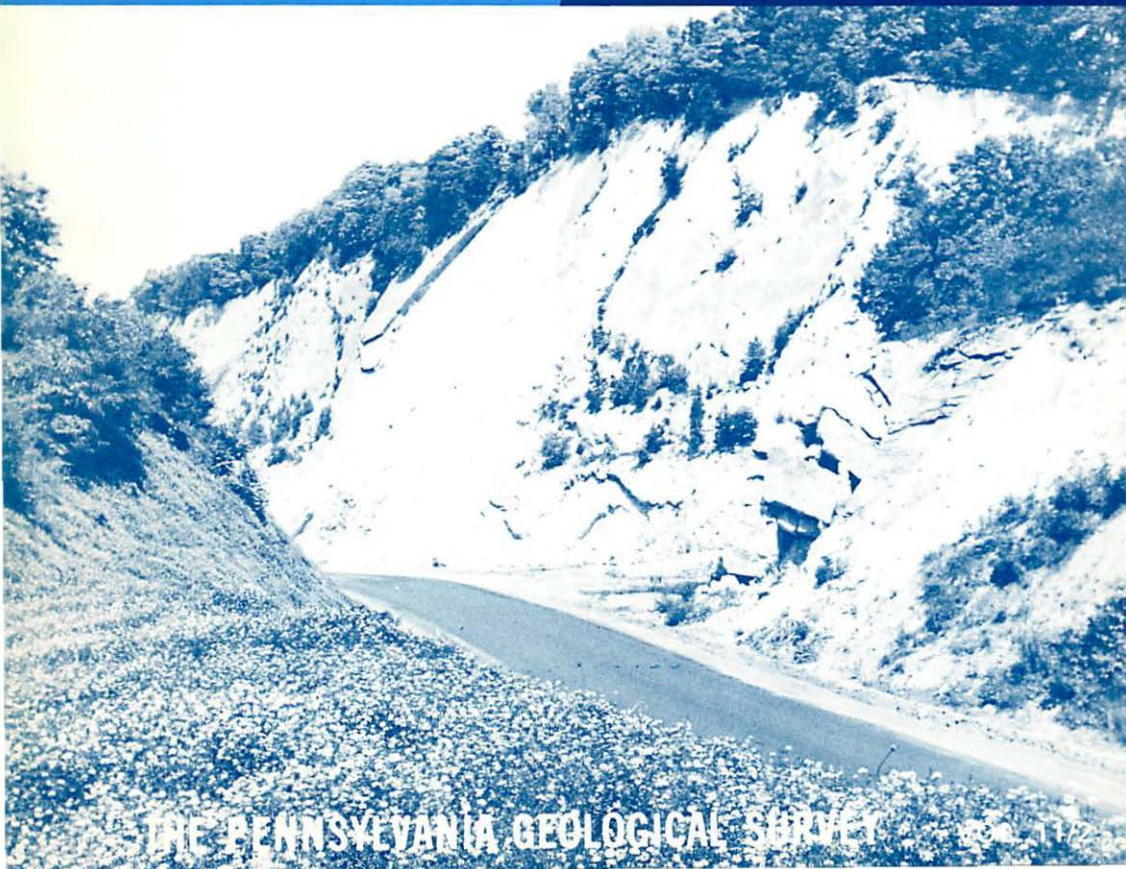
GEOLOGY PENNSYLVANIA



THE PENNSYLVANIA GEOLOGICAL SURVEY

COMMONWEALTH OF PENNSYLVANIA
Richard L. Thornburgh, Governor

DEPARTMENT OF ENVIRONMENTAL RESOURCES
Clifford L. Jones, Secretary

TOPOGRAPHIC AND GEOLOGICAL SURVEY
Arthur A. Socolow, State Geologist

CONTENTS

ON THE COVER: View of entrance to a quarry in the Oriskany Formation near Mapleton, Pa. (Huntingdon County). This pure silica sandstone is a highly desirable raw material for the manufacture of glass. Photo courtesy of Commonwealth Photographic Services, Pa. Dept. of Transportation.

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Editor, Arthur A. Socolow; Associate Editor, Donald M. Hoskins.

APRIL 1980

FROM THE DESK
OF THE
STATE GEOLOGIST . . .

EVERY PLACE IS SOMEBODY'S BACKYARD

It was most appropriate that the 1980 meeting of the Pennsylvania Environmental Council focused on the theme "Hazardous Wastes: Everybody's Worry." Pennsylvania, and particularly DER, has in recent years become acutely aware that there is a serious problem with certain industrial and municipal wastes that must be resolved in the near future in order to safeguard the health of present and future generations. The recent illegal dumping of toxic liquids into anthracite mine voids, with subsequent pollution of the Susquehanna River, was the latest, well publicized such event in Pennsylvania. And of course, the Love Canal situation of upper New York is another highly publicized pollution situation. But the problem is not one of isolated occurrences; on one scale or another it is part of our daily industrial and municipal activities. Included in this list must be the problem of large-scale sewage sludge disposal with its heavy metals content; the federal government has set a date when ocean dumping must cease.

While Pennsylvania is properly moving with new legislation on the subject, the basic challenge is to find a solution to the problem. Wastes are endemic to the life process itself. It is excess waste which poses the first hazard and it is manufactured wastes which natural processes are incapable of neutralizing that result in the greatest hazards to man and the environment.

While in recent years much attention has been focused on the issue of high-level nuclear waste disposal, in terms of daily volumes created, geographical extent of the problem, and numbers of people affected, the disposal of non-nuclear hazardous wastes is by far the most extensive and challenging environmental problem facing our society.

The serious investigations and research which have been initiated on this subject invariably focus quickly on the fact that geology must and will play a major role in alternative solutions for hazardous waste disposal. This calls for accurate data on the location and characteristics of our rock formations, both on the surface and in depth. There are not only opportunities, but urgent need for sophisticated research into the physical and chemical characteristics of the various rock types.

While some of the wastes may be neutralized by industrial or chemical processing, there will be a major need for acceptable disposal sites where the conditions will eliminate or minimize the hazards to man. Geologists must help find those sites. We recognize that the final choices will involve other factors in addition to geology, but the responsibility for geologists is a major one.

As we noted at the PEC Conference, no one wants the wastes in their backyard. But everyplace is somebody's backyard. Geologists can help point to the safest ones.

Arthur A. Socolow

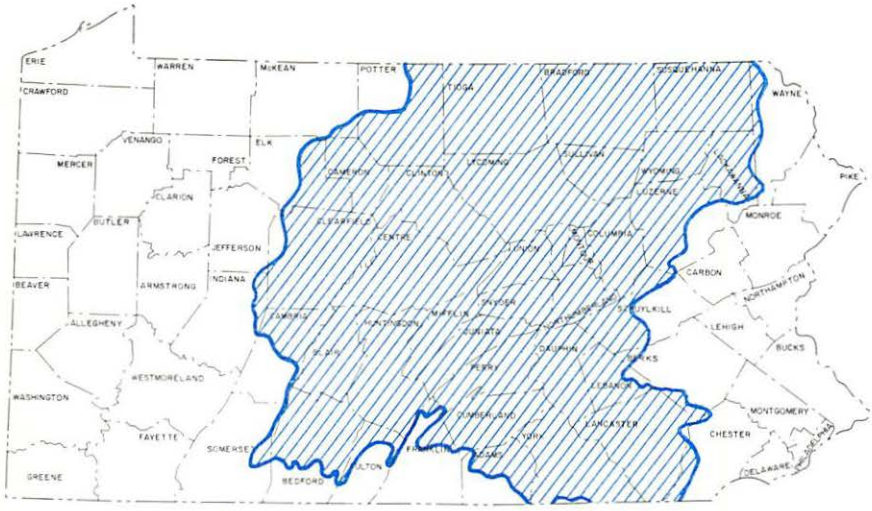
SURVEY TO PARTICIPATE IN MAJOR GROUNDWATER STUDY

The Pennsylvania Geological Survey and the Susquehanna River Basin Commission (SRBC) have begun a jointly funded groundwater study of the Pennsylvania portion of the Susquehanna River Basin. The project leader of the study is Larry Taylor, senior groundwater geologist of the Pennsylvania Survey. He is assisted by three SRBC geologists who have been employed specifically for this project. The study, a three-year project, is headquartered in the Survey offices in Harrisburg.

An important objective of the project is the collection and assimilation of the large amount of data and information that is needed to plan for the proper utilization and management of groundwater resources of the basin. The collected information will be used to prepare a series of reports to be published by the SRBC. The occurrence and availability of groundwater as related to geology, topography, and climate in addition to the natural or existing water quality of each aquifer or aquifer system will be described in the reports. The Pennsylvania Geological Survey will also utilize the data to prepare a series of groundwater summary reports for use by county and local officials, planners, and developers.

This project is part of a larger, four-year study of groundwater in the Susquehanna River Basin. Agencies from the states of Maryland, New York, Pennsylvania and the United States Geological Survey are cooperating with the SRBC in this effort. Several types of projects are planned including modeling of groundwater in high groundwater-use areas, concentrated evaluations of areas having the potential for the development of large quantities of groundwater for use in water supply or low flow augmentation, and large scale resource summaries for the primarily rural parts of the basin.

Additional information about the project may be obtained from Jerrald Hollowell of the SRBC, the study manager, or Larry Taylor at the Survey.



Susquehanna River Basin in Pennsylvania

CONTROL OF LAKE ERIE LEVEL BEING STUDIED

by John H. Barnes

Seven years ago, an article in *Pennsylvania Geology* reported on record high levels that were reached by Lake Erie (Barnes, 1973). An all-time record high lake level was reached in June of 1973, 2.5 feet above the normal June level of the lake. A decline in lake level began at that time, as the annual cycle of lake levels usually reaches a maximum in June. Monthly records continued to be broken, however, until November, when the lake was below the record-setting level it had reached the previous November. However, over the past seven years, the lake has still not reached its normal level. As of November 1979, it is 1.4 feet above the normal level for the month, and only 0.7 feet below the record for the month (Fig. 1).

There are essentially three types of variations noted in the level of Lake Erie. Short-term variations, often lasting hours or, at most, days, are the result of storms producing sustained high winds that

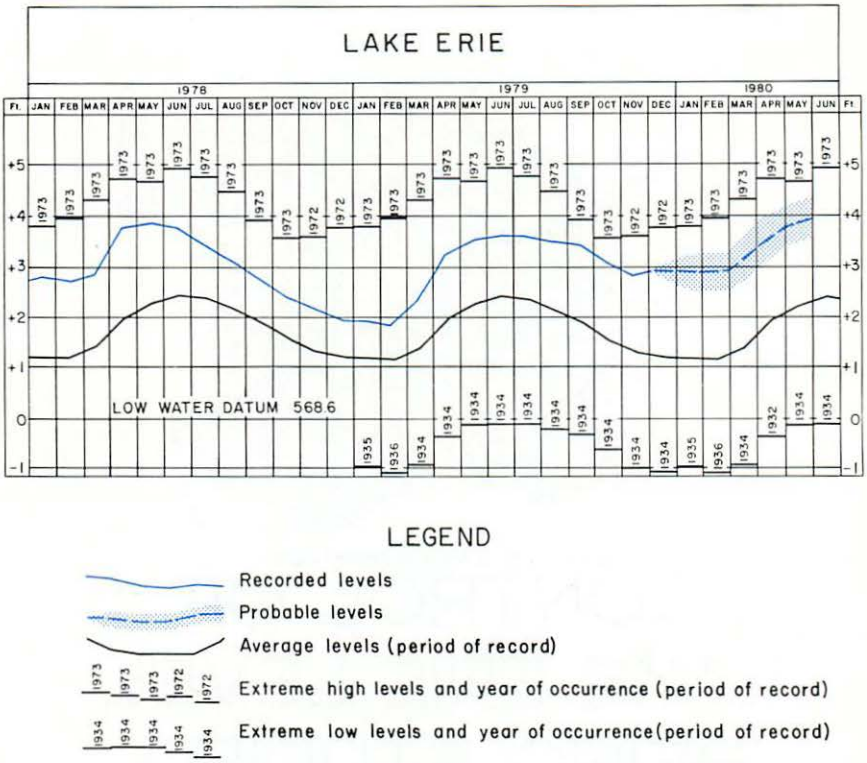


Figure 1

effectively tilt the lake level, producing low water at the windward end of the lake and high water at the leeward end.

Annual variations in the lake level are somewhat predictable (see Fig. 1) and generally follow a cycle with a maximum in June and a minimum in February, reflecting seasonal variations in precipitation and runoff.

Long-term variations are irregular and less predictable. The current high-water trend, which began in the late 1960's and reached its peak in 1973, was preceded by a period of low water in the early 1960's. Factors that influence these trends are variations in precipitation on the drainage basin, evaporation, and the inflow and outflow of the lake.

Extremely high or low lake levels can have serious consequences for those who use or reside near the lake. Water levels that are too

high can result in increased occurrence of storm-related floods in low-lying areas, and accelerated erosion of shoreline property (Fig. 2). Levels that are too low can reduce hydroelectric power generation capacity and interfere with navigation and commerce by not allowing ships to be loaded to capacity.

Because of the seriousness of these problems, the International Joint Commission, a bilateral commission of Canada and the United States responsible for overseeing boundary waters issues, is currently studying the possibility of partial regulation of Lake Erie water levels. The study is considering only the reduction of long-term high water levels, such as has been experienced through most of the 1970's. Such reduction would be accomplished through some form of channel enlargement with a related control structure at Buffalo to increase the outflow from Lake Erie into the Niagara River. Depending on the alternatives found feasible, the outflow could be increased as much as 30,000 cubic feet per second. A preliminary study has shown that this increase in capacity could have reduced the maximum level of 1973 by 1.3 feet.

Figure 2. Erosion of unconsolidated material along the Lake Erie shore. The large semi-circular gaps are places where trees were undermined by erosion and fell to the beach below.

The study is concerned with methods of regulation, economic feasibility, and effects on power generation, navigation, shoreline erosion and flooding, and environmental effects. Consideration must also be given to the effects on water levels in Lake Ontario and the St. Lawrence River.

The study is seeking public response to the proposals, and will be issuing newsletters on the subject in the spring and summer of 1980. For additional information, or to comment, write to Public Affairs Office, U.S. Corps of Engineers, Buffalo District, 1776 Niagara Street, Buffalo, NY 14202.

REFERENCES

Barnes, J. H. (1973) *Lake Erie reaches record high level*, Pa. Geology, v. 4, n. 3, p. 2-4.

International Lake Erie Regulation Study Board (1979), *Lake Erie Water level study*, Newsletter No. 1, Fall 1979.

DEVONIAN ORISKANY SANDSTONE PROJECT ON OPEN FILE

A regional study of the Oriskany Sandstone in the Subsurface of Pennsylvania by Kathleen D. Abel and Louis Heyman was completed this year and is scheduled for publication in late 1980. The study is based on gamma ray log correlations of all available wells in Pennsylvania that penetrate the Oriskany.

The following maps at a scale of 1:1,000,000 are the final products of the Oriskany project:

1) Ridgeley isopach and sub-Onodaga subcrop map
2) Sandstone thickness map
3) Oriskany production map
4) Drilling depth map (shows depth to top of Oriskany)

LOWER SILURIAN MEDINA SANDSTONE PROJECT ON OPEN FILE

The Lower Silurian Medina Sandstone Group is one of the most actively drilled targets for natural gas in Pennsylvania. In 1979, 128 gas wells were successfully completed in Erie County along in this horizon.

Prepared as part of the project are a series of nine regional cross sections defining the regional stratigraphy of the Lower Silurian clastics in Northwestern Pennsylvania. Also included are a series of eleven maps detailing gas production, drilling depth, structure on top of Queenston, a series of isopach maps plus net sand isolith and sand/shale ration of the Medina Group.

Both of these reports are now available for inspection prior to publication at the Pennsylvania Geological Survey, Oil and Gas Geology Division, 1201 Kossman Building, Pittsburgh, PA 15222.

NEW USGS PENNSYLVANIA WATER RESOURCES CHIEF

David E. Click has been named the U.S. Geological Survey's top water-resources official in Pennsylvania, and will direct the USGS cooperative water-investigations and data-management program in the state.

A 20-year veteran with the USGS, Click comes to the Pennsylvania post after serving 2 years as chief of the USGS Water Resources Division's Ohio program. He succeeds Norman H. Beamer, who retired after 32 years with the Survey.

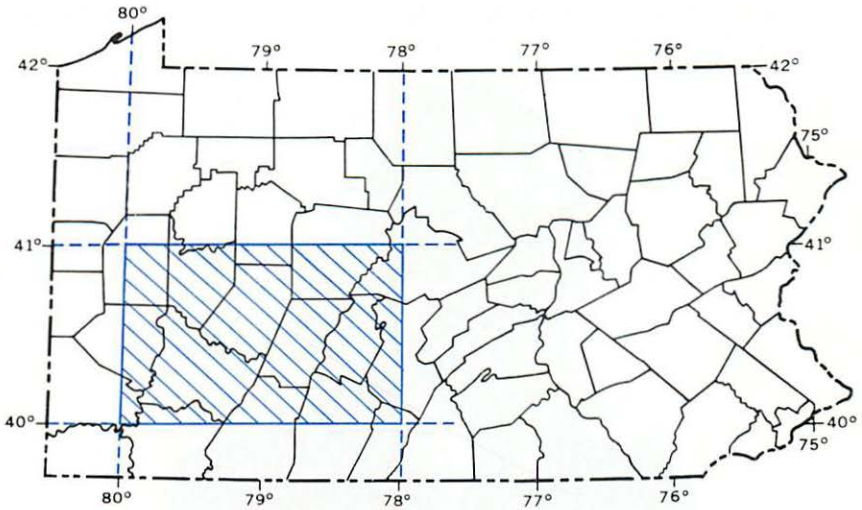
Click directs a staff of more than 100 hydrologists, technicians, and administrative personnel. He administers the USGS water-resources program in cooperation with other federal, state, and local agencies to measure and assess the quantity and quality of the state's surface-water and ground-water resources and to conduct flood and other special interest water studies. The USGS state program operates from headquarters in the Federal Building in Harrisburg, with subdistrict offices in Pittsburgh, Harrisburg, and Malvern, and field offices in Williamsport and Meadville.

The office of David Click also serves as a public liaison for all branches of the U.S. Geological Survey. Should anyone have any matters they wish to direct to the USGS, Dave Click's office can be of service. The address is: David E. Click, Water Resources Division, U.S. Geological Survey, P.O. Box 1107, 4th Floor, Federal Building, 228 Walnut Street, Harrisburg, Pa. 17108.

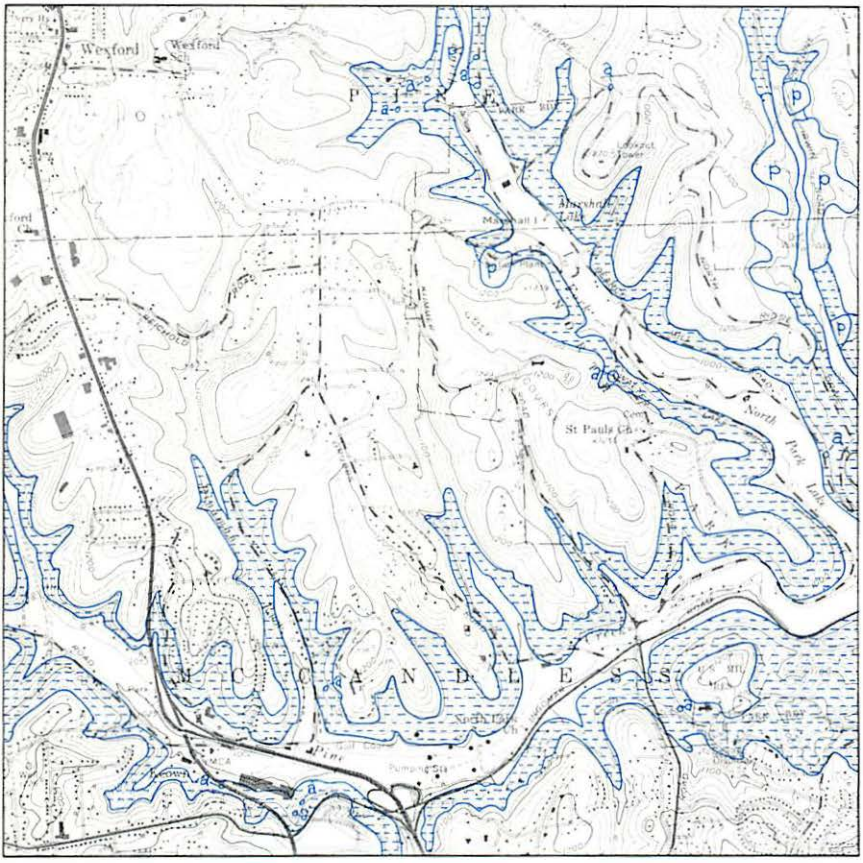
LANDSLIDE MAPS ON OPEN FILE

Maps of landslides and related features in an area covering all of Blair, Cambria, Indiana and Westmoreland counties and portions of Allegheny, Armstrong, Bedford, Butler, Centre, Clarion, Clearfield, Fayette, Fulton, Huntingdon, Jefferson, Somerset, and Washington counties, as shown on the index map below, have been released by the U.S. Geological Survey and are on open file at the office of the Pennsylvania Geological Survey. The maps consist of 128 quadrangles (7½-minute series, 1:24,000 scale) which by different symbols show active or recently active landslides, old landslides, slopes that are susceptible to sliding, slopes with small landslides, areas susceptible to debris flows and debris avalanches, areas susceptible to rockfall, and areas least prone to landslides. The maps were prepared by John S. Pomeroy and William E. Davies of the U.S. Geological Survey.

Depositories for the maps are the U.S. Geological Survey Library, Reston, Virginia and the Pennsylvania Bureau of Topographic and Geologic Survey, 914 Executive House, Second and Chestnut Streets, Harrisburg. The maps will be available for review and inspection at the Bureau offices in Harrisburg and may be copied from mylar originals at the user's expense.



Location of open file maps



Example of landslide mapping from open file map. Not all of the map symbols are shown in this example.

New Survey Report Provides Key To Crawford County Drainage Puzzle

Samuel S. Harrison
Allegheny College

The report on the Geology and Groundwater Resources of Western Crawford County, recently published by the Pennsylvania Topographic and Geologic Survey, provides information from which the location of ancient stream paths can be determined. The basic data in the report, painstakingly compiled by U.S.G.S. geologists George Shiner and Jack Gallaher, includes a map showing the thickness of glacial drift. The areas shown to have more than 100 ft. of drift over bedrock are most likely valleys which existed prior to the end of the Wisconsin glaciation. (Fig. 1).

Some of the NW-SE running valleys in western Crawford County contain in excess of 500' of natural, glacial fill. These filled valleys were the main drainageways in pre-glacial time. Some, such as Cussewago and portions of French Creek, still contain sizeable streams. Others presently carry little surface water (e.g. Conneaut Marsh), and still others are not presently the site of streams. These latter are true buried valleys, giving no hint to their presence except through careful examination of water well records. The drift-thickness map in the new report makes possible the identification of several buried valleys for the first time.

The new report solves an important mystery of local drainage which was pointed out by Leverett in 1902. Leverett noted that the portion of the French Creek channel near Saegertown is within several feet of bedrock, whereas upstream (near Cambridge Springs) and downstream (near Meadville) valley fill exceeds several hundred feet. That there had to be a buried valley which was the connecting link between these two ancestral reaches was evident. Examination of Schiner and Gallaher's drift thickness map now reveals that the mysterious French Creek connection is buried beneath what is now an upland area north of Saegertown. Wells here show over 250' of drift whereas bedrock is usually encountered at 10'-20' depths in the uplands. French Creek now flows in a channel which is within a few feet of bedrock and located only a few thousand feet east of

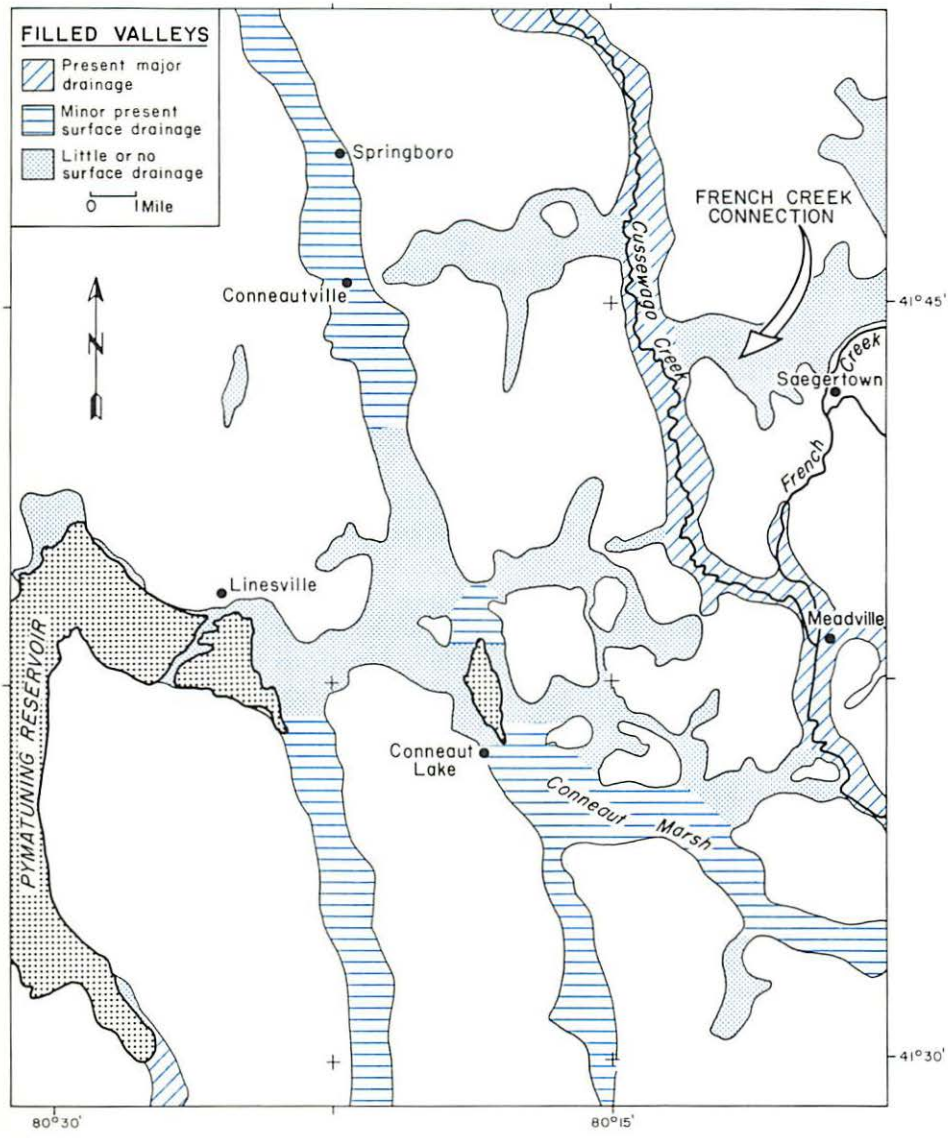


Figure 1. Areas in Western Crawford County where drift is more than 100' thick (from Schiner and Gallaher, 1979). Previously unlocated French Creek connection shows that the juncture of French and Cussewago creeks was once six miles WNW of its present location.

this buried valley connection. It is now apparent that former juncture of French and Cussewago Creeks was some six miles WNW of its present location.

Smaller buried and filled valleys which are tributary to the main ancestral NW-SE valleys are also indicated by the study. One such buried tributary valley became evident after several water wells drilled in a new housing development showed that Pennsylvania sandstone "bedrock," encountered only a few feet below the surface, was underlain by 100'+ of glacial drift. Detailed study showed that a slab of bedrock 2¼ acres in extent had been quarried by the glacier, transported *en masse* for nearly one mile, and deposited near the top of this valley fill sequence (Topp and Harrison, 1975).

It appears from the map (Fig. 1) that preglacial valleys which had an orientation roughly parallel to the direction of ice flow (NW-SE) were not completely filled, but remain as present-day surface drainageways. Those preglacial valley reaches which were oriented perpendicular to the ice flow, however, appear to have been completely filled in. They are now buried valleys which carry little if any surface drainage.

Besides providing important clues for those interested in deciphering earlier drainage systems in western Crawford County, the Water Resources Report 46 also has very practical implications for future land use. In many places the sediment sequences in these filled and buried valleys provide excellent aquifers. Large industrial water wells in these valleys yield as much as 2,000 gpm whereas very few bedrock wells in the area yield more than 100 gpm.

REFERENCES CITED

Leverett, Frank, 1902, *Glacial formations and drainage features of the Erie and Ohio Basins.* United States Geolgical Survey. Monograph 41,802p.

Schiner, George R., and Gallaher, John T. 1979, *Geology and groundwater resources of western Crawford County, Pennsylvania.* Pennsylvania Geological Survey. 4th Ser., Water Resource Report 46, 103 p.

Topp, Linda M., and Harrison, Samuel S., 1975, *False "bedrock" in glacial drift.* Bulletin of the Association of Engineering Geologists, V. XII, No. 4 p. 323-325

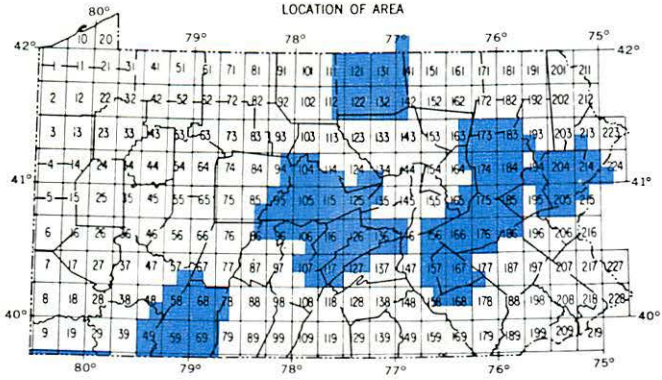
ORTHOPHTOQUADS

The U.S. Geological Survey produces general-purpose base maps that serve a wide range of needs. Now, in addition to the existing series of conventional line maps a new series of photoimage maps is being produced at a scale of 1:24,000.

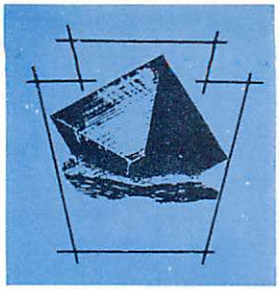
An orthophotoquad consists of an orthophotograph or a mosaic of orthophotographs in standard quadrangle format with little or no cartographic treatment. Tick marks denoting the latitude and longitude and the State plane coordinates of the map projection are shown only at the map neatline. The Universal Transverse Mecator grid is fitted precisely to the plotted projection and is printed on the photoimagery as fine black lines without labels. For general orientation, the major highways and a few principal places or features are labeled. The map collar is composed in much the same style as for standard topographic maps.

Orthophotoquads portray by photoimagery an abundance of detail not found on conventional line maps. They can be used for land use information; site selection for industries, utilities, and public transportation; urban renewal and urban-suburban growth studies; development and conservation of natural resources; and flood hazard, pollution, and coastal wetland studies. Data such as timber, soil, and crop inventories can be plotted directly on the orthophotoquad, and reliable determination of acreage made. The orthophotoquad can be used to revise other maps or to serve as a base for making special-purpose maps.

The index map shows those quadrangles in Pennsylvania that are covered by orthophotoquads. A set of the orthophotoquads is on file for public examination at the library of the Pennsylvania Geological Survey, 916 Executive House, Harrisburg.



To obtain additional information about the availability of orthophotoquads or to place an order for maps contact the Eastern Mapping Center, National Cartographic Information Center, U.S. Geological Survey, National Center, Stop 536, Reston, Virginia 22092 (703) 860-6336. Price of paper copy is $1.25 each.



EARTH SCIENCE TEACHERS' CORNER

PROJECT FAMOUS (25 min.)
A geological look at details along the Mid-Atlantic Ridge. Good footage from *Alvin* dives. Volcanic vs. tectonic influences on topography. 1979. University Media, P.O. Box 881, Solana Beach, CA 92075.

MOONWALK (40 min.)
Dramatic documentary of the Apollo II story from blastoff to splashdown. Beautiful footage, all phases. 1976. Learning Corp. of America, 1350 Avenue of the Americas, New York, NY 10019.

OUR DYNAMIC EARTH (23 min.)
A brief look at plate tectonics, well done. Examples of subduction, convergence, translation. Almost half the film is observations from the submersible *Alvin*, including life sustained by water warmed and vented along the mid-Atlantic rift. 1979. Karol Media, East 36A Midland Ave., Paramus, NY 07652.

PLANET MARS (29 min.)
Excellent. The story of Martian exploration, from early observations by telescope to the Viking lander and its messages. 1979. NASA, Code LFD-13, Washington, DC 20546.

VOYAGER JUPITER ENCOUNTERS (17 min.)
Voyager 1 and 2, from flight plan to time-lapse sequences of Jupiter's rotation and atmospheric circulation; close-ups of the red spot and moons, including volcanic eruption on Io. Real footage backed up by clear computer simulation. 1979. Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, CA 91103.

GEOTHERMAL ENERGY FROM HOT DRY ROCK (14 min.)
Los Alamos Scientific Lab experiments with extracting heat energy from hot, dry rock by use of two wells, controlled fracturing and water circulation. Result: water at 130°C, good for 5-10 megawatts. A good, straightforward statement of a full scale experiment. 1978. Los Alamos Scientific Laboratory, Report Librarian, P.O. Box 1663, Mail Stop 364, Los Alamos, NM 87545.

GROUNDWATER - A PART OF THE HYDROLOGIC CYCLE (29 min.)

A high quality film covering many aspects of the difficult subject of groundwater, from recharge to discharge; excessive pumping, artificial recharge, pollution and solution, geothermal power. 1979. Cherry Film Productions, Ltd., 25 Bell Street, Regina, Saskatchewan S4S 4B7.

BIG HOLE DRILLING (25 min.)

A fascinating look at the relatively new technology for drilling holes up to 10 feet in diameter to depths of thousands of feet using modified oil well methods. Developed primarily at the Nevada Test Site. 1979. U.S. Department of Energy, Nevada Operations Office, P.O. Box 14100, Las Vegas, NV 93114. Attn: Public Information Office.

EARTHSPACE-OUR ENVIRONMENT (15 min.)

Dwells primarily on earth's magnetosphere through the work of many scientists (Van Allen etc.). Spectacular shots of auroras and solar flares. 1978. NASA, Lyndon B. Johnson Space Center, Public Information Branch/AP3, Film Distribution Library, Houston, TX 77058 for NASA Regional Film Library serving your state.

OUR MINERAL WORLD (29 min.)

Brian Skinner and others discuss our dependence on minerals; source areas, consuming areas, shipping recycling, re-mining, remote sensing and global interdependence. A good review of the finite resource problem and a plea for intelligent world-wide cooperation. 1979. Index Film and Television Library, Ltd., 12 Charlotte Mews, London WIP ILN, England.

NEW STAFF MEMBERS

DON A. GADDESS

Don A. Gaddess joined the Oil and Gas Regulation Division in December, 1979 as an inspector of oil and gas wells.

After receiving his B.S. in Petroleum Geology from Tulsa Univ. in 1958, he worked for a geological consulting firm. From 1959 to 1971 he was company geologist with the North Penn Gas Co. where he prepared sub-surface structural geologic maps, examined well samples and seismic reports relating to the company's activities regarding drilling and storage. Since that time he worked as a consultant geologist and lease broker until taking on inspection duties in Erie and Crawford Counties.

CHRISTOPHER D. LAUGHREY

Christopher D. Laughrey, a native of Cambria County, joined the Survey in February, 1980 as a geologist with the Oil and Gas Geology Division in Pittsburgh.

Chris completed his B.S. degree at the University of Pittsburgh at Johnstown in 1977 and has done graduate work in geology through Bowling Green State University and in exploration geophysics at the University of Houston.

Chris spent 2-1/2 years working as a geophysicist for Western Geophysical Company in Houston, Texas, primarily involved with offshore seismic investigations in Alaska, California, the Baltimore Canyon and the Fiji Islands.

He is assigned to the Pennsylvania oil and gas fields project preparing a new oil and gas fields map of Pennsylvania.

FRANK E. MACKEY

Frank E. Mackey, who comes from Bradford, Pa., is now part of the Survey's oil and gas inspection team. Frank graduated from the University of Pittsburgh with a B.A. degree in 1974.

Prior to 1963 he had been associated with the drilling industry and during 1970-1974 he worked full-time and part-time dressing tools on BuCyrus Erie 24's and 28's while attending college.

He joined the Survey's Division of Oil and Gas Regulation, as an Oil and Gas Inspector on November 23, 1979.

GERALD W. WILDERS

Gerald Wilders is a mining engineer who is a native to the beautiful mountain area of Saltlick Township, Fayette County, Pennsylvania.

A graduate in civil engineering from the University of Saskatchewan, Canada, he began working in coal mines during summer vacations. After graduation, he worked briefly on construction projects before beginning his mining career with Eastern Associated Coal Corp. Gerry also worked for a period with the Pennsylvania Railroad and later joined the U.S. Treasury as a Natural Resource and Valuation Engineer.

Before joining the Oil and Gas Division as a mining engineer in December, 1979, he did mine engineering and appraisal work independently.

PENNSYLVANIA GEOLOGICAL SURVEY STAFF

Arthur A. Socolow, *State Geologist*

Donald M. Hoskins, *Assistant State Geologist*

TECHNICAL SERVICES

Shirley J. Barner, *Stenographer*
Sandra Blust, *Librarian*
James H. Dalimpio, *Draftsman*
John G. Kuchinski, *Draftsman*
Christine Miles, *Geologist Supervisor*
Mary A. Miller, *Stenographer*
Geary L. Sarno, *Draftsman*
Marjorie Steel, *Stenographer*
Albert Van Olden, *Draftsman*
Janet L. Wotring, *Typist*

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William B. Barber, *Geologist* (Pittsburgh Office)
Denise W. Royer, *Hydrogeologist*
Donna M. Snyder, *Stenographer*
Larry E. Taylor, *Hydrogeologist*
Martha Walter, *Clerk*
John P. Wilshusen, *Geologist*

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Clifford H. Dodge, *Geologist*
Rodger T. Faill, *Geologist*
Albert D. Glover, *Geologist*
Jon D. Inners, *Geologist*
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David B. MacLachlan, *Geologist*
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Viktoras W. Skema, *Geologist*
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Paul D. Mourer, *Inspector*
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Claude A. Olson, *Inspector*
E. Louise Radovic, *Typist*
Barbara C. Snowdon, *Typist*
Frederic H. Sturm, *Geologist*
Raymond Townsend, *Surveyor Technician*
Charles H. Updegraff, *Geologist Supervisor*
Richard F. Walther, *Geologist*
Gerald W. Wilders, *Mining Engineer*

TOPOGRAPHIC DIVISION

In Cooperation with The U.S. Geological Survey

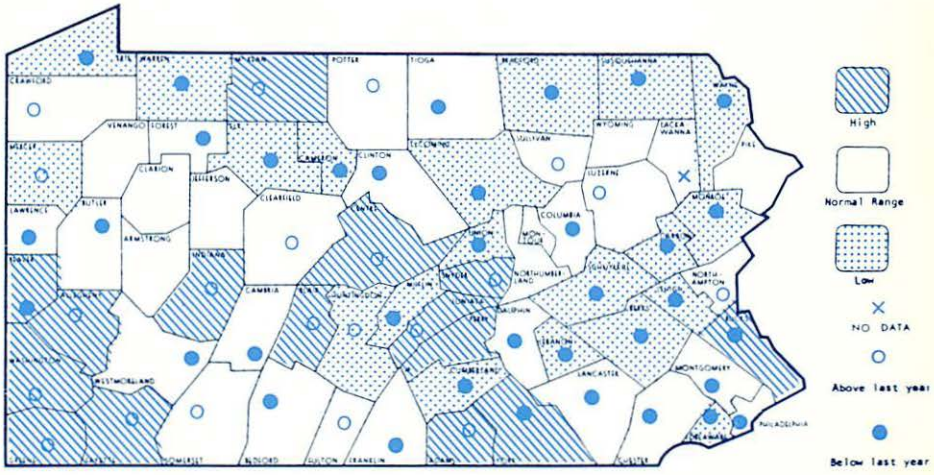
GROUND WATER DIVISION

In Cooperation with The U.S. Geological Survey

GROUND-WATER LEVELS

FOR

MARCH 1980



COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
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