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Summary of the Groundwater-Level Hydrologic Conditions in New Jersey, Water Year 2009

Groundwater is one of the Nation's most important natural resources. It provides about 40 percent of our Nation's public water supply. Currently, nearly one-half of New Jersey's drinking water is supplied by more than 300,000 wells that serve more than 4.3 million people. As demand for water increases, managing the development and use of the groundwater resource so that the supply can be maintained for an indefinite time without causing unacceptable environmental, economic, or social consequences is critical.

The U.S. Geological Survey (USGS) has operated a groundwater-level monitoring network in New Jersey since 1923. Long-term systematic measurement and computerized data storage of water levels provide the information needed to evaluate changes in the groundwater resource over time. Records of groundwater levels are used to evaluate groundwater recharge and discharge, seasonal fluctuations, long-term climate change, and water-supply development. Water-level data also are used to develop groundwater models and to forecast trends.

This report describes the USGS New Jersey Water Science Center Observation Well Network during water year 2009 (October 1, 2008 through September 30, 2009). Trends in water levels in confined aquifers in southern New Jersey, fractured rock aquifers of northern New Jersey, and unconfined aquifers throughout the State are summarized. Hydrographs of 12 wells- 3 wells open to bedrock, 3 unconfined (water-table) wells, one glacial aquifer well, and five confined wells- are shown. Worldwide Web site addresses for access to the data also are included.

Water-Level Monitoring in 2009

During water year 2009, groundwater levels were measured in 193 network wells; 136 wells were equipped with water-level recorders, and 57 wells were measured manually two to six times per year. Twenty-two wells are equipped with satellite data-collection platforms that provide near real-time data. The locations of the observation wells in New Jersey during the 2009 water year are shown in figure 1. A map with the locations of wells with hydrographs presented in this report is shown in the inset in figure 1. The published data for water year 2009, including site information, tables of water-levels, and water-level hydrographs, are available at *http://wdr.water.usgs.gov/wy2008/search.jsp*.

Water Levels in Unconfined and Fractured-Rock Aquifers

Fractured-rock aquifers have less storage than Coastal Plain or valley-fill aquifers and therefore are more prone to depletion during drought. Groundwater supplies from deep wells in major aquifers may be unaffected by drought; however, shallower wells in aquifers with limited storage are adversely affected by shorter periods of below-normal precipitation. Average annual precipitation in New Jersey ranges from about 40 inches along the southeastern coast to 51 inches in the north-central part of the State. Statewide, the annual mean precipitation is 45 inches per year based on precipitation during 1895–2009 (Office of the N.J. State Climatologist, Rutgers University, New Jersey, unpublished data, accessed February 8, 2009, at *http://climate.rutgers.edu/*. Water levels in wells completed in unconfined and fractured rock aquifers are directly related to the amount of annual precipitation, which was more than 6 inches above average during the 2009 water year (fig. 2). A December in which precipitation was 3 inches above average was followed by the driest January through March since records began (1895). Total rainfall between June and August was 19.18 inches (6.34 inches above normal). By summer's end, the Department of Environmental Protection's drought status indicators (*http://www.njdrought.org/regions.html*) for all six regions of the State rose to normal or above normal for the first time since May 2007.

The effects of climate on daily mean water levels in six observation wells during water year 2009 can be seen in the hydrographs shown in figure 3. Daily mean water-level data for three wells open to bedrock aquifers [Taylor (37-202), Readington School 11 (19-270), and Cranston Farms 15 observation wells (21-364)] and for three wells open to the unconfined aquifer [Morrell 1 (23-104), Lebanon State Forest 23-D (5-689), and Vocational School 2 (11-42)] are shown in relation to long-term monthly extremes, the median, and percentile classes. In the wells that tap bedrock aquifers (37-202, 19-270, and 21-364), the highest groundwater levels of the year occurred during December. Groundwater levels declined from January to March. Cool and wet conditions from late June to early September caused groundwater levels in these wells to return to above average levels. At wells open to the unconfined Kirkwood-Cohansey aquifer (5-689 and 11-42) in the Coastal Plain of New Jersey, water levels also rose as a result of above average rainfall but remained below their long-term monthly median most of the water year.

Water levels in many observation wells that tap stratified drift deposits in northern New Jersey remained near their highest levels in the last 30 years (27-1, 27-4, 27-5, 27-6, 27-12, 27-17, and 27-20). The water level in the Briarwood School well (27-12) rose nearly 25 feet from December 2002 to April

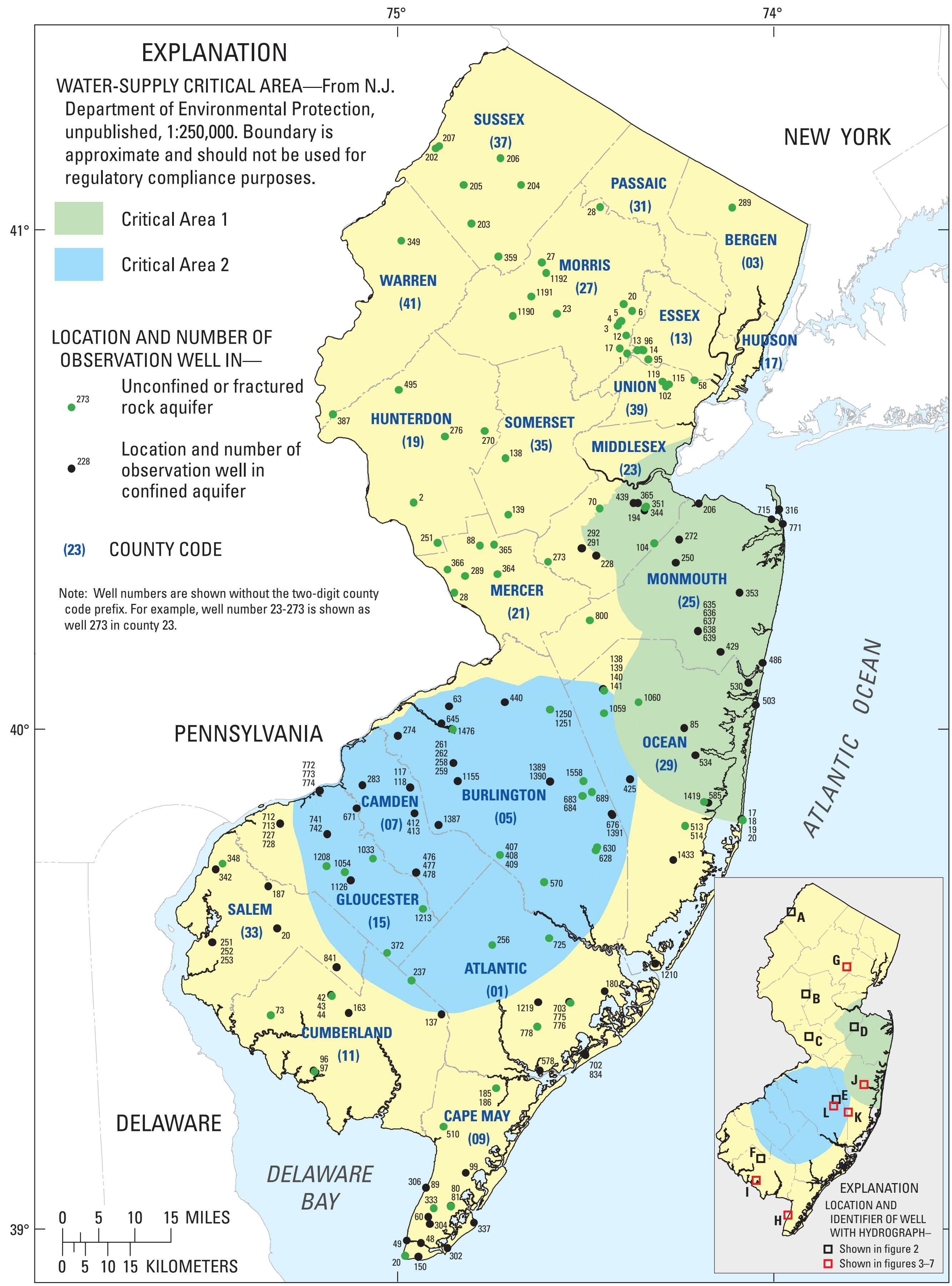

Figure 1. Location of ground-water-level observation wells in New Jersey.

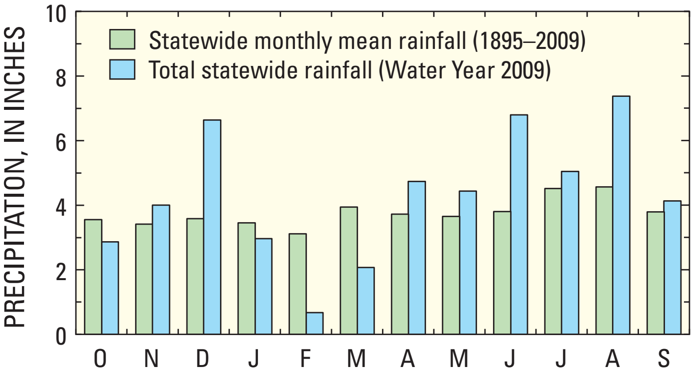

Figure 2. Monthly total (WY 2009) and monthly mean rainfall in New Jersey (1895–2009). [Data from the Office of the New Jersey State Climatologist, Rutgers University, New Jersey.]

2009 (fig. 4). This rise was due to a reduction in the use of groundwater and increased use of surface water in this area in recent years.

Confined Aquifers

Water levels in the confined aquifers in the Coastal Plain of New Jersey fluctuate seasonally in response to increased groundwater withdrawals during the summer when water levels decline and decreased withdrawals during the winter when water levels rise. However, groundwater levels also show the effects of changes in withdrawal patterns. In general, water-level changes in these aquifers are the result of changes in withdrawals rather than climatic variations.

Seasonal fluctuations in water levels in the confined Cohansey aquifer in Cape May County caused by withdrawal patterns ranged from 3 to 15 feet in USGS observation wells. Groundwater levels in this aquifer have remained stable in recent years.

Increased withdrawals have affected water levels in the Atlantic City 800-foot sand in Cape May County. Water levels in three wells open to this aquifer (9-302, 9-306 (fig. 5), and 9-337) exceeded previous lows of record for those wells during the 2009 water year.

In Atlantic County, water levels in the Atlantic City 800-foot sand have declined over the past 20 years. The water level in the Jobs Point well (1-578) exceeded the recorded monthly lowest levels for the well from March through August 2009 and the water level in the Oceanville observation well (1-180) exceeded the previous recorded low for the well during the 2009 water year.

Increased withdrawals from the Piney Point aquifer have affected groundwater levels in USGS observation wells. Water levels in three wells that tap the Piney Point aquifer in Cumberland County (11-44, 11-96 (fig. 6), and 11-163) declined 65, 28, and 39 feet, respectively, from February 2003 to September 2009. In Atlantic County and southern Ocean County, water levels continued a long-term decline in wells 1-834, 1-1219, and 29-1210. Water levels in wells 5-407, 5-676, and 29-425 in the Piney Point aquifer in northern Ocean and Burlington Counties have been relatively stable over the past 10 years.

Water levels in observation wells that tap the Wenonah-Mount Laurel aquifer and Englishtown aquifer system in Burlington, Camden, and Salem Counties remained stable or rose slightly (5-1155, 7-478 15-1126, and 33-20), but the water level in the New Lisbon 2 well (5-1390) screened in the Englishtown aquifer system in Burlington County exceeded the previous low of record for the well during the 2009 water year. In eastern Monmouth and Ocean Counties, groundwater levels in several observation wells that tap the Wenonah-Mount Laurel aquifer and the Englishtown aquifer system have risen over the past 5 years. The water level in the Toms River 2 Obs well (29-534) in central Ocean County has risen by nearly 20 ft since 2000 (fig. 7).

The reaction of groundwater levels to withdrawal trends in the Potomac-Raritan-Magothy aquifer system has been mixed. Water levels in several wells have declined over the past few years in eastern Burlington, southern Monmouth, northern Ocean, and Salem Counties (5-1389, 5-1391, 25-639, 29-85, and 33-251). Water levels in a number of other observation wells that tap the Potomac-Raritan-Magothy aquifer system in Burlington, Camden, and Gloucester Counties have risen gradually over the past few years (5-258, 5-261, 5-262, 5-274, 5-683, 7-117, 7-283, 7-412, 7-413, 7-476, 7-477, 11-137, 15-671, and 15-772).

Availability of data

The water-level data in the 2009 New Jersey Annual Data Report can be accessed online at Water Resources of the United States—2009 Annual Water Data Reports Search (*http://wdr.water.usgs.gov/wy2008/search.jsp*). Multiple-year graphs of mean daily water levels and tables of the water levels recorded or measured during water year 2009 are available at this site. A map interface of the well sites also is available.

A list of the sites in the New Jersey water-level monitoring network and links to historical water-level data at the USGS NWISWEB site are available at *http://nj.usgs.gov/gw/gw_hydrographs.html*. The Active Ground Water-Level Network web site shows data and statistics (if sufficient data are available to produce statistics) for all wells measured in the current year by New Jersey Water Science Center personnel; it can be accessed at *http://groundwaterwatch.usgs.gov/StateMaps/NJ.html*. Real-time data from a National Groundwater Climate Response Network, which includes 22 wells equipped with real-time capability in New Jersey, can be accessed at *http://groundwaterwatch.usgs.gov/rtn/StateMaps/NJ.html*.

Hydrologic data are recognized as the cornerstone of hydrologic science. Accurate measurements of groundwater levels provide important indicators of the status of our groundwater resources. By collecting and storing data pertaining to the quantity, quality, and use of our nation's groundwater and providing timely access via the internet, the USGS helps water resource-managers develop, regulate, and monitor the resource to ensure its continued availability for future generations.

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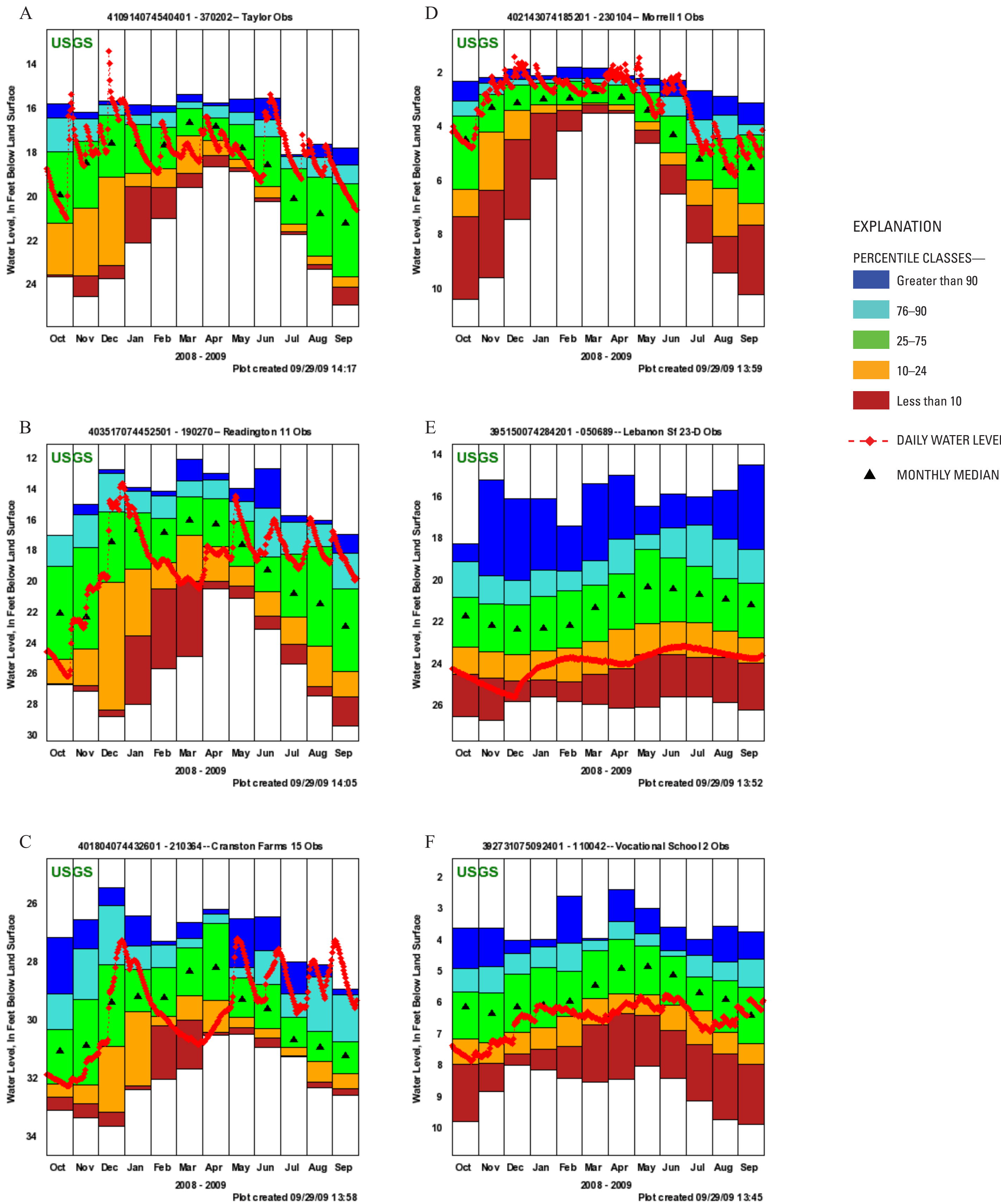

Figure 3. Groundwater levels in three bedrock wells in northern New Jersey (A-C) and three unconfined aquifer wells (D-F) in the New Jersey Coastal Plain, 2009.

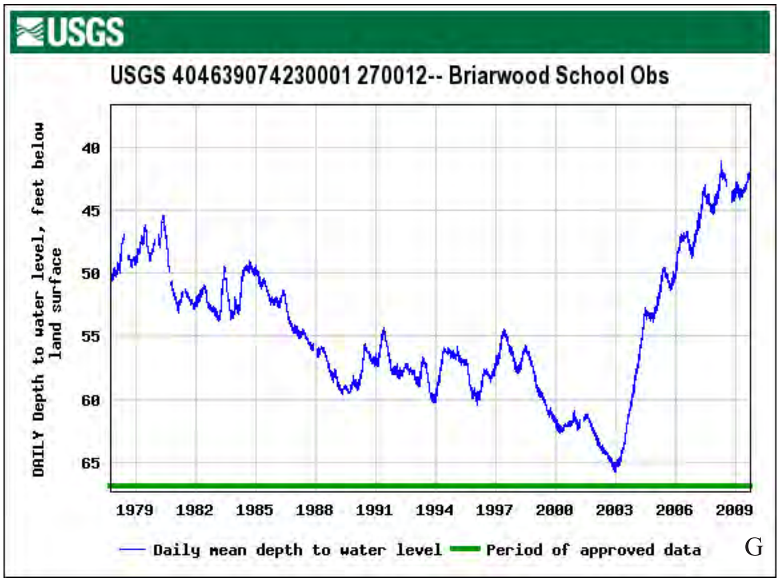

Figure 4. Long-term water levels in glacial aquifer (stratified drift) well 27-12, 1978–2009.

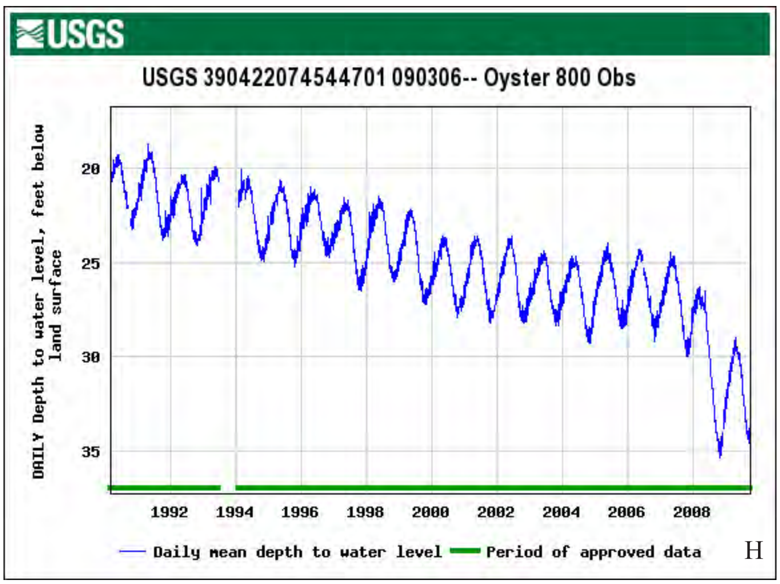

Figure 5. Long term water levels in well 9-306 screened in the Atlantic City 800-foot sand, New Jersey, 1990–2009.

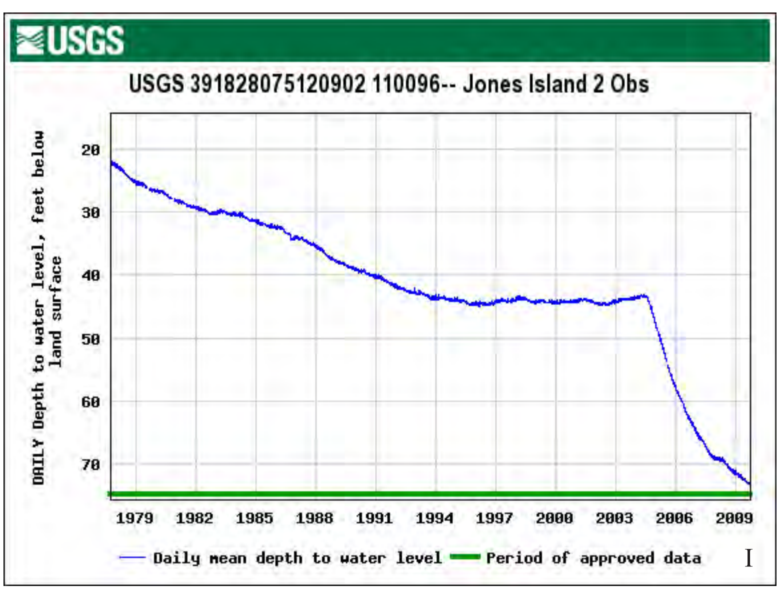

Figure 6. Long-term water levels in well 11-96 screened in the Piney Point aquifer, New Jersey, 1977–2009.

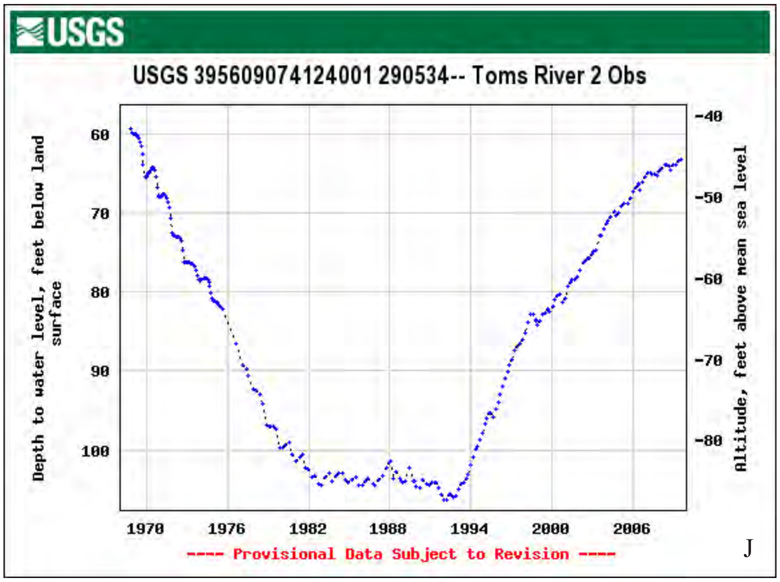

Figure 7. Long-term water levels in well 29-534 screened in the Englishtown aquifer, New Jersey, 1968–2009

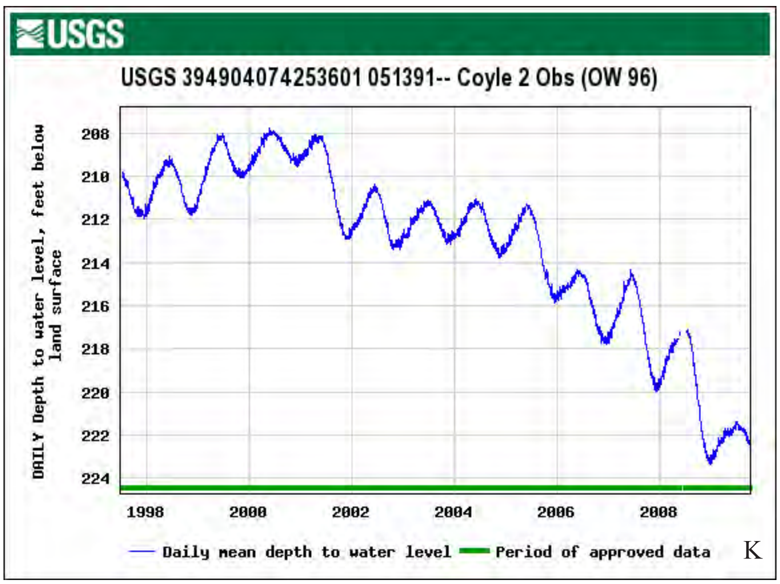

Figure 8. Long-term water levels in well 5-1391 screened in the Upper Potomac-Raritan-Magothy aquifer, New Jersey, 1997–2009.

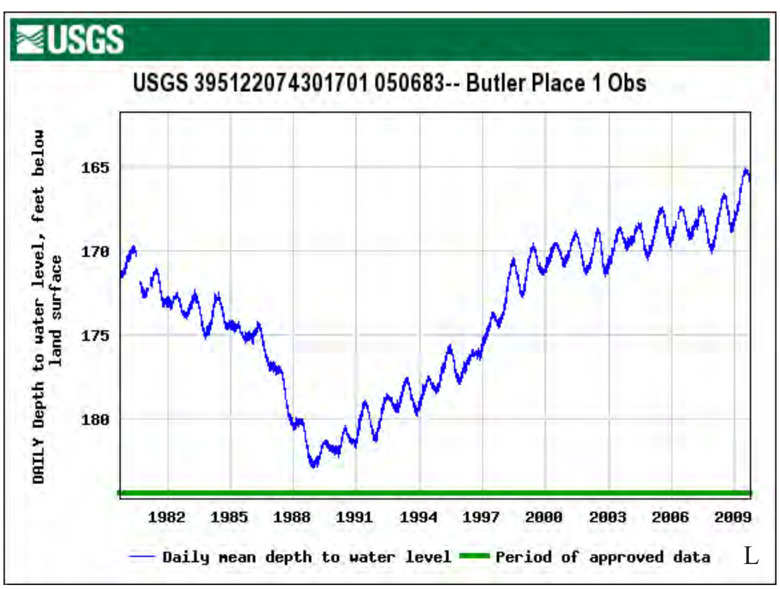

Figure 9. Long-term water levels in well 5-683 screened in the Undifferentiated Potomac-Raritan-Magothy aquifer, New Jersey, 1981–2009