

Prepared in cooperation with the Wyoming Department of Environmental Quality

Wyoming Groundwater-Quality Monitoring Network

Introduction

A wide variety of human activities have the potential to contaminate groundwater. In addition, naturally occurring constituents can limit the suitability of groundwater for some uses. The State of Wyoming has established rules and programs to evaluate and protect groundwater quality based on existing and potential uses. The Wyoming Groundwater-Quality Monitoring Network (WGQMN) is a cooperative program between the U.S. Geological Survey (USGS) and the Wyoming Department of Environmental Quality (WDEQ) and was implemented in 2009 to evaluate the water-quality characteristics of the State's groundwater. Representatives from USGS, WDEQ, U.S. Environmental Protection Agency (USEPA), Wyoming Water Development Office, Wyoming State Geological Survey, and Wyoming State Engineer's Office formed a steering committee, which meets periodically to evaluate progress and consider modifications to strengthen program objectives. The purpose of this fact sheet is to describe the WGQMN design and objectives, field procedures, and water-quality analyses. USGS groundwater activities in the Greater Green River Basin also are described.

Network Design and Objectives

The WGQMN is designed to include wells that are in priority areas where groundwater has been identified as an important source of drinking water to public and private water supplies, is susceptible to contamination, and is overlain by one or multiple land-use activities that could negatively affect groundwater resources (Bedessem and others, 2003) (fig. 1, table 1). The State identified 33 priority areas and grouped them together by major basin for implementation purposes (table 1). Groundwater-quality samples will be collected from 20 to 30 wells within each priority area. Wells to be selected for sampling will be completed in Quaternary-age unconsolidated aquifers and shallow (less than 500 feet deep) bedrock aquifers. Data collection and reporting activities by the USGS as part of the WGQMN will include the following:

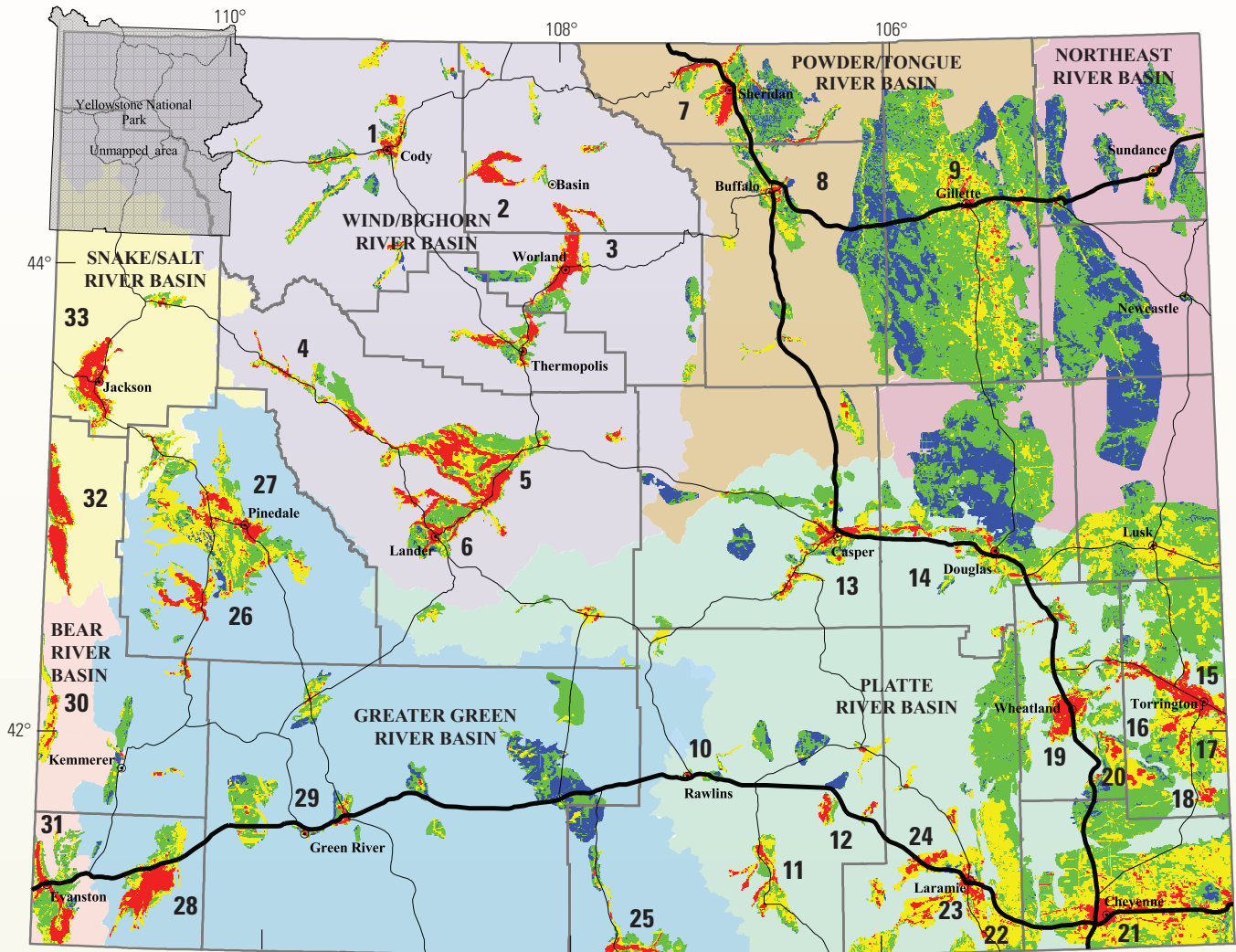
- Measurement of the water level in each well;
- Collection of groundwater samples from each well to be analyzed for a wide variety of natural and human-made constituents;

- Analysis of select samples for constituents such as stable isotopes to help determine recharge characteristics of the groundwater;
- Reporting of analytical results through a publicly available USGS water-quality Web site (<http://waterdata.usgs.gov/wy/nwis/qw/>); and
- Periodic summaries of groundwater data in published USGS Fact Sheets and Scientific Investigations Reports.

Field Procedures

Site selection, field measurements, and water-quality sampling procedures are performed in accordance with approved methods in the USGS National Field Manual for the Collection of Water-Quality Data (U.S. Geological Survey, variously dated). Prior to sampling, the depth to water in the well is measured to the nearest 0.01 foot, if possible. If a pump is not permanently installed in the well, a submersible pump is used for purging and sampling. Field properties (temperature, pH, oxidation-reduction potential, specific conductance, dissolved oxygen, and turbidity) are measured and recorded regularly during purging. Each well is purged by removing a minimum of three casing volumes of standing water. After purging, samples are collected when field properties have stabilized. Sample-collection connections are made at the wellhead or other sampling point to allow the use of a mobile water-quality laboratory to process the samples (figs. 2 and 3). Samples are preserved and containerized on site, according to individual analytical method requirements.

Details about the site and well are useful for interpreting analytical results. Field documentation includes groundwater-quality notes, which are used to record information about sampling conditions, analytical laboratories, calibration, well condition, water-level measurements, well purging and associated stability measurements, and quality-control samples. Analytical services request forms are used to record the USGS site identification number, sample date and time, requested laboratory schedules and codes, and types of bottles and their treatments. Photographs are used to document the well condition and surrounding land uses.



Lambert projection, standard parallels 33 and 45 degrees north, central meridian 107.5 degrees west



Figure 1. Groundwater with the highest priority for sampling is shown as red and yellow (modified from Bedessem and others, 2003).

EXPLANATION
Aquifer Prioritization for Ambient Groundwater Monitoring

Aquifer prioritization

- Low
- Low-moderate
- Moderate-high
- High
- No data

15 Map number (see table 1) for moderate-high and high priority areas

Produced by the University of Wyoming Geographic Information Science Center and the Department of Civil and Architectural Engineering at the University of Wyoming, in cooperation with the Wyoming Department of Environmental Quality Water Quality Division, the Wyoming State Geological Survey, the U.S. Geological Survey, and the University of Wyoming Department of Geology and Geophysics.



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Table 1. Priority areas identified for inclusion in the Wyoming Groundwater-Quality Monitoring Network.

Site number (fig. 1)	Priority area	Basin	Site number (fig. 1)	Priority area	Basin
1	Cody/Wapiti	Wind/Bighorn	18	LaGrange/Hawk Springs	Platte
2	Emblem	Wind/Bighorn	19	Wheatland	Platte
3	Thermopolis/Big Horn River/Worland	Wind/Bighorn	20	Slater/Chugwater	Platte
4	Dubois/Crowheart	Wind/Bighorn	21	Cheyenne	Platte
5	Riverton/Wind River	Wind/Bighorn	22	Laramie/Tie Siding	Platte
6	Lander/Hudson	Wind/Bighorn	23	Laramie River	Platte
7	Sheridan/Dayton	Powder/Tongue	24	Little Laramie River	Platte
8	Buffalo	Powder/Tongue	25	Baggs	Greater Green
9	Gillette/Rozet	Powder/Tongue	26	Big Piney/Marbleton	Greater Green
10	Rawlins	Platte	27	Pinedale/Boulder/Daniel	Greater Green
11	Saratoga	Platte	28	Mountain View	Greater Green
12	Elk Mountain	Platte	29	Rock Springs	Greater Green
13	Casper/Evansville/Alcova	Platte	30	Cokeville	Bear
14	Glenrock/Douglas/Orin	Platte	31	Evanston	Bear
15	Torrington	Platte	32	Star Valley	Snake/Salt
16	Yoder/Veteran	Platte	33	Jackson/Teton Village	Snake/Salt
17	Huntley and by border	Platte			



Figure 2. Mobile water-quality laboratory used for the collection of samples from groundwater wells.



Figure 3. Wellhead connections for groundwater sampling that lead to the mobile water-quality laboratory and discharge line.

Water-Quality Analyses

Groundwater samples are analyzed for major ions, trace elements, nutrients, and volatile organic compounds at the USEPA Region 8 Laboratory in Denver, Colo., and for total dissolved solids, dissolved organic carbon, and stable isotopes at various USGS laboratories. Coliform bacteria (total coliform and *E. coli*) colony counts and alkalinity values are determined in the field. Select samples also may be analyzed for wastewater compounds, radionuclides (tritium, gross-alpha and gross-beta radioactivity, and radon-222), total petroleum hydrocarbons (diesel-range and gasoline-range organics), dissolved hydrocarbon gases, and biological activity reaction tests.

USGS Groundwater Activities in the Greater Green River Basin

Although the WGQMN scope is Statewide, water-quality sampling will be implemented by basin. Sampling by the USGS began in December 2009 in five priority areas within the Greater Green River Basin. The WGQMN in the Greater Green River Basin builds on existing USGS projects in the basin such as the Wyoming Landscape Conservation Initiative, not only to leverage limited resources, but also to improve the understanding of groundwater. A recently completed summary of physical and chemical characteristics of groundwater resources (Clarey and others, 2010) and an ongoing project by Bowen and others (2010) were used to select wells to be sampled in unconsolidated and bedrock aquifers within the priority areas for the Greater Green River Basin. Selection of basins for future sampling will be conducted in consultation with the WDEQ and will be based on groundwater management needs of the State.

References Cited

- Bedessem, M.E., Casey, Brenda, Frederick, Kevin, and Nibbelink, Nathan, 2003, Phase I: Aquifer prioritization, Final report: Prepared for the Wyoming Department of Environmental Quality by the University of Wyoming Department of Civil and Architectural Engineering, Laramie, Wyo., variously paged.
- Bowen, Z.H., Aldridge, C.L., Anderson, P.J., Assal, T.J., Biewick, L.R.H., Blecker, S.W., Bristol, S., Carr, N.B., Chalfoun, A.D., Chong, G.W., Diffendorfer, J.E., Fedy, B.C., Garman, S.L., Germaine, S., Grauch, R.I., Holloway, J., Homer, C., Kauffman, M.J., Keinath, D., Latysh, N., Manier, D., McDougal, R.R., Melcher, C.P., Miller, K.A., Montag, J., Nutt, C.J., Potter, C.J., Sawyer, H., Schell, S., Shafer, S.L., Smith, D.B., Stillings, L.L., Tuttle, M., and Wilson, A.B., 2010, U.S. Geological Survey Science for the Wyoming Landscape Conservation Initiative—2009 Annual Report: U.S. Geological Survey Open-File Report 2010–1231, 106 p., accessed March 7, 2011, at <http://pubs.usgs.gov/of/2010/1231/>.
- Clarey, K.E., Bartos, Timothy, Copeland, David, Hallberg, L.L., Clark, M.L., and Thompson, M.L., 2010, Available groundwater determination, Technical memorandum, Green River Basin Water Plan II—Groundwater study Level I (2007–2009): Prepared for the Wyoming Water Development Commission by the Wyoming State Geological Survey, Laramie, Wyo., variously paged, accessed March 7, 2011, at http://waterplan.state.wy.us/plan/green/2010/finalrept/gw-tpage_preface.pdf.
- 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, available online at <http://pubs.water.usgs.gov/twri9A>.

For More Information

Visit the USGS Wyoming Water Science Center Web site at: http://wy.water.usgs.gov/projects/gw_monitoring/index.htm, or contact:

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