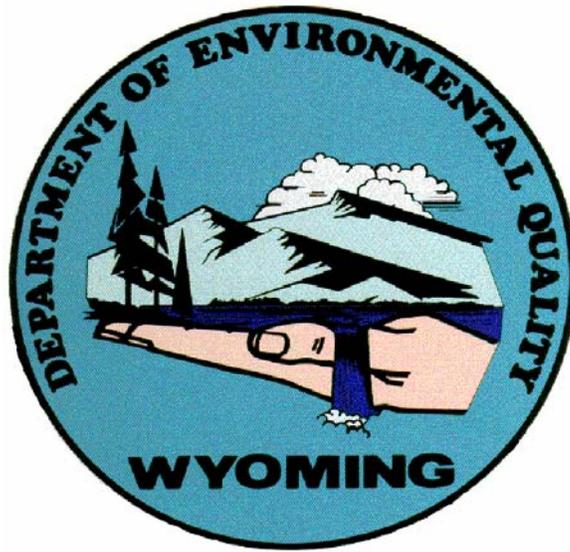


Addendum

Water Quality Monitoring Strategy 2004 – 2008



Wyoming Department of Environmental Quality
Water Quality Division
Groundwater Pollution Control Program

Introduction

Under the Clean Water Act (CWA), states have primary responsibility for implementing programs to manage water quality. This responsibility includes establishing water quality standards, monitoring and assessing the quality of their waters, and developing and implementing cleanup plans for waters that do not meet standards. (1) The U.S. Environmental Protection Agency (EPA) encourages the collection of ambient ground-water quality monitoring data to support ground water protection and management. The objectives of such monitoring programs have recently been outlined in the recommendations of the Intergovernmental Task Force on Monitoring Water Quality Monitoring (ITFM¹) and EPA's *Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b)) Reports*. (2)

Federal, State, and local water resource management agencies have only recently begun to focus their attention on monitoring ambient ground-water quality for analytes such as nitrates, volatile organic compounds (VOCs), and pesticides. Ground water samples are relatively expensive to collect and analyze. (3)

Other problematic characteristics of state ground-water quality monitoring programs identified by the U.S. Government Accounting Office (GAO) include:

- Numerous agencies, local watershed groups, volunteer monitoring groups, industries, and academic groups collect water quality data. Organizations often collect data to achieve specific missions, which sometimes affects their willingness and ability to modify their approaches toward data collection to make the results more widely usable, and which may even make organizations reluctant to share data they have already collected;
- Groups' data collection protocols often vary, resulting in incomparable definitions to measure the same or similar analytes, different detection limits, inconsistent levels of quality assurance, and inconsistent collection of metadata;
- Without a centralized clearinghouse on water quality data, many collectors are simply unaware of the data being collected by, or available from, other organizations;
- Data coordination is often assigned a low priority, as shown in the lack of support for national and state monitoring councils, which were established specifically to improve data coordination. (1)

Additionally, the data are not necessarily stored on a database available to others, or they may never be entered into an electronic database. The above conditions, together with insufficient funding for assessment and monitoring preclude a comprehensive understanding of the environmental health of Wyoming's ground water resources.

¹ ITFM created the National Water-Quality Monitoring Council (NWQMC).

Monitoring Program Strategy

Since the adoption of its 1984 Ground-Water Protection Strategy, EPA has been providing technical and financial assistance under the Clean Water Act to build State capacity to protect ground water in a comprehensive manner. In *Protecting the Nation's Ground Water: EPA's Strategy for the 1990s* the agency identified common elements of "mature" ground-water protection programs. Among those, EPA specifically identified ground water monitoring and assessment activities as fundamental to the development and implementation of state ground water protection programs:

"The State has a program to ensure that the data collected within the State are consistent, of known and reliable quality, and are efficiently stored for retrieval and use. This data are readily accessible to State and local agencies for use in analysis and decision making such as ground-water protection planning, enforcement, trend analysis, permitting and other activities." (4)

An integral part of Wyoming's *Groundwater Protection Strategy* (described in Wyoming's *Non-Point Source Management Plan*²) is the development of a statewide ground-water monitoring program. In *Ambient Ground Water Quality Monitoring Cost Analysis* (6) EPA describes two fundamental stages characteristic of ground water monitoring programs; *development*, and *operation* (i.e. implementation). These two stages are comprised of individual components, as follows:

Development:

1. Monitoring program design;
2. Monitoring network installation.

Operation:

3. Monitoring network maintenance;
4. Ground water sampling;
5. Ground water sample analyses;
6. Ground water analyte data management;
7. Ground water analyte data interpretation;
8. Communication of ground water monitoring results; and
9. Monitoring program evaluation and redesign.

The development and implementation of the Water Quality Division's ground water monitoring program will require and include the same components as those described by EPA, above. As described below in **Monitoring Design**, Wyoming has achieved advances in completing the first component in the *development* stage of its monitoring program; monitoring program design. Additional funding and human resources are needed to complete the remaining eight (8) *development* and *operation* components.

² Reference Goal VIII, Objective VIII.1 and VIII.2, Ground Water section of Non-Point Source Management Plan.

Monitoring Objectives

Ground water monitoring objectives are essentially the same as for surface water monitoring, including:

- Determining ground water quality status and trends;
- Establishing and/or modifying ground water standards;
- Identifying impaired ground waters;
- Identifying causes and sources of water quality problems;
- Implementing ground water quality protection programs;
- Determining interactive relationships between ground water and surface waters;
- Evaluating effectiveness of groundwater protection programs.

Monitoring Design

Over the past several years EPA, through CWA §319 funding, has assisted DEQ's Groundwater Pollution Control Program in developing the necessary tools to use in the design of a ground water monitoring program design. In the mid 1990s, the University of Wyoming in conjunction with Wyoming's 'Pesticides in Ground Water Strategy Committee' completed development of statewide, ground water vulnerability maps in GIS format. When combined with the GIS coverage depicting pesticide application areas, the vulnerability maps were used to focus the state's monitoring program for pesticides to areas where ground water quality would be most susceptible to infiltration of pesticides.³ The ground water vulnerability maps were also subsequently used in partially completing the design component of Wyoming's ground water monitoring program, *Phase I: Aquifer Prioritization*.

“The goal of Phase I in the development of a Statewide Ground Water Protection Strategy is a prioritization of Wyoming aquifers for the purpose of ambient ground-water monitoring. This prioritization is necessary to ensure resources go toward assessing aquifers most susceptible to contamination.” (5)

The Phase I project ascertained the likely potential impact to ground water quality that various potential and existing sources of pollution (e.g. LUST sites, RCRA sites, pipelines, oilfields, etc.) exhibit. The final product of Phase I includes a GIS-based digital map illustrating areas where drinking water supplies are most (and least) susceptible to contamination. This map of 'priority' drinking water supplies is intended to identify and prioritize areas (and aquifers) for monitoring in order to provide an efficient and effective use of resources during future ground water monitoring and ground water protection efforts. This approach includes design aspects contained within alternative monitoring designs, including intensive and screening-level monitoring, rotating basin, and fixed station. The rationale and approach for selection of the monitoring program design are further detailed in the Phase I final report.

³ Using §319 funds USGS, under contract to the Wyoming Department of Agriculture, has sampled ground water for pesticides and nitrates. Beginning in 1995, the most vulnerable areas within 18 of Wyoming's 23 counties have been monitored.

Recently, products from Phase I, above, have been used in *Phase II: Ground Water Monitoring Plan Design* to complete the monitoring program design component of the ground water monitoring program. The draft final report includes recommendations for ground water monitoring indicators, sampling locations, monitoring frequency, and implementation cost estimates under various scenarios. The rationale and approach for selection of sample sites, including a probability-based determination of the number of sample sites needed are further detailed in the Phase II draft final report. (6)

Installation of the monitoring well network is the remaining component of the *design* stage that needs to be completed before Wyoming can *operate* its ground water monitoring program. Lack of funding for the installation component is the major obstacle preventing implementation of the program.

Core and Supplemental Water Quality Indicators

As stated in *Conceptual Frameworks for Ground-Water Quality Monitoring*, one of the principal goals of the Intergovernmental Task Force on Monitoring Water Quality Monitoring (ITFM) was to encourage collection of water-quality data that are affordable; use well-established analytical methods with minimum detection and reporting levels that are appropriate for achieving the objectives of the study; are comparable between individual studies and between agencies; and, are suitable for more than one purpose. (7)

Based on these criteria, the following physical parameters and chemical analytes are routinely considered as core indicators for ground-water quality monitoring projects:

1. Field parameters (temperature, specific conductance, pH, dissolved oxygen, and alkalinity)
2. Major inorganic ions (Ca, Mg, Na, K, Cl, SO₄) and total dissolved solids (TDS)
3. Nutrients (NO₂ + NO₃, ammonium, orthophosphate)
4. Dissolved organic carbon (DOC)

Supplemental water quality indicators may be added dependent upon the objectives of the monitoring program (or program element) and land use activities to be evaluated. Supplemental indicators will be used when there is a reasonable expectation that a specific pollutant may be present, when core indicators indicate contamination, or to support a special study such as screening for potential pollutants of concern. These indicators usually include one or more of the following groups of analytes:

1. Pesticides⁴
2. Volatile organic compounds (VOCs)
3. Metals and trace elements
4. Radionuclides
5. Bacteria

⁴ Pesticides in ground water are being monitored under existing USGS monitoring efforts.

A suggested general process that will be considered for determining whether there is a reasonable expectation that a specific pollutant may be present is outlined within *Conceptual Frameworks for Ground-Water Quality Monitoring*.

Quality Assurance

WDEQ's Groundwater Pollution Control Program has developed a Quality Assurance Project Plan (QAPP) containing ground water monitoring Standard Operating Procedures (SOPs) which was approved by EPA on October 21, 1993. QAPPs document the planning, implementation, and assessment procedures for a particular project, as well as any specific quality assurance and quality control activities. In its recent (August, 2004) "Management System Review of the State of Wyoming Water Quality and RCRA Divisions" EPA recommended that the QAPP be revised as necessary to meet QA/QC requirements. The Groundwater Pollution Control Program has committed to complete this task by June, 2005.

Data Management

To date, ground water quality samples have been collected for the purposes of determining ground water quality status and trends related to pesticide use and application statewide. This monitoring has been performed in accordance with Wyoming's *State Management Plan for Pesticides in Ground Water*, approved by EPA in November, 1999. Ground water quality monitoring under the Plan has been accomplished by the USGS, with water quality data up-loaded to USGS's NWISWeb on-line database. Public access to this ground water quality data is also available through USGS's "Ground-Water Monitoring for Pesticides in Wyoming" webpage (<http://wy.water.usgs.gov/projects/pesticide/index.htm>) as well as the Groundwater Pollution Control Program's webpage (<http://deq.state.wy.us/wqd/pollution.asp>). It is our understanding that USGS periodically uploads this dataset, as well as other Wyoming ground water quality to EPA's STORET database. Future data management efforts will include these systems, or similar systems designed to accomplish efficient data storage, retrieval, and accessibility. All ground water monitoring points will be geo-spatially referenced for integration into existing and future, GIS-based ground water management datasets.

Data Analysis/Assessment

Ambient ground water quality data will be compared to existing state ground water quality standards promulgated in Wyoming Water Quality Rules and Regulations, Chapter 8, "Quality Standards for Wyoming Groundwaters". These standards have been established to classify groundwater according to either existing use, or suitability for various types (i.e. class) of use as determined from intrinsic, ambient ground water quality. Wyoming's ground water classifications include: Domestic, Agricultural, Livestock, Fish & Aquatic, Industrial, Mineral/Hydrocarbon/Geothermal, and Unsuitable. Ground water quality data from secondary sources will be evaluated for QA/QC practices and incorporated, when deemed acceptable, into the ground water quality data

management system. Secondary data could include that collected by other federal and state agencies, or pursuant to regulatory monitoring requirements through programs such as RCRA, LUST, CERCLA, UIC, etc. Data will also be incorporated from §319 ground water characterization projects.

Reporting

The Groundwater Pollution Control Program contributes water quality monitoring results and determinations to EPA through the 305(b) water quality inventory report. Related ground water quality information and summaries are also periodically reported to Congress through periodic “Ground Water Report to Congress: Summaries of State Ground Water Conditions”, coordinated through the Ground Water Protection Council (GWPC), the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA), and the Association of State Drinking Water Administrators (ASDWA) with assistance from EPA’s Office of Water and Drinking Water (OGWDW).

The annual data reporting requirement will be satisfied by uploading data to the national STORET warehouse, or updating the 305(b) assessment information in the National Assessment Database.

Efforts will continue to provide ground water quality information to the public both electronically, and through reports, brochures, presentations, public meetings, newspaper articles, etc.

Programmatic Evaluation

In consultation with EPA, the Groundwater Pollution Control Program will conduct periodic reviews of each aspect of its monitoring program to determine how well the program serves its ground water quality decision needs. This will involve evaluating the monitoring program to determine how well each of the 10 elements of the monitoring strategy is addressed, and determining how changes and additions are incorporated into future monitoring cycles. This evaluation will take into consideration the effects of funding shortfalls on implementing Wyoming’s ground water monitoring program.

The primary goals for program improvement over the next five years are:

1. Update, and revise as necessary, the Groundwater Pollution Control Program Quality Assurance Project Plan (QAPP);
2. Establish a ground water quality monitoring network, using existing wells where QA/QC standards are adequate, or installing new monitoring points where needed;
3. Implement ground water quality monitoring in high priority, critical areas as determined from *Phase I: Aquifer Prioritization* of Wyoming’s ground water monitoring strategy, or potentially problematic areas identified by the;

4. Develop electronic data management systems to warehouse ground water quality monitoring data internally, and for uploading to national STORET dataset; and
5. Coordinate on-going and future ground water monitoring programmatic needs with local, state, and federal water management agencies and cooperating organizations.

General Support and Infrastructure Planning

Staff and Training: Currently, no full time staff is dedicated to the Ground Water Monitoring Program. With completion of *Phase II: Ground Water Monitoring Plan Design* of Wyoming's ground water monitoring strategy, the state is well positioned to complete the *development* stage of its monitoring program, the monitoring network installation component, in **Year 1**. The installation component will be phased, with monitoring well installation (or selection of existing wells) proceeding annually into the priority areas established in *Phase I: Aquifer Prioritization*, and/or other watersheds considered to be department priorities. As mentioned earlier, the network can consist of existing wells where QA/QC standards are adequate, or installing new monitoring points where needed. One part time staff position will be needed to direct and manage completion of the network installation component and update the Groundwater Pollution Control Program QAPP, as needed. We anticipate the need to contract out monitoring well installation, where needed. Staff training may be needed to ensure these components are completed to satisfactory standards. Anticipated funding requirements are provided in Table 1.

Upon completion of the *development* stage, Wyoming will implement the monitoring program's *operations* components each year during **Years 2 through 5**: Ground water sampling; Ground water sample analyses; Ground water analyte data management; Ground water analyte data interpretation; Communication of ground water monitoring results; Monitoring network maintenance; and Monitoring program evaluation and redesign. It is anticipated that one full time staff position will be needed to assist with completing these annual *operations* components, including development of a data management system and annual data reporting to EPA. Staff training may be needed to ensure these components are completed to satisfactory standards.

Laboratory Resources: Laboratory analysis of samples collected as part of the ground water quality monitoring program will initially be performed by the Water Quality Division's laboratory in Cheyenne. Depending on laboratory limitations to perform certain analyses (e.g. radionuclides), contract laboratories may be needed on occasion; however, use of outside laboratories will require a demonstration that all lab work will be accomplished in accordance with acceptable QA/QC protocols. Anticipated funding requirements are provided in Table 1.

Table 1

**Projected Funding Requirements¹
Years 1 through 5**

	Network Installation ²	Staff ³ (Operations Components)	Training	Supplies	Travel	Laboratory Analysis	Total
Year 1	100,000	50,000	2,500	1,000	10,000	2,000	165,500
Year 2	100,000	100,000	5,000	5,000	10,000	20,000	240,000
Year 3	100,000	100,000	5,000	1,000	10,000	20,000	240,000
Year 4	100,000	100,000	5,000	1,000	10,000	20,000	240,000
Year 5	100,000	100,000	5,000	1,000	10,000	20,000	240,000
Total	500,000	450,000	22,500	9,000	50,000	82,000	1,125,500

- 1 Assumes Standard 106/State Match.
- 2 Installation of 50 monitoring wells during each Year.
- 3 One FTE during Year 1; 2 FTEs during Years 2 through 5.

References

1. *Water Management: Better Coordination of Data Collection Efforts Needed to Support Key Decisions*, United States General Accounting Office, GAO-04-382, June, 2004.
2. *Ambient Ground Water Quality Monitoring Cost Analysis*, U.S. EPA, Office of Water, EPA 816-R-97-013, October, 1997.
3. *Ground Water in Region 8 States: A Report on the Status of Ground-Water Management and Protection*, U.S. EPA, Region 8, EPA 908-R-03-001, November, 2003.
4. *Protecting the Nation's Ground Water: EPA's Strategy for the 1990s*, U.S. EPA, Office of the Administrator, 21Z-1020, July, 1991.
5. *Phase I: Aquifer Prioritization*, §319 Final Report, University of Wyoming, 2003.
6. *Phase II: Ground Water Monitoring Plan Design*, §319 Draft Final Report, University of Wyoming, 2004.
7. *Conceptual Frameworks for Ground-Water Quality Monitoring*, Ground-Water Focus Group – Intergovernmental Task Force on Monitoring Water Quality, August, 1997.