

Chapter 6 -- DIRECTIONS FOR FUTURE GROUNDWATER PROTECTION

The Groundwater Coordinating Council (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.). The purpose of this Chapter is to call attention to statewide priorities in the area of research, monitoring, policy, planning, and coordination related to groundwater and to provide direction to the GCC and its Subcommittees. In addition, this Chapter sets forth the Council's recommendations for future groundwater protection and management needs to state agencies, the Governor, the Legislature, and the citizens of Wisconsin.

RESEARCH & MONITORING PRIORITIES

- **Protect funding for groundwater monitoring and research:** For several years state budget cuts have limited the number of groundwater research and monitoring projects that were funded (see Table 3 in Chapter 2). DNR's state funding for projects has been cut since FY 02 and it has been forced to use more Federal dollars with high overhead costs. Although relatively new Wellhead Protection and Groundwater Quantity funding has offset some of these DNR cuts, the new funding is earmarked towards a limited scope of work. The UWS budget was cut by 10% in FY 04 and FY 05. DATCP and Commerce have been unable to fund any new projects in the last five fiscal years. Continued cuts will hamper the State's ability to address critical groundwater monitoring and research needs in the future. Research and monitoring are necessary to identify and test cost-effective groundwater pollution prevention strategies. These strategies are needed to prevent groundwater problems that are much more time-, labor-, and cost-intensive to remediate than to prevent in the first place. The GCC encourages its member agencies and the Legislature to restore adequate resources for groundwater monitoring and research and to seek partnerships to leverage additional funds.
- **Acute and chronic impacts to groundwater from manure management practices.:** Groundwater contamination from manure has been an increasing problem in recent years for private well owners. The continued replacement of high quality historically recharged water with poor quality recently recharged water is degrading our groundwater resource and, in some cases, has made it unusable for human consumption. A statewide assessment is needed to understand the scope and magnitude of the problem. Mechanisms, pathways, and timing of movement into groundwater, the influence of landscape settings and climatic factors, the applicability of new analytical tools and methods of vulnerability assessment and best management practices (BMPs) and the threat of associated contaminants (bacteria, nitrate, pharmaceuticals, viruses, other pathogens, etc) all need to be understood better to address the problem. Several manure management research and monitoring projects started in FY 08. The GCC and its subcommittees need to help evaluate the findings and guide follow-up projects on this topic to assure an effective response to this problem.
- **Investigate adverse impacts from groundwater withdrawals:** Recent headlines about lakes and streams drying up, long term availability of water supplies in the Fox River Valley, and severe groundwater level drawdowns in southeastern Wisconsin have generated many questions about the effects of groundwater withdrawals on surface waters and long-term groundwater availability. There is a need to further quantify hydrographic relationships

between surface and groundwater, as well as to develop tools to evaluate the impacts of withdrawals on surface waters. The GCC should continue to encourage research efforts that will provide information useful in addressing this issue.

- **Other unresolved groundwater quantity issues – How water-rich are we?** A common perception is that Wisconsin has an abundance of water – more than enough to support our current usage. But, the truth is expected to be more complicated. As Hunt (2003) describes, in Wisconsin we receive about 31 inches of precipitation a year—some 29 trillion gallons of water—falling as snow and rain (WDNR 2006). So why do we hear about possible water shortages in our water-rich state? Most of this water (around 75%) is transferred back to the atmosphere by evaporation and plant transpiration before it makes it to groundwater or surface water (WDNR 2006). A significant amount of the remaining water does eventually make it to groundwater and surface water bodies, but the issue of availability is more subtle: water supply problems are typically not statewide problems but rather local supply problems. That is, the flow of water in the natural system cannot, in some cases, keep up with the local demands placed upon it; our ability to extract water locally exceeds the natural replenishment. In addition, water cannot be transported easily around the state to meet local shortages. So although we do have an ample amount of water in our state, we can still experience water shortages locally.
- **Investigate extent and origins of naturally occurring substances in groundwater:** Continued problems of elevated arsenic, low pH, and other water quality problems in domestic wells exist over large areas of northeast Wisconsin. Additionally elevated sulfate, total dissolved solids (TDS), and radium have been found in some new deep municipal wells in the Lower Fox River Valley, making the wells difficult to use. In some other existing deep wells as far south as Milwaukee, the TDS have been steadily increasing over the years. These sulfate and TDS levels pose a problem for local water managers, and the origin of the dissolved solids is not completely understood. The State needs more information about the extent and causes of these problems in order to give advice to homeowners, municipalities, and well drilling contractors. The GCC should continue to encourage research efforts that will provide information useful in addressing these issues.
- **Evaluate occurrence of recently discovered groundwater contaminants:** Recent research conducted in Europe and the U.S. indicates that traces of pharmaceuticals (including antibiotics and hormones) and pesticide breakdown products are common contaminants found in groundwater and surface water. Recent sampling funded by the WDNR and USGS documented wastewater tracers occurring in some drinking water wells in Wisconsin. In addition, studies have found evidence of viruses and other microbial agents in both municipal water supplies and domestic wells. More research is needed to determine whether these substances pose a threat to Wisconsin's groundwater resource, and also to human health.
- **Research the impacts of various land uses on the groundwater resource:** Additional research is needed on the effect of various land uses (e.g. urbanization and agriculture) on groundwater quality and quantity. For example, Juckem et al. (2008) show that land management mitigates or magnifies stresses such as climate change; agricultural nonpoint source rules require nutrient management plans that protect surface water quality, but may also improve groundwater quality. Projects must be managed in such a way as to maximize their relevance to state land-use problems. This issue crosses agency lines and promises to be an important issue for years to come. Another example is the impact of storm water infiltration on groundwater. Recently enacted stormwater infiltration rules require storm water infiltration trenches in many commercial and multi-family residential settings in Wisconsin. This will help reduce runoff in urban areas, but the impacts of trenches on

groundwater are not fully understood. Also, there are no requirements regarding abandonment of trenches. Research is needed to determine the impact of infiltration trenches on local groundwater, and to assess the need for signage or abandonment criteria to protect the groundwater resource.

- **Evaluate potential impacts of climate change and global warming on Wisconsin's groundwater:** Climate change will likely increase the frequency and severity of inclement weather patterns that may produce unprecedented flooding or drought conditions. As a result, land use patterns may also change and bring new threats to the groundwater supply. These may include biological or chemical contamination issues or increased demand for groundwater by agricultural, municipal, and commercial users. Additionally, recent groundwater/surface-water modeling by USGS suggests that climate change will affect timing of groundwater recharge, amount of baseflow in streams, whether lakes will be groundwater fed or rain fed, and the wetland distribution on our landscape. More work is needed on the range of possible climates in Wisconsin's future. Work is also needed on feedback mechanisms between climate and groundwater to fully characterize the envelope of possible changes to Wisconsin's groundwater resource. This research will help identify ways to properly manage Wisconsin's groundwater supply under changing conditions.
- **Evaluate the impact of the production of biofuels on Wisconsin's groundwater. This includes concerns with farmers moving out of Conservation Reserve Program (CRP).** Biofuels requires relatively large quantities of water – in some cases a single plant can pump as much as a municipality. Unlike a municipality, biofuel production is largely consumptive, removing the water from the system rather than returning the majority back to the local hydrologic system through sewage treatment return flows. In addition to the potential direct water use effects, an indirect effect on Wisconsin's groundwater is expected: the conversion of marginal crop land put in fallow by the CRP into corn or other biofuel source crops. CRP lands have been shown to enhance infiltration of precipitation by 8 to 10 times more than the same soils in active agriculture (Steuer and Hunt, 2001). Thus, converting the CRP land back to crop production is expected to reduce groundwater recharge and increase runoff and related flood peaks. The combination of direct and indirect effects has the potential to significantly change the local hydrologic flows in some watersheds. More work is needed to identify vulnerable watersheds, and quantify the carrying capacity of other watersheds.

POLICY & PLANNING PRIORITIES

- **Address groundwater quantity management issues at both statewide and regional levels:** Groundwater quantity issues came to the forefront of public discussion in FY 04, with the development and passage of landmark groundwater quantity legislation, 2003 Wisconsin Act 310. Since passage of the new law the DNR has begun implementing the new law and the Groundwater Advisory Committee has addressed specific policy issues related to groundwater management planning and the overall effectiveness of the law. There is a need for proactive regional groundwater planning in certain areas of the state where development/population growth pressures intersect limited groundwater resources leading to water availability and sustainability issues. The GCC will continue to serve as a resource for addressing scientific and technical questions related to groundwater quantity and facilitate further dialogue among all parties on potential approaches and solutions as well as identifying additional areas with developing or potential groundwater quantity problems.
- **Find solutions to groundwater nonpoint pollution problems:** A 2008 DATCP report indicates that 33.5% of wells contain a detectable level of at least one pesticide or pesticide

metabolite and 11.7% of Wisconsin's wells still contain detectable atrazine residues. In addition, 9% exceed the nitrate standard. These rates are substantially higher in agricultural areas. More work is needed to determine how far Wisconsin groundwater will deteriorate without a substantial change in farming practices, and what practices will sustain both agriculture and groundwater quality. The GCC will support the agencies and the UWS in obtaining information pertinent to the human health implications of consuming nitrate and pesticide contaminated groundwater and the effect of discharge of this groundwater on surface waters and their ecosystems.

Meet funding needs for nutrient management plan implementation and evaluation of its effectiveness in resource protection. From 2005 to 2007, nitrogen fertilizer sales increased 25% resulting in the application of approximately 400 million pounds of N in excess of UW recommendations. A recent DATCP survey of private well water quality shows increasing probability of nitrogen contamination of drinking water as the percentage of nearby agricultural land use increases. The adoption of nutrient management plans by farmers would reduce nitrogen loading to groundwater. However, only 1 in 8 Wisconsin cropland acres are currently farmed under an approved nutrient management plan. Nutrient management plans can be required if cost-sharing is provided to the farmer. Maintaining and expanding the funds for nutrient management cost-sharing is critical if groundwater quality is to be improved. While nutrient management planning is a necessary first step, the plans must be implemented and maintained over time. Additionally, the individual practices that make up nutrient management plans need to be researched and evaluated to ensure both practicality for farmers as well as effective groundwater and surface water protection. No funds for this needed research are currently budgeted.

- **Provide resources to local governments for Smart Growth/Comprehensive Planning activities.** Legislation enacted in 1999 requires local units of government to develop a comprehensive plan by 2010 in order to undertake land use activities. This plan must address nine elements (including natural and agricultural resources, housing, utilities, and land use), and presents a unique opportunity to address and implement groundwater protection at the local level. The GCC has helped guide a DNR-funded project that has developed a website to provide groundwater information to communities involved in comprehensive planning. The website provides a suggested process for integrating groundwater information into comprehensive plans. It also includes webpages for each of Wisconsin's 72 counties that include current, local data about groundwater susceptibility, sources of drinking water, groundwater quality, potential sources of contaminants, groundwater quantity, money spent on cleanup and ground-water protection strategies. Since its official launch in March of 2008 the website has averaged nearly 800 successful requests for information per day. Over 950 different individuals or organizations have visited the site. Maintaining and enhancing the site over the next several years is critical for communities to incorporate ground-water information into their comprehensive plans. However, long term hosting and maintenance of the site is undetermined, and a source of continued funding has not been identified. As a result the site will not be updated, nor will it be possible to provide agency support for anything but basic questions from users.
- **Develop methods to assess and protect against health hazards posed by exposure to 'orphan' contaminants as well as multiple contaminants in a water supply.** Data collected by DNR and DATCP indicate that many groundwater aquifers are contaminated with 'orphan' chemicals, such as pesticide degradates, chlorinated organics and petroleum derivatives, for which toxicity information is inadequate to support risk assessment. Solutions are needed to effectively address scenarios where multiple contaminants are present in a well. Frequently wells are found to have one or more pesticide degradates

present, perhaps in tandem with a parent compound or totally unrelated compounds. The GCC will support the agencies in their attempt to develop uniform methods that can be used to establish contaminant-specific advisories for owners of impacted water supplies.

COORDINATION PRIORITIES

- **Support implementation of a Statewide Groundwater Monitoring Strategy:** Chapter 160 of the Wisconsin Statutes requires the DNR to work with other agencies and the GCC to develop and operate a system for monitoring and sampling groundwater to determine whether harmful substances are present (s. 160.27, Wis. Stats.). In FY 04, several agencies worked together to develop and refine a Statewide Groundwater Monitoring Strategy to guide agency monitoring efforts for the next eight to ten years. The strategy has been incorporated into the DNR Water Monitoring Strategy (<http://dnr.wi.gov/org/water/monitoring/strategy.htm>.) In FY 07 a multiagency groundwater monitoring workgroup developed a process and priorities for taking the first step: enhancing the Wisconsin Observation Well Network. The GAC, in its 2006 and 2007 reports, stressed the value of an enhanced monitoring network and included recommendations urging sufficient funding. However, at this time funding has not been found to support significant improvement of the monitoring well network. The GCC encourages agencies, the university, and federal and local partners to implement this and other components of the strategy and to seek funding to support its implementation.
- **Support Implementation of the Great Lakes Compact:** The Great Lakes Compact establishes a consistent framework oversight of withdrawals and use of water, including groundwater, in the Great Lakes basin. Implementing legislation includes mechanisms for review and approval of water withdrawals and interbasin transfers and also requirements for development of water conservation and efficiency programs. Effective implementation will rely on sound data and research and development of innovative approaches to water use and management. The GCC will play an important role in supporting these research and management initiatives.
- **Coordinate and facilitate consistent messages on groundwater related issues:** The public has benefited from the consistent educational messages that have been endorsed by the GCC. Through the Education Subcommittee, the GCC will continue to provide its leadership and assistance to state agencies that provide educational materials to the public. In FY 05, the Subcommittee created a “Groundwater Information Network” with non-governmental organizations to further its mission of promoting consistent messages regarding groundwater protection and building a groundwater consistency. The GCC will continue to use this network and other means to promote water stewardship and awareness, find innovative ways to encourage testing of private water supplies, and provide materials for local communities to support comprehensive planning activities.
- **Promote consistency between the agencies on data management issues:** Through the DNR’s Groundwater Retrieval Network (GRN) and the GCC’s Monitoring and Data Management Subcommittee’s two publications *Directory of Groundwater Databases* and *Recommended Minimum Data Elements for Groundwater Databases*, state and local government agencies now have more convenient access to groundwater data and guidance on multi-user-friendly data element choices. These efforts must be maintained by continuing to identify data needs and ways to make data easily accessible and promote data consistency. This commitment to management of the resource through sound scientific methods needs to be continued by the GCC providing leadership and communication on data management.

- **Ensure access to findings of groundwater research and monitoring projects:** The UW-Madison Water Resources Institute website (www.wri.wisc.edu) was rebuilt in FY 08 to make it easier and faster for visitors to find information about WRI research projects and publications. To provide the public with a real-time link to information about current research the site was integrated with the UW Aquatic Sciences Center's interactive Project Reporting Online (iPRO) system, an online tool that allows principal investigators to report on the progress of their projects. The new site features a fresh design with better readability and vivid photography. The redesigned WRI website went online February 15, 2008 and by the end of the fiscal year has logged more than 200 visitors and 1,000 page views per week. More than 70 summaries of groundwater-related monitoring and research projects funded through the Wisconsin Groundwater Research and Monitoring Program are now available online. The WRI Water Resources Library has digitized and posted the full text of many WRI and DNR project final reports. New summaries and reports are added as they become available. Another WRI initiative is the development of topical fact sheets to summarize research and monitoring findings relative to important groundwater issues in the state. The GCC supports development of these fact sheets and resources and will continue to promote ways to translate sound science into effective groundwater management strategies.

References Cited:

Hunt, R.J., 2003, A water science primer. Wisconsin Academy of Sciences, Arts and Letters *Transactions* 90: 11-21.

Juckem, P.F., Hunt, R.J., Anderson, M.P., and Robertson, D.M., 2008, Effects of climate and land management change on streamflow in the Driftless area of Wisconsin. *Journal of Hydrology* 355: 123-130.

Steuer, J.J., and Hunt, R.J., 2001, Use of a Watershed-Modeling Approach to Assess Hydrologic Effects of Urbanization, North Fork Pheasant Branch Basin near Middleton, Wisconsin. USGS Water-Resources Investigations Report 01-4113. 49 p.