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WATER RESOURCES DATA MARYLAND AND DELAWARE WATER YEAR 1997
Volume 2. Ground-Water Data
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U.S. GEOLOGICAL SURVEY WATER DATA REPORT MD-DE-97-2

Page 1 and 2: replace entire pages; final draft replaces rough draft.

Page 484: should be page 485.

Page 485: should be page 484.

Page 523: QUALITY OF GROUND WATER -- ANNE ARUNDEL COUNTY, MARYLAND
The following water quality constituents were omitted from the final table:
ALPHA RADIO WATER DISSOLVED AS TH-230, ALPHA COUNT, 2 SIGMA WATER DISSOLVED AS TH-230, BETA 2 SIGMA WATER DISSOLVED AS CS-137, RA-226 DISSOLVED PLANCHET COUNT, RA-222 SIGMA WATER DISSOLVED, RADIUM 228 DISSOLVED, RA-228 2 SIGMA WATER DISSOLVED, URANIUM NATURAL 2 SIGMA WATER DISSOLVED, ALACHLOR TOTAL RECOVER, AMETRYNE TOTAL, ATRAZINE WATER UNFILTERED, BUTACHLOR WATER WHLREC, BUTYLATE WATER WHLREC, BROMACIL WATER WHLREC, CARBOXIN WATER WHOLE RECOVERABLE, CYANAZINE TOTAL, CYCLOATE WATER WHOLE RECOVERABLE, DEETHYLATRAZINE WATER WHOLE TOTAL, DE-ISO PROPYL ATRAZIN WATER WHOLE TOTAL, DIPHENAMID WATER WHOLE RECOVERABLE, HEXAZINONE WATER WHOLE RECOVERABLE, METOLACHLOR WATER WHOLE TOTAL RECOVERABLE, METRIBUZIN WATER WHOLE TOTAL RECOVERABLE, PROMETONE TOTAL, PROMETRYNE TOTAL, PROPACHLOR WATER WHOLE RECOVERABLE, PROPAZINE TOTAL, SIMAZINE TOTAL, SIMETRYNE TOTAL, TERBACIL WATER WHOLE RECOVERABLE, TRIFLURALIN TOTAL RECOVERABLE, VERNOLATE WATER WHOLE RECOVERABLE,

Page 526: QUALITY OF GROUND WATER -- BALTIMORE COUNTY, MARYLAND
The following water quality constituents were omitted from the final table:
ALPHA RADIO WATER DISSOLVED AS TH-230, ALPHA COUNT 2 SIGMA WATER DISSOLVED AS TH-230, BETA 2 SIGMA WATER DISSOLVED AS CS-137, RA-226 DISSOLVED PLANCHET COUNT, RA-226 2 SIGMA WATER DISSOLVED, RA-222 SIGMA WATER DISSOLVED, RADIUM 228 DISSOLVED, RA-228 2 SIGMA WATER DISSOLVED, RADON 222 TOTAL RN-222 2 SIGMA WATER WHOLE TOTAL, URANIUM NATURAL DISSOLVED, URANIUM NATURAL 2 SIGMA WATER DISSOLVED,

Page 533: QUALITY OF GROUND WATER -- CARROLL COUNTY, MARYLAND
The following water quality constituents were omitted from the final table:
ALPHA RADIO WATER DISSOLVED AS TH-230, ALPHA COUNT 2 SIGMA WATER DISSOLVED AS TH-230, BETA 2 SIGMA WATER DISSOLVED AS CS-137, RA-226 DISSOLVED PLANCHET COUNT, RA-226 2 SIGMA WATER DISSOLVED, RA-222 SIGMA WATER DISSOLVED, RADIUM 228 DISSOLVED, RA-228 2 SIGMA WATER DISSOLVED, RADON 222 TOTAL RN-222 2 SIGMA WATER WHOLE TOTAL, URANIUM NATURAL DISSOLVED, URANIUM NATURAL 2 SIGMA WATER DISSOLVED,

Page 536: QUALITY OF GROUND WATER -- CHARLES COUNTY, MARYLAND
The following water quality constituents were omitted from the final table:
ALPHA RADIO WATER DISSOLVED AS TH-230, ALPHA COUNT 2 SIGMA WATER DISSOLVED AS TH-230, GROSS BETA DISSOLVED, BETA 2 SIGMA WATER DISSOLVED AS CS-137, RADON 222 TOTAL, RN-222 2 SIGMA WATER WHOLE TOTAL

Page 539: QUALITY OF GROUND WATER -- HOWARD COUNTY, MARYLAND
The following water quality constituents were omitted from the final table:
ALPHA RADIO WATER DISSOLVED AS TH-230, ALPHA COUNT 2 SIGMA WATER DISSOLVED AS TH-230, GROSS BETA DISSOLVED, BETA 2 SIGMA WATER DISSOLVED AS CS-137, RA-226 DISSOLVED PLANCHET COUNT, RA-226 2 SIGMA WATER DISSOLVED, RADIUM 228 DISSOLVED, RA-228 2 SIGMA WATER DISSOLVED, RADON 222 TOTAL, RN-222 2 SIGMA WATER WHOLE TOTAL, URANIUM NATURAL DISSOLVED, URANIUM NATURAL 2 SIGMA WATER DISSOLVED,

Page 541 QUALITY OF GROUND WATER -- QUEEN ANNE’S COUNTY, MARYLAND
"DEPTH" over SAMPLING METHOD and DEPTH OF WELL heading should be omitted.

Page 547: QUALITY OF GROUND WATER -- WORCESTER COUNTY, MARYLAND
The following water quality constituents were omitted from the final table:
CALCIUM DISSOLVED, MAGNESIUM DISSOLVED, POTASSIUM DISSOLVED, SODIUM DISSOLVED, SULFATE DISSOLVED, CHLORIDE DISSOLVED, FLUORIDE DISSOLVED, BROMIDE DISSOLVED, SILICA DISSOLVED, SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED, SOLIDS SUMMARY OF CONSTITUENTS DISSOLVED, IRON DISSOLVED, and MANGANESE DISSOLVED

VOLUME 2. GROUND-WATER DATA

INTRODUCTION

The Water Resources Division of the U.S. Geological Survey, in cooperation with State agencies, obtains a large amount of data pertaining to the water resources of Maryland and Delaware each water year. These data, accumulated during many water years, constitute a valuable data base for developing an improved understanding of the water resources of the State. To make these data readily available to interested parties outside the U.S. Geological Survey, the data are published annually in this report series entitled **"Water Resources Data - Maryland and Delaware."**

This series of annual reports for Maryland and Delaware began with the 1961 water year with a report that contained only data relating to the quantities of surface water. For the 1964 water year, a similar report was introduced that contained only data relating to water quality. Beginning with the l975 water year, the report format was changed to present, in one volume, data on quantities of surface water, quality of surface and ground water, and ground-water levels. In the 1989 water year, the report format was changed to two volumes. Both volumes contained data on quantities of surface water, quality of surface and ground water, and ground-water levels. Volume 1 contained data on the Atlantic Slope Basins (Delaware River thru Patuxent River) and Volume 2 contained data on the Monongahela and Potomac River basins. Beginning with the 1991 water year, Volume 1 contains all information on quantities of surface water and surface- water-quality data and Volume 2 contains ground-water levels and ground-water-quality data.

This report is Volume 2 in our 1997 series and includes records of water levels and water quality of ground-water wells and springs. It contains records for water levels at 397 observation wells, discharge data for 6 springs, and water quality at 107 wells. Location of ground-water level wells are shown on figures 3 and 4. The location for the ground-water-quality sites are shown on figures 5. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Maryland and Delaware.

Prior to introduction of this series and for several water years concurrent with it, water resources data for Maryland and Delaware were published in U.S. Geological Survey Water-Supply Papers. Data on water levels for the 1935 through 1974 water years were published under the title **"Ground-Water Levels in the United States."** The above mentioned Water-Supply Papers may be consulted in the libraries of the principal cities of the United States and may be purchased from the Branch of Information Services, Federal Center, Bldg. 41, Box 25286, Denver, CO 80225-0286.

Publications similar to this report are published annually by the Geological Survey for all States. These official Survey reports have an identification number consisting of the two-letter State abbreviation, the last two digits of the water year, and the volume number. For example, this volume is identified as **"U.S. Geological Survey Water-Data Report MD-DE-97-2."** For archiving and general distribution, the reports for l971-74 water years also are identified as water data reports. These water-data reports are for sale in paper copy or in microfiche by the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

Additional information, including current prices, for ordering specific reports may be obtained from the District Chief at the address given on the back of the title page or by telephone (410)238-4200.

COOPERATION

The U.S. Geological Survey and agencies of the State of Maryland have had cooperative agreements for the collection of water-resource records from 1896 to 1909 and since 1924. Similar cooperative agreements have existed between the Survey and agencies of the State of Delaware, since 1943. Organizations that assisted in the funding or services in this report through cooperative agreements with the Survey or through the Maryland Geological Survey and Delaware Geological Survey are:

Maryland Geological Survey, Emery T. Cleaves, Director.

Delaware Geological Survey, Robert R. Jordan, State Geologist.

Delaware Department of Transportation, Anne P. Canby, Secretary of Transportation.

Delaware Department of Natural Resources and Environmental Control, Christophe Tulou, Secretary of Natural Resources and Environmental Control.

Maryland Department of the Environment, Drinking Water Program, John Grace.

Maryland Department of Natural Resources, Tidewater Ecosystem Assessment, Robert Magnien, Director.

Maryland Department of Natural Resources, Research Assessment Service, Power Plant Research Program, Peter Dunbar, Director.

Anne Arundel County Health Department, Well Construction and Well Quality Program, John Simpson, Program Manager.

Baltimore County Department of Environmental Protection and Resource Management, Water Well Program, Susan Farinetti, Supervisor.

Town of Ocean City, Water Department, Ronald Ellis, Superintendent.

U.S. Army Garrison, Aberdeen Proving Ground, Environmental Conservation and Restoration Division, Kennith P. Stachiw, Division Chief.

U.S. Environmental Protection Agency, Office of Research and Development, Tom Pheiffer.

U.S. Navy, Naval Surface Warfare Center, Indian Head Division, James Sirinakis, Utilities Division Chief.

Dover Air Force Base, 436TH Support Group, Civil Engineering Squadron, EnvironmentalFlight, Charles Mikula, Restoration Program Manager.

Organizations and projects that provided data are acknowledged in the site Remarks description.

SUMMARY OF HYDROLOGIC CONDITIONS

Ground-Water Levels

Ground-water levels in water-table and artesian observation wells in Maryland and Delaware fluctuated in response to precipitation and ground-water withdrawal. Water-table levels were above normal levels throughout the bi-State area at the beginning of the 1997 water year (fig. 1). These above normal levels were attributed to tropical storm Fran which moved up the eastern seaboard on September 7, 1996, dumping 6 to 8 inches of precipitaion on the bi-State area. In November, heavy rains fell on the bi-state area that accounted for over 8 inches of precipitation, raising ground-water-levels even higher. As the water year progressed, the normal springtime and summer precipitation rainfall events did not occur. This decline in rainfall during the growing season affected farming, but had little effect on ground-water because of the heavy precipitation events in the beginning of the water year.

In the bi-State areas where artesian aquifers are the main source for municipal water supplies, the water levels continued to decline for most of the area. Water-level conditions are summarized below for each of the physiographic provinces:

Appalachian Plateau.-- Water-table levels were above normal at the beginning of the water year, in part due to tropical storm Fran, in September 1996. Several major storm systems moved from the Gulf of Mexico up along the Appalachian mountains throughout October and November. Several of these stroms dumped most of their precipitation on the western mountains causing minor flooding in the valleys. The pattern of storms seemed to be all or nothing throughout the water year. Heavy, solitary strom events were followed by long periods of no percipitation. This can easily be seen in figure 1, with well GA Bc 1. Water levels at the end of the 1997 water year were slightly below normal levels. No record high or low water-table levels were recorded in the Appalachian Plateau.

Valley and Ridge.-- Ground-water-table levels were slightly below normal at the beginning of the 1997 water year. Water-table levels rose to a peak high level in January due to steady rain showers throughout most of the first half of the water year. By mid-March strom fronts that normally move over the Appalachian mountains were depleted of most of their precipitation and only small amounts of rain fell on this area for the remainder of the water year. Record high or low water-table levels were not recorded in this physiographic province during the 1997 water year.

Blue Ridge.-- Water-table levels were above normal at the beginning of the water year. A wetter than normal fall and winter kept ground-water levels above normal most of the spring. With little rainfall in the spring, ground-water-table levels dropped below normal by summer and remained below normal throughout the remainder of the water year. No record high or low water levels were recorded during the water year.

Piedmont.-- Ground-water-table levels at the beginning of the water year were above normal. Water-table levels remained above normal until June. The lack of summertime thunderstorms caused ground-water levels to drop to below normal. Ground-water-table levels declined gradually during the summer, rising in September from several heavy storm events moving up the Atlantic Coast. No record high or low water-table levels were recorded, but levels were above normal at the end of the 1997 water year.

Coastal Plain.-- Water-table levels on the western shore of the Chesapeake Bay were at normal levels at the beginning of the 1997 water year. These water-table levels rose above normal by November and remained above normal throughout the water year. On the Delmarva Peninsula water-table levels were below normal at the start of the 1997 water year, and did not rise above nomal water-table levels until January and February. Water- table levels remained above normal in the Coastal Plain through the end of the water year, with no high or low water-level records occuring.

Artesian aquifers on the western shore of the Chesapeake Bay lie close to their surface-recharge zones at the northwestern boundary with the Piedmont physiographic province. It is in this outcrop belt where these aquifers receive most of their ground-water recharge. This area is heavily populated because of its close proximity to the Baltimore-Washington and Annapolis metropolitan area. These areas rely exclusively on ground-water supplies, except for the northwestern part of Prince Georges County where the Washington Suburban Sanitary Commission supplies surface water from the Potomac and Patuxent Rivers.

Artesian aquifers (identified in parentheses) in the following towns or areas of Maryland continued to decline due to the general regional increase in ground-water withdrawals: Annapolis and vicinity (Patapsco), Cecilton (Potomac), Charlotte Hall (Aquia), Indian Head and vicinity (Patapsco, Patuxent), La Plata (Patapsco), Leonardtown (Aquia, Piney Point), Lexington Park (Aquia, Piney Point), Prince Frederick (Aquia), St. Charles (Patuxent, Lower Patapsco, Magothy), Solomons Island (Aquia), southern Anne Arundel County (Aquia), and Waldorf (Patuxent, Patapsco, Magothy).

In the Glen Burnie area, the Patapsco aquifer water-levels rose because water management shifted to using the Patuxent aquifer to make better use of the area’s available ground-water resources.