sadlowski	J	45
F. Hulse	I	70
R. Barauskas	K	70
A. Povilaucks	L	34
B. Novick	M	36
C. Belson	N	33
Fire Equip. Repair	O	23
Brown	P	-
J. Tilman	Q	-
J. Bruno	R	28
McCutcheon	S	-
B. Schulberg	T	-
Betz	24	-
O'Brien	25	-
D. White	26	30?
F.C. White	27	20
Fisher	28	-
Noble Laird	32	-
J. Fitzharris	33	-
H. Boyd	34	21?
W.H. Mayo	35	-
C. Northington	36	-
E. Schultz	37	54?
D. Smiley	38	-
D. Fitchugh	39	-
B. Beczak	40	-
L. Rogers	41	25?
R. Kavan	42	32?
Stanch	43	50

(1) These measurements may be sampling depths. Some are the footage numbers written under the names and address on sampling data.

TABLE IV

Suffolk County Department of Health Wells

Well No	Well Depth (ft)	Screen Interval	Depth to Water (ft)	Comment
2	82		32	removed
3	82	remaining wells believed to have 4'-5' screens	34	
4	37		34	
5	82		28	removed
6	40		35	
7	-		36	

TABLE V

Suffolk County Water Authority Wells

Well No.	Well Depth (ft)	Screen Interval (ft)	Depth to Water (ft)	Elevation of Measuring Point (ft)	Diameter Casing (in)
1(S52496)		20.8-25.8	19.9-8/74	25.4	2
2(S5249F)		17.6-22.6	16.7-8/74	22.2	
3(S52498)		15.8-20.8	15.0-8/74	20.5	
4(S52553)		13.4-18.4	12.7-8/74	18.0	
5(S52554)		14.0-19.0	13.4-8/74	18.6	2
S52128	37	32-37	31-6/74	41.38	5
S52492	8.4	5.4-8.4	7-7/74	17.50	2
S52548	40	30.3-35.3	31-8/74	41.37	2.5
S52549	42.5	35.1-40.1	36-8/74	45.82	2.5
S52550	44	36.5-41.5	37-8/74	46.82	2.5
S52551	28.9	20.2-25.2	21-8/74	29.63	2.5
Meetinghouse Road Well Field					
1	46				8
12	47				10
13	47				10
14	58.3				10
15	56.4				10
16	58.3				10
17	56.2				10
18	54.6				10
19	54.7				10
20	77.8				16
21	50.3				8

53 & 63

TABLE VI

New York Air Guard Wells

Well No.	Date Drilled	Well Depth (ft)	Well Diameter (in)	Screen Interval (ft)	Depth to Water (ft)	Comments from Well Logs
1	5/3/82	38	3	28-38	33	
2	5/4/82	38	3	28-38	33	petro odor from 30'-38'
3	5/4/82	38	3	28-38	32.5	
4	5/4/82	38	3	28-38	34	
5	5/4/82	38	3	28-38	35	
6	5/6/82	25.5	3	15.5-25.5	22.7	
7	5/6/82	17	3	7-17	14.8	
8	5/5/82	10	3	10	5.7	
9	5/6/82	40	3	30-40	36	
10	5/6/82	40	3	30-40	35.5	
11	5/5/82	38	3	28-38	34	
12	5/582	35.5	3	25.5-35.5	33	petrol odor
14	5/5/82	36	3	26-36	32	petro odor
15	6/7/82	38	4	28-38	31	no fuel odor
16	6/7/82	38	4	28-38	31	fuel odor at 10' to 38'
17	6/8/82	38	4	28-38	31.7	fuel odor 20' to 40'
18	6/8/82	38	4	28-38	31.8	fuel odor 20' to 40'
19	6/8/82	38	4	28-38	32.3	fuel odor 30' to 40'
20	6/9/82	38	4	28-38	32.5	fuel odor 30' - 38'
21	6/9/82	38	4	28-38	35.3	fuel odor 30' - 38'
22	6/9/82	38	4	28-38	34.8	no fuel odor
23	6/10/82	38	4	28-38	30.6	
24	6/10/82	38	4	28-38	32.6	

54863

TABLE VII

Quoque Wildlife Refuge Wells

Well No.	Depth (ft)	Screen Interval (ft)	Depth Water (ft)
Q-1	57	54-57	45
Q-2	22	19-22	5
Q-3	65	62-65	41
Q-4	42	39-42	30
Q-5	34	31-34	6
Q-6	24	21-24	11

55963

TABLE VIII

Monitoring Wells Installed by Suffolk County Department of Health (1)

Well No.	Date Drilled	Depth (ft)	Screen Interval (ft)	Depth to Water (ft)	Comments
#118	6/77	82	61 - 63	10	fuel 30' - 55'
#117	6/77	82	64 - 66	20	fuel 30' - 60'
#119	6/77	82	Top of Water Table	22	no fuel
#140	7/77	82	30 - 35	35	upper 5' of aquifer contamination
#141	7/77	82	Top of Water Table	28	no fuel
#142	7/77	82	Top of Water Table	18	no fuel
S72534	3/82	62	60 - 62	15	airport landfill
S72535	3/82	62	60 - 62	15	airport landfill
S72536	3/82	22	20 - 22	15	airport landfill

(1) Sources: December, 1980 Memo from Markel to Baier.
October, 1983 Letter from Markel to DRAI.

56863

TABLE IX

Relative Ground Water Elevations NYDOT Wells (1)
March 22, 1982

NYDOT Well No	NY DOT (2) Top of Well Elev. (ft)	NY DOT Ground Water Elev. (ft)	NYDOT Depth to Water (ft)	Relative (3) Top of Well Elev. (ft.msl)	Relative Ground Water Elev. (ft.msl)
1	107.41	81.73	25.68	32.41	6.73
2	109.58	81.90	27.68	34.58	6.90
3	110.25	81.94	28.31	35.25	6.94
4	108.80	82.10	26.70	33.80	7.10
5	106.70	80.96	25.74	31.70	5.96
6	111.73	86.06	25.67	36.70	11.06
7	107.75	84.12	23.63	32.75	9.12
8	102.35	81.48	20.87	27.35	6.48
9	96.55	80.56	15.99	21.55	5.56
10	106.72	80.78	25.94	31.72	5.78
11	104.50	80.53	23.97	29.50	5.53
12	100.50	81.13	19.37	25.50	6.13
13	99.72	80.34	19.58	24.92	5.34
14	119.53	85.85	33.68	44.53	10.85
15	120.14	85.89	34.25	45.14	10.89
16	118.22	86,09	32.17	43.22	11.05
17	121.39	85.44	35.94	46.39	10.45
18	110.99	85.06	25.93	35.99	10.06
19	116.84	84.16	32.68	41.84	9.16
20	116.97	84.34	32.63	41.97	9.34
21	113.94	83.40	30.54	38.94	8.40
22	104.92	80.02	24.90	29.92	5.02

---

(1) Relative elevations determined by substitution of the topographic elevation estimate for the starting point elevation of 100 ft by the NYDOT.

(2) All elevations were taken from fire hydrant N/W corner of South Country Road and Peters Lane on top of bolt opposite "N" is "TENN" and assumed as elevation 100.00.

(3) Elevations determined using the 25 ft. elevation contour (on which the fire hydrant is located)) substituted for the 100.00 ft elevation.

TABLE X

Relative Density of Organic Compounds Detected in Water Samples(1) Suffolk County Airport

Compound No.(2)	Organic Compound(3)	Relative Density(4) (dimensionless)
1	pentane	0.6262
2	2-methylpentane	0.6532
3	hexane	0.6603
4	2,3-dimethylbutane	0.6616
5	3-methylpentane	0.6645
6	2-methylhexane	0.6787
7	heptane	0.6838
8	3-methylhexane (5)	0.6860
9	2,3-dimethylpentane (6)	0.6951
10	diethyl ether	0.7138
11	2,4,4-trimethyl-2-pentene (7)	0.7218
12	methylcyclopentane	0.7486
13	1,3 dimethylcyclohexane (8)	0.7660
14	ethylcyclopentane	0.7665
15	methylcyclohexane	0.7694
16	1,3,5-trimethylcyclohexane (9)	0.7708
17	cyclohexane	0.7786
18	2-propanol	0.7855
19	ethylcyclohexane	0.7880
20	acetone (2-propanone)	0.7899
21	2-butanone	0.8054
22	2,4-dimethyl-3-pentanone	0.8108 (10)
23	2-methyl-3-pentanone	0.830
24	para-xylene (1,4-dimethylbenzene)	0.8611
25	isopropylbenzene	0.8618
26	propylbenzene	0.8620
27	meta-xylene (1,3-dimethylbenzene)	0.8642
28	1,3,5-trimethylbenzene	0.8652
29	toluene	0.8669
30	ethylbenzene	0.8670
31	total xylenes (11)	0.8685
32	1,2,4 trimethylbenzene	0.8758
33	benzene	0.8786
34	ortho-xylene (1,2-dimethylbenzene)	0.8802
35	tetrahydrofuran	0.8892
36	cyclohexanone	0.9478

5-8463

TABLE X (cont.)

Compound No.[2]	Organic Compound[3]	Relative Density[4] (dimensionless)
[WATER]		[1.0]
101	chlorobenzene	1.1058
102	1,1-dichloroethane	1.1757
103	dichlorodifluoromethane	1.1834[12]
104	carbon disulfide	1.2632
105	methylene chloride (dichloromethane)	1.3266
106	1,1,1-trichloroethane	1.3390
107	1,1,2-trichloroethane	1.4397
108	trichloroethylene (trichloroethene)	1.4642
109	bromobenzene	1.4950
110	carbon tetrachloride (tetrachloromethane)	1.5940
111	tetrachloroethylene	1.6227

COMPOUNDS REPORTED FOR WHICH RELATIVE DENSITIES ARE NOT AVAILABLE:

201	1-ethyl-2-methylcyclopentane	
202	1-ethyl-3-methylcyclopentane	
203	JP-4	0.751 - 0.802[13]
204	BTX + (benzene, toluene, xylene,+)	

59863

TABLE X (cont.)

Footnotes

Source: CRC Handbook of Chemistry and Physics, 60th and 62nd editions.

(1) Complete list of organic compounds [analyzed for] is shown in Appendix A.

(2) See Figure 4, Water Quality Map.

(3) Compound name as reported; name in parentheses is synonymous compound name for which relative density is available.

(4) Density of liquid organic compounds at 20°C relative to water at 4°C, unless otherwise noted.

(5) Relative density for (d) stereoisomer.

(6) 1,2-dimethylpentane also reported, but no relative density available.

(7) Reported as 3,4,4-trimethyl-2-pentene, but no relative density available.

(8) Relative density for (cis) structure.

(9) Reported as 1,1,3-trimethylcyclohexane, but no relative density available; relative density for (cis) structure.

(10) Both organic liquid and water at 0°C.

(11) Average of relative densities of meta-, para-, and ortho-xylenes.

(12) Organic liquid at 57°C, water temperature not known.

(13) Approximate density range - Military Specification MIL-J-5624E, March 23, 1960

New York Department of Transportation Wells

NEW YORK TESTING LABORATORIES, INC.

 Lab No. 82-64452 (A)

Sample: R17-01

VOLATILE COMPOUNDS Parameter (µg/l):	Method No.	CAS No.	Detection Limit (µg/l)	Found (µg/l)
Acrolein	603, 624	107-02-8	100	< 100
Acrylonitrile	603, 624	107-13-1	100	< 100
Benzene	624	71-43-2	10	16.6
Bromodichloromethane	624	75-27-4	10	< 10
Bromoform	624	75-25-2	10	< 10
Bromomethane	624	74-83-9	10	< 10
Carbon Tetrachloride	624	56-23-5	10	< 10
Chlorobenzene	624	108-90-7	10	< 10
Chlorodibromomethane	624	124-48-1	10	< 10
Chloroethane	624	75-00-3	10	< 10
2-Chloroethyl vinyl ether	624	110-75-8	10	< 10
Chloroform	624	67-66-3	10	< 10
Chloromethane	624	74-87-3	10	< 10
Dichlorodifluoromethane	624	-	10	< 10
1,1-Dichloroethane	624	75-34-3	10	< 10
1,2-Dichloroethane	624	107-06-2	10	< 10
1,1-Dichloroethylene	624	75-35-4	10	< 10
Trans, 1,2-Dichloroethylene	624	156-60-5	10	< 10
1,2-Dichloropropane	624	78-87-5	10	< 10
1,3-Dichloropropene	624	10061-02-6	10	< 10
Ethylbenzene	624	100-41-4	10	88.6
Methylene Chloride	624	75-09-2	10	< 10
1,1,2,2-Tetrachloroethane	624	79-34-5	10	< 10
Tetrachloroethylene	624	127-18-4	10	< 10
Toluene	624	108-88-3	10	< 10
1,1,1-Trichloroethane	624	71-55-6	10	< 10
1,1,2-Trichloroethane	624	79-00-5	10	< 10
Trichloroethylene	624	79-01-6	10	< 10
Trichlorofluoromethane	624	-	10	< 10
Vinyl chloride	624	75-01-4	10	< 10

< = None detected, less than

Sample: R17-01

62863

VOLATILE COMPOUNDS - cont'd

Parameter (µg/l):	Method No.	CAS No.	Detection Limit (µg/l)	Found (µg/l)
Cyclohexane	-	-	-	Present
Methylcyclopentane	-	-	-	Present
Tetrahydrofuran	-	-	-	Present
2-Butanone	-	-	-	Present
1,2-Dimethylpentane	-	-	-	Present
Methylcyclohexane	-	-	-	Present
Ethylcyclopentane	-	-	-	Present
Cyclohexanone	-	-	-	Present
3-Methylhexane	-	-	-	Present
1-Ethyl-2-Methylcyclopentane	-	-	-	Present
1-Ethyl-3-Methylcyclopentane	-	-	-	Present
3,4,4-Trimethyl-2-Pentene	-	-	-	Present
1,3-Dimethylcyclohexane	-	-	-	Present
1,1,3-Trimethylcyclohexane	-	-	-	Present
iso-propylbenzene	-	-	-	Present
p-xylene	-	-	-	Present
o-xylene	-	-	-	Present
Propyl benzene	-	-	-	Present

Sample: R19-01

VOLATILE COMPOUNDS Parameter (µg/l):	Method No.	CAS No.	Detection Limit (µg/l)	Found (µg/l)
Acrolein	603, 624	107-02-8	100	< 100
Acrylonitrile	603, 624	107-13-1	100	< 100
Benzene	624	71-43-2	10	< 10
Bromodichloromethane	624	75-27-4	10	< 10
Bromoform	624	75-25-2	10	< 10
Bromomethane	624	74-83-9	10	< 10
Carbon Tetrachloride	624	56-23-5	10	< 10
Chlorobenzene	624	108-90-7	10	16
Chlorodibromomethane	624	124-48-1	10	< 10
Chloroethane	624	75-00-3	10	< 10
2-Chloroethyl vinyl ether	624	110-75-8	10	< 10
Chloroform	624	67-66-3	10	< 10
Chloromethane	624	74-87-3	10	< 10
Dichlorodifluoromethane	624	-	10	< 10
1,1-Dichloroethane	624	75-34-3	10	< 10
1,2-Dichloroethane	624	107-06-2	10	< 10
1,1-Dichloroethylene	624	75-35-4	10	< 10
Trans, 1,2-Dichloroethylene	624	156-60-5	10	< 10
1,2-Dichloropropane	624	78-87-5	10	< 10
1,3-Dichloropropene	624	10061-02-6	10	< 10
Ethylbenzene	624	100-41-4	10	< 10
Methylene Chloride	624	75-09-2	10	< 10
1,1,2,2-Tetrachloroethane	624	79-34-5	10	< 10
Tetrachloroethylene	624	127-18-4	10	< 10
Toluene	624	108-88-3	10	< 10
1,1,1-Trichloroethane	624	71-55-6	10	< 10
1,1,2-Trichloroethane	624	79-00-5	10	< 10
Trichloroethylene	624	79-01-6	10	< 10
Trichlorofluoromethane	624	-	10	< 10
Vinyl chloride	624	75-01-4	10	< 10
Dichlorodifluoromethane	-	-	-	Present
Tetrahydrofuran	-	-	-	Present

< = None detected, less than

EA SCIENCE AND TECHNOLOGY
A Division of EA Engineering, Science, and Technology Inc

COMMUNICATIONS RECORD FORM

Distribution: (✓) Quogue LF file, ( ) ______
( ) ______, ( ) ______
( ) Author

Person Contacted: Mr. Marty Trent Date: 8-19-86

Phone Number: 516 348 2895 Title: Senior Sanitarian

Affiliation: SCDHS Bureau of Drinking H_2O Type of Contact: Phone

Address: 225 Rabro Dr Person Making Contact: Going
Hauppauge NY 11788

Communications Summary: I asked Mr. Trent what kinds of ground water investigations the SCDHS had made in the vicinity of Quogue LF, and if I could have a copy of the analytical data.

He indicated there had been a "Peter's Love Drilling Investigation" in 1981 to establish the extent of a jet fuel (spill) plume --- parameters of study were primarily those associated with jet fuel oil. Also, an investigation of drinking water at numerous homes south of the landfill was conducted in 1982, and parameters of study included conductivity, metals and organics among others. He will send me a map and a complete set of analytical data.

SCDHS believes the data do not implicate the Quogue landfill; however new samples would be recommended to update the data base.

(see over for additional space)

Signature: William Going

p.2/38

COUNTY OF SUFFOLK

RECEIVED AUG 27 1986

PETER F. COHALAN
SUFFOLK COUNTY EXECUTIVE

DEPARTMENT OF HEALTH SERVICES

DAVID HARRIS, M.D., M.P.H.
COMMISSIONER

August 20, 1986

Bud Going
EA Science and Technology
RD2 Goshen Turnpike
Middletown, NY 10940

Dear Mr. Going:

Enclosed for your information is a survey of private well quality south of the Westhampton Air Base. The analyses were performed primarily to determine the presence of hydrocarbons from spills at the airport.

Additional studies would be required to ascertain whether or not there has been contamination of the aquifer by leachate from the old Quiogue landfill.

Should you have any questions on the data, feel free to contact this office.

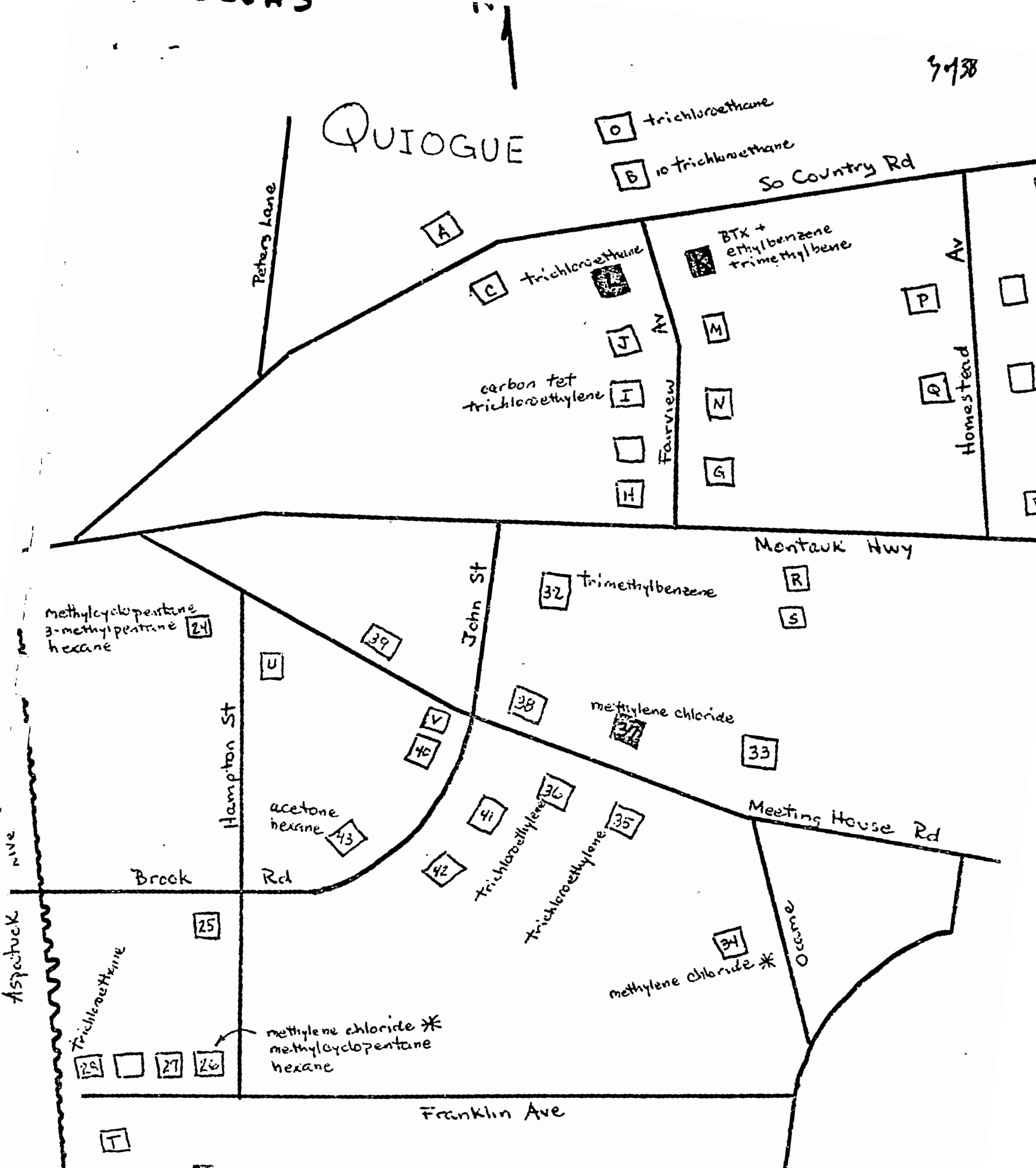
Very truly yours,

Martin Trent
Senior Sanitarian
Bureau of Drinking Water

MT/cs

Enclosures

225 RABRO DRIVE EAST
HAUPPAUGE, N.Y. 11788
(516) 348-2917



▩ = exceeded limit for synthetic organics or hydrocarbons

☐ = traces of " " "

* presence could not be confirmed by SCDHS lab

Quiogue

A-1

4/38

	Public Works Garage & Country 2/9/82	(A) J. Phares 48 S Country 2/9/82	(B) Chesterfield Assoc 5 Country 2/9/82	
coliform /100 ml	<2.2	<1	<1	
free ammonia mg/l	12.0	1.71	0.05	
nitrates "	<0.4	15.9	3.4	
MBAS "	<0.1	<0.1	<0.1	
pH	6.7	4.5	5.5	
specific conductivity	380	250	115	
chlorides mg/l	18.	22.	17.	
sulfates "	6.	18.	13.	
iron "	6.3	0.10	0.5	
manganese "	9.4	0.34	0.07	
copper "	<0.10	<0.10	<0.10	
zinc "	<0.4	0.9	<0.4	
sodium "	15.4	15.5	11.2	
magnesium "				
phosphorous "				
cadmium ug/l				
silver "				
lead "				
chromium "				
arsenic "				
selenium "				
methylene chloride ug/l	80			
bromochloromethane "				
1,1 dichloroethane "				
trans dichloroetyhlene				
chloroform ug/l	<5	<5	<5	
1,2 dichloroethane "				
1,1,1 trichloroethane	<2	<2	10	
carbon tetrachloride	<1	<1	<1	
1 bromo 2 chloroethane				
1,2 dichloropropane				
1,1,2 trichloroethylene	<5	<5	<5	
chlorodibromomethane	<2	<2	<2	
1,2 dibromoethane ug/l				
bromoform ug/l	<5	<5	<5	
tetrachloroethylene "	<2	<2	<2	
cis dichloroethylene				
freon 113 "	<4	<4	<4	
dibromomethane "				
1,1 dichloroethylene				
bromodichloromethane	<3	<3	<3	
benzene ug/l	<5	<5	<5	
toluene "	<5	<5	<5	
total xylenes "	<5	<5	<5	
chlorobenzene "	<6	<6	<6	
ethylbenzene "	<5	<5	<5	
bromobenzene "	<8	<8	<8	
total chlorotoluene "	<6	<6	<6	
m-dichlorobenzene "	<7	<7	<7	
o-dichlorobenzene "	<7	<7	<7	
1,2,4 trimethylbenzene	<5	<5	<5	
1,3,5 trimethylbenzene	<5	<5	<5	
2,3 dichloropropene "				
1,1,2 trichloroethane				

SCDHS

Quiogue

5/138

	J. Valdes (C) 395 S. County 2/1/82 70'	V. Allen (E) 90 S. County 2/1/82	P. Vella (E) 106 S County 2/1/82 98' (6 mo old)	Stain (E) 572 Montauk Hwy 2/1/82 SCWA
coliform /100 ml	<1	<1	<1	<1
free ammonia mg/l	<0.04	0.47	0.09	<0.04
nitrates "	3.1	<0.4	2.0	3.4
MBAS "	<0.1	<0.1	<0.1	<0.1
pH	5.4	6.5	6.4	6.4
specific conductivity	95	142	72	168
chlorides mg/l	14.	5.	7.	11.
sulfates "	9.	7.	<4.	29.
iron "	<0.10	7.14	<0.10	<0.10
manganese "	<0.05	0.86	0.15	<0.05
copper "	0.10	<0.10	<0.10	<0.10
zinc "	0.4	0.4	<0.4	<0.4
sodium "	10.0	4.4	6.5	7.5
magnesium "				
phosphorous "				
cadmium ug/l				
silver "				
lead "				
chromium "				
arsenic "				
selenium "				
methylene chloride ug/l				
bromochloromethane "				
1,1 dichloroethane "				
trans dichloroetyhlene				
chloroform ug/l	<5	<5	<5	<5
1,2 dichloroethane "				
1,1,1 trichloroethane	<2	<2	<2	<2
carbon tetrachloride	<1	<1	<1	<1
1 bromo 2 chloroethane				
1,2 dichloropropane				
1,1,2 trichloroethylene	<5	<5	<5	<5
chlorodibromomethane	<2	<2	<2	<2
1,2 dibromoethane ug/l				
bromoform ug/l	<5	<5	<5	<5
tetrachloroethylene "	<2	<2	<2	<2
cis dichloroethylene				
freon 113 "	<4	<4	<4	<4
dibromomethane "				
1,1 dichloroethylene				
bromodichloromethane	<3	<3	<3	<3
benzene ug/l	<5	<5	<5	<5
toluene "	<5	<5	<5	<5
total xylenes "	<5	<5	<5	<5
chlorobenzene "	<6	<6	<6	<6
ethylbenzene "	<5	<5	<5	<5
bromobenzene "	<9	<8	<9	<9
total chlorotoluene "	<6	<6	<6	<6
m-dichlorobenzene "	<7	<7	<7	<7
o-dichlorobenzene "	<7	<7	<7	<7
1,2,4 trimethylbenzene	<5	<5	<5	<5
1,3,5 trimethylbenzene	<5	<5	<5	<5
2,3 dichloropropene "				
1,1,2 trichloroethane				

Quiogue

A-3
6/38

	(G) W. Burding 19 Fairview 2/1/82 34'	(H) M. Barausk 9 Fairview 2/1/82 150'	(J) H. Sadlowsk. 25 Fairview 2/9/82 45'	(I) F. Hulse 21 Fairview 2/9/82
coliform /100 ml	<1	<1	<1	<1
free ammonia mg/l	<0.04	<0.04	0.04	0.08
nitrates "	2.8	0.7	3.3	9.0
MBAS "	<0.1	<0.1	<0.1	<0.1
pH	5.4	5.4	5.5	5.5
specific conductivity	79	72	121	147
chlorides mg/l	10.	12.	19	8.
sulfates "	8.	9.	12.	16.
iron "	<0.10	0.21	0.19	<0.10
manganese "	<0.05	<0.05	0.05	0.05
copper "	<0.10	<0.10	0.19	0.29
zinc "	<0.4	<0.4	<0.4	<0.4
sodium "	6.0	7.4	9.3	6.3
magnesium "				
phosphorous "				
cadmium ug/l				
silver "				
lead "				
chromium "				
arsenic "				
selenium "				
methylene chloride ug/l				<2
bromochloromethane "				<2
1,1 dichloroethane "				<2
trans dichloroetyhlene				<2
chloroform ug/l	<5	<5	<5	<2
1,2 dichloroethane "				<2
1,1,1 trichloroethane	<2	<2	<2	<2
carbon tetrachloride	<1	<1	<1	7
1 bromo 2 chloroethane				<2
1,2 dichloropropane				<2
1,1,2 trichloroethylene	<5	<5	<5	6
chlorodibromomethane	<2	<2	<2	<2
1,2 dibromoethane ug/l				<2
bromoform ug/l	<5	<5	<5	<2
tetrachloroethylene "	<2	<2	<2	<2
cis dichloroethylene				<2
freon 113 "	<4	<4	<4	<2
dibromomethane "				<2
1,1 dichloroethylene				<2
bromodichloromethane	<3	<3	<3	<2
benzene ug/l	<5	<5	<5	<5
toluene "	<5	<5	<5	<5
total xylenes "	<5	<5	<5	<5
chlorobenzene "	<6	<6	<6	<6
ethylbenzene "	<5	<5	<5	<5
bromobenzene "	<8	<8	<8	<8
total chlorotoluene "	<6	<6	<6	<6
m-dichlorobenzene "	<7	<7	<7	<7
o-dichlorobenzene "	<7	<7	<7	<7
1,2,4 trimethylbenzene	<5	<5	<5	<5
1,3,5 trimethylbenzene	<5	<5	<5	<5
2,3 dichloropropene "				<2
1,1,2 trichloroethane				<2

Quiogue

A-4

70/38

	(K) R. Barauska 30 Fairview 12/4/81	(L) A. Pavlauck 27 Fairview 2/1/82 Depth 34	(M) B. Novick 26 Fairview 2/1/82	(N) C. Belson 22 Fairview 2/1/82 33'
coliform /100 ml	<1	<1	<1	<1
free ammonia mg/l	<0.04	<0.04	<0.04	<0.04
nitrates "	0.8	10.8	0.5	4.3
MBAS "	<0.1	<0.1	<0.1	<0.1
pH	5.6	5.8	5.6	5.3
specific conductivity	75	186	64	100
chlorides mg/l	11.	21.	9.	12.
sulfates "	8.	9.	7.	7.
iron "	0.56	0.28	<0.10	<0.10
manganese "	0.09	<0.05	<0.05	0.05
copper "	<0.1	<0.10	<0.10	<0.10
zinc "	<0.4	2.3	1.3	0.7
sodium "	7.	15.3	6.1	6.9
magnesium "				
phosphorous "				
cadmium ug/l				
silver "				
lead "				
chromium "				
arsenic "				
selenium "				
methylene chloride ug/l				
bromochloromethane "				
1,1 dichloroethane "				
trans dichloroetyhlene				
chloroform ug/l	<5	<5	<5	<5
1,2 dichloroethane "				
1,1,1 trichloroethane	<2	71	<2	<2
carbon tetrachloride	<1	<1	<1	<1
1 bromo 2 chloroethane				
1,2 dichloropropane				
1,1,2 trichloroethylene	<5	<5	<5	<5
chlorodibromomethane	<2	<2	<2	<2
1,2 dibromoethane ug/l				
bromoform ug/l	<5	<5	<5	<5
tetrachloroethylene "	<2	<2	<2	<2
cis dichloroethylene				
freon 113 "	<4	<4	<4	<4
dibromomethane "				
1,1 dichloroethylene				
bromodichloromethane	<3	<3	<3	<3
benzene ug/l	250	<5	<5	<5
toluene "	130	<5	<5	<5
total xylenes "	1200	<5	<5	<5
chlorobenzene "	<6	<6	<6	<6
ethylbenzene "	310	<5	<5	<5
bromobenzene "	12	<8	<8	<8
total chlorotoluene "	<6	<6	<6	<6
m-dichlorobenzene "	<7	<7	<7	<7
o-dichlorobenzene "	<7	<7	<7	<7
1,2,4 trimethylbenzene	310	<5	<5	<5
1,3,5 trimethylbenzene		<5	<5	<5
2,3 dichloropropene "				
1,1,2 trichloroethane				

SCDHS

A-5
8/38

	ⓞ Fire Equip Repair S Country Rd 3/1/82 231	Ⓟ Brown 50 Homestead 3/9/82	Ⓠ J. Tilman Homestead 3/8/82	? Carpenter 66 Montauk 3/9/82
coliform /100 ml	<1	<1	<1	2.2 and conf
free ammonia mg/l	0.12	0.04	<0.04	0.05
nitrates "	7.5	0.9	0.8	2.6
MBAS "	<0.1	<0.1	<0.1	<0.1
pH	6.1	5.7	5.5	5.7
specific conductivity	230	65	60	139
chlorides mg/l	21.	7	8	24
sulfates "	22	9	<4	8
iron "	0.20	0.45	0.17	0.37
manganese "	0.14	<0.05	<0.05	<0.05
copper "	<0.1	0.12	0.13	<0.10
zinc "	10.0	<0.4	<0.4	<0.14
sodium "	17.2	3.9	4.2	4.0
magnesium "				
phosphorous "				
cadmium ug/l	4.5			
silver "				
lead "	<10			
chromium "				
arsenic "				
selenium "				
methylene chloride ug/l			<2	
bromochloromethane "			<2	
1,1 dichloroethane "			<2	
trans dichloroetyhlene			<2	
chloroform ug/l	<5	<5	<2	<5
1,2 dichloroethane "			<2	
1,1,1 trichloroethane	4	<2	<2	<2
carbon tetrachloride	<1	<1	<2	<1
1 bromo 2 chloroethane			<2	
1,2 dichloropropane			<2	
1,1,2 trichloroethylene	<5	<5	<2	<5
chlorodibromomethane	<2	<2	<2	<2
1,2 dibromoethane ug/l			<2	
bromoform ug/l	<5	<5	<2	<5
tetrachloroethylene "	<2	<2	<2	<2
cis dichloroethylene			<2	
freon 113 "	<4	<4	<2	<4
dibromomethane "			<2	
1,1 dichloroethylene			<2	
bromodichloromethane	<3	<3	<2	<3
benzene ug/l	<5	<5	<5	<5
toluene "	<5	<5	<5	<5
total xylenes "	<5	<5	<5	<5
chlorobenzene "	<6	<6	<6	<6
ethylbenzene "	<5	<5	<5	<5
bromobenzene "	<8	<8	<8	<8
total chlorotoluene "	<6	<6	<6	<6
m-dichlorobenzene "	<7	<7	<7	<7
o-dichlorobenzene "	<7	<7	<7	<7
1,2,4 trimethylbenzene	<5	<5	<5	<5
1,3,5 trimethylbenzene	<5	<5	<5	<5
2,3 dichloropropene "			<2	<2
1,1,2 trichloroethane			<2	<2

SCDHS

	(R) J. Bruno 529 Montauk Hwy 3/9/82 28'	(S) McCutcheon Montauk Hwy	(T) B. Schulberg 707 Franklin 3/9/82	C Lebrun 2 Debbie La 3/9/82
coliform /100 ml	<2.2	<1	<2.2	<2.2
free ammonia mg/l	0.16	<0.04	<0.04	<0.04
nitrates "	4.4	0.4	2.1	2.4
MBAS "	<0.1	<0.1	<0.1	<0.1
pH	4.6	5.7	5.0	6.8
specific conductivity	172	79	94	139
chlorides mg/l	30.	16	14	10.
sulfates "	12.	5	9	22.
iron "	<0.10	0.15	<0.10	<0.10
manganese "	0.15	<0.05	0.06	<0.05
copper "	<0.10	<0.10	<0.10	<0.10
zinc "	<0.4	0.8	<0.4	<0.4
sodium "	17.8	8.5	7.9	5.4
magnesium "				
phosphorous "				
cadmium ug/l				
silver "				
lead "				
chromium "				
arsenic "				
selenium "				
methylene chloride ug/l				
bromochloromethane "				
1,1 dichloroethane "				
trans dichloroetyhlene				
chloroform ug/l	<5	<5	<5	<5
1,2 dichloroethane "				
1,1,1 trichloroethane	<2	<2	<2	<2
carbon tetrachloride	<1	<1	<1	<1
1 bromo 2 chloroethane				
1,2 dichloropropane				
1,1,2 trichloroethylene	<5	<5	<5	<5
chlorodibromomethane	<2	<2	<2	<2
1,2 dibromoethane ug/l				
bromoform ug/l	<5	<5	<5	<5
tetrachloroethylene "	<2	<2	<2	<2
cis dichloroethylene				
freon 113 "	<4	<4	<4	<4
dibromomethane "				
1,1 dichloroethylene				
bromodichloromethane	<3	<3	<3	<3
benzene ug/l	<5	<5	<5	<5
toluene "	<5	<5	<5	<5
total xylenes "	<5	<5	<5	<5
chlorobenzene "	<6	<6	<6	<4
ethylbenzene "	<5	<5	<5	<5
bromobenzene "	<8	<8	<8	<8
total chlorotoluene "	<6	<6	<6	<6
m-dichlorobenzene "	<7	<7	<7	<7
o-dichlorobenzene "	<7	<7	<7	<7
1,2,4 trimethylbenzene	<5	<5	<5	<5
1,3,5 trimethylbenzene	<5	<5	<5	<5
2,3 dichloropropene "				
1,1,2 trichloroethane				

SCDHS
3/22/82

A-7

10/3?

	(24) Betz 11 Hampton	O'Brien 37 Hampton	(33) J. Fitzharris PO Box 968 N. Oconee	(34) H. Boyd 3 Oconee	4/20/82
coliform /100 ml	<1	<1	<1	<1	
free ammonia mg/l	<0.04	<0.04	0.06	<0.04	
nitrates "	2.7	0.9	2.8	<0.4	
MBAS "	<0.1	<0.1	<0.1	<0.1	
pH	5.5	6.4	4.5	5.0	
specific conductivity	83	181	178	77	
chlorides mg/l	7.	20	25	13.	
sulfates "	10.	17	27	10.	
iron "	<0.1	<0.1	<0.1	<0.1	
manganese "	0.51	<0.05	0.17	<0.05	
copper "	0.2	<0.1	<0.1	0.2	
zinc "	<0.4	0.5	0.5	<0.4	
sodium "	4.4	14.7	18.0	8.5	
magnesium "					
phosphorous "					
cadmium ug/l					
silver "					
lead "					
chromium "					
arsenic "					
selenium "					
methylene chloride ug/l					<2
bromochloromethane "					<2
1,1 dichloroethane "					<2
trans dichloroetyhlene					<2
chloroform ug/l	<5	<5	<5	<5	<2
1,2 dichloroethane "					<2
1,1,1 trichloroethane	<2	<2	<2	<2	<2
carbon tetrachloride	<1	<1	<1	<1	<2
1 bromo 2 chloroethane					<2
1,2 dichloropropane					<2
1,1,2 trichloroethylene	<5	<5	<5	<5	<2
chlorodibromomethane	<2	<2	<2	<2	<2
1,2 dibromoethane ug/l					<2
bromoform ug/l	<5	<5	<5	<5	<2
tetrachloroethylene "	<2	<2	<2	<2	<2
cis dichloroethylene					<2
freon 113 "	<4	<4	<4	<4	<2
dibromomethane "					<2
1,1 dichloroethylene					<2
bromodichloromethane	<3	<3	<3	<3	<2
benzene ug/l	<5	<5	<5	<5	<5
toluene "	<5	<5	<5	<5	<5
total xylenes "	<5	<5	<5	<5	<5
chlorobenzene "	<6	<6	<6	<6	<4
ethylbenzene "	<5	<5	<5	<5	<5
bromobenzene "	<8	<8	<8	<8	<8
total chlorotoluene "	<6	<6	<6	<6	<6
m-dichlorobenzene "	<7	<7	<7	<7	<7
o-dichlorobenzene "	<7	<7	<7	<7	<7
1,2,4 trimethylbenzene	<5	<5	<5	<5	<5
1,3,5 trimethylbenzene	<5	<5	<5	<5	<5
2,3 dichloropropene "					<2
1,1,2 trichloroethane					<2

SCDHS
3/22/82

A-8

11 of 38

	(27) FC White Box 1012 Franklin 20'	(26) D. White 44 Franklin	4/20/83 NJ	(28) Fisher 60 Franklin	(32) N. Laird John St
coliform /100 ml	<1	<1		<1	<1
free ammonia mg/l	0.07	0.11		<0.04	<0.04
nitrates "	3.2	6.8		1.1	5.7
MBAS "	<0.1	<0.1		<0.1	<0.1
pH	5.5	5.0		4.9	4.6
specific conductivity	133	215		125	200
chlorides mg/l	21	31		23	29
sulfates "	10	13		12	14
iron "	0.6	0.15		<0.1	0.13
manganese "	<0.05	<0.05		<0.05	0.26
copper "	0.12	<0.1		<0.1	<0.1
zinc "	1.3	0.6		<0.4	<0.4
sodium "	15.6	25.7		15.4	21.4
magnesium "					
phosphorous "					
cadmium ug/l					
silver "					
lead "					
chromium "					
arsenic "					
selenium "					
methylene chloride ug/l			<2		
bromochloromethane "			<2		
1,1 dichloroethane "			<2		
trans dichloroetyhlene			<2		
chloroform ug/l	<5	<5	<2	<5	<5
1,2 dichloroethane "			<2		
1,1,1 trichloroethane	<2	<2	<2	2	<2
carbon tetrachloride	<1	<1	<2	<1	<1
1 bromo 2 chloroethane			<2		
1,2 dichloropropane			<2		
1,1,2 trichloroethylene	<5	<5	<2	<5	<5
chlorodibromomethane	<2	<2	<2	<2	<2
1,2 dibromoethane ug/l			<2		
bromoform ug/l	<5	<5	<2	<5	<5
tetrachloroethylene "	<2	<2	<2	<2	<2
cis dichloroethylene			<2		
freon 113 "	<4	<4	<2	<4	<4
dibromomethane "			<2		
1,1 dichloroethylene			<2		
bromodichloromethane	<3	<3	<2	<3	<3
benzene ug/l	<5	<5	<5	<5	<5
toluene "	<5	<5	<5	<5	<5
total xylenes "	<5	<5	<5	<5	<5
chlorobenzene "	<6	<6	<6	<6	<6
ethylbenzene "	<5	<5	<5	<5	<5
bromobenzene "	<8	<8	<8	<8	<8
total chlorotoluene "	<6	<6	<6	<6	<6
m-dichlorobenzene "	<7	<7	<7	<7	<7
o-dichlorobenzene "	<7	<7	<7	<7	<7
1,2,4 trimethylbenzene	<5	<5	<5	<5	5
1,3,5 trimethylbenzene	<5	<5	<5	<5	<5
2,3 dichloropropene "			<2		
1,1,2 trichloroethane			<2		

SCDHS
3/22/82

A-7

12/38

	(39) D. Fitzhugh 22 Meeting House Rd	(38) D. Smiley 40 Meeting House Rd	(37) E. Schultz 48 Meeting House Rd	(36) C. Northington 51 Meeting House Rd
coliform /100 ml	<2.2	<1	<1	<2.2
free ammonia mg/l	<0.04	0.04	0.07	<0.04
nitrates "	0.8	2.5	7.9	3.3
MBAS "	<0.1	<0.1	<0.1	<0.1
pH	5.0	5.7	4.8	5.6
specific conductivity	153	111	165	114
chlorides mg/l	32	16	18	8.
sulfates "	10	8	10	14.
iron "	<0.1	0.13	<0.1	<0.1
manganese "	0.12	<0.05	0.28	<0.05
copper "	0.25	<0.1	<0.1	<0.55
zinc "	<0.4	1.2	<0.4	<0.4
sodium "	19.8	10.8	13.1	4.7
magnesium "				
phosphorous "				
cadmium ug/l				
silver "				
lead "				
chromium "				
arsenic "				
selenium "				
methylene chloride ug/l	<2			
bromochloromethane "	<2			
1,1 dichloroethane "	<2			
trans dichloroetyhlene	<2			
chloroform ug/l	<2	<5	<5	<5
1,2 dichloroethane "	<2			
1,1,1 trichloroethane	<2	<2	<2	<2
carbon tetrachloride	<2	<1	<1	<1
1 bromo 2 chloroethane	<2			
1,2 dichloropropane	<2			
1,1,2 trichloroethylene	<2	<5	<5	18
chlorodibromomethane	<2	<2	<2	<2
1,2 dibromoethane ug/l	<2			
bromoform ug/l	<2	<5	<5	<5
tetrachloroethylene "	<2	<2	<2	<2
cis dichloroethylene	<2			
freon 113 "	<2	<4	<4	<4
dibromomethane "	<2			
1,1 dichloroethylene	<2			
bromodichloromethane	<2	<3	<3	<3
benzene ug/l	<5	<5	<5	<5
toluene "	<5	<5	<5	<5
total xylenes "	<5	<5	<5	<5
chlorobenzene "	<6	<6	<6	<6
ethylbenzene "	<5	<5	<5	<5
bromobenzene "	<8	<8	<8	<8
total chlorotoluene "	<6	<6	<6	<6
m-dichlorobenzene "	<7	<7	<7	<7
o-dichlorobenzene "	<7	<7	<7	<7
1,2,4 trimethylbenzene	<5	<5	<5	<5
1,3,5 trimethylbenzene	<5	<5	<5	<5
2,3 dichloropropene "	<2			
1,1,2 trichloroethane	<2			

SCDHS

A-10.

P18/35

	D. Gentile 115 Beach Rd 3/16/82	R. Israels 94 Griffing 3/9/82	(38) M. Fitzhugh 22 Meeting House Rd 2/16/82	(35) WH Mayo 53 Meeting House Rd
coliform /100 ml	<1	<2.2	<1	<2.2
free ammonia mg/l	0.04	6.21		<0.04
nitrates "	3.4	4.1		2.1
MBAS "	<0.1	<0.1		<0.1
pH	5.4	6.0		5.5
specific conductivity	165	155		103
chlorides mg/l	17	22		5.
sulfates "	31	14		16.
iron "	<0.10	3.06		0.15
manganese "	<0.05	<0.05		<0.05
copper "	0.29	0.24		<0.1
zinc "	<1.4	<0.4		<0.4
sodium "	13.8	12.8		3.5
magnesium "				
phosphorous "				
cadmium ug/l				
silver "				
lead "				
chromium "				
arsenic "				
selenium "				
methylene chloride ug/l				
bromochloromethane "				
1,1 dichloroethane "				
trans dichloroetyhlene				
chloroform ug/l	<5	<5	<5	<5
1,2 dichloroethane "				
1,1,1 trichloroethane	<2	<2	<2	<2
carbon tetrachloride	<1	<1	<1	<1
1 bromo 2 chloroethane				
1,2 dichloropropane			<	
1,1,2 trichloroethylene	<5	<5	<5	12
chlorodibromomethane	<2	<2	<2	<2
1,2 dibromoethane ug/l				
bromoform ug/l	<5	<5	<5	<5
tetrachloroethylene "	<2	<2	<2	<2
cis dichloroethylene				
freon 113 "	<4	<4	<4	<4
dibromomethane "				
1,1 dichloroethylene				
bromodichloromethane	<3	<3	<3	<3
benzene ug/l	<5	<5	<5	<5
toluene "	<5	<5	<5	<5
total xylenes "	<5	<5	<5	<5
chlorobenzene "	<6	<6	<6	<6
ethylbenzene "	<5	<5	<5	<5
bromobenzene "	<9	<8	<8	<8
total chlorotoluene "	<6	<6	<6	<6
m-dichlorobenzene "	<7	<7	<7	<7
o-dichlorobenzene "	<7	<7	<7	<7
1,2,4 trimethylbenzene	<5	<5	<5	<5
1,3,5 trimethylbenzene	<5	<5	<5	<5
2,3 dichloropropene "				
1,1,2 trichloroethane				

SCDHS
3/22/82

p. 14/38

	(43) Stanek 140 Brook 50'	(42) RL Kavan 147 Brook 32'	(40) B. Beczak 152 Brook	(41) L. Rogers 153 Brook 25'
coliform /100 ml	<1	<1	<1	<1
free ammonia mg/l	<0.04	<0.04	<0.04	<0.04
nitrates "	2.6	1.8	1.7	0.8
MBAS "	<0.1	<0.1	<0.1	<0.1
pH	5.7	5.2	5.6	5.8
specific conductivity	118	136	107	106
chlorides mg/l	15.	23.	15.	17.
sulfates "	9.	11	9.	9.
iron "	0.15	<0.1	<0.1	<0.1
manganese "	<0.05	<0.05	<0.05	<0.05
copper "	0.20	<0.1	0.23	0.25
zinc "	2.4	<0.4	<0.4	0.6
sodium "	9.4	16.5	9.2	11.1
magnesium "				
phosphorous "				
cadmium ug/l				
silver "				
lead "				
chromium "				
arsenic "				
selenium "				
methylene chloride ug/l				
bromochloromethane "				
1,1 dichloroethane "				
trans dichloroetyhlene				
chloroform ug/l	<5	<5	<5	<5
1,2 dichloroethane "				
1,1,1 trichloroethane	<2	<2	<2	<2
carbon tetrachloride	<1	<1	<1	<1
1 bromo 2 chloroethane				
1,2 dichloropropane				
1,1,2 trichloroethylene	<5	<5	<5	<5
chlorodibromomethane	<2	<2	<2	<2
1,2 dibromoethane ug/l				
bromoform ug/l	<5	<5	<5	<5
tetrachloroethylene "	<2	<2	<2	<2
cis dichloroethylene				
freon 113 "	<4	<4	<4	<4
dibromomethane "				
1,1 dichloroethylene				
bromodichloromethane	<3	<3	<3	<3
benzene ug/l	<5	<5	<5	<5
toluene "	<5	<5	<5	<5
total xylenes "	<5	<5	<5	<5
chlorobenzene "	<6	<6	<6	<6
ethylbenzene "	<5	<5	<5	<5
bromobenzene "	<8	<8	<8	<8
total chlorotoluene "	<6	<6	<6	<6
m-dichlorobenzene "	<7	<7	<7	<7
o-dichlorobenzene "	<7	<7	<7	<7
1,2,4 trimethylbenzene	<5	<5	<5	<5
1,3,5 trimethylbenzene	<5	<5	<5	<5
2,3 dichloropropene "				
1,1,2 trichloroethane				

p.15 of 30

	V. Kommer 14 Hampton 29' 4/12/82	P. Shaw 156 Brook 4/12/82		
coliform /100 ml	<1	<2.2		
free ammonia mg/l	<0.04	0.35		
nitrates "	0.5	1.5		
MBAS "	<0.1	<0.1		
pH	5.0	6.5		
specific conductivity	185	125		
chlorides mg/l	37.	16.		
sulfates "	18.	7.		
iron "	0.22	2.07		
manganese "	0.05	<0.05		
copper "	<0.10	0.18		
zinc "	0.8	3.2		
sodium "	24.1	10.4		
magnesium "				
phosphorous "				
cadmium ug/l				
silver "				
lead "				
chromium "				
arsenic "				
selenium "				
methylene chloride ug/l				
bromochloromethane "				
1,1 dichloroethane "				
trans dichloroetyhlene				
chloroform ug/l	<5	<5		
1,2 dichloroethane "				
1,1,1 trichloroethane	<2	<2		
carbon tetrachloride	<1	<1		
1 bromo 2 chloroethane				
1,2 dichloropropane				
1,1,2 trichloroethylene	<5	<5		
chlorodibromomethane	<2	<2		
1,2 dibromoethane ug/l				
bromoform ug/l	<5	<5		
tetrachloroethylene "	<2	<2		
cis dichloroethylene				
freon 113 "	<4	<4		
dibromomethane "				
1,1 dichloroethylene				
bromodichloromethane	<3	<3		
benzene ug/l	<5	<5		
toluene "	<5	<5		
total xylenes "	<5	<5		
chlorobenzene "	<6	<6		
ethylbenzene "	<5	<5		
bromobenzene "	<4	<8		
total chlorotoluene "	<6	<6		
m-dichlorobenzene "	<7	<7		
o-dichlorobenzene "	<7	<7		
1,2,4 trimethylbenzene	<5	<5		
1,3,5 trimethylbenzene	<5	<5		
2,3 dichloropropene "	<2			
1,1,2 trichloroethane	<2			

Betz 11 Hampton St

VOLATILE COMPOUNDS Parameter (µg/l):	Method No.	CAS No.	Detection Limit (µg/l)	Found (µg/l)
Acrolein	603, 624	107-02-8	100	< 100
Acrylonitrile	603, 624	107-13-1	100	< 100
Benzene	624	71-43-2	10	< 10
Bromodichloromethane	624	75-27-4	10	< 10
Bromoform	624	75-25-2	10	< 10
Bromomethane	624	74-83-9	10	< 10
Carbon Tetrachloride	624	56-23-5	10	< 10
Chlorobenzene	624	108-90-7	10	< 10
Chlorodibromomethane	624	124-48-1	10	< 10
Chloroethane	624	75-00-3	10	< 10
2-Chloroethyl vinyl ether	624	110-75-8	10	< 10
Chloroform	624	67-66-3	10	< 10
Chloromethane	624	74-87-3	10	< 10
Dichlorodifluoromethane	624	-	10	< 10
1,1-Dichloroethane	624	75-34-3	10	< 10
1,2-Dichloroethane	624	107-06-2	10	< 10
1,1-Dichloroethylene	624	75-35-4	10	< 10
Trans, 1,2-Dichloroethylene	624	156-60-5	10	< 10
1,2-Dichloropropane	624	78-87-5	10	< 10
1,3-Dichloropropene	624	10061-02-6	10	< 10
Ethylbenzene	624	100-41-4	10	< 10
Methylene Chloride	624	75-09-2	10	< 10
1,1,2,2-Tetrachloroethane	624	79-34-5	10	< 10
Tetrachloroethylene	624	127-18-4	10	< 10
Toluene	624	108-88-3	10	< 10
1,1,1-Trichloroethane	624	71-55-6	10	< 10
1,1,2-Trichloroethane	624	79-00-5	10	< 10
Trichloroethylene	624	79-01-6	10	< 10
Trichlorofluoromethane	624	-	10	< 10
Vinyl chloride	624	75-01-4	10	< 10
Carbon Disulfide	-	-	-	Present
Methylcyclopentane	-	-	-	Present
3-methylpentane	-	-	-	Present
Hexane	-	-	-	Present

< = Less than, None detected

NEW YORK TESTING LABORATORIES, INC. p17/18

 Sample: RO-25-01 Lab No. 82-64452 (A-1)

O'Brien 37 Hampton St

VOLATILE COMPOUNDS Parameter (µg/l):	Method No.	CAS No.	Detection Limit (µg/l)	Found (µg/l)
Acrolein	603, 624	107-02-8	100	< 100
Acrylonitrile	603, 624	107-13-1	100	< 100
Benzene	624	71-43-2	10	< 10
Bromodichloromethane	624	75-27-4	10	< 10
Bromoform	624	75-25-2	10	< 10
Bromomethane	624	74-83-9	10	< 10
Carbon Tetrachloride	624	56-23-5	10	< 10
Chlorobenzene	624	108-90-7	10	< 10
Chlorodibromomethane	624	124-48-1	10	< 10
Chloroethane	624	75-00-3	10	< 10
2-Chloroethyl vinyl ether	624	110-75-8	10	< 10
Chloroform	624	67-66-3	10	< 10
Chloromethane	624	74-87-3	10	< 10
Dichlorodifluoromethane	624	-	10	< 10
1,1-Dichloroethane	624	75-34-3	10	< 10
1,2-Dichloroethane	624	107-06-2	10	< 10
1,1-Dichloroethylene	624	75-35-4	10	< 10
Trans, 1,2-Dichloroethylene	624	156-60-5	10	< 10
1,2-Dichloropropane	624	78-87-5	10	< 10
1,3-Dichloropropene	624	10061-02-6	10	< 10
Ethylbenzene	624	100-41-4	10	< 10
Methylene Chloride	624	75-09-2	10	< 10
1,1,2,2-Tetrachloroethane	624	79-34-5	10	< 10
Tetrachloroethylene	624	127-18-4	10	< 10
Toluene	624	108-88-3	10	< 10
1,1,1-Trichloroethane	624	71-55-6	10	< 10
1,1,2-Trichloroethane	624	79-00-5	10	< 10
Trichloroethylene	624	79-01-6	10	< 10
Trichlorofluoromethane	624	-	10	< 10
Vinyl chloride	624	75-01-4	10	< 10
2,4-dimethyl-3-pentanone	-	-	-	Present

< = Less than, None detected

p. 18 of 38

NEW YORK TESTING LABORATORIES, INC.

 Sample: RO-26-01 **Lab No.** 82-64452 (A-1)

D. White 44 Franklin Ave resampled 4/20

VOLATILE COMPOUNDS

Parameter (µg/l):	Method No.	CAS No.	Detection Limit (µg/l)	Found (µg/l)
Acrolein	603, 624	107-02-8	100	< 100
Acrylonitrile	603, 624	107-13-1	100	< 100
Benzene	624	71-43-2	10	< 10
Bromodichloromethane	624	75-27-4	10	< 10
Bromoform	624	75-25-2	10	< 10
Bromomethane	624	74-83-9	10	< 10
Carbon Tetrachloride	624	56-23-5	10	< 10
Chlorobenzene	624	108-90-7	10	< 10
Chlorodibromomethane	624	124-48-1	10	< 10
Chloroethane	624	75-00-3	10	< 10
2-Chloroethyl vinyl ether	624	110-75-8	10	< 10
Chloroform	624	67-66-3	10	< 10
Chloromethane	624	74-87-3	10	< 10
Dichlorodifluoromethane	624	-	10	< 10
1,1-Dichloroethane	624	75-34-3	10	< 10
1,2-Dichloroethane	624	107-06-2	10	< 10
1,1-Dichloroethylene	624	75-35-4	10	< 10
Trans, 1,2-Dichloroethylene	624	156-60-5	10	< 10
1,2-Dichloropropane	624	78-87-5	10	< 10
1,3-Dichloropropene	624	10061-02-6	10	< 10
Ethylbenzene	624	100-41-4	10	< 10
Methylene Chloride	624	75-09-2	10	30.6
1,1,2,2-Tetrachloroethane	624	79-34-5	10	< 10
Tetrachloroethylene	624	127-18-4	10	< 10
Toluene	624	108-88-3	10	< 10
1,1,1-Trichloroethane	624	71-55-6	10	< 10
1,1,2-Trichloroethane	624	79-00-5	10	< 10
Trichloroethylene	624	79-01-6	10	< 10
Trichlorofluoromethane	624	-	10	< 10
Vinyl chloride	624	75-01-4	10	< 10
Methylcyclopentane	-	-	-	Present
Hexane	-	-	-	Present
2,4-dimethyl-3-pentanone	-	-	-	Present

< = Less than, None detected

NEW YORK TESTING LABORATORIES, INC.

 Sample: RO-27-01 Lab No. 82-64452 (A-1)

F C White Box 1012 Franklin AV

VOLATILE COMPOUNDS

Parameter (µg/l):	Method No.	CAS No.	Detection Limit (µg/l)	Found (µg/l)
Acrolein	603, 624	107-02-8	100	< 100
Acrylonitrile	603, 624	107-13-1	100	< 100
Benzene	624	71-43-2	10	< 10
Bromodichloromethane	624	75-27-4	10	< 10
Bromoform	624	75-25-2	10	< 10
Bromomethane	624	74-83-9	10	< 10
Carbon Tetrachloride	624	56-23-5	10	< 10
Chlorobenzene	624	108-90-7	10	< 10
Chlorodibromomethane	624	124-48-1	10	< 10
Chloroethane	624	75-00-3	10	< 10
2-Chloroethyl vinyl ether	624	110-75-8	10	< 10
Chloroform	624	67-66-3	10	< 10
Chloromethane	624	74-87-3	10	< 10
Dichlorodifluoromethane	624	-	10	< 10
1,1-Dichloroethane	624	75-34-3	10	< 10
1,2-Dichloroethane	624	107-06-2	10	< 10
1,1-Dichloroethylene	624	75-35-4	10	< 10
Trans, 1,2-Dichloroethylene	624	156-60-5	10	< 10
1,2-Dichloropropane	624	78-87-5	10	< 10
1,3-Dichloropropene	624	10061-02-6	10	< 10
Ethylbenzene	624	100-41-4	10	< 10
Methylene Chloride	624	75-09-2	10	< 10
1,1,2,2-Tetrachloroethane	624	79-34-5	10	< 10
Tetrachloroethylene	624	127-18-4	10	< 10
Toluene	624	108-88-3	10	< 10
1,1,1-Trichloroethane	624	71-55-6	10	< 10
1,1,2-Trichloroethane	624	79-00-5	10	< 10
Trichloroethylene	624	79-01-6	10	< 10
Trichlorofluoromethane	624	-	10	< 10
Vinyl chloride	624	75-01-4	10	< 10

< = Less than, None detected

NEW YORK TESTING LABORATORIES, INC.

 Sample: R-28-01 Lab No. 82-64452 (A-1)

Fisher 60 Franklin Ave

VOLATILE COMPOUNDS

Parameter (µg/l):	Method No.	CAS No.	Detection Limit (µg/l)	Found (µg/l)
Acrolein	603, 624	107-02-8	100	< 100
Acrylonitrile	603, 624	107-13-1	100	< 100
Benzene	624	71-43-2	10	< 10
Bromodichloromethane	624	75-27-4	10	< 10
Bromoform	624	75-25-2	10	< 10
Bromomethane	624	74-83-9	10	< 10
Carbon Tetrachloride	624	56-23-5	10	< 10
Chlorobenzene	624	108-90-7	10	< 10
Chlorodibromomethane	624	124-48-1	10	< 10
Chloroethane	624	75-00-3	10	< 10
2-Chloroethyl vinyl ether	624	110-75-8	10	< 10
Chloroform	624	67-66-3	10	< 10
Chloromethane	624	74-87-3	10	< 10
Dichlorodifluoromethane	624	-	10	< 10
1,1-Dichloroethane	624	75-34-3	10	< 10
1,2-Dichloroethane	624	107-06-2	10	< 10
1,1-Dichloroethylene	624	75-35-4	10	< 10
Trans, 1,2-Dichloroethylene	624	156-60-5	10	< 10
1,2-Dichloropropane	624	78-87-5	10	< 10
1,3-Dichloropropene	624	10061-02-6	10	< 10
Ethylbenzene	624	100-41-4	10	< 10
Methylene Chloride	624	75-09-2	10	< 10
1,1,2,2-Tetrachloroethane	624	79-34-5	10	< 10
Tetrachloroethylene	624	127-18-4	10	< 10
Toluene	624	108-88-3	10	< 10
1,1,1-Trichloroethane	624	71-55-6	10	< 10
1,1,2-Trichloroethane	624	79-00-5	10	< 10
Trichloroethylene	624	79-01-6	10	< 10
Trichlorofluoromethane	624	-	10	< 10
Vinyl chloride	624	75-01-4	10	< 10

< = Less than, None detected

VOLATILE COMPOUNDS

Parameter (ug/l)	Method No.	CAS No.	Detection Limit (ug/l)	Found (ug/l)
Acetone	-	-	-	Present
Diethyl ether	-	-	-	Present
Hexane	-	-	-	Present
2-methyl-3-pentanone	-	-	-	Present
2,4-dimethyl-3-pentanone	-	-	-	Present

NEW YORK TESTING LABORATORIES, INC.

p. 22/8

 Sample: RO-32-01 Lab No. 82-64452 (A-1)

Laird John St

VOLATILE COMPOUNDS

arameter (µg/l):	Method No.	CAS No.	Detection Limit (µg/l)	Found (µg/l)
Acrolein	603, 624	107-02-8	100	< 100
crylonitrile	603, 624	107-13-1	100	< 100
Benzene	624	71-43-2	10	< 10
romodichloromethane	624	75-27-4	10	< 10
Bromoform	624	75-25-2	10	< 10
romomethane	624	74-83-9	10	< 10
Carbon Tetrachloride	624	56-23-5	10	< 10
Chlorobenzene	624	108-90-7	10	< 10
hlorodibromomethane	624	124-48-1	10	< 10
Chloroethane	624	75-00-3	10	< 10
-Chloroethyl vinyl ether	624	110-75-8	10	< 10
Chloroform	624	67-66-3	10	< 10
hloromethane	624	74-87-3	10	< 10
Dichlorodifluoromethane	624	-	10	< 10
,1-Dichloroethane	624	75-34-3	10	< 10
1,2-Dichloroethane	624	107-06-2	10	< 10
,1-Dichloroethylene	624	75-35-4	10	< 10
rans, 1,2-Dichloroethylene	624	156-60-5	10	< 10
,2-Dichloropropane	624	78-87-5	10	< 10
,3-Dichloropropene	624	10061-02-6	10	< 10
Ethylbenzene	624	100-41-4	10	< 10
Methylene Chloride	624	75-09-2	10	< 10
1,1,2,2-Tetrachloroethane	624	79-34-5	10	< 10
Tetrachloroethylene	624	127-18-4	10	< 10
Toluene	624	108-88-3	10	< 10
1,1,1-Trichloroethane	624	71-55-6	10	< 10
1,1,2-Trichloroethane	624	79-00-5	10	< 10
Trichloroethylene	624	79-01-6	10	< 10
Trichlorofluoromethane	624	-	10	< 10
Vinyl chloride	624	75-01-4	10	< 10

< = Less than, None detected

NEW YORK TESTING LABORATORIES, INC.

p23 of 38

Page 13. Sample: RO-33-01 **Lab No.** 82-64452 (A-1)

Fitzharris N Ocame

VOLATILE COMPOUNDS

Parameter (µg/l):	Method No.	CAS No.	Detection Limit (µg/l)	Found (µg/l)
Acrolein	603, 624	107-02-8	100	< 100
Acrylonitrile	603, 624	107-13-1	100	< 100
Benzene	624	71-43-2	10	< 10
Bromodichloromethane	624	75-27-4	10	< 10
Bromoform	624	75-25-2	10	< 10
Bromomethane	624	74-83-9	10	< 10
Carbon Tetrachloride	624	56-23-5	10	< 10
Chlorobenzene	624	108-90-7	10	< 10
Chlorodibromomethane	624	124-48-1	10	< 10
Chloroethane	624	75-00-3	10	< 10
2-Chloroethyl vinyl ether	624	110-75-8	10	< 10
Chloroform	624	67-66-3	10	< 10
Chloromethane	624	74-87-3	10	< 10
Dichlorodifluoromethane	624	-	10	< 10
1,1-Dichloroethane	624	75-34-3	10	< 10
1,2-Dichloroethane	624	107-06-2	10	< 10
1,1-Dichloroethylene	624	75-35-4	10	< 10
Trans, 1,2-Dichloroethylene	624	156-60-5	10	< 10
1,2-Dichloropropane	624	78-87-5	10	< 10
1,3-Dichloropropene	624	10061-02-6	10	< 10
Ethylbenzene	624	100-41-4	10	< 10
Methylene Chloride	624	75-09-2	10	< 10
1,1,2,2-Tetrachloroethane	624	79-34-5	10	< 10
Tetrachloroethylene	624	127-18-4	10	< 10
Toluene	624	108-88-3	10	< 10
1,1,1-Trichloroethane	624	71-55-6	10	< 10
1,1,2-Trichloroethane	624	79-00-5	10	< 10
Trichloroethylene	624	79-01-6	10	< 10
Trichlorofluoromethane	624	-	10	< 10
Vinyl chloride	624	75-01-4	10	< 10

< = Less than, None detected

NEW YORK TESTING LABORATORIES, INC. p21/38

Page 14. Sample: RO-34-01 **Lab No.** 82-64452 (A-1)

Boyd 3 Ocame [illegible]

VOLATILE COMPOUNDS

Parameter (µg/l):	Method No.	CAS No.	Detection Limit (µg/l)	Found (µg/l)
Acrolein	603, 624	107-02-8	100	< 100
Acrylonitrile	603, 624	107-13-1	100	< 100
Benzene	624	71-43-2	10	< 10
Bromodichloromethane	624	75-27-4	10	< 10
Bromoform	624	75-25-2	10	< 10
Bromomethane	624	74-83-9	10	< 10
Carbon Tetrachloride	624	56-23-5	10	< 10
Chlorobenzene	624	108-90-7	10	< 10
Chlorodibromomethane	624	124-48-1	10	< 10
Chloroethane	624	75-00-3	10	< 10
2-Chloroethyl vinyl ether	624	110-75-8	10	< 10
Chloroform	624	67-66-3	10	< 10
Chloromethane	624	74-87-3	10	< 10
Dichlorodifluoromethane	624	-	10	< 10
1,1-Dichloroethane	624	75-34-3	10	< 10
1,2-Dichloroethane	624	107-06-2	10	< 10
1,1-Dichloroethylene	624	75-35-4	10	< 10
Trans, 1,2-Dichloroethylene	624	156-60-5	10	< 10
1,2-Dichloropropane	624	78-87-5	10	< 10
1,3-Dichloropropene	624	10061-02-6	10	< 10
Ethylbenzene	624	100-41-4	10	< 10
Methylene Chloride	624	75-09-2	10	21.0
1,1,2,2-Tetrachloroethane	624	79-34-5	10	< 10
Tetrachloroethylene	624	127-18-4	10	< 10
Toluene	624	108-88-3	10	< 10
1,1,1-Trichloroethane	624	71-55-6	10	< 10
1,1,2-Trichloroethane	624	79-00-5	10	< 10
Trichloroethylene	624	79-01-6	10	< 10
Trichlorofluoromethane	624	-	10	< 10
Vinyl chloride	624	75-01-4	10	< 10

< = Less than, None detected

NEW YORK TESTING LABORATORIES, INC. p25 of 38

 Sample: RO-35-01 **Lab No.** 82-64452 (A-1)

Mayo 53 Meeting House Rd

VOLATILE COMPOUNDS

Parameter (µg/l):	Method No.	CAS No.	Detection Limit (µg/l)	Found (µg/l)
Acrolein	603, 624	107-02-8	100	< 100
Acrylonitrile	603, 624	107-13-1	100	< 100
Benzene	624	71-43-2	10	< 10
Bromodichloromethane	624	75-27-4	10	< 10
Bromoform	624	75-25-2	10	< 10
Bromomethane	624	74-83-9	10	< 10
Carbon Tetrachloride	624	56-23-5	10	< 10
Chlorobenzene	624	108-90-7	10	< 10
Chlorodibromomethane	624	124-48-1	10	< 10
Chloroethane	624	75-00-3	10	< 10
2-Chloroethyl vinyl ether	624	110-75-8	10	< 10
Chloroform	624	67-66-3	10	< 10
Chloromethane	624	74-87-3	10	< 10
Dichlorodifluoromethane	624	-	10	< 10
1,1-Dichloroethane	624	75-34-3	10	< 10
1,2-Dichloroethane	624	107-06-2	10	< 10
1,1-Dichloroethylene	624	75-35-4	10	< 10
Trans, 1,2-Dichloroethylene	624	156-60-5	10	< 10
1,2-Dichloropropane	624	78-87-5	10	< 10
1,3-Dichloropropene	624	10061-02-6	10	< 10
Ethylbenzene	624	100-41-4	10	< 10
Methylene Chloride	624	75-09-2	10	< 10
1,1,2,2-Tetrachloroethane	624	79-34-5	10	< 10
Tetrachloroethylene	624	127-18-4	10	< 10
Toluene	624	108-88-3	10	< 10
1,1,1-Trichloroethane	624	71-55-6	10	< 10
1,1,2-Trichloroethane	624	79-00-5	10	< 10
Trichloroethylene	624	79-01-6	10	< 10
Trichlorofluoromethane	624	-	10	< 10
Vinyl chloride	624	75-01-4	10	< 10

< = Less than, None detected

NEW YORK TESTING LABORATORIES, INC.

Page 16. Sample: RO-36-01 **Lab No.** 82-64452 (A-1)

Northington 51 Meeting House

VOLATILE COMPOUNDS

Parameter (μg/l):	Method No.	CAS No.	Detection Limit (μg/l)	Found (μg/l)
Acrolein	603, 624	107-02-8	100	< 100
Acrylonitrile	603, 624	107-13-1	100	< 100
Benzene	624	71-43-2	10	< 10
Bromodichloromethane	624	75-27-4	10	< 10
Bromoform	624	75-25-2	10	< 10
Bromomethane	624	74-83-9	10	< 10
Carbon Tetrachloride	624	56-23-5	10	< 10
Chlorobenzene	624	108-90-7	10	< 10
Chlorodibromomethane	624	124-48-1	10	< 10
Chloroethane	624	75-00-3	10	< 10
2-Chloroethyl vinyl ether	624	110-75-8	10	< 10
Chloroform	624	67-66-3	10	< 10
Chloromethane	624	74-87-3	10	< 10
Dichlorodifluoromethane	624	-	10	< 10
1,1-Dichloroethane	624	75-34-3	10	< 10
1,2-Dichloroethane	624	107-06-2	10	< 10
1,1-Dichloroethylene	624	75-35-4	10	< 10
Trans, 1,2-Dichloroethylene	624	156-60-5	10	< 10
1,2-Dichloropropane	624	78-87-5	10	< 10
1,3-Dichloropropene	624	10061-02-6	10	< 10
Ethylbenzene	624	100-41-4	10	< 10
Methylene Chloride	624	75-09-2	10	< 10
1,1,2,2-Tetrachloroethane	624	79-34-5	10	< 10
Tetrachloroethylene	624	127-18-4	10	13.5
Toluene	624	108-88-3	10	< 10
1,1,1-Trichloroethane	624	71-55-6	10	< 10
1,1,2-Trichloroethane	624	79-00-5	10	< 10
Trichloroethylene	624	79-01-6	10	< 10
Trichlorofluoromethane	624	-	10	< 10
Vinyl chloride	624	75-01-4	10	< 10

< = Less than, None detected

NEW YORK TESTING LABORATORIES, INC.

p27 of 38

Page 17. Sample: RO-37-01 Lab No. 82-64452 (A-1)

Shultz 48 Meeting House Nsampled 4/22

VOLATILE COMPOUNDS

Parameter (µg/l):	Method No.	CAS No.	Detection Limit (µg/l)	Found (µg/l)
Acrolein	603, 624	107-02-8	100	< 100
Acrylonitrile	603, 624	107-13-1	100	< 100
Benzene	624	71-43-2	10	< 10
Bromodichloromethane	624	75-27-4	10	< 10
Bromoform	624	75-25-2	10	< 10
Bromomethane	624	74-83-9	10	< 10
Carbon Tetrachloride	624	56-23-5	10	< 10
Chlorobenzene	624	108-90-7	10	< 10
Chlorodibromomethane	624	124-48-1	10	< 10
Chloroethane	624	75-00-3	10	< 10
2-Chloroethyl vinyl ether	624	110-75-8	10	< 10
Chloroform	624	67-66-3	10	< 10
Chloromethane	624	74-87-3	10	< 10
Dichlorodifluoromethane	624	-	10	< 10
1,1-Dichloroethane	624	75-34-3	10	< 10
1,2-Dichloroethane	624	107-06-2	10	< 10
1,1-Dichloroethylene	624	75-35-4	10	< 10
Trans, 1,2-Dichloroethylene	624	156-60-5	10	< 10
1,2-Dichloropropane	624	78-87-5	10	< 10
1,3-Dichloropropene	624	10061-02-6	10	< 10
Ethylbenzene	624	100-41-4	10	< 10
Methylene Chloride	624	75-09-2	10	54.6
1,1,2,2-Tetrachloroethane	624	79-34-5	10	< 10
Tetrachloroethylene	624	127-18-4	10	< 10
Toluene	624	108-88-3	10	< 10
1,1,1-Trichloroethane	624	71-55-6	10	< 10
1,1,2-Trichloroethane	624	79-00-5	10	< 10
Trichloroethylene	624	79-01-6	10	< 10
Trichlorofluoromethane	624	-	10	< 10
Vinyl chloride	624	75-01-4	10	< 10
Diethyl ether	-	-	-	Present

< = Less than, None detected

NEW YORK TESTING LABORATORIES, INC.

 Sample: RO-38-01 Lab No. 82-64452 (A-1)

Smiley 40 Meeting House

VOLATILE COMPOUNDS

Parameter (µg/l):	Method No.	CAS No.	Detection Limit (µg/l)	Found (µg/l)
Acrolein	603, 624	107-02-8	100	< 100
Acrylonitrile	603, 624	107-13-1	100	< 100
Benzene	624	71-43-2	10	< 10
Bromodichloromethane	624	75-27-4	10	< 10
Bromoform	624	75-25-2	10	< 10
Bromomethane	624	74-83-9	10	< 10
Carbon Tetrachloride	624	56-23-5	10	< 10
Chlorobenzene	624	108-90-7	10	< 10
Chlorodibromomethane	624	124-48-1	10	< 10
Chloroethane	624	75-00-3	10	< 10
2-Chloroethyl vinyl ether	624	110-75-8	10	< 10
Chloroform	624	67-66-3	10	< 10
Chloromethane	624	74-87-3	10	< 10
Dichlorodifluoromethane	624	-	10	< 10
1,1-Dichloroethane	624	75-34-3	10	< 10
1,2-Dichloroethane	624	107-06-2	10	< 10
1,1-Dichloroethylene	624	75-35-4	10	< 10
Trans, 1,2-Dichloroethylene	624	156-60-5	10	< 10
1,2-Dichloropropane	624	78-87-5	10	< 10
1,3-Dichloropropene	624	10061-02-6	10	< 10
Ethylbenzene	624	100-41-4	10	< 10
Methylene Chloride	624	75-09-2	10	< 10
1,1,2,2-Tetrachloroethane	624	79-34-5	10	< 10
Tetrachloroethylene	624	127-18-4	10	< 10
Toluene	624	108-88-3	10	< 10
1,1,1-Trichloroethane	624	71-55-6	10	< 10
1,1,2-Trichloroethane	624	79-00-5	10	< 10
Trichloroethylene	624	79-01-6	10	< 10
Trichlorofluoromethane	624	-	10	< 10
Vinyl chloride	624	75-01-4	10	< 10
2,4-dimethyl-3-pentanone	-	-	-	Present

< = Less than, None detected

NEW YORK TESTING LABORATORIES, INC.

p.29/138

Page 19. Sample: RO-39-01 Lab No. 82-84452 (A-1)

Fitzhugh 22 Meeting House

VOLATILE COMPOUNDS

arameter (µg/l):	Method No.	CAS No.	Detection Limit (µg/l)	Found (µg/l)
Acrolein	603, 624	107-02-8	100	< 100
:rylonitrile	603, 624	107-13-1	100	< 100
Benzene	624	71-43-2	10	< 10
romodichloromethane	624	75-27-4	10	< 10
Bromoform	624	75-25-2	10	< 10
romomethane	624	74-83-9	10	< 10
arbon Tetrachloride	624	56-23-5	10	< 10
Chlorobenzene	624	108-90-7	10	< 10
hlorodibromomethane	624	124-48-1	10	< 10
Chloroethane	624	75-00-3	10	< 10
-Chloroethyl vinyl ether	624	110-75-8	10	< 10
Chloroform	624	67-66-3	10	< 10
hloromethane	624	74-87-3	10	< 10
Dichlorodifluoromethane	624	-	10	< 10
,1-Dichloroethane	624	75-34-3	10	< 10
.,2-Dichloroethane	624	107-06-2	10	< 10
,1-Dichloroethylene	624	75-35-4	10	< 10
rans, 1,2-Dichloroethylene	624	156-60-5	10	< 10
1,2-Dichloropropane	624	78-87-5	10	< 10
,3-Dichloropropene	624	10061-02-6	10	< 10
Ethylbenzene	624	100-41-4	10	< 10
ethylene Chloride	624	75-09-2	10	< 10
1,1,2,2-Tetrachloroethane	624	79-34-5	10	< 10
etrachloroethylene	624	127-18-4	10	< 10
Toluene	624	108-88-3	10	< 10
1,1,1-Trichloroethane	624	71-55-6	10	< 10
1,1,2-Trichloroethane	624	79-00-5	10	< 10
Trichloroethylene	624	79-01-6	10	< 10
Trichlorofluoromethane	624	-	10	< 10
Vinyl chloride	624	75-01-4	10	< 10

< = Less than, None detected

NEW YORK TESTING LABORATORIES, INC. 0.30/18

Page 20. **Sample:** RO-40-01 **Lab No.** 82-64452 (A-1)

Beczak 152 Brook Rd

VOLATILE COMPOUNDS

Parameter (µg/l):	Method No.	CAS No.	Detection Limit (µg/l)	Found (µg/l)
Acrolein	603, 624	107-02-8	100	< 100
:rylonitrile	603, 624	107-13-1	100	< 100
Benzene	624	71-43-2	10	< 10
romodichloromethane	624	75-27-4	10	< 10
Bromoform	624	75-25-2	10	< 10
[redacted]romomethane	624	74-83-9	10	< 10
Carbon Tetrachloride	624	56-23-5	10	< 10
hlorobenzene	624	108-90-7	10	< 10
hlorodibromomethane	624	124-48-1	10	< 10
Chloroethane	624	75-00-3	10	< 10
-Chloroethyl vinyl ether	624	110-75-8	10	< 10
Chloroform	624	67-66-3	10	< 10
hloromethane	624	74-87-3	10	< 10
Dichlorodifluoromethane	624	-	10	< 10
,1-Dichloroethane	624	75-34-3	10	< 10
1,2-Dichloroethane	624	107-06-2	10	< 10
,1-Dichloroethylene	624	75-35-4	10	< 10
rans, 1,2-Dichloroethylene	624	156-60-5	10	< 10
,2-Dichloropropane	624	78-87-5	10	< 10
,3-Dichloropropene	624	10061-02-6	10	< 10
Ethylbenzene	624	100-41-4	10	< 10
lethylene Chloride	624	75-09-2	10	< 10
1,1,2,2-Tetrachloroethane	624	79-34-5	10	< 10
etrachloroethylene	624	127-18-4	10	< 10
Toluene	624	108-88-3	10	< 10
1,1,1-Trichloroethane	624	71-55-6	10	< 10
1,1,2-Trichloroethane	624	79-00-5	10	< 10
Trichloroethylene	624	79-01-6	10	< 10
Trichlorofluoromethane	624	-	10	< 10
Vinyl chloride	624	75-01-4	10	< 10
2,4-dimethyl-3-pentanone	-	-	-	Present

< = Less than, None detected

NEW YORK TESTING LABORATORIES, INC. p.31 of 38

 Sample: RO-41-01 Lab No. 82-64452 (A-1)

Rogers 153 Brook

VOLATILE COMPOUNDS

Parameter (µg/l):	Method No.	CAS No.	Detection Limit (µg/l)	Found (µg/l)
Acrolein	603, 624	107-02-8	100	< 100
Acrylonitrile	603, 624	107-13-1	100	< 100
Benzene	624	71-43-2	10	< 10
Bromodichloromethane	624	75-27-4	10	< 10
Bromoform	624	75-25-2	10	< 10
Bromomethane	624	74-83-9	10	< 10
Carbon Tetrachloride	624	56-23-5	10	< 10
Chlorobenzene	624	108-90-7	10	< 10
Chlorodibromomethane	624	124-48-1	10	< 10
Chloroethane	624	75-00-3	10	< 10
2-Chloroethyl vinyl ether	624	110-75-8	10	< 10
Chloroform	624	67-66-3	10	< 10
Chloromethane	624	74-87-3	10	< 10
Dichlorodifluoromethane	624	-	10	< 10
1,1-Dichloroethane	624	75-34-3	10	< 10
1,2-Dichloroethane	624	107-06-2	10	< 10
1,1-Dichloroethylene	624	75-35-4	10	< 10
Trans, 1,2-Dichloroethylene	624	156-60-5	10	< 10
1,2-Dichloropropane	624	78-87-5	10	< 10
1,3-Dichloropropene	624	10061-02-6	10	< 10
Ethylbenzene	624	100-41-4	10	< 10
Methylene Chloride	624	75-09-2	10	< 10
1,1,2,2-Tetrachloroethane	624	79-34-5	10	< 10
Tetrachloroethylene	624	127-18-4	10	< 10
Toluene	624	108-88-3	10	< 10
1,1,1-Trichloroethane	624	71-55-6	10	< 10
1,1,2-Trichloroethane	624	79-00-5	10	< 10
Trichloroethylene	624	79-01-6	10	< 10
Trichlorofluoromethane	624	-	10	< 10
Vinyl chloride	624	75-01-4	10	< 10

< = Less than, None detected

NEW YORK TESTING LABORATORIES, INC. p. 32-13

Page 22. Sample: RO-42-01 Lab No. 82-64452 (A-1)

Kavan 147 Brook

LATILE COMPOUNDS

Parameter (µg/l):	Method No.	CAS No.	Detection Limit (µg/l)	Found (µg/l)
rolein	603, 624	107-02-8	100	< 100
Acrylonitrile	603, 624	107-13-1	100	< 100
nzene	624	71-43-2	10	< 10
Bromodichloromethane	624	75-27-4	10	< 10
omoform	624	75-25-2	10	< 10
Bromomethane	624	74-83-9	10	< 10
irbon Tetrachloride	624	56-23-5	10	< 10
unlorobenzene	624	108-90-7	10	< 10
ilorodibromomethane	624	124-48-1	10	< 10
iloroethane	624	75-00-3	10	< 10
2-Chloroethyl vinyl ether	624	110-75-8	10	< 10
iloroform	624	67-66-3	10	< 10
Chloromethane	624	74-87-3	10	< 10
ichlorodifluoromethane	624	-	10	< 10
1,1-Dichloroethane	624	75-34-3	10	< 10
,2-Dichloroethane	624	107-06-2	10	< 10
1,1-Dichloroethylene	624	75-35-4	10	< 10
rans, 1,2-Dichloroethylene	624	156-60-5	10	< 10
,2-Dichloropropane	624	78-87-5	10	< 10
,3-Dichloropropene	624	10061-02-6	10	< 10
thylbenzene	624	100-41-4	10	< 10
ethylene Chloride	624	75-09-2	10	< 10
,1,2,2-Tetrachloroethane	624	79-34-5	10	< 10
Tetrachloroethylene	624	127-18-4	10	< 10
oluene	624	108-88-3	10	< 10
1,1,1-Trichloroethane	624	71-55-6	10	< 10
,1,2-Trichloroethane	624	79-00-5	10	< 10
Trichloroethylene	624	79-01-6	10	< 10
richlorofluoromethane	624	-	10	< 10
Vinyl chloride	624	75-01-4	10	< 10
2,4-dimethyl-3-pentanone	-	-	-	Present

< = Less than, None detected

p.33/31

NEW YORK TESTING LABORATORIES, INC.

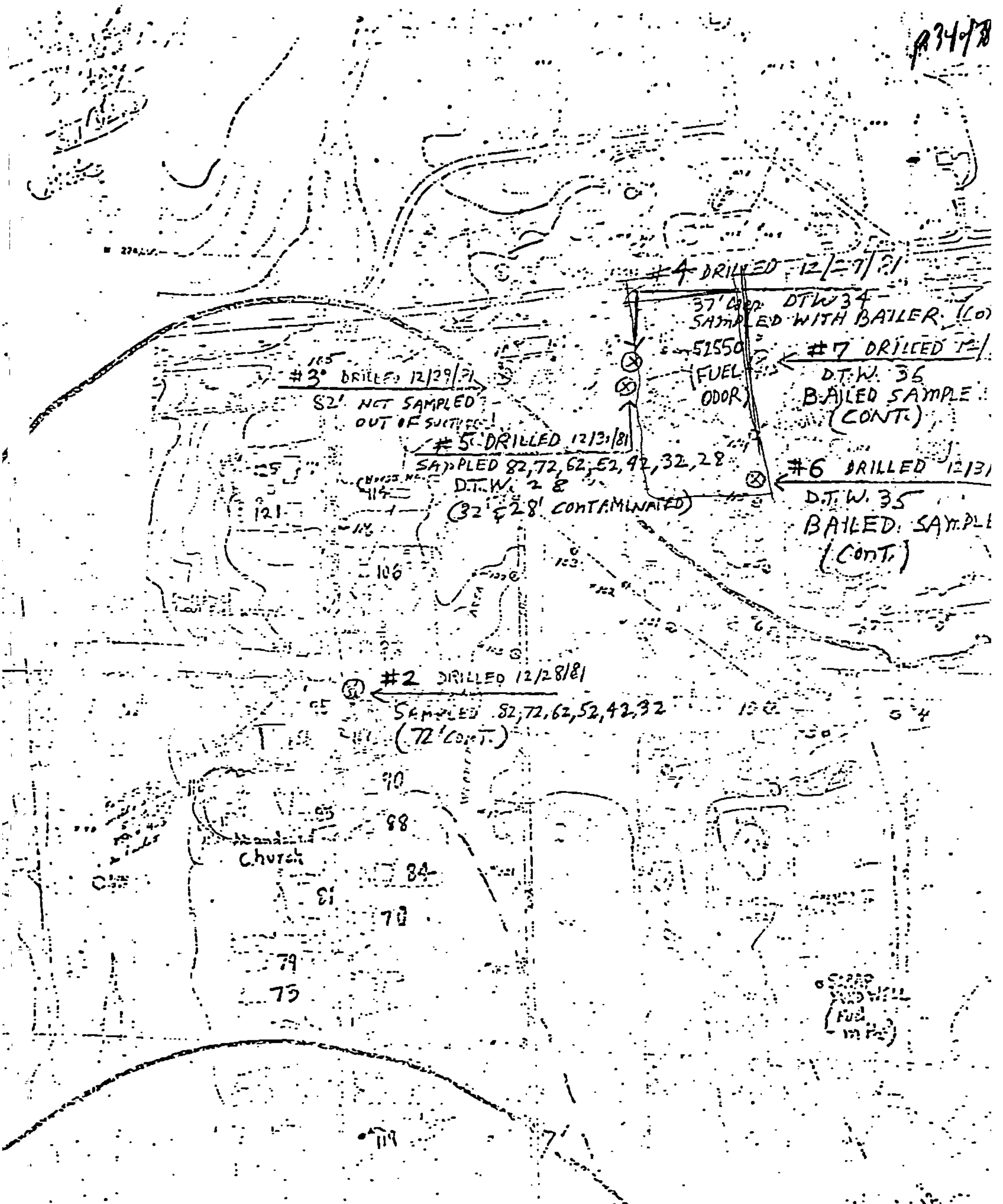
Page 23. Sample: RO-43-01 **Lab No.** 82-64452 (A-1)

Stanek 140 Brook

VOLATILE COMPOUNDS

arameter (µg/l):	Method No.	CAS No.	Detection Limit (µg/l)	Found (µg/l)
crolein	603, 624	107-02-8	100	< 100
crylonitrile	603, 624	107-13-1	100	< 100
enzene	624	71-43-2	10	< 10
romodichloromethane	624	75-27-4	10	< 10
Bromoform	624	75-25-2	10	< 10
romomethane	624	74-83-9	10	< 10
Carbon Tetrachloride	624	56-23-5	10	< 10
hlorobenzene	624	108-90-7	10	< 10
Chlorodibromomethane	624	124-48-1	10	< 10
hloroethane	624	75-00-3	10	< 10
-Chloroethyl vinyl ether	624	110-75-8	10	< 10
hloroform	624	67-66-3	10	< 10
hloromethane	624	74-87-3	10	< 10
ichlorodifluoromethane	624	-	10	< 10
,1-Dichloroethane	624	75-34-3	10	< 10
1,2-Dichloroethane	624	107-06-2	10	< 10
,1-Dichloroethylene	624	75-35-4	10	< 10
Trans, 1,2-Dichloroethylene	624	156-60-5	10	< 10
,2-Dichloropropane	624	78-87-5	10	< 10
1,3-Dichloropropene	624	10061-02-6	10	< 10
thylbenzene	624	100-41-4	10	< 10
ethylene Chloride	624	75-09-2	10	< 10
1,1,2,2-Tetrachloroethane	624	79-34-5	10	< 10
Tetrachloroethylene	624	127-18-4	10	< 10
Toluene	624	108-88-3	10	< 10
1,1,1-Trichloroethane	624	71-55-6	10	< 10
1,1,2-Trichloroethane	624	79-00-5	10	< 10
Trichloroethylene	624	79-01-6	10	< 10
Trichlorofluoromethane	624	-	10	< 10
Vinyl chloride	624	75-01-4	10	< 10
Acetone	-	-	-	Present
Hexane	-	-	-	Present

< = Less than, None detected



PETER'S LANE DRILLING INVESTIGATION

DEC 28 – DEC 31 1981

Lab No. 1201441
Field No. 5 — #5
Date 12-30-81
Time
Col. By HANSEN
(Name Not Initials)

Received in Lab
Public Water
Private Water
Other
Date Completed 3-2-82
Examined By

p.88

SUFFOLK COUNTY DEPARTMENT OF HEALTH SERVICES
DIVISION OF MEDICAL LEGAL INVESTIGATIONS & FORENSIC SCIENCES
PUBLIC HEALTH LABORATORY

N.Y. State Attorney General Office Trade Center

TRACE ORGANIC ANALYSIS OF WATER

Name SCDHS ([illegible]) Owner or District
Location Potters Ln, Westhampton
Point of Collection Well #5 #5 #1 Depth: 29 Ft.
Remarks: Results to Rich Immarker

	Compound	ppb		Compound	ppb
305	Methylene Chloride	<2	250	Benzene	2600
90	Bromochloromethane	<2	251	Toluene	3200
323	1,1 Dichloroethane	<2	254	o-Xylene	—
09	Trans Dichloroethylene	<2	252	m-Xylene	—
300	Chloroform	<2	253	p-Xylene	—
24	1,2 Dichloroethane	<2	255	Xylene (s)	3700
121	1,1,1 Trichloroethane	<2	[illegible]	Chlorobenzene	<180
04	Carbon Tetrachloride	<2		Ethylbenzene	660
94	1 Bromo-2-Chloroethane	<2		Bromobenzene	<160
405	1,2 Dichloropropane	<2		o-Chlorotoluene	<120
10	1,1,2 Trichloroethylene	<2		m-Chlorotoluene	<120
303	Chlorodibromomethane	<2		p-Chlorotoluene	<120
193	1,2 Dibromoethane	<2	265	Chlorotoluene (s)	—
	2-Bromo-1-Chloropropane	<2	415	m-Dichlorobenzene	<140
101	Bromoform	<2	412	o-Dichlorobenzene	<140
311	Tetrachloroethylene	<2	413	p-Dichlorobenzene	—
	Cis-Dichloroethylene	<2		1,2,4 Trimethylbenzene	980
				1,3,5 Trimethylbenzene	290
	Freon 113	<2		2,3 Dichloropropene	<2
	Dibromomethane	<2		1,1,2 Trichloroethane	<2
	1,1 Dichloroethylene	<2		1,1,1,2 Tetrachlorethane	<2
302	Bromodichloromethane	<2		1,2,2,3 Tetrachlorpropane	—

Lab No. ... 100...
Field No. S- #4
Date 12-30-81
Time
Coll By Hensla
(Name not Initials)

No. ...
Public Water
Private Water
Other
Date Completed 3-2-82
Examined By [illegible]

P3498

SUFFOLK COUNTY DEPARTMENT OF HEALTH SERVICES
DIVISION OF MEDICAL LEGAL INVESTIGATIONS & FORENSIC SCIENCES
PUBLIC HEALTH LABORATORY

TRACE ORGANIC ANALYSIS OF WATER

Name SCDHS (~~Tittle Study~~) Owner or District
Location Pistore's Lot. (Westhampton)
Point of Collection Well #5 #4 Depth 36 Ft.
Remarks: Results to Rich Wilker

	Compound	ppb		Compound	ppb
305	Methylene Chloride	<2	250	Benzene	1200
250	Bromochloromethane	<2	251	Toluene	4500
323	1,1 Dichloroethane	<2	254	o-Xylene	—
309	Trans Dichloroethylene	<2	252	m-Xylene	—
300	Chloroform	<2	253	p-Xylene	—
324	1,2 Dichloroethane	<2	255	Xylene (s)	6700
321	1,1,1 Trichloroethane	<2	25?	Chlorobenzene	<120
304	Carbon Tetrachloride	<2		Ethylbenzene	1000
294	1 Bromo-2-Chloroethane	<2		Bromobenzene	<160
405	1,2 Dichloropropane	<2		o-Chlorotoluene	<120
310	1,1,2 Trichloroethylene	<2		m-Chlorotoluene	<120
303	Chlorodibromomethane	<2		p-Chlorotoluene	<120
293	1,2 Dibromoethane	<2	265	Chlorotoluene (s)	—
	2-Bromo-1-Chloropropane	<2	415	m-Dichlorobenzene	<140
301	Bromoform	<2	412	o-Dichlorobenzene	<140
311	Tetrachloroethylene	<2	413	p-Dichlorobenzene	—
	Cis-Dichloroethylene	<2		1,2,4 Trimethylbenzene	2200
				1,3,5 Trimethyl Benzene	730
	Freon 113	<2		2,3 Dichloropropene	<2
	Dibromomethane	<2		1,1,2 Trichloroethane	<2
	1,1 Dichloroethylene	<2		1,1,1,2 Tetrachlorethane	<2
302	Bromodichloromethane	<2		1,2,2,3 Tetrachlorpropane	—
				...chloroethane	—

Lab No. T- 1601100
Field No. 43 Peters Lane #6
Date 12/31/81
Time Loc Pt.
Col. By HANSEN
(Name not Initials)

Public Water
Private Water
Other
Date Completed 2-24-82
Examined By [illegible]

p. 37/38

SUFFOLK COUNTY DEPARTMENT OF HEALTH SERVICES
DIVISION OF MEDICAL LEGAL INVESTIGATIONS & FORENSIC SCIENCES
PUBLIC HEALTH LABORATORY

TRACE ORGANIC ANALYSIS OF WATER

Westhampton Airbase
Name SCDHS ([illegible]) Owner or District
Location 400 ft South of R.R. Track & 1000 ft. East of Pet...
Point of Collection Well #5 ~~#6~~ Depth: 35 Ft.
Remarks: RESULTS TO RICH MARKER

	Compound	ppb		Compound	ppb
305	Methylene Chloride		250	Benzene	<60
298	Bromochloromethane		251	Toluene	520
323	1,1 Dichloroethane		254	o-Xylene	—
309	Trans Dichloroethylene		252	m-Xylene	—
300	Chloroform	<2	253	p-Xylene	—
324	1,2 Dichloroethane		255	Xylene (s)	17,000
312	1,1,1 Trichloroethane	170	258	Chlorobenzene	—
304	Carbon Tetrachloride	<2		Ethylbenzene	2300
294	1 Bromo-2-Chloroethane			Bromobenzene	<100
405	1,2 Dichloropropane			o-Chlorotoluene	<75
310	1,1,2 Trichloroethylene	<6		m-Chlorotoluene	<75
303	Chlorodibromomethane	<3		p-Chlorotoluene	<75
293	1,2 Dibromoethane		265	Chlorotoluene (s)	—
	2-Bromo-1-Chloropropane		415	m-Dichlorobenzene	<35
301	Bromoform	<6	412	o-Dichlorobenzene	<35
311	Tetrachloroethylene	<3	413	p-Dichlorobenzene	—
	Cis-Dichloroethylene			1,2,4 Trimethylbenzene	6300
				1,3,5 Trimethylbenzene	2400
	Freon 113	<5		2,3 Dichloropropene	—
	Dibromomethane			1,1,2 Trichloroethane	—
	1,1 Dichloroethylene			1,1,1,2 Tetrachloroethane	—
302	Bromodichloromethane	<4		1,2,2,3 Tetrachloropropane	—

Lab No. ... 1281467
Field No. ~~...~~ Peters Lane #7
Date 12/31/81
Time 1:10
Coll. by Hansen
(Name not initials)

Received in Lab
Public Water
Private Water
Other
Date Completed 3-2-82
Examined by [illegible]

P380838

SUFFOLK COUNTY DEPARTMENT OF HEALTH SERVICES
DIVISION OF MEDICAL LEGAL INVESTIGATIONS & FORENSIC SCIENCES
PUBLIC HEALTH LABORATORY

TRACE ORGANIC ANALYSIS OF WATER

Name SCDHS (~~[illegible]~~ Westhampton Air Base) Owner or District

Location 450' South of R.R. Track [illegible] ft East of Peters Lane

Point of Collection Well #7 Depth: 36 Ft.

Remarks: Results to Rich Walker

	Compound	ppb		Compound	ppb
315	Methylene Chloride	85	250	Benzene	130
220	Bromochloromethane		251	Toluene	1400
323	1,1 Dichloroethane		254	o-Xylene	—
309	Trans Dichloroethylene		252	m-Xylene	—
300	Chloroform	<7	253	p-Xylene	—
324	1,2 Dichloroethane		255	Xylene (s)	8900
321	1,1,1 Trichloroethane	<3	[illegible]	Chlorobenzene	<75
314	Carbon Tetrachloride	<2		Ethylbenzene	1600
294	1 Bromo-2-Chloroethane			Bromobenzene	<100
495	1,2 Dichloropropane			o-Chlorotoluene	<75
310	1,1,2 Trichloroethylene	<7		m-Chlorotoluene	<75
303	Chlorodibromomethane	<3		p-Chlorotoluene	<75
293	1,2 Dibromoethane		265	Chlorotoluene (s)	—
	2-Bromo-1-Chloropropane		415	m-Dichlorobenzene	<85
301	Bromoform	<7	412	o-Dichlorobenzene	<85
311	Tetrachloroethylene	<3	413	p-Dichlorobenzene	—
	Cis-Dichloroethylene			1,2,4 Trimethylbenzene	2700
				1,3,5 Trimethylbenzene	970
	Freon 113	<6		2,3 Dichloropropene	
	Dibromoethane			1,1,2 Trichloroethane	
	1,1 Dichloroethylene			1,1,1,2 Tetrachloroethane	
302	Bromodichloromethane	<4		1,2,2,3 Tetrachloropropane	

EA SCIENCE AND TECHNOLOGY
A Division of EA Engineering, Science, and Technology Inc.

COMMUNICATIONS RECORD FORM

Distribution: ( ) L. Wilson, ( ) ______
( ) ______, ( ) ______
( ) Author A. Lapins

Person Contacted: Dennis Moran Date: 2/4/86

Phone Number: 518/348-2891 Title: Public Health Engineer

Affiliation: SCDHS, Div. of Env'tal Health Services Type of Contact: ______

Address: ______ Person Making Contact: Andris Lapins

Communications Summary: Re: Town of Southhampton's Municipal Well Fields → Quiogue and Hampton Bays

- Both well fields owned by SCWA

- Quiogue well fields:
  - 2 wells on Meeting House Rd → S10345 and S20688
  - Both wells currently in use and are in compliance with all applicable drinking water standards → no decid water quality problems.
  - 1 well is 78" deep, screened into the glacial aquifer and has an approved capacity of 700 gpm. Not sure which well and has no data on other well; can get detailed info. from SCWA directly.
  - in 1980 pumped 194 million gals. over →

(see over for additional space)

Signature: Andris Lapins

Communications Summary (cont.): Hampton Bays
" " water District

- 2 well fields 7 wells total
  - 3 wells located on Bellows Rd:
    558350, 558351, 558352

- 558350 → 150' deep, 26' of screen, "glacial wells", 500 gpm approved capacity.
- 558351 → 146' deep, 26' of screen, 500 gpm
- 558352 → 131' deep, 26' of screen, 500 gpm

- 4 wells located on Punk Log Rd:

515687	524848	531636	550970
108' deep	123'	120'	208'
22' of screen	23'	30'	20'
500 gpm Approv. Capac.	500 gpm	750 gpm	750'

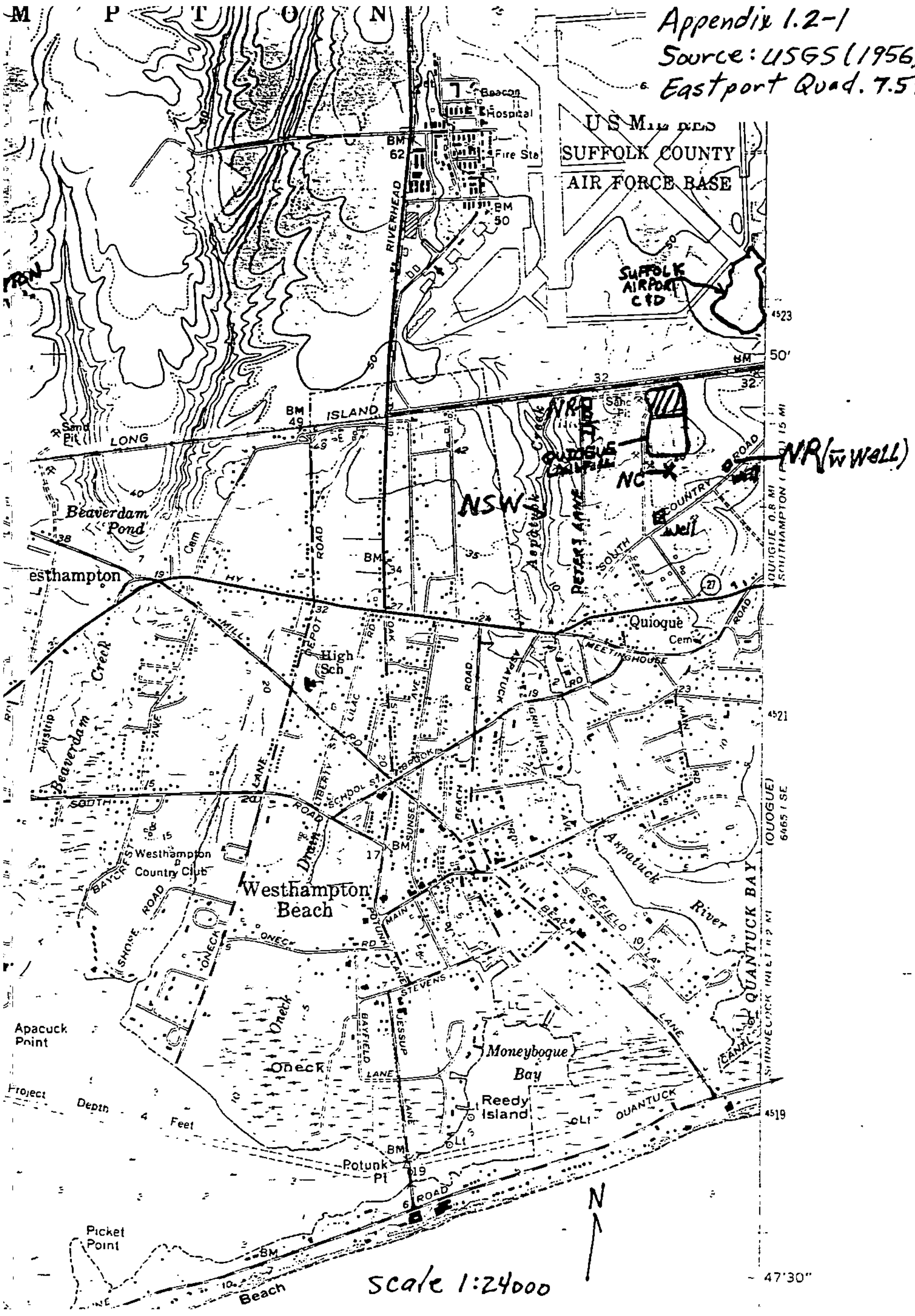
- All wells in Hampton Bays water district are in compliance w/ all applicable drinking water standards i.e. - No water quality problems.

- For further information contact Suffolk Co. Water Authority (SCWA)
  Re: Well specs,

Signature: [signature]

Note:
- Quiogue well fields located w/in 1 mile (downgradient) of Quiogue LF, Old Quogue LF, and Suffolk Airport sites (C&D and K-9) sites.
- Hampton Bays well field located w/in 1.5 miles (downgradient) of Hampton Bays LF site.

Appendix 1.2-1
Source: USGS (1956)
Eastport Quad. 7.5 min.



Appendix 1.3-1

1 of 4

HYDROGEOLOGIC DATA FROM SELECTED WELLS AND TEST HOLES IN SUFFOLK COUNTY, LONG ISLAND, NEW YORK

By

H. M. Jensen and Julian Soren

LONG ISLAND WATER RESOURCES

LONG ISLAND WATER RESOURCES
BULLETIN NUMBER 3

Prepared by the U. S. Department of Interior, Geological Survey, in cooperation with the New York State Department of Environmental Conservation, the Nassau County Department of Public Works, the Suffolk County Department of Environmental Control, and the Suffolk County Water Authority.

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HYDROGEOLOGIC DATA FROM SELECTED WELLS AND TEST HOLES IN SUFFOLK COUNTY, LONG ISLAND, NEW YORK

By

H. M. Jensen and Julian Soren

INTRODUCTION

Suffolk County, N. Y., comprising roughly the eastern two-thirds of Long Island along with several smaller islands has an area of about 920 square miles (fig. 1). The western half of the county is mainly suburban; the eastern half is more rural. The population of Suffolk County has increased sharply from less than 200,000 in 1940 to about 1.1 million in 1970. However, most of the increase has occurred since 1950, when the population was about 275,000.

The fresh-water supply for the county is obtained solely from the underlying ground-water reservoir. The major hydrogeologic units in the ground-water reservoir are summarized in table 1, and a generalized section showing the vertical relation of these units is shown in figure 2. Ground-water pumpage increased from an average of about 42 mgd (million gallons per day) in 1950 to about 131 mgd in 1969 (New York State Conservation Department, written commun., May 1970). The projected water use in Suffolk County in 1990 for an estimated population of 2 million is about 300 mgd (New York State Conservation Department, Division of Water Resources, 1970, p. 26-27).

Water-related problems associated with increased population and attendant increased ground-water development are of considerable concern to the water-resources managers of Suffolk County. To help supply the hydrologic information needed to anticipate and cope with these problems, the U.S. Geological Survey is participating in a cooperative program of water-resources studies with the Suffolk County Water Authority, the Suffolk County Department of Environmental Control, and the New York State Department of Environmental Conservation. Several reports have been published as a result of the cooperative program. (See "Selected References.") One of the best known and most widely used of those reports is New York State Water Power and Control Commission Bulletin GW-18, "Mapping of geologic formations and aquifers of Long Island, New York" (Suter, de Laguna, and Perlmutter, 1949). That report includes three major sections: (a) a fairly detailed description of the surface and the subsurface geology of Long Island; (b) a detailed table of geologic correlations of well logs; and (c) a series of maps showing pertinent surficial features and structure contours on the tops of key hydrogeologic units.

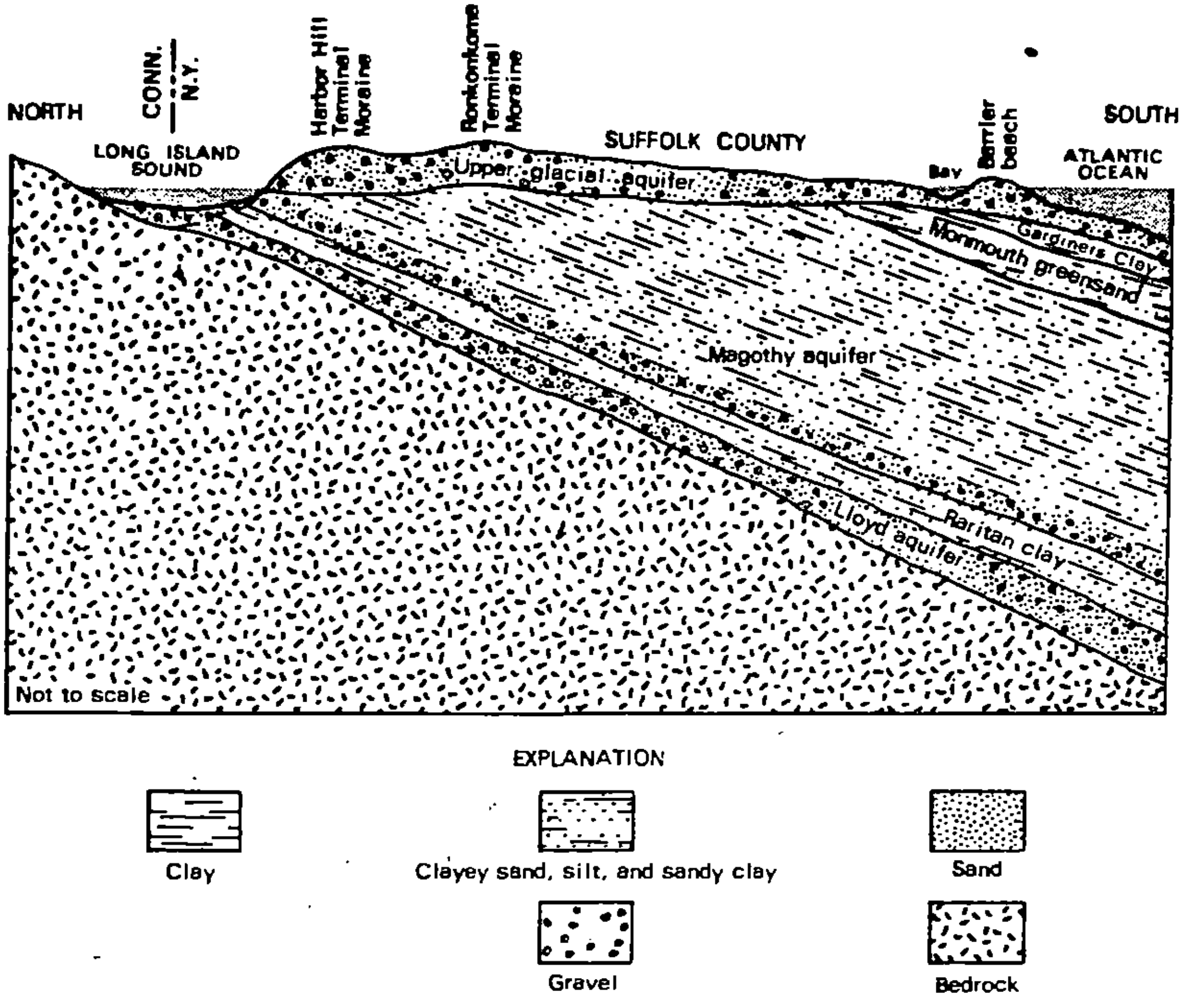

Figure 2.--Generalized section showing major hydrogeologic units in Suffolk County, N.Y.

Table 1.--Major hydrogeologic units in Suffolk County, N. Y.

Hydrogeologic unit 1/	Geologic name	Approximate thickness (feet)	Description and water-bearing character
Upper glacial aquifer	Holocene and upper Pleistocene deposits, and Mannetto Gravel	0-750	Mainly brown and gray sand and gravel of moderate to high hydraulic conductivity; also includes deposits of clayey glacial till and lacustrine clay of low hydraulic conductivity. A major aquifer.
Gardiners Clay	Gardiners Clay	0-75	Green and gray clay, silt, clayey and silty sand, and some interbedded clayey and silty gravel; of low hydraulic conductivity. Unit tends to confine water in underlying aquifer.
Jameco aquifer	Jameco Gravel	Not known	Not identified in Suffolk County.
Monmouth greensand 2/	Monmouth Group	0-200	Interbedded marine deposits of dark-gray, olive-green, dark-greenish-gray, and greenish-black glauconitic and lignitic clay, silt, and clayey and silty sand. Unit has low hydraulic conductivity and tends to confine water in underlying aquifer.
Magothy aquifer	Matawan Group-Magothy Formation, undifferentiated	0-1,100	Gray and white fine to coarse sand of moderate hydraulic conductivity. Generally contains sand and gravel beds of low to high hydraulic conductivity in basal 100 to 200 feet. Contains much interstitial clay and silt, and beds and lenses of clay, of low hydraulic conductivity. A major aquifer.
Raritan clay	Clay member of the Raritan Formation	0-200	Gray, black, and multicolored clay and some silt and fine sand. Unit has low hydraulic conductivity and tends to confine water in underlying aquifer.
Lloyd aquifer	Lloyd Sand Member of the Raritan Formation	0-500	White and gray fine-to-coarse sand and gravel of moderate hydraulic conductivity and some clayey beds of low hydraulic conductivity. Not highly developed as an aquifer.
Bedrock	Undifferentiated crystalline rocks	Not known	Mainly metamorphic rocks of low hydraulic conductivity; surface generally weathered; considered to be the bottom of the ground-water reservoir. Not a source of water in Suffolk County.

1/ Adapted largely from Cohen and other (1968, p. 18).

2/ Name adopted in this report.

STUDIES OF SITES FOR NUCLEAR ENERGY FACILITIES—BROOKHAVEN NATIONAL LABORATORY

GEOLOGY OF BROOKHAVEN NATIONAL LABORATORY AND VICINITY, SUFFOLK COUNTY, NEW YORK

By Wallace de Laguna

ABSTRACT

In connection with the construction and operation of atomic research facilities at the Brookhaven National Laboratory, the U.S. Geological Survey made a study of the geologic and ground-water conditions at and near the Laboratory. The area is in central Suffolk County, about 60 miles east of New York City, and extends in a 26-mile-wide strip across the island from Long Island Sound on the north to the Atlantic Ocean on the south. The geologic fieldwork consisted of examination of surface outcrops and the supervision of the drilling of and examination of samples from shallow test wells 100 to 200 feet deep and two deep test wells about 1,600 feet deep.

The gently rolling land surface at the Laboratory is bordered by two lines of hills; the Harbor Hill moraine on the north, and the Ronkonkoma moraine on the south. A broad flat, relatively featureless outwash plain extends south from the Ronkonkoma moraine to the tidal swamps, bays, and barrier beaches, which form the southern boundary of the area. The Carmans, Forge, and Peconic Rivers, and their tributaries, carry most of the surface water.

Six principal stratigraphic units, some containing subdivisions of local importance, were recognized in the test holes and surface exposures. At the bottom is the southeasterly sloping bedrock of Precambrian age, which is at a depth of about 1,500 feet beneath the Laboratory. Above the bedrock is the Raritan formation of Cretaceous age about 500 feet thick, which is divided into the lower Lloyd sand member and an upper clay member. Resting on the clay member of the Raritan formation is about 900 feet of sand, sandy clay, and some gravelly beds, which have been tentatively assigned to the Magothy(?) formation. The Gardiners clay, an interglacial deposit of Pleistocene age, overlies the Magothy(?) formation in much of the area. The Gardiners is 10 to 20 feet thick at Brookhaven National Laboratory, but it thickens appreciably to the south. Above the Gardiners clay are upper Pleistocene deposits, which have a maximum thickness of about 200 feet. Locally these deposits are divided into an unidentified unit of sand and gravel characterized by a greenish color, a unit of silt and clay recognized near Manorville, and the Harbor Hill and Ronkonkoma moraine deposits and associated outwash deposits. Recent deposits of gravel, sand, silt, and clay are restricted to stream channels, bays, and beaches, and are generally less than 40 feet thick.

Fresh water under artesian pressure occurs in several permeable zones in the Raritan and Magothy(?) formations. Most of the water in the upper Pleistocene deposits is unconfined and fresh, and it is the principal source of supply. Recent deposits are not a source of water except for small supplies at scattered localities on the barrier beaches.

INTRODUCTION

PURPOSE AND SCOPE OF INVESTIGATION

In the fall of 1946, the War Department, then in charge of the atomic energy program, requested the U.S. Geological Survey to prepare a preliminary report on the possible water-supply problems of the proposed nuclear research laboratory at Camp Upton. In the fall of 1947, the Geological Survey began a detailed investigation of the ground-water conditions in the vicinity of the Laboratory with particular reference to the effect of a hypothetical accidental release to the environment of radioactive wastes. The routine operation of Brookhaven National Laboratory does not constitute a hazard because of the very stringent precautions that the Laboratory exercise in handling and disposing of radioactive materials. The work on which the present report is based began in March 1948. During the first 2 years, 2 deep test wells and about 12 shallow observation wells were drilled. As a guide to the installation of test wells, an attempt was made to obtain information on the subsurface geology by earth-resistivity observations, but the method was found to be poorly adapted to the conditions in the area.

During this same period, 95 samples of surface and ground waters were collected and shipped to Washington for analysis. On the basis of the data provided by this work, a second water-sampling program was set up in November 1950 to monitor the surface-water and ground-water supplies of the area, but this sampling was stopped in the summer of 1953 because the program was felt to be unsound.

Some instrumental leveling was done in the first year or two, and in 1949 the Topographic Division of the Geological Survey established a network of bench marks covering the area of immediate interest. This made it possible to convert water-level measurements to a sea-level datum so that accurate water-table contour maps could be drawn.

A more detailed study of the hydrology began in 1950; a detailed pumping test was run at the end of that year. In 1951 the observation-well net was expanded, and in 1952 a study was made of the hydrology of the Carmans River. At the same time, an attempt was made to estimate the amount of water lost annually by evaporation and by transpiration so that an estimate could be made of the recharge to the ground-water reservoir.

Attempts were made during the first year to measure the rate of movement of the ground water directly by tracers. The work provided answers which seemed to be valid, but it was dropped because of the complexity of the theoretical and practical problems involved. Some laboratory work with dye solutions was attempted later to illustrate the pattern of movement of contaminated liquids, but again problems involved in faithfully representing natural conditions were not satisfactorily solved.

The investigation was made under the immediate supervision of M. L. Brashears, Jr., and J. E. Upson, former district geologists. The organization and preparation of the report were coordinated by C. V. Theis and J. E. Upson.

PREVIOUS INVESTIGATIONS

Previous work on the hydrology and geology of Long Island has dealt either with Long Island as a whole or with the western part. In 1903 the water-supply problems of Greater New York were studied in detail by the Commission on Additional Water Supplies and described in a report by Burr, Hering, and Freeman (1904). This report related primarily to the occurrence and availability of ground water in Nassau County and western Suffolk County. In 1906, this study was enlarged to investigate the possibility of developing 250 mgd. (million gallons per day) of water from Suffolk County by extending the Brooklyn aqueduct eastward along the south shore through Patchogue, Moriches, and Quogue. Branches and collecting works were to tap, among other sources, the Carmans River and the lower Peconic. A report on this study was made by Spears (1908). Because of the general interest in the problem of water supply at this time, and as the result of a cooperative agreement with the Commission on Additional Water Supply, the U.S. Geological Survey made a study of both the geology and the hydrology of all Long Island in the years 1902–05. The results of this investigation were published under the authorship of Veatch and others (1906). Later, geologic investigations were made by Fuller (1914).

In 1932, the U.S. Geological Survey returned to the study of Long Island under cooperative agreements with the New York State Water Resources Commission (formerly Water Power and Control Commission) and with Nassau County. Later, these agreements were extended to include Suffolk County.

The principal publications dealing with central Suffolk County that have resulted from these cooperative investigations are listed under "References cited." These reports are concerned mainly with the problem areas of western Long Island, and little has been published for Suffolk County except for the reports on the mapping of the aquifers by Suter, de Laguna, and Perlmutter (1949), and the mapping of the water table by Lusczynski and Johnson (1952). Among the independent workers who have contributed to the glacial geology of Long Island are MacClintock and Richards (1936) and Fleming (1935).

LOCATION OF AREA

Brookhaven National Laboratory is on the site of Camp Upton, formerly an Army post during World Wars I and II. It is nearly in the geographical center of Long Island, about 60 miles east of New York City. (See fig. 1) The Laboratory tract is an irregular polygon that is roughly rectangular and about 2.5 miles on a side.

Brookhaven National Laboratory lies in a strip across the island about 13 miles wide extending approximately north-south between long 72°45′ and 73° W. This area (fig. 1) is referred to in this report as the Upton area from the post office address of the Laboratory, and it is the area of principal concern in the hydrologic part of this report.

The geologic studies cover a somewhat wider area (fig. 1), as it was felt desirable to include some information from adjoining areas where wells had been drilled deep enough to reach beds of Cretaceous age. This larger area, extending from about long 73°07′30″ W. on the west to long 72°37′30″ W. on the east, a distance of about 26 miles, is here called central Suffolk County.

WELL-NUMBERING SYSTEM

Numbers of wells mentioned in the text and shown on illustrations of this report are those assigned by the New York State Water Resources Commission. Wells are numbered serially and are designated by letter prefix according to the county in which they are: S for Suffolk County and N for Nassau County. Records and logs of wells referred to in this report are either published in Bulletins GW 4, 9, and 31 of the New York Water Resources Commission or may be examined at the Geological Survey office at 1505 Kellum Place, Mineola, N.Y. The location of wells referred to in this report are shown on plate 1.

TOPOGRAPHY

Brookhaven National Laboratory is on gently rolling ground in the upper part of the Peconic River valley, which is bordered by two lines of low hills. These extend beyond the limits of the valley east and west nearly the full length of Long Island and form its most prominent topographic features. The northern line of hills, known as the Harbor Hill moraine, lies along the north shore of Long Island; the

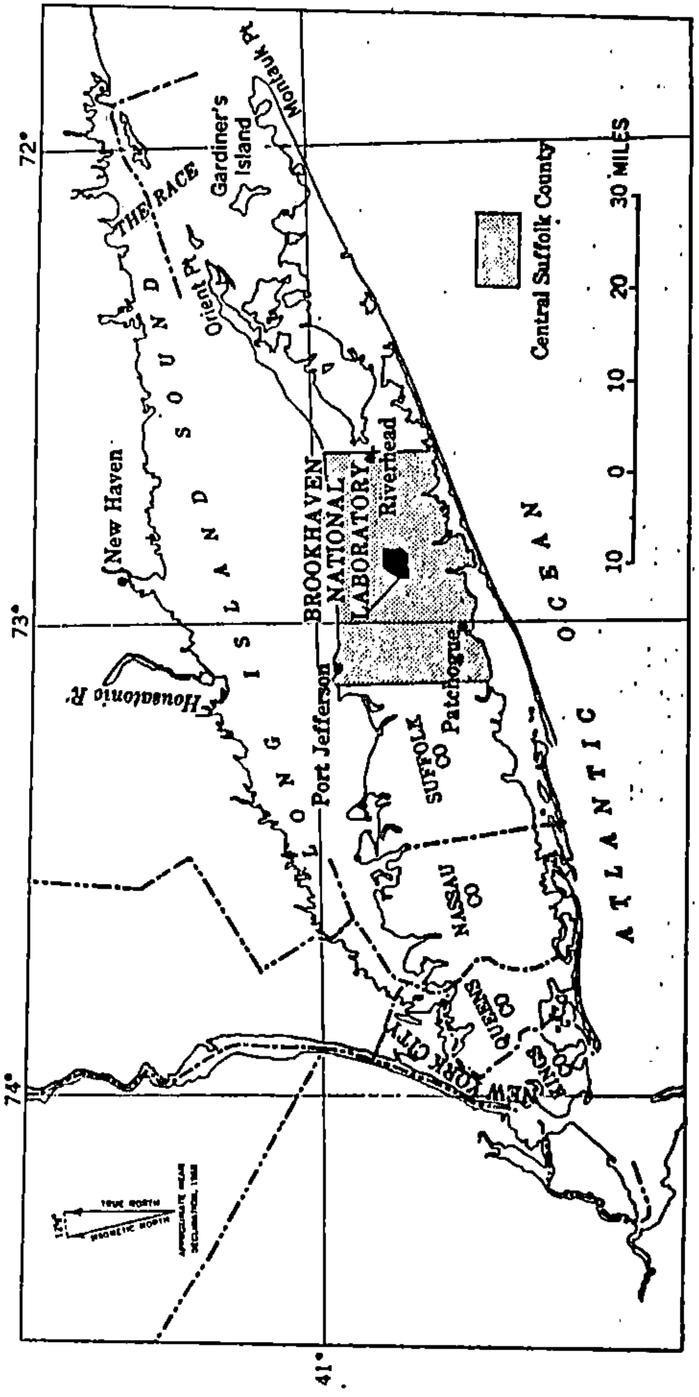

FIGURE 1.—Outline of map of Long Island, showing location of Brookhaven National Laboratory and adjoining areas.

southern line of hills, the Ronkonkoma moraine, trends along the center of Long Island and passes just south of Brookhaven National Laboratory. (See pl. 1.)

Just west of Brookhaven National Laboratory, the two moraines are connected by a narrow north-south ridge, which gives the neighboring hamlet of Ridge its name. East of this ridge, and enclosed by it and two moraines. is the Manorville basin (pl. 1), on the relatively high west margin of which are the main Laboratory grounds. The basin forms the upper drainage area of the Peconic River. It is partly enclosed on the east south of Calverton by Bald Hill, a salient of the Ronkokoma moraine, so that the surface drainage of the Manorville basin is poor, and much of the land near the river is swampy. East of Calverton, the valley widens and forms the Riverhead basin (pl. 1).

West of the north-south ridge is the narrow, straight valley of the Carmans River, branches of which formerly drained Artist Lake and a pond at Middle Island. To the east, along the south margin of the Harbor Hill moraine are two large kettle holes, Long Pond and Deep Pond.

Just west of the Carmans River, another ridge extends north from Coram Hill and nearly joins one of the wide low spurs extending south from the Harbor Hill moraine. West of this ridge, between the two moraines, is the Selden basin (pl. 1), a wide shallow basin that has no surface-drainage outlet.

South of the Ronkonkoma moraine is a comparatively flat featureless plain of irregular width. This surface slopes gently to the south, where it merges into a swamp and then passes under Great South Bay and Moriches Bay. The shoreline is indented by many small estuaries that are the drowned mouths of the small streams that drain the plain. The principal irregularities of the plain south of Brookhaven National Laboratory are the valleys of the Carmans River, which head north of the moraine, and the much shorter Forge River which heads in the Ronkonkoma moraine just south and southeast of the Laboratory.

Between the mouths of the Carmans and the Forge Rivers, the south shore bays are divided by a wide tongue of land which extends nearly across to Fire Island Beach. This tongue is occupied by the summer community of Mastic and by the southern part of another community called Mastic Beach. To the east is Moriches Bay; to the west is Great South Bay. The bays are bordered on the south by a long narrow line of barrier beaches.

The north shore of central Suffolk County is bordered by a long line of steep bluffs overlooking Long Island Sound. These bluffs form a series of shallow arcs, concave northward, each of which is 8 to 10 miles long. The line of bluffs is broken by several small embayments such as at Mount Sinai Harbor and Wading River. These embayments have flat swampy bottoms and are bordered on the south by an abrupt line of hills. West of Port Jefferson the shoreline is much less regular, because it comprises a succession of bays and necks.

SUMMARY OF STRATIGRAPHY

Six principal stratigraphic units, some of which include subdivisions of minor importance, were recognized in the test drilling at Brookhaven National Laboratory and have been identified in well logs and at exposures in central Suffolk County (table 1). Their general relationships are indicated diagrammatically in figure 2, and their lithology, as determined in the two deep test wells at Brookhaven National Laboratory, is indicated in figure 3. Plate 2 shows the lithologic characteristics of the uppermost units, particularly those of Pleistocene age. Plate 1 shows the location of wells used in preparing the report; the cross sections are shown in plate 2.

At the base is the oldest of the stratigraphic units, the bedrock of pre-Cretaceous age, to which no formational name has been attached. Above the bedrock is the Raritan formation of Cretaceous age, which is as much as 500 feet thick. This formation has two members. The lower, as much as 300 feet thick, called the Lloyd sand member, is composed of coarse-grained sand, gravel, and some clay. The upper member, as much as 200 feet thick, is mostly clay and is called the clay member of the Raritan formation. Overlaying the Raritan formation is the Magothy(?) formation, also of Cretaceous age. Beneath Brookhaven National Laboratory this formation consists of about 900 feet of mostly clayey sand, and it includes beds of clay and of sand and gravel.

Beneath most of the laboratory tract, and in general beneath the southern half of central Suffolk County, the Magothy(?) formation is overlain unconformably by the Gardiners clay of Pleistocene age. Within Brookhaven National Laboratory and for a few miles to the south, test wells showed the Gardiners clay to be 10 to 20 feet thick and to be composed of clay containing sand and gravel. Still farther south, along the ocean shore, the Magothy(?) formation is overlain by 150 feet or more of clay, silt, and clayey sand, which in texture, color, and composition is somewhat like the Gardiners clay, but which resembles neither the Magothy(?) below nor the upper Pleistocene deposits above. This material is tentatively referred to as the Gardiners clay, although it is possible that detailed paleontologic studies may show that other units are present in some places (Perlmutter and Crandell, 1959).

TABLE 1.—*Physical character and water-bearing properties of the geologic units underlying central Suffolk County*

System	Series		Geologic unit	Approximate thickness (feet)	Physical character of deposits	Water-bearing properties
Quaternary	Recent		Recent deposits	0–40	Gravel, sand, silt, some clay, organic matter, and shell fragments.	Permeable beds contain fresh and salt water near shoreline. Clay and silt are local confining units.
Quaternary	Pleistocene	Upper Pleistocene deposits	Moraine deposits and outwash	0–150	Moraine deposits composed of unsorted boulders, gravel, silt and clay; compact in places. Outwash composed chiefly of gravel and sand. Locally, thin loesslike deposits of silt and clay at and near surface.	Moraine deposits generally of low permeability but permeable sandy zones are common. Outwash generally highly permeable and productive. Water-table conditions prevail almost everywhere.
Quaternary	Pleistocene	Upper Pleistocene deposits	Clay at Manorville	0–60	Silt and clay, laminated, gray and brown.	Relatively impermeable local confining unit.
Quaternary	Pleistocene	Upper Pleistocene deposits	Unidentified unit	0–50	Fine to coarse sand, greenish; some silt and clay.	Contains water under water-table conditions. Tapped by few wells.
			Unconformity?			
Quaternary	Pleistocene		Gardiners clay	0–150	Clay and silt, grayish-green; some lenses of sand and gravel.	Relatively impermeable. Confining unit in southern part of area.
			Unconformity			
Cretaceous	Upper Cretaceous		Magothy(?) formation	0–1,000	Sand, fine to coarse, clayey, lenses of clay; coarse basal zone containing gravel. Lignite is abundant. Light and dark gray are predominant colors.	Low to high permeability. Tapped by few wells but has several productive zones. Water is under artesian pressure.
			Unconformity			
Cretaceous	Upper Cretaceous	Raritan formation	Clay member	150–200	Clay and silt, dark- and light-gray; some red and white; some lenses of sand.	Relatively impermeable, extensive confining unit.
Cretaceous	Upper Cretaceous	Raritan formation	Lloyd sand member	130–300	Sand and gravel, gray; some beds of sandy clay and clay and silt.	Permeable zones are potential sources of water. Not tapped by pumping wells at present. Water is under artesian pressure.
			Unconformity			
Precambrian(?)			Bedrock	----------	Granitic-gneiss, upper 30–50 feet moderately to highly weathered.	Relatively impermeable. Not an aquifer.

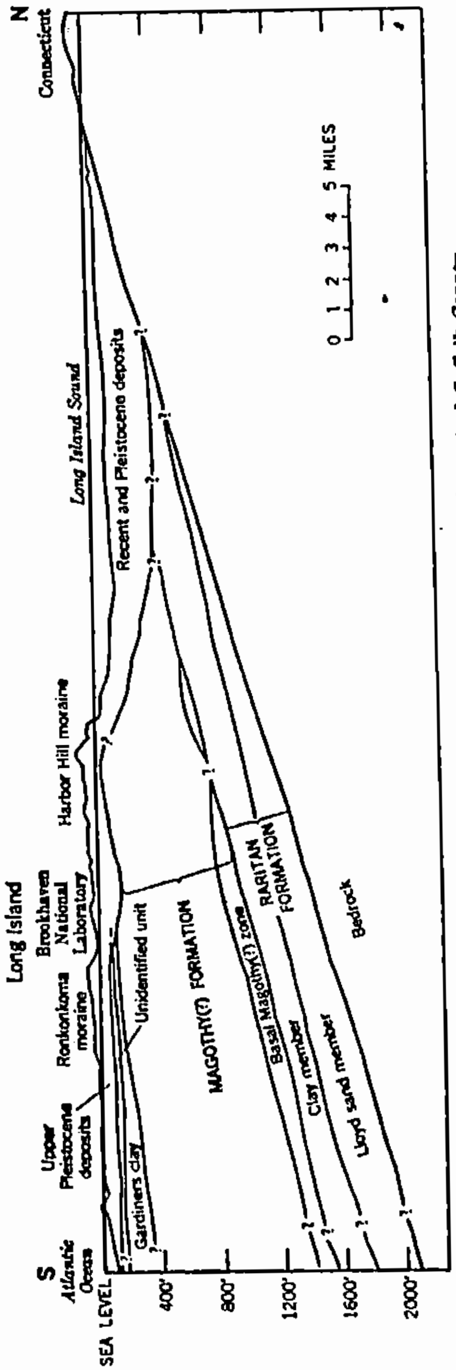

FIGURE 2.—Generalized cross section along long 72°52'30'' W. in central Suffolk County.

The sixth major stratigraphic unit is called the upper Pleistocene deposits, an informal term used to describe the glacial deposits which, in nearly all Long Island, overlie the Gardiners clay or the Magothy(?) formation. Most of these deposits consist of sand and gravel which, with local silt and clay, form the stratified outwash and morainal deposits of presumed Wisconsin age. Their maximum known thickness is about 200 feet. The formational units into which Fuller (1914, p. 80–176) divided these deposits have not been recognized within the area of this report. However, some distinctive subdivisions were recognized. For example, overlying the Gardiners clay in the southern half of the report area is a greenish sand 25- to 50-feet thick of uncertain origin, but apparently the oldest outwash material in this area. It has not been named and, therefore, is called here the unidentified unit. At Manorville, and probably beneath a surrounding area of several square miles, there is a varved clay in the middle of the upper Pleistocene deposits. In the lower part of the Peconic River valley, beneath the south-shore beaches and in a buried valley south of Mount Sinai Harbor, the upper Pleistocene deposits include a complex series of alternating layers of sand, silt, and clay, some fossiliferous, which may in part represent the Gardiners clay. Despite these variations, however, most of the upper Pleistocene deposits form a comparatively uniform blanket of sand and gravel.

The current differentiation of stratigraphic units on Long Island is the result of gradual refinement of knowledge based largely on data from wells. Substantial contributions were made by Thompson, Wells, and Blank (1937), and more recently by Suter, de Laguna, and Perlmutter (1949). Most of the formations recognized here occur nearly everywhere beneath Long Island.

BEDROCK

The bedrock which underlies the unconsolidated deposits is known principally from well records. It includes hard, dense schist, gneiss, and granite similar in character to that which underlies much of the mainland in nearby parts of New York and Connecticut. These rocks were previously thought to be of Precambrian age, but now many geologists believe that some of them are metamorphosed early Paleozoic age sediments. Data from well records and samples on Long Island do not warrant any identification except of rock type.

Two deep test wells (S6409 and S6434, pl. 1) penetrated bedrock at a depth of nearly 1,600 feet beneath Brookhaven National Laboratory. The bedrock was found to be a hard, banded, granitic gneiss. Microscopic examination showed it to be composed of about 50 percent plagioclase (oligoclase and andesine) feldspar, about 50 percent quartz, about 1 percent biotite, and a trace of garnet. The plagioclase feldspar in the sample from well S6434 contained a little more sodium than that from S6409; otherwise, the two samples were identical.

This bedrock contains no openings capable of holding or transmitting appreciable quantities of water, thus it forms the base of the water-bearing material beneath Brookhaven National Laboratory.

In Connecticut, the bedrock includes, in addition to the gneiss and schist, a body of sandstone, shale, and diabase of Triassic age which could conceivably extend south from New Haven as far as Long Island. Seismic studies (Oliver and Drake, 1951, p. 1295) suggest that it does not. No rocks of Triassic age have been found in any wells drilled on Long Island.

CONFIGURATION OF THE BEDROCK SURFACE

The shape of the upper surface of the bedrock of Long Island is best known beneath the west end of the island (de Laguna and Brashears, 1948). Here the bedrock surface, as indicated by well records, has a maximum relief of about 100 feet, except where it is near the surface and may have been modified by erosion in Pleistocene or Recent time. The apparent low relief and local deep weathering of the bedrock in western Long Island as shown by well logs (de Laguna and Brashears, 1948, p. 8) suggest that the surface had reached an advanced stage of peneplanation. Indeed, the surface is considered to be part of the Fall Zone peneplain (Von Engeln, 1942, p. 353). The most recent map of the bedrock surface underlying Long Island (Suter, and others, 1949, pls. 8, 9, and 10) shows that this surface slopes southeast about 80 feet per mile beneath most of Long Island. It seems to slope more southerly at the east end of Long Island. If the surface represents a peneplain, the relief on the bedrock surface in the Brookhaven area is not likely to be greater than 50 to 100 feet.

FORMATIONS OF LATE CRETACEOUS AGE

RARITAN FORMATION

The Raritan formation rests directly on highly to slightly weathered bedrock. The formation is probably entirely continental and was laid down as a costal-plain deposit by streams flowing off the uplifted Fall Zone peneplain. The name Raritan was applied to the Long Island deposits by Veatch and others (1906, p. 23) who correlated the formation with deposits of the same name in New Jersey. On Long Island the formation has two fairly distinct members; the Lloyd sand member below, and a clay member above.

The formation probably occurs beneath all central Suffolk County. Northward the Lloyd sand thins and probably pinches out beneath Long Island Sound, and the clay member may do likewise. Southward the formation extends a considerable distance offshore, possibly as far as the continental shelf (about 100 miles), where the beds probably have lithologic characteristics different from those beneath Long Island.

At many wells the position of the contact with overlying deposits, and in fact between the members themselves, cannot be defined precisely. Nevertheless, the units are distinctive in their general characteristics.

LLOYD SAND MEMBER OF THE RARITAN FORMATION

The Lloyd sand member is a fairly uniform and extensive unit consisting predominantly of sand and gravel with some clay. It is known only from well logs. At the two deep test wells (S6409 and S6434) at Brookhaven National Laboratory, it is separated from the hard crystalline bedrock by 15 to 30 feet of tough, white, structureless clay containing scattered angular grains of quartz, which is considered to be weathered bedrock. At the same wells, the upper contact of the Lloyd sand member with the overlying clay member is fairly definitely marked by a change in the lithology of the sediments.

As shown by the columnar section (fig. 3) of well S6409, the Lloyd sand member is about 300 feet thick. It is largely composed of fine to coarse sand containing silt and clay in the interstices. It also includes beds of clay or sandy clay and coarser textured beds that contain gravel. Near the middle, the unit consists chiefly of sand and coarse gravel, which contains some pebbles at least 2 inches in diameter. The voids between the pebbles are for the most part filled with sand and some clay. The porosity of the unit is, therefore, appreciably less than that of a well-sorted sand or gravel. A somewhat similar sequence of material was found at well S6434. The dominantly sandy material which makes up the bulk of the unit here rests directly on highly weathered bedrock.

The pebbles and the sand found in the Lloyd member at Brookhaven National Laboratory and elsewhere on Long Island are composed almost entirely of quartz. This composition suggests that the material was derived from a region in which the climate was warm and the rate of erosion slow, so that all but the most resistant material was entirely decomposed. The clay is entirely or dominantly kaolinite, a mineral indicative of complete weathering.

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The cores, the drill cuttings, the rate of drilling, and other evidence suggests that the Lloyd found at Brookhaven National Laboratory is in many respects similar to that found in western Suffolk, Nassau, Queens, and Kings Counties where more than a hundred wells have been drilled into it. In both the Laboratory wells and in a well drilled at Port Jefferson, however, the interstitial clay seems to be tougher and more tightly packed than it is farther west.

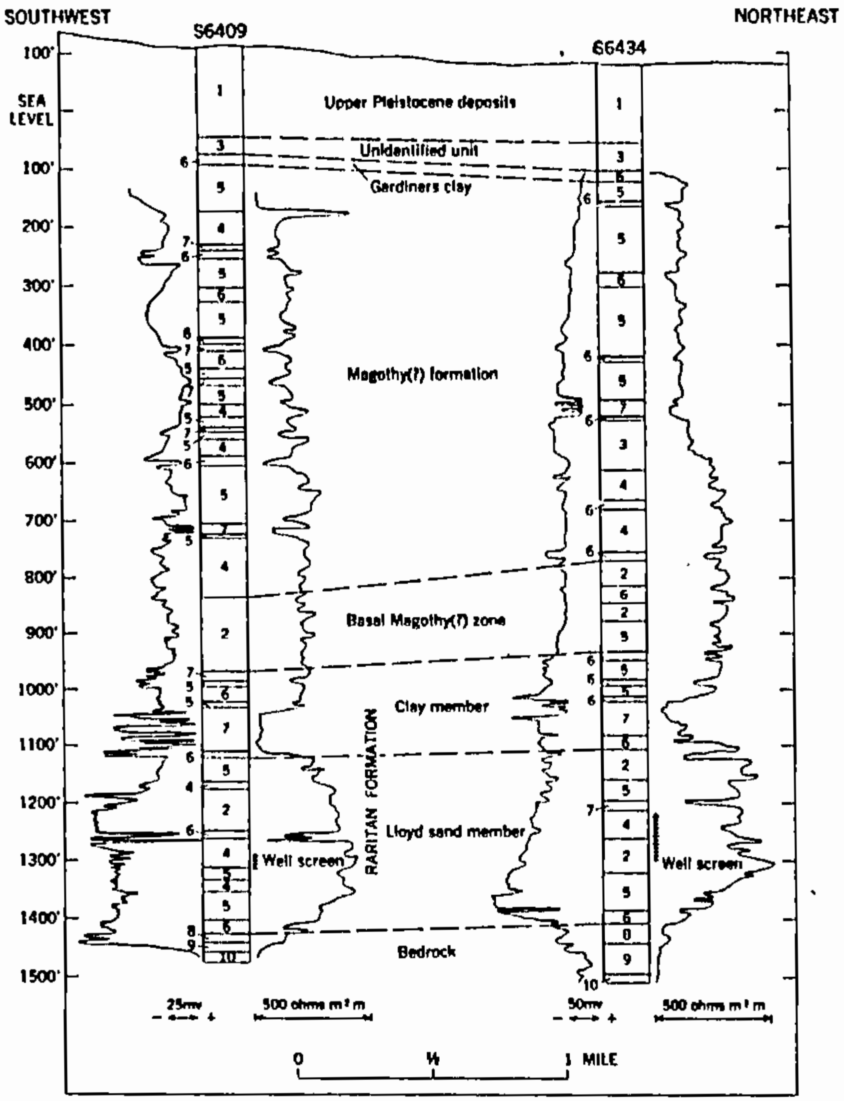


FIGURE 8.—Columnar sections and electric log of deep test wells at Brookhaven National Laboratory.

EXPLANATION

Numbers arranged in order of estimated decreasing permeability

Unit No.	Description of unit
1	Sand, or sand and gravel, clean; little or no silt or clay.
2	Sand, coarse, or sand and gravel; includes some clay.
3	Sand, fine or medium; includes some clay.
4	Sand, coarse, or sand and gravel; mixed with considerable clay and containing beds of clay.
5	Sand, fine to medium; mixed with considerable clay and containing beds of clay.
6	Clay, mixed with some sand, and containing beds of clayey sand.
7	Clay, tough; containing little sand.
8	Bedrock weathered. Original rock texture no longer visible, but material has not been transported or sorted by water.
9	Bedrock, weathered. Original igneous texture visible, but most minerals except quartz much altered chemically.
10	Bedrock, fresh. May show some staining or discoloration.

In the western part of Long Island, the Lloyd ranges in thickness from about 350 feet on the south shore to a few tens of feet along the north shore, where in a few places it is absent. These variations in thickness apparently represent the form in which the Lloyd was originally deposited. At Port Jefferson the Lloyd has a thickness of 135 feet, which shows that it thins to the north in central Suffolk County also. Indeed, it is possible that beneath Long Island Sound, the Lloyd sand pinches out and that the overlying clay member of the Raritan overlaps it and extends beyond it. (See fig. 2.) Thus, although penetrated by only a few wells in the report area, the Lloyd probably is a continuous unit of substantial thickness.

CLAY MEMBER OF THE RARITAN FORMATION

The clay member, which overlies the Lloyd sand, makes up the balance of the Raritan formation. At Brookhaven National Laboratory, the top of the clay member is 975 feet below sea level at well S6409 and 940 feet below at S6434. In both wells, its thickness was less than 200 feet. It is largely composed of tough dark-gray or black lignitic clay and some red and white clay and includes some sandy layers and thin lenses of gravel. It also contains some light-gray silty and sandy clay. It is not clearly bedded, as the textures and colors grade into one another. Zones which contain well marked, narrow bands of light silty clay alternate with darker clay which may represent annual variations in rate of deposition, as between a rainy and dry season.

The clay member shows little if any systematic variation in thickness on Long Island. In most of the carefully logged wells that penetrate it, the clay is about 200 feet thick, and at least some of the greater or lesser thicknesses reported may be due to difficulty in placing the contacts, for these depend only on differences in lithology. In parts of King County, and in northern Queens and Nassau Counties, where the top of the clay member is at or near sea level, the member is much less than 200 feet thick and in places it may be absent. This is probably due to local erosion, most of which probably took place in late Tertiary or Pleistocene time. Where the clay member is found at greater depths, as in central Suffolk County, there is no evidence of erosion, but the data are scanty. Thompson, Wells, and Blank (1937, p. 455) suggest that in Kings and Queens Counties, channels were cut into the clay member at the close of Raritan time and then filled with sand or other permeable material at the beginning of Magothy(?) deposition. There is no evidence that such deep erosion and deposition took place within the area investigated; the Lloyd member in central Suffolk County is everywhere covered by the clay member.

Like the Lloyd member below and the Magothy(?) formation above, the clay member has not yielded any fossils except plant remains and is probably nonmarine. The scattered pieces and grains of lignite, the widely distributed spores and pollen, the casts of twigs and leaves, and the possible varving suggest deposition on a coastal plain by generally sluggish but sometimes flooded rivers, that drained a deeply weathered area of moderate relief. It is possible, but unlikely, that some of the rivers crossing this plain maintained their channels in the same place over long periods of time, because aggrading streams commonly build up both their banks and their beds and then shift some distance laterally to lower ground. Accordingly, the coarser grained materials found locally probably are lenses of limited extent both horizontally and vertically. However, at places these may act as relatively permeable but devious paths for the movement of water.

WATER-BEARING PROPERTIES

The Lloyd sand is one of the most important aquifers on Long Island largely because it yields adequate supplies of good quality water in areas, generally beneath the margins of Long Island, where supplies from overlying formations are inadequate or are contaminated by or readily subject to contamination by sea water. The Lloyd can supply water under these circumstances because it is overlain by the relatively impermeable and virtually continuous blanket of the clay member.

The problem of how fresh water moves into and out of the Lloyd has been considered by many investigators. Such movement may occur by means of valleys cut through the clay member or by slow seepage of water through the clay (Suter, and others, 1949, p. 16). As there is little evidence of deep buried valleys in the clay member in central Suffolk County, it is likely that most of the movement of water into and out of the Lloyd is by means of slow seepage through the overlying clay. Luszczynski (oral communication) speculates that if the clay member has an average permeability of 0.2 to 0.3 gpd per square ft, then quite possibly all the water in the Lloyd reaches the unit by percolation through the clay member. Wenzel (1942, p. 13) gives the permeability of a clay (sample No. 2278) that is similar to the clay member of the Raritan as 0.2 gpd per ft, which suggests that there is no compelling need to assume permeable channelways. In any event, movement of water through the clay member of the Raritan either up or down doubtless is very slow in most places.

Although the water from the Lloyd is relatively high in iron content, the usefulness of the aquifer in central Suffolk County is more seriously compromised by the probability of poor yield, as exemplified by the two Brookhaven National Laboratory wells. In the western part of the island, many wells tapping the Lloyd sand member have a specific capacity between 10 and 20, which means that they yield 10 to 20 gpm per ft of drawdown. Test well S6409 at Brookhaven National Laboratory was finished with 25 feet of screen and had a specific capacity of about 2. The other deep test well, S6434, was underreamed and gravel-packed and finished with 80 feet of screen, but it had a specific capacity of only 2.5. The principal reason for these low yields seems to be the toughness of the interstitial clay in the deposits, which made it difficult to wash the clay out thoroughly during the development. Much of the same type of tough interstitial clay was found in the cores from test well S5901 at Port Jefferson.

MAGOTHY(?) FORMATION

The Magothy(?) formation in central Suffolk County is a thick body of continental deposits composed of lenses of sand, sandy clay, clay, and some gravel. It rests on the Raritan formation and is in turn unconformably overlain by upper Pleistocene deposits. The greatest thickness, revealed by drilling, is about 1,000 feet. The present upper surface of the Magothy(?) on Long Island is an erosional surface, and the original total thickness is not known.

The type area of the Magothy formation is in Maryland along the Magothy River, where it was first described by Darton (1893, p. 407–419). W. O. Crosby (1910) and later Horace R. Blank (written communication, 1935) suggested that the Cretaceous deposits overlying the Raritan formation on Long Island were a greatly thickened extension of the Magothy formation of New Jersey. Later work (Perlmutter and Crandell, 1959, p. 1060–1076) shows that the uppermost part of the Magothy (?) formation beneath the south shore of Suffolk County includes marine beds possibly equivalent in age to the Monmouth group of New Jersey. In this report, as in recent publications by Survey authors, the name Magothy when applied to the upper part of the Long Island Cretaceous, is followed by a question mark to indicate the doubt. Examination of pollen and spores may lead to both a reliable correlation of the Cretaceous deposits on Long Island with those of New Jersey and to the establishment of a useful type sequence for Long Island itself.

The Magothy (?) formation underlies most of Long Island except for parts of Kings and Queens Counties and northwestern Nassau County where it was removed by erosion. It may extend beneath Long Island Sound, but is probably truncated by erosion and overlain by Pleistocene deposits. (See fig. 2.) To the south, the Magothy (?) formation, like the Raritan, extends out under the sea, where it also probably changes from a terrestrial to a marine deposit.

The formation crops out at only a few places on Long Island, most of them in northern Nassau County, so that the formation is known chiefly from well records. At test wells S6409 and S6434, the Magothy (?) is about 885 and 810 feet thick, respectively. (See fig. 3.) Well S5901 at Port Jefferson, 12 miles northwest of Brookhaven National Laboratory, passed through nearly 500 feet of the Magothy (?) formation, and well S128 about 5 miles southwest of the Laboratory penetrated about 760 feet of the Magothy (?) and did not reach the bottom of the formation.

The Magothy (?) at Brookhaven National Laboratory has about the same characteristics as elsewhere on Long Island. It is composed of beds of poorly sorted quartzose sand mixed with and interbedded with silt and clay, and locally it contains pebbles or small lenses of gravel. Sandy clay and clayey sand make up most of the fine beds, but there are also several thick beds of clay. In both of the deep test wells (S6409 and S6434), the basal 100–150 feet of the Magothy (?) contains a greater proportion of coarse-grained material. This consists partly of coarse sand and gravel that contains pebbles as much as 2 or 3 inches in diameter. The voids are largely filled with silt and soft clay, however, and the coarse-grained beds are separated by beds of sandy clay. A similar coarse-grained zone can be distinguished in most reliable well logs in other parts of Long Island (J. J. Geraghty, written communication, 1953). It is best described as a zone, immediately overlying the clay member of the Raritan, in which relatively coarse-grained permeable material is commonly found.

The Magothy (?) formation typically contains several clay layers, some of them as much as 50 feet thick. Where the Magothy (?) itself is thick, the aggregate thickness of the clay beds is nearly as great as that of the clay member of the Raritan. Even in the western part of the Island, where wells are close together, it is difficult or impossible to trace any of these clay beds from one well to the next; hence, they are probably lenticular and individually of small extent. Thus, they probably do not constitute as effective a barrier to the movement of ground water as the clay member of the Raritan formation.

WATER-BEARING PROPERTIES

Although it consists in part of beds of dense clay and layers of coarse sand and gravel, by far the greater part of the Magothy (?) formation is made up of sandy clay and clayey sand. Thus, although the formation as a whole is probably less permeable than the Lloyd because of its thickness it can transmit and store large amounts of ground water. Also, there are no effective barriers to the movement of water through the formation except locally. Wells that are constructed and developed carefully generally yield large quantities of water from all but the most clayey parts of the formation. In other parts of Long Island, the beds of gravel at the base of the Magothy (?) and the lenses of sand and gravel of smaller extent that occur at various zones within the formation also yield substantial quantities of water. The Magothy (?) is important as an alternate aquifer in the event that the water in the overlying upper Pleistocene deposits becomes contaminated.

A well near Brookhaven National Laboratory that produces water from the Magothy (?) is S5902 at Port Jefferson. The aquifer tapped by this well is apparently not the basal Magothy, but a coarse-grained zone 100 feet higher. Well S5901, only 0.2 mile from S5902, did not penetrate productive water-bearing material in the Magothy (?) and was abandoned. This is one of a very few places in central Suffolk County where difficulty has been encountered in obtaining water. At most other places, where adequate supplies of water are not available from the upper Pleistocene, ample supplies have been developed from the Magothy (?) formation.

The highly productive beds of the Magothy (?) are by no means confined to the basal zone, but there is no other zone in which a reliable supply can be predicted. Rather it is a case of drilling carefully until material of appropriate grain size and permeability is found. Both of the deep wells at Brookhaven National Laboratory penetrated considerable material in the Magothy (?) from which water might be obtained. Well S6434 was screened temporarily between 656 and 676 feet and tested by pumping. Even with only 20 feet of screen, no gravel pack, and little development the zone yielded water at a specific capacity of 15 gpm per ft of drawdown.

CONFIGURATION OF THE MAGOTHY(?) SURFACE

Between the Late Cretaceous and the end of Tertiary time, the Raritan and Magothy(?) formations were tilted gently to the south and considerably dissected by streams. The shape of the land surface thus formed is important for it is related to the thickness and distribution of the younger deposits resting on it. As these younger deposits have somewhat different hydrologic properties than the Cretaceous beds, their thickness is a matter of considerable importance to this report. In particular, extensive valleys now filled with permeable deposits occur in the western part of Long Island. If similar valleys are present in central Suffolk County, they might provide buried channelways for the movement of ground water. Although few wells penetrate to the Cretaceous in central Suffolk County, the general shape of the surface may be inferred from its configuration in the western part of the Island, where more data are available, and by inference from the general geology.

When the coastal plain formed on the Magothy(?) deposits began to be eroded, the lower reaches of the ancestral Housatonic and Connecticut Rivers probably were the first main streams flowing south or southeast across the area which subsequently became Long Island. As these streams trenched themselves, tributaries called subsequent streams developed along the outcrops of the less resistant beds and in particular along the contact of the Cretaceous deposits and the crystalline bedrock. As the main streams cut deeper, the tributaries which followed this contact migrated southward down the slope of the surface of the more resistant bedrock and removed in the process a wider and wider strip of the Cretaceous cover. The inner lowland so formed is the site of Long Island Sound, and the cuesta ridge to the south of it forms the core of Long Island. Thus, in general, the surface of the Cretaceous deposits of Long Island in pre-Pleistocene time probably consisted of gentle south-dipping slopes (dipslopes), steep north-facing slopes (scarp slopes) scarred by short steep valleys, and a few main stream valleys, the original consequent streams, which traversed across or detoured around the cuesta ridges.

Whether or not such a major stream valley crossed central Suffolk County is not known. Veatch and others (1906, pl. 6*A*) suggest that the ancestral Housatonic River at first crossed the area not far west of the present site of Brookhaven National Laboratory. Well records suggest that there is a buried valley extending at least a few miles south of Mount Sinai Harbor, but there is no evidence to show that this valley extends across the island. Even if the Housantonic River crossed the island, such a remnant of its valley might well be a short segment only across the higher part of the postulated cuesta ridge.

Veatch (1906, pls. 6*B and* 6*C*) believed that the ancient Housatonic and Connecticut Rivers were eventually deflected westward where they entered the inner lowland, as the result of steam piracy, and flowed across the west end of Long Island as the ancient Sound River. Veatch thought that this river flowed to the west rather than to the east, partly because the Delaware, Susquehanna, and Potomac Rivers turn west where they cross the basal Cretaceous beds, and partly because well records revealed segments of buried valleys in southern Queens County and in south-central Kings County. Veatch (1906, pl. 6*D*) suggested also that the ancestral Housatonic and Connecticut Rivers were deflected east around the end of Long Island during the late Pleistocene time.

Many of the well records in central Suffolk County are generalized, and the correlations are somewhat questionable. However, within and a short distance south of the Laboratory area, several test wells were cored and the samples carefully studied. Interpretations as to the position of the Cretaceous surface at these wells are considered to be reasonably accurate. Data were particularly sought in the area south and southeast of Brookhaven National Laboratory, for this is the general direction of movement of the ground water from the Laboratory. These core identifications show that the Cretaceous surface is 92 feet below sea level at the southwest corner of the laboratory tract (well S6409, pl. 2). From here the surface slopes down gently to the south and southeast to 149 feet below sea level at well S6457 near Route 27, and it slopes down to about 140 feet below sea level at well S6460 (pl. 2). Still farther south, the position of the upper surface of the Cretaceous beds is uncertain, but it may be as much as 250 to 300 feet below sea level to the south according to interpretation of drillers' logs. Conceivably some of the clay correlated as Gardiners may be part of the Magothy(?) formation.

Beneath Brookhaven National Laboratory north of well S6409, the Cretaceous surface slopes to the north and is 161 feet below sea level at the northeast corner of Brookhaven National Laboratory (well S6458, pl. 2). Still farther north, few reliable well records are available, but the surface probably rises along the north shore in the vicinity of Shoreham, perhaps even to altitudes above sea level. West along the north shore, near Mount Sinai Harbor, is the valley already referred to, and still farther west, in Port Jefferson, well records and one exposure show clearly that the Cretaceous surface is 50 feet or more above sea level. A small buried ridge which appears to trend east-west beneath the southern boundary of Brookhaven National Laboratory may be part of a minor cuesta.

East of Brookhaven National Laboratory, beneath the valley of the modern Peconic River, there may be a buried valley of considerable extent. Wells at Manorville and Riverhead reached the Magothy (?) at considerable depths below sea level.

The total relief on the surface of the Cretaceous deposits in central Suffolk County is about 400 feet. Except for parts of the north shore, which are outside of the area of immediate interest to Brookhaven National Laboratory, the Cretaceous surface is very gently sloping, and the valleys and ridges referred to are but very minor undulations on a generally flat and nearly level surface.

DEPOSITS OF PLEISTOCENE AGE

During the Pleistocene epoch there were four major glacial stages. These were separated by three relatively warm interglacial stages. Long Island is about at the southern limit of the last major advance of the ice, the Wisconsin stage, and perhaps near the limit of the ice front of the earlier glacial stages.

In central Suffolk County, the deposits of Pleistocene age comprise: the Gardiners clay, believed to be a shallow marine deposit of the last major interglacial stage; and a complex sequence of glacial and nonglacial deposits, probably all of Wisconsin age, grouped under the name upper Pleistocene deposits. (See pl. 2.) The Jameco gravel found in western Long Island and the Mannetto gravel identified near the Nassau-Suffolk County boundary have not been recognized in central Suffolk County.

GARDINERS CLAY

In about the southern half of central Suffolk County, the Magothy (?) formation is overlain unconformably by a fossiliferous marine clay that probably is the equivalent of the Gardiners clay as defined and described by Fuller (1914, p. 92). The type locality of this formation is on Gardiners Island at the east of Peconic Bay. It is not possible to trace the deposits from the type locality to Long Island proper; therefore, the name Gardiners clay in this report is restricted to the fossiliferous clay beneath much of the southern part of the area that is between the upper Pleistocene deposits above and the Magothy (?) formation below.

In most of Long Island, except where it has locally been deformed by ice shove, the top of the Gardiners clay is about 50 feet or more below present sea level. In central Suffolk County, it is everywhere about 100 feet below sea level or deeper. The nonmarine clays exposed at or about sea level along the north shore of Long Island, described by Fuller as Gardiners clay, are no longer believed to be part of that formation (Weiss, 1954, p. 148).

As used in this report, the Gardiners clay comprises three somewhat different types of material that occur in three separate bodies and

that may or may not be contiguous with one another. These bodies are somewhat different lithologically and thus have somewhat different effects on the movement of ground water.

One of these is a thin body of clay or clay and sand that extends, in the area where it is best known, from about the northern border of Brookhaven National Laboratory as far south as Route 27 at well S6457 (pls. 1, 2). Similar deposits were penetrated by wells S128 and S95 to the west. Most wells in the area do not penetrate the Cretaceous beds, so the extent and continuity of the Gardiners is not known. However, it appears to underlie a belt around 6 miles wide north and south, roughly north of Route 27, and extending east and west across central Suffolk County. In this belt, the Gardiners clay is about 10 feet thick. The altitude of its upper surface is 101 feet below seal evel at S6456 (pl. 2), 91 feet below at S 6459 (pl. 2), and 130 feet below at S 6457 (pl. 1). Where penerated by these wells, the formation is composed of tough dark-gray to green sandy clay that contains a few pebbles. The green color is in part due to a small amount of glauconite and a small amount of green clay minerals.

A few pelecypod and gastrapod shells were found in the Gardiners clay at several of the wells in this area. At well S6409, a thin layer of dark brown peat underlies the clay. None of this material was particularly diagnostic; the peat being described by E. S. Barghoorn (Harvard Univ., written communication, 1952) as yielding only conifer pollen grains, Lycopodium spores, and other evidence of arboreal flora, which suggests a climate similar to, or more probably, slightly colder than the present.

Microfossils in the Gardiners were somewhat more indicative. Lawrence Weiss, formerly of the Geological Survey, prepared a report (1954) of the foraminifera obtained from cores and other samples. The foraminifera, and to a lesser degree the diatoms (K. E. Lohman, written communication, 1950), suggest strongly that the thin northern part of the formation in the vicinity of the laboratory was deposited in a shallow body of brackish water, not unlike the bays that fringe the southern shore of Long Island today. The fossil forms are largely identical with those living in the present bays. They do not resemble the forms living in the less well protected and more saline water of Long Island Sound. Similar forms are also found in protected waters to the north along the New England coast, which suggests that the Gardiners clay was formed during an interglacial period when the climate was similar to or perhaps a little colder than now. This conclusion agrees with the less conclusive evidence furnished by the peat. Also indicative of a somewhat colder climate is the altitude of the top of the clay, which suggests that sea level at the time of deposition was 50 to 100 feet lower than at present. This could be true if the glaciers and polar icecaps of the time were more extensive than those of today. MacClintock and Richards (1936, p. 330–331) suggest that the Gardiners clay is the equivalent of the Cape May formation of New Jersey, and they indicated on a map the probable position of the shoreline in New Jersey, New York, and Connecticut when the Cape May formation and the Gardiners clay were deposited. On this map, the sea level is shown as higher than at present in New Jersey, but lower than at present in Long Island and Connecticut. This would suggest that the land had been susequently tilted, or that the two formations are not actually contemporaneous.

The second body of the Gardiners clay, as here considered, comprises the thick clay penertated by wells S5591, S8549, and others (pl. 2), south of Route 27. The upper surface of this clay is at about 130 feet below sea level, but the lower contact slopes seaward so that the unit attains its greatest apparent thickness at well S8549 (pl. 2), where it consists of a nearly continuous body of tough generally green clay. A similar sequence, not quite so thick, was penetrated in well S5591 (pl. 2). Predominantly clay beds, as much as 80 feet thick, occur at depths of 130 feet below sea level at other southerly wells such as S6187 and S152. Thus, these thick clays may extend along the entire shore from Blue Point to Westhampton Beach and possibly beyond.

Clays of such thickness seem to be inconsistent with the apparent mode of deposition of the thin clay to the north. Also, the basis for an age determination is not firm. Hence, the thick clay may not be entirely of Gardiners age and may include beds of the Magothy(?) formation. Similar thick clays have been found farther west beneath Fire Island Beach, and Cretaceous foraminifera have been found in some of them (Perlmutter and Crandell, 1959, p. 1066–1067). However, the writer feels that lithologically the clay here discussed is not typical of the Magothy(?), and believes that if it is not Gardiners it must wholly or partly belong to some intervening formation hitherto unidentified.

A third body of deposits tentatively correlated with the Gardiners clay comprises certain fossiliferous sands and clays found in wells in the Riverhead area and south of Mount Sinai Harbor. As explained in foregoing paragraphs, it is likely that valleys were cut into the surface of the Magothy(?) formation at both of these places during the Tertiary. These valleys may have been invaded by the sea during deposition of the Gardiners clay. At well S5140 in Riverhead, Weiss (1954) found microfossils similar to those present in the Gardiners clay beneath Brookhaven National Laboratory and considered that the beds represent a shore facies of the Gardiners clay. These fossils were present in two sand layers and in an intervening clay penetrated between depths of 70 and 101 feet below sea level. Shells also were reported in fine sand at 33 feet below sea level at about 1.5 miles east-northeast, but no samples were available for study. The fossiliferous sand 33 feet below sea level is presumably pre-Wisconsin if it is overlain by glacial outwash. However, at this comparatively shallow depth, the overlying material may be of Recent age.

In the Mount Sinai Harbor area, clay or sand and clay containing shells have been found in several wells at depths below sea level as follows: S43, −60 to −200 feet; S2650, −10 feet; S9087, −60 to −70 feet; and S108 at about −100 feet. These are approximate figures, and as the area was overridden by later ice sheets, the clay may have been deformed by ice shove. The foraminifera from well S2650 were briefly examined by N. M. Perlmutter who found them similar to those described by Weiss from the Gardiners clay. The material is therefore, like the sand at Riverhead, probably interglacial, and possibly contemporaneous with the Gardiners clay.

WATER-BEARING PROPERTIES

With respect to water-bearing properties, the chief concern is with the predominantly clayey parts of the Gardiners that lie beneath and south of Brookhaven National Laboratory. Beneath the laboratory and roughly north of Route 27, the thin supposedly lagoonal portion of the Gardiners, as here distinguished, lies between the highly permeable upper Pleistocene deposits above and the moderately permeable Cretaceous formations below. The effectiveness of this part of the Gardiners clay as a barrier to ground-water movement is an important factor in determining whether contamination reaching the ground water in the glacial sands would be carried down to the lower aquifers. The beds of tough clay are probably relatively impermeable, but they do not appear to occur in sufficiently thick and continuous strata to form a fully effective barrier to ground-water movement. If the Gardiners clay was indeed formed in a bay such as those which now fringe the south shore of the Island, and if the sea level rose from −140 feet to −90 feet during deposition, the formation would then probably consist of overlapping lenses of clay with zones of coarser grained silt and sand around the margins and local silty or sandy zones throughout. Indeed, the logs of wells S6457 and S6459 indicate that such sandy zones exist. Accordingly, this part of the Gardiners clay is apparently not a continuous and complete barrier to ground-water movement over the whole area, although the tough clay zones probably are effective barriers locally.

Certain hydrologic data, discussed more fully by de Laguna (written communication, 1962) bear out this conclusion. The hydraulic head differential across the clay in the area south of the Laboratory, as measured at wells S6456, S6459, and S6460 is on the order of half a foot. The clay therefore must be sufficiently impermeable to restrict somewhat the movement of water, which here is from upper to lower strata. However, the sandy zones in the clay, which as far as is known may occur anywhere, would offer relatively little restriction to the movement of water, which could then pass downward wherever the hydraulic gradient is favorable. Thus, taking the unit as a whole, water can pass through the Gardiners clay, although at a slow rate, in small amounts and probably at most places only by circuitous routes.

The thicker beds of clay and sand and clay beneath the south shore of the island, which were referred to the Gardiners clay, are doubtless appreciably more effective as a barrier to the movement of ground water than the thin beds of clay farther north. This is due not only to their greater thickness but also to the inferred greater continuity of the clays, although the log of well S1592 (pl. 2) suggests that there are sandy zones even in this material. However, the significance of these characteristics is less than in the clay to the north, because the southern clay beds lie within the area where ground water is moving upward rather than downward. The thick clay in the vicinity of well S5591 and southward greatly retards the actual movement of water from the deeper formations. In fact, it may force relatively large amounts of water to discharge upward in more northern areas, perhaps through more permeable deposits such as those penetrated by well S1592.

The scattered fossiliferous sands and clays in the Riverhead and Mount Sinai Harbor areas are impossible to evaluate hydrologically as their structure and distribution are not known. It would appear, however, that they are but a part of a geologically complex filling of the buried valleys in these areas, and that the details of the hydrology of these areas is likely to be similarly complex. These areas are remote from the Laboratory and their hydrology is of correspondingly small importance to the basic problems of this report.

UPPER PLEISTOCENE DEPOSITS

The term upper Pleistocene deposits was used by the writer in 1948 (de Laguna, 1948, p. 16) to include all the Pleistocene deposits on Long Island above the Gardiners clay. Fuller (1914, p. 106–176) divides this material into three formations: the Jacob sand, thought to grade downward into the Gardiners clay; the Manhasset formation, thick glacial deposits presumably of Illinoian age; and a thin, surficial veneer considered to be Wisconsin drift. Subsequent work

suggests that the Jacob sand is not a separate formation, and that the Manhasset formation is actually largely, if not entirely, of Wisconsin age.

The Jacob sand, as described by Fuller (1914, p. 106), consists of very fine sand, silt, and rock flour, which are plastic when wet, but which contain little true clay. The color is very light gray, or yellow or buff. Fuller gives no thickness for the unit. According to Fuller, the Jacob sand is exposed at several places in wave-cut bluffs at or near sea level along the north shore of Long Island and at the type area at Jacobs Point, 15 miles northeast of Brookhaven National Laboratory. At places, the Jacob sand grades downward into a brown silty clay which Fuller believed to be the Gardiners clay, but this clay contains no fossils and is no longer believed to be Gardiners. Also, Fuller's suggestion (1914, p. 105–106 and fig. 77) that the nonfossiliferous Jacob sand at the type locality and elsewhere along the north shore is equivalent to fine-grained fossiliferous sand which overlies the Gardiners clay on Gardiners Island probably is incorrect. This fossiliferous sand probably should be considered part of the Gardiners clay (MacClintock and Richards, 1936). In its type area the Jacob sand does not appear to be a true stratigraphic unit, but rather to comprise beds and lenses, each of rather limited extent, of fine sand, silt, and rock flour probably deposited in quiet water ponded along the ice front. Deposits comparable to the Jacob sand are not recognized in well logs beneath the central or southern part of Long Island.

The type locality of the Manhasset formation of Fuller is in Manhasset in northern Nassau County, where thick deposits of glacial sand and gravel contain a thin intercalated bed of clayey till. The lower gravel Fuller called the Hempstead gravel member, the till was called the Montauk till member (after the type locality at Montauk Point), and the gravel above the till was called the Herod gravel member, although the correlation of this particular gravel with the sand and gravel at Herod Point in central Suffolk County is also uncertain. Fuller believed that only the top few feet of till which overlies the Manhasset formation at the type locality was deposited by the Wisconsin ice sheet. This belief was based on an interpretation of the physiography with which subsequent workers have not been in agreement. Wells (1935, p. 121–122) and Fleming (1935, p. 222) state that they could find no evidence of weathering or erosion to indicate that there was an interglacial period at any time subsequent to the deposition of the Gardiners clay. The writer agrees with this opinion.

Fleming (1935, p. 216–238) proposes a three-fold subdivision of the post-Gardiners glacial material into Herod, Montauk, and Latest, as he believes that three separate advances of the Wisconsin ice were represented. The writer found no evidence in central Suffolk County, however, of three ice sheets. The glacial deposits observed in the Brookhaven National Laboratory area appear to be the product of two ice advances similar in character and probably both of Wisconsin age.

The Ronkonkoma and Harbor Hill moraines as mapped by Fuller (1914, pl. 1) are accepted with slight modification; and the bulk of the upper Pleistocene deposits are considered to be outwash from the same glaciers that formed the moraines. The chief points of disagreement with Fuller are: (1) the Manhasset formation, as defined by Fuller, is not considered to occur within the area and does not underlie the two outwash deposits at shallow depth as he believed; (2) the outwash is believed to be substantially thicker than Fuller thought; and (3) the thin till (supposedly ground moraine of the Ronkonkoma advance), which Fuller maps as underlying central Suffolk County and considerable territory to the north and west, is not believed to be present. This last unit is here replaced by Ronkonkoma and Harbor Hill outwash as discussed in the following paragraphs.

On the other hand, some units are here recognized in the upper Pleistocene that Fuller had little or no chance of observing. The first of these, called the unidentified unit (Weiss, 1954, p. 148), occurs at the base of the upper Pleistocene deposits. The second unit is clay, some of it varved, which is best known from cores from a test well at Manorville. Lastly are some thin surficial fine-grained deposits, not typical outwash, that occur in the upper part of the Harbor Hill outwash in the headwaters of the Peconic River in or near the eastern part of Brookhaven National Laboratory.

Thus in summary, the upper Pleistocene deposits in the vicinty of Brookhaven National Laboratory comprise the Harbor Hill and Ronkonkoma moraine deposits and outwash, which are indistinguishable on the basis of texture and composition alone, but which occupy somewhat different physiographic positions; and three minor units, differentiated on the basis of their composition: the unidentified unit, the clay at Manorville, and fine-grained surficial deposits of limited but uncertain extent.

UNIDENTIFIED UNIT

South of Brookhaven National Laboratory, and for an unknown distance east and west, the Gardiners clay is overlain by 25 to 50 feet of sand or clay and sand characterized by a greenish color which is referred to as the unidentified unit. Beneath the southern half of the laboratory tract, and south to Route 27, this material forms the basal part of the upper Pleistocene deposits. Its relation to the other units

in this area is shown in plate 2. Similar greenish deposits are reported in wells as far west as Patchogue (well S7519) and as far east as West Hampton Beach (wells S9973 and S152). It probably extends beyond these areas. The northern limit of the unit has been located only at Brookhaven National Laboratory where test drilling indicates that this unit extends north of well S6459 (pl. 2). To the south, the unit can be traced nearly as far as well S1592 (pl. 2), but beyond this point the greenish deposits cannot be distinguished in well logs from similar material that may be part of the Gardiners clay or older deposits. The data from other wells along the south shore of the Island are not adequate to define the unit.

The unidentified unit, in the vicinity of Brookhaven National Laboratory, where it is most clearly defined, is composed of fine- to medium-grained white and gray sand, and 5 to 10 percent of interstitial green clay. The sand grains consist mostly of quartz, but some other minerals also are present, principally feldspar, amphibole, and garnet. The green clay was identified by Clarence Ross (written communication, 1949) as nontronite, but probably there are other clay minerals present. Some broken grains of reworked glauconite are also present; and the nontronite may well have been formed by the weathering of glauconite. Elsewhere, the unit apparently contains considerable clay or sandy clay.

Samples of sand were collected for mechanical analysis from well S6456. The texture of the sample of greenish sand is not distinctive. The amounts and proportions of fine and medium sand are similar to those in some of the upper Pleistocene outwash; the content of coarse and very coarse material is small. Mineralogically the greenish sand differs from the overlying outwash mainly in the apparent absence of biotite and the presence of glauconite. It appears to have a more varied mineral content than the Gardiners clay.

The origin of the unit is uncertain, but it is here considered to be part of the upper Pleistocene deposits because of its general mineralogic and lithologic similarity to the sands of those deposits. The glauconite may well have been derived from the shallow marine deposits in Long Island Sound, then dry, by the first advance of the ice across this area, and it need not have come from the area of the Atlantic Ocean to the south.

WATER-BEARING PROPERTIES

The unidentified unit, although very similar in texture to much of the outwash, contains less coarse sand, and probably on the average a little more clay. The difference is difficult to estimate quantitatively.

However, it may be inferred that the movement of the ground water in the unidentified unit is somewhat slower than it is in the overlying material. Even a small difference may be of some importance. As shown in a later section, a body of contaminated liquid of even slightly greater density than the normal ground water will tend to sink to the bottom of the aquifer. Also, the adsorptive and ion-exchange capacity of the nontronite and glauconite in the unit is appreciably higher than that of the overlying outwash. It is concluded, therefore, that following a spill or leak, any contaminated water which sinks into the unidentified unit at the bottom of the upper Pleistocene, will move less rapidly and be subject to more adsorption than it would be in the overlying material.

MORAINE DEPOSITS AND OUTWASH

The moraine deposits and outwash comprise four separate units: the Ronkonkoma moraine, outwash and other meltwater deposits from the Ronkonkoma ice, the Harbor Hill moraine, and outwash from the Harbor Hill ice. These units are distinguishable topographically, but not lithologically with present information.

The Ronkonkoma moraine is a line of irregular hills that lies immediately south of Brookhaven National Laboratory (pl. 1). It extends eastward past South Manor, where it forms the south side of the Manorville Basin, and still farther east through Bald Hill. It also extends westward, paralleling the Carmans River valley at Yaphank, and then crosses that valley and includes Coram Hill and others to the west.

The Ronkonkoma outwash underlies and forms the sloping but fairly smooth terrain south of Brookhaven National Laboratory, and also the irregular hills on and among which the main Laboratory tract is situated. These hills are considered to be kames formed during the late stages of melting of the Ronkonkoma glacier.

The Harbor Hill moraine (pl. 1) lies along the north shore of Long Island and is of little direct concern in connection with the ground-water problems of the Laboratory. Outwash from the Harbor Hill ice, however, extends southward to within about 1½ miles of the north boundary of Brookhaven National Laboratory, and to the east it extends south of the Peconic River and underlies most of the Manorville Basin. It is believed that meltwater from the Harbor Hill ice flowed down the site of the Carmans River, through the gap in the Ronkonkoma moraine, and into the narrow tongue that broadened at the south to form a fanlike feature; the broad, flat area where the communities of Mastic and Mastic Beach are now located (pl. 1).

Within the Laboratory tract, except for the thin, surficial clay and silt described below, all these morainal and outwash deposits are lithologically inseparable and form virtually a single water-bearing unit. As a unit, these deposits rest upon the unidentified unit and, where that unit is missing or unrecognizable, upon the Gardiners clay. At places, where the Gardiners is missing, it rests on the Magothy(?) formation. In the laboratory area, it is from 100 to more than 200 feet thick. Its thickness, altitude, relationships to underlying formations, and general lithologic characteristics are shown by the cross sections in plate 2.

The moraine and outwash deposits are a crudely stratified body of clean sand and gravel which contains very little clay or silt, and only locally a few boulders. The sand grains are mostly quartz with small amounts of alkali feldspar, mica, amphibole, and other minerals. As indicated by a few exposures, the sand is well but coarsely bedded. Individual beds are difficult to define, as variations in texture are gradational.

Cores from some of the test holes reveal thin layers of silt or clay, which at most are 1 to 2 inches thick. Thicker lenses of clay are absent in the immediate vicinity of the Laboratory, but they are exposed locally along the north shore, especially at Wildwood State Park and Rocky Point (pl. 1). These lenses of silt and clay were probably deposited in small lakes formed between the retreating face of the Harbor Hill ice sheet and the Harbor Hill moraine. They are not more than 20 to 30 feet thick, and the majority are less than 10 feet thick. They appear to be at most a few hundred yards long. All these beds of silt and clay are near sea level, and they are evidently the material identified as the Jacob sand and the Gardiners clay by Fuller (1914).

No systematic variations in texture were actually observed in the glacial outwash or moraine deposits, and indeed to detect any would probably require a statistical study of a considerable number of large samples. The data available, however, suggest that the Ronkonkoma outwash becomes finer grained south of the Ronkonkoma moraine, and that the lower part of the outwash is somewhat finer than the upper part. No such generalization appears to hold for the material north of the Ronkonkoma moraine.

WATER-BEARING PROPERTIES

Because of their similarity in structure and texture, the moraine and outwash deposits are considered a hydrologic unit. In the Laboratory area, the water table lies within what is probably the Ronkonkoma outwash, so that this deposit is of primary concern. The clean, coarse sand and gravel is very porous and highly permeable. It makes a

›orous soil, so that a high proportion of the rainfall infiltrates where t falls; there is virtually no surface runoff. Because of their high ›orosity, the deposits store large quantities of water. Because of heir high permeability, the deposits yield large quantities of water o wells and are the source of nearly all the ground water pumped in entral Suffolk County.

So far as is known there are no effective barriers to the movement f water anywhere in the unit. However, because the deposits are enticular, there may be substantial variation in permeability over hort distances. The permeability of the deposits south of the Ronkonkoma moraine may decrease slightly with depth and with distance o the south.

Some of these minor variations in water-bearing characteristics night become significant in connection with possible movement of a ontaminant. As the moraine deposits and outwash were deposited by vater flowing in general from north to south, it is reasonable to uppose that individual lenses of sand and gravel are themselves longated in this direction. Thus, there may be threads of relatively ›ermeable material along which water might move a little more apidly under proper hydraulic conditions. Also, there may be either ine- or coarse-grained deposits localized beneath and along the valleys f the principal streams, such as the Carmans or Forge Rivers.

Finally, as discussed by de Laguna (written communication, 1962) here is apparently a substantial difference between permeabilities in he horizontal and vertical directions.

CLAY AT MANORVILLE

A test well (S10,384) drilled by a private contractor near Manorville (pl. 1) penetrated a bed of tough clay which was underlain and verlain by outwash sand and gravel, between 2 and 33 feet below sea evel. The lower part of this clay has typical glacial varving, which ndicates that it was deposited in a lake left in the Manorville basin luring the ice retreat. Similar clay was found in well S6422 from 4 o 62 feet below sea level. East, in the Riverhead basin, several wells ›enetrated what are probably equivalent beds of clay 15 to 30 feet elow sea level. Three of these reached the bottom of the clay at 74, 1, and 130 feet below sea level. It is tentatively suggested that the arved clay at well S10,384 is possible interglacial, at least intersubtage, and may separate Ronkonkoma from Harbor Hill outwash. Vhether the clays penetrated by the other wells to the east and to the vest are of the same unit is not known. There are, however, clay and ilt of Gardiners age at about these depths in the eastern part of the Riverhead basin, and in well logs it would be impossible to distinguish

between them and the clay at Manorville. Wells for which there are reliable logs are not so located as to permit a determination of the continuity and extent of this clay. However, if the clay is post-Ronkonkoma, the temporary lake in which it formed presumably would have been limited to the north of the Ronkonkoma moraine, and the clay itself should occur correspondingly. It was not found in the Laboratory area, nor to the south of Brookhaven National Laboratory. West of the Laboratory, in the upper valley of the Carmans River, there are few data, and none to indicate the presence of a comparable clay.

The clay at Manorville, if laterally extensive, probably exerts a considerable influence on the movement of the ground water in the upper Pleistocene deposits in the area where it occurs. The water table is some 35 feet above sea level at Manorville, so that there is about 35 feet of saturated sand and gravel above the clay. The clay at well S10,384 is about 31 feet thick, and it is underlain by about 42 feet of sand and gravel. Movement of water between the upper and lower strata is certainly considerably impeded by the clay, and presumably artesian conditions prevail in the lower strata, although water-level measurements are not available to indicate the head difference. It is also possible that in some parts of the Manorville basin the water in the deposits beneath the clay flows southeastward toward and eventually to the south shore, whereas the water in the deposits above the clay discharges into the Peconic River. The clay appears to terminate, however, well to the east of the Laboratory, so that it does not influence directly the movement of ground water in the areas of potential contamination, but it may well be an important factor in the hydrology of the central and lower Peconic River valley.

SURFICIAL SILT AND CLAY

In the east third of the Laboratory area, test drilling and shallow excavations have revealed in places thin deposits of silt and clay. The material is discontinuous and unevenly distributed. It is at most 5 or 10 feet thick, and is generally found at or very near the surface; and not deeper than 20 to 30 feet. It appears to be more widespread in the slightly lower land along the Peconic River and minor headwater tributaries than in higher ground. It may have been first deposited by the wind as loess, shortly after the retreat of the ice sheets and before a vegetative cover had developed; and subsequently moved by running water and redeposited on lower land. Some of it may have originated as waterlain material, and some may be unreworked loess. The extent of the deposits is determined in part by hydrologic data.

These deposits are sufficiently fine grained so that they appreciably impede the movement of shallow ground water. They hold water at or near the land surface, and thus locally form swampy areas or ponds.

Also, they impede the downward movement of water enough so that at times when the level in the main underlying water body declines, they support perched or semiperched water bodies. Similarly, when the level in the main underlying water body rises, these fine-grained deposits confine the water under slight artesian pressure. These relationships are areally complex because the deposits are discontinuous and occur close to the water table. The deposits affect the movement of shallow water into and out of the Peconic River and associated ponds, swamps, and drainage ditches in a rather complex way, and thus they have a bearing on the possible movement of contaminated waters in and outside the eastern part of the Laboratory area.

DEPOSITS OF RECENT AGE

Deposits of Recent age comprise gravel and sand on beaches, organic matter, silt and clay in tidal swamps, gravel, and sand and silt in stream channels. These deposits are thin and discontinuous, and they occur chiefly along the shores of the present Long Island Sound, the open ocean, bays behind barrier beach and various bars, and along the channels of the few larger streams. They are not sufficiently extensive to make it important to differentiate them from underlying deposits (almost everywhere the upper Pleistocene deposits) upon which they rest unconformably.

They are generally neither thick enough nor extensive enough to comprise any appreciable ground-water reservoirs. Nearly all these deposits are remote from the Laboratory and there is no immediate problem in regard to their possible contamination.

REFERENCES CITED

Burr, W. H., Hering, Rudolph, and Freeman, J. R., 1904, Report of the commission on additional water supply for the City of New York: New York, Martin B. Brown Co., 980 p.

Crosby, W. O., 1910, Report of the geological relations of the ground water of Long Island: New York City Board of Water Supply, open-file report, 64 p.

Darton, N. H., 1893, The Magothy formation of northeastern Maryland: Am. Jour. Sci., 3d ser., v. 45, p. 407–419.

de Laguna, W., and Brashears, M. L., Jr., 1948, The configuration of the rock floor in western Long Island: New York Water Power and Control Comm. Bull. GW–13, 86 p.

Fleming, W. L. S., 1935, Glacial geology of central Long Island: Am. Jour. Sci., 5th ser., v. 30, p. 216–238.

Fuller, M. L., 1914, The geology of Long Island, N.Y.: U.S. Geol. Survey Prof. Paper 82, 231 p.

Johnson, A. H., and others, 1952, Record of wells in Suffolk County, N.Y.: New York Water Power and Control Comm. Bull. GW–31, 137 p.

Legette, R. M., and others, 1938, Record of wells in Suffolk County, N.Y.: New York Water Power and Control Comm. Bull GW–4, 19 p.

Lusczynski, N. J., and Johnson, A. H., 1951, The water table in Long Island, New York, in January 1951: New York Water Power and Control Comm. Bull. GW–27, 28 p.

MacClintock, Paul, and Richards, H. G., 1936, Correlation of late Pleistocene marine and glacial deposits of New Jersey and New York: Geol. Soc. America Bull., v. 47, no. 3, p. 289–338.

Oliver, J. E., and Drake, C. L., 1951, Geophysical investigations in the emerged and submerged Atlantic Coastal Plain: Geol. Soc. America Bull., v. 62, p. 1287–1296.

Perlmutter, N. M., and Crandell, H. C., 1959, Geology and ground-water supplies of the south-shore beaches of Long Island, N.Y.: New York Acad. Sci. Annals, v. 80, art. 4, p. 1060–1076.

Roberts, C. M. and Brashears, M. L., Jr., 1945, Record of wells in Suffolk County, N.Y., supplement 1: New York Water Power and Control Comm. Bull. GW–9, 155 p.

Spear, W. E., 1908, Long Island sources, an additional supply of water for the City of New York: New York City Board of Water Supply, v. 1, p. 55–102.

Suter, Russell, de Laguna, Wallace, and Perlmutter, N. M., 1949, Mapping of geologic formations and aquifers of Long Island, N.Y.: New York State Water Power and Control Comm. Bull. GW–18, 178 p.

Thompson, D. G., Wells, F. G., and Blank, H. R., 1937, Recent geologic studies on Long Island with respect to ground-water supplies: Econ. Geology, v. 32, no. 4, p. 451–470.

Veatch, A. C., and others, 1906, Underground water resources of Long Island, N.Y.: U.S. Geol. Survey Prof. Paper 44, 394 p.

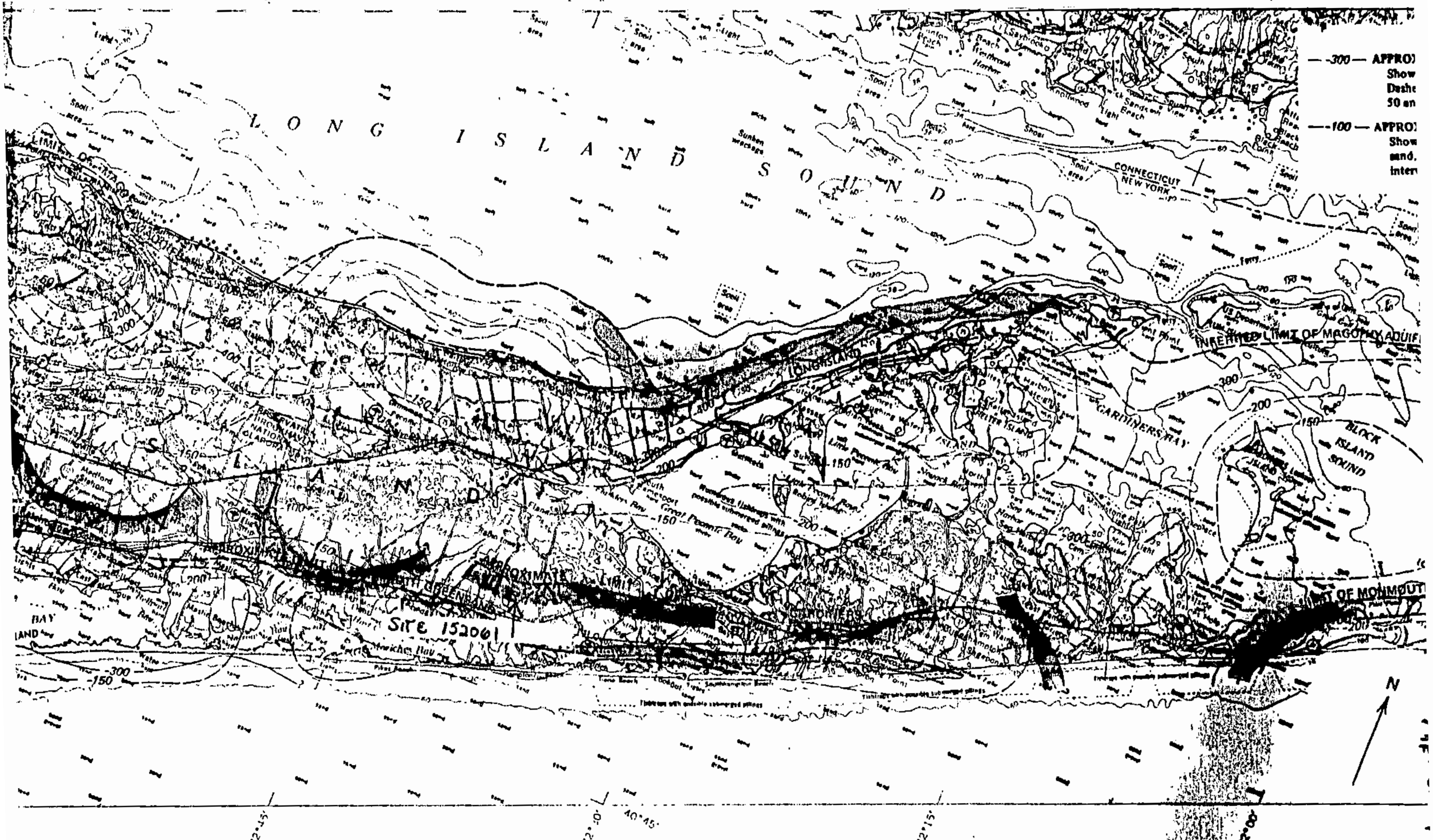
Von Engeln, O. D., 1942, Geomorphology, systematic and regional: New York, The MacMillan Co., 655 p.

Weiss, Lawrence, 1954, Foraminifera and origin of the Gardiners clay (Pleistocene), eastern Long Island, N.Y.: U.S. Geol. Survey Prof. Paper 254–G, p. 143–162.

Wells, F. G., 1935, Reconsideration of the Pleistocene geology of Long Island [abs.]: Geol. Soc. America Proc., 1934, p. 121–122.

Wenzel, L. K., 1942, Methods for determining permeability of water-bearing materials: U.S. Geol. Survey Water-Supply Paper 887, 192 p.

1961



MAP SHOWING ALTITUDE OF TOP OF MAGOTHY AQUIFER AND MONMOUTH GREENSAND AND APPROXIMATE LIMIT OF THE GARDINERS CLAY

Hydrologic Investigations Atlas HA-501 (Sheet 1 of 2)

SCALE 1:250 000

CONTOUR INTERVALS 25, 50, AND 100 FEET
DATUM IS MEAN SEA LEVEL

HYDROGEOLOGY OF SUFFOLK, COUNTY, LONG

Appendix 1.3-3
1 of 3

Hydrogeology of Suffolk County, NY
Jensen and Soren
1974

MAP UNITS

QUATERNARY

TERTIARY(?)

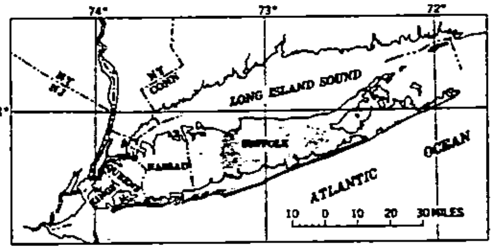
IAP UNITS

IARSH DEPOSITS
L, UNDIFFERENTIATED
MORAINE
DRAINE
RAINE
IAL MORAINE
FERENTIATED
NTIATED

INTRODUCTION

WATER NEEDS OF SUFFOLK COUNTY

Water pumped from aquifers underlying Suffolk County (index map) is the sole source of water used for public supply, agriculture, and industry. The county's population grew from less than 200,000 in 1940 to 1.1 million in 1970. Most of the growth occurred after 1950. Ground-water pumpage increased from 40 mgd (million gallons per day) in 1950 to 155 mgd in 1970 (New York State Department of Environmental Conservation, written commun., June 1, 1971). The projected ground-water use for an anticipated population of 2 million in the county by 1990 is 300 mgd (New York State Conservation Department, 1970, p. 26–27).



INDEX MAP SHOWING LOCATION (SHADED) OF SUFFOLK COUNTY

PURPOSE AND SCOPE

The large and growing demand for ground water in Suffolk County has created a need for a detailed knowledge of the geometry and the hydrologic characteristics of the ground-water reservoir. Mapping of subsurface geology and hydraulic heads in the aquifers are important prerequisites to obtaining this information. Maps of the subsurface geologic units of Long Island were first shown in a report by Suter and others (1949, pls. VIII to XXI). But those maps were highly generalized, because there were few data on deep borings and wells in the county when the report was prepared. Since 1949, additional data from many deep borings and wells in the county have been collected.

In 1968, as part of a continuing cooperative program of water-resources studies with the Suffolk County Water Authority and Suffolk County Department of Environmental Control, the U.S. Geological Survey began an updating of the hydrogeologic and hydrologic maps of all the county. The basic data in Jensen and Soren (1971), the first product of the program, are the basis for the hydrologic maps in this report.

ACKNOWLEDGMENTS

The authors appreciate the cooperation of well-drilling companies, their employees, and the many officials of public and private water companies who furnished geologic and hydrologic data for use in this report.

GEOLOGIC AND HYDROGEOLOGIC UNITS

Pleistocene glacial drift generally mantles the county's surface. Pleistocene deposits overlie unconsolidated deposits of Late Cretaceous age. The Cretaceous strata lie on a peneplain that was developed on Precambrian(?) crystalline rocks.

Major landforms include ridges, valleys, and plains. These landforms are roughly oriented in belts parallel to the county's length. The northern and the central parts are traversed by irregular sandy and gravelly ridges of terminal moraine. The crest of the northern ridge ranges in height from 100 to 300 feet above sea level and the crest of the central ridge from 150 to 400 feet. The highest altitudes in the inter-ridge area range from 100 to 200 feet. Irregular plains and rolling hills, formed from sandy and gravelly ground moraine and outwash deposits of sand and gravel lie in the area between the ridges. An outwash plain slopes at a near-uniform gradient from the southern base of the central ridge, which is about 100 feet above sea level, southward to Great South Bay and the ocean. Along the north shore, steep bluffs as high as 100 feet and generally narrow sandy and gravelly beaches face Long Island Sound. The barrier-bar system at the southernmost side of the county is composed of sandy beach and dune deposits. The highest altitudes of the barrier bars generally range from 10 to 45 feet.

The ground-water reservoir system of Suffolk County is composed of hydrogeologic units that include lenses and layers of clay, silt, clayey and silty sand, sand, and gravel. A hydrogeologic unit consists of a geologic unit or a group of contiguous geologic units classified by hydraulic characteristics. These units include aquifers, which are principal water sources, and confining layers, which separate the aquifers. The aquifers are, from the land surface downward, the upper glacial aquifer, the Magothy aquifer, and the Lloyd aquifer. The major areal confining layers are, in descending order, the Gardiners Clay, the Monmouth greensand, and the Raritan clay. The base of the ground-water reservoir is the crystalline bedrock. Characteristics of the geologic and the hydrogeologic units are summarized in the table, and the following data of hydrologic significance are shown on the maps: base of ground-water reservoir, altitudes of aquifers, altitudes and limits of confining layers, and distribution of surficial deposits. The hydrogeologic sections show the vertical relations of the units to each other.

The sharp angular shapes of some of the contours reflect the fact that in places the contours are drawn on stratigraphic tops of the hydrogeologic units and in places the contours are drawn on erosional surfaces. The sharp angles result from the juncture of a stratigraphic top and an eroded surface.

GROUND-WATER SYSTEM

RECHARGE AND DISCHARGE OF FRESH GROUND WATER

Precipitation is the sole source of fresh-water recharge in the county. Average annual precipitation is about 45 inches; it generally ranges from 40 inches at the eastern end of the county to 50 inches in the middle and is nearly evenly distributed over the year (Miller and Frederick, 1969, plate 1). About half the precipitation seeps into the ground and percolates downward to the water table to become ground water; nearly half the precipitation is returned to the atmosphere by evaporation and plant transpiration; and a small amount of the precipitation, about 5 percent, enters streams by direct runoff (Cohen and others, 1968, p. 36–40, and Cohen and others, 1970, p. 11 and 14).

Ground water moves to discharge seaward mainly by subsurface outflow to salty ground water that is hydraulically connected with the sea and by seepage into streams that discharge into tidewater.

More than 50 streams discharge fresh water into the bordering bays, Long Island Sound, and the ocean. Most of the surface divide for the streams that drain the county lies in the northern half and extends from Melville, on the west, eastward through the Centereach area to the vicinity of the Brookhaven National Laboratory. From the area of the Brookhaven National Laboratory, the divide bifurcates into branches that approximately traverse the central lengths of the county's north and south forks. Streams flow to tidewater north and south of the divides, except for the Peconic River, which flows eastward to tidewater from the branching of the divides.

The total annual streamflow discharging into tidewater from about 1945 to 1971 averaged 390 cfs (cubic feet per second), or 253 mgd, distributed as follows (D.E. Vaupel, written commun., January 1969, and A.G. Spinello, oral commun., August 1971): most of the discharge, 280 cfs, from the southern part of the county into Great South Bay and, to a lesser extent, into the ocean; 60 cfs into Peconic Bay and other bays, between the north and south forks; and 50 cfs from the northern part of the county into Long Island Sound. Ground-water seepage constitutes about 95 percent of stream outflow.

MAN-MADE CONDITIONS

The effects of man's development on the ground water of Suffolk County has primarily been the diversion of part of it by wells and a return of the used, and generally chemically altered, ground water to the soil and ground-water reservoir. Used ground water is currently returned to the ground-water reservoir principally through cesspools. Some waste water from industrial processes returns to the ground through seepage pits; and ground water pumped for air conditioning and industrial cooling is returned, with higher temperatures, through recharge wells to the ground-water reservoir. Ground water pumped for crop irrigation and lawn sprinkling mostly represents a net loss from the system by evapotranspiration. Artificial filling of marshy shore areas has probably reduced evapotranspiration.

In 1970, gross ground-water pumpage in Suffolk County was 155 mgd (New York State Department of Environmental Conservation, written commun., June 1, 1971). An unknown amount of the pumpage was consumed by evapotranspiration, and virtually all the remainder (probably more than 75 percent) was returned to the ground through local waste-disposal facilities.

MOVEMENT OF GROUND WATER

Ground water moves from three major drainage subareas toward discharge at or near the shore. These subareas are (1) the main land area of the county from the Nassau County boundary to a point near the Brookhaven National Laboratory, (2) the north fork, from the Brookhaven National Laboratory to Orient Point, and (3) the south fork, from the Brookhaven National Laboratory to Montauk Point. The ground-water divides of these subareas form a "Y"-shaped pattern that approximately coincides with the major surface-water drainage divides. The arms of the Y radiate from the general area of the Brookhaven National Laboratory through the centers of the north and the south forks. Ground water moves northward toward Long Island Sound and southward toward Great South Bay and the ocean; lesser amounts in the Brookhaven National Laboratory and Riverhead areas percolate eastward toward Peconic Bay. Ground-water drainage from the north-fork area moves northward to Long Island Sound and southward into Peconic and Gardiners Bays and Block Island Sound; in the southfork

QUALITY OF THE GROUND WATER

The concentrations of chemical constituents in the ground water in most of Suffolk County are generally below the recommended maximum limits of the U.S. Public Health Service (1962, p. 7). However, some local water-quality problems exist, both natural and man-made.

ACIDITY

The pH of ground water ranges from 5.5 to 7.2 but is generally less than 7.0. The water commonly is sufficiently acidic to be corrosive. The Public Health Service has set no standards on acidity of drinking water other than that it should not be excessively corrosive to the supply system (1962, p. 7). Accordingly, water from many public-supply systems is treated with alkaline compounds to reduce acidity before distribution.

DISSOLVED IRON

According to the U.S. Public Health Service (1962, p. 7), dissolved iron concentrations in drinking and culinary water should not exceed 0.3 mg/l (milligram per liter). Excessive iron impairs the taste of water and of food and beverages prepared with the water; it also stains laundry and stains and clogs plumbing fixtures. High iron concentrations, locally more than 1 mg/l, are common in water from the Magothy and the Lloyd aquifers. As a result, many public-water suppliers remove excessive iron.

CHLORIDE

Along the seaward margins of the county, the fresh ground water is underlain and bordered by salty ground water that is hydraulically connected to the ocean, the bays, or Long Island Sound. Zones of mixed water, called zones of diffusion, separate the fresh and the salty ground water. The thickness of these zones probably ranges from a few feet in the upper glacial aquifer to as much as 500 feet in the Magothy aquifer (Lusczynski and Swarzenski, 1966, p. 23). The chloride content of the ground water in the zone of diffusion ranges from less than 10 mg/l to that of sea water—about 18,000 mg/l.

Contamination of the fresh ground water with salty ground water associated with the upward and landward movement of the zones of diffusion has not resulted in the abandonment of many wells in Suffolk County. However, the long-term potential threat of increased contamination of this type is of concern to numerous agencies and individuals in the county. A detailed discussion of this potential problem is beyond the scope of this report; however, considerable insight to the problem can be obtained from reports by Crandell (1962, p. 17–19, and 1963, p. G28–G31), Perlmutter and DeLuca (1963, p. B31–B34), Lusczynski and Swarzenski (1966, p. F66–F69), Holzmacher, McLendon, and Murrell (1970, p. 247–271), Collins and Gelhar (1970, p. 144–150), and Soren (1971b, p. A31–A34).

DETERGENT CONSTITUENTS (MBAS)

More than 95 percent of the ground water used for domestic supply in Suffolk County is returned to the ground through cesspools, septic tanks, and similar structures. As a result, the ground water and the ground-water-fed streams locally contain measurable amounts of certain substances of sewage origin, including foaming agents derived from synthetic detergents, commonly referred to as MBAS or methylene blue active substance. MBAS has been noted mainly in water from the upper glacial aquifer (Perlmutter and Guerrera, 1970, p. B14) and in the streams (Cohen, Vaupel, and McClymonds, 1971). Apparently, little or no MBAS had been found in water in the Magothy and the Lloyd aquifers. Where MBAS has been found in the water, the content is commonly less than 0.5 mg/l, the maximum limit in public-supply water recommended by the U.S. Public Health Service (1962, p. 24). However, locally, as much as 5 mg/l has been found in the ground water; and in some areas the MBAS content of the water seems to be increasing. As a result, the Suffolk County Legislature recently (1971) passed a law banning the sale of certain detergents in the county. In addition, plans have been developed for the construction of widespread sanitary-sewer systems that will discharge treated waste water into the sea.

NITRATE

The amount of nitrate in the ground water of Suffolk County is of concern of water managers and health officials. According to the U.S. Public Health Service (1962, p. 7) more than 45 mg/l nitrate (10 mg/l NO_3-N) in water supplies may be harmful, especially to infants. Perlmutter and Koch

Moriches and Shinnecock Bays and the ocean.

Movement of water in the aquifers of Suffolk County is more rapid horizontally than vertically. This partly reflects the low vertical hydraulic conductivity of the near-horizontal interbedded clay and silt lenses and beds. The estimated average rates of horizontal movement in the upper glacial, the Magothy, and the Lloyd aquifers are 0.5, 0.2, and 0.1 foot per day, respectively, in areas remote from pumping wells, and hundreds of feet per day near the screens of pumping wells (Soren, 1971a, p. 16). Vertical rates of movement are described in the following section.

HYDRAULIC INTERCONNECTION OF AQUIFERS

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

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

The contact between the upper glacial and the Magothy aquifers is not a smooth plane. Glacial deposits fill buried valleys that were cut in the Magothy aquifer, and these deposits are in lateral contact with truncated beds in the Magothy aquifer. In the buried valleys, water enters the Magothy aquifer at depths of hundreds of feet directly from the upper glacial aquifer. Near Huntington, a buried valley cuts completely through the Magothy aquifer and extends into the Raritan clay; in the Ronkonkoma basin, the Magothy aquifer seems to be nearly completely cut through; and along the north shore, where locally all the pre-Pleistocene deposits were completely eroded, the upper glacial aquifer is in contact with the full thickness of the Magothy aquifer. (See map showing altitude of top of Magothy aquifer and hydrogeologic sections, sheet 1.)

Where the upper glacial aquifer lies directly on sandy beds of the Magothy aquifer, good vertical hydraulic continuity exists between the two aquifers. Head losses between the water table in the upper glacial aquifer and the base of the Magothy aquifer in the area of the main ground-water divide in western Suffolk County (a vertical distance of as much as 900 feet) in 1968 generally were less than 2 feet (Soren, 1971a, p. 17–19). Furthermore, in areas of Long Island where ground-water withdrawals from both the upper glacial and the Magothy aquifers are large, the cones of depression in their water-level surfaces caused by pumping are similar in areal extent and configuration (Soren, 1971b, p. 15; and Kimmel, 1971, p. B227–B228). These observations confirm the high degree of hydraulic continuity between the two aquifers in many parts of the county.

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

Recharge to the Lloyd aquifer results from downward movement of water from the Magothy aquifer and from the upper glacial aquifer through the Raritan clay. The main recharge area of the Lloyd aquifer seems to be in the Ronkonkoma area. Head losses across a thickness of 150 to 180 feet of Raritan clay in the county generally ranged from 6 to 42 feet in 1968 (Soren, 1971a, p. 17).

GROUND-WATER LEVELS

THE WATER TABLE

The water table on Long Island was first mapped in 1903 (Veatch and others, 1906, pl. 12). At that time its highest point in Suffolk County was 100 feet above sea level, near Melville on the main ground-water divide near the Nassau County border, and was 70 feet above sea level at another high point on the divide in the Lake Ronkonkoma-Selden area. Subsequent maps show that water-table altitudes have continued to be highest in these two areas but had declined to 80 and 65 feet respectively in both 1943 and 1951 (Jacob, 1945, pl. 1; and Lusczynski and Johnson, 1951, pls. 1–2); recovered to 90 and 70 feet by 1958 (Lubke, 1964, pl. 5); and had reached new lows of 70 and 65 feet by 1968 (Soren, 1971a, p. 20). This latest significant decline probably resulted mainly from a regional drought from 1962 to 1966 (Cohen, Franke, and McClymonds, 1969, p. 1).

The water-table map shows the altitude of the water table in early 1971. At that time, in the Melville area it was about 5 feet higher than in 1968, and in the Lake Ronkonkoma-Selden area it was about 5 feet lower. The water table still has not recovered from the apparent effects of the 1962–66 drought in areas of significant pumping, partly because of

Counties was less than 1 mg/l (less than 0.2 mg/l NO_3-N).

Numerous wells in Kings County (G.E. Kimmel, written commun., August 1971), Queens County (Soren, 1971b, p. A30–A31), Nassau County (Perlmutter and Koch, 1972), and Suffolk County (Harr, 1971) yield water containing more than 0.2 mg/l NO_3-N. Moreover, at least 50 wells on Long Island yield water containing more than 10 mg/l NO_3-N. 363

The amount of water having more than 0.2 mg/l NO_3-N, its rate of increase, and the depth at which it is found seem to increase westward on Long Island as a whole, as well as in Suffolk County. These relations probably largely reflect the westward increase in population density, the westward increase in the age of the communities, and the associated degree of contamination of the ground water related to man's activities.

In Suffolk County, the two major sources of nitrate nitrogen in the ground water are (1) disposal of waste water into the ground and (2) agricultural activities, especially those involving the use of fertilizers. A planned countywide sanitary-sewer system is intended to reduce sewage as a source of nitrate nitrogen in the ground water of Suffolk County.

GROUND-WATER PUMPAGE

Pumpage from Suffolk County's aquifers increased from about 40 mgd in 1950 to about 155 mgd in 1970, to supply a population that has been increasing rapidly since the end of World War II. The greatest increases in population and ground-water pumpage have been in the western part of the county. Before about 1960, wells tapping the upper glacial aquifer supplied nearly all the water used in Suffolk County. Since then, pumpage from the Magothy aquifer has increased, and in 1970, the wells tapping the Magothy aquifer supplied about one-third the water used. (See map showing areal distribution of major pumpage by aquifer 1970.)

CHANGES OF GROUND WATER IN STORAGE

An area of about 140 square miles in west-central Suffolk County is underlain by about 4.5 trillion gallons of fresh water (Soren, 1971a, p. 20). By extrapolation, the total fresh ground water beneath all the county is probably 4 to 5 times this volume.

Withdrawals of ground water have caused the water table in some parts of the county to decline as much as 25 feet from earliest known levels in 1903 (map showing net change in the position of the water table) and have probably caused a small regional but generally undetected landward advance of salty ground water. The decline of the water table reflects a loss of 60 to 80 billion gallons of fresh water from the ground-water reservoir between 1903 and 1971. However, this loss of ground water from storage is less than 1 percent of the total ground water in storage in Suffolk County.

SELECTED REFERENCES

Cohen, Philip, Franke, O.L., and Foxworthy, B.L., 1968, An atlas of Long Island's water resources: New York Water Resources Comm.[1] Bull. 62, 117 p.

——— 1970, Water for the future of Long Island, New York: New York State Dept. Environmental Conserv. Water Resources Bull. 62A, 36 p.

Cohen, Philip, Franke, O.L., and McClymonds, N.E., 1969, Hydrologic effects of the 1962–66 drought on Long Island, New York: U.S. Geol. Survey Water-Supply Paper 1879-F, 18 p.

Cohen, Philip, Vaupel, D.E., and McClymonds, N.E., 1971, Detergents in the streamflow of Suffolk County, Long Island, New York, *in* Geological Survey Research, 1971: U.S. Geol. Survey Prof. Paper 750-C, p. C210–C214.

Collins, M.A., Gelhar, L.W., 1970, Ground-water hydrology of the Long Island aquifer system: Mass. Inst. Technology, Hydrodynamics Lab. Rept. no. 122, 185 p.

Crandell, H.C., Jr., 1962, Geology and ground-water resources of Plum Island, Suffolk County, New York: U.S. Geol. Survey Water-Supply Paper 1539-X, 35 p., 4 pls.

———1963, Geology and ground-water resources of the Town of Southold, Suffolk County, New York: U.S. Geol. Survey Water-Supply Paper 1619-GG, 36 p., 3 pls.

de Laguna, Wallace, 1948, Geologic correlation of logs of wells in Kings County, New York: New York State Water Power and Control Comm.[1] Bull. GW-17, 35 p., 3 pls.

———1963, Geology of Brookhaven National Laboratory and vicinity, Suffolk County, New York: U.S. Geol. Survey Bull. 1156-A, 35 p., 2 pls.

Fuller, M.L, 1914, The geology of Long Island, New York: U.S. Geol. Survey Prof. Paper 82, 231 p.

Harr, C.A., 1971, Partial chemical analyses of water from selected sources in Nassau and Suffolk Counties, Long Island, New York: U.S. Geol. Survey open-file rept., 21 p.

Holzmacher, McLendon, and Murrell, Consulting Engineers, 1970, Comprehensive public water supply study, Suffolk County, New York: CPWS-24, v. II, 373 p.

Isbister, John, 1966, Geology and hydrology of northeastern Nassau County, Long Island, New York: U.S. Geol. Survey Water-Supply Paper 1825, 89 p., 5 pls.

Jacob, C.E., 1945, The water table in the western and central parts of Long Island, New York: New York State Water

Appendix 1.3-4
1 of 7

Hydrology of Brookhaven National Laboratory and Vicinity Suffolk County, New York

By M. A. WARREN, WALLACE DE LAGUNA *and* N. J. LUSCZYNSKI

STUDIES OF SITES FOR NUCLEAR ENERGY FACILITIES—BROOKHAVEN NATIONAL LABORATORY

GEOLOGICAL SURVEY BULLETIN 1156-C

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STUDIES OF SITES FOR NUCLEAR ENERGY FACILITIES—BROOKHAVEN NATIONAL LABORATORY

HYDROLOGY OF BROOKHAVEN NATIONAL LABORATORY AND VICINITY, SUFFOLK COUNTY, NEW YORK

By M. A. Warren, Wallace de Laguna, and N. J. Lusczynski

ABSTRACT

The Brookhaven Natonal Laboratory is in central Suffolk County, Long Island, New York. The area studied surrounds and includes the Laboratory and is referred to herein as the Upton area. It extends across the island in a band about 13 miles wide from the Atlantic Ocean to Long Island Sound between longitudes 72°45′ and 73°00′. Its climate is characterized by mild winters and relatively cool summers. Precipitation averages about 45 inches a year evenly distributed throughout the year. The soil and the immediately underlying sediments are generally sandy and highly permeable. Water penetrates them readily and except in periods of intense precipitation there is very little direct overland runoff to streams.

Permeable Pleistocene deposits, 100–200 feet thick, constitute the uppermost aquifer. It receives recharge from precipitation (the only source of fresh water on the island) and discharges mainly into streams, the ocean, and the sound and to a some lesser extent into lower aquifers. The lower aquifers, several hundred feet in total thickness, transmit water under artesian pressure from the high central part of the island toward its edges where it is discharged into streams or into bodies of salt water. Streamflow is supported throughout the year very largely by ground-water discharge.

Within this broad pattern the details of the movement and behavior of water are determined by the geology, the topography, and the seasonal and local distribution of precipitation. Tests at the Laboratory site indicated that under favorable conditions water may move from the land surface to the water table at a rate of about 30 feet per day. Under less favorable conditions it may move 1 foot a day or less.

The topography of the water table conforms only generally to that of the land surface. Ground-water divides between the small streams in the area differ significantly from topographic divides and explain apparent differences in the rates of discharge per square mile. At the Laboratory site most of the ground-water movement is southward toward the Atlantic Ocean, but part of it is eastward to Peconic Bay. Ground-water movement in a part of the Laboratory area is either to the south or to the east, depending upon the stage of the water table, and is controlled by the presence of relatively impermeable beds near the surface.

5 to 10 feet above mean high tide. Long Island was also visited by two hurricanes in 1954. Unconfined ground water in low-lying areas near the shore is salted by sea water blown inland during hurricanes.

The maximum depth of freezing in the soil zone is 15 inches; the average is much less. Because the soil is not frozen during most of the winter season, recharge to the water table is possible during the winter, and because evapotranspiration is low, most of the ground-water recharge does, in fact, take place during the colder months, from December to May.

PRECIPITATION

Precipitation, the only source of fresh water for the streams and ground water in the Upton area, is used here as the starting point of the hydrologic cycle. The average precipitation ranges from about 42 inches in the western part to about 46 inches in the eastern part of Long Island. In an average year, about 120 days have 0.01 inch or more of precipitation. Long Island is supplied with moisture from the Gulf of Mexico and from the Atlantic Ocean through the action of winds of cyclonic storms. The general current of the prevailing westerlies plays only a small part in producing precipitation in Long Island. Natural variations in precipitation are largely due to physiographic and storm-pattern factors.

The Upton area of Long Island has little relief and thus monthly, and especially yearly, precipitation does not differ much from one locality to another within the area. Such differences as do occur are due largely to local summer storms or to differences in the local details of the rain gage or its exposure. But, though geographic variations are not large, a careful study of cummulative records shows some variation in rainfall within the Upton area.

RECORDS AVAILABLE

Precipitation records for eight stations within a 13-mile radius of the center of the Brookhaven National Laboratory are used in this report. Three of these stations are on the Laboratory grounds; no two stations are more than 20 miles apart (fig. 1). The length of record at the end of 1953 ranges from 5 complete years (at two gages within the Laboratory area) to nearly 69 complete years at Setauket (tables 1 and 2). The earliest records are for 1864–82 at the village of Brookhaven. The record at Setauket began in 1885.

The rainfall records and the values for average, minimum, and maximum precipitation proved satisfactory for correlating precipitation with surface-water stages and flows and with ground-water levels. Precipitation data for periods of less than a month are discussed briefly, because they have some bearing on the problems of ground-water contamination (de Laguna, 1966).

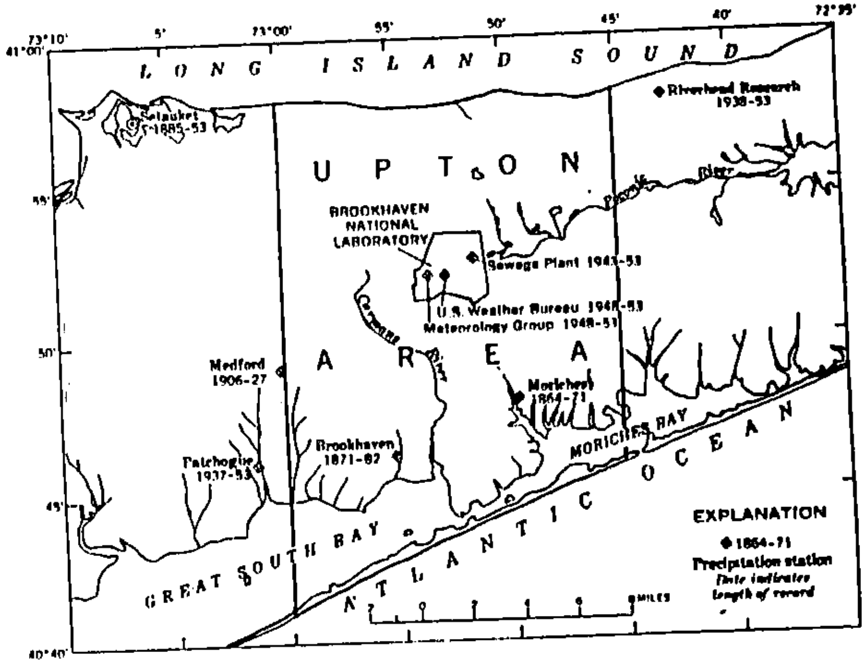

Figure 1.—Location of study area and precipitation stations.

The precipitation data for the 1864–71 period, listed for the village of Brookhaven, were actually collected at Moriches about 5 miles to the east. From 1871 to 1882 the data were collected at the village of Brookhaven, about 7 miles south of the present Laboratory area. This record, started under the sponsorship of the Smithsonian Institute (tables 1 and 2) before the establishment of the U.S. Weather Bureau, show that the average annual precipitation from 1864 to 1882 was 46.20 inches. This precipitation record includes the maximum and minimum yearly rainfalls for the Upton area, a high of 71.38 inches in 1869 (a year of a hurricane) and a low of 27.65 inches in 1881. The 2-year average for 1868–69 was 65.51 inches; the 3-year average for 1867–69 was 62.05 inches; and the 5-year average from 1865–69 was 59.61. These are all records and are considerably in excess of any recent data.

These data, especially those for 1865–69, are accepted with some reservation because they are much greater than those recorded at other stations along the northeastern seaboard. For example, precipitation in the city of New York, about 57 miles to the west, averaged 48.45 inches during this period, or about 11.16 inches less than that at Brookhaven. The present-day average at New York City is only 2–4 inches less than that for the Brookhaven area. Furthermore, the average precipitation reported for 1865–69 at Brookhaven was 0.35 inch higher

The average annual infiltration plus overland runoff for the 12 years was 22.59 inches. This value may also be computed from the average mean monthly temperatures and average precipitation for each of the calendar months, from which one may calculate average monthly evapotranspiration. From these 12 monthly averages, an average yearly rate of infiltration plus overland runoff of 22.06 inches may be calculated; it is 0.53 inch less than the average annual value found by computing by individual months (table 5), a difference of less than 5 percent.

SUMMARY OF COMPUTED RECHARGE

During the 12 water years from October 1941 to September 1953, the precipitation averaged 43.64 inches, evapotranspiration averaged 21–22 inches, and the residual (mostly recharge to ground water) averaged about 22 inches. During this period, the residual varied appreciably from month to month and from year to year. It was over 7 inches on 3 different months and was zero for about 2–3 months in an average year. The annual rate of infiltration (plus overland runoff) was as much as 31.99 inches in 1951–52, 29.33 inches in 1947–48, 26.93 inches in 1952–53, and as little as 11.70 inches in 1946–47.

Over a 50- to 100-year period, precipitation in the Upton area varies from a minimum of perhaps less than 30 inches per year to a maximum of perhaps more than 60 inches per year. The average annual evapotranspiration, over a similar period, will range from a minimum of 15 inches per year where the soil is very sandy to a maximum of 30 inches per year, and perhaps more, in swampy areas. Replenishment to ground water in the Upton area may, therefore, be as low as 10 inches in some areas in dry years and as much as 35 inches in other areas in wet years. Locally, recharge to ground water may even vary from practically nothing in some swampy localities, when precipitation is extremely low, to as much as 45 inches in sandy localities, when precipitation is extremely high.

GROUND WATER IN UPPER PLEISTOCENE DEPOSITS

OCCURRENCE

The 200 feet of upper Pleistocene deposits in the Upton area consists of sand and gravel, some silt and clay layers, and also some till in the two morainal areas. Water first enters through the soil zone. The zone of aeration, about 50–60 feet in average depth, serves both as a sizable underground reservoir and also as the conduit for water moving downward to the zone of saturation. Locally within the zone of aeration are bodies of perched and semiperched water, held up by layers of relatively impermeable material, one each in the northern, northwestern, and eastern sections of the Laboratory tract, and one east of the Laboratory tract beyond the Peconic River. A few small areas of this kind occur in the extreme west-central section of the Upton area. The major areas underlain by relatively impermeable layers above the zone of saturation are shown on plates 1–4.

The zone of saturation in the upper Pleistocene deposits averages about 140–150 feet in thickness. This zone serves both as an immense storage reservoir and also as the principal conduit for water moving from points of recharge to points of discharge.

THE WATER TABLE

MAPS OF THE WATER TABLE

The water table in the Upton area is defined by the position of the static water level in wells ending in the zone of saturation in the upper Pleistocene and Recent deposits. Plates 1 and 2 show the position of the water table on August 29–31, 1951, and July 28–30, 1952. The water-level contours are based on readings in about 120 wells, 50 of them inside the Laboratory area, and also on the altitudes of the water surface in streams, ditches, ponds, and lakes at about 35 additional points. Only a few of the wells are plotted on plates 1 and 2. Plates 3 and 4 show the position of the water table on October 1–3, 1952, and April 25, 1953, and also the locations of all the observation wells within the Laboratory area.

NETWORK OF OBSERVATION WELLS

A table giving complete information on the location, owner, use, depth, method of construction, size of casing, screen setting, altitude of measuring point, and height above land surface for all wells used in this study is on file with the U.S. Geological Survey and State and Laboratory authorities. The well numbers, assigned by the New York State Water Power and Control Commission in chronological order, have no particular geographical significance. The letter S preceding the number signifies Suffolk County. The code numbers of the points used in determining surface-water stages were assigned by the Survey staff at Brookhaven National Laboratory. Letters C and P preceding the number are for measuring points on or near the Carmans and Peconic Rivers, respectively. Some points on the larger lakes or ponds are identified only by their names. The tables on file also give information on the location of all measuring points other than wells, and also their descriptions, altitudes, and the altitude of the accompanying bench marks.

Third-order accuracy (or better) was maintained in the leveling used to determine the altitudes of the measuring points at wells, of the surface-water observation stations, and of bench marks; that is,

487

the error of closure of the level circuit, in feet, did not exceed the length of circuit, in miles, divided by 0.5. For short runs the allowable error of closure, in feet, did not exceed the number of setups divided by 0.008. All levels are referred to the 1929 mean sea-level datum of the U.S. Coast and Geodetic Survey. Observed water levels are accurate within at least 0.1 foot.

RELATION OF WATER TABLE TO SHALLOW, PARTLY CONFINING LAYERS

In some areas (see pls. 1–4) of low permeability, beds of silt or clay occur in the zone of aeration. In these areas, where shallow water is perched or semiperched, the water table is defined by water levels in wells screened below this material. The maximum depth of this retarding zone below land surface is about 30 feet; only at well S9123 east of the Laboratory was the bottom of the less permeable material found to be deeper, at about 50 feet below land surface. The water surface, mapped in plates 1–4 will be referred to as the water table, even though the water is confined to some degree part of the time in localities where less permeable material occurs at shallow depths.

In the Peconic River valley east of the Laboratory, from about Manorville to Riverland, an intersubstage (de Laguna, 1963, p. 32) occurs at about middepth in the glacial sands. In this locality the water-table map is based on levels in wells ending above this clay.

SIGNIFICANT FEATURES OF THE WATER TABLE

The shape of the water table reflects the location of areas of recharge, areas of discharge, and of the ground-water divides. (See pls. 1–4; fig. 34A.) The water table in the Upton area suggests the cross section of a bullet, flattened at the tip and pointing eastward; the south side is somewhat irregular. The depressions and troughs in the contour pattern are ground-water discharge areas.

In the Upton area, the main ground-water divides lies about 3–5 miles south of Long Island Sound and roughly parallel to it. East of the eastern boundary of the Laboratory tract a second ground-water divide appears, which defines the southern boundary of the area contributing ground water to the Peconic. The north branch of the divide extends beyond the Upton area into the North Fork of Suffolk County, and the south branch extends into the South Fork. There are not enough water-level data to define the south branch accurately.

North of the divide, ground water moves northward to Long Island Sound. South of the divide, the ground water moves southward to Great South Bay and Moriches Bay, either directly or by way of streams. In general, the ground water from the area between the two branches of the divide moves out eastward to the Peconic River and Peconic Bay. Details of the movement vary with the stage and slope of the water table.

The highest part of the water table in the Upton area is the west-central section where it is about 55 feet above sea level; the lowest is along the shoreline, where it stands at about mean sea level. A few miles west of the Upton area (fig. 34A), the water table is about 60 feet above sea level (Lusczynski and Johnson, 1951). The slope of the water table ranges from more than 10 feet per mile to less than 2 feet per mile; in the Laboratory tract, the slope averages about 5 feet per mile.

DEPTH TO WATER TABLE

The depth to the water table in the Upton area ranges from less than 0.1 foot along the shorelines to more than 200 feet under the higher hills on the north shore and averages about 50–60 feet. North of the ground-water divide, and along the south branch of the divide, the average depth to the water table is about 80 feet; between the divides and to the south it is about 40 feet. Figure 8 gives five north-south profiles (pls. 1, 2) showing the water-table altitudes as of July 28–30, 1952, when the water table was slightly below the average stage for 1941–53. As the sections show, from the north shore the land surface rises abruptly about 150 feet or more to a line of hills, part of the Harbor Hill moraine. Here the depths to water are from 75 to 150 feet and locally even 200 feet. Just south of the Laboratory area, the water table is also relatively deep beneath another line of east-west hills known as the Ronkonkoma moraine. Profiles showing the approximate altitudes of the land surface and the water table are shown in figure 8. In the low land between the two moraines the water table is at somewhat shallower depths, and because this wide valley slopes gently eastward, in the eastern part of the Laboratory area and in the Manorville area the water table is even shallower, within 5–10 feet of the land surface. The Peconic River originates in this valley and flows eastward between the two moraines. The headwaters of the Carmans River also lie in this intermoraine belt. South of the Ronkonkoma moraine, the land slopes gently toward the south, and the depth to water decreases southward, so that the land surface and the water table converge.

Figure 9 shows the depth from the land surface to the water table in the Laboratory tract. The depths vary from less than 10 feet along streams in the eastern and northern parts of the Laboratory, to more than 80 feet in a belt extending from the center of the Laboratory tract, near the reactor, to the hospital in the southwest corner. The average depth to the water table is about 45 feet. Land-surface altitudes for this depth-to-water map were taken from the 10-foot con-

587

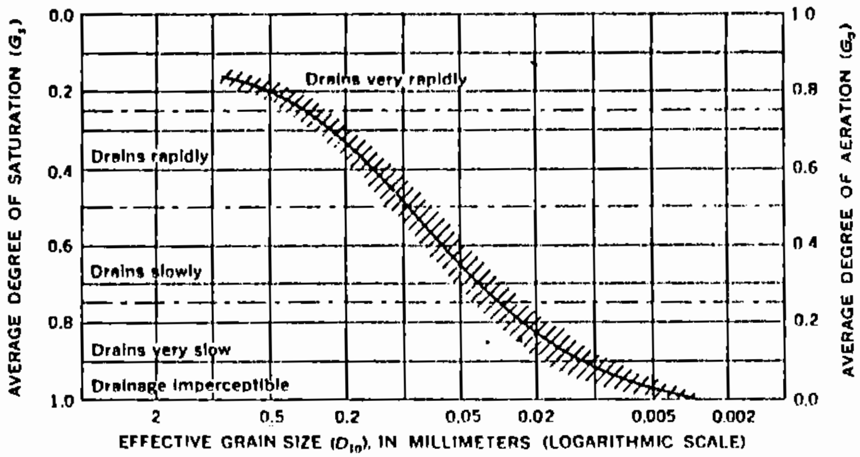

FIGURE 15.—Relation of effective grain size to average degree of liquid saturation in pores of unconsolidated formations (from field observations after Terzaghi, 1940). Diagonal lines represent probable range of seasonal variations.

to that of a sand composed entirely of grains of the effective size. The uniformity coefficient, also defined by Hazen, is the ratio of D_{60}/D_{10}, or the ratio of that grain size chosen so that 60 percent of the sample by weight is of a smaller grain size, to the effective size.

The effective size of nine samples from the upper 135 feet of well S6456 (table 6) near the center of the Laboratory area averaged 0.134 mm; the uniformity coefficient was 4.7. Samples from three wells, S6456, S6458, and S4660, selected by visual inspection as typical glacial outwash sand, were somewhat coarser grained, having effective sizes of 0.25, 0.17, and 0.30 mm and uniformity coefficients of 2.0, 2.4, and 1.8. Figure 15 shows that for a sand having an effective size of 0.20 mm, the percentage of liquid saturation ranges seasonally from 0.28 to 0.38.

TABLE 6.—*Effective size and uniformity coefficient of samples of sand, silt, and clay from well S6456*

Depth, in feet below land surface	Type of sample	Effective size, millimeter	Uniformity coefficient, 60 percent size to 10 percent size
0–10	Auger	0.23	2.3
10–20	Core	.35	15.4
20–30	Bailer	.16	2.5
30–40	Bailer	.18	2.9
40–50	Bailer	.088	4.3
83	Bailer	.096	4.9
104	Bailer	.15	3.0
118	Bailer	.085	5.3
134	Bailer	.19	2.0
159	Bailer	.14	2.3
168	Bailer	.20	2.0
177	Bailer	.092	2.0
215	Core	.13	3.2

Such values appear reasonable for the glacial outwash sand in the Upton area. Both the porosity and the degree of liquid saturation of the glacial sand in the Upton area vary between wide limits under natural hydrologic conditions. Locally, under certain artificial conditions, the percent saturation has approached 100.

Veatch (Veatch and others, 1906) made many laboratory determinations of the porosity of the upper Pleistocene of Long Island, and the approximate average of these, 0.33, is used here. Specific yield and specific retention were determined from field tests; no attempt was made to determine these values in the laboratory from samples. The specific yield of the outwash sand in the Laboratory area was determined, from a 7-day pumping test, to be 0.24. The specific yield, found by filling and draining the pore space in a lysimeter built by de Laguna in 1953, was 0.26. This lysimeter, installed in the southeastern part of the Laboratory area where the average depth to the water table is 13 feet from land surface, is a vertical metal cylinder 12 feet deep and 5 feet in diameter and open at the top. It was set about 7 feet below land surface so that the bottom was 6 feet in the zone of saturation. In excavating and backfilling, care was taken to keep the material in approximately its original sequence and to compact it as nearly as possible to its original degree of compaction. However, the value of 0.24 from the pumping test is preferred because a much larger volume of sediments was involved.

A porosity of 0.33 and a specific yield of 0.24 gives a specific retention of 0.33−0.24, or 0.09. On the assumption that 0.28, the low value in the range of liquid saturation in figure 15, is approximately the fraction of the void space filled by specific retention, then specific retention is computed to be 0.28×0.33, or 0.092, which is in good agreement.

The flow-line pattern (fig. 19) in the vicinity of the well pumped during an aquifer test in December 1950 in the Laboratory area suggests that the vertical permeability of the outwash sand in the zone of saturation is about a fourth that of the horizontal permeability, or about 350 gpd per square foot. Results of an infiltration test, discussed in the following section, indicate that the vertical permeability may be as low as 75 gpd per square foot, or about one-eighteenth of the horizontal permeability.

RATE OF MOVEMENT IN THE LABORATORY AREA

High rates

If the sand is saturated with water, if the vertical permeability is 350 gpd per square foot, and if the porosity is one-third, then water will move downward in the zone of aeration at a rate of 140 feet a day.

689

DIRECTION AND RATE OF MOVEMENT OF GROUND WATER UNDER NATURAL CONDITIONS

Plates 1 and 2 show water-table contours for August 29–31, 1951, when the water table was about a half a foot below average, and for July 28–30, 1952, when the water table was 12 feet above average. The direction of ground-water flow may be taken as normal to these contours because the formation is almost isotropic. The rate of flow may be approximately determined by either of two independent methods, one of which is based on consideration of the quantities of water involved, and the other on the relation between transmissibility and the ground-water gradient.

The transmissibility of the upper Pleistocene aquifer is very close to 200,000 gpd at unit gradient. The water-table gradient is about 5 feet to the mile, so that in the Laboratory area each 1-foot width of the aquifer is carrying about 200 gpd, or 26.7 cubic feet per day, which represents a ground-water velocity of about 0.535 foot per day, or about one-third the velocity derived from consideration of the volume of recharge. Thus, in the belt between the Laboratory and the water-table divide, a large proportion of the ground-water recharge, perhaps two-thirds of the total, apparently moves into the deeper Cretaceous aquifers, and only the smaller part moves laterally through the upper Pleistocene aquifer.

A more detailed study of the direction and rate of movement of the ground water in the upper Pleistocene may be based on the map shown in figure 29. The solid flow lines in this figure are based on the water-table map for August 29–31, 1951, and the dashed flow lines on the map for July 28–30, 1952. In general, these lines follow much the same pattern, but, the slight changes in the contours of lines *C–D* and *C′–D′* produced a marked difference in the ultimate destination of the water.

The average annual recharge to the water table is about 22 inches. A strip of land 1 foot wide extending from the water-table divide for a distance of 1 mile in the direction of ground-water flow would contribute annually a volume of about 9,700 cubic feet. The water would flow from the lower end of the strip through the saturated part of the aquifer, about 150 feet thick, which has a porosity of about 0.33. The rate of movement is the same as if 9,700 cubic feet of water a year flowed through an opening 50 feet high and 1 foot wide, or about 195 feet per year or 0.535 foot per day. According to this method of analysis, the rate of movement at any point is directly proportional to the flow-line distance from the water-table divide; thus, under the center of the Laboratory tract, 2.5 miles from the divide, the rate of movement of the ground water would be about 1.6 feet per day.

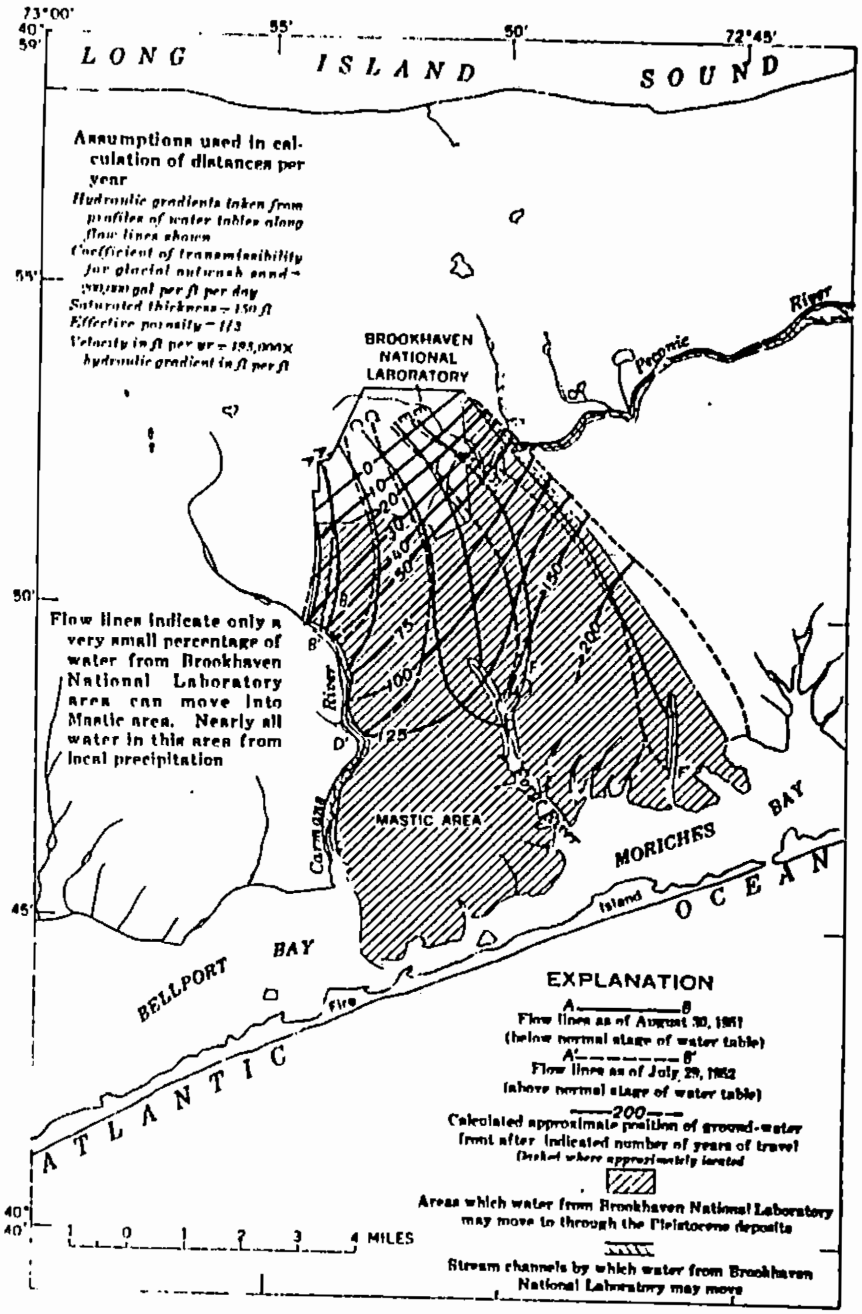

FIGURE 29.—Direction and time of travel of ground water laterally in upper Pleistocene deposits from the Brookhaven National Laboratory area to points of discharge.

WORKSHEET: COMMUNITY WATER SUPPLIES AND MONITORING WELLS WITHIN A 3-MI RADIUS OF THE SITE Quogue Landfill

Community Water Supply	Water District	Well Field	Well	Depth (ft)	Aquifer
SCWA	WB	Old Country Rd.	1S-16892	76	Glacial
			2S-16893	70	Glacial
			3S-16905	161	Glacial
SCWA	WB	SPINNEY RD.	1S-23184	118	Glacial
			2S-53593	161	Glacial
SCWA	WB	MEETING HOUSE RD.	1S-01345	46	Glacial*
			12S-07383	47	Glacial*
			13S-10328	47	Glacial*
			14S-10733	58	Glacial*
			15S-12702	56	Glacial*
			16S-17577	58	Glacial*
			17S-17576	56	Glacial*
			18S-20686	55	Glacial*
			19S-20687	55	Glacial*
			21S-64716	50	Glacial*
			20S-20688	78	Glacial

Sources:

SCDHS Water Resources Division. Supply and Monitoring Well Location Maps.
SCWA. 1984. Well Descriptions.
SCWA. 1985. Distribution System Plates 15H-18H, 15I, +17I.
SCWA. 1986. Active Services Estimates and Service Area Map.
SCWA 1986 Data from Mr. Wm. Schickler, Chief Engineer

* - These wells are all part of a suction header system

COUNTY OF SUFFOLK

Michael A. LoGrande
SUFFOLK COUNTY EXECUTIVE

DEPARTMENT OF HEALTH SERVICES

DAVID HARRIS, M.D., M.P.H.
COMMISSIONER

March 20, 1987

Mr. Anthony Candella
New York State Department of
Environmental Conservation
SUNY - Bldg. 40
Stony Brook

Re: Comments on Phase I EA Science and Technology Draft Reports

Dear Mr. Candella:

I have the following comments on the listed Phase I reports:

M.B ✓ 1. Circuitron Corporation - Site No. 152082

Since the report was written, the Circuitron building has been vacated and emptied of all contents of value including machiney. No cleanup of the building, grounds or groundwater has occurred. Left behind in the empty building are over 50 drums of concentrated waste plating solutions, the contents of five concrete holding tanks in the floor and the contents of the secret leaching pool under the floor in the plating room.

After the machinery was removed from the etching and plating lines, it was found that the floor under the tanks was completely deteriorated and saturated with metal solutions. The soil below the floor in these areas is probably contaminated and will have to be removed.

The leaching pools outside have not been excavated and no further groundwater investigation has been performed.

We concur with the findings of the report that the next step of site investigation should involve the evaluation of the horizontal and vertical extent of the groundwater contamination and that a Phase II not be done. It is suggested, however, that the Direct Contact Score be re-evaluated in light of the current status of the facility as an abandoned site containing more than 50 drums of highly toxic material and several thousand gallons of toxic waste in underground tanks. The building is locked but unattended in a densely populated

Continue ...

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