INDEX OF CURRENT WATER-RESOURCES ACTIVITIES IN OHIO, 1985

Compiled by Michael Eberle

U.S. GEOLOGICAL SURVEY

Open-File Report 85-555

Columbus, Ohio

1985

UNITED STATES DEPARTMENT OF THE INTERIOR

DONALD PAUL HODEL, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information write to:

District Chief
Water Resources Division
U.S. Geological Survey
975 W. Third Avenue
Columbus, Ohio 43212

Copies of this report can be purchased from:

Open-File Services Section
Western Distribution Branch
U.S. Geological Survey
Box 25425, Federal Center
Denver, Colorado 80225
(Telephone: (303) 236-7476)

FOREWORD

The U.S. Geological Survey, Water Resources Division, has been active in water-resource investigations in Ohio for more than 70 years. During that time, volumes of data have been collected, numerous investigations completed, and more than 150 reports published on various aspects of Ohio's water resources. Many changes have taken place in the Geological Survey and the Water Resources Division since its formation in 1879, but our mission remains firm--"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." As the water resources of Ohio become increasingly important to its economy and quality of life, the Ohio District's role as an unbiased water resource investigation and data-collection agency also becomes increasingly important.

Over the years the District's programs have reflected the needs of the people and priority issues of the times. We have evolved from the early days of ground- and surface-water reconnaissance studies into flood and low-flow studies, projects associated with energy production, and finally, into studies relating to toxic- and hazardous-waste disposal. Through all of this, the district has continued to expend a considerable amount of its resources in collecting and disseminating basic data on surface water, ground water, water quality, and sediment.

Our present program centers on four areas: Basic hydrologic data collection, surface-water modeling, coal-mine reclamation, and ground-water assessment. In all of the above areas, chemical quality of the resource is an important factor. In fact, I feel that water quality will become the overriding concern in all water-resource investigations through the remainder of the 1980's and into the 1990's. The use of computers and digital modeling will continue to be an integral part of all investigations.

The next few years promise a growth of new projects directed toward contamination of ground and surface waters and associated effects on hydrologic systems. To meet this need, the district will correspondingly increase its technical expertise in the fields of geohydrology and organic geochemistry. I look forward to the U.S. Geological Survey's active role in these activities and a continuing relationship with State, county, local, and other Federal agencies in studying the water-resource issues of Ohio.

Steven M. Hindall,
District Chief

CONTENTS

	Page
Foreword	iii
Abstract	1
Introduction	2
Origin of the U.S. Geological Survey	2
Basic mission and program of the Water Resources Division	3
Organization and activities of the Ohio District	4
Organization	4
Types of funding and cooperating agencies	4
Public-information and public-service activities	7
Summary of water conditions in Ohio	7
Information contained in this report	10
Other information available	11
Current projects	11
Surface-water stations for which records are published	34
Ground-water stations for which records are published	39
Selected references on Ohio hydrology	46

ILLUSTRATIONS

Figure 1.--Total offstream water withdrawal in Ohio, by county, 1980	9
2.--Average discharge of principal streams in Ohio	10

INDEX OF CURRENT WATER-RESOURCES ACTIVITIES IN OHIO, 1985

Compiled by Michael Eberle

ABSTRACT

The mission of the U.S. Geological Survey's Water Resources Division 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 United States. This report summarizes the Division's program in Ohio in 1985.

The work of the Ohio District is carried out through the District office in Columbus and a field office in New Philadelphia. Collection of basic data needed for continuing determination and evaluation of the quantity, quality, and use of Ohio's water resources is the responsibility of the District's Hydrologic Surveillance Section. The Hydrologic Investigations Section conducts analytical and interpretive water-resource appraisals describing the occurrence, availability, and the physical, chemical, and biological characteristics of surface and ground water.

In addition to introductory material describing the structure of the Ohio District, information is presented on current projects, sites at which basic surface- and ground-water data are collected, and reports on Ohio's water resources published by the U.S. Geological Survey and cooperating agencies.

INTRODUCTION

Origin of the U.S. Geological Survey

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

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

- Conducting detailed assessments of the energy and mineral potential of the Nation's land and offshore areas.
- Investigating and issuing warnings of earthquakes, volcanic eruptions, landslides, and other geologic and hydrologic hazards.
- Conducting research on the geologic structure of the Nation.
- Studying the geologic features, structure, processes, and history of the other planets of our solar system.
- Conducting topographic surveys of the Nation and preparing topographic and thematic maps and related cartographic products.
- Developing and producing digital cartographic data bases and products.
- Collecting data on a routine basis to determine the quantity, quality, and use of surface and ground water.
- Conducting water-resource appraisals in order to describe the consequences of alternative plans for developing land and water resources.
- Conducting research in hydraulics and hydrology, and coordinating all Federal water-data acquisition.

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

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

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

Basic Mission and Program of the Water Resources Division

The mission of the Water Resources Division 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 is accomplished, in large part, through cooperation with other Federal and non-Federal agencies, by:

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

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

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

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

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

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

Organization and Activities of the Ohio District

Organization

The Ohio District is part of the U.S. Department of the Interior, Geological Survey, Water Resources Division. There are a total of 42 districts throughout the country located in each individual state, with the exception of four districts encompassing two or more states.

The Ohio District is comprised of the district office in Columbus and a field office in New Phiiladelphia. There are two major sections in the district office--Hydrologic Investigations and Hydrologic Surveillance. The New Philadelphia field office is part of the Hydrologic Surveillance section.

Steven M. Hindall, District Chief, is responsible for the overall operation and management of the district, and is assisted by Section Chiefs Richard V. Swisshelm, Jr., and Harold L. Shindel. To carry out the diversity of tasks in support of its varied program, the Ohio District's additional 48-member staff consists of hydrologists, hydrologic technicians, and other administrative, clerical, and support personnel.

The chart on page 6 depicts the organization of the Ohio District and explains the functions of the individual sections and units within those sections.

Types of Funding and Cooperating Agencies

Funds to support the work performed by the Ohio District, Water Resources Division, are derived from three principal sources:

- Federal Program, including Energy Hydrology--Funds for the Federal Program are appropriated by the Congress, and are specifically identified in the annual Geological Survey budget. These funds are used to support research, data collection, high-priority topical programs including energy-related programs, the coordination of all Federal programs related to collection of water data, and internal support services.

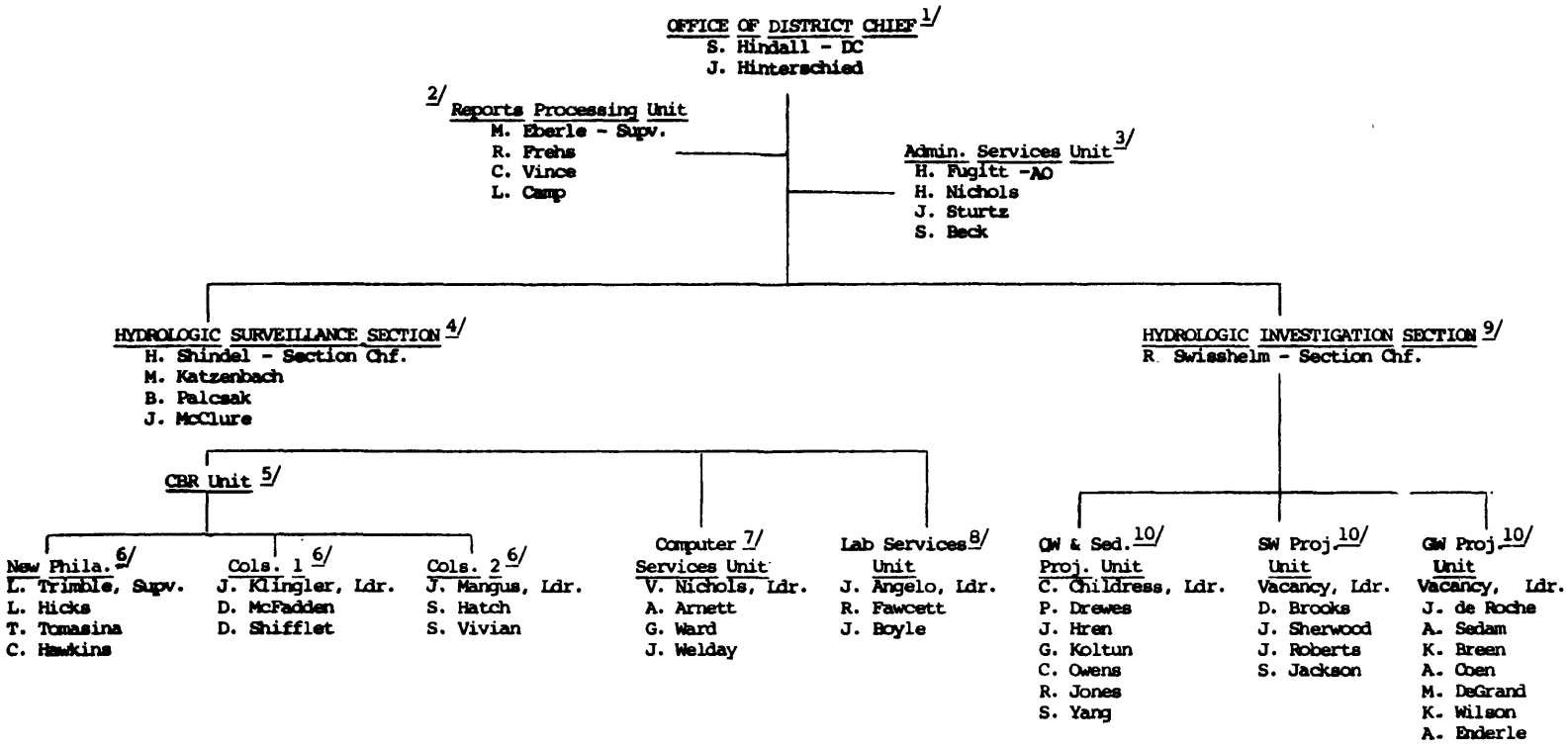
- Federal-State Cooperative Program--Federal funds are appropriated by the Congress and used to match those furnished by State and other tax-supported agencies on a 50-50 basis. These funds are used for a variety of hydrologic data-collection activities and water-resources investigations in which the Water Resources Division represents the national responsibilities and the cooperating agencies represent State and local interests.

- Other Federal Agencies (OFA) Program--In this program, the funds are transferred to the Geological Survey as reimbursement for work performed at the request of another Federal agency.

The Ohio District's 1985 Fiscal Year programs, cooperating agencies, funds allocated,* and percentages of total budget are listed by category below:

Federal Program	$ 440,000	(18%)
Federal-State Cooperative Program	$ 1,690,000	(67%)
Ohio Department of Natural Resources Division of Water Division of Reclamation		
Ohio Department of Transportation		
Ohio Environmental Protection Agency		
Miami Conservancy District		
Williams County		
City of Columbus		
City of Northwood		
Seneca Soil & Water District (Heidelberg College)		
City of Canton		
City of Toledo		
City of Fremont		
Other Federal Agencies Program	$ 370,000	(15%)
U.S. Army Corps of Engineers		
Federal Emergency Management Agency		
U.S. Department of Agriculture (SCS)		
TOTAL	$ 2,500,000	

*Rounded to the nearest $10,000



Footnotes

1/ The office of the District Chief is responsible for technical capability of the district and overall planning and management of all district activities.

2/ The Reports Processing Unit advises district personnel on format and standards for all types of Survey reports, and provides drafting, editing, and typing services required in report preparation, review, and publication.

3/ The Administrative Services Unit provides administrative support to the district, all units reporting to it, and the NWTS Program Representative concerning fiscal and budgetary affairs, accounting, personnel administration, procurement, and office services.

4/ The Surveillance Section is responsible for the continual ongoing data collection and technical support programs of the district.

5/ The CBR Unit is responsible for operation and maintenance of hydrologic data networks and dissemination of the data collected therein, field operations relating to installation, operation and maintenance of stream gaging, ground water, sediment and water-quality monitoring stations, including reconnaissance for site selection.

6/ Area groups are responsible for hydrologic data collection in specific areas of Ohio.

7/ The Computer Services Unit provides district personnel all services related to data processing, programming, systems analysis, equipment analysis and maintenance, and word processing.

8/ The Laboratory Services Unit conducts laboratory field service operations associated with the central laboratory, including treating and shipping samples to the Central Lab and reviewing analytical results.

9/ The Investigations Section is responsible for program development and conducting both problem-oriented and resource appraisal types of hydrologic studies.

10/ The project units are responsible for the routine operation of the district's various hydrologic studies.

Public-Information and Public-Service Activities

The activities of the Ohio district staff are not confined to project work. Much of the daily activity of the staff is devoted to answering requests from landowners, public officials, and business concerns on a wide range of hydrologic and geologic topics. For example, the Ohio district spent a total of 300 hours answering 550 telephone and mail inquiries during 1984.

District personnel also are involved in education. Staff hydrologists and hydrologic technicians have served as instructors and guest lecturers for water-resources courses at Ohio State University. The district also has sponsored seminars and information-exchange meetings with themes ranging from well design to political and social water-resources issues in Ohio.

Equally important is the involvement of district staff in work groups, committees, and task forces of professional societies and other government agencies. Among these groups are:

- Technical Committee and Toxic Strategy Subcommittee of the Ohio River Valley Water Sanitation Commission (ORSANCO).
- Planning and Ground-Water Committees of the Water Management Association of Ohio (WMAO).
- Public Advisory Groups and the Phosphorus-Reduction Task Force of the Ohio Environmental Protection Agency.
- Program Review Panel for the Ohio State University Water Resources Center.
- Steering Committee for the Ohio Water Seminar Luncheon Series.
- The Ohio Safety Council.
- The Ohio State University Student Chapter of the American Society of Civil Engineers (advisory role).

Summary of Water Conditions in Ohio

The availability of water has been an important factor in Ohio's development. Ohio's rivers were the settlers' first avenues of transportation and their first sources of power for manufacturing. Shallow, hand-dug wells provided water to a growing farm population. The construction of canals beginning in 1825 continued to encourage the growth of cities and industries and stimulate agricultural production.

Today, Ohio is still characterized by a diverse economy in which water resources play a vital part. Ohioans use an estimated 14 billion gallons of water a day for domestic purposes, agriculture, industry and commerce, and electric power generation. A county-by-county summary of water use in the State is shown in figure 1.

Precipitation in Ohio averages about 39 inches annually. About 26 inches returns to the atmosphere through evapotranspiration, consumptive use, or other forms of water loss. The 13 inches that remains eventually becomes part of the discharge from one of Ohio's principal streams (fig. 2). This 13 inches is equivalent to approximately 25 billion gallons of water per day, nearly twice Ohio's daily water use.

Ohio's water problems tend to be localized. Generally, these problems involve excess water (flooding or poor drainage) or water quality.

Ohio has serious local flooding nearly every year. Most Ohio floods are either flash floods resulting from intense summer thunderstorms or large-stream floods resulting from a combination of rain and snowmelt. The most significant flooding during the past 2 years was in the Maumee River basin in northwestern Ohio during the last week of February 1985. Accelerated erosion of bare ground and streambanks and deposition of sediment in stream channels, culverts, and drainage ditches are negative side effects of flooding. Eleven projects are active in the Ohio District in 1985 that directly or indirectly contribute to our knowledge of flooding and (or) related sedimentation problems in the State.

The focus of concern about Ohio's water quality in recent years has been on waste disposal and its effects on ground-water quality. Despite the predominance of surface water in terms of total withdrawal, the importance of ground water to Ohio cannot be overlooked. Nearly 80 percent of the public water-supply systems in the State depend to some extent on ground water as a source. Of the six ground-water projects active in the Ohio District in 1985, two deal specifically with waste-disposal sites. Both are scientific studies to describe local ground-water levels and flow and to provide baseline water-quality data near the sites.

Figure 1.--Total offstream water withdrawal in Ohio by county, 1980.

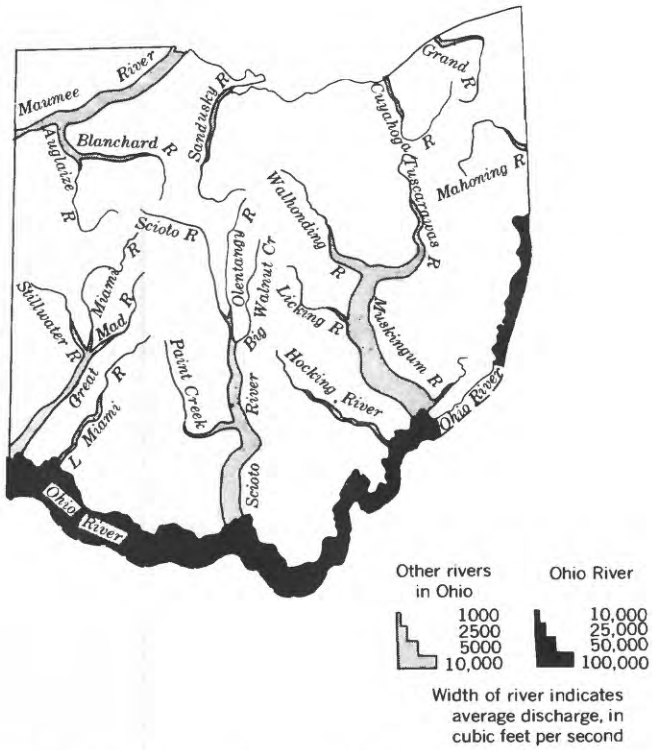


Figure 2.--Average discharge of principal streams in Ohio.

INFORMATION CONTAINED IN THIS REPORT

Information is presented in the remainder of this index in four parts: (1) A listing and brief description of current projects, (2) a listing of surface-water hydrologic data stations, (3) a listing of ground-water hydrologic data stations, and (4) selected references on Ohio hydrology.

The first part contains information on the status of all projects in which there has been activity during 1985. Further information concerning project activities is available from the project leader or from Richard V. Swisshelm, Jr., Chief, Hydrologic Investigations Section.

The second and third parts contain tables showing station numbers, station names, and types of data collected. Further information on statewide station activities, unpublished records, or provisional data prior to publication is available from Harold L. Shindel, Chief, Hydrologic Surveillance Section.

The fourth part is a selected list of reports issued by the U.S. Geological Survey and its cooperating agencies concerning hydrologic investigations in Ohio. Further information on these reports is available from Ann E. Arnett, Information Officer for the Ohio district.

These contact people can be reached at:

District Office
Water Resources Division
U.S. Geological Survey
975 W. Third Avenue
Columbus, OH 43212
(614) 469-5553

Information about data-collection activities in northeastern Ohio also can be obtained by contacting:

Lowell Trimble
New Philadelphia Field Office
Water Resources Division
U.S. Geological Survey
551 Wabash Avenue, P.O. Box 272
New Philadelphia, OH 44663
(216) 343-2343

OTHER INFORMATION AVAILABLE

The U.S. Geological Survey publishes an annual series of reports titled "Water Resources Data for Ohio," in which the hydrologic data collected during each water year are presented. Information about these reports and how to obtain them is available from the district office at the address and phone number given above.

Flood-prone-area maps for selected parts of Ohio also are available from the district office. These maps were prepared in cooperation with the U.S. Department of Housing and Urban Development, Federal Insurance Administration, to serve as guides for public agencies and private citizens concerned with present and future land development. The maps were prepared on standard 7-1/2 minute topographic quadrangles, and show the approximate area subject to inundation by a 100-year flood.

CURRENT PROJECTS

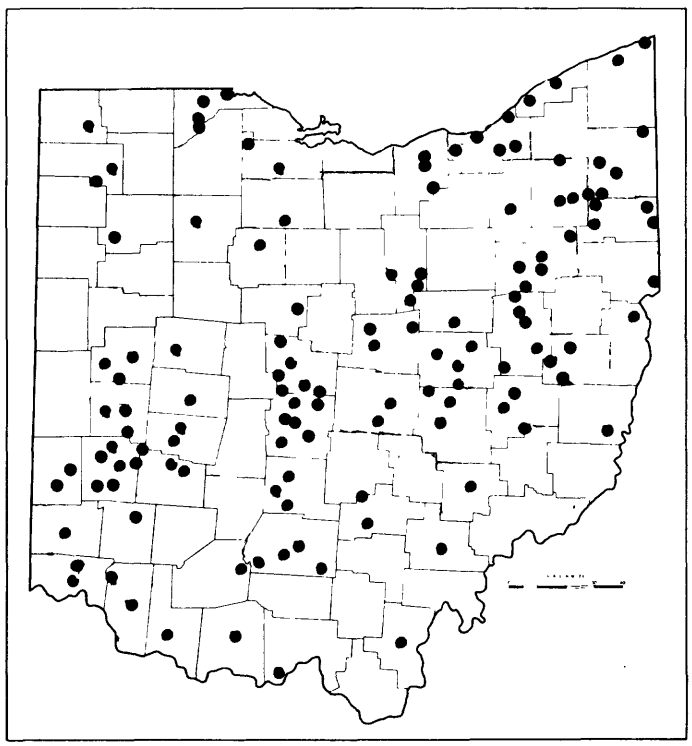
The project descriptions that follow show the project number, title, period of the project, cooperating agencies, project leader, purpose of the project, and progress and significant results.

SURFACE-WATER STATIONS
(OH 001)

Period of Project:
Continuous since October 1915

Project Leader:
Harold L. Shindel

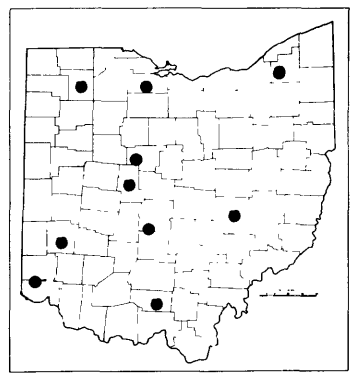
Cooperators:
Ohio Department of Natural Resources
City of Columbus
Miami Conservancy District
Ohio Environmental Protection Agency
City of Canton
U.S. Army Corps of Engineers
Seneca Soil and Water District



Purpose: To provide a surface-water data base through collection, analysis, and publication of records for gaging stations and selected sites along streams, lakes, and reservoirs throughout Ohio. The gaging network is operated in cooperation with other Federal, State, and local agencies. The surface-water data base provides information for research purposes of surveillance, planning, design, hazards warning, accounting systems, operation, and management in various water-related fields.

Progress and significant results: Field data were collected on schedule and prepared for publication (1984 water year). Network maintenance was continued, including modernizing equipment in places to improve record quality. Modifications to the network, such as additions or deletions of stations or data-collecting activity, were made in response to program's needs.

GROUND-WATER STATIONS
(OH 002)


(STATE-OPERATED WELLS NOT SHOWN)

Period of Project:
Continuous since January 1938

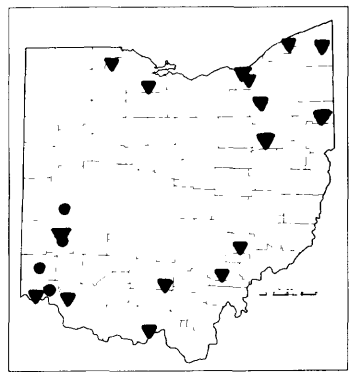
Project Leader:
Stephen A. Vivian

Cooperator:
Ohio Department of Natural Resources

Purpose: To observe the effects on ground-water quantity and quality exerted by such factors as climatic variations and withdrawal patterns. Water-level data are collected to provide a data base against which short- and long-term fluctuations can be compared for proper planning and management.

Progress and significant results: Field data were collected and processed on schedule. Network currently consists of 10 sites with continuous recorders, 16 sites with periodic measurements, and 80 state-operated sites with continuous recorders.

WATER-QUALITY STATIONS
(OH 003)



▼ Surface water
● Ground water

Period of Project:
Continuous since January 1946

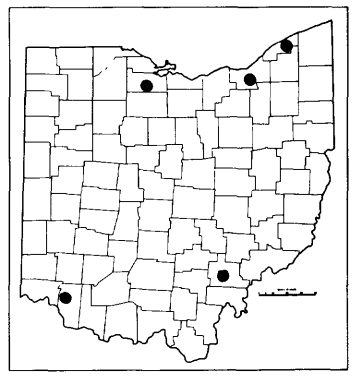
Project Leader:
Clifford G. Angelo

Cooperators:
Miami Conservancy District
Ohio Environmental Protection Agency

Purpose: To collect, analyze, and publish water-quality records for selected sites in Ohio in cooperation with State and local agencies. The records contribute to a national water-quality data base requisite to nationwide and regional planning and action programs.

Progress and significant results: Stations operated by the U.S. Geological Survey consisted of nine NASQAN stations and one Benchmark station in the water-quality network in the 1984 water year. Four Miami Conservancy District ground-water sites were also sampled. The Geological Survey collects a water sample at the NASQAN sites for the Ohio Environmental Protection Agency for the determination of chemical oxygen demand. All 1984 data were collected on schedule. The water-quality monitor network, which was formerly considered a separate project, is now a part of this project. There are ten stations in this network at which temperature, specific conductance, pH, and dissolved oxygen data are continuously collected.

SEDIMENT STATIONS
(OH 004)



Period of Project:
Continuous since July 1970

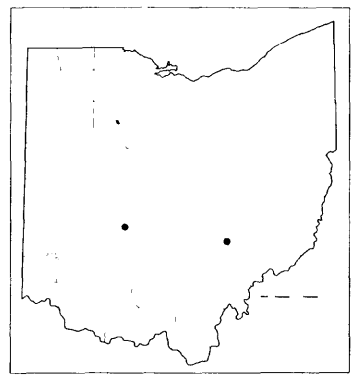
Project Leader:
Jesse H. Klingler

Cooperators:
Ohio Department of Natural Resources
City of Akron

Purpose: To provide a data base needed to assess sedimentation characteristics of drainage areas required for planning and management of State and Federal programs. The data are also needed to evaluate effectiveness of Ohio House Bill 513, which concerns the abatement of sediment pollution in agricultural and urban situations.

Progress and significant results: A network of five daily sediment stations representative of Ohio's major physiographic provinces is being operated to provide spatial and temporal averages of concentration, discharge, and particle-size distribution of suspended sediment carried by major streams. Suspended-sediment data were also collected from finite-duration studies in selected aricultural, mined, and urban areas. All 1984 data were collected on schedule.

FLOOD INVESTIGATIONS
(OH 006)



Period of Project:
March 1984 (reestablished) through February 1986.

Project Leader:
K. Scott Jackson

Cooperator:
Federal Emergency Management Agency (FEMA)

Purpose: The National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973 provide for the operation of a flood insurance program. The Federal Emergency Management Agency (FEMA) needs flood studies in selected areas to determine applicable flood insurance premium rates.

The purpose of this project is to conduct the necessary hydrologic and hydraulic evaluations and studies of areas assigned by FEMA and to present the results in an appropriate format.

Progress and significant results: Work has been started on FEMA-FIA Type 15 flood-insurance studies at Crooksville, Perry County, and London, Madison County, Ohio. Meetings were held with FEMA, State, and community officials to determine time required and costs of both studies.

WATER USE IN OHIO
(OH 007)

Period of Project:
Continuous since October 1977

Project Leader:
Clifford G. Angelo

Cooperator:
Ohio Department of Natural Resources

Purpose: To establish an effective and coordinated program for collecting, storing, accessing, and disseminating water-use data. The data are organized to be compatible with a national data base for water use. In Ohio, there is a demonstrated need for local and statewide water-use information that is consistent with regard to definitions, standards, and methods of presentation.

Progress and significant results: Water-use data through 1982 have been entered into the National Water-Use Data System (NWUDS). A report titled, "Water Use in Ohio, 1980," was published; the report presents detailed data originally collected for the U.S. Geological Survey's national census of water use in 1980.

HYDRAULICS OF RIVER VALLEYS AND BRIDGE SITES
(OH 010)

Period of Project:
Continuous since June 1963

Project Leader:
G. F. Koltun

Cooperator:
Ohio Department of Transportation

Purpose: To evaluate the hydraulic effects of proposed or existing bridges and highway fills at selected locations. Such structures decrease the capacity of river valleys for conveying floodwaters, and in turn may cause backwater and excessive upstream flooding. Hydraulic information is needed by highway engineers for making design decisions.

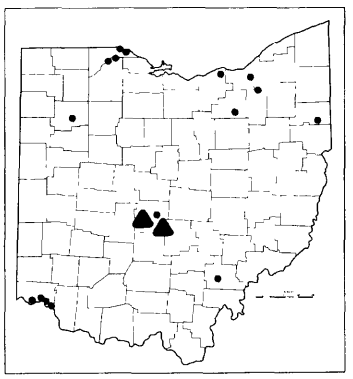
Progress and significant results: Field investigations and surveys will be conducted at sites specified by the cooperating agency to supplement existing hydrologic data for use in the hydraulic analysis. A study was completed in which two proposed bridge plans were analyzed to determine the effects on flood profiles subsequent to the placement of a 376-foot-long, four-span deck bridge across the stream 90 feet upstream of the existing State Route 762 truss bridge near Orient, Ohio. The analysis shows that the 25-year flood profiles immediately upstream of the new bridge would increase by 0.4 foot if plan one is adopted and by 0.3 foot if plan two is adopted. Both profiles converge with the present-condition profiles 5,750 feet upstream.

EFFECTS OF URBANIZATION ON RUNOFF FROM SMALL DRAINAGE AREAS
IN THE STATE OF OHIO
(OH 028)

Period of Project:
July 1974 to June 1986

Project Leader (Acting):
James M. Sherwood

Cooperator:
Ohio Department of Transportation



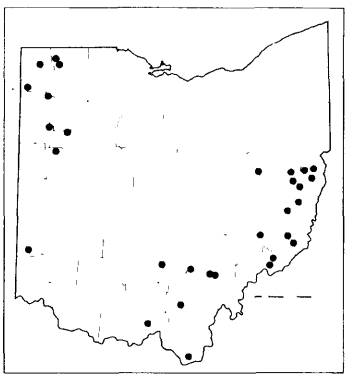
• Rainfall-runoff

▲ Rainfall-runoff & water quality

Purpose: To obtain runoff and water-quality data applicable to areas affected by urbanization. Such information is needed by designers and planners of roadways and structures in urban settings. Much of the U.S. Geological Survey's basic streamflow program from rural areas has had little transfer value for predicting peak flows in areas of concern by urban planners. Phase one is to establish precipitation and runoff data collecting stations selected to represent differences in drainage areas, types of urbanization, flow regime, and slope. Phase two is to analyze and interpret the data through development and calibration of a rainfall-runoff model. Ultimately, a flow model for predicting peak discharge based on hydrologic, land use, meteorologic, and geologic characteristics will be developed; and modifications will give the model transfer value outside Ohio. Site data will also provide information relative to the total storm hydrograph, which could lead to development of a reliable flood-volume model. Characteristic water-quality differences in relation to storm events at selected sites will be noted.

Progress and significant results: Review of the data collected showed that sufficient data existed for model calibrations. In total, 174 years of data were collected at the 30 sites in this urban study. Annual peak flows for two sites were published in the 1984 annual water-resources data report for Ohio. Models were calibrated at 21 sites and initiated at six additional sites. Long-term simulations and flood-frequency characteristics were completed at seven sites.

INVESTIGATION AND ANALYSIS OF FLOODS FROM SMALL NORTHWESTERN, STRIP-MINED, AND FORESTED DRAINAGE BASINS IN OHIO
(OH 034)



Period of Project:
July 1977 to June 1988

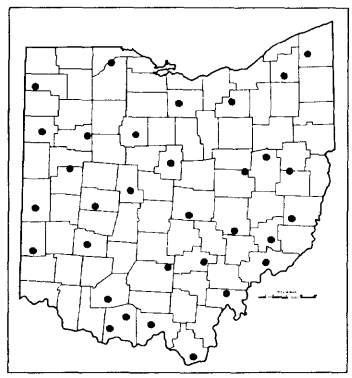
Project Leader:
John W. Roberts

Cooperator:
Ohio Department of Transportation

Purpose: To determine flood characteristics for 30 small basins in reclaimed strip-mined areas, forested areas, and northwestern Ohio. Information is needed for engineering design purposes concerning the degree to which flood flows from small basins are influenced by strip-mine reclamation techniques and by forest cover. Flow model to predict peak discharge, along with an updated flood frequency report, are to be prepared, which are applicable to a wider range of land-use types than previously available.

Progress and significant results: Peak-stage data and discharges for the 1984 water year were obtained for 30 crest-stage stations. In addition, an interim progress report has been written (in press) in which flood peaks observed during water years 1978-82 are compared with peaks predicted from regionalized regression equations for Ohio. The observed flood peaks are lower than predicted peaks by a significant amount in surface-mined basins. Predicted flood peaks from forested basins agree with the observed values fairly well. Predicted flood peaks from the published equations are lower than the observed flood peaks in the northwestern Ohio sites. Some preliminary regression analyses indicate that revised flood-prediction equations can be developed after a longer period of data collection.

FLOOD-VOLUME FREQUENCY FROM SMALL DRAINAGE BASINS IN OHIO
(OH 056)



Period of Project:
February 1981 to December 1987

Project Leader:
James M. Sherwood

Cooperator:
Ohio Department of Transportation

Purpose: To define the magnitude and frequency of flood volumes and to develop a method for deriving a design-flow hydrograph from small rural basins in Ohio. The information would be used by planners to design safe and economical hydraulic structures to convey floodflows. Complete hydrograph records for rural Ohio basins generally are lacking.

Progress and significant results: Data collection and processing continued at all 32 sites. Thirty-seven discharge measurements were made at 27 sites for theoretical rating verification. An average of 8.4 storm events per site were stored in water years 1982 and 1983. Annual peak discharges for the 1984 water year were published in the annual water-resources data report. An interim report was prepared and approved.

RESEARCH MODELING OF COAL AREAS IN OHIO
(OH 063)

Period of Project:
October 1981 to September 1985

Project Leader:
Paul A. Drewes

Purpose: (1) To describe the hydrology and land-use practices of two basins in Ohio's coal areas, (2) to evaluate impact of different land-use practices,and (3) to compare predicted hydrologic parameters of unmined and surface-mined areas and quantify impacts of land-use changes on the hydrology.

Progress and significant results: Two basins were instrumented to collect data for hydrologic modeling. Two precipitation runoff models have been calibrated. A report has been started on the results of model calibrations.

GLACIAL VALLEY AQUIFERS IN NORTHEASTERN OHIO
(OH 066)

Period of Project:
March 1982 to September 1986

Project Leader:
Kevin J. Breen

Purpose: To obtain a better understanding and definition of the flow characteristics of a glacial aquifer near Wooster, Ohio, as part of the Northeast Buried Valley Regional Aquifer System Analysis study. Emphasis is placed on determining the flow contribution from stream infiltration and surrounding bedrock. Use will be made of stream and aquifer head relationships in combination with computer simulations of flow. Isotopic and inorganic-chemical characteristics of water will also be analyzed.

Progress and significant results: Thirteen observation wells have been installed in shallow (30 ft.) and deep (60+ ft.) glacial aquifers. Water levels and samples for isotope and quality analysis have been collected from 30 wells and two streams. Gain-loss measurements have been made during low-flow conditions. Preliminary flow simulations by computer model indicate that stream infiltration is minimal and that contributions from bedrock may be important. Preliminary analysis of water-quality data also indicates contributions from bedrock may be important.

SEDIMENTATION IN WHEELING CREEK BASIN,
BELMONT COUNTY, OHIO
(OH 068)

Period of Project:
Continuous since July 1982

Project Leader:
G. F. Koltun

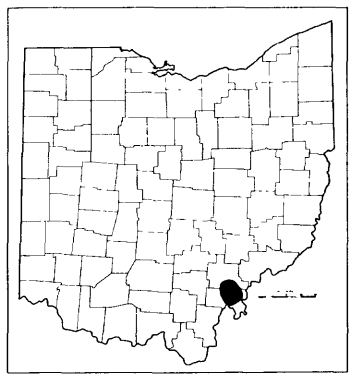
Cooperator:
Ohio Department of Natural Resources

Purpose: Recent flooding along Wheeling Creek and its tributaries has caused concern among residents of Belmont County. The flooding could be caused by extreme climatic conditions or by loss of conveyance of the stream channels due to sedimentation.

This study has developed in two phases. The objectives of the first phase were to: (1) Assess the recurrence intervals of recent floods in the Wheeling Creek basin to determine the severity of those flood events, (2) determine areas acting as major sources of sediment or major repositories of deposition, (3) determine the rates of deposition in selected parts of the basin, and (4) establish a discharge and suspended-sediment gaging station near the mouth of Wheeling Creek. Dredging of selected reaches of Wheeling Creek is planned to help alleviate flooding. The objectives of the second phase are to document the rates at which the channel aggrades or degrades in and near three of the dredged reaches.

Progress and significant results: The objectives of phase I were completed in 1984. A report on the findings is in review. In order to meet the objectives of phase II, cross sections have been surveyed and monumented on three reaches where dredging is planned. These cross sections will be surveyed immediately after dredging and periodically thereafter.

EFFECTS OF SURFACE-MINE RECLAMATION WITHIN
WEST BRANCH SHADE RIVER BASIN
(OH 073)



Period of Project:
February 1983 through December 1986

Project Leader:
Carolyn J. Oblinger Childress

Cooperator:
Ohio Department of Natural Resources

Purpose: Residents and local and State officials are concerned about sedimentation and flooding in the West Branch Shade River basin in Meigs and Athens Counties. The flooding may be due in part to a loss of conveyance of the channels caused by heavy sediment deposition from abandoned surface mines. The Ohio Department of Natural Resources is reclaiming some of these mines, and data are needed to measure the effectiveness of reclamation.

The objectives of this study are to: (1) Measure changes in stream discharge and sediment concentrations at two points in the basin, (2) measure changes in water chemistry at three points in the basin, (3) measure sediment deposition and scour rates at nine typical stream cross-sections on West Branch Shade River and Kingsbury Creek, and (4) correlate data from (1) above with data from part of nearby East Branch Shade River basin, which is unaffected by mining.

Progress and significant results: Cross sections were surveyed, quarterly water-quality samples were collected, and daily sediment load and daily mean discharge were computed. From June through September 1983, suspended-sediment yield was 18 times higher in West Branch (219 tons/mi^2) than East Branch (12 tons/mi^2) Shade River. In addition, acidity is higher, pH is lower, and concentrations of dissolved sulfate and metals are higher in the West Branch Shade River basin than in the East Branch Shade River basin. First preliminary report has been published and a second is in review.

HYDRAULIC IMPACT OF THE PALMITER CHANNELIZATION METHOD
(OH 074)

Period of Project:
July 1983 through September 1988

Project Leader:
James P. Mangus

Cooperator:
U.S. Department of Agriculture,
Soil Conservation Service

Purpose: The Palmiter method of controlling and directing stream channnelization has the potential for being able to alter a stream by means of natural hydraulic forces at a much lower cost than for traditional channelization techniques. The method has not yet been adquately tested, and there are doubts about its effectiveness. Two questions concerning the method need to be answered:

(1) Will this method cause selected reaches to aggrade or degrade?
(2) Will this method cause streambanks to shift laterally?

The purpose of this project is to address these questions by determining the hydraulic impact of the Palmiter method on selected reaches of a 22-mile segment of South Turkeyfoot Creek, Henry County, Ohio.

Progress and significant results: Since the start of the project in 1983, the USGS has established a crest-stage gage and has defined four stage-discharge ratings for the stream segment being studied. Each year, current-meter measurements have been made to check and refine the ratings and peaks monitored by the crest stage gage.

Seven sites have been selected to monitor channel movement. A total of 22 cross sections will be surveyed and evaluated among the 7 sites. Each cross section will be established and monumented just prior to the channelization work and surveyed again upon its completion. (Channelization is scheduled to begin sometime in FY 1985.) Cross sections will be surveyed twice annually in FY 1986 and FY 1987 and once in FY 1988. A full report on the results of the study will be prepared at the close of the project.

EFFECTS OF HAZARDOUS WASTE DISPOSAL ON GROUND- AND SURFACE-WATER RESOURCES, CITY OF NORTHWOOD, WOOD COUNTY (OH 076)

Period of Project:
October 1983 through September 1986

Project Leader:
Jeffrey T. de Roche

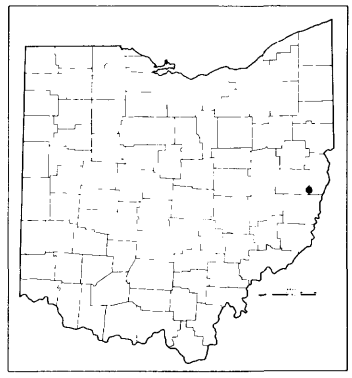
Cooperator:
City of Northwood, Ohio

Purpose: The Evergreen Landfill, located within the City of Northwood, is one of the only licensed hazardous-waste landfills in northwestern Ohio. The site overlies a carbonate aquifer system which supplies 56 percent of the water used in Wood County. The carbonate aquifer is overlain by glacial clay and till; topography is generally flat and drainage is poor. City officials are concerned that ground- and surface-water contamination may be occurring.

The objectives of the study are to: (1) Investigate the chemical quality and interaction of the carbonate aquifer and surface-water systems, and (2) establish and maintain a ground- and surface-water data network near the hazardous-waste site.

Progress and significant results: Literature search has been completed. Twenty-two wells and three streams were chosen to characterize the study area. Geological borings and geophysical techniques are being used to define hydrogeology of landfill area. Inorganic, organic, and heavy-metal data were collected from nine wells and three stream sites. Precipitation gage, stream gage-automatic sampler, and ground-water-level recorders were installed and are producing data. Routine water-level measurements are being made. A digital ground-water model is being used to aid in definition of ground-water flow.

IMPACTS OF SURFACE MINING AND RECLAMATION
ON A SMALL WATERSHED IN OHIO
(OH 077)



Period of Project:
October 1983 to September 1985

Project Leader:
Janet Hren

Purpose: The study area is a 29-acre watershed in the eastern Ohio coal region. The U.S. Geological Survey, in cooperation with the U.S. Bureau of Mines, collected 3 years of premining data and 9 months of postreclamation data. However, hydrologic conditions had not stabiblized sufficiently at the close of the original study to indicate the final impacts of mining and reclamation. The purpose of the present study is to predict postreclamation water quality after geochemical reactions have reached equilibrium.

Progress and significant results: Additional ground- and surface-water samples are being collected to establish the water quality at the site approximately 3 years after mining and reclamation.

AMBIENT ORGANIC LEVELS, LANDFILL SURFACE LEACHING,
AND RISK-ASSESSMENT MODELING NEAR A MUNICIPAL GROUND-WATER SUPPLY,
FRANKLIN COUNTY, OHIO
(OH 078)

Period of Project:
November 1983 through September 1986

Project Leader:
Alan C. Sedam

Cooperator:
City of Columbus, Ohio

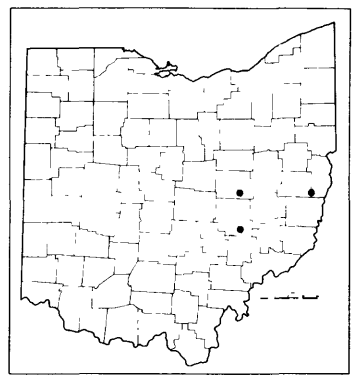
Purpose: The City of Columbus, Ohio, recently installed an induced-infiltration water supply in a glacial aquifer along the Scioto River, downstream from landfills and a sewage treatment plant. City officials are concerned that surface leaching from landfills, chemical spills from nearby roads, and dewatering by an adjacent quarry will adversely affect the new water supply. Baseline organic water-quality data are also needed to protect the municipal water supply.

The objectives of this project are to: (1) Establish a ground- and surface-water observation network to identify contamination that might affect the water supply, (2) provide baseline chemical-quality data, and (3) identify areas that are particularly sensitive to contamination by means of a transient-state computer model.

Progress and significant results: Station network was established. Baseline sampling was done and routine (quarterly) sampling is continuing. An earth resistivity survey was conducted in the project area.

Declining water levels in the northwestern part of the project area show some reversal during winter and spring recharge periods. Drawdowns imposed by the collector well system are temporary, as the system is operating at partial capacity. Preliminary analysis of chemical quality data indicates that the system is stable.

SURFACE-MINE IMPACTS ON GROUND-WATER
HYDROLOGY AND QUALITY OF SMALL WATERSHEDS:
INFORMATION TRANSFER
(OH 080)



Period of Project:
May 1984 through April 1985

Project Leader:
Michael Eberle

Purpose: The purpose of this project is to inform the general public of the effects of surface mining on hydrology and water quality in small watersheds (30-50 acres) in Ohio. Specifically, the project will describe premining and postmining hydrologic and water-quality characteristics, flow systems, water-level trends, and ground-water quality in a concise, semi-technical publication.

The aquifer system at each watershed consisted of two localized perched aquifers (top and middle) above a deeper, more regional aquifer. The premining top aquifer was destroyed by mining in each case, and was replaced by spoils during reclamation.

No new data will be collected; most of the data to be used were collected during 1976-83 as part of a cooperative study sponsored by the U.S. Bureau of Mines.

Progress and significant results: The new top aquifers in the spoils were slowly becoming resaturated at the end of the study period. Water levels in the middle aquifers were about the same after reclamation as before mining, although levels rose in a few places. Water in the new top aquifers was calcium sulfate in type, whereas calcium bicarbonate type water predominated before mining. The median specific conductance of water in the new top aquifers was about 5 times greater than that of the original top aquifers in two of the watersheds, and 1-1/2 times the level of the original top aquifer in the third. Water levels and water quality in the deeper, regional aquifers were unaffected by mining.

The publication has been written and is in review.

SUMMARY OF WATER-QUALITY MONITORING ACTIVITIES IN OHIO
(OH 081)

Period of Project:
September 1984 through March 1986

Project Leader:
Janet Hren

Purpose: The purpose of this study is to determine the extent that existing water-quality data -- collected by various public agencies, for varying purposes, using varying procedures -- can be aggregated for use in answering National-scope questions, such as "Is water quality getting better or worse?"

The project has been divided into three phases. The objectives of each phase are:

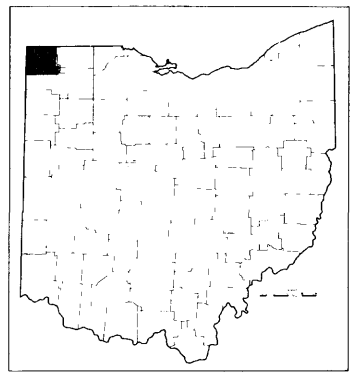
Phase I - Characterize current (1984) water-quality programs and identify those with data useful for addressing National water-quality issues. Detemine costs for past (1972 to 1984) water-quality data collection programs.

Phase II - Determine methods of analysis that are adequate to address selected water-quality issues of National scope. Determine which data bases passing the phase I screening are adequate to potentially address selected issues.

Phase III - Assess the ability of data bases passing phase II screening to address selected water-quality issues for Ohio.

Progress and significant results: Data collection has begun. At present, 130 water-quality programs have been documented from 293 agencies contacted. A report on the first phase of the study is in preparation.

GROUND-WATER RESOURCES OF SHALLOW GLACIAL AQUIFERS
IN WILLIAMS COUNTY, OHIO
(OH 082)



Period of Project:
September 1984 through September 1987

Project Leader:
Alban W. Coen, III

Cooperator:
City of Bryan, Ohio

Purpose: Water for domestic, municipal, and industrial uses in Williams County is totally derived from ground water. A better understanding of the hydrogeologic setting is needed to protect the resource and to manage potential problems. For example, municipal ground-water pumpage has significantly lowered the water table near Bryan.

The objectives of this project are to define the availability and quality of ground water in the shallow glacial aquifers in Williams County, Ohio, by: (1) Literature and data search, (2) collecting ground-water level and quality data, (3) constructing and calibrating a quasi 3-dimensional ground-water flow model, (4) using surface geophysics and well logs to define the hydrogeologic system, and (5) measuring stream gains and losses.

Progress and significant results: Water levels in 80 wells have been measured quarterly for a year. Most areas in the county showed 2 or 3 feet of recharge from November 1984 through April 1985, and show a slight decline in water levels in July 1985. Regional ground-water flow is to the southeast, with local flow towards streams.

Water samples from 48 wells, including domestic, commercial, and municipal water supplies, were collected and analyzed for common dissolved constituents in April 1985. Preliminary results show generally good water quality.

IMPACTS OF SURFACE-MINE RECLAMATION ON SURFACE-WATER QUALITY IN RACCOON CREEK BASIN (OH 083)

Period of Project:
October 1984 through April 1993

Project Leader:
Paul A. Drewes

Cooperator:
Ohio Department of Natural Resources

Purpose: The Ohio Department of Natural Resources, Division of Reclamation, is planning to reclaim many of the abandoned surface mines that are producing acid mine drainage in the Raccoon Creek basin. The hydrologic impact of this reclamation needs to be defined.

The objectives of this study are to: (1) Monitor the long-term and large-scale changes in water quality and suspended sediment at five sites, (2) determine the usefulness of macroinvertebrates as water-quality indicators or as indicators of reclamation effectiveness, (3) measure long-term rates of deposition and scour in the basin as a whole, and (4) determine the cumulative effects of reclamation by collecting water-quality data in Raccoon Creek basin for nine years.

Progress and significant results: Five main gages have been instrumented to collect suspended-sediment and stream-discharge data. Monthly water-quality samples are being collected to determine dissolved-metal concentrations. Cross sections are being surveyed on a quarterly basis to determine deposition and scour rates. Biological samplings are being collected twice annually.

SURFACE-WATER STATIONS FOR WHICH RECORDS ARE PUBLISHED

The tables in this section list hydrologic data stations for which daily records have been published by the U.S. Geological Survey in 1985. Surface-water stations are numbered and listed in downstream order along the main stem. A station on a tributary entering between two main-stem stations is listed between them. A similar order is followed in listing stations on first rank, second rank, and other ranks of tributaries. This downstream order numbering system is a permanent system of numerical designations adopted by the Survey in 1950.

Surface-water stations for which daily data are collected are classified as: Discharge, stage only, sediment, continuous-record water quality, and reservoir or lake contents and (or) elevation. Daily discharge and stage-only stations are sites instrumented to provide a continuous stage record. For daily discharge stations, calculations of mean daily discharge, peak flows during floods, and total monthly and yearly runoff are made by applying stage data to a stage-discharge rating curve derived from actual discharge measurements.

Pool-elevation data collected at reservoir or lake stations are used to determine periodic changes in the amount of water held in storage. Continuous-record water-quality stations are sites equipped to record one or more physical or chemical characteristics. The record is used to determine maximum and minimum daily values. For daily sediment stations, samples collected daily are analyzed for their suspended-sediment concentrations to develop a curve from which daily mean concentrations are determined. Suspended-sediment discharges are computed by multiplying water discharge times concentration times a conversion factor.

In addition to the daily stations listed, data are collected at many sites where daily stations are not feasible. At these "partial-record stations," data are collected at regular intervals ranging from once to several times annually. Types of data collected include peak discharge, low-flow discharge, chemical quality, sediment, and biologic. Information about locations of partial-record stations and types of data collected is available upon request.

SURFACE-WATER STATIONS FOR WHICH RECORDS ARE PUBLISHED

[Letter after station name designates type of data: (B) biological, (C) chemical, (D) discharge, (E) contents and (or) elevation, (M) microbiological, (NASQAN) National stream-quality accounting network, (R) radiochemical, (S) sediment, and (T) temperature]

Station number	Station	Type of data
	OHIO RIVER BASIN	
	Ohio River:	
	BEAVER RIVER BASIN	
03086500	Mahoning R (head of Beaver R) at Alliance	D
03090500	Mahoning R bl Berlin Dam, nr Berlin Center	D
03091500	Mahoning R at Pricetown	D
03092000	Kale C nr Pricetown	D
03092090	W B Mahoning R nr Ravenna	D
03092460	W B Mahoning R bl M. J. Kirwan Dam, at Wayland	D
03093000	Eagle C at Phalanx Station	D
03094000	Mahoning R at Leavittsburg	D
	Mosquito Creek:	
03095500	Mosquito C bl Mosquito C Dam, nr Cortland	D
03099500	Mahoning R at Lowellville	D
03099510	Mahoning R at Oh-Pa State line bl Lowellville	CT
	Shenago River:	
03102950	Pymatuning C at Kinsman	D
	LITTLE BEAVER CREEK BASIN	
	North Fork L Beaver Creek:	
03109500	L Beaver C nr East Liverpool	D
	YELLOW CREEK BASIN	
03110000	Yellow C nr Hammondsville	D
	SHORT CREEK BASIN	
	Short Creek:	
03111500	Short C nr Dillonvale	D
	WHEELING CREEK BASIN	
	Wheeling Creek:	
03111548	Wheeling C bl Blaine	DS
	CAPTINA CREEK BASIN	
03114000	Captina C at Armstrong Mills	D
	MUSKINGUM RIVER BASIN	
	Tuscarawas R (head of Muskingum R):	
03117000	Tuscarawas R at Massillon	D
03117100	Tuscarawas R at Navarre	CT
03117500	Sandy C at Waynesburg	D
03118000	M B Nimishillen C (head of Nimishillen Creek) at Canton	D
03118500	Nimishillen C at North Industry	D

SURFACE-WATER STATIONS--Continued

Station number	Station	Type of data
	McGuire Creek:	
03120500	McGuire C bl Leesville Dam, nr Leesville	D
03122500	Tuscarawas R bl Dover Dam, nr Dover	D
03123000	Sugar Creek bl Beach City Dam, nr Beach City	D
03124500	Sugar Creek at Strasburg	D
	Stillwater Creek:	
03126000	Stillwater C at Piedmont	D
03127000	Stillwater C at Tippecanoe	D
03127500	Stillwater C at Uhrichsville	D
	Clear Fork (head of L Stillwater Creek):	
03128500	L Stillwater C bl Tappan Dam, at Tappan	D
03129000	Tuscarawas R at Newcomerstown	D
03130000	Black F (head of Walhonding River) bl Charles Mill Dam, nr Mifflin	D
03131500	Black F at Loudonville	D
03133500	Clear F bl Pleasant Hill Dam nr Perrysville	D
	Mohican R (continuation of Black Fork):	
	Lake Fork:	
03135000	L F bl Mohicanville Dam, nr Mohicanville	D
03136235	Kokosing R nr Mount Vernon	D
03138500	Walhonding R (continuation of Mohican R) bl Mohawk Dam, at Nellie	D
03139000	Killbuck C at Killbuck	D
03140000	Mill C nr Coshocton	D
03140500	Muskingum R (continuation of Tuscarawas R) nr Coshocton	D
	Wills Creek:	
	Seneca Fork:	
03141500	Seneca F bl Senecaville Dam, nr Senecaville	D
03142000	Wills C at Cambridge	D
03143500	Wills C bl Wills C Dam, at Wills Creek	D
03144000	Wakatomika C nr Frazeysburg	D
	Licking River	
03145000	S F Licking R (head of Licking River) nr Hebron	D
03146500	Licking R nr Newark	D
03147500	Licking R bl Dillon Dam, nr Dillon Falls	D
03150000	Muskingum R at McConnelsville (NASQAN)	DCBMS
03142290	Muskingum River basin ..Salt Fork..	E
	HOCKING RIVER BASIN	
	Hocking River:	
03157000	Clear C nr Rockbridge	D
03157500	Hocking River at Enterprise	D
03159510	Hocking River bl Athens (NASQAN)	DCBS

SURFACE-WATER STATIONS--Continued

Station number	Station	Type of data
	SHADE RIVER BASIN	
03159534	W B Shade R in Burlingham	DCS
03159555	E B Shade R in Tuppers Plains	DCS
03159540	Shade R nr Chester	D
	RACCOON CREEK BASIN	
	Raccoon Creek:	
03202000	Raccoon C at Adamsville	D
	SCIOTO RIVER BASIN	
03219500	Scioto R nr Prospect	D
03219590	Bokes C nr Warrensburg	D
03220000	Mill C nr Bellepoint	D
03221000	Scioto R bl O'Shaughnessy Dam nr Dublin	D
	Olentangy River:	
03223000	Olentangy R at Claridon	D
03225500	Olentangy R nr Delaware	D
03227500	Scioto R at Columbus	D
03228500	Big Walnut C at Central College	D
03228805	Alum C at Africa	D
03229000	Alum C at Columbus	D
03229500	Big Walnut C at Rees	D
03230500	Big Darby C at Darbyville	D
03230900	Deer C nr Pancoastburg	D
03231000	Deer C at Williamsport	D
03231500	Scioto R at Chillicothe	D
	Paint Creek:	
03232470	Paint C bl Paint C Dam nr Bainbridge	D
	Rocky Fork:	
03232500	Rocky F nr Barretts Mills	D
03234000	Paint C nr Bourneville	D
03234500	Scioto R at Higby (NASQAN)	DCBMTS
	Reservoirs in Scioto R basin	E
	UPPER TWIN CREEK BASIN	
03237280	Upper Twin C at McGaw (HBM)	DCMSRT
	OHIO BRUSH CREEK BASIN	
03237500	Ohio Brush C nr West Union	D
	WHITEOAK CREEK BASIN	
03238500	Whiteoak C nr Georgetown	D
	LITTLE MIAMI RIVER BASIN	
03240000	L Miami R nr Oldtown	D
03241500	Massies C at Wilberforce	D
03245500	L Miami R at Milford (NASQAN)	DCBMTS
03247050	E F L Miami R nr Batavia	D
03247500	E F L Miami R at Perintown	D
	MIAMI CREEK BASIN	
03255500	Mill C at Reading	D
03259000	Mill C at Carthage	D

SURFACE-WATER STATIONS--Continued

Station number	Station	Type of data
	GREAT MIAMI RIVER BASIN	
	G Miami River:	
03260700	Bokengehalas C nr De Graff	D
03261500	G Miami R at Sidney	D
03261950	Loramie C nr Newport	D
03262000	Loramie C at Lockington	D
03262700	G Miami R at Troy	D
03263000	G Miami R at Taylorsville	D
	Stillwater River:	
03264000	Greenville C nr Bradford	D
03265000	Stillwater R at Pleasant Hill	D
03266000	Stillwater R at Englewood	D
03267000	Mad R nr Urbana	D
03267900	Mad R (at St. Paris Pike) at Eagle City	D
03269500	Mad R nr Springfield	D
03270000	Mad R nr Dayton	D
03270500	G Miami R at Dayton	D
03270800	Wolf C at Trotwood	D
03271500	G Miami R at Miamisburg	D
03271510	G Miami R nr Linden Ave at Miamisburg	CT
03271800	Twin C nr Ingomar	D
03272000	Twin C nr Germantown	D
	Sevenmile Creek:	
03272700	Sevenmile C at Camden	D
03274000	G Miami at Hamilton	D
03274600	G Miami R at New Baltimore (NASQAN)	CBMTS
	ST LAWRENCE RIVER BASIN	
	(STREAMS TRIBUTARY TO LAKE ERIE)	
04177000	Ottawa R at Toledo University	D
04185000	Tiffin R at Stryker	D
04186500	Auglaize R nr Ft Jennings	D
04189000	Blanchard R nr Findlay	D
04191500	Auglaize R nr Defiance	D
04192500	Maumee R near Defiance	D
04193490	Maumee R nr Waterville	CT
04193500	Maumee R at Waterville (NASQAN)	DCBMT
04194107	Lake Erie at Reno Beach	E
04195500	Portage R at Woodville	D
04196800	Tymochtee C at Crawford	D
04197020	Honey C nr New Washington	D
04197100	Honey C at Melmore	D

SURFACE-WATER STATIONS--Continued

Station number	Station	Type of data
04197170	Rock C at Tiffin	D
04198000	Sandusky R near Fremont (NASQAN)	DCMBTS
04199160	Old Woman's C ab U.S. 6 nr Huron	E
04199165	Old Woman's C at U.S. 6 nr Huron	E
04199170	Lake Erie at Huron	E
04200500	Black R at Elyria	D
04201500	Rocky R nr Berea	D
04202000	Cuyahoga R at Hiram Rapids	D
04206000	Cuyahoga R at Old Portage	D
04207200	Tinkers C at Bedford	D
04208000	Cuyahoga R at Independence (NASQAN)	DCBMTS
04208502	Big C at Cleveland	D
04208506	Cuyahoga R at W 3rd St bridge in Cleveland	CT
04208690	Euclid Creek near Euclid	D
04212100	Grand R nr Painesville	DS
04212200	Grand R at Painesville (NASQAN)	CMBTS
04212680	Fields Brook at Ashtabula	CT
04213000	Conneaut C at Conneaut	D

STANDARD ABBREVIATIONS USED IN STATION NAMES

ab	above	e	east	nr	near
b	branch	f	fork	r	river
bk	brook	g	great	re	reservoir
bl	below	l	little	rn	run
c	creek	lk	lake	s	south
ca	canal	m	middle	tr	tributary
d	ditch	n	north	w	west

GROUND-WATER STATIONS FOR WHICH RECORDS ARE PUBLISHED

The following table lists the ground-water stations in Ohio for which the U.S. Geological Survey is publishing data in 1985. The first six digits of the well numbers denote degrees, minutes, and seconds of latitude, and the next seven digits denote degrees, minutes, and seconds of longitude. The last two digits are used, if needed, for sequential numbering within a 1-second grid.

In addition to the sites listed, data on water levels, yield, and chemical quality of ground water have been collected at many other locations in Ohio. Information about these miscellaneous measurements is available upon request.

GROUND-WATER STATIONS FOR WHICH RECORDS ARE PUBLISHED

[Letter after station location designates type of data:
c chemical; l, water level.]

Well number	Local number	Location
		ASHLAND COUNTY
405303082170700	AS-2	Ashland (l)
405425082173000	AS-3	Jerome Fork (l)
		ATHENS COUNTY
392004082071600	AT-2A	Athens (l)
392009082072200	AT-5	Athens (l)
		AUGLAIZE COUNTY
403233083574500	AU-3	Southwest of New Hampshire (l)
		BELMONT COUNTY
400118081082200	B-3	Mount Olive (l)
		BUTLER COUNTY
391805084261800	BU-9	Northwest of Sharonville (l)
393202084241500	BU-15	Middletown (l)
391904084371800	BU-12	East of Ross (l)
392017084345200	BU-7	Fairfield (l)
392021084340300	BU-56	Fairfield (l)
392048084311400	BU-8	East of Hamilton (l)
392445084333000	BU-36	Hamilton (c)
392515084322000	BU-5	North of Hamilton (l)
392733084293000	BU-16	Southwest of Trenton (l)
392939084231700	BU-3	Middletown (l)
393103084240900	BU-2	Middletown (l)
		CARROLL COUNTY
403709081052800	C-1	North of Carrollton (l)
		CHAMPAIGN COUNTY
400638083453900	CH-3	Urbana (l)
		CLARK COUNTY
395639084012200	CL-9	New Carlisle (l)
395840083495200	CL-7	Northwest of Springfield (l)

GROUND-WATER STATIONS--Continued

Well number	Local number	Location
		COSHOCTON COUNTY
401256081525100	CS-3	North of Conesville (1)
		CRAWFORD COUNTY
404838082563100	CR-1	Bucyrus (1)
		DARKE COUNTY
400514084345700	D-2	East of Greenville (1)
		DELAWARE COUNTY
402126083040400	DL-3	Delaware (1)
		FAIRFIELD COUNTY
394257082362900	F-6	Lancaster (1)
394544082271000	F-1	West Rushville (1)
395053082361900	F-5	Baltimore (1)
		FAYETTE COUNTY
393153083322000	FA-1	West of Washington Court House (1)
		FRANKLIN COUNTY
395118083573300	FR-3	Southwest of Rees (1)
395157083003500	FR-109	Columbus (1)
400101083021800	FR-10	Columbus (1)
		GALLIA COUNTY
383638082103300	G-2	East of Crown City (1)
		GEAUGA COUNTY
412518081221500	GE-3A	Southeast of Chagrin Falls (1)
		GREENE COUNTY
394411083561300	GR-1	North of Xenia (1)
394425083551100	GR-10	North of Xenia (1)

GROUND-WATER STATIONS--Continued

Well number	Local number	Location
		HAMILTON COUNTY
391003084291500	H-11	Cincinnati (1)
391101084172100	H-3	Southeast of Miamiville (1)
391201084281600	H-10	Cincinnati (1)
391324084272500	H-9	Cincinnati (1)
391341084275300	H-8	Wyoming (1)
391442084262900	H-7	Evendale (1)
391608084254400	H-6	Glendale (1)
391733084392400	H-2	South of Ross (1)
391748084393800	H-19	Southwest of Venice (c)
391817084393300	H-4	Southwest of Ross (1)
		HARDIN COUNTY
404218083503700	HN-1	Alger (1)
404648083412600	HN-2A	Southeast of Dola (1)
		HENRY COUNTY
412123083574000	HY-2	Southwest of McClure (1)
		HOCKING COUNTY
393200082235300	HK-1	Logan (1)
		KNOX COUNTY
402344082300700	K-1	Mt. Vernon (1)
		LICKING COUNTY
400159082282100		Heath (1)
		LUCAS COUNTY
413704083362200	LU-1	Toledo (1)
		MADISON COUNTY
395301083272200	M-2	London (1)
395357083304400	M-4	Northwest of London (1)
395740083255700	M-3	North of London (1)
		MAHONING COUNTY
400042080453800	MA-1	Canfield (1)

GROUND-WATER STATIONS--Continued

Well number	Local number	Location
		MARION COUNTY
403413083170500	MN-4	Southeast of New Bloomington (1)
403443083230400	MN-1	LaRue (1)
403601083110400	MN-2	West of Marion (1)
		MEDINA COUNTY
410120081431800	MD-3	Wadsworth (1)
410142082005900	MD-1	Lodi (1)
		MERCER COUNTY
402833084375200	MR-2	Coldwater (1)
		MIAMI COUNTY
395848084085500	MI-3	Northeast of Tipp City (1)
400308084112900	MI-44	Troy (c)
		MONTGOMERY COUNTY
393757084173600	MT-928	Miamisburg (c)
394012084151700	MT-55	West Carrollton (1)
394025084162800	MT-49	West Carrollton (1)
394425084113200	MT-3	Dayton (1c)
394533084113800	MT-6	Dayton (1)
		MUSKINGUM COUNTY
395804081593200	MU-1A	Zanesville (1)
		PICKAWAY COUNTY
393327082571600	PK-7	South of Circleville (1)
393402082572500	PK-4	South of Circleville (1)
393638082572300	PK-6	Northwest of Circleville (1)
393438083072200	PK-8	Williamsport (1)
		PIKE COUNTY
390359083015100	PI-2	West of Piketon (1)
		PORTAGE COUNTY
411401081025000	PO-1	Windham (1)
410920081192000	PO-6	East of Kent (1)
		PREBLE COUNTY
394438084335900	PR-2	East of Eaton (1)

GROUND-WATER STATIONS--Continued

Well number	Local number	Location
		PUTNAM COUNTY
405505084032900	PU-1	Columbus Grove (1)
		RICHLAND COUNTY
404625082305100	R-4	Mansfield (1)
405753082360800	R-3	Shiloh (1)
		ROSS COUNTY
391341083172200	RO-7	West of Bainbridge (1)
391913082580500	RO-8	Chillicothe (1)
		SANDUSKY COUNTY
411914083045300	S-3	Fremont (1)
412703083213600	S-2	Woodville (1)
		SENECA COUNTY
410802083093900	SE-2	Tiffin (1)
		SHELBY COUNTY
401712084103500	SH-4	Sidney (1)
		STARK COUNTY
404939081203800	ST-5A	Canton (1)
405051081244200	ST-28	Northwest of Canton (1)
405211081253500	ST-27	North Canton (1)
		SUMMIT COUNTY
410141081315200	SU-4A	Akron (1)
410330081282000	SU-6	Akron (1)
410846081271600	SU-7	Cuyahoga Falls (1)
		TRUMBULL COUNTY
411604080505600	T-3	Near Warren (1)
		TUSCARAWAS COUNTY
403207081293800	TU-3	Dover (1)
403557081313600	TU-4	Strasburg (1)
403653081321800	TU-1	North of Strasburg (1)
403823081324200	TU-5	Near Strasburg (1)

GROUND-WATER STATIONS--Continued

Well number	Local number	Location
		UNION COUNTY
401826083255200	U-4	Southeast of Raymond (1)
		VAN WERT COUNTY
405215084335400	VW-1	Van Wert (1)
		VINTON COUNTY
391452082282900	V-1	McArthur (1)
		WARREN COUNTY
392712084191700	W-5	East of Monroe (1)
		WASHINGTON COUNTY
392553081281600	WA-2	Marietta (1)
		WAYNE COUNTY
404655081553200	WN-3	Near Wooster (1)
404802081583100	WN-2A	Near Wooster (1)
405745081510200	WN-7	Near Sterling (1)
405805081462300	WN-6	Rittman (1)
		WILLIAMS COUNTY
413108084415300	WM-12	East of Blakeslee (1)
		WYANDOT COUNTY
405009083172600	WY-1	Upper Sandusky (1)

SELECTED REFERENCES ON OHIO HYDROLOGY

Selected references on water resources in Ohio are listed below; many of them are available for inspection at the Ohio District office and at large public and university libraries. The publications are grouped as follows: (1) U.S. Geological Survey publications; (2) reports prepared by the Geological Survey in cooperation with specific agencies and which can be obtained from the cooperating agencies; and (3) other publications, such as contributions to technical journals.

Professional Papers

511 Geology and ground-water resources of Portage County, Ohio, by J. D. Winslow and G. W. White. 1966.

605-A Ground-water hydrology and geology of the lower Great Miami River valley, Ohio, by A. M. Spieker. 1968.

605-B Seismic refraction survey of Pleistocene drainage channels in the lower Great Miami River valley, Ohio, by J. S. Watkins and A. M. Spieker. 1971.

605-C Effects of increased pumping of ground water in the Fairfield-New Baltimore area (Hamilton County), Ohio--A prediction by analog-model study, by A. M. Spieker. 1968.

605-D Future development of the ground-water resources in the lower Great Miami River valley, Ohio--Problems and alternative solutions, by A. M. Spieker. 1968.

700-D The effect of stream discharge on streambed leakage to a glacial outwash aquifer, by S. E. Norris, in Geological Survey Research 1970, Chapter D, p. D262-D265. 1970.

750-B Availability of ground water from limestone and dolomite aquifers in northwest Ohio and its relation to geologic structure, by S. E. Norris and R. E. Fidler, in Geological Survey Research 1971, Chapter B, p. B229-B235. 1971.

750-C Carbonate equilibria distribution and its relation to an area of high ground-water yield in northwest Ohio, by S. E. Norris and R. E. Fidler, in Geological Survey Research 1971, Chapter C, P. C202-C206. 1971.

750-D Resistivity and neutron logging in Silurian dolomite of northwest Ohio, by L. M. MacCary, in Geological Survey Research 1971, Chapter D, p. D190-D197. 1971.

813-A Summary appraisals of the Nation's ground-water resources--Ohio Region, by R. M. Bloyd, Jr. 1974.

813-J Summary appraisals of the Nation's ground-water resources--Great Lakes Region, by W. G. Weist, Jr. 1978.

Water-Supply Papers

334 The Ohio valley flood of March-April, 1913, including comparisons with some earlier floods, by A. H. Horton and H. J. Jackson. 1913.

800 The floods of March 1936--Part 3, Potomac, James, and upper Ohio Rivers, by N. C. Grover, with a section on weather associated with the floods of March 1936, by Stephen Lichtblau. 1937.

838 Floods of Ohio and Misissippi Rivers, January-February 1937, by N. C. Grover, with a section on flood deposits of the Ohio River, January-February 1937, by G. R. Mansfield. 1938.

869 Flood of August 1935 in the Muskingum River basin, Ohio, by C. V. Youngquist and W. B. Langbein. 1941.

999 Ground-water resources of the Cincinnati area, Butler and Hamilton Counties, Ohio, by F. H. Klaer, Jr., and D. G. Thompson. 1948.

1460-E Geological and geophysical study of the preglacial Teays valley in west-central Ohio, by S. E. Norris and H. C. Spicer. 1958.

1619-A Hydrogeology of a spring in a glacial terrane near Ashland, Ohio, by S. E. Norris. 1963.

1750-A Floods of January-February 1959 in Ohio and adjacent states, by E. L. Hendricks. 1964.

1798-I Fluvial sediment in Hocking River subwatershed 1 (North Branch Hunters Run, Hocking County), Ohio, by R. F. Flint. 1972.

1808 Ground-water resources of the Dayton area (Montgomery County), Ohio, by S. E. Norris and A. M. Spieker. 1966.

1840-A Floods of March 1964 along the Ohio River, by H. C. Beaber and J. O. Rostvedt. 1965.

1859-C Analysis of water quality of the Mahoning River in Ohio, by G. A. Bednar, C. R. Collier, and W. P. Cross. 1968.

1872 Hydrogeology of the Scioto River valley near Piketon (Pike County), Ohio, by S. E. Norris and R. E. Fidler. 1969.

1893 Potential development and recharge of ground water in Mill Creek valley, Butler and Hamilton Counties, Ohio, based on analog model analysis, by R. E. Fidler. 1970.

2045 Fluvial sediment in Ohio, by P. W. Anttila and R. L. Tobin. 1978.

Bulletins

1133-A Geology and hydrology of the Piqua area (Miami County), Ohio, by S. E. Norris and A. M. Spieker. 1961.

Circulars

177 Water resources of the Mahoning River basin, Ohio, with special reference to the Youngstown area, by W. P. Cross, M. E. Schroeder, and S. E. Norris. 1952.

340 Water resources of the Wheeling-Steubenville area, West Virginia and Ohio, by R. C. Smith, W. L. Doll, and Garland Stratton. 1955.

418 Floods of January-February 1959 in Ohio, by W. P. Cross and H. P. Brooks. 1959.

526 Stream quality in Appalachia as related to coal-mine drainage, 1965, by J. E. Biesecker and J. R. George. 1966.

546 Time of travel of water in the Great Miami River, Dayton to Cleves, Ohio, by D. P. Bauer. 1968.

719 The National Stream Quality Accounting Network (NASQAN)--Some questions and answers, by J. F. Ficke and R. O. Hawkinson. 1975.

Journal of Research of the U.S. Geological Survey

Norris, S. E., 1974, Regional flow system and ground-water quality in western Ohio: U.S. Geological Survey Journal of Research, v. 2, no. 5, p. 527-531.

Hydrologic Investigations Atlases

40 Floods at Mount Vernon (Knox County), Ohio, by G. W. Edelen, Jr., F. H. Ruggles, Jr., and W. P. Cross. 1961 (revised 1964).

43 Floods at Springfield (Clark County), Ohio, in 1913 and 1959, by G. W. Edelen, Jr., F. H. Ruggles, Jr., and W. P. Cross. 1961.

44 Floods at Newark (Licking County), Ohio, by G. W. Edelen, Jr., F. H. Ruggles, Jr., and W. P. Cross. 1962 (revised 1964).

45 Floods at Chillicothe (Ross County), Ohio, by G. W. Edelen, Jr., F. H. Ruggles, Jr., and W. P. Cross. 1964.

46 Floods at Zanesville (Muskingum County), Ohio, by G. W. Edelen, Jr., F. H. Ruggles, Jr., and W. P. Cross. 1964.

47 Floods at Fremont (Sandusky County), Ohio, by G. W. Edelen, Jr., F. H. Ruggles, Jr., and W. P. Cross. 1962.

48 Floods at Circleville (Pickaway County), Ohio, by G. W. Edelen, Jr., F. H. Ruggles, Jr., and W. P. Cross. 1964.

49 Floods of Barberton (Summit County), Ohio, by G. W. Edelen, Jr., F. H. Ruggles, Jr., and W. P. Cross. 1962.

50 Floods at Canton (Stark County), Ohio, by G. W. Edelen, Jr., W. P. Somers, and W. P. Cross. 1962.

51 Floods at Warren (Trumbull County), Ohio, by G. W. Edelen, Jr., F. H. Ruggles, Jr., and W. P. Cross. 1963.

52 Floods at Columbus (Franklin County), Ohio, by G. W. Edelen, Jr., F. H. Ruggles, Jr., W. P. Somers, and W. P. Cross. 1962.

56 Floods on Crab Creek at Youngstown (Mahoning County), Ohio, by G. W. Edelen, Jr., W. P. Cross, and W. P. Somers. 1963.

198 Water resources of the Appalachian Region, Pennsylvania to Alabama, by W. J. Schneider and others. 1965.

295 Ground-water resources of the Appalachian region, by G. G. Wyrick. 1968.

324 Floods at Amesville (Athens County), Ohio, by R. I. Mayo and E. E. Webber. 1969.

325 Floods at Jackson (Jackson County), Ohio, by E. E. Webber and R. I. Mayo. 1968.

341 Hydrogeology of the Berea and Cussewago Sandstones in northeastern Ohio, by J. L. Rau. 1969.

366 Saline ground-water resources of Ohio, by A. C. Sedam and R. B. Stein. 1970.

494 Hydrogeology of the Pottsville Formation in northeastern Ohio, by A. C. Sedam. 1973.

Miscellaneous Investigations Series

316 Glacial map of Ohio, by R. P. Goldthwait, G. W. White, and J. L. Forsyth. 1961 (revised in part, 1967).

Hydrologic Unit Map

U.S. Geological Survey, 1974, Hydrologic unit map of Ohio. An overprint of the 1:500,000 scale state base map. No contours. Sheet is 36 by 40 inches. 1951 base, drainage modified in 1974. This map and accompanying table show hydrologic units that are basically hydrographic in nature. The Cataloging Units shown supplant those previously used by the U.S. Geological Survey in its Catalog of Information on Water Data (1966-72).

Open-File Reports of the U.S. Geological Survey

Open-file reports are available for inspection at the Columbus, Ohio and Reston, Virginia offices of the U.S. Geological Survey. For information about purchasing these reports, contact the Open-File Services Section, Western Distribution Branch, U.S. Geological Survey, Box 25425, Federal Center, Denver, CO 80225, telephone (303) 236-7476.

Unnumbered Open-File Reports

Anttila, P. W., 1970, A proposed streamflow program for Ohio.

Cross, W. P., 1967, Flood of July 12, 1966, in the vicinity of Sandusky (Huron County), Ohio.

Deutsch, Morris, and Wallace, J. C., 1966, Six illustrations showing water-resources information on Maumee River basin, Ohio.

Feulner, A. J., 1960, The ground-water resources of Champaign County, Ohio.

Mayo, R. I., Webber, E. E., and Ellis, D. W., 1971, Floods of July 4-8, 1969, in north-central Ohio.

U.S. Geological Survey, 1961-64, Surface-water records of Ohio. (published annually)

----- 1964, Water-quality records of Ohio.

----- 1965-74, Water-resources data for Ohio--Part 1, Surface-water records; Part 2, Water-quality records. (published annually)

Webber, E. E., and Mayo, R. I., 1970, Flood of July 5, 1969, in the vicinity of Wooster (Wayne County), Ohio.

----- 1971, Low-flow study for southwest Ohio streams.

Numbered Open-File Reports

76-768 Floods in Ohio--magnitude and frequency, by E. E. Webber and W. P. Bartlett, Jr. 1976.

77-399 Hydraulic analysis, Mad River at State Highway 41, Springfield, Ohio, by R. I. Mayo. 1977.

78-684 Hydrologic environment of the Silurian salt deposits in parts of Michigan, Ohio, and New York, by S. E. Norris. 1978.

79-269 The Silurian salt deposits in eastern Lake, northwestern Ashtabula, and northeastern Geauga Counties, Ohio, by S. E. Norris. 1978.

81-343 Hydrology of Area 4, Eastern Coal Province, Pennsylvania, Ohio, and West Virginia, by D. K. Roth, M. J. Engelke, Jr., and others. 1981.

81-350 Hydraulic analysis, Paint Creek at State Route 772, Chillicothe, Ohio, by R. I. Mayo and W. P. Bartlett, Jr. 1981.

81-409 Assessment of water quality in streams draining coal-producing areas in Ohio, by C. L. Pfaff, D. R. Helsel, D. P. Johnson, and C. G. Angelo. 1981.

81-414 Flood of August 20, 1979, on a tributary of Chickamauga Creek, near Gallipolis, Ohio, by R. I. Mayo and E. E. Webber. 1981.

81-815 Hydrology of Area 7, Eastern Coal Province, Ohio, by M. J. Engelke, Jr., D. K. Roth, and others. 1981.

81-913 Ground-water hydrology of strip-mine areas in eastern Ohio, by J. O. Helgesen and A. C. Razem. 1981.

81-919 Ground-water quality in the vicinity of landfill sites, southern Franklin County, Ohio, by J. T. de Roche and A. C. Razem, 1981.

81-1105 Floodflow characteristics related to channel geometry in Ohio, by E. E. Webber and J. W. Roberts. 1981.

81-1195 Low-flow characteristics of Ohio streams, by D. P. Johnson and K. D. Metzker. 1981.

82-109 Potential impacts of a proposed reservoir on hydrologic and water-quality conditions in Little Rush Creek watershed, Fairfield County, Ohio, by Janet Hren and R. L. Jones. 1982.

82-170 Water resources of the Black Hand Sandstone Member of the Cuyahoga Formation and associated aquifers of Mississippian age in southeastern Ohio, by S. E. Norris and G. C. Mayer. 1982.

83-217 Drift mine reclamation in Big Four Hollow near Lake Hope, Ohio -- A preliminary data report, by V. E. Nichols. 1983.

84-233 Hydrology of Area 11, Eastern Coal Province, Ohio, Kentucky, and West Virginia, by D. K. Roth and S. C. Cooper. 1984.

84-249 Chemical and biological quality of selected lakes in Ohio, 1978 and 1979, by C. G. Angelo and J. D. Youger (in press).

83-681 Guidelines for use of water-quality monitors, by A. B. Gordon and M. S. Katzenbach. 1983.

84-470 Preliminary report on a study to estimate flood volumes of small rural streams in Ohio -- Methods, site selection, and data base, by J. M. Sherwood (in press).

84-619 Literature review and need for additional study of surface-water quality in the Cuyahoga Valley National Recreation Area, Ohio, by C. J. Oblinger Childress. 1984.

84-824 Low-flow data for selected partial-record stations in Ohio, by R. R. Schwartz. 1985.

Water-Resources Investications Reports of the U.S. Geological Survey

Reports in this series are available for inspection at the Columbus, Ohio, and Reston, Virginia offices of the U.S. Geological Survey. Information about purchasing these reports may be obtained from the District Chief, Water Resources Division, in Columbus.

17-73 Availability of water from limestone and dolomite aquifers in southwest Ohio and the relation of water quality to the regional flow system, by S. E. Norris and R. E. Fidler. 1973.

18-75 Digital model simulation of the glacial-outwash aquifer at Dayton, Ohio, by R. E. Fidler. 1975.

76-50 Time of travel of solutes in selected reaches of the Sandusky River basin, Ohio, 1972 and 1973, by A. O. Westfall. 1976.

77-23 Time of travel of solutes in the Tuscarawas River basin, Ohio, August and September 1974, by A. O. Westfall and E. E. Webber. 1977.

77-76 Water quality of the glacial-outwash aquifer in the Great Miami River basin, Ohio, by K. F. Evans. 1977.

77-105 Limnology of selected lakes in Ohio, 1975, by R. L. Tobin and J. D. Youger. 1977.

78-109 Chemical and biological quality of selected lakes in Ohio, 1976 and 1977, by R. L. Tobin and J. D. Youger. 1979.

79-17 Water-quality assessment of Rattlesnake Creek watershed, Ohio, by K. F. Evans and R. L. Tobin. 1979.

80-28 Ground-water conditions in Geauga County, Ohio, 1978, by V. E. Nichols. 1980.

80-56 A model for flow through a glacial-outwash aquifer in southeast Franklin County, Ohio, by E. J. Weiss and A. C. Razem. 1980.

81-17 Water use in Ohio, 1975, by R. M. Hathaway and Michael Eberle. 1981.

82-4019 Model modifications for simulation of flow through stratified rocks in eastern Ohio, by J. O. Helgesen, S. P. Larson, and A. C. Razem. 1982.

82-4044 Flood of June 13-15, 1981, in the Blanchard River basin, northwestern Ohio, by E. E. Webber. 1982.

83-4022 Simulations of nonsteady flow in a glacial-outwash aquifer, southern Franklin county, Ohio, by A. C. Razem. 1983.

83-4130 Effects of relocating State Route 151 on the flood profiles of Conotton Creek and its tributaries between Bowerston and Scio, Ohio, by W. P. Bartlett, Jr., and others. 1984.

83-4155 Ground-water hydrology before, during, and after coal strip mining of a small watershed in Coshocton County, Ohio, by A. C. Razem. 1983.

83-4192 Measurement of the reaeration coefficients of the North Fork Licking River at Utica, Ohio, by radioactive tracers, by Janet Hren. 1983.

83-4215 Ground-water hydrology and quality before and after strip mining of a small watershed in Jefferson County, Ohio, by A. C. Razem. 1984.

84-4024 Water use in Ohio, 1980, by Michael Eberle and J. A. McClure. 1984.

84-4061 Overview of surface-water quality in Ohio's coal region, by Susan Westover and Michael Eberle. (in press).

84-4117 A statistical approach to evaluate the relation of coal mining, land reclamation, and surface-water quality in Ohio, by Janet Hren, K. S. Wilson, and D. R. Helsel. 1984.

84-4139 Determination of reaeration coefficients for Ohio streams, by Janet Hren. 1984.

84-4179 Effects of surface coal-mine reclamation on stream quality in a small watershed near Nelsonville, southeastern Ohio, by S. M. Hindall. 1984.

84-4212 Classification of stream basins in southeastern Ohio according to extent of surface coal mining, by C. J. Oblinger Childress. 1985.

84-4238 Water quality of a stream-aquifer system, southern Franklin County, Ohio, by J. T. de Roche and A. C. Razem. 1984.

84-4276 Flood-profile analysis, Big Darby Creek at State Route 762, Orient, Ohio, by W. P. Bartlett, Jr., and J. M. Sherwood. 1984.

84-4314 Chemical and isotopic characteristics of brines from three oil- and gas-producing formations in eastern Ohio, with applications to the geochemical tracing of brine sources, by K. J. Breen, C. G. Angelo, R. W. Masters, and A. C. Sedam. 1985.

84-4336 Contributions of suspended sediment by highway construction and other land uses to the Olentangy River, Columbus, Ohio, by D. R. Helsel. 1985.

Publications of the Ohio Department of Natural Resources, Division of Water, Prepared by or in Cooperation with the U S. Geological Survey

These reports may be obtained from the Chief, Division of Water, who can furnish a more complete list of reports of the Ohio Department of Natural Resources, or they may be consulted in the offices of the Chief, Division of Water, or of the District Chief, Water Resources Division, U.S. Geological Survey, at the address given in this report.

Archer, R. J., 1960, Sediment discharge of Ohio streams during floods of January-February 1959: Miscellaneous Report 13.

Cross, W. P., 1961, Floods of January-February 1959 in Ohio: Bulletin 35.

----- 1963, Low-flow frequencies and storage requirements for selected Ohio streams: Bulletin 37.

----- 1964, Floods of March 1963 in Ohio: Bulletin 38.

----- 1964, Floods of March 1964 in Ohio: Bulletin 39.

----- 1965, Low-flow frequency and storage-requirement indices for Ohio streams: Bulletin 40.

----- 1966, Flood of July 23, 1965, in the vicinity of Hillsboro (Highland County), Ohio: Miscellaneous Report 16.

----- 1967, Drainage areas of Ohio streams, supplement to Gazetteer of Ohio streams: Inventory Report 12a.

----- 1968, Flow duration of Ohio streams, based on gaging-station records through 1965: Bulletin 42.

Cross, W. P., and Hedges, R. E., 1959, Flow duration of Ohio streams: Bulletin 31.

Cross, W. P., and Mayo, R. I., 1969, Floods in Ohio, magnitude and frequency--Supplement to Bulletin 32 (Cross and Webber, 1959): Bulletin 43.

Cross, W. P. and Webber, E. E., 1950, Ohio streamflow characteristics--Part 2, Water supply and storage requirements: Bulletin 13.

----- 1959, Floods in Ohio--Magnitude and frequency: Bulletin 32.

Cummins, J. W., and Sanderson, E. E., 1947, The water resources of Tuscarawas County, Ohio: (Ohio Water Resources Board) Bulletin 6.

Dove, G. D., 1960, Water resources of Licking County, Ohio: Bulletin 36.

----- 1961, A hydrologic study of the valley-fill deposits in the Venice area (Butler County), Ohio: Technical Report 4.

Hubble, J. H., and Collier, C. R., 1960, Quality of surface waters in Ohio, 1946-58: Inventory Report 14.

Kaser, Paul, and Harstine, L. J., 1965, Ground-water levels in Ohio, October 1959-September 1964: Bulletin 41.

Lamar, W. L, and Schroeder, M. E., 1951, Chemical character of surface waters in Ohio, 1946-50: Bulletin 23.

Norris, S. E., 1959, The water resources of Madison County, Ohio: Bulletin 33.

----- 1959, Vertical leakage through till as a source of recharge to a buried-valley aquifer at Dayton (Montgomery County), Ohio: Technical Report 2.

Norris, S. E., Cross, W. P., and Goldthwait, R. P., 1948, The water resources of Montgomery County, Ohio: (Ohio Water Resources Board) Bulletin 12.

----- 1950, The water resources of Greene County, Ohio: Bulletin 19.

Norris, S. E., Cross, W. P., Goldthwait, R. P. and Sanderson, E. E., 1952, The water resources of Clark County, Ohio: Bulletin 22.

Ohio Department of Natural Resources, Division of Water, 1970, Ground water for planning in northwest Ohio--A study of the carbonate rock aquifers: Inventory Report 22.

Schaefer, E. J., White, G. W., and Van Tuyl, D. W., 1946, The ground-water resources of the glacial deposits in the vicinity of Canton (Stark County), Ohio: (Ohio Water Resources Board) Bulletin 3.

Schmidt, J. J., 1958, The ground-water resources of Franklin County, Ohio: Bulletin 30.

Smith, R. C., and White, G. W., 1953, The ground-water resources of Summit County, Ohio: Bulletin 27.

Walton, W. C., 1953, The hydraulic properties of a dolomite aquifer underlying the village of Ada (Hardin County), Ohio: Technical Report 1.

Walton, W. C., and Scudder, G. D., 1960, Ground-water resources of the valley-train deposits in the Fairborn area (Greene County), Ohio: Technical Report 3.

Winslow, J. D., White, G. W., and Webber, E. E., 1953, The water resources of Cuyahoga County, Ohio: Bulletin 26.

Other Publications

Address inquiries about availability of these reports and papers to the publishers.

Crouch, T. M., Collins, H. R., and Helgesen, J. O., 1980, Abandoned subsurface coal mines as a source of water for coal conversion in eastern Ohio: Ohio Department of Natural Resources Division of Geological Survey Report of Investigations 118.

Deutsch, Morris, Dove, G. D., Jordan, P. R., and Wallace, J. C., 1967, Ground-water distribution and potential in the Ohio River basin: U.S. Army Corps of Engineers, Ohio River Basin Comprehensive Survey, v. VII, app. E--Ground Water.

Dove, G. D., 1960, Drainage of the Teays-stage Mount Vernon and Cambridge Rivers: Ohio Journal of Science, v. 60, no. 2, p. 122-124.

----- 1962, Ground-water resources, in Geology of Fairfield County: Ohio Department of Natural Resources Division of Geological Survey Bulletin 60.

Feulner, A. J., 1961, Cyclic-fluctuation methods for determining permeability as applied to valley train in the Mad River valley in Champaign County, Ohio: Ohio Journal of Science, v. 61, no. 2, p. 99-106.

Feulner, A. J., and Hubble, J. H., 1960, Occurrence of strontium in the surface and ground waters of Champaign County, Ohio: Economic Geology, v. 55, no. 1, p. 176-186.

Hamon, W. R., Haghiri, Faz, and Knochenmus, Darwin, 1977, Research on the hydrology and water quality of watersheds subjected to surface mining, in Fifth Symposium on Surface Mining and Reclamation: Louisville, Ky., National Coal Association and Bituminous Coal Research Inc., p. 37-40.

Hamon, W. R., Bonta, J. V., Haghiri, Faz, and Helgesen, J. O., 1979, Research on the hydrology and water quality of watersheds subjected to surface mining, I--Premining hydrology and water quality conditions, in Coal Conference and Expo V, Symposium on Surface Coal Mining and Reclamation, Louisville, Ky.: Coal Age, p. 70-98.

Helgesen, J. O., and Razem, A. C., 1980, preliminary observation of surface-mine impacts on ground water in two small watersheds in eastern Ohio, in Symposium on Surface Mining Hydrology, Sedimentation and Reclamation: Lexington, Kentucky, University of Kentucky and Institute for Mining and Minerals Research.

Helsel, D. R., and Pfaff, C. L., 1982, Surface-water quality in coal regions of Ohio, in Proceedings, Abandoned Mine Reclamation Symposium, St. Clairsville, Ohio, November 3-5, 1982: Soil Conservation Society of America, All-Ohio Chapter, p. 2/1-2/7.

Nichols, V. E., 1982, Drift mine reclamation in Big Four Hollow near Lake Hope, Ohio -- An overview of preliminary data, in Proceedings, Abandoned Mine Reclamation Symposium, St. Clairsville, Ohio, November 3-5, 1982: Soil Conservation Society of America, All-Ohio Chapter, p. 16/1-16/9.

Norris, S. E., 1957, Characteristics of limestone and dolomite aquifers in western Ohio: Journal of the American Water Works Association, v. 49, no. 4, p. 464-468.

----- 1959, Buried topography and its relation to an important aquifer in Franklin County, Ohio: Ohio Journal of Science, v. 59, no. 6, p. 341-343.

----- 1967, Effects on ground-water quality and induced infiltration of wastes disposed into the Hocking River at Lancaster (Fairfield County), Ohio: Ground Water, v. 5, no. 3, p. 15-19.

----- 1967, The ground-water situation in Ohio: Ohio Chamber of Commerce.

----- 1969, The ground-water situation in Ohio: Ground Water, v. 7, no. 5, p. 25-33.

----- 1975, The ground-water situation in the Circleville area (Pickaway County), south-central Ohio: Ohio Department of Natural Resources Division of Geological Survey Report of Investigations 96.

----- 1976, Change in drawdown caused by enlarging a well in a dolomite aquifer: Ground Water, v. 14, no. 4, p. 191-193.

----- 1979, Hydraulic properties of a limestone-dolomite aquifer near Marion, north-central Ohio: Ohio Department of Natural Resources Division of Geological Survey Report of Investigations 110.

----- 1983a, Aquifer tests and well field performance, Scioto River valley, Ohio; Part I: Ground Water, v. 21, no. 3, p. 287-92.

----- 1983b, Aquifer tests and well field performance, Scioto River valley, Ohio; Part II: Ground Water, v. 21, no. 4, p. 438-44.

Norris, S. E., and Eagon, H. B., Jr., 1971, Recharge characteristics of a watercourse aquifer system at Springfield (Clark County), Ohio: Ground Water, v. 9, no. 1, p. 30-41.

Norris, S. E., and Fidler, R. E., 1966, Use of type curves developed from electric analog studies of unconfined flow to determine the vertical permeability of an aquifer at Piketon (Pike County), Ohio: Ground Water, v. 4, no. 3, p. 43-48.

Razem, A. C., 1982, Comparisons of premining, mining, and postmining ground-water conditions in three small watersheds in eastern Ohio: Geological Society of America Abstracts with Programs, v. 15, no. 7.

----- 1983, Ground-water monitoring of three small surface-mined watersheds of eastern Ohio (abstract): Ground Water Monitoring Review, v. 3, no. 1, p. 153.

Razem, A. C., and Helgesen, J. O., 1981, Preliminary observation of surface-mine impacts on ground water in two small watersheds in eastern Ohio (abstract), in Indiana Water Resources Second Annual Symposium, Spencer, Indiana.

White, G. W., 1951, Illinoian and Wisconsin drift of the southern part of the Grand River lobe in eastern Ohio: Geological Society of America Bulletin, v. 62, no. 9, p. 967-977.

----- 1953, Sangamon soil and early Wisconsin loesses at Cleveland (Cuyahoga County), Ohio: American Journal of Science, v. 251, no. 5, p. 362-368.

☆ U.S. GOVERNMENT PRINTING OFFICE 1985 - 561-928/21684