EXECUTIVE SUMMARY

This is the Executive Summary of the annual Report to the Legislature by the Groundwater Coordinating Council (GCC). The report is required by s. 15.347, Wisconsin Statutes and describes the condition and management of the groundwater resource and summarizes the GCC's activities for fiscal year 2009 (FY 09). The full report along with several appendices can be accessed online at *http://dnr.wi.gov/org/water/dwg/gcc/rtl/gccreport.htm*.

In 1984, the Legislature enacted 1983 Wisconsin Act 410 to improve the management of the state's groundwater. The GCC 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."

Membership of the GCC includes the Secretaries of the Departments of Natural Resources (DNR); Commerce; Agriculture, Trade and Consumer Protection (DATCP); Health Services (DHS); Transportation (DOT); the President of the University of Wisconsin System (UWS); the State Geologist; and a representative of the Governor. Agency designees are listed on the inside of the front cover. More information about the GCC and its activities can be found on the GCC web pages: (*http://dnr.wi.gov/org/water/dwg/gcc/index.htm*).

Highlights from each of the Chapters of the Report are summarized below.

GROUNDWATER COORDINATION

The GCC, its Subcommittees, and member agencies worked together to address groundwater management issues and coordinate groundwater activities in FY 09. Examples include:

The UW Water Resources Institute (WRI) funded and continued to work closely with the GCC Education Subcommittee on a comprehensive groundwater education/outreach project that resulted in fact sheets on nitrate and arsenic in groundwater (*http://aqua.wisc.edu/publications/productslist.aspx?CategoryID=38&sel=6*), and activities for Groundwater Awareness Week (March 9-15, 2009). The latter included groundwater-related press releases prepared by UW-Stevens Point and WRI, and a public radio talk show with DHS and DNR representatives discussing groundwater issues.

Members of the GCC's Education Subcommittees helped guide the Wisconsin Well Water: Planning Web-Based Resources project (http://www.uwsp.edu/cnr/watersheds/programs_outreach/hwpp.htm). The project's focus is on developing web-based tools to systematically provide information to Wisconsin's domestic water well users that will aid in individual determinations of drinking water safety. The subcommittee also provided content for the DNR's web page entitled "What's Wrong with My Water?"

Three groundwater workshops for teachers were held in January of 2009 in Mount Horeb, Eau Claire, and West Bend. Staff from the DNR, WGNHS and the Central Wisconsin Groundwater

Center at UW - Stevens Point instructed teachers on using a groundwater sand tank model and provided other groundwater teaching aids. Teachers from 24 different schools attended the workshops and received a free model for their school.

The DATCP geographic information system-based well construction report search tool was made available to staff in other state agencies. This innovative tool offers user-friendly access to reports fundamentally important to our understanding of groundwater.

The GCC and the UWS Groundwater Research Advisory Council (GRAC) continued coordination of the annual solicitation for groundwater research and monitoring proposals among state agencies. The FY 10 solicitation for groundwater research and monitoring proposals was released in October 2008 (see *Appendix D*). A total of 18 project proposals were received. A comprehensive review process resulted in the selection of 5 new projects for funding for FY 10, all by UWS. The GCC approved the proposed UWS groundwater research plan as required by s. 160.50(1m), Wis. Stats. The FY 10 groundwater monitoring and research projects are listed by funding agency in Table 2, including projects that were carried over from FY 09.

SUMMARY OF AGENCY GROUNDWATER ACTIVITIES

State agencies and the University of Wisconsin System addressed a number of issues related to groundwater protection and management and implementation of Chapter 160, *Wis. Stats.* in FY 09. Several highlights are below.

The Great Lakes Compact - Signed by Governor Doyle in 2008, the Compact requires Wisconsin to have water conservation goals within the Great Lakes Basin. Implementing legislation – 2007 Wisconsin Act 227 – is currently being implemented. In FY 09 the DNR has issued interim approvals to persons who were withdrawing water in the Great Lakes Basin above the threshold permitting level of 100,000 gallons per day as of December 8, 2008. The DNR is also planning to promulgate administrative rules related to the following Compact-related topics: Registration & Reporting; Water Use Permitting; Consumptive Use/Water Loss; Public Participation; Water Conservation & Efficiency; and Water Supply Service Area Planning; and Water Withdrawal Fees.

*Nutrient Management Plan*ning - Through its land and water resource management program, DATCP provides funding primarily to counties to assist in the protection of water resources through farmer adoption of nutrient management planning. In calendar year 2008, $2,900,000 was allocated to provide cost-sharing to farmers for the development and implementation of nutrient management plans (NMP) for their cropland. In 2008, Wisconsin attained a record number of cropland acres under NMPs, achieving 1,600,000 acres, a 60% increase over acres reported in 2007.

The Groundwater Protection Act (2003 Act 310) - Chapter NR 820, Wis. Adm. Code, Groundwater Quantity Protection (effective September 1, 2007), created a mechanism for evaluating proposed high capacity wells to determine if there will be a significant environmental impact on springs, trout streams, outstanding and exceptional resource waters. In FY 09 DNR staff made progress updating a high-capacity well inventory and collecting annual pumpage reports. In May 2009 data on this groundwater usage was first compiled and made widely available. These data are establishing important baseline information regarding water use in the state and will be used for a variety of resource management concerns.

CONDITION OF THE GROUNDWATER RESOURCE

Major groundwater quality and quantity concerns in Wisconsin include:

Volatile Organic Compounds (VOCs): 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.

Pesticides: Pesticide contamination in groundwater results from field applications, pesticide spills, misuse, or improper storage and disposal. Related chemical compounds that form when the parent pesticide compounds break down in the soil and groundwater are called pesticide metabolites. The most commonly detected pesticide compounds in Wisconsin groundwater are: metabolites of alachlor (Lasso) and metolachlor (Dual), and atrazine and its metabolites. A 2007 DATCP private well survey estimated that the proportion of wells in Wisconsin that contained a pesticide or pesticide metabolite was 33.5%. Areas of the state with a higher intensity of agriculture generally had higher frequencies of detections of pesticides. The two most commonly-detected pesticide compounds were the herbicide metabolites metolachlor ESA and alachlor ESA which each had a proportion estimate of 21.6%.

Nitrate: Nitrate-nitrogen is the most common contaminant found in Wisconsin's groundwater. Nitrate can enter groundwater and surface water from a variety of sources including farm fields, animal feedlots, septic tanks, and decaying vegetation. Concentrations of nitrate in private water supplies frequently exceed the state drinking water standard of 10 mg/L. In 2005 and 2007, DNR aggregated and analyzed data from three extensive statewide groundwater databases. This combined dataset from DNR's Groundwater Retrieval Network (GRN) database, the Center for Watershed Science and Education database, and DATCP's groundwater database, included only the most recent nitrate result for each sampled private well. Out of the 48,818 samples, 5686 (11.6 %) equaled or exceeded the 10 mg/L standard. A 2007 DATCP survey estimated the proportion of private wells that exceeded the 10 mg/l enforcement standard for nitrate-nitrogen at 9.0%.

Microbial agents: Microbiological contamination often occurs in areas where the depth to groundwater is shallow, in areas where soils are thin, or in areas of fractured bedrock. Microbial agents include bacteria, viruses, and parasites. These agents can cause acute illness and result in life-threatening conditions for young children, the elderly and those with chronic illnesses. In one assessment (Warzecha et.al., 1994), approximately 23% of private well water samples statewide tested positive for total coliform bacteria, an indicator species of other biological agents. Approximately 3% tested positive for *E. coli*, an indicator of water borne disease that originates in the mammalian intestinal tract. The DNR has recently begun tracking total coliform detects in the raw water samples through its Drinking Water System database.

Viruses in groundwater are increasingly becoming 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 detectible viruses. (Borchardt 1997, 1999). Another study, conducted in conjunction with the USGS, found that 50% of water samples collected from four La Crosse municipal wells were positive for enteric viruses (Hunt and Borchardt, 2002, Borchardt et al. 2004). More recent and on-going studies have shown a link between viruses found in the municipal wells and wastewater system in Madison (Bradbury, 2007).

Leaking sanitary sewers were shown to be a source of infectious viruses to drinking water wells in subsequent work funded by WDNR and the USGS (Hunt and others, in review). Marshfield Clinic and USGS researchers sampled over 30 unconfined municipal wells in 14 Wisconsin communities. From this survey 8 wells had surface water contributions, 4 had unambiguous waste-water tracers, and 5 were positive for viruses. Follow-up investigation of the shallow groundwater system between 3 of these wells and suspected sanitary sewer sources showed that sampling at any one time may not show concurrent virus and trace presence due to analytical precision and seasonality of the sources in the waste stream. However, given sufficient sampling over time, a good relation between unambiguous waste-water tracers and virus occurrence was identified - locations that were characterized by recurring unambiguous tracer occurrence also were found to have enteric viruses present. Moreover, it was demonstrate that high-capacity pumping can induce viruses to move into a well before they are inactivated during their time in the subsurface.

Microbial contamination of groundwater is not restricted to vulnerable or shallow aquifers. Researchers recently discovered human viruses in the confined aquifer supplying Madison's drinking water. This finding was completely unexpected because it was believed a shale confining layer protected the aquifer from microbial contamination. Additional research on the Madison wells has shown virus transport from leaking sanitary sewers to the wells is very rapid, on the order of weeks to months instead of years. The virus transport and contamination levels were particularly high after extreme rainfall events or rapid snowmelt. From a public health perspective, the lesson learned is that all aquifers are potentially vulnerable to microbial contamination and require a similar level of disinfection for drinking water purposes.

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.

Radionuclides: Naturally-occurring radionuclides, including uranium, radium, and radon are becoming an increasing concern for groundwater quality, particularly in the Cambro-Ordovician aquifer system in eastern Wisconsin. The water produced from this aquifer often contains combined radium activities in excess of 5 pCi/L and in some cases in excess of 30 pCi/L. Approximately 35 public water systems exceed the drinking water standard of 15 pCi/L for gross alpha activity (Nelson, personal communication). Federal standards are causing many communities to search for alternative water supplies or treatment options.

Arsenic: Naturally occurring arsenic has been detected in wells throughout Wisconsin. DNR historical data show that 3,830 public wells and 3,013 private wells have detectable levels of arsenic. About 10% of these wells exceed the federal drinking water standard of 10 µg/L. Although arsenic has been detected in well water samples in every county in Wisconsin, the problem is especially prevalent in northeastern Wisconsin where increased water use has likely released arsenic from rocks and unconsolidated material into the groundwater. The State continues to proactively address arsenic concerns through well drilling advisories, health studies, well testing campaigns, and studies aimed at improving geological understanding and developing practical treatment technologies.

Groundwater quantity. Despite a general abundance of groundwater in Wisconsin, there is a concern about the overall availability of good quality groundwater for municipal, industrial, agricultural, and domestic use and for adequate baseflow to our lakes, streams, and wetlands. Groundwater use grew from 570 to 804 million gallons per day (Mgal/d) from 1985 to 2000. Groundwater use was estimated to be 983 Mgal/d in 2005, but much of the increase between

2000 and 2005 was due to a shift in how irrigation water use was estimated. Groundwater quantity problems have occurred both naturally and from human activities, and often affect groundwater quality. Regional effects of groundwater withdrawals are well documented in the Lower Fox River Valley, southeastern Wisconsin, and Dane County. Localized effects of groundwater pumping on trout streams, springs, and wetlands have been noted throughout the state. Groundwater quantity legislation enacted in 2004 was the first step towards managing groundwater quantity on a comprehensive basis. The DNR began to implement the provisions of the new law in FY 06 and FY 07 and began implementing a new rule, NR 820, regulating high-capacity wells in FY 08. The Great Lakes Compact, signed by Governor Doyle in 2008, requires Wisconsin to have water conservation goals within the Great Lakes Basin. Implementing legislation – 2007 Wisconsin Act 227 – is currently being implemented.

BENEFITS OF MONITORING AND RESEARCH PROJECTS

The GCC provides consistency and coordination among state agencies in funding groundwater monitoring and research to meet state agency needs. Approximately $15.2 million has been spent by DNR, UWS, DATCP, and Commerce through FY 09 on 369 different projects dealing with groundwater or related topics. While the application of the results is broad, this report describes topic areas where the results of state-funded groundwater research and monitoring projects have been successfully applied to groundwater problems in Wisconsin. These areas include:

- Pharmaceuticals, personal care products, and endocrine disrupting compounds
- The Atrazine Rule
- Groundwater monitoring at solid waste disposal sites
- Arsenic monitoring and research in Northeastern Wisconsin
- Groundwater movement in shallow carbonate rocks
- Developing new tools for groundwater protection
- Prevention and remediation of groundwater contamination
- Detection and monitoring of microbiological contaminants
- Groundwater drawdowns
- Comprehensive planning
- Rain garden design and evaluation
- Methylmercury formed in groundwater

DIRECTIONS FOR FUTURE GROUNDWATER PROTECTION

The GCC recommends the following priorities for future groundwater protection and management:

- Evaluate acute and chronic impacts to groundwater from manure management practices.
- Understand and better predict impacts from groundwater withdrawals
- Continue to evaluate and catalog Wisconsin's groundwater resources
- Investigate extent and origins of naturally occurring substances in groundwater
- Evaluate occurrence of recently discovered groundwater contaminants
- Understand the links between land use and groundwater quantity and quality
- Evaluate potential impacts of climate change on Wisconsin's groundwater
- Address groundwater quantity management issues at both statewide and regional levels
- Find solutions to groundwater nonpoint pollution problems
- Meet funding needs for nutrient management practice research to evaluate resource protection effectiveness

- Develop methods to assess and protect against health hazards posed by exposure to 'orphan' contaminants as well as multiple contaminants in a water supply
- Continue to fund groundwater monitoring and research
- Support implementation of a Statewide Groundwater Monitoring Strategy
- Support Implementation of the Great Lakes Compact
- Coordinate and facilitate consistent messages on groundwater related issues
- Promote consistency between the agencies on data management issues
- Ensure access to findings of groundwater research and monitoring projects