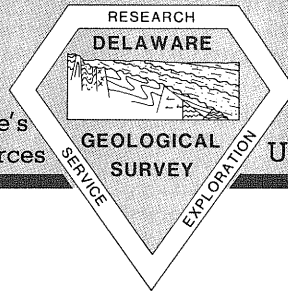


# First State Geology

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



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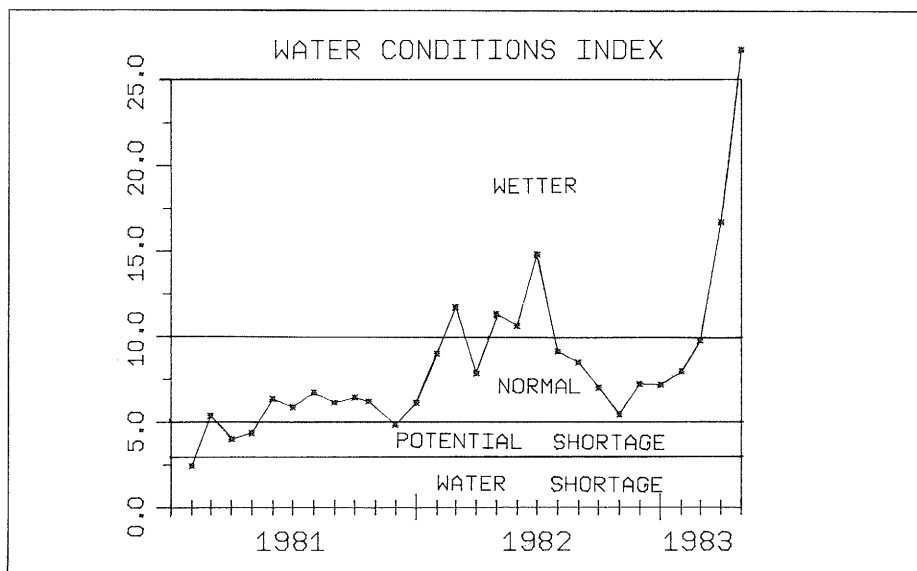
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Summer 1983

## Early 1983 Brings Much Improved Water Conditions

As a result of heavy spring rains, particularly during April, the water conditions index for New Castle County, which is computed regularly by the DGS from its water data records, went off scale at the end of April with a value of 26.7 (see figure). Its recent low was about 6 in the fall of 1982. During most of 1981 the index was low, showing potential water shortages for three months and a real shortage in one. That period was critical for water supplies in the northeastern U.S. Questions about water availability prompted R. R. Jordan and K. D. Woodruff to devise an index of water availability for New Castle County as that county has the most intensive water use. The formula for calculating the index is based on the six-month antecedent precipitation, the current monthly average of streamflow of Brandywine Creek, the level of water in one observation well, and the population of New Castle County. Details are in DGS Open File Report No. 18 published in 1982.

Streamflows and water levels in the shallow, water-table aquifer system throughout the State responded rapidly to the abundant early 1983 precipitation and in some cases reached record high levels. They are measured at selected points throughout Delaware by the DGS in cooperation with the U. S. Geological Survey. Information on precipitation is provided by the National Weather Service and other cooperators. The DGS publishes a "Report on Water Conditions in Delaware" prepared by John H. Talley every two months during normal periods and more frequently during dry periods. That report contains detailed information on indicator wells and streams. Additional information from specific sites is available from the monitoring and record-keeping systems of the DGS.



## Offshore Update

Continuing interest in offshore oil and gas exploration but highly selective bidding for leases, plans for an exploratory oil well that will set a new water depth record, continuing evaluation of an earlier gas discovery, and EPA proposals for ocean dumping of municipal sewage treatment sludge and incineration of toxic chemicals at sea highlight Mid-Atlantic offshore activities, the locations of which are shown on the accompanying map.

**Mid-Atlantic OCS Sale 76.** Only 12 companies submitted a total of 53 bids on only 40 of 4,050 Mid-Atlantic Outer Continental Shelf (OCS) blocks of submerged land offered for oil and gas leases on April 26, 1983 by the Department of Interior in its first area-wide lease sale under its new streamlined leasing program. Thirty-seven of the high bids were accepted by Interior. The blocks, each measuring 4,800 meters (about 3 miles) on a side and containing 2,304 hectares (5,693 acres), are located in the deep waters of the continental slope over an ancient shelf edge of Jurassic age that shows evidence of organic reef development. Many giant oil fields occur in ancient reef deposits.

The current leasing activity follows the first leasing of this reef trend in OCS Sale 59 of December 1981 when 20 companies submitted 240 bids on 98 blocks. However, the Department of Interior rejected nearly half (48) of the high bids as being too low. Although 22.7 million acres were offered in the recent Sale 76, thus giving oil companies the opportunity to bid on other exploration plays in the Mid-Atlantic OCS, bidding again centered over the ancient reef trend. In the earlier Sale 59 there was a total of \$579 million exposed, and high bids totaled about \$425 million of which only 50 were accepted for a total of about \$322 million. In Sale 76, however, only \$86.8 million was exposed and high bids totaled \$71.1 million. ARCO had the highest Sale 76 bid for a single tract with \$5,050,000.

There are several reasons for the apparent lack of strong industry interest in the Mid-Atlantic at this time. First, no drilling has yet taken place on Sale 59 tracts; therefore, too little is known about the hydrocarbon potential of the reef trend. Second, the decline in the worldwide price of oil undoubtedly has economic effects on exploration decision-making. Finally, and perhaps most important, the petroleum industry must have been waiting to invest heavily in the first area-wide lease sale in the Gulf of Mexico off the coasts of Louisiana, Mississippi, Alabama, and Florida. That offering consisted of 7,300 blocks totaling 39 million acres, and on May 25, 1983, 78 companies submitted 1,015 bids on 656 blocks with a total of \$4.6 billion exposed and \$3.47 billion total high bids, a new record.

The next Mid-Atlantic lease sale is scheduled for June 1985. By that time Shell Offshore, Inc. will have drilled its planned exploration wells on its leases over the reef trend, and a decision whether or not a 1978 gas discovery in the 598 unit is commercial will have been made. Discovery of commercial quantities of oil or gas will heighten interest in future Mid-Atlantic OCS sales.

**Shell's water-depth drilling record attempt.** Shell Offshore, Inc., as lease operator for its partners Amoco and Sun, will begin drilling later this summer on its Wilmington Canyon

Block 587 lease at a location 104 miles east of Fenwick Island in water depths of about 6,700-6,800 feet, a new world record attempt. Shell and its partners leased the tract in Sale 59 with a bonus bid of \$41,467,000. The target is a Jurassic carbonate reef feature about 7,700 feet below the sea floor. The well will take about 120 days to complete.

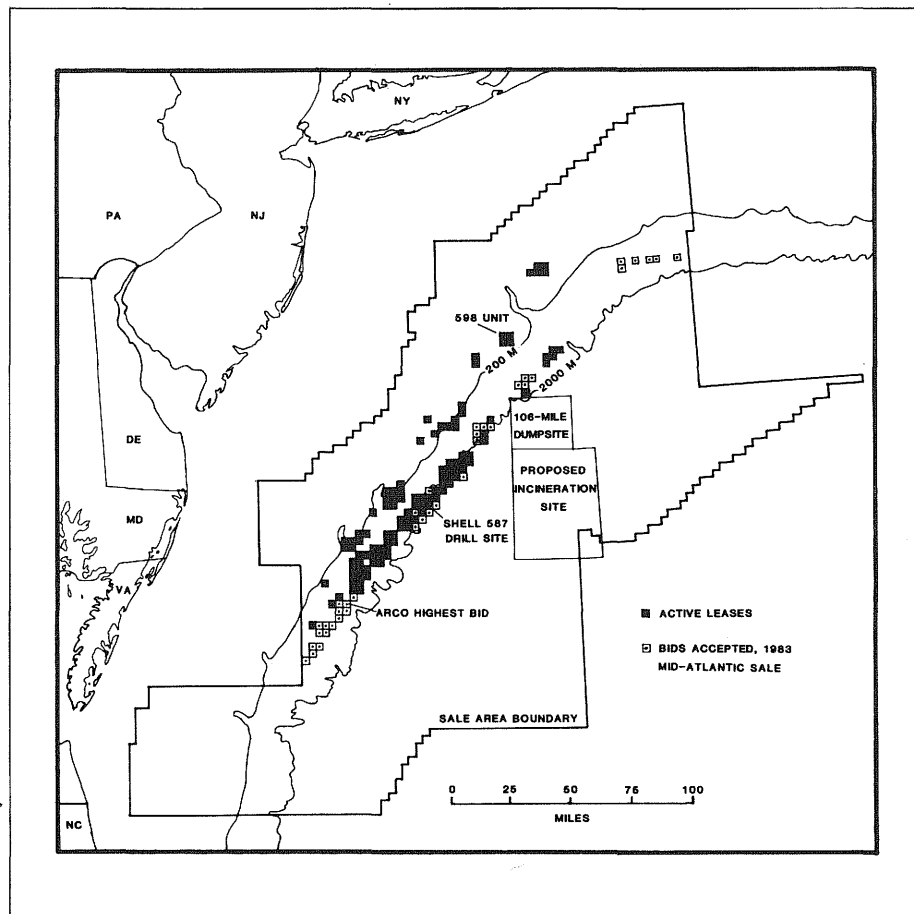
Shell has chosen Sonat Offshore International Inc.'s DISCOVERER SEVEN SEAS drill ship to do the drilling. In December 1982 the ship set a water-depth drilling record of 5,624 feet in drilling a 11,830 foot dry hole in the French Mediterranean. After completing a second hole in that area the ship will move to Norfolk, Virginia where it will be outfitted to drill in water depths to 7,500 feet before moving on location on Block 587. Although drilling costs will be high (\$30 million to \$50 million) and the risks are great, the payoff could be large if indeed the ancient reef trend contains several giant oil fields.

**598 gas discovery.** The only significant hydrocarbon discoveries so far from Mid-Atlantic drilling have been from Jurassic sands in a geologic structure covered by Hudson Canyon Blocks 598, 599, 642, and 643. Because the leases were due to expire in April or May 1982, the lease operators requested and were granted a suspension of production to extend the 4 leases as a

unit for 2 years. The reason for the request is that although 5 wells yielded significant gas flows, commerciality could not be established because the complex geology does not allow for easy calculation of reserves. To justify pipeline construction reserves of 500 billion to 1 trillion cubic feet of gas are required.

Tenneco, as operator for the 598 unit, was required to conduct a three-dimensional seismic survey on the unit as part of the suspension of production agreement. At this time the results of the survey are being evaluated, and by December 1983 a decision will be made as to whether to drill another exploratory well or wells or to submit a development plan. If the latter, a pipeline to shore would have to be constructed, and late 1989 would likely be its completion date. Tenneco with its partners Sun and Aminoil own Block 642; Texaco and its partners Getty, Transco, Allied Chemical, Sun, and Freeport own Block 598; Exxon owns Blocks 599 and 643.

**Waste disposal sites.** The Environmental Protection Agency (EPA) recently held public hearings on two sites requested for ocean disposal of wastes approximately 140-150 miles east of the Delmarva peninsula. Neither of the sites at this time includes areas of active oil and gas leases. On April 14, 1983, a hearing in Ocean City, Maryland considered the proposed incineration site. Incinerator ships would use this area to convert such liquid substances as herbicide orange and PCB wastes to HCl and CO<sub>2</sub> at temperatures of about 1250° C. Two companies are considering collecting wastes in the northeastern seaboard area for incineration at sea, and, according to Al Wastler of the EPA, they have requested EPA to designate a site. On May 10, 1983, in Rehoboth Beach, the EPA heard comments on the proposed continuing designation of the 106-Mile Dump Site as an approved site for disposal of aqueous industrial wastes and also for disposal of municipal sewage treatment sludge for a period of five years, during which time studies on the environmental effects of sludge dumping will be conducted. Currently there are only two industrial permits, both issued to Du Pont, for dumping at the site — for titanium dioxide wastes and for alkaline wastes from the manufacture of Anasole, a pesticide intermediate. According to the EPA, adding municipal sewage treatment sludges for disposal at the site is consistent with the requirements of the Ocean Dumping Act. Delaware's position as stated by Governor du Pont as well as that of Delaware's congressional delegation is to oppose ocean dumping of sewage sludge off our shores.



# Report on Ground-Water Quality Management

A report titled "Groundwater Quality Management" was considered at well-attended workshops during the State Water Conference held in March 1983. The report, which was prepared by a subcommittee chaired by State Geologist Robert R. Jordan, is one of a series being prepared by the Comprehensive Water Resources Management Committee under the auspices of the Department of Natural Resources and Environmental Control.

Among the major conclusions of the report are: all Delaware's ground water merits protection; discrete incidents of contamination are widespread; many materials placed on or in the ground may cause contamination; the general body of ground water should not be degraded below drinking water standards; and regulatory means of protecting ground water should be improved. Agricultural activities, septic systems, solid waste, and hazardous materials are given special attention in issue papers that are included in the report.

The report deals with management issues; it is not a technical report documenting the nature or extent of ground-water contamination in Delaware. It does find that "additional research on many aspects of groundwater quality protection is required and should be supported." This is necessary so that the interdependent functions of management and research may be balanced in the development of countermeasures to assure protection of ground-water quality and to act on existing problems.

Protection of ground-water quality is a growing national problem. It is especially important in Delaware because the most abundant and economical water supplies of the State lie in shallow aquifer systems that are vulnerable to contamination.

DGS studies and publications have dealt with ground-water quality over a period of years. In the present context perhaps the most significant of these is a 1972 study by John C. Miller, "Nitrate Contamination of the Water-Table Aquifer in Delaware." The DGS will continue its investigations of ground-water quality and increase its efforts, principally through acceleration of its

Hydrologic Atlas series and development of a system to aid in quantification of conditions by measurement of a set of inorganic indicators.

## From the State Geologist

Robert R. Jordan

The Delaware Geological Survey is pleased to present this, the first issue of *First State Geology*. Our purpose is to provide information about the geology, water, and other earth resources of Delaware and about the activities of the Survey. The DGS is charged to investigate the geology and resources of the State and to publish the results of its studies. We also make practical applications of our findings in many areas, not all of which are obviously geologic in nature. Our activities and formal publications do not come to the attention of all potentially interested citizens. It is hoped that through *First State Geology* we may improve our service by better communication with concerned Delawareans. In doing this we follow the lead of other State Geological Surveys that have found similar journals helpful to the citizens of their states.

It is expected that *First State Geology* will be issued twice a year. This inaugural issue is being directed to persons and organizations believed from previous communications to be interested in and affected by geologic findings and activities. We welcome your comments on this effort and ask that you notify us of others who may be interested in receiving this publication.

### NCIC State Affiliate

The Delaware Geological Survey now offers information on the availability of Aerial Photography, LANDSAT Imagery, Digital Data, Maps and Charts, Orthophotoquad Maps, and Topographic Map separates as the result of becoming a State Affiliate to the NCIC (National Cartographic Information Center). The NCIC is located at U. S. Geological Survey Headquarters in Reston, Virginia and serves as a national repository for all types of cartographic information. As State Affiliate the DGS offers order forms, price lists and addresses of organizations having cartographic information available for public sale or use. If you have a cartographic question or for more information on the NCIC, please contact William Schenck, Delaware Geological Survey, 302-738-2833.

## Highest Point in Delaware

The Delaware Geological Survey through its relationship with the national Geodetic Survey (NGS) has determined that the highest benchmark monument in Delaware is located on Ebright Road near the Pennsylvania State line. Ebright Road is north of Naamans Road, east of Brandywine Raceway.

The Ebright Road benchmark is 447.85 feet above sea level. Centreville, the other competing area for highest point, has a benchmark at an elevation of 445.58 feet. Surveying by NGS and DGS personnel indicates that the mobile home park adjacent to Ebright Road is at least two feet higher than the benchmark. Therefore, the highest actual elevation in Delaware is around 450 feet above sea level.

## Benchmark Repository

The DGS now has information concerning benchmarks in the State of Delaware. Through a recent project a repository for vertical control benchmarks has been created. Through the use of a computer search program and a microfiche reader/printer, written location descriptions for benchmarks plus a map showing their locations can be obtained. The repository consists of benchmarks from the National Geodetic Survey (NGS), U. S. Geological Survey (USGS), Federal Emergency Management Agency (FEMA), and State-owned marks. For information contact William Schenck, DGS, 302-738-2833.

## Publications

### Recent DGS Publications

#### Bulletins

No. 16 Ground-Water Resources of the Piney Point and Cheswold Aquifers in Central Delaware as Determined by a Flow Model: P. P. Leahy, 1982, 68 p.

#### Hydrologic map series

No. 3 Geohydrology of the Wilmington Area, Delaware, sheet 1, Basic Geology: K. D. Woodruff, 1982, Scale 1:24,000.

No. 4 Geohydrology of the Milford Area, Delaware: J. H. Talley, 1982, Scale 1:24,000.

#### Open file reports

No. 16 Geologic and Hydrologic Aspects of Landfills: N. Spoljaric and J. H. Talley, 1982, 22 p.

- No. 17 A guide to Information on Benchmarks in Delaware: W. S. Schenck, 1982, 12 p.
- No. 18 A Numerical Indicator of Water Conditions for Northern Delaware: R. R. Jordan and K. D. Woodruff, 1982, 17 p.
- No. 19 Regolith Thickness of the Delaware Piedmont: M. J. Christopher and K. D. Woodruff, 1982, Scale 1:24,000.

#### Reports of investigations

- No. 36 History of Oil and Gas Exploration in the Mid-Atlantic Region and Delaware's Involvement in the Federal OCS Leasing Program: R. G. Doyle, 1983, 78 p.

### Forthcoming DGS Publications

- Salinity distribution and ground-water circulation beneath the Coastal Plain of Delaware and the adjacent Continental Shelf, by J. J. Groot.
- Geologic and hydrologic considerations in the disposal of low-level radioactive wastes, by N. Spoljaric.
- Ground-water availability in southern New Castle County, Delaware, by J. J. Groot, P. M. Demicco, and P. J. Cherry.
- Stratigraphic nomenclature of nonmarine Cretaceous rocks of inner margin of Coastal Plain in Delaware and adjacent States, by R. R. Jordan.
- Configuration of the base and thickness of the unconfined aquifer in southeastern Sussex County, Delaware, by J. M. Denver.
- A guide to fossil sharks, skates, and rays from the Chesapeake and Delaware Canal area, Delaware, by E. M. Lauginiger and E. F. Hartstein.
- Geology of the Dover area, Delaware (Geologic Map Series), by Thomas E. Pickett and Richard N. Benson.
- Delaware City quadrangle, page-size quadrangle map showing basic geologic and hydrologic data and other information from the files of the Survey, by DGS staff.

### By U. S. Geological Survey in Cooperation with DGS

- Color orthophotoquad maps of the Lewes, Cape Henlopen, Fairmount, Rehoboth Beach, Frankford, Bethany Beach, Selbyville and Assawoman Bay quadrangles. May be purchased for \$2 per copy from DGS.

### Selected Publications by DGS Staff

- R. N. Benson, 1983. "Rates of sediment accumulation at Deep-Sea Drilling Project Leg 65 sites at the mouth of the Gulf of California," "Quaternary radiolarians from the mouth of the Gulf of California, Deep Sea Drilling Project Leg 65," plus co-authorship with other members of the shipboard scientific party of Section A: Introduction and Site Reports: in Lewis, B. T. R., Robinson, P., et al., 1983, *Initial Reports of the Deep Sea Drilling Project, 65*: Washington, (U.S. Govt. Printing Office).
- R. R. Jordan, 1982, Records of Stratigraphic Commission 1978-1980: American Association of Petroleum Geologists Bulletin, v. 66, p. 238-240.
- \_\_\_\_\_, 1982, Delaware's Water Quality, 30 Years of Observation: Proceedings, 108th Session, Delaware State Grange, p. 13-19.
- \_\_\_\_\_, 1983, Code Revised for Describing Stratigraphy: *Geotimes*, American Geological Institute, v. 28, no. 3, p. 19-20.
- \_\_\_\_\_, 1983, Review: "History of the Texas Bureau of Economic Geology, 1909-1960," *Journal of the History of Earth Sciences Society* (in press).
- R. R. Jordan and R. V. Smith, 1983, "Atlantic Coastal Plain Chart," Project COSUNA (Correlation of Stratigraphic Units of North America), American Association of Petroleum Geologists (in press).
- T. E. Pickett, 1982, "Burrows and Borings," "Carolina Bays," and "Lagoonal Sedimentation": in M. D. Schwartz, Editor, 1982, *Encyclopedia of Beaches and Coastal Environments*, Hutchinson Ross Publishing Company.

### Staff Notes

**25 Years of Service.** Marlene A. Carucci, Executive Secretary, and Robert R. Jordan, State Geologist, have just completed 25 years of service with the DGS and University of Delaware. Both started with the Survey and Department of Geology in 1958. Jordan began as a geologist for the DGS and concurrently with this service achieved the ranks of instructor, assistant professor, and associate professor in the University. In 1969 he was appointed State Geologist and Director, replacing the retiring Johan J. Groot. Carucci began her secretarial and administrative service with Groot and since

1969 has been with DGS exclusively. In 1981 she was appointed Executive Secretary. Congratulations to Marlene and Bob.

**10 Years of Service.** Congratulations to John H. Talley, Scientist, who just received a ten-year service award from the University. John began his service to DGS in 1972 after earning a B. A. degree in geology from the University of Delaware. During his early years with the Survey he completed a thesis on a deep water-test well near Greenwood, Delaware, which earned him a master's degree in geology from Franklin and Marshall. Since then he has been active in hydrogeologic research and service and is currently developing the DGS data base management system.

**Robert R. Jordan** will become next year's President of the Association of American State Geologists. His term will begin upon conclusion of the 75th Annual Meeting of the Association held in Anchorage, Alaska, June 5-10, 1983.

### Editor's Note

Richard N. Benson

In an editorial of the January 1983 issue of *Geotimes*, the monthly publication of the American Geological Institute, Wendell Cochran points out that the coverage of geology in the news is much more extensive than it seems, for example, the supply of and demand for copper ore may be reported as economics but the basis for that news is geologic. In a letter in reply to that editorial, H. Wesley Peirce of the Arizona Bureau of Geology and Mineral Technology writes that though geology is in the news but not always recognized as such, he would take this another step and say that "things geologic" are in the news. Obvious examples of things geologic are in the news today — mudslides in Utah and Nevada, the flooding Pearl and Rhine rivers, the Coalinga earthquake, and in Delaware we have recently contended with drought conditions, and we get our share of coastal storms. To a geologist these are natural geologic processes, operating at greater than average intensity but natural processes nonetheless. They are not unforeseen; only their timing is unpredictable. To another, these are examples of nature on a rampage.

It is our intention that *First State Geology* will inform you, the reader, of things geologic. I will work to ensure that it will not become a publication only for and readable only by geologists.