

California Groundwater Ambient Monitoring and Assessment (GAMA) Program Priority Basin Project: Shallow Aquifer Assessment

What is the GAMA Priority Basin Project (GAMA-PBP)?

The California State Water Resources Control Board's (SWRCB) GAMA Program is a comprehensive assessment of statewide groundwater quality in California. From 2004 to 2012, the GAMA Program's Priority Basin Project focused on assessing groundwater resources used for public drinking-water supplies. More than 2,000 public-supply wells were sampled by U.S. Geological Survey (USGS) for this effort. Starting in 2012, the GAMA Priority Basin Project began an assessment of water resources in shallow aquifers in California. These shallow aquifers provide water for domestic and small community-supply wells, which are often drilled to shallower depths in the groundwater system than public-supply wells. Shallow aquifers are of interest because shallow groundwater may respond more quickly and be more susceptible to contamination from human activities at the land surface, than the deeper aquifers.

The SWRCB's GAMA Program was developed in response to the Groundwater Quality Monitoring Act of 2001 (Water Code sections 10780-10782.3): a public mandate to assess and monitor the quality of groundwater resources used for drinking-water supplies, and to increase the availability of information about groundwater quality to the public. The U.S. Geological Survey is the technical lead of the Priority Basin Project.

Stewardship of California's groundwater resources is a responsibility shared between well owners, communities, and the State. Participants and collaborators in the GAMA Program include Regional Water Quality Control Boards, Department of Water Resources, Department of Public Health, local and regional groundwater management entities, county and local water agencies, community groups, and private citizens. Well-owner participation in the GAMA Program is entirely voluntary.

What Will Participants Gain from the GAMA-PBP Shallow Aquifer Assessment?

The project will provide many benefits to State, local, and community participants and to individual well owners. It will:

- Provide well owners with information about the constituents in their water;
- Establish baseline groundwater quality for comparison with future conditions;
- Identify emergent constituents in groundwater;
- Identify areas of California where domestic households or small communities rely upon poor-quality groundwater for drinking supply;
- Improve understanding of local, regional, and statewide hydrogeology;
- Produce groundwater-quality reports for each study area;
- Provide new information for local, regional, and statewide groundwater programs to help manage groundwater resources;
- Provide new data for the SWRCB's GeoTracker GAMA publicly accessible online database; and
- Compare water quality in the shallow and deeper aquifer systems.



Radon sampling in Temecula, California

GAMA Priority Basin Project Shallow Aquifer Assessment Study Design

The locations of domestic and small system wells across California were identified from well-drillers' logs and U.S. Census data, and the areas of the State with the greatest densities of households that rely on domestic wells were prioritized for sampling for this project. The high-priority areas (see figure below) will be grouped into study units. Sixty to 120 shallow wells will be sampled in each study unit to provide a spatially unbiased assessment of the groundwater quality in the shallow aquifer systems.

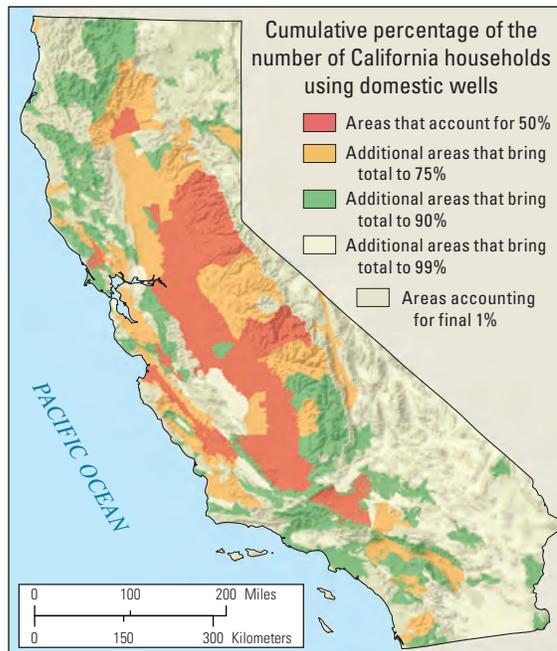
Domestic and small community-supply wells typically tap shallower parts of the aquifer system than do the public-supply wells sampled in the previous phase of the GAMA Priority Basin Project. Shallow parts of the aquifer system may be more susceptible to contamination from human activities at the land surface, and shallow groundwater typically responds more rapidly to land-surface activities than the deeper systems.

Two types of assessments will be conducted for each study unit:

Status: the assessment of current groundwater quality and

Understanding: the assessment of natural and human factors that affect groundwater quality.

Water-quality assessments for the GAMA Priority Basin Project will combine existing water-quality data (such as data from the SWRCB's Domestic Well Project) with new data collected for this project. Samples will be analyzed for a large suite of chemical constituents, including nutrients, human-made organic constituents, naturally occurring trace elements, and tracers used to help identify the source and age of the sampled groundwater (table 1).



Reporting Results

The GAMA Priority Basin Project provides new water-quality data and assessment of water resources to participants. Before releasing data or reports to the public, the SWRCB and USGS will provide results to individual well owners. Well owner information will be kept confidential.

Data summary and interpretive reports prepared by USGS will be posted on GAMA Program websites. Water-quality data also will be available through the SWRCB's GeoTracker GAMA database: <http://geotracker.waterboards.ca.gov>

GAMA Priority Basin Project reports and data can be obtained from:

GAMA Project Chief
U.S. Geological Survey
California Water Science Center
6000 J Street, Placer Hall
Sacramento, CA 95819-6129
Telephone: (916) 278-3000
<http://ca.water.usgs.gov/gama>

GAMA Program Unit Chief
State Water Resources Control Board
Division of Water Quality
P.O. Box 2231
Sacramento, CA 95812
Telephone: (916) 341-5779
<http://www.waterboards.ca.gov/gama>

Table 1. List of analytes.

Sampled constituents	Why constituents are of interest
Specific conductance	The ability of a water sample to transmit an electrical current; related to the salinity of the water
Alkalinity, pH, and dissolved oxygen	The availability of charged ions and dissolved oxygen affects the mobility of dissolved chemical compounds in water
Temperature	Temperature can influence the concentration of dissolved gases (such as oxygen, nitrogen, carbon dioxide) in water
Major and minor ions	Naturally occurring elements that influence water quality
Nutrients	Elevated concentrations of nutrients (such as nitrogen, phosphorous) can degrade water quality
Trace elements	Naturally occurring elements that help define water characteristics and affect water quality
Volatile organic compounds (VOCs)	Include human-made compounds such as solvents, gasoline additives, and organic synthesis products that can degrade water quality
Methyl tert-butyl ether (MTBE)	A compound added to gasoline to improve air quality. At high concentrations, it can degrade water quality
Pesticides	Used to control weeds, insects, and other pests and can degrade water quality
N-Nitrosodimethylamine (NDMA)	A byproduct of water treatment from the reaction of dimethylamine and chloramines which can degrade water quality
Perchlorate (ClO ₄ ⁻)	Inorganic constituent found in rocket fuel, fireworks, and flares, and also occurs naturally at low concentrations in groundwater. At high concentrations, it can degrade water quality
Isotopes, radioactivity	Naturally occurring atoms and radioactivity used to track water movement; may degrade water quality at high concentrations
Tritium (³ H)	Isotope of hydrogen used to identify water recharged since 1952
Noble gases	Dissolved gases used to trace groundwater movement, for chronology, and to study climate change. Noble gases are analyzed at the Lawrence Livermore National Laboratory
Stable isotopes (δ ¹⁸ O, δD)	Naturally occurring isotopes of oxygen and hydrogen used to track water through the hydrologic cycle
Radon (Rn)	A naturally occurring radioactive gas which, at high levels, can contribute to health problems such as lung cancer