

Background Documents Recommended by USGS

USGS Water Mission Area Strategic Planning:

- Strategic Directions for U.S. Geological Survey Water Science, 2012–2022—Observing, Understanding, Predicting, and Delivering Water Science to the Nation—Public Review Release (<http://pubs.usgs.gov/of/2012/1066/>)

Streamgaging:

- The Importance of Streamgages – A Delaware River Basin Commission web page: <http://www.state.nj.us/drbc/gage/gageshp.htm>
- General National Streamflow Information Program web pages: <http://water.usgs.gov/nsip/>
- Uses of streamflow information: <http://water.usgs.gov/nsip/uses9.html>
- NSIP External Review Documents: <http://water.usgs.gov/nsip/reviews.html>
- Includes reviews by the National Hydrologic Warning Council, The National Research Council, and the Advisory Committee for Water Information's Streamgaging Task Force
- NSIP Status Report (current through 2011): <http://pubs.usgs.gov/fs/2009/3020/>
- Streamflow WaterWatch: <http://waterwatch.usgs.gov/>
- The original NSIP design committee's report: <http://pubs.usgs.gov/of/2004/1263/>
- NSIP design summary report: <http://pubs.usgs.gov/of/1999/ofr99456/#pdf>
- Cost comparison of USGS streamgage network and 3 non-federal streamgage programs: <http://pubs.usgs.gov/of/2007/1426/>
- Report describing the NSIP streamgage site selection process: http://water.usgs.gov/nsip/pubs/Ries_EWRI_2001.pdf
- Streamgaging and NSIP reports page: <http://water.usgs.gov/nsip/reports.html>

Groundwater:

Selected Web Pages

OGW: <http://water.usgs.gov/ogw/>
Web pages for the Office of Groundwater. Also the “Groundwater Information Pages” for the USGS.

GWRP: <http://water.usgs.gov/ogw/gwrp/>
Web pages for the Groundwater Resources Program, with emphasis on the program’s Groundwater Availability Studies

GWW: <http://groundwaterwatch.usgs.gov/>

Web pages for “Groundwater Watch”. This system provides the latest data and statistical information for “active” wells and springs. “Active” is defined as a site with a measurement within the last 13 months.

SOGW: <http://acwi.gov/sogw/>
Web pages for ACWI’s Subcommittee on Ground Water.

USGS Reports

Ground Water Procedures

Cunningham, W.L., and Schalk, C.W., comps., 2011, Groundwater technical procedures of the U.S. Geological Survey: U.S. Geological Survey Techniques and Methods 1–A1, 151 p.
(<http://pubs.usgs.gov/tm/1a1/>)

This report provides guidance on USGS field methods and data handling procedures for many aspects of groundwater data collection.

Generic Ground Water Quality Assurance Plan

Jilann O. Brunett, Nancy L. Barber, Alan W. Burns, Ronald P. Fogelman, Daniel C. Gillies, Robert A. Lidwin, and Thomas J. Mack, 1997, A QUALITY-ASSURANCE PLAN FOR DISTRICT GROUND-WATER ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY: U.S. GEOLOGICAL SURVEY Open-File Report 97-11, 19 p.
(<http://water.usgs.gov/ogw/pubs/OFR9711/gwqap.html>)

All USGS Water Science Centers must have a Quality Assurance Plan for groundwater activities. This report provides a general framework/template for such a plan. USGS Centers use this template to develop their own Center-specific plan.

Continuous Record (Surface Water)

Sauer, V.B., 2002, Standards for the Analysis and Processing of Surface-Water Data and Information Using Electronic Methods: U.S. Geological Survey Water-Resources Investigations Report 01–4044, 91 p.
(<http://pubs.er.usgs.gov/publication/wri20014044>)

This report provides USGS guidance for managing “continuous” data. This report is for surface water, but the data management processes are nearly identical for groundwater so it serves as a good reference. (A groundwater-specific version does not exist.)

Climate Response Network

Cunningham, W.L., Geiger, L.H, and Karavitis, George, 2007, U.S. Geological Survey Ground-Water Climate Response Network: U.S. Geological Survey Fact Sheet 2007-3003.
(<http://pubs.usgs.gov/fs/2007/3003/>)

This Fact Sheet describes the “Groundwater Watch” system as it was in 2007, and provides a description of the first “network” in GW Watch – the Climate Response Network (CRN). Page 4 of the Fact Sheet describes the plan for full implementation of the CRN.

Microgravity

J.T.C. Parker and D.R. Pool, 1998, Use of Microgravity to Assess the Effects of El Niño on Ground-Water Storage in Southern Arizona: U.S. Geological Survey Fact Sheet 060-98. (<http://pubs.usgs.gov/fs/FS-060-98/>)

This Fact Sheet describes the process for and use of microgravity measurements to determine changes in groundwater storage.

Circular on Ground Water Levels

Taylor, Charles J. and Alley, W.M., 2001, Ground-water-level monitoring and the importance of long-term water-level data: U.S. Geological Survey circular 1217, 68 p. (<http://pubs.usgs.gov/circ/circ1217/>)

This report describes basic groundwater principles, some of the important uses of groundwater-level monitoring data, as well as some case studies of monitoring networks.

Miscellaneous

- Secure Water Act – Public Law that references the Climate Response Network and the National Ground Water Monitoring Network. This PL also mentions the streamgaging network and other Water Census activities.

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- SGS Furnished Record Policy – (<http://water.usgs.gov/admin/memo/policy/wrdpolicy08.01.html>)

Example USGS Water Mission Area (WMA) Policy memo. WMA policies apply to all parts of the organization, so in this example, the “furnished record policy” applies to groundwater levels, streamflow, and surface- and groundwater-quality data collection and storage.

- USGS Well Integrity Policy (<http://water.usgs.gov/admin/memo/GW/gw12.01.html>)

Example Office of Groundwater (OGW) Policy Memo. OGW policies apply to all activities in the WMA. This policy describes actions that a Science Center must take to assure that a monitoring well maintains a good connection to the aquifer in which it is completed.

ACWI Subcommittee on Ground Water Reports

- National Ground Water Monitoring Network “Framework” Document (<http://acwi.gov/sogw/pubs/tr/index.html>)
- Results of Pilot Studies, National Ground Water Monitoring Network (http://acwi.gov/sogw/pubs/tr/pilot_results/index.html)

Information added in response to questions from the ACWI Workgroup

Groundwater Availability in the United States

Reilly, T.E., Dennehy, K.F., Alley, W.M., and Cunningham, W.L., 2008, Ground-Water Availability in the United States: U.S. Geological Survey Circular 1323, 70 p., also available online at <http://pubs.usgs.gov/circ/1323/>

This report what is known about the Nation's ground-water availability and outlines a program of study by the U.S. Geological Survey Groundwater Resources Program (GWRP) to improve our understanding of groundwater availability in major aquifers across the Nation (referred to above as GWRP's “Groundwater Availability Studies”). During the ACWI presentation, this report was cited by a workgroup member for content on page 13-19, regarding water level declines across the Nation.

Ground Water and Surface Water: A Single Resource

Winter, T.C., Harvey, J.W., Franke, O.L., and Alley, W.M., 1998, Ground water and surface water: a single resource. U.S. Geological Survey Circular 1139, 80 p. <http://pubs.usgs.gov/circ/circ1139/>

This Circular is a primer on groundwater/surface water interaction. It provides myriad examples of natural processes and the effects of human activities on GW/SW interactions. There is nothing specific about GW-level monitoring, but a question about GW/SW interaction came up during the presentation, so it is included here.

Understanding and Managing the Effects of Groundwater Pumping on Streamflow

Leake, S.A., and Barlow, P.M., 2013, Understanding and managing the effects of groundwater pumping on streamflow: U.S. Geological Survey Fact Sheet 2013–3001, 4 p. <http://pubs.usgs.gov/fs/2013/3001/>

Adding to the topic of GW/SW exchange, this Fact Sheet describes some of the misconceptions regarding streamflow depletion by wells.

The Value of Long-Term Monitoring in the Development of Ground-Water-Flow Models

Feinstein, D.T., Hart, D.J., Eaton, T.T., Krohelski, J.T., and Bradbury, K.R., 2004, Simulation of regional groundwater flow in southeastern Wisconsin: Wisconsin Geological and Natural History Survey Open-File Report 2004-01, 134 p. <http://pubs.usgs.gov/fs/fs-116-03/>

A workgroup member commented about the importance of groundwater-level monitoring to modeling. Long-term, systematic collection of hydrologic data is crucial to the construction and testing of ground-water models so that they can reproduce the evolution of flow systems and forecast future conditions. This Fact Sheet provides an example of the incorporation of historical hydrologic data in a regional ground-water model for southeastern Wisconsin.

California's Central Valley Groundwater Study

Claudia C. Faunt, Randall T. Hanson, Kenneth Belitz, and Laurel Rogers, 2009, California's Central Valley Groundwater Study: A Powerful New Tool to Assess Water Resources in California's Central Valley, USGS Fact Sheet 2009-3057, 4 p. <http://pubs.usgs.gov/fs/2009/3057/>

A comment/question was raised about how groundwater data might be used, and the USGS groundwater availability study in the Central Valley of California was mentioned as an example. This Fact Sheet describes that study.

Example of Groundwater Levels used in Decision Making

A comment/question was raised about management ramifications if water-level data were not available. Here are some examples:

1. Regional Scale: High Plains Groundwater Level Network and Reporting

Water levels are compiled from 8 states, and a bi-annual report is produced that describes that status of the High Plains aquifer. This is described on page 18 of the Circular on GW Levels (<http://pubs.usgs.gov/circ/circ1217/>), and on the High Plains Monitoring Project web pages: <http://ne.water.usgs.gov/ogw/hpwlms/>.

2. State Scale: Drought Monitoring in Pennsylvania

Groundwater levels in shallow, water-table aquifers across the state are used as one of 4 primary decision variables (streamflow, precipitation, and Palmer Drought Index) in the determination of a county, multi-count, or statewide drought declaration. This is described on page 31 of the Circular on GW Levels (<http://pubs.usgs.gov/circ/circ1217/>) and on the web pages of the USGS Pennsylvania Water Science Center (<http://pa.water.usgs.gov/drought/index.php>).

3. Local Scale: Sole Source Aquifer for San Antonio.

The groundwater level in Bexar County Index Well is the official well for recording groundwater elevations in the San Antonio Pool of the Edwards Aquifer. The water level in this well is cited nightly on the local San Antonio news (cited on page 2 of this fact sheet: <http://pubs.usgs.gov/fs/fs-090-01/>)

Water Quality:

General Background about USGS Water-quality monitoring and programs

Mallard, G.E., and Hamilton, P.A. 2002, Monitoring and Assessing our Nation's Water Quality, 2002, U.S. Geological Survey Fact Sheet 076-02.

<http://pubs.usgs.gov/fs/fs-076-02/>

Hydrologic Benchmark Network

Murdoch, P.S. Mchale, M. R. Mast, A.M., and Clow, D.W. 2006, The U.S. Geological Survey Hydrologic Benchmark Network. U.S. Geological Survey Fact Sheet 2005-3135.

<http://pubs.usgs.gov/fs/2005/3135/report.pdf>

National Stream Quality Accounting Network

Crawford, C.G., 2009, Monitoring Large Rivers in the National Stream Quality Accounting Network (NASQAN); U.S. Geological Survey Information Sheet Sheet.

<http://water.usgs.gov/nasqan/docs/nasqan.information.sheet.2pager.pdf>

National Water Quality Monitoring Program

National Research Council, **2012**, *Preparing for the third decade of the National Water-Quality Assessment Program*: National Academy Press, Washington, D.C., 185 p.

http://www.nap.edu/catalog.php?record_id=13464

Quality Assurance

USGS Branch of Quality Systems: <http://bqs.usgs.gov/pubs.php>

See also the PDF file describing Branch of Quality Systems projects:

http://acwi.gov/monitoring-challenges_wkg/minutes/BQS_briefing_doc_020113.pdf

Standards and Procedures

U.S. Geological Survey, **variously dated**, National field manual for the collection of water quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 9, chaps. A1-A9.

<http://pubs.water.usgs.gov/twri9A>.

Wagner, R.J., Boulger, R.W. Jr., Oblinger, C.J., and Smith, B.A., **2006**, Guidelines and standard procedures for continuous water-quality monitors: station operation, record computation, and data reporting, U.S. Geological Survey Techniques and Methods 1-D3, 51 p.

<http://pubs.water.usgs.gov/tm1d3>

Koterba, Michael T., Wilde, Francesca D., and Lapham, Wayne W., **1995**, *Ground- water data-collection protocols and procedures for the National water-quality Assessment Program: Collection and documentation of water-quality samples and related data*: U.S. Geological Survey Open-File Report 95-399, 113 p.

<http://pubs.er.usgs.gov/publication/ofr95399>

Lapham, Wayne W., Wilde, Francesca D., and Koterba, Michael T., **1995**, *Ground- water data-collection protocols and procedures for the National water-quality Assessment Program: Selection, installation, and documentation of wells, and collection of related data*: U.S. Geological Survey Open-File Report 95-398, 69 p.

<http://pubs.er.usgs.gov/publication/ofr95398>

Koterba, Michael T., **1998**, *Ground-water data-collection protocols and procedures for the National Water-Quality Assessment Program: Collection, documentation, and compilation of required site, well, subsurface, and landscape data for wells*: U.S. Geological Survey Water-Resources Investigations Report 98-4107, 91 p.

<http://pubs.er.usgs.gov/publication/wri984107>

Meador, M.R., Hupp, C.R., Cuffney, T.F., and Gurtz, M.E., **1993**, *Methods for characterizing stream habitat as part of the National Water-Quality Assessment Program*: U.S. Geological Survey Open-File Report 93-408.

<http://pubs.er.usgs.gov/publication/ofr93408>

Moulton II, S.R., Carter, J.L., Grotheer, S.A., Cuffney, T.F., and Short, T.M., **2000**, *Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory -- Processing, taxonomy, and quality control of benthic macroinvertebrate samples*: U.S. Geological Survey Open-File Report 00-212, 49 p.

<http://nwql.usgs.gov/Public/pubs/OFR00-212.pdf>

Moulton, S.R., Kennen, J.G., Goldstein, R.M., Hambrook, J.A., **2002**. Revised protocols for sampling algal, invertebrate, and fish communities as part of the National Water Quality Assessment Program, U.S. Geological Survey Open-File Report 02-150, 75 p.

<http://pubs.usgs.gov/of/2002/ofr-02-150/>

Charles, Donald F., Knowles, Candia, and Davis, Robin S., eds., **2002**, *Protocols for the analysis of algal samples collected as part of the U.S. Geological Survey National Water-Quality Assessment Program*: The National Academy of Sciences, Patrick Center for Environmental Research, Report No. 02-06, 124 p.

<http://water.usgs.gov/nawqa/protocols/algprotocol/index.html>

Laboratory Analyses

Connor, B.F., Rose, D.L., Noriega, M.C., Murtagh, L., and Abney, S.R., **1998**, *Methods of Analysis by the U.S. Geological Survey National Water Quality Laboratory -- Determination of 86 Volatile*

Organic Compounds in Water by Gas Chromatography/Mass Spectrometry, Including Detections Less Than Reporting Limits: U.S. Geological Survey Open-File Report 97-829, 78 p.
<http://nwql.usgs.gov/Public/pubs/OFR97-829/OFR97-829.html>

Rose, Donna L., and Sandstrom, Mark W., **2003**, *Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory: determination of gasoline oxygenates, selected degradates, and BTEX in water by heated purge and trap/gas chromatography/mass spectrometry*: U.S. Geological Survey Water-Resources Investigations Report 2003-4079, 31 p.
<http://pubs.er.usgs.gov/publication/wri034079>

Sandstrom, Mark W., Stoppel, Max E., Foreman, William T., and Schroeder, Michael P., **2001**, *Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory - determination of moderate-use pesticides and selected degradates in water by C-18 solid-phase extraction and gas chromatography/mass spectrometry* : U.S. Geological Survey Water-Resources Investigations Report 2001-4098, 70 p.
<http://pubs.er.usgs.gov/publication/wri20014098>

