



Wisconsin Groundwater Coordinating Council

Report to the Legislature: Executive Summary

Fiscal Year 2021

The Groundwater Coordinating Council (GCC) prepares an annual report each year that summarizes the operations and activities of the council, describes the state of the groundwater resource and its management and makes recommendations.



2021 GROUNDWATER COORDINATING COUNCIL MEMBERS

- ▶ Department of Natural Resources – Jim Zellmer, Chair
- ▶ Department of Agriculture, Trade & Consumer Protection – Sara Walling
- ▶ Department of Safety & Professional Services – Bradley Johnson
- ▶ Department of Health Services – Jonathan Meiman, MD
- ▶ Department of Transportation – Robert Pearson
- ▶ Geological and Natural History Survey (State Geologist) – Ken Bradbury
- ▶ Governor's Representative – Steve Diercks
- ▶ University of Wisconsin System – James Hurley

SUBCOMMITTEES

Research & Monitoring

- ▶ Geological and Natural History Survey - Dave Hart*(Co-Chair) & Mike Parsen*
- ▶ Department of Natural Resources – Bill Phelps*(Co-Chair), Shaili Pfeiffer* & Matt Silver*
- ▶ Department of Agriculture, Trade and Consumer Protection – Stan Senger* & Ken Potrykus*
- ▶ Department of Safety and Professional Services – Tim Vander Leest*
- ▶ Department of Health Services - Sarah Yang* & Curtis Hedman*
- ▶ University of Wisconsin System - Maureen Muldoon*, Tim Grundl & Jennifer Brand*
- ▶ U. S. Geological Survey - Andy Leaf* & Cheryl Buchwald*
- ▶ UWSP Center for Watershed Science and Education - George Kraft*

* *Member of Standing Joint Solicitation Work Group*

Outreach & Partnership

- ▶ Department of Health Services – Sarah Yang (Chair)
- ▶ Department of Natural Resources – Bruce Rheineck
- ▶ University of Wisconsin System – Moira Harrington
- ▶ Department of Agriculture, Trade and Consumer Protection – Mark McColloch
- ▶ Department of Safety and Professional Services – Travis Wagner
- ▶ Geological and Natural History Survey - Dave Hart
- ▶ Department of Transportation - Robert Pearson
- ▶ Center for Watershed Science and Education – Kevin Masarik
- ▶ State Laboratory of Hygiene – Jocelyn Hemming
- ▶ Wisconsin Rural Water Association – Andrew Aslesen



State of Wisconsin \ GROUNDWATER COORDINATING COUNCIL

Tony Evers, Governor

101 South Webster Street
Box 7921
Madison, Wisconsin 53707

Jim Zellmer,
Council Chair
DNR

August 31, 2021

To: The Citizens of Wisconsin
The Honorable Governor Tony Evers
Senate Chief Clerk
Assembly Chief Clerk
Secretary-designee Craig Thompson - Department of Transportation
Secretary-designee Dawn B. Crim - Department of Safety & Professional Services
Secretary-designee Randy Romanski - Department of Agriculture, Trade & Consumer Protection
Secretary-designee Karen Timberlake - Department of Health Services
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Interim President Tommy G. Thompson - University of Wisconsin System
State Geologist Kenneth Bradbury - Geological and Natural History Survey

Kenneth Bradbury
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Steve Diercks
Governor's Rep.

The Groundwater Coordinating Council (GCC) is pleased to provide its 2021 Report to the Legislature. The GCC was formed in 1984 to help state agencies coordinate non-regulatory activities and exchange information for efficient management of groundwater. For over 30 years, the GCC has been a model for interagency coordination and collaboration among state agencies, local and federal government, and the university. It is one of very few examples of effective statewide coordination of groundwater efforts from an advisory position.

The level of coordinating effort and investment in groundwater is particularly appropriate as Wisconsin depends so heavily on groundwater for its drinking water. Wisconsin also relies on groundwater to irrigate crops, water cattle, and process a wide variety of foods, as well as feed trout streams and spring-fed lakes - all of which are vital to our state economy. New challenges and new ideas continue to warrant the GCC's collaborative approach.

This [online report](#) summarizes and links to information on the GCC and agency activities related to groundwater protection and management in FY21 (July 1, 2020 to June 30, 2021). Search "GCC" on dnr.wi.gov to find the full report. Click on the picture tabs for chapters of the report, beginning with the GCC's recommendations. The Executive Summary is attached.

We hope you will find this report to be a useful reference in protecting Wisconsin's priceless groundwater supply.

Sincerely,

A handwritten signature in black ink that reads "James A. Zellmer".

James A. Zellmer, Chair
Groundwater Coordinating Council

PURPOSE OF THE GCC AND ANNUAL REPORT

In 1984, the Legislature enacted Wisconsin's Comprehensive Groundwater Protection Act, to improve the management of the state's groundwater. The Groundwater Coordinating Council (GCC) was created and is directed by s. 160.50, Wis. Stats., to "serve as a means of increasing the efficiency and facilitating the effective functioning of state agencies in activities related to groundwater management. The Groundwater Coordinating Council shall advise and assist state agencies in the coordination of non-regulatory programs and the exchange of information related to groundwater, including, but not limited to, agency budgets for groundwater programs, groundwater monitoring, data management, public information and education, laboratory analysis and facilities, research activities and the appropriation and allocation of state funds for research."

The GCC is required by s. 15.347, Wis. Stats., to prepare a report which "summarizes the operations and activities of the council..., describes the state of the groundwater resource and its management and sets forth the recommendations of the council. The annual report shall include a description of the current groundwater quality of the state, an assessment of groundwater management programs, information on the implementation of ch. 160, Wis. Stats., and a list and description of current and anticipated groundwater problems." This report is due each August. The purpose of this report is to fulfill this requirement for fiscal year 2021 (FY21). The report is an interactive web page with links to extensive supporting information.

The GCC's role in facilitating inter-agency coordination includes the exchange of information regarding Wisconsin's Comprehensive Groundwater Protection (Act 1983 Wisconsin Act 410), Wisconsin's Groundwater Protection Act (2003 Wisconsin Act 310), the Great Lakes Compact (2007 Wisconsin Act 227), the federal Safe Drinking Water Act's Wellhead and Source Water Protection provisions, and many other programs.

GROUNDWATER COORDINATION ACTIVITIES

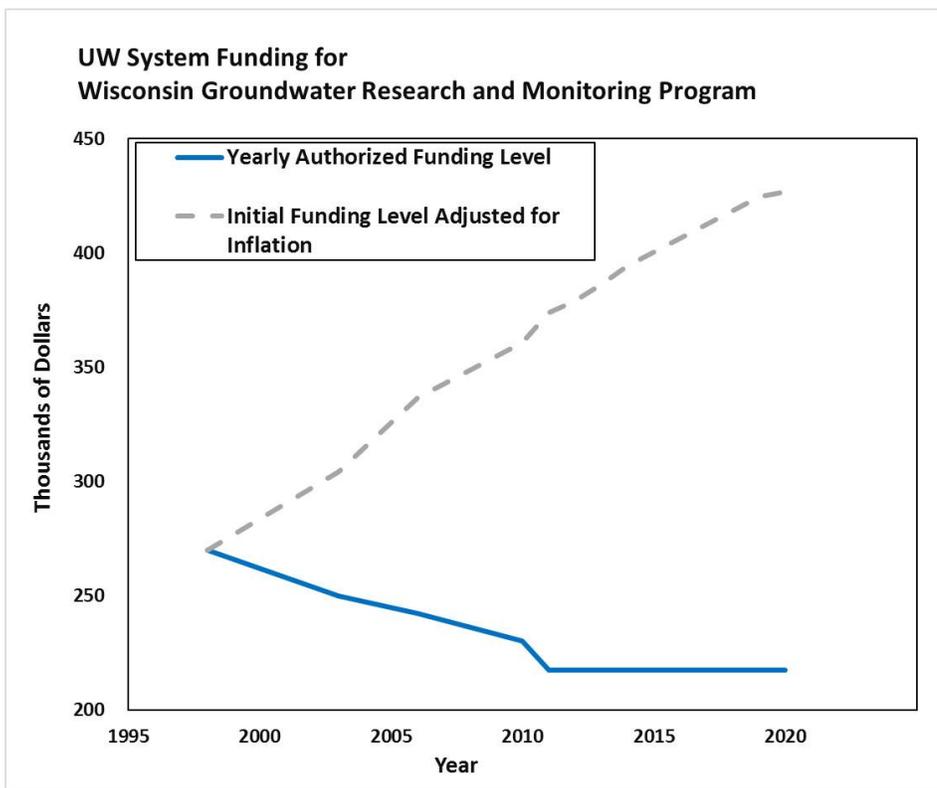
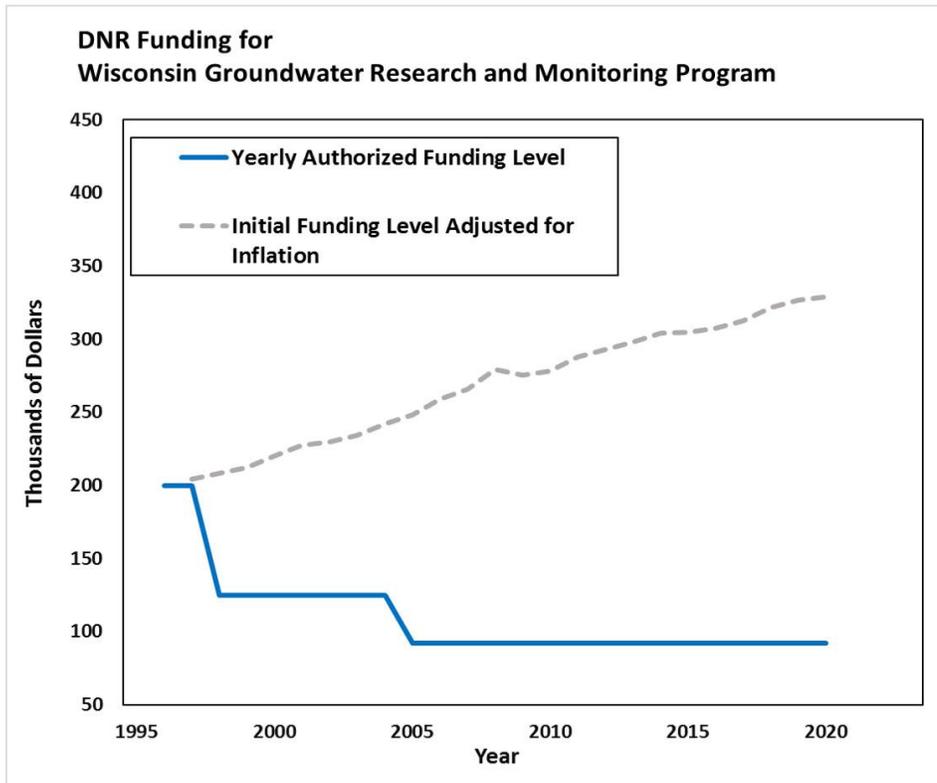
In addition to the council of agency leaders, the GCC is authorized to create subcommittees on "the subjects within the scope of its general duties...and other subjects deemed appropriate by the Council." See a list of GCC members and subcommittees on the inside cover of this executive summary.

The GCC and its subcommittees regularly bring together staff from over 15 different agencies, institutions and organizations to communicate and work together on a variety of research, monitoring and data management, educational, and planning issues. A strong network among GCC and subcommittee members leads to coordination across agency lines on a variety of groundwater-related issues. These activities regularly avoid duplication, create efficiencies, and provide numerous benefits to Wisconsin's taxpayers.

Coordination of Groundwater Research and Monitoring Program

The GCC is directed to "advise the Secretary of Administration on the allocation of funds appropriated to the Board of Regents of the University of Wisconsin under s. 20.285(1)(a) for groundwater research." Since 1992, a joint solicitation process has facilitated selection and funding of sound scientific research and monitoring to answer state priority needs. The history of DNR and UW System state legislative groundwater research funding levels (funding source created in 1996) are shown below. The solid blue line shows the actual

authorized funding level through time, the dashed gray line shows the inflation adjusted value of the initial funding level in today's dollars.



The GCC, the UWS, DNR and the Groundwater Research Advisory Council (GRAC) again collaborated on the annual solicitation for groundwater research and monitoring proposals as specified in the Memorandum of Understanding. After a multi-agency effort spearheaded by the UW Water Resources Institute (WRI), the GCC approved selected projects for the annual program of research to answer current groundwater management questions.

A comprehensive review process including the GRAC, the GCC's Research & Monitoring Subcommittee, and outside technical experts resulted in recommendations that were used by the UWS and DNR in deciding which groundwater-related proposals to fund. From 18 proposals, eight new projects were selected for funding in FY21 - five by UWS, one by DNR, one by Department of Agriculture, Trade & Consumer Protection (DATCP) and one jointly by DNR and DATCP. The GCC approved the proposed UWS groundwater research plan as required by s. 160.50(1m), Wis. Stats., and a letter to this effect was sent to the UWS President and the Department of Administration. Current groundwater research and monitoring projects are listed in the report as well as all Wisconsin Joint Solicitation groundwater research and monitoring projects.

The UW Water Resources Institute provides access to summaries and reports of GCC-facilitated groundwater research, as well as cataloging all WRI research reports into WorldCat and MadCat, two library indexing tools that provide both worldwide and statewide access to this research. The Water Resources Library has partnered with UW Libraries' Digital Collections Center to digitize and post UWS and DNR final project reports. As a result of this partnership, full-text reports are also available through the UW Ecology and Natural Resources Digital Collection. Progress continues in making older final reports and summaries accessible online.

Information and Outreach Activities

Since 1994 groundwater workshops for teachers have been taught jointly by GCC Outreach and Partnership Subcommittee members from the DNR, Wisconsin Geological and Natural History Survey (WGNHS) and the Center for Watershed Science and Education (CWSE) at U.W. Stevens Point. Teacher applications to participate continue to fill all available workshop space and equipment. The workshop leaders instructed teachers on using a groundwater sand-tank model and provided additional resources to incorporate groundwater concepts into their classroom. Educators who attended the workshops received a free model. With funding from a U.S. Environmental Protection Agency (EPA) wellhead protection grant, over 475 groundwater models have been given to schools and nature centers since 2001 and over 900 educators have received hands-on training in using the model effectively. Educators are regularly surveyed to promote continued use and evaluate educational benefits.

Other Coordination Activities

The GCC continued to promote communication, coordination, and cooperation between the state agencies through its quarterly meetings. In addition to identifying collaboration opportunities, making decisions about research, and guiding report development, the GCC received briefings and discussed a variety of current topics at its FY21 meetings:

- DNR: Linking groundwater and climate to understand long-term lake level fluctuations in Wisconsin

- UWS: Joint Solicitation groundwater research project repository
- DNR: Wisconsin Nitrate Initiative and Nitrogen Fertilizer Decision Support Tools
- DNR: WisPAC statewide PFAS Action Plan
- DNR: Central Sands Lake Study findings/recommendations
- UWSP: Integrative monitoring of neonicotinoid insecticides in baseflow-dominated streams on the Central Sand Plain

More information on these topics and the coordinating efforts of the GCC can be found in the FY21 GCC meeting minutes. Through these activities, the GCC plays an important role in ensuring agency coordination, increasing efficiency, avoiding duplication, and facilitating the effective functioning of state agencies in activities related to groundwater protection and management. As a result, groundwater is better protected, which benefits public health, sustains our economy, and preserves Wisconsin's natural resources for future generations.

SUMMARY OF AGENCY GROUNDWATER ACTIVITIES

State agencies and the University of Wisconsin System addressed numerous issues related to groundwater protection and management in FY21. Detailed discussions of the groundwater activities of each agency can be found at the [agency activities tab in the online report](#).

CONDITION OF THE RESOURCE: GROUNDWATER QUALITY

Major groundwater quality concerns in Wisconsin are summarized below and detailed in the [online report](#).

Nitrate

While nitrate in agricultural use has benefits such as larger crop yields, high concentrations in groundwater lead to public health concerns. Nitrate is Wisconsin's most widespread groundwater contaminant and is increasing in extent and severity. Statewide various studies show about 10% of private well samples exceed the 10 mg/L health-based standard for nitrate-N. Nitrate levels in groundwater above 2 milligrams per liter (mg/L) indicate a source of contamination such as agricultural or turf fertilizers, animal waste, septic systems, and wastewater. Approximately 90% of total nitrate inputs into our groundwater originate from agricultural sources.

According to the Wisconsin Department of Health Services (DHS), high levels (above 10 mg/l) of nitrate in drinking water can affect everyone. Nitrate can cause blue baby syndrome and may cause birth defects. Nitrate may cause thyroid disease and may increase the risk for certain kinds of cancer.

More than 200 public water supply systems (mostly systems like mobile home parks, restaurants and taverns) exceeded the nitrate drinking water standard of 10 mg/L in FY 21, requiring them to post notices, provide bottled water, replace wells, install treatment, or take other corrective actions. Concentrations of nitrate in private water wells have also been found to exceed the standard. A 2017 DATCP survey estimated that 8% of private wells exceeded the 10 mg/L enforcement standard for nitrate. GCC member agencies are working on multiple initiatives related to reducing the risk of high nitrate levels in groundwater and drinking water.

Per- and Polyfluorinated Alkyl Substances (PFAS)

(PFAS) are a large group of human-made chemicals that have been used in industry and consumer products worldwide since the 1940s. Their ability to repel water and oil and withstand high temperatures has made PFAS a particularly useful ingredient in industrial and commercial products, including non-stick products, stain- and water-repellent clothing, and aqueous film forming foams (AFFFs). These chemicals do not easily break down in the environment and have been known to accumulate in the environment and humans.

Under the Safe Drinking Water Act's third Unregulated Contaminants Monitoring Rule (UCMR-3), select municipal water systems were asked to test for PFOA and PFOS, between 2013 and 2015. PFAS were detected in public water systems in La Crosse, West Bend and Rhinelander. Testing has also been conducted voluntarily by several municipal water systems and included a more comprehensive list of PFAS (i.e. additional compounds such as those included as part of EPA's Method 537.1). These testing efforts identified PFAS in varying concentrations in municipal water systems in Marinette, Peshtigo and Madison.

PFAS have also been found in groundwater near Department of Defense sites in Wisconsin, such as Wisconsin Air National Guard facilities at Truax Field and Volk Field. PFAS are present in many consumer products and AFFFs and can also be released from industrial facilities that manufacture or use the compounds. Therefore, PFAS are potentially present at fire departments, industrial facilities, landfills and wastewater treatment plants due to the diverse waste streams accepted from industrial and municipal parties. PFAS have also been identified in municipal wastewater treatment plants' biosolids. As biosolids are put to beneficial reuse via agricultural landspreading, this may be an important pathway for the substances to enter groundwater.

At present, the DNR is continuing to identify PFAS sources and their potential impacts to groundwater and other environmental media in Wisconsin. Currently, there are no state or federal groundwater protection standards for PFAS. To address this regulatory gap, the DNR initiated rulemaking to implement DHS recommendations for groundwater enforcement standards for two PFAS, PFOA and PFOS, in accordance with State law. DNR has also begun rulemaking for an additional 16 PFAS compounds and six pesticides.

Bacteria, viruses and other pathogens

Bacteria, viruses and other pathogens often occur in areas where the depth to groundwater is shallow, in areas where soils are thin or in areas of fractured bedrock. These pathogens can cause acute illness and result in life-threatening conditions for young children, the elderly and those with chronic illnesses. An estimated 17% of private water supply wells statewide test positive for total coliform bacteria, an indicator species of other biological agents (Knobeloch et al., 2013). Approximately 3% of these wells tested positive for *E. coli*, an indicator of water borne disease that originates in the mammalian intestinal tract.

Viruses in groundwater are increasingly a concern as new analytical techniques have detected viral material in private wells and public water supplies. Research conducted at the Marshfield Clinic indicates that 4-12% of private wells contain detectable viruses.

Other studies showed virus presence in four La Crosse municipal wells, in the municipal wells in Madison and in five shallow municipal wells serving smaller communities.

Public and private water samples are not regularly analyzed for viruses due to the high cost of the tests. The presence of coliform bacteria has historically been used to indicate the water supply is not safe for human consumption. However, recent findings show that coliform bacteria do not always correlate with the presence of enteric viruses. GCC member agencies are involved with research and risk reduction measures as well as emergency response on this issue.

Pesticides

Pesticides are a broad class of substances designed to kill, repel or otherwise disrupt living things that are considered pests. They include insecticides, herbicides, fungicides and anti-microbials, among other types of biocides. In Wisconsin, the main source of pesticides in groundwater is agricultural herbicide and insecticide applications. For this reason, detection is more common in highly cultivated areas where agriculture is well established, notably in the south-central, central and west-central parts of the state.

In 2016, DATCP conducted a statewide statistical survey of agricultural chemicals in groundwater that found an estimated 41.7% of private wells in Wisconsin contained a pesticide or pesticide metabolite, up from 33% of private wells in a similar survey conducted in 2007 (DATCP, 2008; DATCP, 2017). The primary metabolites of metolachlor and alachlor, metolachlor ESA and alachlor ESA, were the two most commonly detected pesticide products. Atrazine and its metabolites, known collectively as the total chlorinated residues of atrazine (atrazine TCR), were also prevalent and occurred in about 23% of wells.

Many sampling programs initiated by DATCP, DNR and other agencies in the mid-1980s to early 1990s are still ongoing today. The longest running sampling program for pesticides began in 1985 and is designed to evaluate the potential impact of agriculture on groundwater quality by sampling monitoring wells near selected agricultural fields in areas with high groundwater contamination potential. Testing in this program confirms that the metabolites of metolachlor and alachlor are the two most common pesticides products detected in groundwater near the monitoring well sites. A DATCP review of data from samples it collected statewide from 2008 through 2016 revealed an increased occurrence of detections of neonicotinoid insecticides in samples collected from monitoring wells, irrigation wells, private wells and surface water samples.

DATCP has also conducted a statewide, statistically designed survey of agricultural chemicals in Wisconsin groundwater five times since the early 1990s (1994, 1996, 2001, 2007 and 2016). In 2016, nearly four hundred samples from private drinking water wells were analyzed for 101 pesticide compounds, including 70 herbicides, 26 insecticides, 4 fungicides and 1 pesticide safener. Health standards have been established for 27 of the compounds analyzed. In addition to capturing the current picture of agricultural chemicals in groundwater, this series of studies relates these findings to land use and compares results of the 2016 survey to those of previous surveys. The final report of the results of the 2016 survey was published in early 2017 (DATCP 2017).

Arsenic

Arsenic is an odorless and tasteless, naturally occurring element present in soil and rock. Under certain environmental conditions, arsenic can dissolve and be transported in groundwater. It can also be released as a by-product from agricultural and industrial activities. Everyone is exposed to small amounts of arsenic since it is a natural part of the environment, but under some geologic conditions elevated amounts of arsenic can be released to groundwater.

In Wisconsin, most arsenic found in groundwater is naturally occurring, released from minerals in bedrock and glacial deposits. Arsenic has been detected above the enforcement standard (ES) in the groundwater in every county in Wisconsin. Arsenic contamination of groundwater is common in northeastern Wisconsin in areas around Winnebago and Outagamie County and moderately high levels of arsenic (10 ppb – 30 ppb) are also common in some parts of southeastern Wisconsin.

GCC member agencies and partners continue to proactively address arsenic concerns through well drilling advisories, health studies, well testing campaigns, studies aimed at improving geological understanding and developing practical treatment technologies.

Volatile Organic Compounds (VOCs)

Volatile Organic Compounds (VOCs) are a group of common industrial and household chemicals that evaporate, or volatilize, when exposed to air. Examples of products containing VOCs include gasoline and industrial solvents, paints, paint thinners, air fresheners and household products such as spot and stain removers. Chemical names for the VOCs in these products include benzene, Trichloroethylene (TCE), toluene and vinyl chloride, among others. Improper handling or disposal of VOCs is often the reason why they occur in groundwater.

Sources of VOCs in Wisconsin's groundwater include landfills, underground storage tanks and hazardous substance spills. Thousands of wells have been sampled for VOCs and about 60 different VOCs have been found in Wisconsin groundwater. Trichloroethylene is the VOC found most often in Wisconsin's groundwater.

Radionuclides

Radionuclides are radioactive atoms. It is possible for radionuclides to be manmade, as is the case with some materials from nuclear power reactors, but they also occur naturally in rock formations and are released to groundwater over millions of years by geochemical reactions. Common naturally occurring radionuclides in groundwater include uranium, radium and thorium. Naturally occurring radionuclides are a concern for groundwater quality, particularly in the Cambrian-Ordovician aquifer system in eastern Wisconsin. The water produced from this aquifer often contains combined radium activity in excess of 5 pCi/L and in some cases in excess of 30 pCi/L. Historically, about 80 public water systems exceeded a radionuclide drinking water standard, causing these communities to search for alternative water supplies or treatment options. The vast majority of these systems are now serving water that meets the radium standard. The DNR continues to work with the remaining water systems to ensure that they develop a compliance strategy and take corrective actions.

CONDITION OF THE RESOURCE: GROUNDWATER QUANTITY

Groundwater quantity conditions are summarized below and detailed in the [online report](#).

Groundwater is available in sufficient amounts throughout most of Wisconsin to provide adequate water supplies for most municipal, industrial, agricultural and domestic uses. What is frequently missed is that groundwater pumping lowers water levels in aquifers and connected lakes, wetlands and streams; and diverts flow to surface waters where groundwater would have discharged naturally. The amount of water level lowering and flow diversion is a matter of degree. At certain amounts of pumping in an area, streams, lakes and wetlands can dry up and aquifers can be perilously lowered.

Groundwater pumping shows a continued long-term increase. Numbers of high capacity wells, especially in the Central Sands region of the state (parts of Portage, Waushara, Waupaca, Adams and Marquette Counties), indicates pumping amounts will continue to expand.

Groundwater pumping issues have arisen in multiple regions of Wisconsin. Large scale drawdowns of the confined aquifer have been documented in the Lower Fox River Valley and southeastern Wisconsin. Surface water impacts have been well-documented in the Wisconsin Central Sands and Dane County. These impacts have included the drying of lakes and streams.

BENEFITS OF MONITORING AND RESEARCH PROJECTS

The GCC provides consistency and coordination among state agencies in funding Wisconsin's Groundwater Research and Monitoring Program to meet state agency needs. Approximately \$20 million has been spent over 30 years by DNR, UWS, DATCP and DSPS (formerly Commerce) on more than 450 different projects selected to answer essential management questions and advance understanding of groundwater in Wisconsin.

Projects funded have helped evaluate existing programs, increased the knowledge of the movement of contaminants in the subsurface and developed new methods for groundwater protection. While the application of the results is broad, a few examples where the results of state-funded groundwater research and monitoring projects are successfully applied to groundwater problems in Wisconsin include:

- Detection and characterization of sources of microbial pathogens
- Extent of arsenic in Northeastern Wisconsin
- Evaluation of drawdown in Eastern Wisconsin
- Best practices for minimizing risk of groundwater contamination
- Methods for diagnosing causes of bacterial contamination in public water systems
- Understanding barriers to private well testing
- Statewide inventory and database of springs

RECOMMENDATIONS: DIRECTIONS FOR FUTURE GROUNDWATER PROTECTION

The GCC is directed by statute to include in its annual report a "list and description of current and anticipated groundwater problems" and to "set forth the recommendations of the Council" (s. 15.347(13)(g), Wis. Stats.). In this section, the GCC identifies its recommendations for future groundwater protection and management.

These recommendations include top priorities of immediate concern and ongoing efforts that require continued support.

Priority Recommendations

Implement practices that protect groundwater from nitrate and other agricultural contaminants (microbial agents, pesticides and their degradates).

Nitrate that approaches and exceeds unsafe levels in drinking water is one of the top drinking water contaminants in Wisconsin, posing an acute risk to infants and women who are pregnant, a possible risk to the developing fetus during very early stages of pregnancy, and a chronic risk of serious disease in adults. In addition, pesticides are estimated to be present in approximately 40% of private drinking water wells in Wisconsin. Areas of the state with a higher intensity of agriculture generally have higher frequencies of detections of pesticides and nitrate. Agencies should develop and evaluate a strategy to promote practices that lead to efficient use of nitrogen and careful or reduced use of pesticides in order to protect drinking water sources.

Implementation of these practices should be supported with appropriate technical tools and incentives such as:

- Identifying sensitive areas of the state based on geology where elevated nitrate is present and making information available through an online mapping tool
- Assessing soil type specific nitrogen crop application rates and cropping best management practices to further minimize nitrogen losses to groundwater and encourage their use, especially in highly sensitive areas of the state
- Developing a broad outreach plan and educational materials for farmers and nutrient management planners, and agricultural industry stakeholders that identify and encourage the use of specific alternate cropping and nutrient management practices to minimize agricultural nitrogen losses to groundwater
- Supporting research to assess the ability for alternative conservation practices, including saturated buffers and bioreactors, to minimize sources of nitrogen to surface and groundwater
- Developing strategies and outreach programs that encourage the full implementation of nutrient management plans

Address public health and environmental concerns regarding PFAS.

PFAS have been detected in both municipal and private drinking water sources in Wisconsin. PFAS have also been found in groundwater near Department of Defense sites in Wisconsin, such as Wisconsin Air National Guard facilities at Truax Field and Volk Field. PFAS are present in many consumer products and AFFFs. Current studies of these PFAS suggest exposure may affect childhood development, decrease female fertility, increase the risk of high blood pressure in pregnant women, increase cholesterol levels, increase the risk of thyroid disease and decrease antibody response to vaccines. EPA research suggests that some PFAS may have the potential to cause cancer.

The GCC recommends the following actions be supported to address PFAS concerns:

- Implement DHS recommendations for groundwater enforcement standards for two PFAS, PFOA and PFOS, in accordance with State law

- Pursue development of additional groundwater enforcement standards for PFAS compounds detected in Wisconsin
- Continue to identify PFAS sources and their potential impacts to groundwater and other environmental media
- Develop benchmarks for PFAS in other media such as surface water, biosolids and sludge to protect groundwater resources
- Support the Wisconsin PFAS Action Council (WisPAC) in developing and coordinating statewide initiatives around PFAS

Evaluate the occurrence of viruses and other pathogens in groundwater and groundwater-sourced water supplies and develop appropriate response tools.

Viruses and other microbial pathogens have been found in municipal and domestic wells, challenging previous assumptions about their persistence and transport. Monitoring and assessment should focus on refining our understanding of pathogens in groundwater, in particular, where and when they pose threats to human health. Agencies should also work with partners to increase awareness of waste disposal choices, their risks and costs.

Ongoing Recommendations

Without ongoing attention to the following needs, Wisconsin cannot address the priority recommendations (see above) or begin to understand emerging issues.

Support the sustainable management of groundwater quantity and quality in the state to ensure that water is available to be used, which will protect and improve our health, economy and environment now and into the future.

This includes:

- Supporting an inventory of information on the location, quantity and uses of the state's groundwater
- Supporting targeted monitoring and modeling of the impact of groundwater withdrawals on other waters of the state
- Supporting identification and evaluation of options for areas with limited groundwater resources
- Supporting research relating to changes in land-use development patterns and the resulting increase in groundwater use and changes to recharge

Continue to catalog Wisconsin's groundwater resources.

Management and protection of Wisconsin's groundwater resources requires publicly-accessible and up-to-date data in order to foster informed decisions, not only on state policy matters but also for sound business decisions on siting or technology investments. State agencies and the University should continue to collect, catalog, share and interpret new data about Wisconsin's groundwater so that it can be used by health care providers and people seeking business locations, as well as homeowners and local governments. Options for sharing data about groundwater and groundwater vulnerabilities should include accessible formats including online mapping tools. Wisconsin should improve the accessibility of current data and continue to encourage research efforts that will provide information.

Evaluate potential impacts of climate change on Wisconsin's groundwater.

Climate change will likely increase the frequency and severity of weather patterns that may produce unprecedented flooding or drought conditions. More severe flooding can affect groundwater quality, wells and water system operations. Public drinking water supplies as well as water-dependent industries need reliable estimates of these effects in order to develop practical emergency response and adaptation strategies. Additionally, land and water use patterns may also change and affect the groundwater supply. These may include biological or chemical contamination issues, or an increased demand for groundwater by agricultural, municipal and commercial users. More work is needed to determine the range of possible climates in Wisconsin's future. Work is also needed on feedback mechanisms between climate and groundwater to fully characterize possible changes to Wisconsin's groundwater resource. This research will help identify both flood and drought response and long-term management strategies for Wisconsin's groundwater supply.

Support applied groundwater research in Wisconsin.

Wisconsin is recognized as a national leader in [groundwater research](#), which is appropriate given how uniquely important this resource is for public health, the economy and the environment in this state.

For example:

- Wisconsin leads the nation in the number of public water systems that rely on groundwater (more than 11,000).
- Over 97% of agricultural irrigation water and more than one third of the water used for commercial and industrial purposes come from groundwater supplies.
- Many ecosystems in Wisconsin are strongly dependent on groundwater availability and groundwater quality.

Wisconsin's reputation for groundwater research is largely due to the well-established joint solicitation process for groundwater research and monitoring projects coordinated by the GCC. This approach streamlines proposal writing and the review process and improves communication among agencies and researchers. The solicitation is a coordinated effort of the University of Wisconsin System and the Wisconsin Departments of Natural Resources; Agriculture, Trade and Consumer Protection; and Safety and Professional Services.

Collectively, since its inception this annual joint solicitation has funded 483 groundwater research and monitoring projects and has helped establish Wisconsin as an international leader in groundwater research. The GCC recommends the following actions be taken to support applied groundwater research in Wisconsin:

- Restoring the original authorized amounts of DNR and UW groundwater research funding (adjusted for inflation using U.S. Bureau of Labor Statistics Consumer Price Index calculator) to DNR \$329,255 and UW \$426,790 annually. Restoring funds to this level would allow nearly half of the submitted proposals to be funded each year instead of 1/6 to 1/4 typically funded over the last ten years. Alternatively, increasing the funding to \$500,000 each for DNR and UW would allow the joint solicitation program to better attract qualified researchers to address concerns such as PFAS, which is more expensive to test for and research than most other groundwater issues facing Wisconsin.

- Additional consideration could be given to create dedicated funding mechanisms for the departments of Agriculture, Trade and Consumer Protection; Health Services; and Safety and Professional Services to conduct groundwater research targeting the needs of each respective agency.