First State Geology

Current information about Delaware's geology, hydrology and mineral resources

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Drought Warning Declared for Delaware

The deficiency in rainfall in Delaware and surrounding states since last summer has caused concern among Delaware, New Jersey, and Pennsylvania officials. Drought emergencies were declared in portions of Pennsylvania and New Jersey. On May 9, Governor Castle declared a drought warning for Delaware and asked for a voluntary restriction on non-essential uses of water. He established the Drought Advisory Committee consisting of representatives of various State agencies, including the DGS. The Committee has been considering measures that might be necessary should conditions become worse and a drought emergency be declared.

Data compiled by the DGS in cooperation with other State and federal agencies indicate that precipitation in Delaware was below normal from August 1984 through April 1985. Rainfall in May was well above normal across most of the State, but the total precipitation deficiency was 7 to 8 inches at the end of May (Table 1). Ground-water levels are generally below normal, and record low levels were established in one key well during April, in another one during April and May, and in a third in March, April, and May (Table 2). In general, streamflows have remained at the low end of the normal range and below normal for the last several months. Record low flows were measured during March and April on two key streams and on another during April (Table 3).

Figure 1 is a plot of the Water Conditions Index for northern Delaware. The Index was developed by the DGS in 1981 as an element of the State Comprehensive Master Water Plan and takes into account the levels in a key observation well, streamflows on Brandywine Creek, six-month antecedent rainfall, and population. It measures the long-term effect of deficient rainfall on water supply and is not necessarily an indicator of an agricultural drought.

Conditions in nearby areas are similar and have produced more critical supply conditions in those areas dependent on surface water sources. In the upper Delaware River Basin, storage in New York City's reservoirs fell to the drought warning stage briefly in late November 1984 but increased slightly in December and the first part of January 1985.

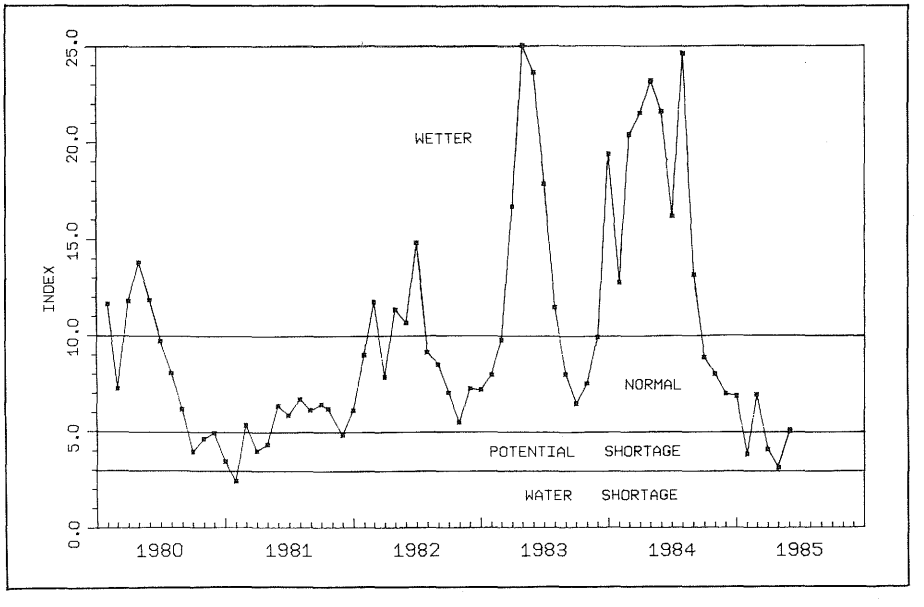

Figure 1. Water conditions index for northern Delaware.

However, storage again declined rapidly in the latter half of January and February, nearly reaching a drought condition by the end of February. Storage has remained in the drought warning stage since February. During times of normal rainfall the upper basin reservoirs can usually be expected to fill to 100% of capacity in the late winter and spring months. Because of the failure of the reservoirs to fill adequately, the Delaware River Basin Commission issued a drought emergency declaration on May 13. Such a declaration, among other things, directs the Basin States to take appropriate measures to decrease non-essential water use and allows the Commission the use of federal reservoirs within the basin for flow augmentation as needed.

Drought conditions were the principal subjects of a meeting of the Advisory Committee to the Delaware River Master held on May 30. State Geologist Robert R. Jordan, Delaware's representative to the River Master, and Kenneth D. Woodruff, DGS Associate Director for Hydrology and Geophysics, presented information on water conditions in Delaware and agreed to adjustments in the management of the river consistent with the Supreme Court Decree of 1954. That Decree apportioned the waters of the Delaware River among the states of Delaware, Pennsylvania, New Jersey, New York, and the City of New York and established the River Master to manage releases from reservoirs and withdrawals from the basin to assure that specific flows reach down-basin areas that include Delaware.

Delaware's extensive ground-water reservoirs make the State less vulnerable to precipitation deficiencies than those areas that depend solely on surface-water supplies. While shallow water-table wells may be affected by falling water levels, deeper artesian wells are generally able to absorb the impact of long periods of below normal rainfall. Delaware depends entirely on ground water for public and domestic supplies except for the Wilmington area and some suburbs in northern Delaware. Wilmington withdraws from Brandywine Creek and has additional storage capacity in Hoopes Reservoir located in the Red Clay Creek watershed.

Table 1

PRECIPITATION

October 1984 - May 1985

Station	October	November	December	January	February	March	April	May
Wilmington Porter Reservoir	AN	BN	BN	BN	BN	BN	BN	AN
New Castle (NWS)	AN	BN	BN	BN	BN	BN	RECORD LOW	AN
Dover	BN	BN	BN	BN	BN	BN	BN	AN
Bridgeville	BN	BN	BN	BN	BN	BN	BN	AN
Georgetown	BN	BN	BN	BN	BN	BN	BN	AN
Lewes	BN	BN	BN	BN	BN	BN	BN	AN

AN - Above Normal BN - Below Normal

Table 2

WATER LEVELS

Shallow Water-Table Wells

October 1984 - May 1985

Well	Years of Record	October	November	December	January	February	March	April	May
Db24-10 Newark	29	AN	AN	N	N	N	N	BN	BN
Hb14-01 Blackbird	29	N	AN	N	N	N	N	BN	BN
Jd42-03 Dover	23	N	N	BN	BN	BN	BN	*BN	*BN
Mc51-01 Farmington	28	-	N	N	N	BN	*BN	RECORD LOW	RECORD LOW
Md22-01 Harrington	28	N	N	BN	BN	BN	BN	RECORD LOW	*BN
Nc45-01 Greenwood	28	-	N	N	N	N	N	N	BN
Qe44-01 Trap Pond	27	N	N	N	BN	N	RECORD LOW	RECORD LOW	RECORD LOW

*2nd lowest of record AN - Above Normal N - Normal BN - Below Normal

Table 3

MONTHLY MEAN STREAMFLOWS

October 1984 - May 1985

Water Course	Years of Record	October	November	December	January	February	March	April	May
Brandywine Creek	38	AN	N	N	BN	N	RECORD LOW	RECORD LOW	
Red Clay Creek	41	AN	N	N	BN	N	*BN	RECORD LOW	
White Clay Creek	44	AN	N	N	N	AN	*BN	*BN	
Christina River	41	N	N	N	BN	N	*BN		
St. Jones River	26	N	N	BN	BN	N	*BN	*BN	
Nanticoke River	41	N	BN	BN	BN	N	RECORD LOW	RECORD LOW	

*2nd lowest of record AN - Above Normal N - Normal BN - Below Normal

Salt-Water Contamination Study in Coastal Sussex County

The DSG, with the U. S. Geological Survey (USGS), has begun a two-year project to monitor seasonal ground-water-level and chloride-concentration trends in the Upper Chesapeake Group (Miocene) aquifer system in coastal Delaware and Maryland. The project is funded by the Delaware Department of Natural Resources and Environmental Control under the Inland Bays Program.

To date, automatic water-level recorders have been installed in five wells, and two to three more recorder installations are planned. Ground-water levels will also be measured on a twice-monthly basis in fifteen additional wells. Water from approximately twenty-five wells will be analyzed twice yearly for the major inorganic constituents. The major municipal water supplies produced from the aquifer system will also be sampled for chlorides on a weekly basis.

The purpose of the work is to identify areas of the aquifer system which have been or are in danger of becoming contaminated by salt water. The aquifer system currently supplies water to Bethany Beach, Sussex Shores, Lewes, and Sea Colony, as well as to a large number of smaller public and private water users. The data and conclusions generated by this project will be used to better manage future increased water supplies in this rapidly developing area.

DGS Receives Additional Funds for Study of Delaware's Petroleum Potential

The Delaware Geological Survey has recently received an additional $25,250 to study the subsurface geology and petroleum potential of Delaware and the adjacent offshore area. This amount adds to the previously allocated $24,535 for an amended total of $49,785. Funds are provided by the U. S. Department of Interior's Minerals Management Service (MMS) in a cooperative agreement with the Association of American State Geologists. The University of Texas at Austin is administering the multi-discipline special studies program through the Texas Bureau of Economic Geology on behalf of the coastal State Geological Surveys participating in the project.

Richard N. Benson, Senior Scientist, is the principal investigator for the DGS and will be joined by Robert R. Jordan, Director and State Geologist. Part of the project funds will be used to establish a research assistantship.

Petroleum Exploration Activities

As noted in the previous issue of *First State Geology* (Winter 1985), petroleum exploration is continuing in the exposed rift basins containing Triassic-Jurassic age rocks belonging to the Newark Supergroup. North Central Oil Corporation of Houston is drilling a 12,000-foot test of an anticlinal structure in the Newark basin in southeastern Pennsylvania, near Revere in Bucks County. Richard N. Benson, DGS Senior Scientist, toured the drilling rig and observed operations soon after drilling began earlier this spring. Environmental concerns related to the project are of great importance not only to the local community but to North Central and the drilling contractor, Delta Drilling Company. For example, drill cuttings and waste liquids are being trucked to proper disposal facilities rather than being dumped at the site. The drilling, which is currently below 6,000 feet, should be completed to the 12,000-foot depth later this summer. As is usual in wildcat exploratory wells, information on results of the drilling is confidential, but if hydrocarbons are discovered it is likely the public will be informed.

As reported in the *Oil and Gas Journal,* Shore Exploration and Production Company, subsidiary of SEPCO of Dallas, will be drilling a 6,000-foot test in the Richmond basin of eastern Virginia. The wildcat well will test a fault block structure indicated by seismic reflection profiles.

The significance of the drilling in these basins is that the petroleum industry is serious about exploring the eastern U.S. rift basins that formed prior to continental breakup and subsequent separation and drifting of North America away from Europe and Africa. The significance to Delaware is that similar basins are buried beneath the Atlantic Costal Plain, perhaps in Delaware, and several buried basins are present in nearshore portions of the Mid-Atlantic Outer Continental Shelf (OCS) (see map in previous issue of *First State Geology*). Because of the possibility of petroleum exploration occurring in Delaware, Senate Joint Resolution No. 4 was submitted in April to the Delaware State Senate. It requires that the State Geologist evaluate and report on activities related to energy exploration in Delaware. The Resolution was voted out of committee in May but no further action has transpired to date.

Offshore update. The Final Environmental Impact Statement for proposed OCS Lease Sale No. 111 offshore the Mid-Atlantic States, scheduled for October 1985, has been received and reviewed by DGS. If industry interest in the acreage being offered is considered inadequate, it is possible that Secretary of the Interior Donald Hodel will cancel the sale. The Governors of the affected States, including Delaware, will next receive an information copy of the Secretarial Issue Document (SID) upon which Secretary Hodel is to base his decision to proceed. Next, a Proposed Notice of Sale will be sent to the Governors followed by a 60-day comment period during which time they may make comments regarding the size, timing, and location of the sale. The Secretary is required to consider the Governors' comments and accept those recommendations that he determines provide for a reasonable balance between the national interest and the well-being of the citizens of the affected States. Thirty days prior to the scheduled sale a final Notice of Sale will be published in the *Federal Register.*

In the proposed lease sale, none of the nearshore acreage over the buried rift basins will be offered. Leases have lapsed on acreage leased in previous Mid-Atlantic sales, and these OCS blocks will be available for bidding in Sale No. 111. Except for gas discovered on the Block 598 unit, all other wells drilled on the previously leased structures were dry holes. Likewise, in deep-water areas, Shell's four drill holes that tested the so-called Jurassic carbonate reef trend were unsuccessful, and interest, if any, in acreage over this exploration play is unlikely to be significant. The only Mid-Atlantic OCS leases still held by industry are over this geologic feature, and currently there are no plans for additional drilling. Although the Minerals Management Service indicated in April that a Mid-Atlantic Exploration Plan might be received by them this summer, Bruce Weetman, Atlantic Region Director, later said that he has no further information that a plan will be submitted in the next few months.

Study Investigates Dissolved-Sodium Anomaly in Piney Point Ground Waters

Higher than normal sodium concentrations in ground waters from the Piney Point aquifer in the Dover area are being studied by Nenad Spoljaric, Senior Scientist. Abnormally high concentrations of sodium exceeding 140 parts per million have been reported recently.

Spoljaric's initial examination of the results of chemical analyses of the ground waters by the State Health Department suggested a cation exchange process as being responsible for the increased sodium content. The Piney Point aquifer is very rich in the mineral glauconite, which has a complex chemical composition and contains significant amounts of sodium. The exchange appears to be taking place between this sodium and calcium that is dissolved in the ground water. Calcium is replacing sodium in glauconite and thus releasing sodium into the ground water.

The purpose of the present study is to test not only this hypothesis but other possible processes that may be causing abnormally high sodium concentrations.

The sample-collecting phase is almost completed. Water samples have been collected from wells supplying water to the City of Dover, Dover Air Force Base, and farms in the area. The samples will be analyzed for sodium, calcium, and several other elements that may be involved.

Following evaluation of the results, solutions to the problem will be proposed. Also, a map showing the distribution of sodium in the water from the Piney Point aquifer in the Dover area will be constructed.

The study is scheduled to be completed by the end of 1985 and the results published soon thereafter.

Computerized Data Base Information System

The new DGS computerized information system that provides data on the geology, hydrology, and mineral resources of the State is now in operation. John H. Talley, Hydrogeologist, with Dorothy C. Windish, Secretary, in DGS Special Publication No. 11, "Instructions for Preparation of Delaware Geological Survey Data Base Schedules," describe the information that is recorded and how the automated data files are prepared.

Throughout its existence, the DGS has emphasized research and exploration to develop the geologic and hydrologic framework of the Delaware Coastal Plain. A comprehensive paperfile data base consisting of raw and processed geologic, hydrologic, geophisical, geochemical, and rock sample information is essential to this effort.

In response to the needs for efficient storage, manipulation, retrieval, and report-generating capability, the paperfile data base is being converted to an integrated automated geologic, hydrologic, and mineral resource management information system. To accomplish this, the DGS has made major revisions in the data recording and filing systems. The report by Talley and Windish contains the new DGS data Schedules, describes the information that should be recorded by each schedule, and presents instructions for preparation of the schedules. The schedules are designed to make various kinds of data consistent with the input format screens used in the automated system. The report is available from the Survey offices in Penny Hall at the University of Delaware.

Cartographic Information Center

The Delaware Geological Survey hosted a State Mapping Conference on March 19 that combined the annual State Mapping Advisory Committee meeting with other items of interest to the State's cartographic community. Guest Speaker Dr. William Kaula, Chief, National Geodetic Survey, described the impacts of global positioning systems on geodesy.

In April, W. S. Schenck, Coordinator of the DGS Cartographic Information Center, was chosen as representative to the U. S. Geological Survey (USGS) for the Northeastern State Affiliates of the National Cartographic Information Center (NCIC). He represents the interests of Connecticut, Delaware, Maryland, Massachusetts, New Hampshire, New Jersey, Pennsylvania, and Rhode Island. Ronald Fair of South Carolina's Land Resources and Conservation Commission was chosen to represent the southern NCIC State affiliates. Together the two represent the Eastern Association of State Affiliates (EASA) and will meet with the USGS in planning the 1986 annual NCIC meeting.

On July 12, 1985, the DGS will host a meeting of the Northeastern State Affiliates of the National Cartographic Information Center. The representatives, including several invited from the southeastern states, will discuss and have "hands on" experience with Side Looking Aerial Radar (SLAR), hear a presentation on finding cartographic products through online library systems, and discuss events for next year's annual NCIC meeting.

Delaware Minerals

In February 1985, the Delaware Geological Survey renewed a cooperative agreement with the U. S. Bureau of Mines (USBM) to do a reconnaissance study of heavy minerals in Delaware sands. Twelve sand samples collected throughout the Coastal Plain, but predominatly from younger formations in Sussex County, were sent to the USBM for analysis of heavy minerals, primarily titanium-bearing ones. Preliminary results, however, have been disappointing. Titanium was less than one percent in all samples except one, which showed three percent.

The DGS provided information on Delaware greensand (glauconitic sand) in the Middletown-Odessa area to Zook and Ranck, Incorporated, Gap, Pennsylvania. The firm has agreed to buy greensand from the Contractors Sand and Gravel Company pit near Mount Pleasant. Zook and Ranck use greensand in their preparation of organic farming soil conditioners. They are seeking additional Delaware sources of greensand with the help of the DGS and the Delaware Development Office.

Delaware Geological Survey Atlas Series

The Delaware Geological Survey has initiated a new long-term project, the Atlas Series, which presents a large amount of geologic, hydrologic, and other relevant information on page-size copies of U. S. Geological Survey topographic maps covering the State. The data, gathered through many years of research by the Survey's staff, are accompanied by concise explanations and supporting statistical information on separate pages.

Each quadrangle set includes information on geology, engineering soils, the water table, flood plains, benchmarks, wells, landfills, and gravel pits. Where data are available, maps of subsurface geology or other pertinent information will be included.

The Atlas Series is specifically designed to be efficient and to provide ready access for many users to otherwise dispersed data, much of which have not been published.

The Delaware City and St. Georges quadrangle atlases have already been published; the Elkton quadrangle is in press. Additional quadrangle atlases will be published at the rate of two or more a year. As new data become available, the published atlases will be updated.

Publications

Recent DGS Publications

Open File Reports

No. 28 Potential for Ground-Water Recharge in the Coastal Plain of Northern New Castle County, Delaware, Sheet 2; S. Petty, W. D. Miller, and B. A. Lanan: K. D. Woodruff, editor. Map with discussion, scale 1:24,000.

No. 30 Sources of Ground-Water Contamination in Delaware: J. H. Talley, 1985, 30 p.

Hydrologic Map Series

No. 3 Geohydrology of the Wilmington Area, Delaware, Sheet 4, Structural Geology: K. D. Woodruff, 1985, scale 1:24,000.

Miscellaneous Map Series

No. 1 Availability of Earth Science Maps of Delaware: W. S. Schenck, 1985 (revised).

Delaware Geological Survey Atlas

Elkton Quadrangle (ELK): N. Spoljaric, editor, 1985.

Staff Notes

Robert R. Jordan, Director and State Geologist, represented Delaware at the U. S. Department of the Interior's Outer Continental Shelf Policy Committee meeting in Santa Monica, California, April 10-11. He presented a commentary on Interior's "Draft Proposed 5-Year OCS Leasing Program" as a member of the Panel on Marine Productivity and Environmental Sensitivity. On April 15 he spoke on "The Boundaries of Delaware" to the Red Clay Creek Kiwanis Club and April 25 on "The Future of Water Resources in Delaware" at the meeting in Dover of the Delaware League of Local Governments. In May, he was appointed by Governor Castle to the Drought Advisory Committee that was established under the Executive Order declaring a drought warning for Delaware. On May 13 he testified before the Delaware River Basin Commission on water conditions in Delaware.

Jordan has recently been appointed to the following: Ad Hoc National Examination Committee of the American Institute of Professional Geologists; Chairman, Committee on the Future of the Association of American State Geologists (AASG); and member of AASG's Continental Margins Committee.

William S. Schenck, Research Associate II, participated in the American Society of Photogrammetry and the American Congress of Surveying and Mapping Conference in Washington, D. C., March 11-14.

John H. Talley, Scientist, presented a summary of current hydrologic conditions at the June 5 hearing in Dover by the Delaware Department of Natural Resources and Environmental Control to receive testimony that might lead to declaring a drought emergency for the State.

Talley and W. S. Schenck attended a Geographic Information System conference and workshop in Mystic, Connecticut, June 6-7.

Papers Presented:

Kenneth D. Woodruff with W. A. Crawford and A. L. Hoersch (Bryn Mawr College), "A reexamination of the Mine Ridge, Southeastern Pennsylvania" at the meeting of the Northeastern Section of the Geological Society of America, Lancaster, Pennsylvania, March 14-15.

_____, "Summary of operations of Delaware's seismic network and associated research" at the U. S. Northeast Seismic Network meeting, Baltimore, MD, May 28.