

Water Priorities for the Nation—U.S. Geological Survey Integrated Water Availability Assessments

The United States faces growing challenges to its water supply, infrastructure, and aquatic ecosystems because of population growth, climate change, floods and droughts, and aging water delivery systems. To help address these challenges, the U.S. Geological Survey (USGS) Water Resources Mission Area (WMA) has established the Integrated Water Availability Assessments (IWAAs) to capitalize on the operational and scientific strengths of the USGS and engage in these complex societal issues. Substantial advances in water science, together with innovations in technological and computational capabilities, have resulted in sophisticated new monitoring and modeling capabilities that can provide managers with the data, decision support systems, information, and insights needed to address today’s water-availability challenges.

Integrated Water Availability Assessments

The USGS IWAAs will provide nationally and regionally consistent assessments of water for human and ecological needs and identify factors that limit water availability at a range of spatial and temporal scales. When fully implemented, the IWAAs will do the following:

1. evaluate current water supplies and demands, along with the factors that affect them (fig. 1);
2. quantify long-term trends in water-availability metrics and their drivers;
3. provide seasonal to decadal forecasts of water availability; and
4. support water resource management through the design of management-relevant integrated data and water-availability assessment products (fig. 2).



The goals and implementation of IWAAs, and particularly the relevance and utility of IWAA products, will rely on effective communication, coordination, and collaboration with the Federal agencies and Tribal, State, regional, and local partners that need or are supporting an enhanced understanding of water availability.



Figure 1. Numerous factors affect water availability. Water availability reflects the quantity, timing, quality, and use of water resources. More specifically, water availability has four components: (1) the need for a certain volume of water to meet the intended purpose, (2) the timing characteristics with which water is delivered, (3) the adequate quality of the water for the intended purpose, and (4) the need for water to meet human and environmental/ecological uses.

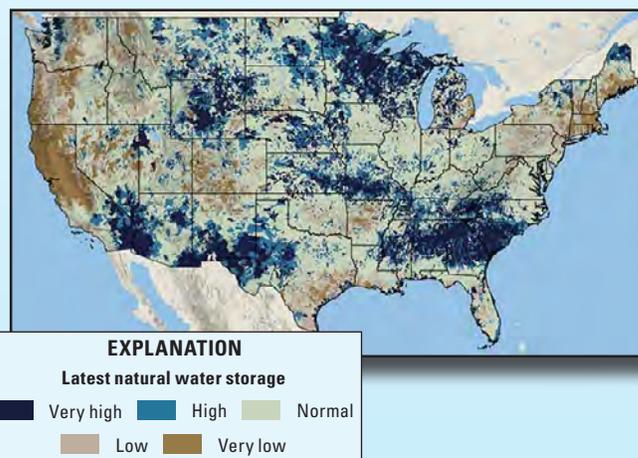


Figure 2. The USGS National IWAAs concept map shows daily estimates of natural water storage (water on the landscape such as standing water, snowpack, soil water, and shallow groundwater) for the conterminous United States. The USGS map is the first product to visualize a current, quantitative view of water availability at the national scale.

National and Regional IWAAs

National Assessments

The national IWAA will provide a near-real-time census of water resources at the subwatershed scale (tracts of 10,000–40,000 acres). When fully realized, the census will provide assessments and forecasts of the amount of surface water and groundwater available to support various uses over spatial extents including individual watersheds, major hydrologic regions, and the Nation. Assessments will also provide information on the quality of available source water and the socioeconomic factors that affect demands on water supplies. This national census—and the data, research, and network of models it comprises—will be supported by next-generation observation systems and an evolving hydrologic cycle and water-quality modeling capacity being developed by the USGS (fig. 3).

Observe **Next Generation Water Observing System (NGWOS)** NGWOS collects real-time data on water quantity and quality in more affordable, rapid, and widespread ways than has previously been possible. The flexible monitoring approach enables USGS networks to evolve with new technology and emerging trends.

Assess **Integrated Water Availability Assessments (IWAA)** IWAAs examine the supply, use, and availability of the Nation's water. These regional and national assessments evaluate water quantity and quality in both surface and groundwater, as related to human and ecosystem needs and as affected by human and natural influences.

Predict **Integrated Water Prediction (IWP)** IWP builds a powerful set of modeling tools to predict the amount and quality of surface and groundwater, now and into the future. These models use the best available science to provide information for more rivers and aquifers than can be directly monitored.

Deliver **National Water Information System (NWIS) Modernization** NWIS data systems that house USGS water information are being modernized to maximize data integrity, simplify data delivery to the general public, and automate early warning to enable faster response times during water emergencies.

Figure 3. The Integrated Water Availability Assessments program is one of four priority programs in the USGS WMA designed to help address current and future societal issues associated with water availability.

Regional Assessments

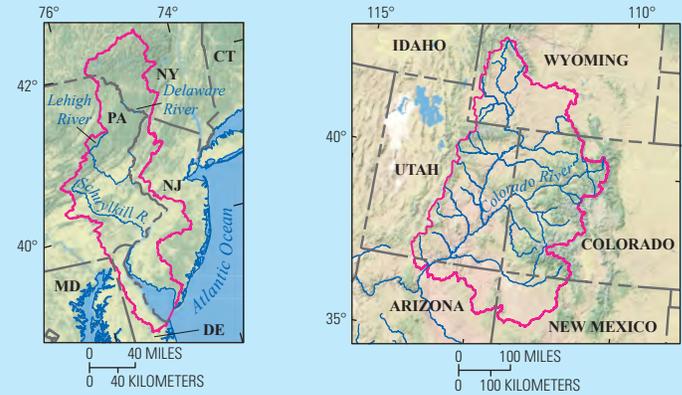
Models, tools, and supporting data developed for the national IWAAs will be augmented by more refined information from select regional studies and assessments to improve national IWAA water-availability models. The specific information needs of each regional IWAA will be informed by local hydrologic conditions and input from partners and stakeholders regarding information gaps and resource management needs. Improved estimates and understanding of the regional water budget; priority components of water availability; and controls on water quantity, quality, and use will be used to meet regional and local information and tool needs and to inform and improve the water-availability assessments and forecasts made by the national IWAAs.

In 2019, the USGS began a pilot regional IWAA in the Delaware River Basin (fig. 4). This pilot is providing an opportunity to explore new approaches to assess factors that affect water supply and demand. Pilot regional IWAA activities in the Delaware River Basin focus on the following:

- understanding historical drought events and future water supply under drought conditions,
- assessing the effect of water quality on water availability for human and ecological purposes,
- developing new data processing techniques and models to predict water use, and
- evaluating streamflow trends as model input toward use in forecasting reservoir storage.

In 2020, the USGS selected the Upper Colorado River Basin (fig. 4) to perform a fully implemented regional IWAA. This basin was selected to provide an opportunity to improve regional water-availability prediction in snowmelt dominated systems. Ultimately, a new regional IWAA will be added each year, as funding is available, until 10 basins identified by a basin selection team have implemented IWAA projects. The basin selection team developed criteria that accounted for environmental, engineered, and social settings; ecological resources; water demand; water quality and water quantity; and changes to water resources in different regions.

The USGS WMA plays an essential role in meeting the current and future challenges associated with managing the Nation's water resources (National Academies of Science, Engineering, and Medicine, 2018). The IWAAs program is one of four priority programs established by the USGS WMA (fig. 3) to help ensure that its observational networks and renowned water science and research continue to provide timely and actionable information to stakeholders, managers, and decision makers.



Base from U.S. Geological Survey National Map, 1:2,000,000, Albers Equal-Area Conic projection, standard parallels 29°30' N, central meridian 96°00' W, latitude of origin 23°00' N, North American Datum of 1983, Map image is the intellectual property of Esri and is used herein under license. Copyright © 2014 Esri and its licensors. All rights reserved. Base modified from Esri digital data, 1:72,000 (Esri, 2014)

Figure 4. The Upper and Lower Delaware River Basins (left) and Upper Colorado River Basin (right) were selected in 2019 and 2020, respectively, to implement regional IWAAs. Additional basins are anticipated to be added each year through 2029.

Reference Cited

National Academies of Sciences, Engineering, and Medicine, 2018, Future water priorities for the Nation—Directions for the U.S. Geological Survey Water Mission Area: Washington, D.C., The National Academies Press, 96 p. [Also available at <https://doi.org/10.17226/25134>.]

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 Integrated Water Availability Assessments Program,
<https://www.usgs.gov/mission-areas/water-resources/science/integrated-water-availability-assessments-iwaas>

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