Establishing a Collaborative National Ground-Water Monitoring Network Program for the United States

Ground-water monitoring networks are operated by many Federal, State, Tribal, and local agencies. Even though ground-water monitoring is done in many places and at many scales, there is no ready access to these data at the national level and there are no standards that address consistent data structure and quality. In aggregate, however, the data being collected by these many entities will provide a relatively comprehensive picture of the Nation's ground-water resources.

The Federal Advisory Committee on Water Information (ACWI; http://acwi.gov/), as directed by the U.S. Office of Management and Budget, fosters collaboration related to water information collection and sharing. In recognition of the dispersed nature of ground-water data networks, the ACWI directed its Subcommittee on Ground Water (SOGW) to develop a nationwide ground-water monitoring framework that could provide information necessary for the planning, management, and development of ground-water resources to meet current and future water needs and ecosystem requirements. To this end, a project to develop a National Ground-Water Monitoring Network (NGWMN) was begun. The SOGW developed an initial network framework in 2009 and conducted a pilot phase to test the feasibility of a NGWMN and to develop a Web sharing portal in 2011. A revised framework incorporating the lessons learned during the pilot phase was completed in 2013 (Subcommittee on Ground Water, 2009; revised 2013; available at http://acwi.gov/sogw/pubs/tr/index.html).

The NGWMN is envisioned as a voluntary, cooperative, integrated system of data collection, management, and reporting that will provide the data needed to help address present and future ground-water management questions. Thus, the NGWMN may be thought of as an aggregation of wells selected from existing Federal, multistate, State, Tribal, and local ground-water monitoring networks completed in selected aquifers across the Nation. It takes advantage of, but also seeks to enhance, the existing monitoring efforts. The NGWMN will provide data that can be used to assess baseline conditions and long-term trends in water levels and water quality in important aquifers on a national, multistate, and regional scale.

"Design and testing of the National Groundwater Monitoring Network reflects a wonderful collaboration of volunteers from all sectors, and the web portal developed by the USGS represents a significant step forward for efficient delivery of groundwater data. The efforts of many volunteers have produced a Network that will eventually fill important data gaps and provide the basis for significantly improved tracking of groundwater 'health' on a nationwide basis."

—Robert P. Schreiber
Vice-President, CDM Smith,
Co-Chair, Subcommittee on Ground Water


Photo by Eve Kuniansky


Photo by Sue C. Kahle


Photo by Rodney Sheets

Principal and Major Aquifers

The National Ground-Water Monitoring Network will focus on the principal aquifers of the Nation (U.S. Geological Survey, 2003), which are its major water-use aquifers, and also other major aquifers identified by contributing agencies. The network will contain information for selected wells from contributing agency databases. The resulting network will not just be a concatenation of all contributing agency databases, but rather will provide selected wells that are chosen by the data providers to represent the status of the ground-water resources to enable a coherent national assessment. Thus, contributing agencies will select appropriate representative wells for the NGWMN and assure the quality of the data contributed to the network.

National Ground-Water Monitoring Network Pilot Studies

A pilot program involving potential State partners was conducted to test the feasibility and proof-of-concept for a NGWMN, and to develop a Web-based data portal. Five pilot projects were undertaken to test these concepts. The pilot project areas and the agencies responsible are Illinois-Indiana (Illinois State Water Survey, and Indiana Department of Natural Resources), Minnesota (Minnesota Department of Natural Resources, and Minnesota Pollution Control Agency), Montana (Montana Bureau of Mines and Geology), New Jersey (New Jersey Geological Survey, and U.S. Geological Survey), and Texas (Texas Water Development Board). The results of these studies are summarized in the report "National Ground-Water Monitoring Network—Results of Pilot Studies" (Subcommittee on Ground Water, 2011). The pilot projects evaluated the distribution of wells within principal and major aquifers, well measurement and (or) sampling frequency, field practices, data elements stored in their environmental database(s), data-management procedures and their documentation, and overall network costs. Pilot project reports are available at (http://acwi.gov/sogw/pubs/tr/pilot_results/index.html). The results and feedback from the pilot studies were then used in the revision of the framework document.

The major goals of the NGWMN: (1) Compile the water-resources data that can be used to define the status and trends of ground-water availability at the national scale; (2) Identify areas where additional monitoring is needed; (3) Provide data to support regional, interstate, and national management actions; and (4) Provide a data-management framework to receive, manage, and distribute data. All of the data and information in the NGWMN will be available to all interested parties at no cost and with no restrictions.

National Ground-Water Monitoring Network Portal Is Key

A key component of the NGWMN is the development of a Web-based NGWMN portal by the U.S. Geological Survey (USGS). The portal dynamically links with databases at participating agencies, retrieves data, and serves the data through a graphical user interface. Portal implementation involves development of data sharing protocols and Web-based software implementation coordinated between the various entities participating in the network. The portal (figure 1) (http://cida.usgs.gov/ngwmn/) was developed during the pilot phase and has been improved from the experience gained. Data from the wells selected by the pilot studies to represent ground-water conditions in the principal and major aquifers in their respective State can be viewed or downloaded through the NGWMN data portal. In addition, since the pilot studies have been completed, select wells managed by the USGS for many States also have been added to the NGWMN.

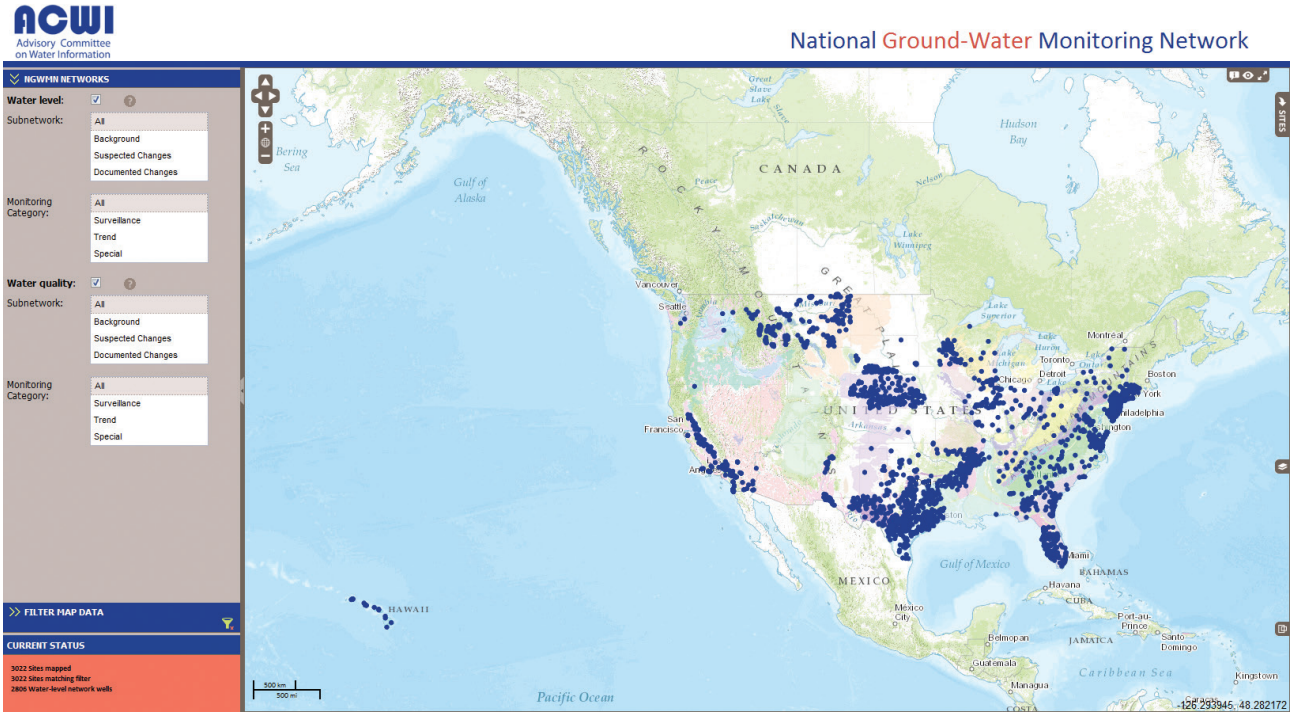

Figure 1. Screen capture of the National Ground-Water Monitoring Network Data Portal.

Why Do We Need a National Ground-Water Monitoring Network?

Determining the status and trends of the Nation's ground-water resources is difficult or nearly impossible because data are either not integrated or not available. Reporting on the areas of the Nation's major aquifers in which water levels are declining, increasing, or stable is one of the 10 highest priority data gaps identified for reporting on the Nation's ecosystems (H. John Heinz III Center for Science, Economics and the Environment, 2006). The NGWMN integrates the necessary data and identifies remaining data gaps. It provides a single, consistent dataset for shared interstate ground-water resources, an opportunity to share data among State agencies, a critical review of field procedures and data-management procedures among data providers, and the opportunity to raise awareness for ground-water monitoring.

Next Steps

A nationwide collaborative network for ground-water monitoring has been discussed for decades. The NGWMN Framework Document and five successful pilot projects have illustrated that the convergence of information technology improvements, increased information needs, recognition of the critical importance of ground water to our Nation, and interest in collaboration have come together to make this the ideal time to develop a NGWMN. The need for a NGWMN is further supported by concerns about the range of economic and environmental factors faced by drinking water purveyors, energy, agricultural, and other economic sectors of the United States. The next steps in making the NGWMN a functioning and usable reality are to enhance the NGWMN portal, encourage other partners to participate in the network, and secure funding commitments to provide for the long-term operation and management of the NGWMN. Agencies interested in participating in the NGWMN are encouraged to view the "Get Involved" information on the portal Web page (http://cida.usgs.gov/ngwmn/learnmore.jsp).

"Without monitoring and measuring groundwater levels and quality, sustainable groundwater resources management and protection is not possible. ….This marks a new era in information sharing on groundwater resources…."

—Timothy K. Parker
Principal Hydrogeologist, Parker Groundwater


Photo by Matthew J. Gilbert

Photo by USGS


Photo by Walter Jones


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Photo by William L. Cunningham

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