

Monitoring the Pulse of Our Nation's Rivers and Streams: The U.S. Geological Survey Streamgaging Network

In the late 1800s, John Wesley Powell, second Director of the U.S. Geological Survey (USGS), proposed gaging the flow of rivers and streams in the Western United States to evaluate the potential for irrigation. Around the same time, several cities in the Eastern United States established primitive streamgages to help design water-supply systems. Streamgaging technology has greatly advanced since the 1800s, and USGS hydrographers have made at least one streamflow measurement at more than 37,000 sites throughout the years. Today, the USGS Groundwater and Streamflow Information Program supports the collection and (or) delivery of both streamflow and water-level information for more than 8,500 sites (continuous or partial record) and water-level information alone for more than 1,700 additional sites. The data are served online—most in near realtime—to meet many diverse needs; more than 640 million requests for streamflow information were fulfilled during the 2017 water year (October 1, 2016–September 30, 2017).

Unique Partnership

The streamgages are primarily operated and maintained by the USGS, but most are funded in partnership with one or more of about 1,400 Federal, State, local, and Tribal agencies or organizations. This unique cooperation results in nationally consistent and impartial data that also aids local decision making. The shared costs result in the operation of far more streamgages than would be possible if financed solely by USGS appropriations, which provide less than one-third of the needed funding. These partnerships also enable fixed costs (such as costs associated with data storage and delivery infrastructure) to be broadly distributed, resulting in more economical streamgaging information for all.

“The independent, science-based streamflow information that we obtain from USGS gages is paramount to assuring compliance under our various interstate compacts with our neighboring states.”

~Julie Cunningham, Oklahoma Water Resources Board



A Network of Networks

The USGS streamgaging network is a multipurpose network that comprises more than 10,000 streamgages. It encompasses several smaller networks that produce specific information or support specific needs.

National Streamflow Network (NSN)

The National Streamflow Network (NSN) consists of all streamgages that continuously monitor streamflow year-round and from which daily mean streamflows are computed and made available online. The data collected at NSN streamgages serve several functions (including flood warning, water allocation, and recreation) and can be used by anyone regardless of whether or not they help fund the network. The use of consistent methods enables data from the many gages to be combined, expanding the use and value of the data from every gage. At present (2018), more than 8,200 gages are in the NSN.

Federal Priority Streamgages (FPS) Network

The Federal Priority Streamgages (FPS) Network (previously known as the National Streamflow Information Program) was conceived in 1999 to be a core, federally funded network. The original network design included 4,300 then active, previously discontinued, or proposed new gages that were strategically positioned across the country to address long-term Federal information needs (such as supporting National Weather Service flood forecasts, or interstate and international compacts and decrees). At present (2018), more than 4,700 locations meet the criteria for inclusion in the FPS network, but only about 3,600 FPS are active because of funding limitations. These active FPS are supported through a combination of Federal and partner funding—less than one-quarter are fully funded by the USGS.

Information Delivery and Application

The USGS operates one of the largest streamgaging enterprises in the world. Water levels are measured by more than 10,000 gages; the data are typically transmitted to USGS computers within 1 hour of measurement. At most gages, continuously measured water levels are used to compute hourly (or more frequent) time series of streamflows from gage-specific rating curves that were developed using onsite streamflow measurements made by USGS hydrographers—more than 80,000 onsite measurements are made each year. The data are quality assured and made available online. Data users include emergency responders, water managers, environmental and transportation agencies, universities, utilities, recreational enthusiasts, and consulting firms. Specific uses of the data include the following:

- planning, forecasting, and warning about floods and droughts;
- managing water rights and transboundary water issues;
- operating waterways for power production and navigation;
- monitoring environmental conditions to protect aquatic habitats;
- describing impacts to streamflow from changing land and water uses;
- assessing water quality and regulating pollutant discharges;
- determining if streams are safe for recreational activities; and
- designing reservoirs, roads, bridges, drinking water and wastewater facilities.

By Sandra M. Eberts, Michael D. Woodside, Mark N. Landers, and Chad R. Wagner

“Many thanks...we sincerely appreciate your [USGS] support. Your data make our forecasts possible.”

*Kevin Low, National Weather Service,
Missouri River Basin Forecast Center Hydrologist,
May 25, 2018*



By the Numbers (2017 Water Year)

Streamflow and Water-Level Gages

(operated year-round or seasonally)



10,330 gages

8,580 monitored streamflow and water level
1,750 monitored water level

80,000 measurements made by hydrographers

Key Networks



National Streamflow Network (NSN)

(monitored streamflow year-round and met a variety of local, State, and Federal needs)

8,230 gages

5,030 had more than 30 years of record
330 had more than 100 years of record

Federal Priority Streamgages (FPS) Network

(met Federal priority information needs)

3,640 gages

3,200 monitored streamflow year-round
(included in the National Streamflow Network)
440 monitored water level or operated seasonally
1,120 eligible locations lacked funding

Funding



\$188 million

\$55 million from Federal appropriation
\$133 million from 1,410 partners

Water Data Delivery



640 million requests made for streamflow info

98 percent fulfilled through web services

For more information

U.S. Geological Survey Water Mission Area
Groundwater and Streamflow Information Program

<https://www.usgs.gov/gwsip>

WaterWatch: <https://waterwatch.usgs.gov/>

WaterAlert: <https://maps.waterdata.usgs.gov/mapper/wateralert/>

WaterNow: <https://water.usgs.gov/waternow/>

National Water Information System: <https://waterdata.usgs.gov/nwis>

Techniques and Methods 3-A8—

Discharge Measurements at Gaging Stations:

<https://pubs.usgs.gov/tm/tm3-a8/>