U.S. GEOLOGICAL SURVEY

WATER-RESOURCES ACTIVITIES IN NEW YORK - 1987-88

Compiled by

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UNITED STATES DEPARTMENT OF THE INTERIOR

DONALD PAUL HODEL, Secretary

GEOLOGICAL SURVEY

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CONTENTS

CONTENTS (CONTINUED)

ILLUSTRATION

INTRODUCTION

The U.S. Geological Survey was established by an act of Congress on March 3, 1879, to provide a permanent Federal Agency to conduct the systematic and scientific "classification of the public lands, and examination of the geological structure, mineral resources, and products of national domain." An integral part of that original mission includes publishing and disseminating the earth-science information needed to understand, to plan the use of, and to manage the Nation's energy, land, mineral, and water resources.

U.S. Geological Survey Programs

Since 1879, the research and fact-finding role of the Geological Survey has grown and been modified to meet the changing needs of the Nation it serves As part of that evolution, the Survey has become the Federal Government's largest earth-science research agency, the Nation's largest civilian map-making agency, the primary source of data on the Nation's surface- and ground-water resources, and the employer of the largest number of professional earth scientists. Today's programs serve a diversity of needs and users. Programs include:

- Conducting detailed assessments of the energy and mineral potential of the Nation's land and offshore areas.

- Investigating and issuing warnings of earthquakes, volcanic eruptions, landslides, and other geologic and hydrologic hazards.

- Conducting research on the geologic structure of the Nation.

- Studying the geologic features, structure, processes, and history of the other planets of our solar system.

- Conducting topographic surveys of the Nation and preparing topographic and thematic maps and related cartographic products.

- Developing and producing digital cartographic data bases and products.

- Collecting data on a routine basis to determine the quantity, quality, and use of surface water and ground water.

- Conducting water-resource appraisals to describe the consequences of alternative plans for developing land and water resources.

- Conducting research in hydraulics and hydrology, and coordinating all Federal water-data acquisition.

- Using remotely sensed data to develop new cartographic, geologic, and hydrologic research techniques for natural resources planning and management.

- Providing earth-science information through an extensive publications program and a network of public access points.

Along with its continuing commitment to meet the growing and changing earth-science needs of the Nation, the Survey remains dedicated to its original mission to collect, analyze, interpret, publish, and disseminate information about the natural resources of the Nation--providing "Earth Science in the public Service."

Water Resources Division's Mission and Program

The mission of the Water Resources Division is to provide the hydrologic information and understanding needed for the optimum use and management of the Nation's water resources for the overall benefit of the people of the United States.

This is accomplished, in large part, through cooperation with other Federal and non-Federal agencies by:

- Collecting, on a systematic basis, data needed for the continuing determination and evaluation of the quantity, quality, and use of the Nation's water resources.

- Conducting analytical and interpretive water-resource appraisals describing the occurrence, availability, and the physical, chemical, and biological characteristics of surface water and ground water.

- Conducting supportive basic and problem-oriented research in hydraulics, hydrology, and related fields of science to improve the scientific basis for investigations and measurement techniques and to understand hydrologic systems sufficiently well to quantitatively predict their response to stress, either natural or manmade.

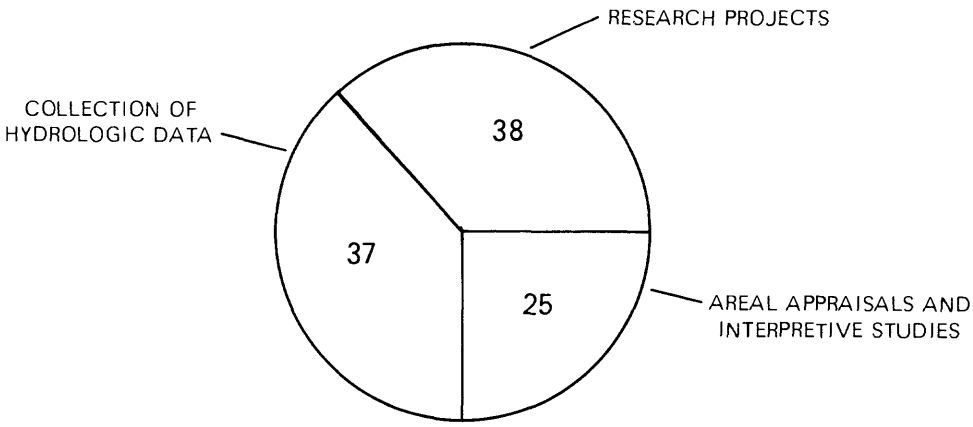
- Disseminating the water data and the results of these investigations and research through reports, maps, computerized information services, and other forms of public releases.

- Coordinating the activities of Federal agencies in the acquisition of water data for streams, lakes, reservoirs, estuaries, and ground water.

- Providing scientific and technical assistance in hydrologic fields to other Federal, State and local agencies, to licensees of the Federal Power Commission, and to international agencies on behalf of the Department of State.

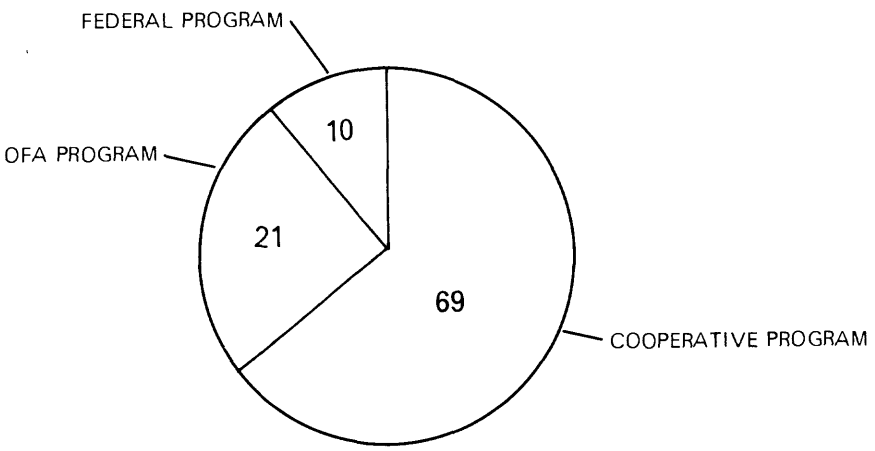
Types of Funding

The diagram below shows the percentage of the investigations for fiscal year 1987 in each of the broad categories of collection of hydrologic data, areal appraisals and interpretive studies, and research projects:



These investigations are directed toward obtaining the information needed by managers and planners for the solution or alleviation of water problems in New York.

The investigations are supported by funds provided by State and local units of government and federal funds from the U.S. Geological Survey and other federal agencies (OFA program). About 80 percent of the federal funds contributed by the Geological Survey are used to match, on a 50-50 basis, the funds contributed by the State and other local units of government. In fiscal year 1987, the financial support for these programs in New York was about $7.3 million, which was distributed as follows:



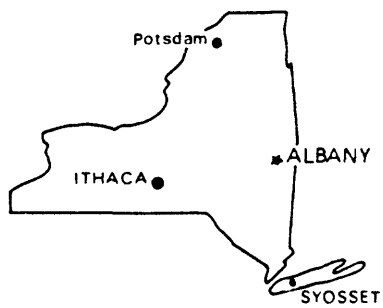
NEW YORK DISTRICT

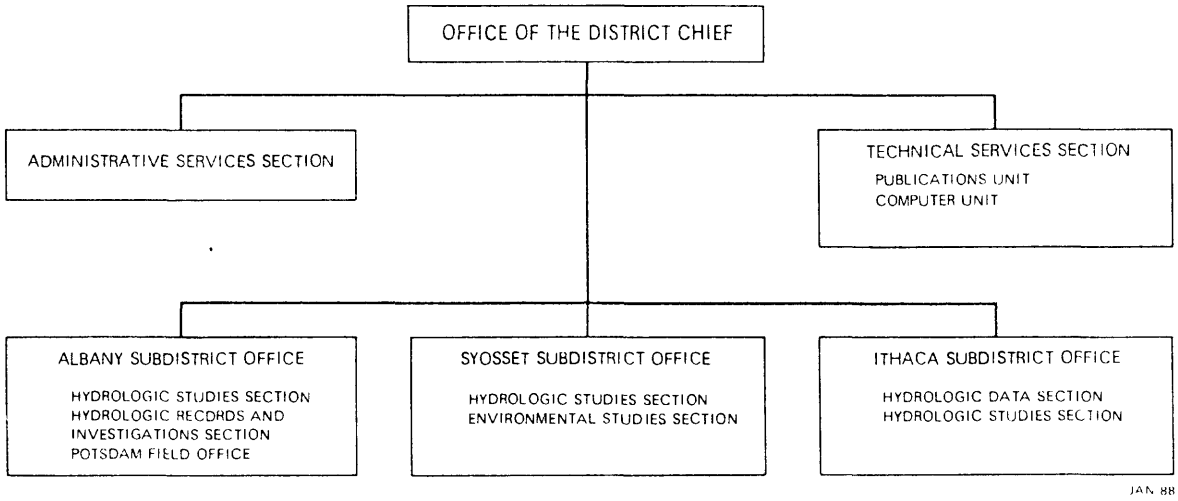
The following sections describe the water-resources investigations conducted by the U.S. Geological Survey in New York in 1987-88; many of these studies will continue into 1989 or longer.

The Geological Survey began its water-resources studies in New York State in 1895 with a stream-gaging program in the Catskill Mountain region and entered its first cooperative program, with the Office of the State Engineer, in 1900. The Survey has maintained a District office in Albany since 1910 to direct its water investigations within the State and has maintained a subdistrict office on Long Island since 1932 to study and monitor the groundwater situation in this area of increasing urbanization. The Survey also maintains subdistrict offices in Ithaca and Albany to collect and interpret data from western and eastern New York, respectively, and maintains a field station in Potsdam to collect records in the northernmost part of the State.

The staff of the New York District numbers about 100. The professional hydrologists represent a variety of scientific and technical backgrounds that include engineering, chemistry, geology, mathematics, physics, biology, and soil science. The hydrologists are assisted by experienced engineering and hydrologic technicians who provide support service in the collection and analysis of field data, and by specialists in computer, publication, and administrative services.

The office addresses and organization chart are given on page 5; the office locations are shown in the map below. A partial list of staff members is given on page 51.





NEW YORK DISTRICT OFFICE ADDRESSES

Inquiries regarding projects described in this section may be directed to the District Office or Subdistrict Office in which the work originated.

District Office	(518) 472-3107	U.S. Geological Survey Water Resources Division U.S. Post Office & Courthouse P.O. Box 1669 Albany, N.Y. 12201
Albany Subdistrict Office	(518) 472-3108	U.S. Post Office & Courthouse P.O. Box 1397 Albany, N.Y. 12201
Ithaca Subdistrict Office	(607) 272-8722	521 West Seneca Street Ithaca, N.Y. 14850
Long Island Subdistrict Office	(516) 938-8830	5 Aerial Way Syosset, N.Y. 11791
Potsdam Field Headquarters	(315) 265-4410	Route 2 Sandfordville, N.Y. 13676

Figure 1.--New York District organization chart with office addresses. *(List of staff members is on page 51.)*

PROJECTS IN 1987-88

Projects conducted by the New York District during 1987-88 are described on the following pages. They are grouped by office location and are given in numerical order by project number. (See list on p. iii.)

ALBANY OFFICE

Surface-Water Stations
(NY 00-001)

Period of project: Continuous since June 1898

Project leader: George C. Gravlee

Field location: Statewide

Principal cooperating agencies: New York State Department of Environmental Conservation; U.S. Army Corps of Engineers; City of New York, Department of Environmental Protection; Nassau County Department of Public Works; Suffolk County Department of Environmental Control; Suffolk County Water Authority; National Weather Service; New York Power Authority; Hudson River-Black River Regulating District; Westchester County Department of Public Works

Problem: Surface-water information is needed for surveillance, planning, design, hazard warning, operation, and management in water-related fields such as water supply, hydroelectric power, flood control, irrigation, bridge and culvert design, wildlife management, pollution abatement, flood-plain management, and water-resources development. To provide this information, an appropriate data base is necessary.

Objective: (1) To collect surface-water data for such purposes as (a) assessment of water resources, (b) operation of reservoirs or industries, (c) forecasting of stage or discharge, (d) pollution control and disposal of wastes, (e) discharge measurements to accompany water-quality sampling, (f) compact and legal requirements, and (g) research or special studies. (2) To collect data to define the properties and trends of water in streams, lakes, estuaries, etc., for use in planning and design.

Approach: To use standard methods of data collection as described in the series "Techiques of Water Resources Investigations of the United States Geological Survey" and to use partial-record gaging instead of complete-record gaging where it serves the required purpose.

Progress and significant results: Operation of the surface-water network continued. Construction and instrumentation of the flood-forecasting system in the Susquehanna River basin was completed.

Plans for next year: To continue to operate gaging-station network.

Reports completed since 1980: U.S. Geological Survey, Water resources data - New York: U.S. Geological Survey Water-Data Report, v. 1, Eastern New York excluding Long Island; v. 2, Long Island; v. 3, Western New York. (Published annually.)

Ground-Water Stations
(NY 00-002)

Period of project: Continuous since July 1934

Project leader: John H. Williams

Field location: Statewide

Principal cooperating agencies: New York State Department of Environmental Conservation; Suffolk County Department of Health Services; Suffolk County Water Authority; Nassau County Department of Public Works.

Problem: Long-term information on ground-water levels is needed to evaluate the effects of climatic and manmade stresses on the aquifer systems of New York.

Objectives: (1) To provide long-term water-level records so that the response to the aquifer systems to climatic and manmade stresses can be evaluated and potential problems defined early to allow for proper planning and management. (2) To provide long-term water-level records with which short-term information from ground-water investigations can be evaluated.

Approach: Collect long-term water-level records at selected observation wells that are representative of the hydrologic conditions in the State.

Progress and significant results: Collection and compilation of ground-water levels at 45 upstate and 119 Long Island wells continued. Ground-water-level records were published in the annual data report.

Plans for next year: To continue to collect, compile, and publish water-level records and evaluate the observation-well network.

Reports completed since 1980:

Donaldson, C. D., and Koszalka, E. J., 1983, Water table on Long Island, New York, March 1979. Potentiometric surface of the Magothy aquifer, Long Island, New York, in March 1979. Potentiometric surface of the Lloyd aquifer, Long Island, New York, in January 1979: U.S. Geological Survey Open-File Reports 82-163, 82-160, and 82-162, respectively; 2 sheets each.

Doriski, T. P., 1987, Potentiometric-surface altitudes of major aquifers on Long Island, New York, in 1983: U.S. Geological Survey Water-Resources Investigations Report 85-4321, 8 sheets.

Smolensky, D. A., 1984, Potentiometric surfaces on Long Island, New York--a bibliography of maps: U.S. Geological Survey Water-Resources Investigations Report 84-070, 31 p.

U.S. Geological Survey, Water resources data - New York: U.S. Geological Survey Water Data Report, v. 1, Eastern New York excluding Long Island, v. 2, Long Island, v. 3, Western New York. (Published annually.)

Water-Quality Stations
(NY-00-003)

Period of project: Continuous since June 1906

Project Leader: Robert J. Rogers

Field location: Statewide

Principal Cooperating Agencies: New York State Department of Environmental Conservation; Suffolk County Department of Health Services; Suffolk County Water Authority; Nassau County Department of Public Works; City of New York, Department of Environmental Protection

Problem: Water-resources planning and water-quality assessment require a statewide and nationwide level of information on the chemical and physical quality of surface water and ground water.

Objective: To develop a statewide and nationwide bank of water-quality data for Federal, State, and local planning and to provide such data where needed to support other projects within New York.

Approach: To maintain and operate a statewide network of water-quality stations, as part of a nationwide network, to provide data on concentrations, loads, and time trends of chemical constituents of surface water and ground water and to provide water-temperature data for management purposes.

Progress and significant results: Water samples were collected at 13 National Stream Quality Accounting Network (NASQAN) stations, 1 hydrologic bench-mark station, 40 additional surface-water stations, 50 ground-water stations, and 2 precipitation stations for analysis. Continous water-temperature records were collected at 13 stations.

Plans for next year: Water-quality data will be collected at most of the stations that were sampled in 1988. New surface-water stations are planned for the network in 1989. Data from 1988 will be published in the annual water-data report.

Reports completed since 1980: U.S. Geological Survey, Water resources data - New York: U.S. Geological Survey Water Data Report, v. 1, Eastern New York excluding Long Island; v. 2, Long Island; v. 3, Western New York. (Published annually.)

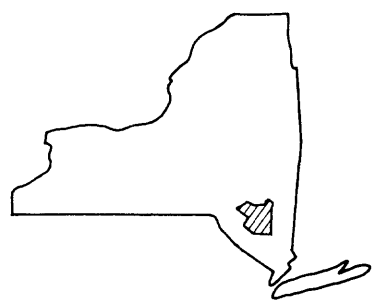
National Trends Network (NTN) for Moniroting Atmospheric Deposition
(NY 83-005)

Period of project: Continuous since June 1983

Project leader: Peter S. Murdoch

Field location: Biscuit Brook, Ulster County

Cooperating agencies: Federal Funding



Problem: A nationwide long-term monitoring network needed to be developed and maintained to detect and measure chemical trends in atmospheric deposition. Prior to the National Atmospheric Deposition Program/NTN program, no national monitoring of deposition chemistry was begin done.

Objective: To document weekly variations in atmospheric deposition and collect wet deposition for analysis for elements and compounds that contribute to the chemical composition of surface waters.

Approach: To (a) set up monitoring stations as part of the National Trends Network; (b) maintain stations, make onsite measurements, and process samples and submit them to a laboratory; (c) verify data retrievals, and (d) prepare a report on results.

Progress and significant results: Monitoring continued. Data were transferred to National data bases. Interaction was established between National Trends Network (NTN) and Albany office staff to correct errors in precipitation data. Investigation of stream chemistry and flow characteristics upstream of the Biscuit Brook gage was begun, and five sampling runs were completed.

Plans for next year: To complete and publish the reports and continue operation of the small watershed study with emphasis on episodic stormflows.

New York Water-Use Data
(NY 79-007)

Period of preoject: Continuous since January 1979

Project leader: Deborah S. Snavely

Field location: Statewide

Cooperating agencies: New York State Department of Environmental Conservation; Dutchess County Enivronmental Management Council

Problem: The demand for water in New York State is unevenly distributed, and little information is available on water use. Because increasing competition for local supplies could lead to shortages, it is necessary to know the present uses, how use may vary with demands, and how the availability and nature of the resources vary with demand. These are addressed by two subprojects that are intended to (1) collect data and estimate withdrawals in New York State; and (2) examine the interaction of water use, availability, and waste sites in Dutchess County.

Objectives: To (a) determine what agencies collect data on water use in the specified categories, (b) collect and compile water-use data for input to the State Water-Use Data System (SWUDS) and subsequently the National Water-Use Data System, (c) develop a system whereby the agencies that collect the data can transmit periodic updates to the main data bank, (d) make the data available through computer processing and reports, (e) evaluate the relation between water use and availability in Dutchess County and possible sources of

ground-water contamination, and (f) collect detailed information on the availability and format of water-use data from the Great Lakes basin.

Approach: (1) New York State agencies will furnish general water-use data for specific categories of use. (2) Local agencies and organizations in specific counties will supply detailed water-use data. (3) A system of data transmittal will be established among State and local agencies, and new geographic areas of the State will be added systematically. (4) The water-use data will be used to update SWUDS. (5) Periodic water-use reports will be written.

Progress and significant results: The report on water use in the Great Lakes States and Provinces was completed, as was the statewide compilation of data for a Geological Survey Circular titled "Estimated Use of Water in the United States, 1985." County and hydrologic-unit water-use data were stored in EUOWITUS, and the New York section for the Geological Survey's 1987 National Water Summary was written and submitted for publication. Dutchess County project maps, data compilation, and data bases were completed except for public-supply wells. Public-supply data tables were updated with 1985 data, and summaries of 1984 and 1985 data were completed. A statewide water-use report was outlined.

Plans for next year: To (a) complete Dutchess County data bases and report, a draft of New York State water-use data report, and an article for the American Water Resources Association symposium; (b) begin Dutchess County Phase II project and use Dutchess County data in ARC-INFO; (c) edit and update statewide public water-supply data in SWUDS; and (d) design and publish a water-fact sheet about water use and the data collection program in New York.

Completed reports:

Snavely, D. S., 1986, Water-use data-collection programs and regional data base of the Great Lakes-St. Lawrence River basin States and Provinces: U.S. Geological Survey Open-File Report 86-546, 204 p.

Snavely, D. S., and Williams, James, 1985, Estimated public-water supply and industrial-commercial ground-water withdrawals and return in Nassau County, Long Island, New York, 1973-79: U.S. Geological Survey Water Resources Investigations Report 84-4246, 16 p.

Flood Investigations
(NY 67-045)

Period of project: Continuous since July 1966

Project leader: Richard Lumia

Field location: Statewide

Cooperating agency: New York State Department of Transportation

Problem: Flooding is a serious problem in many parts of the State. Information on floods and analyses of flood data are needed for use in the design of bridges, highways, and buildings, and in flood-plain zoning and flood-protection works.

Objective: To (a) provide information on magnitude and frequency of floods to agencies and individuals involved in flood-protection planning and design; (b) develop regional flood-frequency relationships for the entire State; and (c) make site studies.

Approach: To (a) collect flood data at crest-stage stations and publish annual peak discharges; (b) calculate discharges of floods, develop flood profiles, and collect information for flood-plain mapping; (c) prepare reports covering individual floods, and (d) make analyses to improve statewide flood-frequency relationships.

Progress and significant results: On April 4-5, 1987, a storm over the Catskill Mountains that brought up to 9 inches of rain caused significant flooding. Particularly hard hit was the Schoharie Creek basin, where flooding led to the collapse of the New York State Thruway bridge over the Schoharie Creek, with 10 fatalities. Several (25) indirect measurements throughout the area and floodmarks along the Schoharie Creek were obtained to help document the flooding. The crest-stage gage network also helped to document that and other floods throughout the year. A report documenting the flooding during April 1987 throughout southeastern New York is underway.

Plans for next year: To (a) publish a report documenting the April 1987 flooding in southeastern New York, (b) continue collection of flood data at crest-stage gage sites and publish annual peak flows, (c) continue work on an update of a statewide flood-frequency analysis, and (d) begin work on a statewide bridge-scour study.

Reports Completed Since 1980:

Lumia, Richard, Burke, P. M., and Johnston, W. H., 1986, Flooding of December 29, 1984 through January 2, 1985 in northern New York State, with flood profiles of the Black and Salmon Rivers: U.S. Geological Survey Water-Resources Investigations Report 86-4191, 53 p.

Lumia, Richard, and Johnston, W. H., 1984, Floods of August 7-8, 1979, in Chautauqua County, New York, with hydraulic analysis of Canadaway Creek in the Village of Fredonia: U.S. Geological Survey Water-Resources Investigations Report 83-4211, 16 p.

Robideau, J. A., Burke, P. M., and Lumia, Richard, 1984, Maximum known stages and discharges of New York streams through September 1983: U.S. Geological Survey Open-File Report 83-927, 83 p.

Transport of Polychlorinated Biphenyl (PCB) Residues in the Upper Hudson River Basin
(NY 77-046)

Period of project: Continuous since February 1977

Project leader: Leonard R. Frost, Jr.

Field location: Hudson River from Fort Edward to Waterford

Cooperating agency: New York State Department of Environmental Conservation

Problem: The industrial discharge of polychlorinated biphenyls (PCB's) into the upper Hudson River has degraded the water quality. Whether significant quantities of PCB-contaminated sediment have already been transported downstream is unknown; thus, the efficacy of proposed sediment-dredging operations in the upper Hudson is also unknown.

Objective: To estimate the amount of PCB's contributed from the upper Hudson to the estuary and determine whether PCB-contaminated sediments have been transported into the estuary. This study will provide a data base from which the effects of dredging the upper Hudson (if carried out) can be evaluated.

Approach: PCB's and sediments transported by the Hudson River will be calculated for a range of flow values.

Progress and significant results: Annual suspended-sediment loads and PCB loads were calculated. A high flow was sampled, and samples were delivered to laboratories for analysis. Much of the flow sampled came from above Fort Edward and passed over areas ("hot spots") of high PCB concentrations in bottom sediments.

Plans for next year: To modify the sampling approach to concentrate at a site immediately downstream of PCB "hot spots."

Completed reports:

Schroeder, R. A., and Barnes, C. R., 1983, Polychlorinated biphenyl concentrations in Hudson River water and treated drinking water at Waterford, New York: U.S. Geological Survey Water-Resources Investigations Report 83-4188, 13 p.

____ 1983, Trends in polychlorinated biphenyl concentrations in Hudson River water five years after elimination of point sources in 1976: U.S. Geological Survey Water-Resources Investigations Report 83-4206, 28 p.

Sloan, R. J., Simpson, K. W., Schroeder, R. A., and Barnes, C. R., 1983, Temporal trends toward stability of Hudson River PCB contamination: Bulletin of Environmental Contamination and Toxicology, v. 31, p. 377-385.

Sloan, R. J., Brown, M. P., Brandt, R. J., and Barnes, C. R., 1984, Hudson River PCB relationship between resident fish, water, and sediments: Northeastern Environmental Science, v. 3, p. 138-152.

Turk, J. T., 1980, Applications of Hudson River basin PCB transport studies, in Baker, R. L., ed., Contaminants and sediments: Ann Arbor Science v. 1, p. 171-183.

Turk, J. T. and Troutman, D.E., 1981, Relationship of water resources to water quality in the Hudson River, New York, during peak discharges to geologic characteristics of contributing subbasins: U.S. Geological Survey Water-Resources Investigations Report 80-108, 15 p.

____ 1981, Polychlorinated biphenyl transport in the Hudson River, New York: U.S. Geological Survey Water-Resources Investigations Report 81-9, 11 p.

Baseline Water Quality Assessment of Selected Aquifers (NY 82-114)

Period of record: Continuous since October 1981

Project leader: Richard J. Reynolds

Field location: Glaciated valleys within upstate New York

Cooperating agency: New York State Department of Environmental Conservation

Problem: Most principal aquifers in upstate New York are isolated unconfined glacial or alluvial deposits in valleys cut into crystalline or shale bedrock. Development that has taken place on those aquifers has made them susceptible to contamination. Contamination, whether from agricultural, industrial, or nonpoint sources, jeopardizes the only economical source of water for homes, communities, and small industries in many places. Management decision for resolution or prevention of these problems would be facilitated by an appraisal of selected areas of known or potential problems.

Objectives: To (a) select aquifers that have a known potential ground-water contamination problem, (b) compile geohydrologic maps of the aquifer systems, (c) select a ground-water-quality monitoring system for major water-supply users, and (d) sample and analyze ground water for baseline qaulity.

Approach: Aquifer selection will be flexible, depending on needs of cooperating agency. Aquifers will be mapped generally at 1:24,000 scale from published geologic, soils, and land-use maps (or minor field mapping). Aquifer characteristics will be interpreted and depicted on maps of aquifer thickness, water levels, and water quality and on geologic sections.

Progress and significant results: Reports on the Olean and Salamanca areas were published, and a report on the Croton-Ossining area is in press. Reports covering the Waverly-Sayre, Owego, Utica, and Rome areas are in preparation. Two additional areas (Norwich and Hornell) were chosen for study, and work is

underway. The scope of this project may be expanded to include delineation of ground-water-contributing areas of major well fields in selected aquifer systems as outlined by the Safe Drinking Water Act Amendment, if funding becomes available.

Plans for next year: (1) To (a) publish reports on the Waverly-Sayre, Utica, Owego, and Rome areas, (b) complete work on the Norwich and Hornell areas, and (c) collect additional data (well drilling, water levels, baseline water quality) from either the Schenectady or Clifton Park areas. (2) To explore several techniques for delineation of ground-water-contributing areas. A previously studied aquifer system will be used as an example.

Completed reports:

Reynolds, R. J., 1984, Hydrogeology of the Clifton Park area, Saratoga County, New York: U.S. Geological Survey Water-Resources Investigations Report 84-4031, 6 sheets, 1:24,000.

_____1986, Hydrogeology of the Fort Drum area, Jefferson, Lewis, and St. Lawrence Counties, New York: U. S. Geological Survey Water-Resources Investigations Report 85-4119, 6 sheets, 1:48,000.

_____1988, Hydrogeology of the Croton-Ossining area, Westchester County, New York: U.S. Geological Survey Water-Resources Investigations Report 87-4159, 5 sheets, 1:12,000.

Zarriello, P. J., 1986, Hydrogeology of the Salamanca area, Cattaraugus County, NewYork: U.S. Geological Survey Water-Resources Investigation Report 85-4149, 5 sheets, 1:24,000.

Zarriello P. J., and Reynolds, R. J., 1986, Hydrogeology of the Olean area, Cattaraugus County, New York: U.S. Geological Survey Water-Resources Investigation Report 85-4157, 9 sheets, 1:24,000.

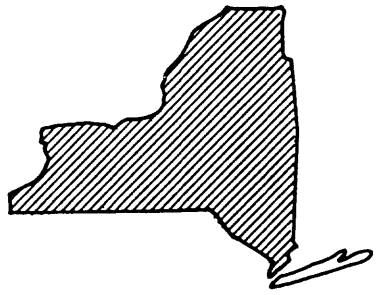
Glacial-Drift Aquifers in Upstate New York
(NY-82-116)

Date project began: March 1983

date project ends: September 1989

Project leader: John H. Williams

Field location: New York State excluding Long Island



Funding: Federal program

Problem: The Geological Survey's Regional Aquifer Systems Analysis (RASA) study of the Northeast glacial-drift aquifer system has identified several types of studies that are needed: (1) chemical processes in glacial-drift aquifers, (2) aquifer geometry at type sites, (3) geophysical techniques for

determining the composition of glacial-drift aquifers, and (4) rate of induced infiltration through streambeds of differing permeability.

Objectives: To (a) evaluate the chemical processes that occur in glacial-drift aquifers, (b) describe the geology of type areas under differing glacial regimes, (c) develop criteria for use of various geophysical methods under a variety of geohydrologic conditions, and (d) conduct streambed-permeability studies at a wellfield with an adjacent stream.

Approach: To (a) interpret aquifer-water analyses through thermodynamic and statistical techniques, (b) make a comprehensive geologic and hydrologic study of a type area of glacial retreat from a headwater valley, (c) conduct geophysical profiles in selected settings to compare results of the different methods, and (d) make synoptic measurements of ground-water levels, pumping, and stream discharge at a selected site.

Progress and significant results: Two reports (regional geochemistry and induced infiltration) and two abstracts (marine seismic) were completed and are in press. Draft report on marine seismic work was completed.

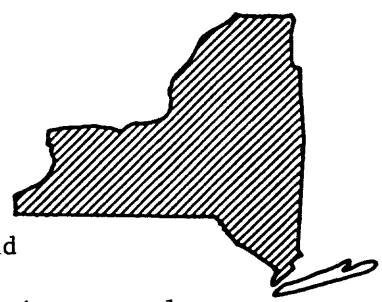
Plans for next year: (1) To complete the Dryden and marine seismic reports. (2) To complete the model of the aquifer and tributary stream at Asaph, Pa.

Ground-Water Resources of Upstate New York
(NY 85-151)

Date project began: January 1985

Date project ends: September 1988

Project leader: John H. Williams



Field location: Upstate New York excluding Long Island

Cooperating agencies: New York State Department of Environmental Conservation, Westchester County Department of Health, Putnam County Health Department, Orange County Planning Department, Orange County Department of Public Works, Oneida County planning Department, Montgomery County Planning Department, Sullivan County Department of Planning and Economic Development.

Problem: No comprehensive effort has been maintained since the 1960's to (a) describe the ground-water resources in a form useful to specific management purposes, (b) provide an easily accessible data base, (c) complete an appraisal of ground-water resources in unstudied basins, (d) guide research into the response of ground-water systems to development, waste disposal, agriculture, and other manmade stresses, or (e) provide easily usable tools, such as maps and models, by which multiple uses of aquifers may be managed. As a result, the comprehensive ground-water-management plan for upstate New York requires information that is not available.

Objectives: To (a) focus and organize several unrelated studies to meet broader areal objectives, (b) foster consolidation of special-interest activities into independent studies that meet areal objectives, (c) guide efforts to accurately describe the ground-water resources and understand how stresses affect them.

Approach: (1) To gather and organize data from a multitude of files into central computer storage files and collect new data to establish geologic and hydrologic data bases. (2) To present information on maps and in other descriptive types of formats. (3) To conduct research into physical and chemical processes that occur within ground-water systems. (4) To apply results of various efforts to subsequent activities in which additional knowledge is required. (5) To coordinate formation of independent, long-term studies.

Progress and significant results: Six reports were published or are in press; another five are in review.

Plans for next year: To have the remaining five reports published.

Completed reports:

Frimpter, M. H., 1987, Surficial geology and ground-water availability in the Allegheny River basin and part of Lake Erie basin, New York: U.S. Geological Survey Water-Resources Investigations 86-4041, 2 sheets, 1:250,000.

Kammerer, J. C. and Hobba, W. A., Jr., 1987, Ground-water availability in the Genesee River basin, New York and Pennsylvania: U.S. Geological Survey Water-Resources Investigations 86-4048, 4 sheets, 1:62,500.

Waller, R. M., 1987, Ground-water availability in the Black River basin, New York: U.S. Geological Survey Water-Resources Investigations 86-4040, 3 sheets, 1:62,500.

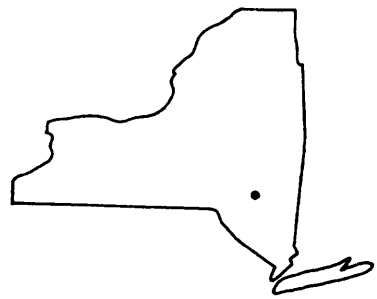
Wolcott, S. W., 1987, Potential well yield from unconsolidated deposits in the lower Hudson and Delaware River basins, New York: U.S. Geological Survey Water-Resources Investigations Report 87-4042, 1 sheet, 1:250,000.

_____1987, Selected ground-water data in the upper Mongaup River basin, Sullivan County, New York: U.S. Geological Sruvey Open-File Report 87-114, 4 sheets, 1:24,000.

Wolcott, S. W. and Irwin, D. J., Estimated thickness and potential well yield of stratified-drift deposits in the upper Croton River basin, Westchester County, New York: U.S. Geological Survey Water-Resources Investigations Report 87-4287, 6 sheets, 1:24,000.

Irwin, D. J., Thickness and potential well yield of stratified-deposits, Croton River basin, Putnam County, New York: U.S. Geological Survey Water-Resources Investigations Report 87-4120, 6 sheets, 1: 24,000.

Dynamics of Stream Chemistry and Discharge at Biscuit Brook and its Peripheral Streams in the Catskill Mountains
(NY 85-152)



Date project began: October 1984

Date Project Ends: September 1991

Project leader: Peter S. Murdoch

Field location: Ulster County

Cooperating Agency: U.S. Environmental Protection Agency

Problem: Reconnaissance data suggest that acid precipitation may affect stream chemistry in the Catskill Mountains. Assessment of the effect of acidic deposition requires data on both short-term and long-term trends in stream chemistry.

Objectives: (1) To assess the relation between stream chemistry and discharge at six streams peripheral to Biscuit Brook and during 10 stormflows at Biscuit Brook. (2) To calculate a mass balance for input and output of key constituents through the Biscuit Brook watershed. (3) To compare the effect of precipitation acidity of different storms on the geochemistry of Biscuit Brook.

Approach: To conduct (a) hourly sampling of stream and rainwater during 10 storms at Biscuit Brook, (b) biweekly sampling during nonstorm periods, (c) weekly sampling of wetfall within the Biscuit Brook watershed as part of the National Trends Network (NTN) program, and (d) monthly sampling at six streams peripheral to the Biscuit Brook watershed with simultaneous discharge measurements.

Progress and significant results: Four years of chemical budgets and chemical sampling during 14 storms indicate a net acidification in Biscuit Brook and surrounding streams by sulfuric acid of approximately 120 mg/L. Nitrate concentrations increase with flow during all storms except those occurring in midsummer. Concentrations of major constituents were similar among the study streams except for calcium, hydrogen, and alkalinity.

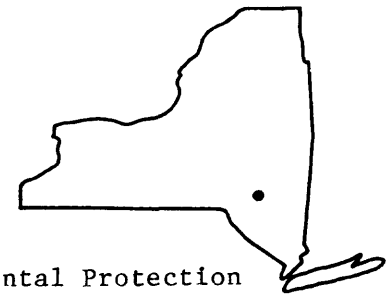
Plans for next year: (1) To complete a national project plan and a proposal for the Catskill segment of the Episodic Response Project (ERP). (2) To install four monitoring stations and collect samples during high discharges at each. The number of storms during the final year is yet to be determined.

Completed reports:

Murdoch, P. S., Chemical budgets and stream-chemistry dynamics of a headwater stream in the Catskill Mountains, New York, October 1, 1983 through September 30, 1985: U.S. Geological Survey Water-Resources Investigations Report 88-4035.

Murdoch, P. S., and Barnes, C. R., 1987, Assessment of stream acidification in the Catskill Mountains of New York, in Programs and Abstracts: American Chemical Society, 17th Northeast Regional Meeting, Rochester, N.Y., November 8-11, 1987, p. 84.

Susceptibility of Catskill Mountain Streams in New York City Reservoir System Watersheds to Acidification
(NY 86-158)



Period of project: Continuous since October 1985

Project leader: Peter S.Murdoch

Field location: Ulster County

Cooperating agencies: New York City Department of Environmental Protection

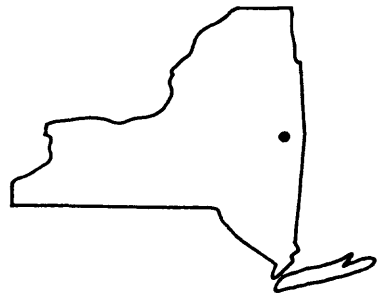
Problem: Acid deposition has affected some headwater streams in New York. Some chemical similarities have been noted between Catskill streams and other streams known to be affected. Six reservoirs in the Catskill Mountains serve as a major source of water supply for New York City. Relatively little research has been done on acidification in watersheds that serve as a public water supply. Neither the vulnerability of headwater streams to acidification, nor the effect of their acidification on the water quality of the reservoir, are known.

Objectives: (1) To examine various techniques for assessing susceptibilty of surface waters to acidification and to evaluate the susceptibility of headwater streams in the New York City Catskill Reservoir system. (2) To examine the mitigating effects of natural processes within a Catskill watershed when headwaters are acidic.

Approach: (1) Water samples will be collected four times annually from approximately 40 headwater streams in the reservoir watersheds, and 14 samples will be collected four times annually along the Neversink River. (2) Methods of appraising susceptibility will be reviewed, and results will be evaluated in relation to basin characteristics. (3) Data from Neversink River will be examined for changes in water quality with increased basin area.

Progress and significant results: Planned sampling of high, medium, and low discharges was completed, and differences in the effects of acid precipitation among watersheds was documented. Sulfate concentrations are uniform across the Catskills, but calcium and alkalinity concentrations are highly divergent. Nitrate concentrations are similar among streams and approximately double during the spring.

Sorptive and Transport Characteristics of PCB Congeners in the Upper Hudson River
(NY 86-165)



Date project began: July 1986

Date project ends: September 1988

Project leader: Leonard R. Frost, Jr.

Field location: Hudson River at Waterford

Cooperating agencies: New York State Department of Environmenmtal Conservation

Problem: Polychlorinated biphenyls (PCB's) are mixtures of up to 209 individual congeners, each having different physical characteristics and environmental hazards. Information is needed on which PCB congeners are present during selected flow regimes to further our understanding of transport mechanisms.

Objectives: To (a) examine the PCB-congener distribution in water and suspended sediment during a variety of flow conditions; (b) examine partitioning of PCB congeners transported in dissolved and suspended phases; (c) compare theoretical desorptive processes from riverbed and suspended material with concentrations of PCB's during the transition period following high flows; (d) examine relations between high-flow and low-flow concentrations of PCB congeners to see if high-flow data can be used to estimate congener distribution later in the year; and (e) compare congener analyses with results of generic aroclor analyses.

Approach: Samples will be collected from the last high flow of the spring that exceeds 708 m^3/s. The samples will be from the rising limb, peak, and falling limb of the flood. Aliquots of selected samples will be analyzed in the Survey's National Water-Quality Laboratory in Denver and in the New York State Department of Environmental Conservation's laboratory in Albany. The relations of congeneric composition of dissolved and suspended PCB's to discharge will be examined.

Progress and significant results: The last high flow of the spring runoff period was sampled, and samples were analyzed at private laboratory for total PCBs. The Survey's National Water Quality Laboratory in Denver has switched to capillary column gas chromatography to produce more accurate data.

Plans for next year: To repeat sampling and obtain data for final report.

Estimation of Volatile-Organic Compound Desorption and Reaeration Coefficients in Low-Slope and Impounded Streams of New York and Massachusetts
(NY 87-166)

Period of project: Continuous since 1986

Project leader: George C. Gravlee

Field location: Statewide

Cooperating agencies: New York State Department of Environmental Conservation

Problem: Adsorption and desorption coefficients for gas transfer at the air/water interface have been established for medium and high-slope rivers in the Northeast but are needed for low-slope rivers that are either channel controlled or consist of a series of pools separated by locks and spillway dams.

Objectives: (1) To use the one- or two-dimensional steady-state gas-transfer methods to compute propane-desorption coefficients for selected stream reaches. (2) To develop predictive equations for volatile-organic and reaeration coefficients on streams of the Northeast. (3) To generate previously unavailable data specific to low-slope and impounded rivers.

Approach: To conduct 20 propane-desorption-coefficient measurements on low-slope and impounded streams in New York. Physical, hydraulic, and water-quality characteristics of these streams will also be measured. Resulting data will then be combined with similar data collected in Massachusetts to develop regression equations that describe volatile-organic and reaeration coefficients for low-slope and impounded streams.

Progress and significant results: Propane-desorption measurements were made on four low-slope stream reaches this year, and four additional reaches were identified for measurement. All physical, hydraulic, and water-quality characteristics of these stream reaches have been or will be collected this year.

Plans for next year: To (a) select and measure desorption rates of seven to ten additional low-slope and impounded stream reaches in New York, and (b) collect all required physical, hydraulic, and water-quality data for each reach.

Westchester Ground-Water Study
(NY87-167)

Date project began: July 1985

Date project ends: June 1989

Project leader: Stephen W. Wolcott

Field location: Westchester County

Cooperating agencies: Westchester County Water Agency

Problem: The limits of growth and development within the upper Croton River basin in Westchester County remain unclear bacause the availability and quality of ground water are unknown. Ground water derived from bedrock is of concern because most of the unconsolidated aquifers have been developed to their maximum potential, do not supply sufficient quantities of water, or have been contaminated. Withdrawals of water from bedrock aquifers must not exceed the annual recharge rate if decreases in storage are to be avoided.

Objectives: To estimate the natural recharge rate and establish the baseline water quality of till and bedrock aquifer systems.

Approach: (1) To estimate the rate of recharge to till and bedrock aquifers through an established technique of analyzing the ground-water component of the mean annual runoff. (2) To calibrate a steady-state ground-water model of a selected subbasin within the study area to (a) verify the estimates, and (b) investigate the hydrogeologic flow processes in upland areas. (3) To collect water samples from each major bedrock unit for chemical analysis.

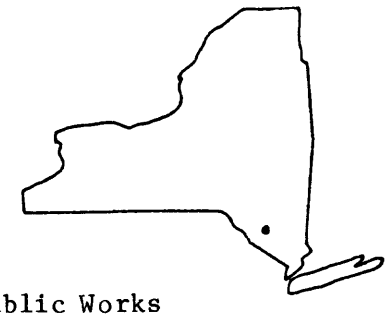
Progress and significant results: A preliminary report is in press. Water-quality data for the upper Croton River basin have been collected. Most of the Ground-Water Site Inventory files have been updated. Initial ground-water model calibration has been started, and preliminary estimates of natural recharge have been made.

Plans for next year: To complete ground-water modeling and summarize the results in a report.

Completed reports:

Wolcott, S. W., and Irwin, D. J., Estimated thickness and potential well yield of stratified-drift deposits in the uper Croton River basin, Westchester County, New York: U.S. Geological Survey Water-Resources Investigations Report 87-4287, 6 plates, 1:24,000 (in press).

Hydrogeology and Water Quality of the Wallkill River Valley near Middletown
(NY 87-168)



Date project began: October 1986

Date project ends: September 1988

Project leader: Edward F. Bugliosi

Field location: Middletown

Cooperating agencies: Orange County Department of Public Works

Problem: Current data are insufficient for the effective planning for the use of the Wallkill valley's water resources. Water quality, aquifer geometry, ground-water movement, and stream/aquifer interaction data must be collected and analyzed to provide the necessary information to determine the hydrogeology of the area.

Objectives: To develop an understanding of the geohydrology of the Wallkill River valley near Middletown by describing the unconsolidated aquifer flow system and its interaction with the Wallkill River, and to describe baseline water-quality data in the unconsolidated aquifer.

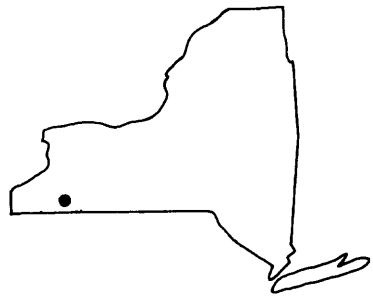
Approach: To sample ground water, measure water levels, determine aquifer boundaries and characteristics, and construct a three-dimensional model of the area.

Progress and significant results: All seismic-refraction data have been interpreted, and 95 percent of the water-quality data have been retrieved. A flow model has been built and is being calibrated to steady-state conditions. Several findings have resulted from the seismic data: (1) The sand and gravel aquifer is not continuous, but rather lensoid in cross section; (2) Acoustic velocities in the "Black Dirt" area indicate a possible difference between the metamorphosed shale and limestone; (3) The hypothesis that the preglacial Wallkill bedrock valley sloped to the south is substantiated by connection of the cross-sectional altitudes of the bedrock surface near the axis of the present valley.

Plans for next year: To finish data analysis and model construction and prepare final report.

ITHACA OFFICE

Verification of Nitrogen Concentrations Predicted by Solute-Transport Model
(NY 83-127)



Date project began: January 1983

Date project ends: December 1992

Project leader: David R. Boldt

Field location: Olean

Cooperating agency: New York State Department of Environmental Conservation

Problem: Nitrogen compounds have contaminated a shallow aquifer in southwestern New York and are migrating toward the Olean municipal well field. A ground-water flow model and a solute-transport model have been constructed to predict contaminant movement given a range of hydraulic characteristics and a variety of pumping scenarios. A monitoring program is needed to compare actual contaminant concentrations with predicted concentrations to verify the accuracy of the model as a predictive tool.

Objective: To (a) compare, on a continuing basis, measured concentrations with those predicted to verify model predictions, and (b) in the event of significant differences, to recalibrate the model to more closely match field results and better predict contaminant migration.

Approach: The cooperating agency will install monitoring wells to measure nitrogen concentrations of the plume as it migrates through the aquifer. Locations of monitoring wells will be selected to provide information on strength of the nitrogen source, ground-water velocity, and effect of dispersion and adsorption on nitrogen concentrations. The observed trend of nitrogen concentrations in the aquifer will be compared with the range of concentrations predicted through sensitivity analysis with the solute-transport model. If arrival times of the solute front are sooner than expected, or peak nitrogen concentrations are higher, the need for recalibration of the model will be considered.

Plans for next year: To install two monitoring wells, collect water samples, analyze water samples for nitrogen species, and compare actual nitrogen concentrations with predicted results.

Completed reports:

Bergeron, M. P., 1985, Effect of reduced industrial pumpage on the migration of dissolved nitrogen in a shallow outwash aquifer at Olean, Cattaraugus County, New York: U.S. Geological Survey Water-Resources Investigations Report 85-4082, 38 p.

Yager, R. M., and Bergeron, M. P., Nitrogen transport in a shallow outwash aquifer at Olean, Cattaraugus County, New York: U.S. Geological Survey Water-Resources Investigations Report 87-4043, 38 p.

Verification of Channel-Roughness Characteristics ("n" Value)
(NY 84-140)

Date project began: October 1983

Date project ends: September 1989

Project leader: William F. Coon

Field location: Statewide

Cooperating agency: New York State Department of Transportation

Problem: The indirect computation of flood discharges and flood profiles requires estimates of channel-roughness coefficients ("n" values). The reliability of results of slope-area measurements and step-backwater analyses, in particular, is heavily dependent on the evaluation of channel roughness. Although several guides for estimating "n" values for natural channels are available, subjective judgment will probably always play a part in the final determination when all factors (streambed composition, bank and flood-plain vegetation, channel shape and curvature, depth of water, etc.) are considered.

Objectives: To (a) develop site-specific relation between "n"-values and such variables as flood depth and seasonal variation of vegetation cover, (b) assess the transferability of these relations to other sites, and (c) compile and maintain a file for each site that includes site maps, cross-sectional plots, site plans, photographs, and stereo slides that can be duplicated and used for office and field-training exercises.

Approach: To select 20 to 30 sites at well-rated gaging stations. After a flood, make a slope-area measurement to obtain initial "n" verification and cross-section location for subsequent installation of crest-stage gages. Operate crest gages until enough record is collected to define the roughness characteristics of the reach and the relation between roughness and variables such as depth and vegetation. Use the data from all sites to evaluate the transferability of site-specific relations.

Progress and significant results: Stage (profile) data were collected at the 22 sites having the required characteristics. Frequent high-water discharge measurements were made to confirm the stability of the ratings, and office and computer files containing site maps, cross-sectional plots, site plans, and tabulations of collected and computed data were updated. Videotaping was completed at approximately half the sites.

Plans for next year: To continue collection of stage (profile) data at all sites, complete videotaping of channel characteristics and flow conditions at remaining sites, collect field data on streambed-particle size and bank vegetation, and conduct preliminary statistical analysis of data.

Effects of an Instream Impoundment on Runoff and Water Quality in a Small Residential Headwater Basin
(NY 86-161)

Date project began: January 1986

Date project ends: September 1990

Project leader: Phillip J. Zarriello

Field location: Irondequoit Creek basin, Monroe County

Cooperating agencies: Monroe County Environmental Health Laboratory

Problem: The use of flow-detention basins to improve the chemical quality of stormflow was recommended by the U.S Environmental Protection Agency National Urban Runoff Program on the basis of a limited amount of data. A more detailed analysis of the effect that detention basins would have on runoff quality is needed to assess the performance of detention basins and to help local water managers determine the cost effectiveness of using such structures to improve the quality of downstream receiving waters.

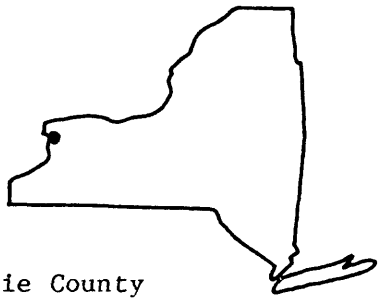
Objectives: To determine the effectiveness of selected detention basin designs in improving stormwater quality.

Approach: The inflows to and outflows from a detention basin will be monitored for flow and water quality for 3 years. Precipitation data will be collected within the watershed to establish rainfall-to-runoff relations. Basin characteristics will be documented. Data will be analyzed to determine accumulated loads, mass flux of the basin, and changes in concentration. Inflow will be compared with outflow to determine water-quality differences. Detention-basin outlets will be modified to retain stormwater for longer periods to assess design modifications for water-quality improvement.

Progress and significant results: Discharge data from 23 storms and water-quality data from 14 storms have been collected. Software development has continued for analysis of storms and publication of results. Aerial photographs of the study area were taken, and a detailed contour map of the drainage basin was produced. The outlet modification has been designed and is being manufactured.

Plans for next year: Data on discharge and quality of water entering and exiting the detention basin will be collected. Loads and mass flux of selected dissolved and suspended materials will be calculated for selected stormflows. The present basin-outlet control will be modified to increase stormflow retention during smaller discharges.

Hydrogeology of the Niagara Falls Area
(NY 86-164)



Date project began: June 1986

Date project ends: September 1991

Project leader: William M. Kappel

Field location: western Niagara County and northwestern Erie County

Cooperating agencies: U.S. Environmental Protection Agency - Region II

Problem: Ground-water and surface-water quality along the Niagara River has been degraded by direct discharge and migration of contaminants from industrial plants and waste-burial sites for more than 50 years. The Niagara Falls area alone contains five U.S. Superfund sites and more than 60 waste-burial sites. A regional ground-water flow study is needed to evaluate the effect of these sites on the surface-water and ground-water resources of the Niagara Falls area in both the United States and Canada.

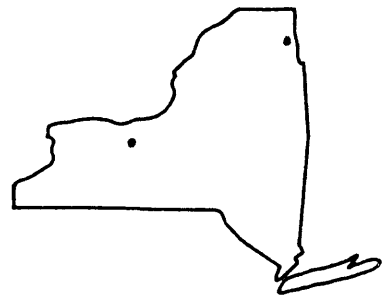
Objectives: To (a) define the hydrogeologic characteristics of surficial and bedrock units in the area, (b) describe the natural chemical quality of ground water in the bedrock aquifers, and (c) develop a three-dimensional flow model to describe hydrologic conditions and ground-water flow patterns and to provide a basis for initial boundary conditions for future site-specific ground-water-modeling studies.

Approach: This study will have four major phases. Phase 1 entails assembling the available hydrogeologic and water-quality information and developing a conceptual regional ground-water model; phase 2 entails field investigations and initial development and calibration of a three-dimensional ground-water model and geochemical model; phase 3 entails calibration and sensitivity analyses of the flow model; and phase 4 entails final data analysis.

Progress and significant results: Preliminary results from the Queenston shale drilling and testing program indicate an extensive overpressured zone within the bedrock that may inhibit downward flow of ground water and contaminants to deeper bedrock zones. A series of electromagnetic surveys suggest that a regional fracture system may intersect the study area, which could have a pronounced effect on ground-water flow near the fractured zone. A paper describing the results of the electromagnetic survey was presented at the third Annual Groundwater Technology Conference at City College of New York in September 1987.

Plans for next year: To complete five deep Thorold Sandstone coreholes; install multilevel monitoring systems, begin geochemical and potentiometric-head data collection and analysis, and begin development of Niagara Falls area model structure.

Subsurface Transport of Pesticides and Nitrates in Fields under Conventional and Conservation Tillage Practices
(NY 87-169)



Date project began: January 1987

Date project ends: December 1992

Project leader: Robert T. Paulsen

Field location: Wayne and Essex Counties

Cooperating agencies: New York State Department of Environmental Conservation

Problem: Agricultural chemicals such as nitrates and pesticides have been identified as a source of ground-water contamination nationally as well as in New York State. Water in soil often does not flow in a uniform, easily predictable manner but instead, as a result of macropores or unstable wetting fronts, may flow along preferential paths and reach deep into the subsoil more quickly than expected. Conservation tillage (no-till) is being promoted in New York State because it reduces erosion. No-till changes the soil's hydraulic characteristics and may lead to a potential increase in the rate of nitrate and pesticide migration to the ground water.

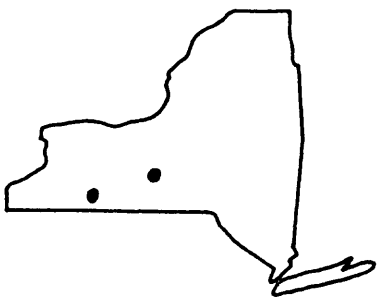
Objectives: To study the downward movement of water, nitrates, and pesticides in fields under conventional and no-till management and to determine whether solute migration in either type poses a significant threat to ground-water quality.

Approach: Paired fields will be managed under conventional tillage and no-till practices, and solute movement will be studied. Site selection, instrumentation installation, and collection of background data will be completed in the first year. Pesticide, nitrate, and solute-tracer transport will be monitored during years 2, 3, and 4. Final reports will be produced in year 5.

Progress and significant results: One field site in Essex County and one in Wayne County were fully instrumented. Samples of soil water and ground water were collected biweekly at the Essex County site from June through December for bromide, nitrate, alachlor, atrazine, and carbofuran analysis. Results of the first field season indicate that water and pesticides move more quickly through the no-till field than through the tilled field. The water table below the no-till field responded more quickly to precipitation than the water table below the conventionally tilled field. The tile draining the no-till field flowed in early summer, whereas the tile line draining the conventionally-tilled field did not flow until late fall. Atrazine was detected in ground water below the no-till field in early summer but not below the conventionally tilled field until late fall. Dye tests suggest that water and pesticides flow preferentially through continuous macropores in the no-till field and flow diffusely through the plowed layer and preferentially through macropores in the subsoil of the tilled field.

Plans for next year: Hydraulic testing of the unsaturated zone is to be done at both sites. Corn will be planted and fertilizer and pesticide applied in April 1988. Sample collection and analyses will be done at both sites. The second round of hydraulic testing in Essex County will begin in spring 1988.

Fate and Transport of Landfill Leachate in a Phragmites Wetland
(NY 87-170)



Date project began: December 1987

Date project ends: December 1989

Project leader: Ward W. Staubitz

Field location: Allegany County and Tompkins County

Cooperating agencies: Tompkins County, Allegany County, New York State Energy Research and Development Authority

Problem: Infiltration of precipitation and migration of ground water through landfills produces leachate that contains varying quantities of toxic organic and inorganic chemicals. Leachate has long been a source of ground-water and surface-water contamination. Problems resulting from the migration of leachate have led to stringent regulations in New York State and elsewhere that require new landfills to be lined and equipped with a leachate-collection system. No economically or environmentally sound system for renovating leachate is available at present, however.

Objectives: (a) To examine the physical, chemical, and biological processes occurring within a wetland system and to determine the ability of wetlands to fix or transform nutrients, metals, and organic constituents from landfill leachate, (b) to measure the efficiency of leachate treatment as a function of substrate material, plant growth, leachate quality, and seasonal change in climate.

Approach: The study is designed to last 3 years and will include 1 year of field-data collection. Four wetland systems consisting of three Phragmites beds of differing substrate material and one bare control bed will be constructed at two sites, and leachate will be applied to the beds. The quantity and quality of leachate influent and effluent will be measured, the speciation of metals in substrate material will be identified, water and chemical mass loadings will be calculated, and treatment efficiencies of each plot will be evaluated.

Plans for next year: The wetland plots will be constructed, instrumented, and planted in the spring of 1988. Leachate applications will begin in midsummer followed by water-quality sampling.

SYOSSET OFFICE

Hydrologic Models of the Ground-Water Flow System on Long Island
(NY 84-125)

Date project began: October 1983

Date project ends: September 1988

Project leader: Herbert T. Buxton

Fieldlocation: Islandwide

Cooperating agencies: Nassau County Department of Public Works; Suffolk County Department of Health Services; Suffolk County Water Authority; New York City Department of Environmental Protection

Problem: Declining ground-water levels, streamflow depletion, saltwater encroachment into aquifers, and pollution with industrial and domestic wastes pose a serious threat to the potable water supply of Long Island. Local governments are aware of the importance of proper management of the ground-water resources. Integral to proper resource-management planning is an understanding of the hydrologic system and comparative testing of various management alternatives through predictive hydrologic models.

Objective: To provide quantitative estimates of (a) the characteristics of the ground-water system under predevelopment conditions; (b) the changes in these characteristics that have been caused by man; and (c) the changes that would result from implementation of future water-resource management strategies. Pertinent characteristics of the ground-water system include the patterns and rates of ground-water movement and the rates of ground-water discharge at boundaries (such as streams, shores, subsea discharge areas).

Approach: A three-dimensional model of the entire ground-water flow system, including all unconsolidated hydrogeologic units, will be constructed. Data for model input include estimates of base flow, definition of the system's hydrogeologic framework, location of the saltwater interface, and estimation of ground-water-recharge rates under natural and urbanized conditions. Steady-state simulations of both predevelopment and recent hydrologic conditions and a transient-state simulation of the 1960's drought will be made, and the results compared with historical data to demonstrate the accuracy of the model. Predictive runs will be made to assess the effects of selected managment strategies for future development of the ground-water system.

Progress and significant results: The three-dimensional flow model was calibrated and completed. Results of calibration simulations of predevelopment, present, and drought conditions gave information on the water budget of the system, including interaction between aquifer and overlying streams, the effects of development on the system, and the effect of hydrogeologic conditions on the operation of the system. Predictive simulations were run to assess islandwide resource-management strategies for the year 2020 and appropriate supplemented-supply plans for the city of New York.

Plans for next year: (1) To complete reports that (a) document construction and calibration of the Long Island regional model, and (b) present results of simulations to evaluate islandwide water-resource-management plans for the year 2020. (2) To run simulations to evaluate the use of ground-water as a supplemental water supply for New York City.

Completed reports:

Buxton, H. T., Smolensky, D. A., and Shernoff, P. K., Hydrogeologic correlations for selected wells on Long Island, New York--A data base with retrieval program: U.S. Geological Survey Water Resources Investigations Report 86-4318, 22 p. (in press).

Smolensky, D. A., Buxton, H. T., and Shernoff, P. K., (in press), Hydrogeologic framework of Long Island, New York: U.S. Geological Survey Hydrologic Investigations atlas, HA-709, 3 sheets (in press).

Interpretation of Hydrologic Data to Address Problems of Water Supply and Demand on Long Island
(NY 83-132)

Date project began: April 1983

Date project ends: September 1989

Project leader: Donald L. Bingham

Field location: Islandwide

Cooperating agency: New York State Department of Environmental Conservation

Problem: Past water-use trends on Long Island and projections of future increases in consumptive water use indicate the need for an effective management approach to the development of Long Island's freshwater resources. Until now, the "safe yield" concept has been fundamental to water-resources management on Long Island, but the complexity of the Island's hydrologic system makes it impossible to predetermine allowable rates of withdrawal in any area without a development plan. An alternative management approach is being developed that will be based on (1) defining pertinent aspects of the present hydrologic condition on a regional scale, and (2) identifying areas most susceptible to undesired hydrologic effects.

Objectives: To (a) compile all hydrologic data pertinent to water-resources management in usable format, (b) publish regional hydrologic interpretations of these data periodically, (c) reevaluate the monitoring networks and recommend augmentation as needed, and (d) demonstrate the feasibility and practicality of technically based water-resource management policy by making available and demonstrating the usefulness of the interpretive hydrologic data.

Approach: A series of maps will be developed that demonstrate a hydrologic interpretation of data collected in regional monitoring networks. The series includes (a) a standard base map and topographic base at scales of 1:125,000 and 1:62,500, (b) hydrogeologic maps showing structure contours and aquifer thickness and cross sections through the aquifers, (c) maps showing hydraulic potential, streamflow data, and water-transmitting properties, and (d) water-quality maps showing concentrations of chloride, nitrate, and selected organic compounds.

Progress and significant results: A depth-to-water report is in review. Technical assistance to New York State Department of Environmental Conservation continues for the implementation of the Long Island ground-water-management plan and well-permit program.

Plans for next year: To (a) continue to update the New York Water Resources Comission Bulletin 62, (b) maintain an active technical role in development of the New York State Department of Environmental Conservation's Long Island ground-water management plan, and (c) design a water-level and water-quality-monitoring network for Kings and Queens counties.

Completed reports:

Soren, Julian, and Simmons, D.L., 1987, Thickness and hydrogeology of aquifers and confining units below the upper glacial aquifer on Long Island, New York: U.S. Geological Survey Water-Resources Investigations Report 86-4175, 3 sheets.

Saltwater Encroachment in Nassau County
(NY 84-147)

Date project began: April 1984

Date project ends: October 1988

Project leader: Stephen A. Terraciano

Field location: Nassau County

Cooperating agency: Nassau County Department of Public Works

Problem: Virtually all of the water supply for Nassau County is obtained from wells. Saltwater encroachment is one of the greatest threats to this water supply, especially under the barrier islands, where a confined aquifer is threatened by both downward movement of saltwater through the confining layer and landward movement of the saltwater front. Integrated planning strategies are needed for all four aquifers in Nassau County. Saltwater intrusion on the south shore needs to be reevaluated to assess the effects of heavy pumping in recent decades.

Objectives: To (a) inspect and recondition outpost wells on the south shore, (b) delineate the position of the saltwater interface in each aquifer, (c) investigate the phenomenon of saltwater movement, both vertically and horizontally, in Nassau County, and (d) present the data in a form suitable for use by water-supply managers.

Approach: This project will require (a) evaluation of all available data on the interface in each aquifer, (b) reconditioning and sampling of outpost wells, (d) evaluation of the offshore position of the interface in confined aquifers to help identify the controlling factors (offshore test drilling may be required), (d) construction of chloride maps and sections for each aquifer, (e) updating of U.S. Geological Survey Professional Paper 700D, p. 281-285, "Status of Saltwater Encroachment," and (7) sampling and analysis of water from selected wells with attention to sampling depth.

Progress and significant results: Two test/monitoring wells were drilled into the Lloyd aquifer along the barrier beach of Nassau County. Chloride data on samples collected indicate that the fresh/saline-water interface may be approaching landward from the southwest. A test/monitoring well was drilled on the mainland into the basal part of the Magothy aquifer near the interface to monitor its northward movement.

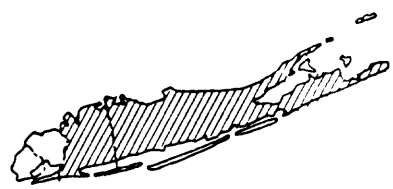
Plans for next year: To (a) evaluate all hydrogeologic and water-quality data collected from old and newly drilled wells, and (b) draft and construct maps and illustrations from data collected and complete the final report.

Ground-Water Quality Appraisal of Long Island
(NY 84-148)

Date project began: April 1984

Date project ends: September 1990

Project leader: David A. Eckhardt



Field location: Nassau and Suffolk Counties

Cooperating agency: Nassau County Department of Publications, Suffolk County Department of health Services, and Suffolk County Water Authority.

Problem: The hydrogeologic setting and land-use characteristics of Nassau and Suffolk Counties provide a unique situation for water-quality appraisal because the 2.6 million people depend on ground water. The use of ground water has grown sharply in the past few years, but contamination has restricted its use in many areas. Successful management of the ground-water resources requires a thorough accounting of water quality in the aquifers and relating the nature and extent of contamination to factors of human development and hydrogeologic processes.

Objectives: To (a) assess the quality of Long Island's ground-water resources by investigating the nature and extent of contamination in key land-use areas, and (b) present hydrologic and water-quality data pertinent to the interpretation and management of the island's ground-water resources and its attendant contamination problems.

Approach: To (a) assemble current and historical quality-water data, (b) inventory and group contaminant classes, (c) define areal and cross-sectional distributions of identified contaminants, (d) correlate land-use patterns and hydrogeologic characteristics with patterns of contamination, (e) provide graphic semiquantitative representation of the extent of identified classes of contaminants, (f) develop well networks and water-quality sampling protocol to provide the data needed for addressing the objectives, and (g) investigate the quality of shallow ground water in areas of discrete land-use effects.

Progress and significant results: (1) Conducted statistical review of available water-quality data. (2) Developed well-sampling network. (3) Collected ground-water samples from more than 100 wells in five different land-use areas for analysis for full inorganic chemistry, volatile organic compounds, liquid-extraction industrial organics, and five pesticide classes. (4) Compiled ancillary data to stochastically describe effects of nonpoint sources of contamination and movement of contaminants within the aquifer system. (5) Established and verified stochastic models relating shallow ground-water quality to factors describing human development in the two-county area.

Plans for next year: To complete (a) sampling at wells and compilation of all water-quality data, (b) continued evaluation of land-use, population density, and other predictive variables, (c) continued statistical analysis of water-quality and ancillary data, (4) analysis of occurrence and movement of contaminants in deeper zones of the aquifer system beneath the five land-use areas, and (5) report preparation.

Completed reports:

Eckhardt, D. A., Flipse, W. J., and Oaksford, E. T., 1988, Relation between land use and ground-water quality in the upper glacial aquifer in Nassau and Suffolk Counties, Long Island, New York: U.S. Geological Survey Water-Resources Investigations Report 86-4142, 35 p. (in press).

Eckhardt, D. A., and Oaksford, E. T., Relation of land use to ground-water quality in the upper glacial aquifer in Nassau and Suffolk Counties, New York--nonpoint source ground-water: U.S. Geological Survey Water Supply Paper 2325 (in press).

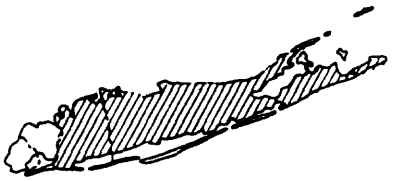
Eckhardt, D.A., Siwiec, S.F., amd Haefner, R.J., Ground-water quality in five land-use areas of Nassau and Suffolk Counties, Long Island, New York, in Proceedings, American Geophysical Union, May 16-20, 1988, Baltimore, Md. (in press).

Selected Topics in Ground-Water Geochemistry on Long Island
(NY 85-153)

Date project began: January 1985

Date project ends: September 1990

Project leader: Kenneth A. Pearsall



Field location: Nassau and Suffolk Counties

Cooperating agencies: Nassau County Department of Public Works; Suffolk County Department of Health Services; Suffolk County Water Authority

Problem: Natural geochemical processes in Long Island's ground-water system have not been adequately studied. A basic understanding of these processes, especially those that operate in reducing ground-water environments, is essential to predicting the fate of contaminants that enter the ground-water system.

Objectives: To expand current knowledge of Long Island's aquifer system and its reducing environments by (a) developing a geochemical-reaction model of the evolution of the major-ion character of the water, (b) investigating in detail the geochemistry of reducing environments in the ground-water system, and (c) examining how and to what extent natural geochemical processes are affected by the introduction of contaminants, and (d) investigating how geochemical processes affect the attenuation of contaminants.

Approach: A multiphase study will examine the evolution of water quality in several different geochemical environments. The first phase will evaluate the evolution of native (natural) water quality in the oxidizing environments that predominate in Long Island's aquifer system; the second will examine geochemical reactions in reducing environments, and the third will examine reactions within contaminated reducing zones. The geochemical speciation models WATQEF, BALANCE, and PHREEQE will be the principal tools used to evaluate the processes.

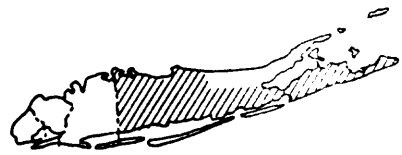
Progress and significant results: 219 samples were collected from 205 wells to complete the main sampling effort for phase I. Analytical data on 213 samples have been returned from the labratory, preliminary screening of water-quality data has been completed, and data from 32 wells that clearly do not reflect natural water quality have been eliminated from the data set. A more limited second sampling effort is underway to obtain data in areas previously unsampled and to resample where previous results are ambiguous.

Plans for next year: The current data, supplemented by more recent data, will be grouped by geochemical environment. Resulting grouping will be examined through geochemical specification models, and resulting data will be published.

Hydrogeologic Factors that Influence Contributing Areas to Pumping Centers
(NY 85-155)

Date project began: October 1984

Date project ends: September 1988



Project leader: Richard A. Cartwright

Field location: Suffolk County

Cooperating agencies: Suffolk County Water Authority and Suffolk County Department of Health Services

Problem: Suffolk County relies completely on ground-water resources for its water supply. This supply is managed and distributed principally by the Suffolk County Water Authority from an extensive network of wellfields or pumping centers. In recent years, contamination has resulted in the closing of several pumping wells in Queens and Nassau Counties. Detailed knowledge of ground-water-flow patterns and geologic conditions at the pumping centers will enable the design of efficient monitoring networks for the Suffolk County Water Authority sites to observe the effects of pumping.

Objectives: (1) To determine (a) changes in regional ground-water flow directions that result from withdrawals by selected pumping centers; (b) the direction of ground-water flow to selected pumping centers in relation to local geologic conditions; and (c) the rate of ground-water movement to selected pumping centers. (2) To recommend a monitoring network for selected pumping centers on the basis of results of the first objective.

Approach: Upon agreement with cooperating agencies, several pumping centers will be selected according to available geologic and hydrologic data and need. Surface geophysics, observation wells, and aquifer tests will be used to further evaluate the sites selected. The resulting data will be used to construct flow nets and calculate rates of ground-water flow to the pumping centers so that a monitoring network can be set up.

Progress and significant results: Two pumping tests were conducted at the Long Springs Road pumping center in Southampton. The first test stressed the Magothy aquifer; the second stressed the upper glacial aquifer. Tests were analyzed through various analytical methods, curve-matching techniques, and several radial flow models. Use of sensitivity analyses and one radial flow-model grid for both aquifer tests gave the following aquifer coefficients: upper glacial and Magothy hydraulic conductivity, 200 and 80 ft/d, respectively, and anisotropy of the upper glacial and Magothy aquifers, 32 and 26, respectively. Investigation was begun at Thomas Avenue in Bayshore, which is considered a confined situation. A simplified radial flow model was constructed to determine the placement of monitoring wells. Pumpage histories also were examined.

Plans for next year: (1) To continue preparation of the Thomas Avenue site in Bayshore for the next pumping test. Suffolk County Department of Health Services will be installing monitoring wells at suitable locations. (2) To

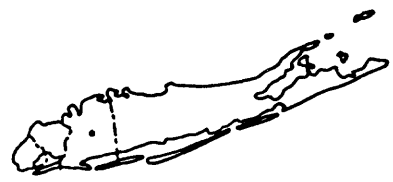
conduct a pumping test in early spring 1988 and begin analysis. (3) To compare the controlling hydrogeologic characteristics, methods of analysis, pumpage effects, monitoring schemes, and contributing areas of the Long Springs Road site with those of the Thomas Avenue site. (4) To examine the possibility of establishing another site such as the pumping center in the intermorainal area.

Analysis of Solute Transport in the Upper Central and Magothy Aquifers
(NY 85-156)

Date project began: October 1984

Date project ends: September 1988

Project leader: Paul M. Heisig



Field location: East Meadow

Cooperating Agency: Nassau County Department of Public Works

Problem: In 1983, an artificial-recharge test was performed in East Meadow, in which approximately 720 million gallons of tertiary-treated wastewater was returned to the ground-water system through surficial basins. The purpose of this study was to assess the feasibility of large-scale artificial recharge on Long Island. Because this form of recharge may become a water-management alternative in the future, the movement and chemical changes of the recharge water within the local ground-water system must be understood.

Objectives: To (a) define the migration of recharge water within the hydrogeologic system in East Meadow from water-quality data; (b) to characterize the movement and chemical changes in recharge-water constituents within the aquifer system over time; and (c) assess the long-term water-quality effects of artificial recharge on ground-water quality.

Approach: Data from both synoptic and weekly sampling runs will be analyzed to determine the influence of recharge water within the ground-water system through: (a) cross-sectional and areal-distribution plots of individual constituents, (b) Stiff diagrams, (c) scatter plots, and (e) chemical equilibria.

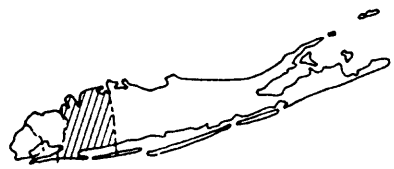
Progress and Significant Results: The maximum extent of the recharge water plume has been defined, although interferences from ambient water require a multiconstituent 'fingerprint' approach for identification. Piper and Stiff diagrams have been generated. At least one local source of water contamination has been delineated.

Effect of Stormwater Basins on the Quantity and Distribution of Recharge in Nassau County
(NY 85-157)

Date project began: October 1984

Date project ends: September 1988

Project leader: Henry F. H. Ku



Field location: Nassau County

Cooperating agency: Nassau County Department of Public Works

Problem: Stormwater basins transmit virtually all inflow to the ground-water reservoir and may increase recharge from precipitation to above the pre-development level. Therefore, the effects of recharge-basin systems on the quantity and distribution of recharge to the Long Island ground-water system must be understood. The three-dimensional aspects of recharge through stormwater recharge basins on an islandwide basis remain largely unquantified.

Objectives: (1) To update and revise the Nassau County part of a 1973 publication categorizing recharge-basin characteristics. (2) To characterize areal infiltration rates and examine the distribution of recharge basins and also the factors that influence recharge capability to estimate the areal redistribution of recharge.

Approach: (1) To install a crest-stage gage at selected basins and determine the infiltration rate and vertical hydraulic conductivity. (2) To use updated recharge distribution as input matrix for the Long Island regional model to examine the effect on regional ground-water flow and the resulting increased vertical flow in the aquifer system.

Progress and significant results: Fieldwork was completed, and data analysis is underway. Clogged recharge basins do not currently pose a management problem. Under most rainfall conditions, almost all recharge basins are able to exfiltrate stormwater, if not through the basin bottom, then through the basin walls. Infiltration tests with double-ring infiltrometers were done at 51 basins. Results show a median infiltration rate of 1.8 ft/h. The median vertical hydraulic conductivity of the upper foot of the unsaturated zone at the bottom of selected basins is 22 ft/d. Urbanization has modified the natural pattern and amount of ground-water recharge. The amount of recharge has increased where storm runoff is routed to basins and decreased where it is routed to streams. Areas where recharge has increased and decreased have been delineated.

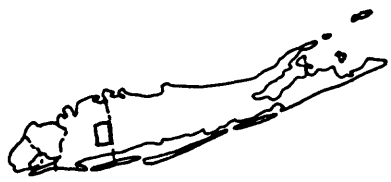
Ground-Water Flow and Contaminant Transport in Two Hydraulically Connected Aquifers
(NY 86-159)

Date project began: October 1985

Date project ends: September 1989

Project leader: Douglas A. Smolensky

Field location: Hicksville-Bethpage



Cooperating Agencies: Nassau County Department of Health

Problem: Ground-water contamination has increased with the growth of residential and industrial development. The upper glacial (water-table) aquifer can no longer be used as source of public supply, and the Magothy aquifer, with which it is in direct hydraulic connection, has shown isolated increases in organic contamination. For the Magothy to remain a potable source, the mechanisms that control the movement of contaminants from one aquifer to another must be understood, and point sources must be identified and delineated.

Objectives: (1) To define ground-water-flow patterns and identify contaminant sources in this highly developed multiaquifer system. (2) To define the mechanisms that affect contaminant transport. This entails (a) delineating patterns of ground-water movement and the extent of contamination in the study area and in areas that have the highest concentrations of contaminants; (b) document ground-water conditions as additional data are collected; (c) define the three-dimensional ground-water flow paths; (d) document subsurface hydrogeologic conditions and the associated hydraulic properties that affect the movement of ground water; and (e) quantify the relative importance of the mechanisms of contaminant transport, primarily advection and hydrodynamic dispersion.

Approach: A complete inventory of available information (hydrogeologic, water-quality, water-level data, etc.) will be made for preliminary assessment of hydrologic conditions in the study area. Additional data from new wells and water-quality analyses will help define current conditions. A three-dimensional ground-water flow model will be developed to improve our understanding of the system geometry, water budget, and local flow patterns. A two-dimensional solute-transport model will be developed to study point source(s) contamination. A cross-sectional model may be used to investigate vertical migration of contaminants and will be used to assess the effects of contaminant transport under present hydrologic conditions, stressed conditions, and seasonal extremes.

Progress and significant results: The extent of observed contaminant plumes has been defined. Compounds whose plumes have been mapped are TCE, PCE, 1-1-1 TCA, and vinyl chloride; maps indicate the possibility of several sources. A three-dimensional finite-difference flow model has been coupled with the previously developed regional flow model. Water-quality sampling and analyses have been completed. System geometry, hydrologic stresses, and boundary conditions have been defined for model simulations.

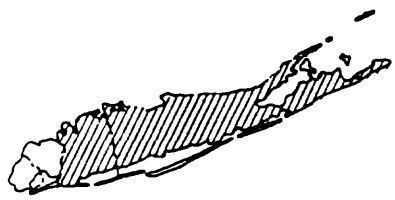
Plans for next year: Selected wells will be sampled for organic and selected inorganic compounds. Results of analyses will be mapped and compared with historical data. Development and calibration of a three-dimensional ground-water flow model, and assessment of the effects of all industrial stresses, will continue along with work on the transport model.

Cross-Sectional Analysis of Ground-Water Flow Patterns
(NY 86-160)

Date project began: October 1985

Date project ends: September 1989

Project leader: Herbert T. Buxton



Field location: Nassau and Suffolk Counties

Cooperating agencies: Nassau County Department of Public Works, Suffolk County Department of Health Services, and Suffolw County Water Authority

Problem: As in most large, multiaquifer ground-water systems, flow patterns in the Long Island system are complex. To investigate many current water-supply problems on Long Island will require information on the three-dimensional nature of these flow patterns . Point-source contamination is becoming increasingly widespread and requires knowledge of the path that a contaminated particle of water takes after entering the ground-water system. Increasing contamination in shallow aquifers from nonpoint sources has forced development of older, uncontaminated waters in deep aquifers. With this trend, concern for protecting the deep aquifers has resulted in legislation to protect the recharge areas (land-surface areas through which water replenishes the deep aquifers). These and many other problems require an understanding of the path a particle of water takes through the ground-water system.

Objectives: To investigate the three-dimensional pattern of flow and the characteristics of the transport of solutes in the Long Island ground-water system through flow-simulation techniques along a representative north-south cross section. The section lies along a flow line common to each of the major aquifers and will therefore allow a realistic estimate of vertical flow patterns in the section. Information gained from this section can be applied to other locations on the Island.

Approach: Phase I will address hydraulic considerations and advective transport. A cross-sectional flow model will be constructed, and stream-function analysis will be used to define flow patterns and assess the grid size needed to represent the velocity field. Phase II will address the effects of dispersion and chemical reactions in the cross section. The distribution of nitrate and other constituents will be evaluated. The model will be used to assess the effects of contamination entering from several hypothetical sources at land surface.

Progress and significant results: The Geological Survey's modular finite-difference and finite-element models were used to simultaneously solve for the stream and potential functions for several generic cross sections (for example, a classic impermeable wall). Software was developed to construct flownets and calculate traveltimes with a digitizer. These techniques were applied to a section on the north fork that is affected by aldicarb pesticide. Considerable effort was given to the design and methods of such applications and to the representations of boundary conditions.

Plans for next year: To formalize the method of application to both finite difference and finite element models and apply the Survey's finite element model to a finely discretized cross section of Long Island.

Data Base Development and Computer Applications to Water Resources of Long Island
(NY 86-162)

Date project began: October 1985

Date project ends: September 1989

Project leader: George W. Hawkins

Field location: Islandwide

Cooperating agencies: Nassau County Department of Public Works, Suffolk County Department of Health Services, and Suffolk County Water Authority.

Problem: The Geolgical Survey's Long Island office maintains information on approximately 9,500 wells, 70 streams, and 10 precipitation sites, which together constitute 204,000 water-level measurements and 50,000 water-quality samples. It also maintains smaller files, such as an inventory of stormwater basins and surface-water partial-record sites. To deal with this amount of data by manual methods is impractical; thus, specialized computer applications are often needed to fill the needs of a particular project.

Objectives: (1) To maintain and enhance software already developed locally that provides "user friendly" access to local data bases. (2) To develop and maintain additional local data bases not provided by software available from headquarters. (3) To assist project personnel in developing specialized computer applications or to undertake the complete development of these applications. (4) To provide easy-to-read program documentation and instruct office personnel in the use of the computer and available software. (5) To install and maintain computer software and peripherals acquired through national contracts or local purchases, monitor their use, and plan new acquisitions. (6) To develop a Geographic Information System (GIS) for Long Island.

Approach: (1) Parts of the local data bases will be converted to update the national data bases, where appropriate. (2) To the extent that software provided by headquarters does not fulfill local requirements, additional applications will be developed. Among the special applications, for example, will be the conversion of individual project data bases into officewide data bases, where appropriate. (3) Preparation of certain hydrologic data reports will be further automated. (4) Existing maps and other spatially referenced data will be automed into digital format for use with a Geographic Information System, and user interfaces will be developed for general and project use to access these geographic data and provide various spatial analyses.

Progress and significant results: (1) Some additional conversion of local data bases was completed. (2) More than 25 geographic data layers have been digitally automated or acquired, including wells, recharge basins, transportation, hydrography, land use, and topography. Several projects are using GIS for specific applications requiring complex spatial analyses and have established additional data layers for selected study areas on Long Island.

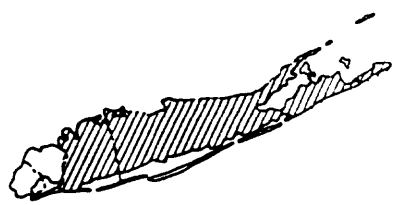
Plans for next year: To continue to support local data bases and other software and develop the application of Geographic Information Systems to project work.

Update and Assessment of Effects of Urbanization on Base Flow of Selected South-Shore Streams
(NY 86-163)

Date project began: April 1986

Date project ends: September 1988

Project leader: Anthony G. Spinello



Field location: Nassau and Suffolk Counties

Cooperating agencies: Nassau County Department of Public Works and Suffolk County Department of Health Services

Problem: Streams on Long Island function as ground-water drains. Relatively small declines in ground-water levels cause pronounced decreases in stream discharge. Progressive eastward urbanization on the south shore of Long Island has caused widespread reductions in ground-water recharge through increases in the amount of impermeable land surface and construction of storm sewers and sanitary sewers. These factors have caused ground-water levels to decline, which in turn has reduced ground-water discharge to streams. These changes through the mid-1970's have been documented, but additional sanitary sewers have been installed since then, and hookups are nearing completion. The changes in base flow that have occurred during the past decade are undocumented.

Objectives: To (a) calculate the percentages of base-flow in selected south-shore streams during the past decade; (b) analyze the effect that increased use of sanitary sewers has had on base flow in the past decade; and (c) evaluate the present status of streamflow with respect to equilibrium conditions.

Approach: (1) To choose approximately 10 streams on the south shore in Nassau and Suffolk Counties that have continuous recording gages; selected streams in Suffolk County will serve as an index of predevelopment conditions. (2) To use hydrograph-separation techniques to quantify base flow as a percentage of total streamflow for each stream through 1985. (3) To prepare and analyze flow-duration curves for selected streams. (4) To assemble and analyze double-mass curves of streams in selected areas to evaluate their status (transitional, equilibrium, or approaching equilibrium).

Progress and significant results: Data analysis is complete, and a report is in preparation. Hydrograph analyses indicate that, in addition to a significant long-term decline in total stream discharge, the percentage of streamflow that consists of base flow has decreased from a predevelopment value of about 95 percent to between 0 and 60 percent in areas that have been sewered since the mid-1950's, and to between 75 and 90 percent in areas that have been sewered more recently. Effects of urbanization are seen as far east as Sampawams Creek in western Suffolk County. Streams farther west are more severely affected; for example, Valley Stream showed zero base flow during 4 of the 5 years from 1981-85. Flow duration curves for 1948-52, 1971-75, and 1981-85 show that stream base flow is decreasing and peak discharges are increasing.

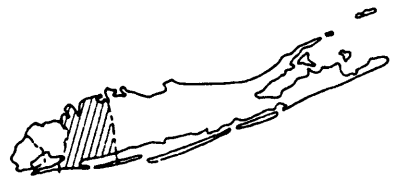
Analysis of Advective Transport in an Area Affected by Agricultural Pesticides
(NY 88-172)

Date project began: October 1987

Date projedt ends: September 1990

Project leader: Debra E. Bohn

Field location: Suffolk County



Cooperating Agencies: Suffolk County Department of Health Services and Suffolk County Water Authority

Problem: Ground-water contamination from agricultural pesticides is a major concern on the north fork. Advection, the primary mechanism of solute transport, must be defined before considering the effects of dispersion and chemical reactions. The advective movement of a dissolved contaminant would follow a plug-flow front through the system while the effects of dispersion and chemical reactions would smear and retard the progress of this front. A quantitative understanding of advective transport in this shallow ground-water system is essential in determining the approximate natural flow paths contaminated water would follow.

Objectives: To investigate the advective movement of ground water associated with the complex ground-water flow patterns in the shallow ground-water systems of the north fork by using a numerical flownet analysis along several hydrologic cross sections. Traveltimes calculated along the length of flow paths will be corroborated by selected tritium analyses on each cross-section and related to the transport of the agricultural pesticide aldicarb.

Approach: Water-table and salt/fresh water interface maps will be constructed to define the various ground-water systems of the north fork. Cross sections, representative of each system, will be selected. Numerical models of cross sections will solve for the potential and stream functions to create flownets. Traveltimes along flowlines will be calculated from these flownets. Resulting traveltime data will be compared to water quality data for age correlation.

Progress and significant results: A well-monitoring-network has been developed for the study area. Available water-level measurements, hydrogeologic data and chloride data have been accumulated for selected wells. Maps have been constructed of the water table, salt/fresh water interface, potentiometric surface below interstadial clay, contours of the interstadial clay surface, and various hydrogeologic cross sections.

Plans for next year: Cross-sectional models will be constructed and solved to create flownets from which traveltimes will be calculated.

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