

WATER-RESOURCES INVESTIGATIONS IN PENNSYLVANIA:

**Programs and Activities
of the
U.S. Geological Survey, 1993**

Compiled by Leona O. McLanahan

U.S. Geological Survey
Open-File Report 93-152



Lemoyne, Pennsylvania
1993

U.S. DEPARTMENT OF THE INTERIOR

BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY

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Message from the District Chief

The constantly changing technology of the digital computer continues to have a major influence on the way the U.S. Geological Survey investigates and reports on hydrologic processes and systems, collects and archives basic hydrologic data, and performs administrative tasks. The Water Resources Division has been using digital computers to compute records since the late 1950's. In the early 1980's, the Water Resources Division installed a minicomputer network at 74 of its offices throughout the country and created a distributed information system (DIS-I); wherein, hydrologic data bases were maintained at District offices. For the first time, DIS-I provided District staff with interactive computer capability, allowing for an increase of work and interpretative capabilities, while staff numbers remained mostly constant.

A new evolution of computer technology is now occurring. The Water Resources Division is developing DIS-II, a national network of UNIX-based, scientific computers commonly referred to as workstations. These desk-top computers (workstations) exceed the capabilities of the minicomputer system of 10 years ago; and steer the direction for new methods and capabilities of accomplishing our work.

Perhaps the largest and most fundamental change of DIS-II is the creation of a new National Water Information System (NWIS-II). NWIS-II will reside on the UNIX workstations at the Water Resources Division District level and will contain capabilities far beyond current software. Geographic information systems have become basic hydrologic interpretive tools with excellent output products for the visualization of complex hydrologic systems. The transmission of real-time and near real-time hydrologic data to office management sites from remote field sites has become very common through the use of specialized computers in conjunction with radio systems (Data-Collection Platforms). Damage from the floods of March and April 1993 in Pennsylvania was kept to a minimum because a comprehensive network of rain and streamflow gages having this telemetry capability was in place.

Even though our methodology may change as we use advanced technology, our commitment to accomplish the basic mission of the U.S. Geological Survey remains unchanged. This report explains our mission and provides brief descriptions of current water-resources investigations in Pennsylvania. In addition, a complete list of publications are shown for reports and maps that have been published about Pennsylvania water resources. Please contact me or any one of the Pennsylvania staff if you have any questions.

David E. Telick

Basic Mission and Programs

U.S. Geological Survey

The U.S. Geological Survey (USGS) 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.

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



- Conducting detailed assessments of the energy and mineral potential of 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 land and offshore areas.
- Studying the geologic features, structure, processes, and history of the other planets of our solar system.
- Conducting topographic surveys 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 USGS 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."

The mission of the Water Resources Division (WRD) is to provide the hydrologic information and understanding needed for the optimum utilization and management of the Nation's water resources for the overall benefit of the people of the United States. This mission is accomplished, in large part, through cooperation with other Federal and non-Federal agencies, by:

Water Resources Division

- 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 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 man-made.
- 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 Energy Regulatory Commission, and to international agencies on behalf of the U.S. Department of State.



**ORGANIZATION OF THE
U.S. GEOLOGICAL SURVEY, WATER RESOURCES DIVISION
PENNSYLVANIA DISTRICT
September 1993**

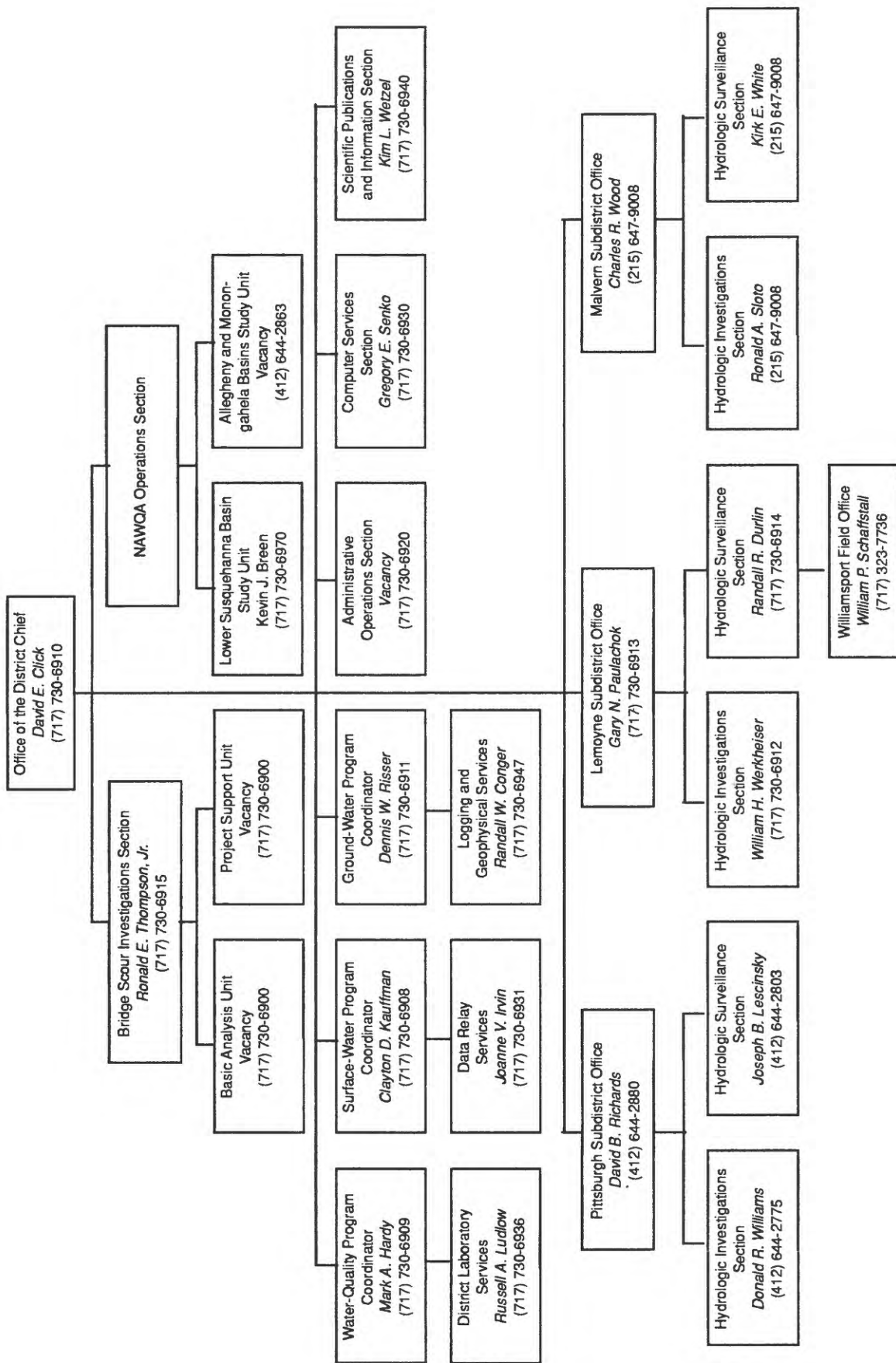
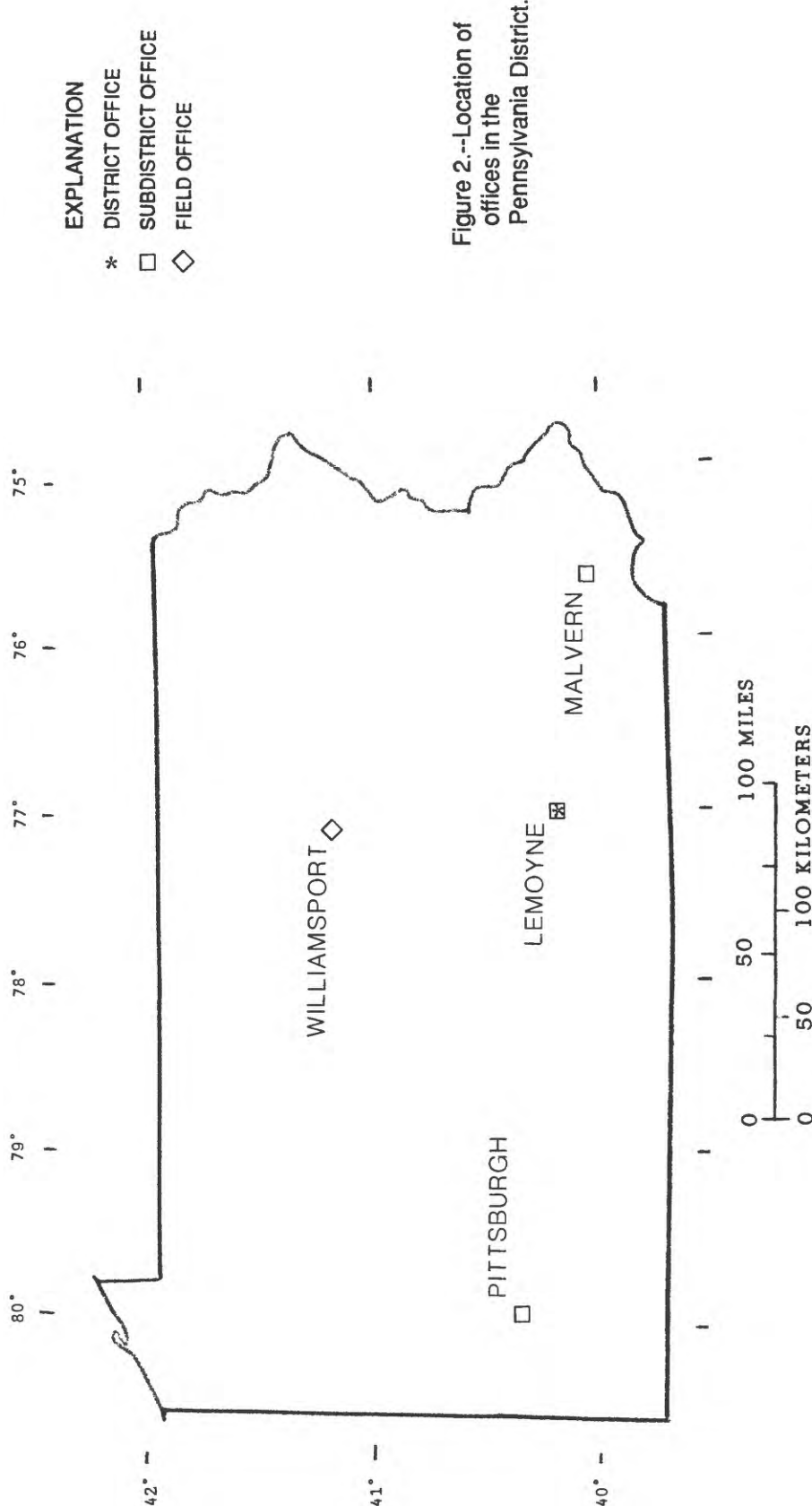


Figure 1.--Organization chart of the U.S. Geological Survey, Water Resources Division, Pennsylvania District.



Pennsylvania District Office Addresses

District Office: U.S. Geological Survey Water Resources Division 840 Market Street Lemoyne, PA 17043-1586 (717) 730-6900 FAX (717) 730-6997	Lemoyne Subdistrict Office: U.S. Geological Survey Water Resources Division 840 Market Street Lemoyne, PA 17043-1586 (717) 730-6900 FAX (717) 730-6997	Williamsport Field Office: U.S. Geological Survey Water Resources Division P.O. Box 1805 Room 301 Federal Building 240 W. Third Street Williamsport, PA 17703 (717) 323-7736 or 323-9571	Pittsburgh Subdistrict Office: U.S. Geological Survey Water Resources Division Room 2204 Federal Building 1000 Liberty Avenue Pittsburgh, PA 15222 (412) 644-2863 FAX (412) 355-2548	Malvern Subdistrict Office: U.S. Geological Survey Water Resources Division Great Valley Corporate Center 111 Great Valley Parkway Malvern, PA 19355 (215) 647-9008 FAX (717) 647-4594
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Program Funding and Cooperation

Moneys for program operation of the U.S. Geological Survey in Pennsylvania come from joint-funding agreements with State and local agencies, transfer of funds from other Federal agencies, and direct Federal allotments to the USGS. The following page lists those agencies cooperating with the USGS in Pennsylvania during the 1993 fiscal year:

Commonwealth of Pennsylvania Agencies

Department of Environmental Resources (PaDER)
 Bureau of Community Environmental Control
 Bureau of Land and Water Conservation
 Bureau of Mining and Reclamation (BMR)

Bureau of Topographic and Geologic Survey (PaGS)
 Bureau of Water Quality Management
 Bureau of Water Supply and Community Health
 Department of Transportation (PennDOT)

Local Agencies

Alliance for the Chesapeake Bay
 Bucks County
 City of Allentown
 City of Bethlehem
 City of Harrisburg
 City of Philadelphia
 City of Reading
 City of Williamsport
 Chester County Water Resources Authority
 Delaware County Solid Waste Authority
 Doylestown Township Municipal Authority

Hazleton City Authority Water Department
 Joint Planning Commission Lehigh-Northampton Counties
 Letort Regional Authority
 Media Borough Water Department
 North Penn Water Authority
 North Wales Water Authority
 Pennsylvania State University
 Somerset Conservation District
 Tinicum Township
 Township of West Bradford
 University Area Joint Authority

Other Federal Agencies

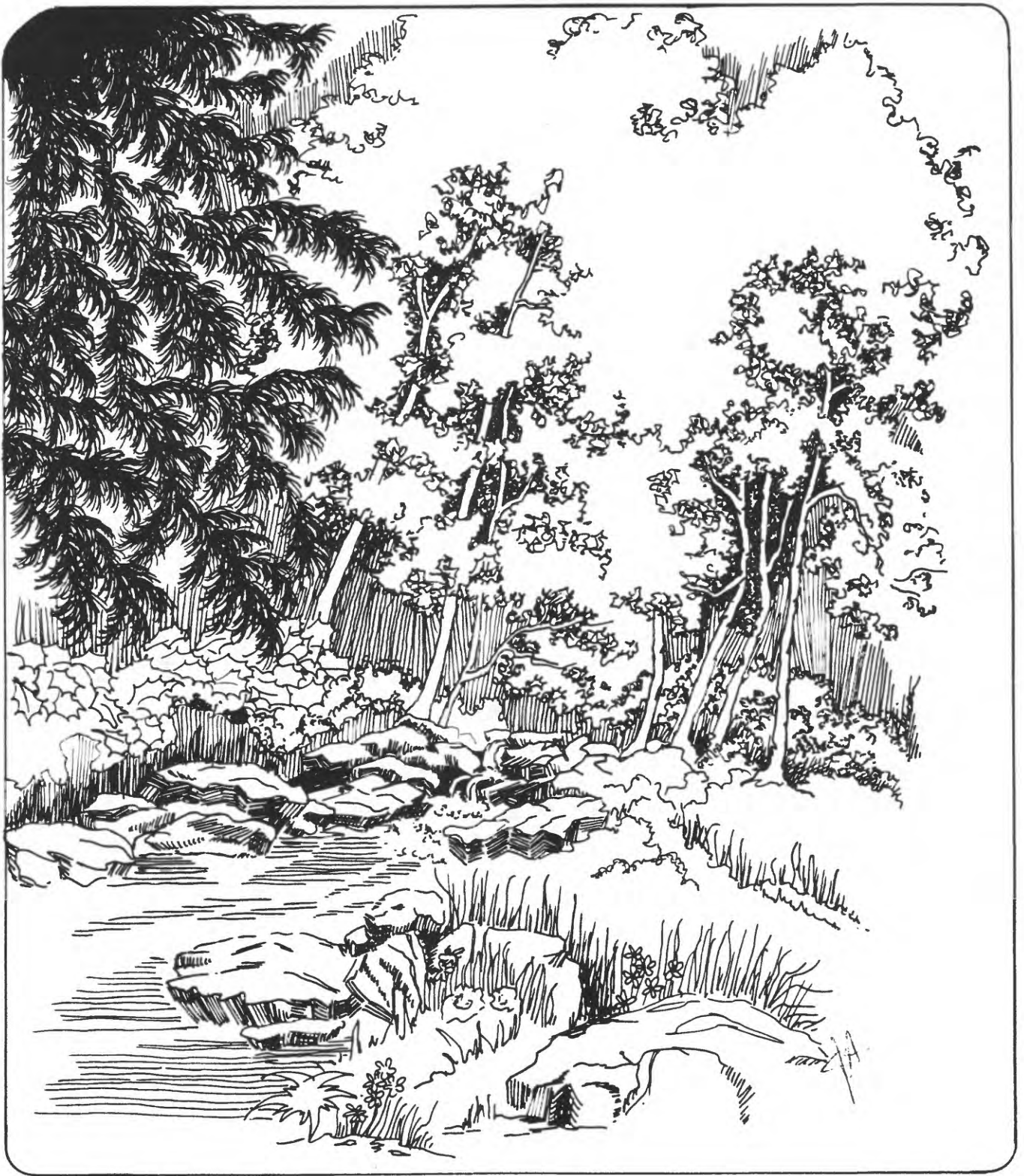
Federal Emergency Management Agency (FEMA)
 Federal Energy Regulatory Commission (FERC)
 U.S. Army Corps of Engineers
 Baltimore District
 Philadelphia District
 Pittsburgh District

U.S. Department of Commerce
 National Oceanic and Atmospheric
 Administration (NOAA)
 National Weather Service (NWS)
 U.S. Department of Defense
 Navy Northern Division
 U.S. Environmental Protection Agency (USEPA)

Other Agencies

City of Cumberland, Maryland
 Delaware River Basin Commission (DRBC)

New York State Department of Environmental Conservation
 State of Delaware Geological Survey
 Susquehanna River Basin Commission (SRBC)



Water-data stations at selected locations throughout the nation are used by the USGS to obtain records on stream discharge (flow) and stage (height), reservoir and lake stage and storage, ground-water levels, well and spring discharge, and the quality of surface water and ground water. These data provide a continuing record of the quantity and quality of the Nation's surface-water and ground-water resources, and thus provide the hydrologic information needed by Federal, State, and local agencies and the private sector for the development and management of land and water resources. All data collected are stored in the Survey's National Water Data Storage and Retrieval System (see section "WATSTORE" for additional information on this system) and also are published by water year for each state in a publication series entitled "U.S. Geological Survey Water-Data Reports." Information about the Water-Data Program in Pennsylvania can be obtained from the District Chief of the Pennsylvania office.

Water-Data Program

The National Water-Data Exchange is a confederation of Federal and non-Federal water-oriented organizations working together to improve access to available water data. It is managed by a Program Office, which is administered by the Water Resources Division. Information on sites for which water data are available, the types of data available, and the organizations that store the data is available from NAWDEX. Assistance in identifying, locating, and acquiring data is provided by the Program Office at Reston, Virginia, by NAWDEX Assistance Centers at the Water Resources Division District offices, and by offices of other NAWDEX member organizations. A directory of assistance centers, and more detailed information about services, can be obtained from the NAWDEX Program office, Branch of Water Information Transfer. The NAWDEX headquarters address is: National Water-Data Exchange, U.S. Geological Survey, 421 National Center, Reston, VA 22092. The office may be reached by phone at (703) 648-5677.

National Water-Data Exchange (NAWDEX)

As explained in the section "Water-Data Program," all data collected through that program are stored in WATSTORE, and the data are available on request. These data can be retrieved in machine-readable form or as computer printed tables or graphs, statistical analyses, and digital plots. Local assistance in the acquisition of service or products from WATSTORE can be obtained from the District offices. A pamphlet, "WATSTORE: A WATER Data STORAGE and RETrieval System," may be obtained from these offices or from the WATSTORE Program office, Branch of Computer Technology, U.S. Geological Survey, 440 National Center, Reston, VA 22092. The office may be reached by phone at (703) 648-5680.

National Water-Data Storage and Retrieval System (WATSTORE)

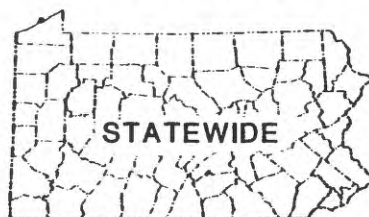
Data-Collection Programs

SURFACE-WATER STATIONS (PA001)

PROJECT CHIEF:
Clayton Kauffman

COOPERATOR(S):
Multiple

PERIOD OF PROJECT:
Continuous since June 1931



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.

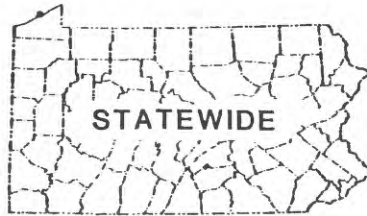
OBJECTIVE: A. To collect surface-water data sufficient to satisfy needs for uses such as: (1) assessment of water resources; (2) operation of reservoirs or industries; (3) forecasting; (4) disposal of wastes and pollution controls; (5) discharge data to accompany water-quality measurements; (6) compact and legal requirements; and (7) research or special studies. B. To collect data necessary for analytical studies to define for any location the statistical properties of, and trends in, the occurrence of water in streams, lakes, and estuaries for use in planning and design.

APPROACH: To operate a surface-water hydrologic data network and to insure collection and analysis of data are made by standardized methods, such as those described in the series "Techniques of Water Resources Investigations of the United States Geological Survey."

PROGRESS: Both archival and real-time data collection systems were maintained in operation. Hydrologic data for continuous record, reservoir, and partial-record surface-water stations were published. The current data network consists of 527 active sites--230 continuous-recording sites and 297 others.

PLANS: Continue to collect and publish surface-water data and maintain data base.





**GROUND-WATER
STATIONS (PA002)**

PROJECT CHIEF:
Dennis W. Risser

COOPERATOR(S):
PaDER, PaGS,
Bureau of Water
Resources Management;
Chester County Water
Resources Authority

PERIOD OF PROJECT:
Continuous since
January 1931

PROBLEM: Long-term water-level records are needed to evaluate the effects of climatic variations on the recharge to and discharge from the ground-water systems, to provide a data base from which to measure the effects of development, to assist in the prediction of future supplies, and to provide data for management of the resource.

OBJECTIVE: To collect water-level data sufficient to provide an adequate long-term data base so that the general response of the hydrologic system to natural climatic variations and induced stresses is known and potential problems can be defined early enough to allow proper planning and management. To provide a data base against which the short-term records acquired in areal studies can be analyzed.

APPROACH: Data will be collected, processed, and published in each of the Subdistrict offices.

PROGRESS: Continuous ground-water-level data were collected from 62 wells and checked for accuracy prior to publication in the annual reports. Selected wells were tested for functional response by various methods.

PLANS: Continue to operate network, store data in the daily values file, and publish data in the annual reports. The network will be upgraded as needed based on functionality testing and consultation with cooperators.

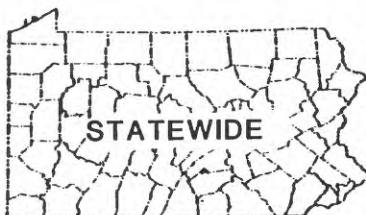


**WATER-QUALITY
STATIONS (PA003)**

PROJECT CHIEF:
Mark Hardy

COOPERATOR(S):
Multiple

PERIOD OF PROJECT:
Intermittent since
August 1949



PROBLEM: Water-quality data are needed for surveillance, planning, design, and management of water resources. Water-quality problems can affect industries, water-treatment facilities, and the individual consumer. A data base is necessary to allow most effective use of the data.

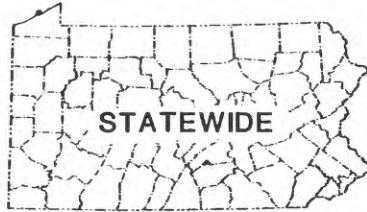
OBJECTIVE: To collect water-quality data sufficient for current uses (such as assessment of water resources, operation of reservoirs, and research or special studies) and defining spatial and temporal trends in the quality of streams, lakes, and ground water.

APPROACH: Water samples are periodically collected at over 50 sites and analyzed at the USGS National Water Quality Laboratory (NWQL). Benthic-invertebrate data are collected at 42 sites in Chester County. At 20 sites, temperature, dissolved oxygen, pH, and specific conductance are monitored continuously. The operation of the network provides chemical concentrations and loads required by water planning and managing agencies.

PROGRESS: Water-quality data were collected from all network stations, stored in the Water Data Storage and Retrieval System (WATSTORE) data base, and published in the annual reports.

PLANS: Continue collection of water-quality data at network sites.





PROBLEM: Suspended sediment fills reservoirs and harbors, contaminates water supplies, adversely affects machinery, transports chemical contaminants, and causes fishery problems. However, sediment is needed to maintain beaches, control algae, and remove toxic chemicals from the water. Sediment data are necessary for erosion studies, reservoir design, dredging scheduling, assessing water quality, and determining fluvial transport of certain chemicals. A network of sediment stations is needed to provide a data base for proper water-resources management.

OBJECTIVE: To collect sediment data and related information sufficient for uses such as: (1) reservoir design, (2) water-quality assessment, (3) determining land-use effects, (4) erosion assessment, (5) water-resource management, (6) dredging, and (7) research or special studies. To collect data necessary for analytical studies to delineate the effects of land use, such as highway construction, mining, and urbanization. To describe the effects of sediment on water chemistry and to assess spatial and temporal trends.

APPROACH: Suspended-sediment samples are collected and loads calculated by methods described in the series "Techniques of Water Resources Investigations of the United States Geological Survey." An observer collects water samples daily from the center of flow in selected streams. Special studies may require the collection of data on particle-size distributions of suspended and deposited sediment, stream morphology, bed scour in streams and reservoirs, reservoir volumes, and volumetric estimates of deposited sediments.

PROGRESS: Sediment network data were collected on schedule and published by the Subdistrict offices. Data was stored in the WATSTORE data base.

PLANS: Continue to collect data at the network stations. Bathymetric maps of Conowingo Reservoir, Lake Aldred, and Lake Clarke on the Lower Susquehanna River will be prepared to provide baseline bed configuration and volumetric information that will aid in evaluating future sedimentation and scour in these impoundments. The draft of the map report is scheduled for December 1993.

**SEDIMENT STATIONS
(PA004)**

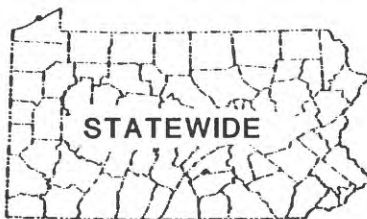
**PROJECT CHIEF:
Mark Hardy**

**COOPERATOR(S):
None**

**PERIOD OF PROJECT:
Intermittent since
October 1948**



Hydrologic Investigations



PROBLEM: The National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973 provides for the operation of a flood insurance program. FEMA needs flood studies in selected areas to determine flood risk for insurance purposes and to regulate floodplain development.

OBJECTIVE: To conduct the necessary hydrologic and hydraulic evaluations and studies of areas assigned by FEMA and to present the results in an appropriate format.

APPROACH: To conduct the necessary evaluations or to conduct surveys by ground or photogrammetric methods. Determine flood-discharge frequency relations by use of local historical information, gaging-station records, or other applicable information. Determine water-surface profiles by use of step-backwater models or other acceptable methods and furnish the results in reports prepared to FEMA specifications.

PROGRESS: Completion of a restudy for Rostraver Township, Westmoreland County, was delayed, pending removal of an undersized culvert in a major channel. The completion date was later revised to April 30, 1993, owing to unforeseen difficulties in reformulating the hydraulic model to accommodate the revised flood discharges. Work is proceeding on new Limited-Map-Maintenance (LMM) and Less-Detailed studies for Orange Township, Columbia County; the Borough of Marion Center, Indiana County; and Roulette and Eulalia Townships, Potter County. These studies are to be completed by May 31, 1993.

PLANS: Consider new LMM contracts, as needed by FEMA.

FLOOD INVESTIGATIONS (PA006)

PROJECT CHIEF:
Herbert N. Flippo

COOPERATOR(S):
FEMA

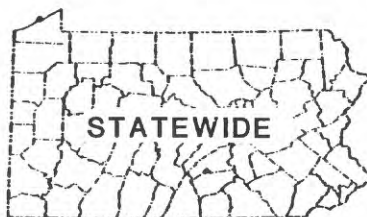
PERIOD OF PROJECT:
July 1972 to September 1993

**PROGRAM FOR THE
COLLECTION, STORAGE,
AND RETRIEVAL OF
WATER-USE DATA IN
PENNSYLVANIA (PA007)**

PROJECT CHIEF:
Scott A. Hoffman

COOPERATOR(S):
**PaDER, Bureau of Water
Supply and Community
Health**

PERIOD OF PROJECT:
**Continuous since
January 1981**



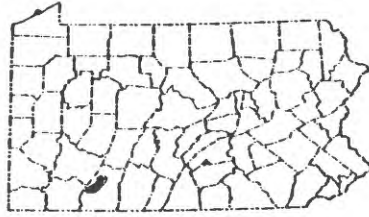
PROBLEM: Waters in Pennsylvania are under stress to supply increasing demands for domestic, industrial, agricultural, and other uses. Competition for water dictates that available supplies be matched with uses most beneficial to the common good. Information has been collected for many years describing quantity and quality of available water. Information on use of water is needed also if the best decisions are to be made about critical water problems such as resource allocations, water-quality residuals, environmental impact, and energy development.

OBJECTIVE: To provide water-use information for the optimum utilization and management of the State's water resources for the overall benefit of the people of Pennsylvania and the United States. This program modifies and improves the State's existing system to collect, store, and disseminate water-use data to complement data on availability and quality of the State's water resources. The new system is responsive to the data needs of local users, the USGS, and other federal agencies.

APPROACH: Responsibilities are divided between the cooperator and the USGS to reflect the most efficient means of meeting the objectives of the program. Direction, management, and standards development to meet the national needs is the responsibility of the USGS. Field activities for the acquisition and storage of the data at the state level is primarily the responsibility of the PaDER, Bureau of Water Supply and Community Health.

PROGRESS: Water-use stream codes were assigned in the Lower Susquehanna River Basin to drainage basins with named streams. Additions to the water-use data base have continued.

PLANS: Report on 1990 water-use data for Pennsylvania will be completed. Attributing of water-use stream codes to named streams for the entire state is continuing. Combine and edgematch streams from county designations into major drainage basins. Correct stream digitizing errors and configure streams into downstream direction.



**EFFECTS OF ACID RAIN
ON THE WATER QUALITY
OF LAUREL RIDGE,
SOMERSET COUNTY,
PENNSYLVANIA (PA145)**

PROBLEM: Headwater streams in parts of Somerset County, Pennsylvania, are extremely sensitive to acidic deposition and chemical weathering of soils. As a result of this situation, there is possible damage to fish and other components of the aquatic ecosystem.

OBJECTIVE: To determine the effects of acid deposition on the chemistry of a poorly buffered headwater stream.

APPROACH: A single 3.45-square mile forested basin has been selected for long-term monitoring. Data collection includes continuous streamflow and precipitation monitoring and monthly base-flow water-quality sampling. Interpretation of the data will involve the application of nonparametric statistics to determine trends in water quality.

PROGRESS: Twelve additional water-chemistry samples were collected and analyzed. Open-File Report 89-584, "Water-Resources Data for North Fork Bens Creek, Somerset County, Pennsylvania, August 1983 through September 1988," was published in 1991.

PLANS: Continue streamflow and precipitation monitoring and monthly base-flow water-quality sampling at the study site.

PROJECT CHIEF:
Donald R. Williams

FUNDING:
**USGS, WRD, Regional
Research, ER,
Surface-Water Chemistry**

PERIOD OF PROJECT:
April 1983 to September 1993

**GEOPHYSICAL STUDY OF
USEPA SUPERFUND SITES
IN PENNSYLVANIA,
DELAWARE, MARYLAND,
WEST VIRGINIA,
VIRGINIA, AND
WASHINGTON, D.C.
(USEPA, REGION III)
(PA183) (PA197¹)**

PROJECT CHIEF:
Gary N. Paulachok

FUNDING:
Other Federal Agency;
USEPA, Region III,
Environmental Monitoring
Systems Laboratory

PERIOD OF PROJECT:
Ongoing since
October 1988

MID-ATLANTIC STATES

PROBLEM: An understanding of local geologic and hydrogeologic conditions is essential for the design and implementation of efficient remediation protocols at USEPA Superfund sites. Geophysical studies can contribute detailed information on these conditions, which can be used by USEPA and its contractors during the site-assessment and remediation processes.

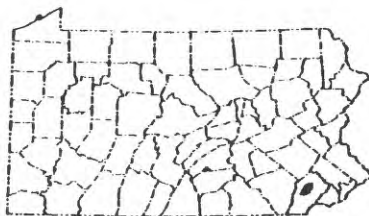
OBJECTIVE: To collect borehole and surface geophysical data at USEPA Superfund sites. To provide information on the geology and hydrogeology of aquifers at Superfund sites, on the basis of an interpretation of geophysical and related data.

APPROACH: Borehole- and surface-geophysical studies will be conducted at sites designated by USEPA, Region III. For each site, a work plan and a quality-assurance plan will be developed with the USEPA project leader and approved by USEPA. USEPA will provide equipment-decontamination procedures and health and safety information for each site. The data from the geophysical studies will be analyzed separately and interpreted collectively with available related information. A digital geophysical logger with computer is available in the District, and seismic and electrical resistivity surface-geophysical equipment are readily available to the District.

PROGRESS: Geophysical or other studies of Superfund sites in eastern and central Pennsylvania were conducted as requested by USEPA. These studies provided geologic and hydrogeologic information needed for the site-assessment and remediation processes.

PLANS: Geophysical studies at Superfund sites will be conducted as requested by USEPA.

¹ PA197 is a continuation of PA183.



**HYDROLOGY OF WEST
VALLEY CREEK BASIN,
CENTRAL CHESTER
COUNTY, PENNSYLVANIA
(PA187)**

PROJECT CHIEF:
Lisa A. Senior

COOPERATOR(S):
**Chester County Water
Resources Authority**

PERIOD OF PROJECT:
**October 1989 to
September 1993**

PROBLEM: West Valley Creek Basin is undergoing very rapid growth and urbanization because of its location in an expanding business and high-technology corridor. Ground water is the only source of supply for the area, and development is increasing demand. The basin is partly underlain by highly permeable carbonate rocks that are among the highest yielding sources of ground water in the county. Ground water is already contaminated at a few sites. Increased ground-water withdrawal and contamination of ground water may have adverse effects on streamflow and stream-water quality.

OBJECTIVE: (1) Characterize the hydrologic system; (2) provide baseline stream-quality data.

APPROACH: The hydrologic system will be characterized by: (1) developing a basin water budget and ground-water budget; (2) describing ground-water and surface-water relations; and (3) describing ground-water and surface-water flow. Baseline stream-water quality will be established through a 12-month sampling program.

PROGRESS: First draft of report completed; report describes hydrogeologic setting, presents water budgets for 2 years (1990-91) and water-quality data for ground water and streams under base-flow conditions. Effects of urbanization in the basin include elevated concentrations of chloride in ground and surface water, presence of volatile organic compounds and metals in ground water; effects of agricultural activities include elevated concentrations of nitrate in ground and surface water.

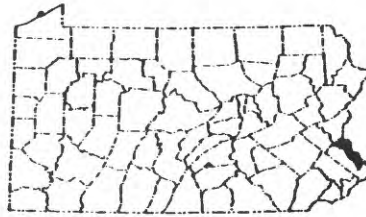
PLANS: Publish report after colleague review and Director's approval.

**HYDROGEOLOGY OF
THE MESOZOIC ROCKS
OF THE NEWARK-
GETTYSBURG BASIN,
NORTHERN BUCKS
COUNTY, PENNSYLVANIA
(PA194)**

PROJECT CHIEF:
Ronald A. Sloto

COOPERATOR(S):
Tinicum Township

PERIOD OF PROJECT:
October 1990 to
September 1994



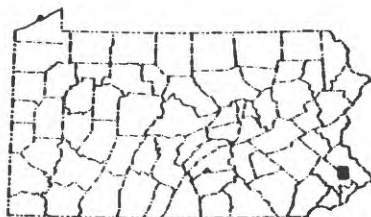
PROBLEM: Because of increasing population and development of southeastern Pennsylvania, the demand for ground water has increased greatly. Low storage capacity of the aquifers produces low base-flow discharges. Clay rich soils retard recharge and promote rapid runoff; therefore, the aquifers are sensitive to droughts and excessive ground-water withdrawals. Increased withdrawals may cause substantial reductions in local and regional ground-water availability and reduce streamflow.

OBJECTIVE: (1) Characterize the hydrogeologic framework and determine the hydraulic properties of the aquifers; (2) quantify the components of the hydrologic budget; (3) evaluate the hydraulic connection between aquifers and between aquifers and streams; and (4) assess natural ground-water quality and determine areas affected by ground-water contamination.

APPROACH: The project objectives will be accomplished by: (1) water-budget studies of four small, representative basins to determine the hydrologic budget, ground-water/surface-water relations, and ground-water availability; (2) a well inventory and borehole geophysical logging to define the hydrogeologic framework and ground-water-flow system and to characterize the hydraulic properties of the geologic units; and (3) limited ground-water sampling to characterize natural ground-water quality and areas of contamination.

PROGRESS: Data collection is completed. Four water-level maps have been published.

PLANS: Complete writing of two reports: (1) a basic hydrologic data report to be published as a USGS Open-File Report, and (2) a final interpretive report to be published as a USGS Water-Resources Investigations Report.



PROBLEM: Three hazardous-waste sites are located in the study area. Three public water suppliers use the Stockton Sandstone in the vicinity of these sites. The number of improperly abandoned (not properly plugged) multi-aquifer supply wells and poorly constructed monitoring wells is unknown, but potentially large. Multi-aquifer wells that connect several water-bearing zones can cause, contribute to, or exacerbate the spread of contamination from a hazardous-waste site into uncontaminated parts of aquifers.

OBJECTIVE: (1) Identify wells near hazardous-waste sites that intersect several water-bearing zones and could potentially contribute to the spread of contaminants in the Stockton Sandstone; (2) quantify the magnitude of internal borehole flow in selected wells; (3) quantify the amount of contaminant that could potentially move up or down the borehole in selected wells; (4) identify all sources that may have contributed to the contamination of the Stockton Sandstone and determine the fate of these contaminants in the aquifer system; and (5) test the effectiveness of remedial action to correct the problems caused by poorly constructed wells and improperly abandoned wells.

APPROACH: A well inventory will be conducted to obtain well locations, geological and driller logs, depth, casing length, depth of water-bearing zones, and yield of water-bearing zones. About 35 wells will be selected for geophysical logging, which will determine the location of water-bearing zones, direction and rate of fluid movement within the borehole, and quantity of water moving through the borehole. Approximately 85 water samples will be taken from wells; an additional 20 samples will be quality assurance samples. Water from all logged wells will be sampled. Samples will be taken from one or more intervals of borehole in which fluid is moving. Analytical results will be used to estimate the quantity of contaminants moving between water-bearing zones in multi-aquifer wells. One abandoned multi-aquifer well contributing to ground-water contamination will be selected to test the effectiveness of remediation.

PROGRESS: Geophysical logging and water sampling has been completed.

PLANS: Prepare an article for the Journal of Applied Geophysics and finish interpretive USGS report.

**ROLE OF ABANDONED
MULTI-AQUIFER
WELLS IN REGIONAL
GROUND-WATER
CONTAMINATION,
BUCKS AND
MONTGOMERY
COUNTIES,
PENNSYLVANIA (PA196)**

PROJECT CHIEF:
Ronald A. Sloto

FUNDING:
Other Federal Agency;
USEPA, Region III

PERIOD OF PROJECT:
October 1990 to
September 1994

**THE EFFECTIVENESS
OF AGRICULTURAL
BEST-MANAGEMENT
PRACTICES IN
IMPROVING GROUND-
WATER QUALITY IN A
55-ACRE FIELD SITE
NEAR EPHRATA,
LANCASTER COUNTY,
PENNSYLVANIA (PA206)**

PROJECT CHIEF:

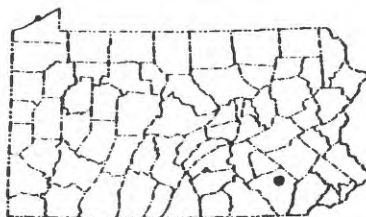
David W. Hall

COOPERATOR(S):

**PaDER, Bureau of Land and
Water Conservation**

PERIOD OF PROJECT:

**October 1990 to
September 1994**



PROBLEM: Manure and fertilizer applications to cropped land in intensively agricultural areas of southeastern Pennsylvania have resulted in elevated concentrations of nitrogen in surface and ground waters. These waters are used for animal habitat, recreation, livestock watering, and water supplies. Consumption of water with elevated concentrations of nitrogen is associated with birth defects, infant methemoglobinemia, and cancer in animals. Additionally, nitrogen-induced algal blooms in the Chesapeake Bay and its tributaries have been linked to critically low dissolved oxygen concentrations in water, decreased numbers of aquatic animals, and decreased survival of submerged aquatic vegetation. The mechanisms, pathways, and timing of nitrogen movement from the land surface to ground water in the Chesapeake Bay watershed are poorly understood.

OBJECTIVE: To determine the time required for nitrogen applied to cropped fields to leach to ground water at a 55-acre farm site in Lancaster County, Pennsylvania. The farm is located in the Chesapeake Bay watershed.

APPROACH: Monitoring will be conducted from 1991-93. Agricultural activity and climatic data will be collected and related to ground-water quality data, using a paired study design. Tracer tests that use fluorescent whitening agents (FWA's) and chloride will be performed in an investigation of rates of chemical transport through the unsaturated zone.

PROGRESS: Land-use, water-level, rainfall, and water-quality data were collected according to schedule. Tracers were applied to farm fields in November 1991 to define the time required for transport of soluble chemicals to ground water.

PLANS: Collect data according to schedule. Continue ongoing data analysis. Prepare annotated outline for final journal article and obtain Regional approval. Begin writing journal article.



Figure 3.--Well LN 1677 with meter used to measure the temperature and specific conductance of water flowing 35 feet below the land surface.



Figure 4.--Well LN 1676 (foreground) is one of five wells used to collect water-level and water-quality data at the 55-acre farm.

**NATIONAL
WATER-QUALITY
ASSESSMENT (NAWQA)
PROGRAM: LOWER
SUSQUEHANNA RIVER
BASIN STUDY UNIT
(PA207)**

PROJECT CHIEF:
Kevin J. Breen

COOPERATOR(S):
**USGS, WRD, Office of
Program Coordination and
Technical Support for
NAWQA**

PERIOD OF PROJECT:
**Continuous; first 10-year
cycle October 1990 to
September 2000**



PROBLEM: Comprehensive information on water-quality conditions and trends, collected and analyzed on a nationally-consistent, long-term basis, is needed by policy makers and water managers for evaluating the effectiveness of water-quality management programs and for use in predicting the likely effects of changes in land- and water-management practices. Policies and practices affecting surface- and ground-water resources in the Susquehanna River Basin are important for protection of human health and environmental health for millions of residents in Pennsylvania, Maryland, and the Chesapeake Bay region.

OBJECTIVES: (1) Describe current water-quality conditions in the lower Susquehanna River Basin; (2) define long-term trends (or lack of trends) in water quality; and (3) identify, describe, and explain, as possible, the major factors that affect observed water-quality conditions and trends.

APPROACH: (1) Identify major water-quality issues and sources of data by establishing contacts with Federal, State, and local agencies, and with representatives of basin commissions, colleges and universities, private consultants, and industry. Select individuals to serve on a technical steering committee for the project; (2) use retrospective analyses of data, guidance from steering committee, and results of reconnaissance sampling to develop a work plan; (3) collect chemical and biological data from networks of fixed, synoptic, and case study sites using established NAWQA protocols; (4) develop and use ancillary data, such as land use, to relate observed water-quality conditions to environmental factors and processes; (5) make information from the study available to the NAWQA National synthesis project, the technical steering committee, the water-resources community, and to the public through meetings and published reports.

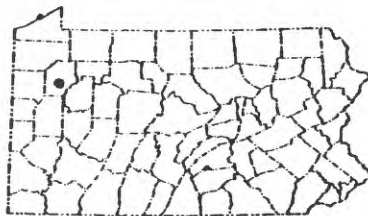
PROGRESS: Established a technical steering committee for the project comprised of 24 representatives from water-resources agencies and organizations in Pennsylvania and Maryland. Identified major water-quality issues and compiled available water-quality data. Prepared a draft report on factors affecting water quality in the study area. Conducted a reconnaissance survey of water-quality and aquatic biota at 90 stream sites. Designed a sampling network to assess the occurrence of organic and trace element contaminants in streams.

**WATER-QUALITY
EFFECTS OF SPECIAL
HANDLING OF PYRITIC,
ACID-FORMING
MATERIALS AT A
RECLAIMED SURFACE
COAL MINE,
PENNSYLVANIA (PA209)**

PROJECT CHIEF:
Charles A. Cravotta, III

COOPERATOR(S):
PaDER, BMR

PERIOD OF PROJECT:
April 1991 to September 1993



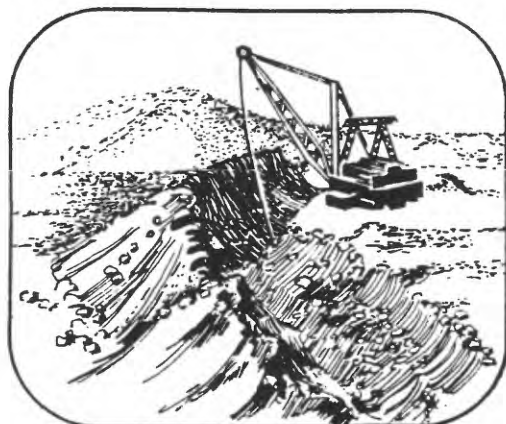
PROBLEM: "Special handling" of pyritic acid-forming materials promises to reduce, or prevent acid-mine drainage (AMD) from reclaimed surface coal mines. Thus, implementation of the special handling technique, where pyritic materials are separated from overburden and coal and then buried in isolated pods above the water table in reclaimed mine spoil, has potential for permitting mining in areas that are prone to produce AMD. However, the success of the special handling method has not been evaluated.

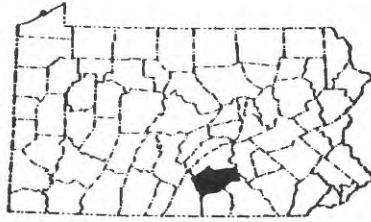
OBJECTIVE: To evaluate the effectiveness of special handling of pyritic materials as an AMD abatement technique to maintain pre-mining, or improve post-mining, surface- and ground-water quality. The study will relate the distribution of pyrite and the frequency of recharge and leaching to local ground-water quality.

APPROACH: The USGS will select a coal mine where half was mined by the use of conventional surface mining and reclamation methods (control) and the other half by the use of special handling methods (test). Geophysical measurements will be used to locate buried pyritic materials and mineralized ground water. Then monitoring holes will be drilled upflow, downflow, and within the mine spoil and underlying bedrock. Ground-water-quality data and unsaturated-zone moisture, temperature, and gas-composition data will be collected at least monthly during the late summer through early spring. Statistical and geochemical modeling will be used to evaluate the difference in water quality between the test and control.

PROGRESS: Completed water-quality and gas-chemical sampling in December 1992. Prepared data tables for publication in USGS annual Water-Resources Data report. Completed chemical and mineralogical analysis of rock cuttings. Began statistical and geochemical evaluation of data.

PLANS: Complete data evaluation and write final report.





**ATMOSPHERIC
DEPOSITION OF
NITROGEN AND
TRIAZINE HERBICIDES
IN THE
CONODOGUINET CREEK
BASIN, PENNSYLVANIA
(PA211)**

PROJECT CHIEF:
David W. Hall

COOPERATOR(S):
**Alliance for the Chesapeake
Bay**

PERIOD OF PROJECT:
**October 1990 to
September 1993**

PROBLEM: Atmospheric deposition of nitrogen in precipitation and dryfall is estimated to contribute as much as 25 percent of the annual load of nitrogen entering the Chesapeake Bay. Although concentrations of nitrogen in precipitation have been monitored nationally and regionally, little information exists on the effects of local land use on precipitation quality. Similarly, little data exists to describe local variation in the concentrations of herbicides in precipitation or to define the effects of local land uses on concentrations of herbicides in precipitation. Knowledge of the loading and transport of nitrogen and herbicides in precipitation is needed by land-use managers who model and attempt to improve water quality in the Chesapeake Bay Watershed.

OBJECTIVE: (1) To define the concentrations of nutrients and triazine compounds in atmospheric deposition of the Conodoguinet Creek Basin; (2) to describe similarities or differences in these chemical concentrations for agricultural, forested, and urban areas; and (3) to determine if local variation in nitrogen concentration is influenced by manure-holding facilities.

APPROACH: Ten sites for sample collection have been located within the Conodoguinet Creek Basin, Pa., and an additional site has been co-located with the Pennsylvania Atmospheric Deposition Monitoring Network gage in Little Buffalo State Park, Pa. Volunteer members of the Alliance for the Chesapeake Bay are scheduled to collect precipitation-event samples intermittently from August 1991 to September 1993. Measurements of pH, specific conductance, alkalinity, and presence of triazine herbicides (by immuno-assay procedures) will be made at the USGS office in Lemoyne, Pa., immediately after sample collection. Selected samples will be analyzed for nutrients, major ions, and pesticides (by solid-phase extraction) at the USGS National Water Quality Laboratory. Concentrations of nitrogen and triazine herbicides in precipitation will be statistically compared between categories of land use at data-collection sites to determine the effects of local land use on precipitation quality.

PROGRESS: Eleven data-collection platforms were installed at stations in forested, agricultural, and urban areas. During 1991-92, rainfall events were sampled for concentrations of ammonium, nitrate, major ions, and presence of triazine herbicides.

PLANS: No sample collection is scheduled during the winter of 1992-93 because of complications arising from freezing conditions. Sampling of rainfall will resume in early March 1993, and continue until September 1993. A final report will be drafted from May through September 1993. The final report will be co-authored by personnel from the Pennsylvania Department of Environmental Resources, the Alliance for the Chesapeake Bay, and the U.S. Geological Survey.

**HYDROLOGIC
INVESTIGATION OF THE
LAKE WALLENPAUPACK
WATERSHED (PA212)**

PROJECT CHIEF:

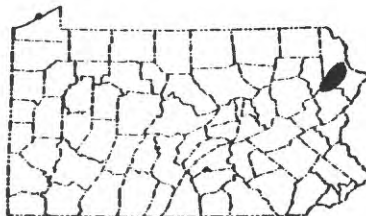
James I. Sams

COOPERATOR(S):

Pennsylvania State University

PERIOD OF PROJECT:

August 1991 to March 1996



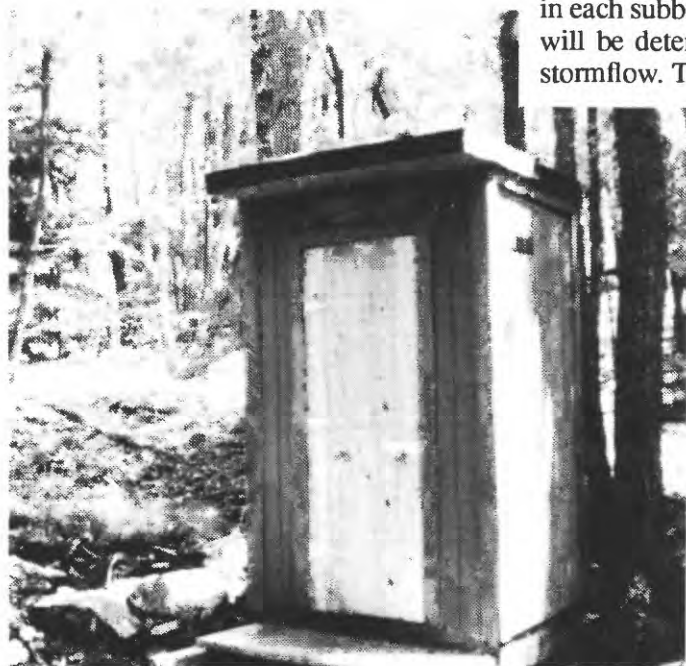
PROBLEM: Lake Wallenpaupack is one of the largest lakes in Pennsylvania. It is located in the northeast corner of the state in Wayne and Pike Counties. This large recreational resource is being affected by excess nutrients that have caused eutrophic conditions in the lake. In 1979, algal blooms in the lake resulted in numerous cases of algae-related infections such as allergic reactions and gastrointestinal disorders. In September 1979, the Lake Wallenpaupack Watershed Management District (LWWMD) was formed in order to manage water resources in the lake region and address the problem of nutrient loading to the lake. The watershed to the lake is 219 square miles and consists of agriculture, commercial, residential, and forested land use. Hydrologic data collected during the investigation will be used to evaluate hydrologic conditions and nutrient loads from selected sub-watersheds draining to Lake Wallenpaupack.

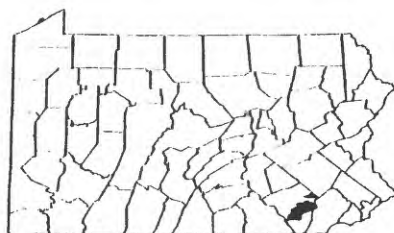
OBJECTIVE: (1) Determine hydrologic conditions and nutrient load for selected subbasins in the Lake Wallenpaupack watershed; (2) evaluate the fate of nutrients transported through small ponds located in the drainage system; and (3) calibrate a watershed model of rainfall-runoff characteristics.

APPROACH: Streamflow and nutrient loads will be monitored at five streamgaging stations constructed in the study area. Two of the sites will be used to monitor nutrients transported into and out of an 8-acre pond. Precipitation and ground-water levels will be monitored in each subbasin to determine an annual water budget. Nutrient loads will be determined from water samples collected at base flow and stormflow. The Hydrologic Simulation Program-FORTRAN (HSPF) model will be calibrated from precipitation and streamflow data collected during the study.

PROGRESS: All streamgaging stations are in operation. Data-collection platforms (DCP's) are used to store and transmit data to USGS computers in Lemoyne, Pa., through the Geostationary Operational Environmental Satellite (GOES) system. The DCP's also control the sampling frequency of automatic water quality samplers at each gage. Flow rating curves have been developed for each gaging station. Water samples have been collected and analyzed for nutrients at each gaging station during base flow and stormflow periods.

PLANS: Continue to monitor streamflow and nutrient loads at each gaging station. Preliminary statistical analysis will be performed on the data collected to date. Initial calibration of the HSPF model will be performed.





PROBLEM: Lancaster County has an intensive agricultural base and transport of agricultural chemicals in surface waters is an issue of concern to local users of surface water and to researchers investigating its effect on the Chesapeake Bay.

OBJECTIVE: To measure concentrations of and estimate loads of agricultural pesticides transported by the Pequea, Mill, and Little Conestoga Creeks during the 1992-93 water years.

APPROACH: Samples for analysis of pesticides and suspended-sediment concentrations will be collected from Pequea, Mill, and Little Conestoga Creeks from February 1992 through September 1993. Ten base-flow and 12 stormflow events will be sampled at each stream and loads transported will be computed from the concentration and streamflow data collected.

PROGRESS: Continuous-record gaging stations were installed as part of a revised data collection approach for water year 1993. Immunoassay analyses of stormflow water-quality samples were also incorporated into revised approach. Water-quality data for the 1992 water year were published in the 1992 Annual Data Report.

PLANS: Collect base flow and stormflow samples as scheduled. Complete data collection by September 30, 1993. Publish water-quality data in annual Water-Resources Data report. Deliver quarterly reports to cooperator.

AGRICULTURAL PESTICIDES IN THE CONESTOGA RIVER HEADWATERS, PEQUEA CREEK, AND MILL CREEK BASINS, LANCASTER COUNTY, PENNSYLVANIA (PA213)

PROJECT CHIEF:
Edward H. Koerkle

COOPERATOR(S):
PaDER, Bureau of Land
and Water Conservation,
Susquehanna River Basin
Commission

PERIOD OF PROJECT:
February 1992 to
September 1994

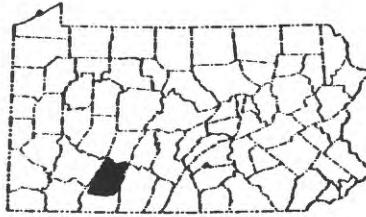


**THE STONYCREEK RIVER
AND LITTLE
CONEMAUGH RIVER
ACID MINE DRAINAGE
STUDY (PA215)**

PROJECT CHIEF:
Donald R. Williams

COOPERATOR(S):
**Somerset County
Conservation District**

PERIOD OF PROJECT:
**October 1991 to
September 1995**



PROBLEM: The water quality of the Stonycreek and Little Conemaugh Rivers, which drain through Somerset and Cambria Counties, has been severely degraded for many decades by AMD from abandoned coal mines. The USGS, in cooperation with the Somerset County Conservation District, will conduct a study of the Stonycreek River Basin to locate and quantify most AMD's that contribute to the degradation of the river. Historical and current data available for the Little Conemaugh River will be reviewed by the USGS for reliability and accuracy.

OBJECTIVE: A Geographic Information System (GIS) data base will be created for the Stonycreek River watershed with various data layers that can be used to appraise the water resources. All existing data on loads of acid, iron, and manganese discharged by mines and transported by streams in the Stonycreek River Basin will be assembled. All subbasins that may be contaminated by AMD will be determined by field screening most first-order streams in the Stonycreek River Basin. A comprehensive sampling plan will be developed to inventory and quantify most mine discharges in the Stonycreek River Basin. The mainstem water-quality conditions and the effects that the mine discharges have on the mainstem will be defined. A Hydrologic Simulation program-FORTRAN (HSPF) model will be calibrated to better understand the stream dynamics with respect to streamflow and quality. Historical data and current data available for the Little Conemaugh River Basin will be reviewed for reliability and accuracy.

APPROACH: A comprehensive GIS data base coverage will be developed to assess hydrologic and ancillary data. A preliminary screening run will be conducted on the mainstem and all major tributaries to define which streams are affected by AMD. Intensive sampling of mainstem sites, major tributaries affected by AMD, and most mine discharges will provide data to assess and prioritize the discharges that produce the most significant acid loads. An HSPF model will be used to help better understand the stream dynamics with respect to streamflow and quality. The study results can be used by water resource managers to perform the most cost effective acid mine abatement project first.

PROGRESS: A final project proposal was developed to address the needs of the cooperator. The following water-quality samples were collected throughout the year: 96 mine-drainage samples; 36 base-flow stream samples; 29 mine drainage-receiving stream samples for QW model verification. A wetland evaluation form was developed and completed for all mine-drainage sites. A water-quality monitor (hydrolab) was deployed at the Stonycreek River at Ferndale gaging station in July 1992 to continuously monitor water temperature, pH and specific conductance during low-flow conditions. A Global Positioning System (GPS) receiver was purchased and used to accurately locate mine discharges. Plans were made with the Pennsylvania District GIS Specialist and Subdistrict Computer Specialist to begin work on GIS aspects of the project.

PLANS: Continue to locate and sample mine discharges throughout the basin primarily during high- and low-base-flow conditions. Input the mine drainage receiving stream data into the QW model and determine the model's usefulness in predicting downstream effects from acid mine discharges. Continue to locate mine-discharge sites with GPS receiver. Begin to develop selected GIS data layers. Input all field and laboratory data into project data bases.

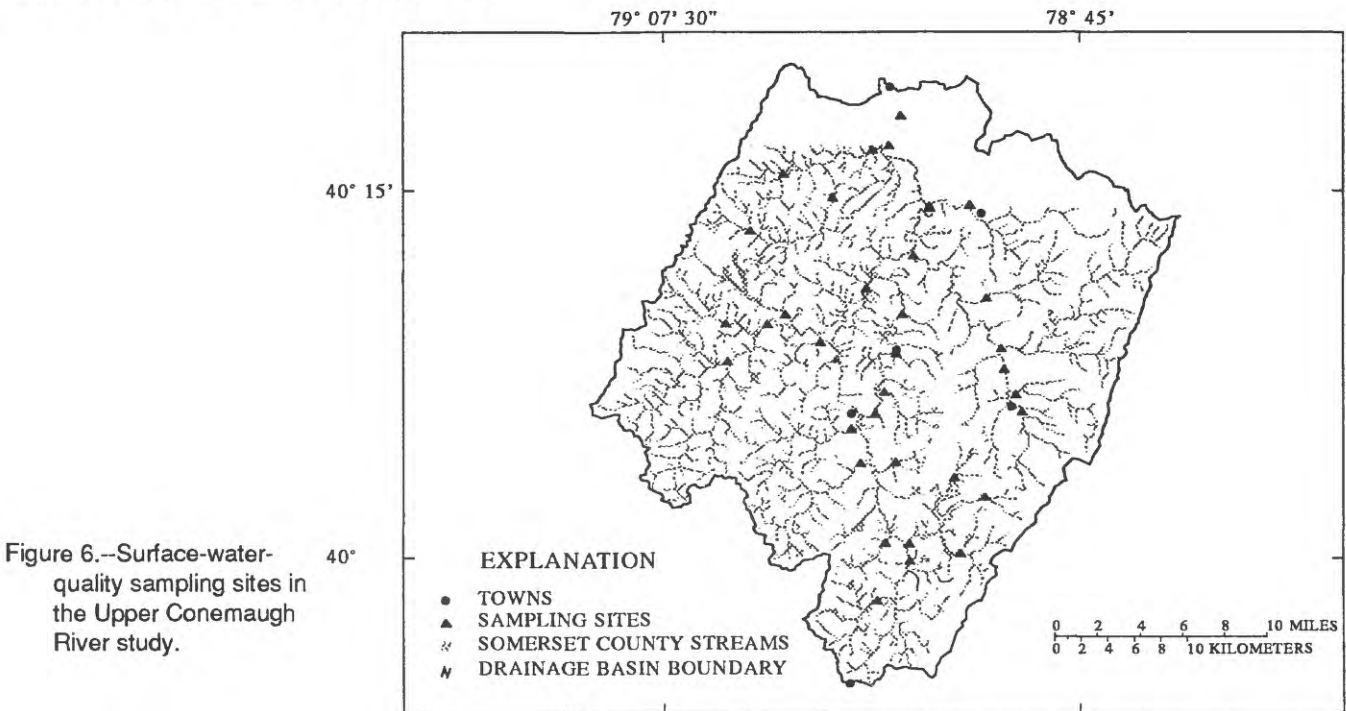


Figure 6.--Surface-water-quality sampling sites in the Upper Conemaugh River study.

**GROUND-WATER
QUALITY ASSESSMENT
OF A FRACTURED
CRYSTALLINE ROCK
AQUIFER SYSTEM IN THE
PIEDMONT PROVINCE OF
THE LOWER DELAWARE
RIVER BASIN (PA216)**

PROJECT CHIEF:

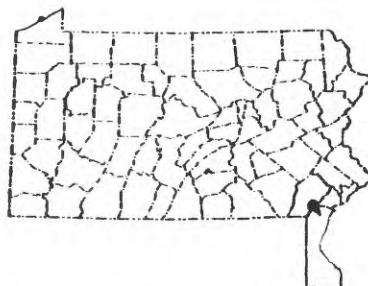
Lisa A. Senior

COOPERATOR(S):

**Chester County Water
Resources Authority**

PERIOD OF PROJECT:

May 1992 to September 1996



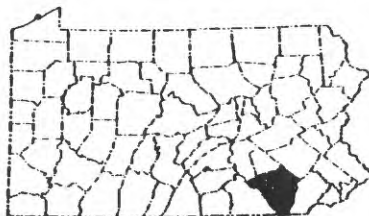
PROBLEM: Organochlorine and organophosphorus insecticides, formaldehyde, polychlorinated biphenyls, zinc and other metals, and chlorinated dioxins and furans have been detected in fish tissue, water, and sediment in the Red Clay Creek Basin. Although the presence of these constituents indicates that human activities in the basin have degraded surface-water quality, the effects on ground-water quality are not known.

OBJECTIVE: Characterize ground-water quality and determine the type and magnitude of ground-water contamination. Assess the hydrogeologic and human factors associated with ground-water quality.

APPROACH: (1) Use a stratified random sampling design to identify ground-water sampling sites; (2) collect ground-water samples from 65 wells and analyze for major and minor ions, nutrients, radon, pesticides, and volatile organic compounds; and (3) analyze relations between ground-water quality, geohydrology, and human factors by use of nonparametric statistics.

PROGRESS: Land-use and geologic data collected and entered into GIS in preparation for selection of sites on the basis of a stratified random sampling design.

PLANS: Select location for ground-water sampling and collect 50 ground-water samples for chemical analysis at NWQL.



PROBLEM: The U.S. Department of Agriculture's Hydrologic Unit Area water-quality initiative is targeting the Pequea/Mill Creek for implementation of untested agricultural best-management practices in an attempt to improve the quality of surface and ground water. The area is intensively farmed with over 76 percent of the land used for agriculture. There are over 1,000 farms averaging about 90 acres each, which house about 55,000 dairy animals, 122,000 swine, and 5.5 million poultry.

OBJECTIVE: To establish a record of surface-water quality and calculation of base flow, suspended sediment, nitrogen, and phosphorus loads in the Pequea and Mill Creek subbasins.

APPROACH: Surface-water quality monitoring stations will be established near the mouths of Pequea and Mill Creeks, and Muddy Run to determine nutrient and sediment loads for a period of 5-10 years.

PROGRESS: Base-flow water-quality sampling and stormflow sampling is being conducted monthly by PaDER at Mill Creek and Muddy Run gaging locations as part of a static sampling network established throughout the Commonwealth of Pennsylvania.

PLANS: Cooperator will continue monthly base flow and monthly stormflow sampling. USGS will continue daily streamflow and precipitation data collection. Publish data in USGS annual data report.

**CHARACTERIZING
BASELINE WATER
QUALITY, AND
EVALUATING THE
CAUSE/EFFECT
RELATIONS OF THE
IMPLEMENTATION OF
AGRICULTURAL
MANAGEMENT
PRACTICES ON SURFACE-
AND GROUND-WATER
QUALITY IN THE
PEQUEA/MILL CREEK
WATERSHEDS (PA217)**

PROJECT CHIEF:
Michael J. Langland

COOPERATOR(S):
**PaDER, Bureau of Water
Quality Management**

PERIOD OF PROJECT:
June 1992 to September 1999



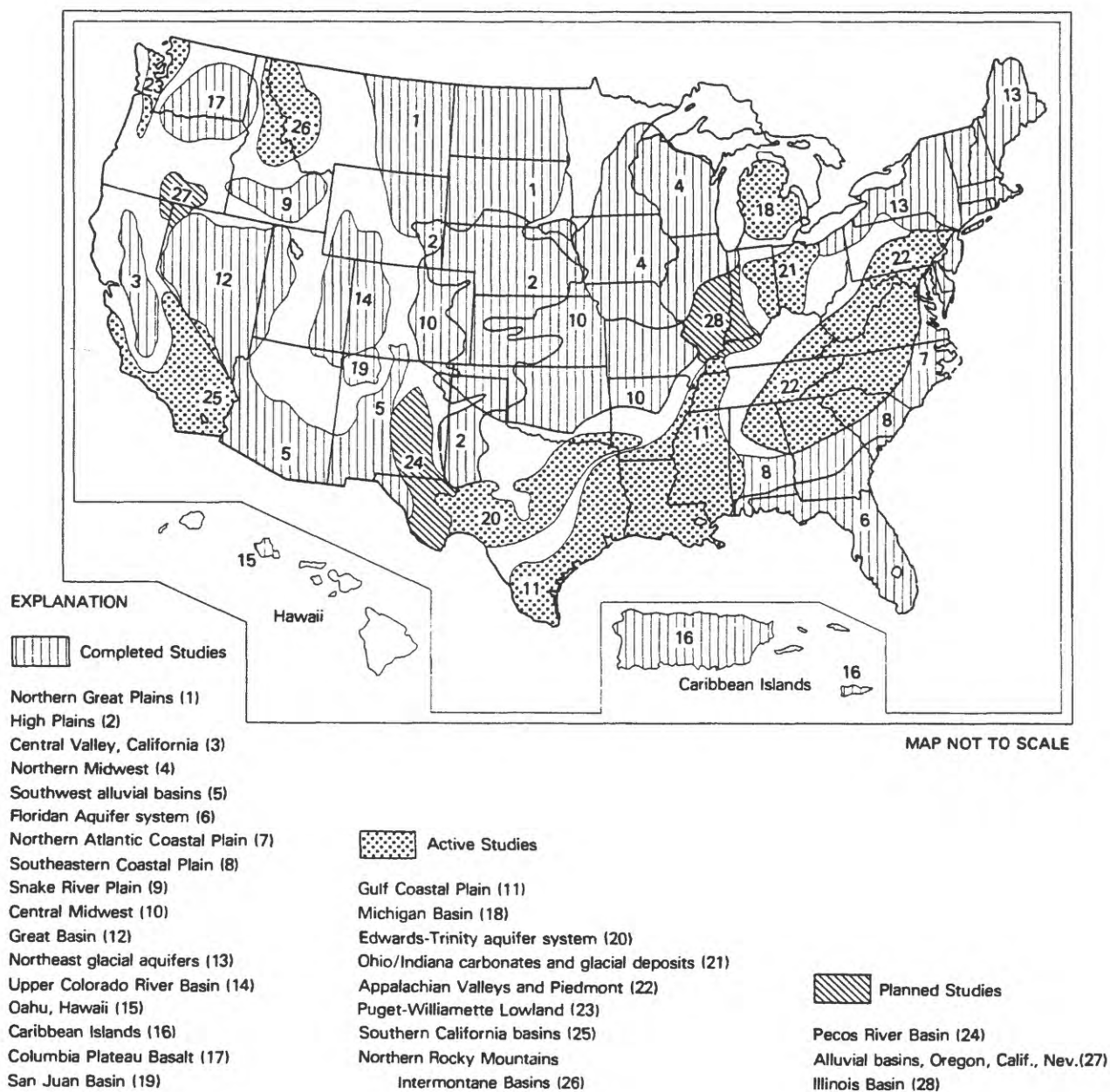


Figure 7.--Locations of regional aquifer-system studies (from Sun and Weeks, WRIR 91-4122, 1991).

PROBLEM: Important digital information used to develop ground-water flow models for the Regional Aquifer-System Analysis (RASA) Program has not been archived such that the information will be accessible on WRD Distributed Information Systems-II (DIS-II) computer hardware.

OBJECTIVE: The project objective is to archive essential digital information of regional ground-water flow models developed for completed RASA projects. The archive shall be stored on stable media that is compatible with USGS, DIS-II hardware. The digital information from these regional models includes input data, model source codes, model output, and ancillary data.

APPROACH: The archival effort will be performed in accordance with Office of Ground Water Technical Memorandum 93.01 and in coordination with WRD Regional and District ground-water model-archival efforts. Essential model data will be obtained by former RASA personnel or other contact persons. Where possible, models will be reactivated on DIS-II computer hardware, and model output will be verified by use of published reports or output from original calibrated model.

PROGRESS: The number of RASA projects and models to be included in the archival effort has been determined. RASA project personnel or district staff have been contacted and informed of the archival effort. An approach and workplan for acquiring and archiving digital data has been drafted. Modifications have been made to the FORTRAN model source code of both the two and three-dimensional ground-water flow models that were used for a majority of the completed RASA projects, such that the models compile and run on the DIS-II computer equipment. Model data has been obtained for six of the RASA projects.

PLANS: To obtain available digital data for ground-water flow models of each of the completed RASA projects, to reactivate and verify each model, and to assemble the digital information into an archive that will be accessible with DIS-II computer equipment.

**ARCHIVAL OF REGIONAL
GROUND-WATER FLOW
MODELS OF THE U.S.
GEOLOGICAL SURVEY
REGIONAL AQUIFER-
SYSTEM ANALYSIS
PROGRAM (PA218)**

PROJECT CHIEF:
Daniel J. Hippe

COOPERATOR(S):
**USGS, WRD, Office of
Ground Water**

PERIOD OF PROJECT:
**January 1992 to
September 1994**

**QUANTIFICATION OF
HYDROLOGIC AND
SEDIMENT RESPONSE
DURING STORMFLOW
RUNOFF IN A
STORMFLOW DRAINAGE
CHANNEL IN THE
CARBONATE TERRAIN OF
CUMBERLAND COUNTY,
PENNSYLVANIA (PA219)**

PROJECT CHIEF:

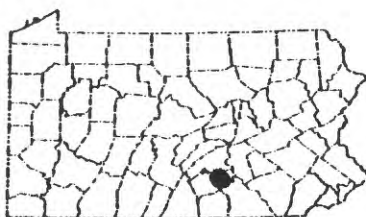
Lloyd A. Reed

COOPERATOR(S):

U.S. Navy

PERIOD OF PROJECT:

June 1992 to September 1994



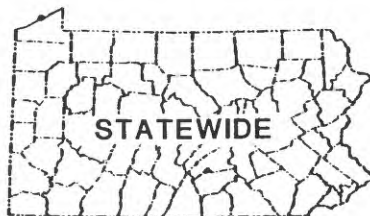
PROBLEM: Storm-water runoff from impervious surfaces at the 825-acre Navy Ships Parts Control Center (SPCC) in Mechanicsburg, Pa., drains to an open channel along the western boundary of the SPCC. The drainage channel is in karst terrain and a large part of the storm water is probably lost to sinkholes in the channel. Previous studies indicate that sediments in this drainage channel are contaminated with trace metals and polychlorinated biphenyls (PCB's). During stormflows, these sediments and associated contaminants may be resuspended and transported to sinkholes in the channel and to Trindle Spring Run, a high-quality cold-water fishery. To develop a remediation strategy for this drainage channel, the U.S. Navy needs a detailed streamflow budget that quantifies the discharge of storm water and suspended sediment to the sinkholes and to Trindle Spring Run.

OBJECTIVE: The proposed study will quantify (1) the gains and losses of surface water during stormflows in the SPCC drainage channel and (2) the concentrations and loads of suspended sediment during stormflows in the channel.

APPROACH: A streamflow budget (mass balance) for the drainage channel during October 1992 - September 1993 will be developed from continuous measurements of: (1) precipitation at one site; (2) surface-water discharge at three stations; and (3) ground-water levels in 11 monitoring wells along the channel. The concentrations and loads of suspended sediment in the drainage channel will also be assessed at the three surface-water discharge stations; about 188 water samples will be collected and analyzed for suspended-sediment concentration. A USGS Water-Resources Investigations Report will be prepared to describe the data-collection activities; the streamflow budget, and the concentrations and loads of suspended sediment in stormflows in the drainage channel.

PROGRESS: Three surface-water gages and three automatic suspended-sediment samplers were installed along the channel. Bank-operated cableways were installed at the two upstream gages. Water-level recorders were installed on nine ground-water wells. Data have been collected during six storms that produced streamflow in the channel and during several smaller storms that only produced flow in the upstream segment of the channel.

PLANS: Continue collection and analysis of surface-water and ground-water data until September 30, 1993.



**TECHNICAL SUPPORT OF
USEPA RCRA SITE
INVESTIGATIONS IN
PENNSYLVANIA (PA221)**

PROJECT CHIEF:
Gary N. Paulachok

COOPERATOR(S):
USEPA, Region III

PERIOD OF PROJECT:
June 1992 to September 1993

PROBLEM: The USEPA, Region III, Resource Conservation and Recovery Act (RCRA) program has requested USGS technical assistance with geologic and hydrogeologic aspects of RCRA Facility Investigations (RFI), Corrective Measures Studies (CMS), and Corrective Measure Implementations (CMI) prepared for active, hazardous-waste generation and management facilities in Pennsylvania.

OBJECTIVE: To provide technical assistance required for RCRA sites designated by USEPA, Region III. The assistance can include oversight or performance of RFI, evaluation of CMS, and review of CMI pertaining to hydrogeologic mitigation of contaminants.

APPROACH: For each site designated by USEPA, Region III, the USGS will assign a project chief who will meet with the USEPA site manager to discuss the scope of work to be performed. A site workplan acceptable to both agencies will be prepared. Tasks may include review of contractor workplans and reports, field oversight of investigations, collection of water samples, oversight of sampling activities, review of remedial designs involving hydrogeology, performance of special scientific studies, and long-term monitoring of site remedial investigations.

PROGRESS: Detailed inventories of drinking-water wells in the vicinity of two RCRA facilities in western and south-central Pennsylvania were conducted. A site visit and review of geologic and hydrogeologic components of reports on a facility in northeastern Pennsylvania were performed.

PLANS: Technical assistance at RCRA sites will be provided as requested by USEPA.

**FACTORS AFFECTING
TRANSPORT OF SOIL
PHOSPHORUS TO
SURFACE WATER (PA222)**

PROJECT CHIEF:

Daniel G. Galeone

COOPERATOR(S):

**PaDER, Bureau of Land and
Water Conservation**

PERIOD OF PROJECT:

**August 1992 to
September 1995**

PROBLEM: The transport of phosphorus from agricultural soils to surface-water systems affects the quality and biological communities of the receiving waters. Although much of the phosphorus reaching surface water is transported on suspended particles, agricultural-management practices to reduce the sediment load do not necessarily cause a reduction in phosphorus transport. Physical and chemical characteristics of the soil, and the hydrology of the soil-water system, generally affect phosphorus transport to surface-water systems. The proposed study is structured to identify specific physical, chemical, and hydraulic factors affecting soil-phosphorus transport to surface water.

OBJECTIVE: The primary goal is to quantify and determine the significance of factors affecting the transport of phosphorus from soil to surface water at a farm site in Lancaster County. Prior to and after various application rates of phosphorus in the form of manure, the chemical, physical, and hydraulic characteristics of the soil that affect phosphate equilibrium reactions will be identified. A phosphorus

budget will be developed to determine the fate of applied phosphorus in the soil-water system.

APPROACH: The study approach is designed to vary the concentration of soil phosphorus on a site segmented into plots. The chemical, physical, and hydraulic properties of the soil-water system will be characterized prior to applying manure, the source of the phosphorus, at different rates. After manure applications, phosphorus transported from plots that received high phosphorus loads relative to plots that received low phosphorus loads will be measured to



Figure 8.—Surface runoff from a conventionally-farmed site in Lancaster County.

determine the amount of applied phosphorus stored in the soil system and the amount transported to surface water. Laboratory experiments will be conducted to determine the effect of application rates on the phosphate maximum adsorption capacity of different intervals of the soil profile. Results from field and laboratory components of the study will be integrated to estimate the time needed to saturate the soil with phosphorus, given the specific application rates and site conditions.

PROGRESS: Three plots were located and surveyed at the 40-acre farm site. Vegetation samples were collected for plant-tissue analysis. Surface-runoff, subsurface-flow, and precipitation-measuring instruments were installed at the study site. Manure was applied to two plots in spring 1993. Chemical, physical, and x-ray diffraction analysis of soil were conducted before and after manure application. Surface-runoff and subsurface-flow samples were collected and chemically analyzed before and after manure applications. Precipitation amounts were monitored and precipitation from several storms was chemically analyzed.

PLANS: (1) Monitor the phosphorus movement on the control and treated study plots through the spring of 1994 and determine the effects of different manure applications on phosphate equilibrium reactions; and (2) begin data analysis and first draft of report.



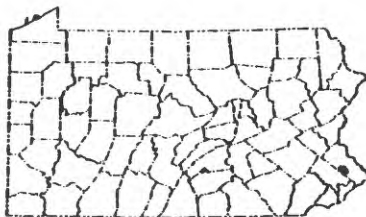
Figure 9.--Gully erosion caused by a surface-runoff event.

**HYDROGEOLOGICAL
INVESTIGATION OF THE
STOCKTON FORMATION
IN THE VICINITY OF THE
FISCHER AND PORTER
SITE, BUCKS COUNTY,
PENNSYLVANIA (PA223)**

PROJECT CHIEF:
Ronald A. Sloto

COOPERATOR(S):
USEPA, Region III

PERIOD OF PROJECT:
September 1992 to
September 1993



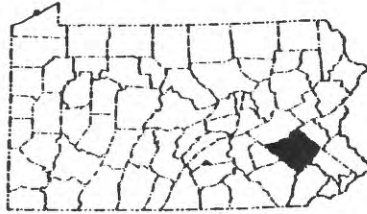
PROBLEM: A pump-and treat system of decontaminating ground water at a hazardous-waste site in the Stockton Formation has been operating since 1986. As part of a study to determine the effectiveness of this method of removing trichloroethylene (TCE) and tetrachloroethylene (PCE) from the aquifer, it is necessary to understand the hydrogeology of the site.

OBJECTIVE: A three-dimensional characterization of the geology and ground-water flow system in the vicinity of the hazardous waste site will be developed. Zones contaminated by organic contaminants in each well will be determined.

APPROACH: Inventory wells to determine construction information, stratigraphy, depths to water-bearing zones, and yields. Geophysical logs will be run on all available wells to confirm locations of water-bearing zones, stratigraphy, and direction and rate of fluid movements in the borehole. On the basis of compiled data, three holes will be cored and five clusters of three multi-depth wells drilled. Geophysical logs will be run on wells and samples analyzed to determine contaminant zones. Water from all yield zones will be analyzed for organic contaminants.

PROGRESS: All available wells have been logged. Deep wells in each monitoring well cluster are being drilled.

PLANS: Run geophysical logs in deep wells. Packer testing and sampling of available and new deep wells will determine contaminated zones. Reconstruct deep wells and drill additional wells so that each well is open to a specific contaminated zone.



PROBLEM: The USEPA requires that all U.S. Army installations apply for a stormwater-discharge permit. The USGS will collect the hydrologic data needed for the permit.

OBJECTIVE: To collect water-quality data for all storm sewers located on site in order to establish a record of the USEPA priority contaminants discharged in stormwaters and to complete the federal and state permits required to certify that site.

APPROACH: Stormwater from one storm event with precipitation within 50 percent of normal and after an antecedent dry period of at least 72 hours will be sampled. Samples will be analyzed for all constituents on the USEPA priority contaminants list. Samples for analyses of other hazardous materials or toxics will be collected and analyzed as needed.

PROGRESS: Visits were made to characterize the site, obtain information on sampling locations and inventory all chemicals stored on site. Proper bottles and preservatives have been obtained for stormflow sampling.

PLANS: Sample single runoff event, analyze resulting water-quality data and complete USEPA stormwater discharge permits and submit for approval.

**ARMY STORMWATER
RUNOFF PROGRAM
(PA224)**

**PROJECT CHIEF:
Michael J. Langland**

**COOPERATOR(S):
U.S. Army**

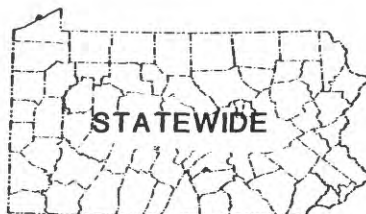
**PERIOD OF PROJECT:
November 1992 to
September 1993**

**ASSESSMENT OF
CHANNEL INSTABILITY
AND EVALUATION OF
SCOUR AT SELECTED
BRIDGES IN
PENNSYLVANIA (PA225)**

PROJECT CHIEF:
Vacancy

COOPERATOR(S):
PennDOT

PERIOD OF PROJECT:
1993 - 2001



PROBLEM: Channel instability and scour around foundations during high streamflow events are the primary processes of bridge failure over waterways. During 1992, scour-associated problems resulted in the closure of three bridges and the institution of emergency repairs at two bridges in Pennsylvania. Inadequate knowledge of the interrelated factors involved in the channel-instability and scour processes may result in increased occurrence of bridge failures, risk to the public, and expenditure of public funds to replace failed and damaged bridges. The Pennsylvania Department of Transportation (PennDOT) has identified 15,808 bridges over water that meet the Federal Highway Administration (FHWA) mandate for evaluation of scour vulnerability. The mandate requires completion of the evaluation by January 1, 1997. Because of the large number of bridges subject to the mandate, methods are needed for rapid evaluation of scour vulnerability, development of a channel-instability rating for each bridge site, and identification of bridges in immediate need of countermeasures. This information will enable PennDOT to define the severity and extent of bridge-scour problems, develop plans and cost estimates for remedial work, and prioritize the work in accordance with available resources. The USGS will conduct for PennDOT the complete evaluation required by the FHWA.

OBJECTIVE: The principal objective of the evaluation is to field-inspect approximately 13,808 bridge sites across the Commonwealth for scour vulnerability, develop a channel-instability rating for each site, and report to PennDOT on bridges in immediate need of countermeasures. The remaining 2,000 bridges will be evaluated through office-based review of PennDOT files. This objective directly addresses the FHWA mandate for a Commonwealth-wide evaluation of scour vulnerability. Secondary objectives are concerned with assessing the utility of computerized hydraulic and sediment-transport models for estimating potential scour depths at bridge sites in Pennsylvania.

APPROACH: The approach for meeting the FHWA mandate to evaluate scour vulnerability at all bridges over water is to initially perform a geomorphic and qualitative site analysis for each bridge of 20 or more feet in length. These analyses, which are broader in scope than those resulting from PennDOT's biennial bridge inspections, will follow the scour-evaluation guidelines outlined by the Federal Highway Administration. The protocols to be used in data collection, and in subsequent analyses of these data, will be based generally on

procedures employed in other states, but will be customized to meet the conditions typically encountered at bridge sites in Pennsylvania and the specific requirements of PennDOT. The principal products of these analyses will be a site-inspection report and a channel-instability rating for each of approximately 15,808 bridges, descriptions of possible countermeasures needed to correct or prevent any existing or potential scour problems, and hydraulic-analysis reports for 20 selected bridges. The channel-instability rating will disclose bridges that are susceptible to scour and, in most cases, application of countermeasures is expected to be cost-effective in preventing scour-associated bridge damage or failure. However, some of the largest bridges with high instability ratings, but which may not be in obvious need of countermeasures, will be analyzed hydraulically to estimate potential depths of various types of scour. The USGS will submit a list of 20 such bridge sites to PennDOT for approval for hydraulic analysis; the analysis will be used to derive parameters needed to estimate potential scour depths with the equations presented in FHWA scour-evaluation manuals. Three of these 20 bridge sites, also approved by PennDOT, will be modeled additionally for sediment transport to evaluate the utility of such models for estimating potential scour depths in the alluvial stream channels of Pennsylvania.

PROGRESS: New project.

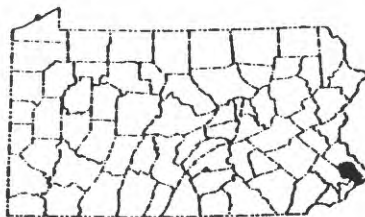
PLANS: Individual site-assessment reports will be prepared in a format suitable to PennDOT, for all 15,800 bridge sites that will be assessed for channel instability. Detailed site-evaluation reports will be prepared for the 20 bridge sites evaluated for scour potential by hydraulic analyses and for the 3 bridge sites evaluated by sediment-transport modeling. These reports will discuss the analytical methods used, model-input data, and the calibration process. Model results will be compared with remnant scour depths measured in the field. The reports will also discuss the reliability of modeling methods for estimating potential scour depths. These reports will be given technical reviews by PennDOT and USGS colleagues prior to publication as formal USGS reports.

**WATER-MANAGEMENT
MODEL FOR THE
NESHAMINY CREEK
BASIN, BUCKS AND
MONTGOMERY
COUNTIES,
PENNSYLVANIA (PA229)**

PROJECT CHIEF:
Curtis L. Schreffler

COOPERATOR(S):
DRBC

PERIOD OF PROJECT:
April 1993 to December 1994



PROBLEM: Increasing population and development in southeastern Pennsylvania has increased the demand for public, industrial, and commercial water supplies. The data needed for effective water-resource management must be available and easily accessible. In southeastern Pennsylvania, water-resource management data are in many different data bases managed by many different water-resources agencies. Therefore, a water-management model compiling, organizing, and managing these data is needed.

OBJECTIVE: (1) Develop a microcomputer data base to compile and manage ground-water and surface-water withdrawals, allocations, discharges, imports and exports, and ground-water availability data using commonly available data-base-management software; (2) Write microcomputer programs to input, manage, manipulate, and display data in the data base; (3) Develop GIS coverages to calculate and display drainage basins, geology, and ground-water and surface-water withdrawal locations and quantities for each subbasin; (4) Document the data bases, computer programs, and methodologies so data can be edited and updated and the same methodology can be transferred to other basins.

APPROACH: Develop GIS coverages and locate all water withdrawals and discharges. Collect monthly data for ground-water and surface-water withdrawals, allocations and discharges and enter into appropriate data bases. Estimate ground-water availability for each subbasin. Develop a water-management model for the basin to incorporate linkage of withdrawals and discharges. Develop an interface between the data bases and the GIS and use the GIS to produce maps.

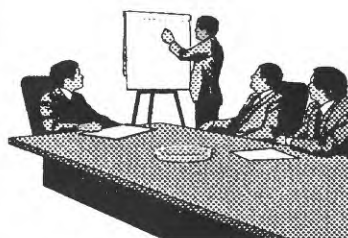
PROGRESS: New project.

PLANS: Delineate drainage basins and geology and digitize into the GIS. Develop data bases, formats and input codes and have cooperator enter all input data into the developed data bases. Construct and develop the water-management model and the interface with the GIS. Document model and write report.

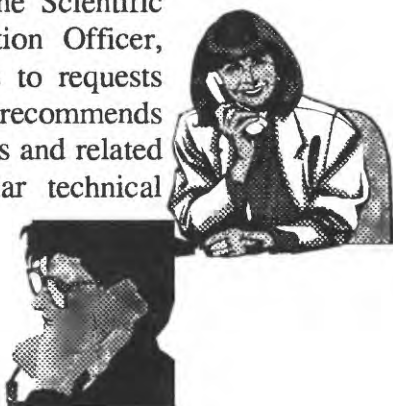
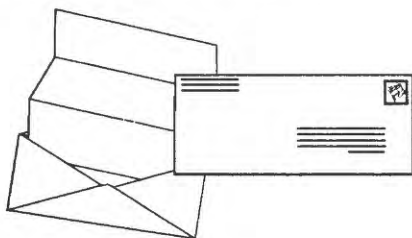
WATER-RELATED INFORMATION SERVICES



As part of its responsibility to provide information to all water users, the USGS is involved in numerous activities in addition to regular programs of hydrologic investigations and data collection. For example, District employees often serve as representatives on advisory committees and *ad hoc* groups established for specific purposes. Additionally, some personnel are members or officers of professional scientific organizations, such as the American Geophysical Union, the American Water Resources Association, and others. They also participate in public service functions as speakers at community meetings or various statewide programs concerning water information and management.



Additionally, public inquiries are received by the Scientific Publications and Information Section [Information Officer, (717) 730-6916]. This service provides answers to requests made in person, by mail, or by telephone; recommends publications relating to general or specific subjects and related statewide areas; or refers requests of particular technical information to appropriate sources.



Recently Completed Projects

The following is a list of completed projects that are in various stages of preparation, but manuscripts have not received Director's approval nor an assigned report number. Descriptions of these projects are available in U.S. Geological Survey Open-File Reports 91-214 and 89-273.

- PA118** Effects of Agricultural Best-Management Practices on Nonpoint Sources in the Conestoga River Basin Above Lancaster, Pennsylvania
- PA124** Impacts of Surface Mining on Water Quality of the Stony Fork Watershed, Fayette County, Pennsylvania
- PA142** Application of Limestone Quarry Waste in the Abatement of Acidic Drainage From a Coal Strip-Mine Site
- PA157** Ground-Water Quality Assessment of Warren County, Pennsylvania
- PA158** Evaluation of Agricultural Best-Management Practices and Other Innovative Methods of Controlling Nutrient Discharges in the Lower Susquehanna River Basin
- PA159** Assessment of Nutrient Sources in the Susquehanna River Basin
- PA160** Water-Quality Effects of the Application of Sewage Sludge on Surface Coal Mines
- PA166** Hydrology and Water Resources of Indiana County, Pennsylvania
- PA168** Ground-Water Quality of Erie County, Pennsylvania
- PA171** Aquifer Characteristics of the Rocks of Pennsylvania
- PA181** Potential Impacts of Climate Change on the Delaware River Basin Water Resources, Pennsylvania
- PA182** Effect of Land Use and Organochlorine Insecticides on Benthic-Invertebrate Diversity Indices, Chester County, Pennsylvania

Recently Completed Projects--Continued

- PA185** Use of Multiple Stable Isotopes to Distinguish Sources of Nitrogen Contamination in the Susquehanna River Basin, Pennsylvania
- PA186** Evaluation of Methods to Delineate the Area of Ground-Water Contribution for Various Hydrogeologic Settings in Pennsylvania
- PA189** Effectiveness of Agricultural Best-Management Practices in Reducing Nutrient Loads to the Conestoga Headwaters, Lancaster County, Pennsylvania
- PA191** Ground-Water Flow in a Mantled-Carbonate System, Cumberland Valley, Pennsylvania
- PA192** Effects of Lower Susquehanna River Reservoir System on Sediment and Chemical Loads to Chesapeake Bay
- PA193** The Extent of Pesticide Contamination and Relation to Land Use in Two Spring Basins in the Northern Cumberland County, Pennsylvania
- PA208** Transport of Pesticides in the Unsaturated Zone Overlying a Carbonate Rock Aquifer
- PA210** Contribution of Septic Systems and Parking Lot Runoff to Ground-Water-Nutrient Concentrations, Milford-Matamoras Area, Pike County, Pennsylvania

General Information

The U.S. Geological Survey announces all its publications in a monthly report "New Publications of the Geological Survey." Subscriptions to this monthly listing are available upon request to the U.S. Geological Survey, 582 National Center, Reston, VA 22092. All publications are for sale unless specifically stated otherwise. Prices, which are subject to change, are not included here. Prepayment is required and information on price and availability should be obtained before placing an order. The "U.S. Geological Survey Yearbook" provides a comprehensive description of the Federal Government's largest earth-science agency; copies may be purchased at the address where professional papers are sold. Summaries of research in progress and results of completed investigations are published each fiscal year in the professional paper series "Geological Survey Research." A publication entitled "List of U.S. Geological Survey Geologic and Water-Supply Reports and Maps for Pennsylvania and New Jersey," which includes reports of the geology and other water-resources reports, is available at cost upon request to: Map Distribution Section, U.S. Geological Survey, Federal Center, Box 25286, Denver, CO 80225, phone (303) 236-7477.

Water-Resources Information

A monthly summary of the national water situation is presented in the "National Water Conditions." Records of streamflow, ground-water levels, and quality of water were published for many years as Geological Survey water-supply papers as explained below.

Streamflow Records

Records of daily flows of streams prior to 1971 were published in the Water-Supply Paper series "Surface-Water Supply of the United States," which was released in numbered parts as determined by natural drainage basins. Until 1961, this was an annual series. Monthly and yearly summaries of these data were compiled in two reports: "Compilation of Records of Surface Waters of the United States through 1950," and "Compilation of Records of Surface Waters of the United States, October 1950 to September 1960." For 1961-70, 5-year compilations were published. Data for Pennsylvania are published in Parts 1, 3, and 4. Daily streamflow records also were published on a State-boundary basis during 1961-74.

Ground-Water Records

Ground-water levels and artesian pressures in observation wells prior to 1975 were reported by geographic areas in a 5-year Water-Supply Paper series. Data for Pennsylvania are in "Ground-Water Levels in the United States, Northern States."

Quality-of-Water Records

Data on quality of surface water prior to 1971 were published annually in the Water-Supply Paper series "Quality of Surface Waters of the United States," which also was released in numbered parts as determined by natural drainage basins. Data for Pennsylvania are in Parts 1, 3, and 4. For water years 1964-74, these data also were released annually on a State-boundary basis.

Data reports covering the years 1971 through 1974 were published by the Geological Survey and archived by the National Technical Information Service, and were retroactively numbered and included in the state water-data report series. Beginning with the 1975 water year, these series were replaced by a new publication series "U.S. Geological Survey Water-Data Reports." This series combines under one cover streamflow data, water-quality data for surface water and ground water, and ground-water level data for each state. For Pennsylvania, the title is "Water Resources Data for Pennsylvania--Water Year (date)," and is published in three volumes for each water year: Volume 1.--Delaware River Basin; Volume 2.--Susquehanna and Potomac River Basins; and Volume 3.--Ohio River and St. Lawrence River Basins. A limited supply of current volumes are available from the District office. Additional volumes may be purchased from:

National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4650

Methods for estimating the magnitude and frequency of floods for selected streams are given in the Water-Supply Paper series "Magnitude and Frequency of Floods in the United States," which is composed of reports released in parts by drainage basins; data for Pennsylvania are in Parts 1, 3, and 4. The U.S. Geological Survey also outlines flood-prone areas on topographic maps as part of a nationwide Federal program for managing flood losses. In Pennsylvania, 757 of these maps have been completed. Copies can be obtained by contacting the Pennsylvania District office.

Series of U.S. Geological Survey Publications

The Water Resources Division of the U.S. Geological Survey is the Nation's lead agency in the collection of water data and the dissemination of information on water resources. The Division makes water data and information readily and equally available to water managers, policymakers, the scientific community, and the public in formats that meet their needs.

The U.S. Geological Survey has published the results of its studies for more than 100 years. The information is multipurpose, and after its initial use, becomes a basis for future resource evaluation and water-management decisions. The Water Resources Division releases its information through several publication series, explained below, and through computerized systems, accessible through NAWDEX and WATSTORE (see page 9).

A description of these publications series, the types of information presented in them, and ordering information is given below.

Water Supply Paper	Significant interpretive results of hydrologic investigations that are considered to be of broad interest.
Professional Paper	Comprehensive or topical reports on any earth-science subject of interest to multi-discipline scientific audiences.
Bulletin	Significant interpretive results of earth-science investigations of broad interest, including computer applications.
Circular	Summaries of topical investigations or programs that are of short-term or local interest.
Map Series	Such as Hydrologic Investigations Atlas--Significant results of hydrologic investigations presented in map format.
Techniques of Water-Resources Investigations	Reports on methods and techniques used in collecting, analyzing, and processing hydrologic data for technically-oriented audiences.
Geological Survey Yearbook	Significant activities of the Water Resources Division that are summarized each year for general audiences.
Water-Resources Investigations Reports	Comprehensive or topical interpretive reports, and maps mainly of local or short-term interest, for interdisciplinary audiences.
Open-File Book and Map	Compilations of data and preliminary interpretive reports of limited interest, or reports awaiting formal publication that require interim release.
Water-Data	Water year data on streamflow, ground-water levels, and quality of surface water and ground water for each state, Puerto Rico, Virgin Islands, and the Trust Territories.
National Water Conditions	A monthly news release that summarizes the national water situation for water-resources-oriented audiences.

With the exception of the "National Water Conditions," which is a form of news release, all the above publication series are listed in three catalogs--"Publications of the Geological Survey, 1879-1961," "Publications of the Geological Survey, 1962-1970," and "Publications of the Geological Survey, 1971 through 1981"--and in yearly supplements to these catalogs for 1982 through 1991.

As new publications are released, they are announced in a monthly list, "New Publications of the Geological Survey," to which a free subscription is available by writing to the U.S. Geological Survey, 582 National Center, Reston, VA 22092.

Many items of scientific interest are published in technical and scientific journals to make the information readily available to those in related fields of study. Other reports of local interest are published by cooperating State agencies and made available within the State.

A report--U.S. Geological Survey Circular 900, "Guide to Obtaining USGS Information"--describes sources of U.S. Geological Survey information and shows in tabular form the types of U.S. Geological Survey products and where they are available. (See below for ordering information.)

Professional papers, bulletins, water-supply papers, techniques of water-resources investigations, water-resources investigations reports, circulars, publications of general interest (such as leaflets, pamphlets, booklets), single copies of the Earthquake Information Bulletin, Preliminary Determination of Epicenters, and some miscellaneous reports, including some from the foregoing series that have gone out of print at the Superintendent of Documents, are obtainable by mail from the U.S. Geological Survey, Books and Open-File Reports, Federal Center, Building 41, Box 25425, Denver, CO 80225.

To Obtain Publications

Certain U.S. Geological Survey reports, including most of the Water Resource Investigations (WRI) series released before 1982, "Water Resources Data - [State] Water Year [year]," beginning with the 1975 issues, and many compilations of data, can be purchased only from the National Technical Information Service (NTIS). New U.S. Geological Survey reports that are available only from NTIS are cited in the monthly list, "New Publications of the U.S. Geological Survey." For information on obtaining these reports, contact: National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 2216, phone (703) 737-4650.

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- WSP 109.** Hydrography of the Susquehanna River drainage basin, by J.C. Hoyt and R.H. Anderson. 1905.
- WSP 161.** Quality of water in the upper Ohio River basin and at Erie, Pennsylvania, by S.J. Lewis. 1906.
- WSP 799.** The floods of March 1936--Part 2, Hudson River to Susquehanna River region. 1937 (1938).
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- WSP 915.** Major winter and nonwinter floods in selected basins in New York and Pennsylvania, by W.B. Langbein and others. 1947.
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- WSP 1532-F.** Appraisal of stream sedimentation in the Susquehanna River Basin, by K.F. Williams and L.A. Reed. 1972.
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- WSP 1779-X.** Quality of Delaware River water at Trenton, New Jersey, by L.T. McCarthy, Jr., and W.B. Keighton. 1964.
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Hydrologic Investigations Atlases are sold by Map Distribution Section, U.S. Geological Survey, Federal Center, Box 25286, Denver, CO 80225.

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PA137, WRIR 89-4023. Distribution of water-quality indicators of acid mine drainage in streams of the Interior Coal Province, eastern coal region of the United States, by S.A. Hoffman and K.L. Wetzel.

PA138, WRIR 87-4136. A feasibility study to estimate minimum surface-casing depths of oil and gas wells to prevent ground-water contamination in four areas of western Pennsylvania, by T.F. Buckwalter and P.J. Squillace.

PA148, WRIR 90-4076. Hydrogeology and ground-water flow in the carbonate rocks of the Little Lehigh Creek Basin, Lehigh County, Pennsylvania, by R.A. Sloto, L.D. Cecil, and L.A. Senior.

PA158, WRIR 93-4069. Hydrology and the effects of selected agricultural best-management practices in the Bald Eagle Creek watershed, York, County, Pennsylvania, prior to and during nutrient management, by M.J. Langland and D.K. Fishel.

PA170, WRIR 92-4088. Radium and radon in ground water in the Chickies Quartzite, southeastern Pennsylvania, by L.A. Senior and K.L. Vogel.

PA173, WRIR 92-4093. Simulation of streamflow and sediment transport in two surface-coal-mined basins in Fayette County, Pennsylvania, by J.I. Sams, III and E.C. Witt, III.

PA179, WRIR 93-4055. Geohydrology and simulation of ground-water flow in the Red Clay Creek Basin, Chester, County, Pennsylvania, and New Castle County, Delaware, by K.L. Vogel and A.G. Reif.

PA107, OFR 89-620. Water resources and the hydrologic effects of coal mining in Washington County, Pennsylvania, by D.R. Williams, J.K. Felbinger, and P.J. Squillace.²

PA146, OFR 90-109. Ground-water resources of cambrian and ordovician carbonate rocks in the Valley and Ridge physiographic province of Pennsylvania, by A.E. Becher.²

PA160, OFR 93-115. Water-quality data for two surface coal mines reclaimed with alkaline waste or urban sewage sludge, Clarion County, Pennsylvania, May 1983 through November 1989, by D.L. Dugas, C.A. Cravotta, III, and D.A. Saad.

PA172, OFR 92-81. Geology, hydrology, and ground-water quality of Chester County, Pennsylvania, by R.A. Sloto.²

PA186, OFR 92-635. Evaluation of methods for delineating areas of contributing areas, and time-of-travel areas of water to wells completed in valley-fill aquifers in Pennsylvania, by D.W. Risser and T.M. Madden, Jr.³

Cooperative Reports

Listed below are cooperative reports at PaDER, PaGS for publication.

PA130. Ground-water resources of Delaware County, Pennsylvania, by W.T. Balmer.

PA143. Hydrogeology and ground-water quality of the glaciated valleys of Bradford, Tioga, and Potter Counties, Pennsylvania, by J.H. Williams, L.E. Taylor, and D.J. Low.

² This manuscript also was approved for State publication by PaDER, T&GS.

³ This manuscript also was approved for publication as a USGS Water-Supply Paper.

Sources of Additional Information on U.S. Geological Survey Programs

Water

Pennsylvania District
U.S. Geological Survey, WRD
840 Market Street
Lemoyne, PA17043
Ph: (717) 730-6910

Mapping

National Cartographic Information Center
U.S. Geological Survey
507 National Center
Room 1-C-107
12201 Sunrise Valley Drive
Reston, VA 22092
Ph: (703) 860-6045

Geology

Geologic Inquiries Group
U.S. Geological Survey
907 National Center
Reston, VA 22092
Ph: (703) 648-4383

General Information

Public Inquiries Office
U.S. Geological Survey
503 National Center
Room 1-C-402
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Pennsylvania State Publications

Several Commonwealth agencies conduct water-resources investigations and present their results in State publications. The Department of Environmental Resources, Bureau of Topographic and Geologic Survey, in addition to the cooperative studies with the U.S. Geological Survey, conducts its own water resource studies and publishes the results in their Water Resource Reports Series. A bibliography of these reports can be obtained by writing:

Pennsylvania Topographic and Geologic Survey
Department of Environmental Resources
P.O. Box 8453
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