

Observing Systems Division

U.S. Geological Survey National Groundwater Climate Response Network

The U.S. Geological Survey’s National Water Monitoring Network is a set of national water data collection networks that support the U.S. Geological Survey’s mission to protect life, property, the environment, and the economy of the Nation.

What is the U.S. Geological Survey National Groundwater Climate Response Network?

The U.S. Geological Survey’s (USGS) National Water Monitoring Network is a network of networks that includes the Climate Response Network (CRN). The CRN is a network of wells selected to monitor the effects of climate variability, including droughts, on groundwater systems within the United States, Puerto Rico, and the U.S. Virgin Islands. The primary purpose of the CRN is to monitor these effects on groundwater levels in unconfined or near-surface confined aquifers that are minimally affected by pumping or other human-induced stresses.

The Climate Response Network is Designed to Help Answer Two Important Questions

- What are the current conditions of our Nation’s groundwater levels?
- How are climatic conditions affecting our Nation’s groundwater levels?

The CRN provides the water-level data needed to understand how changing climate affects groundwater systems nationwide. Data provided by the CRN form the basis for assessments and models that characterize the connections between climate and groundwater levels (depth to water below land surface).

Building on Decades of Monitoring

Water-level measurements from observation wells are the primary source of information about the effects of hydrologic stresses on groundwater systems (Taylor and Alley, 2001). The USGS uses consistent data-collection and quality-control methods to measure real-time water levels nationwide at more than 2,000 sites (United States Geological Survey, 2024b). A subset of these wells is included in the CRN.

The CRN network is designed to have at least 1 monitored site within each of the Nation’s 366 climate divisions in the United States, Puerto Rico, and the Virgin Islands (United States Geological Survey, 2016; Luo and others, 2024; National Oceanic and Atmospheric Administration, 2024). In 2006, the CRN operated approximately 140 federally funded wells (Cunningham and others, 2007). At its peak (2021–23), the CRN included federally funded data collection at 256 sites representing nearly 70 percent of the Nation’s climate divisions.

The Climate Response Network in 2024

In 2024, the USGS monitors 186 federally funded wells located within about 51 percent of the Nation’s climate divisions across the United States and its territories as part of the CRN (fig. 1). The CRN also includes over 400 supplemental sites located mostly in the eastern United States monitored in cooperation with State, Local, Regional, Tribal, or other Federal partners.

- Federally-funded sites: These sites are authorized by the SECURE Water Act of 2009 (U.S. Congress, 2009) through the USGS Groundwater and Streamflow Information Program (U.S. Geological Survey, 2024a). Groundwater levels are continuously measured at 15- to 60-minute intervals with water level sensors and regularly transmit data to USGS databases. These data are available for viewing on the Water Data for the Nation website (U.S. Geological Survey, 2024b).
- Supplemental sites: The frequency of groundwater-level measurements ranges from periodic (monthly–quarterly) manual measurements to continuously measured. Currently, there are over 300 real-time supplemental sites in the CRN.

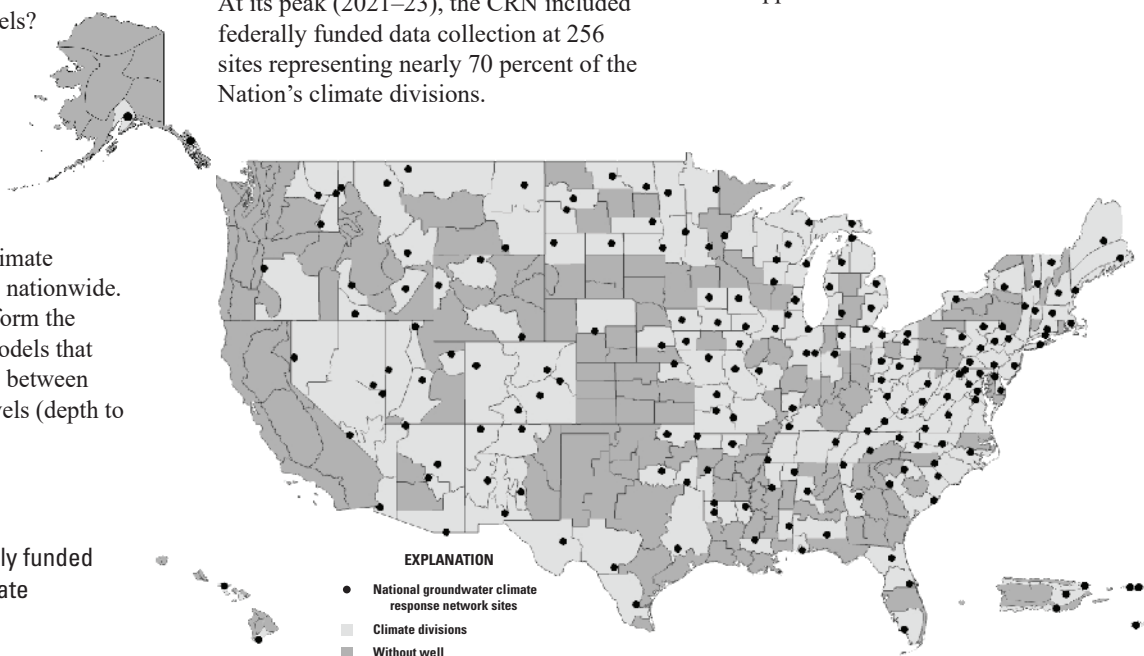


Figure 1. The 2024 federally funded National Groundwater Climate Response Network sites.

Criteria for Climate Response Network Sites

Generally, observation wells tend to be concentrated in areas where aquifers are heavily developed. In contrast, the CRN sites (fig. 2) are intentionally located away from the influence of water-supply pumping, irrigation, and other human activities to allow for monitoring of the natural effects of climate variability. Additionally, the following are the criteria for inclusion in the CRN:

- Open to a single, known hydrogeologic unit;
- Located in unconfined aquifers or near-surface confined aquifers;
- Known well construction;
- Long-term accessibility; and
- Unlikely to go dry.



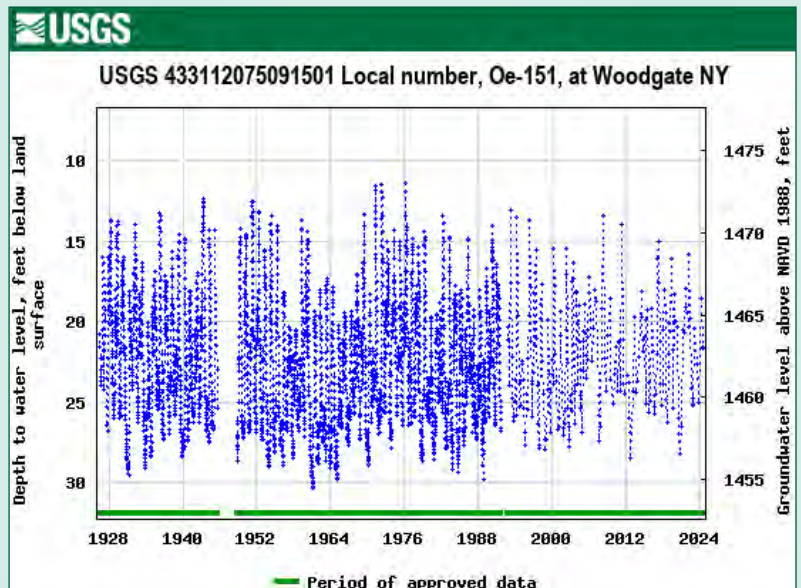
Figure 2. U.S. Geological Survey (USGS) hydrologic technician measures a groundwater level at a Climate Response Network monitoring well in Worcester County, Massachusetts (USGS station 422058072085101). Photograph by Samuel Banas, USGS, October 2022.

Data Access

Data are available through the USGS Groundwater Climate Response Network websites accessible at <https://reconnect.usgs.gov/crnmap/CRNmap.html> and <https://dashboard.waterdata.usgs.gov/>.

References Cited

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Tracking the Response of Climate Variability in Our Nation's Groundwater Systems

The collection of water-level data to adequately assess water-level trends, including the effects of climate variability and regional aquifer development, typically requires years or decades (Taylor and Alley, 2001). Currently, the average period of record among the federally funded CRN sites is over 37 years, and 53 of the 186 sites have over 50 years of groundwater level records. The longest running CRN well is a 31-foot-deep, hand-dug well located in Oneida County, New York (USGS station 433112075091501), that has groundwater measurements from 1926 to present (fig. 3).

Figure 3. Groundwater hydrograph from a Climate Response Network monitoring well (U.S. Geological Survey [USGS] station 433112075091501) located in Oneida County, New York. The graph has a nearly complete record of groundwater levels dating back to 1926, broken only during a period in the late 1940s.

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By Rodney R. Caldwell and Jason M. Fine

For more information about the Climate Response Network:

Visit <https://www.usgs.gov/mission-areas/water-resources/observing-systems-division>
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